



Association of British Insurers

ABI RESEARCH PAPER NO 24, 2010

THE USE OF GENDER IN INSURANCE PRICING

Analysing the impact of a potential ban on the use of gender as a rating factor

Report from Oxera

EXECUTIVE SUMMARY

The ABI commissioned Oxera to conduct an independent and objective economic study on the use of gender in UK insurance pricing. The aim is to inform the ongoing policy debate, and in particular to evaluate the impact that a potential ban on the use of gender as a risk-rating factor might have on insurers and consumers.

Overview of main points

- Risk-based pricing is key to the efficient operation of private insurance markets.
- There are significant gender differences in accident, morbidity and mortality risks. Gender is used when it helps the accuracy of pricing products which cover these risks.
- In line with UK gender legislation (and the EU Gender Directive), the use of gender as a rating factor is based on actuarial and statistical data on gender risk differences.
- A ban on a relevant rating factor such as gender cannot be achieved without costs. These costs can be significant and would ultimately be borne by consumers.
- Among other adverse effects for consumers, motor insurance premiums for young females would increase (by up to 25% on average, based on modelling), and pension income for the majority of annuitants would fall (by 2% or more).
- Just removing gender as a rating factor does not necessarily achieve gender neutrality in insurance prices. Gender-neutral pricing would often be very costly, if not impossible, to achieve.

The current use of gender in insurance pricing

UK insurance markets are generally considered competitive and well-functioning. Risk-based pricing, using sophisticated risk-classification techniques and pricing models, is a key principle underlying the efficient operation of these markets.

There are significant differences between females and males in their accident risk, morbidity risk and mortality risk. Hence, the costs of providing insurance products that cover these risks, including motor insurance, private medical insurance, life insurance and pension annuities, differ between men and women.

Gender is used as a risk-rating factor only when it helps to price the risks covered by the insurance products in question. It is used in addition to (and in combination with) other rating factors and, for some products, gender is the second-most important factor used (after age). Where gender is not related to risk differentials, it will not be used in pricing decisions.

In line with UK gender legislation (and the EU Gender Directive), the use of gender as a rating factor is based on actuarial and statistical data on gender-related risk differences, which is published in accordance with HM Treasury guidelines.

There is no significant systematic bias in the pricing of insurance against any particular gender, and no corresponding detriment for females or males in the sense of either gender being overcharged compared with the costs they impose on insurance providers. Any such overcharging would not be sustainable in a competitive product market.

The use of gender varies depending on the product and the gender risk differential. For motor insurance, all else being equal, young female drivers currently pay significantly less than young male drivers owing to the lower risk of young female drivers being involved in accidents and the resulting lower claims costs per policy sold. For private medical insurance (PMI), gender differences in medical conditions explain why premiums tend to be higher for females aged 35 to 55, but lower for females than for males from the age of 60 onwards. The premium differentials reflect the claims cost differences.

In the case of life insurance and pension annuities, the gender differentials in premiums or benefits can be explained by differences in the life expectancy of men and women. Owing to their lower mortality risk, women benefit from lower premiums on life insurance.

For annuities, women may receive a lower annuity payment in any year, but this payment stream can in general be expected over a longer period of time, such that for the same lump-sum annuity purchase price, women receive the same (or indeed higher) total annuity benefit as men (see Table A).

Table A Pension annuities and life expectancy

	Annual annuity payment (£)	Number of years expected to live	Total annuity benefit (£)	NPV of annuity benefit (5%) (£)	NPV of annuity benefit (10%) (£)
Male	6,510	17.37	113,079	74,395	52,654
Female	6,111	20.04	122,464	76,244	52,059

Note: This table shows the average annual annuity payments for a 65-year-old, non-smoking man and woman (standard annuity, purchase amount £100,000, single-life, non-escalating), obtained from a price-comparison website. Life-expectancy data is based on Office for National Statistics (ONS) Interim Life Tables, using 2006 to 2008 data. The total annuity benefit is calculated as the simple product of the annual annuity payment and the number of years expected to live, without discounting. The NPV refers to the net present value of the annuity payments, at two different illustrative discount rates.

Source: ONS, find.co.uk, and Oxera calculation.

The impact of a potential ban on the use of gender in insurance

Some may consider gender differentials in insurance pricing to be unacceptable per se, even if this can be justified by objective evidence and is 'fair' from an actuarial perspective. However, a ban on the use of a relevant rating factor such as gender cannot be achieved without costs. These costs are most significant where gender is highly correlated with risk—where there is no correlation, there is no impact (and gender would not be used in product pricing in the first place).

The overall impact of a ban on the use of gender as a rating factor varies by insurance product (also because of the variable degree of gender correlation with the risks being insured), but the same economic considerations apply. There are three broad categories of impact, as follows.

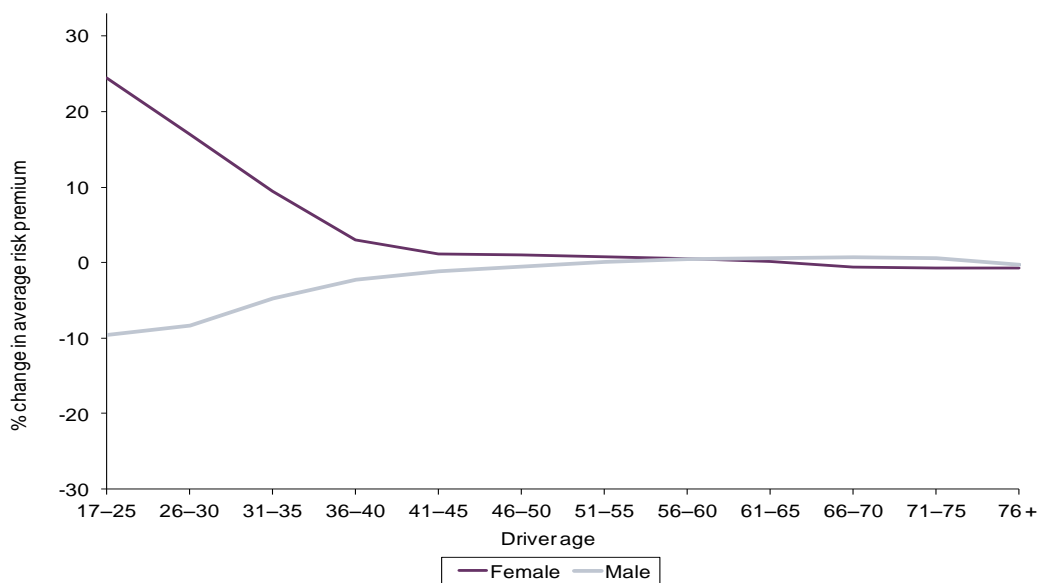
- **Redistribution impact**—the first-order effects are redistributive. The removal of gender as a rating factor and resulting prices at unisex rates imply that the lower-risk gender experiences increases in premiums (or reductions in benefits) in order to cross-subsidise the higher-risk gender. The benefiting gender varies by product. Broadly speaking, under

unisex pricing, for motor and life insurance, females would be worse off, while in the case of pension annuities, males would be worse off.

For example, a requirement to price pension annuities at a unisex rate may increase the annuity rates for females, but this can be achieved only at the detriment of male annuitants. Since most annuities are at present for male policyholders, the main impact would be a reduction in the retirement income for the majority of annuitants (and their spouse or other dependants), by 2% or more, depending on calculations.

As another example, Figure A shows the results of modelling the redistributive impact of removing gender as a rating factor from motor insurance pricing. Female drivers under the age of 25 would experience average premium increases of almost 25%. Male drivers in the same age group, on the other hand, would benefit from an average 10% reduction in their premium.

Figure A Changes in motor insurance premiums following a ban on the use of gender



Note: Based on modelling of gender-based rating versus unisex rating for motor insurance. Dataset based on information on policies and modelled claims costs provided by a significant sample of major insurers in 2008.

Source: Modelling by actuarial consultants, EMB

- **Impact on individual insurers and supply response**—a ban on a relevant rating factor such as gender corresponds to a restriction on risk-based pricing. From the perspective of an individual insurer, less accurate pricing increases the risk of insurance provision. Insurers have a number of options available to respond to the uncertainty, namely to:
 - increase the weight assigned to the other rating factors used in the pricing models (eg, age, engine size, occupation), in particular if any of these are correlated with gender;
 - search for new rating factors or rating methods to proxy some of the gender-related risks—these other factors or methods are likely to be less accurate, more costly and/or potentially more intrusive for consumers than using gender;

- include a risk margin, either directly by charging higher premiums or indirectly by making changes to the capital reserves (which will also tend to increase premiums)—a greater risk in insurance provision will require higher margins and additional capital to cover the risk, in particular under Solvency II;
- impose product restrictions to limit the risk coverage (or potentially stop providing insurance cover in the market segment altogether), reducing the level and quality of insurance available for consumers; and
- target the marketing and distribution process to control the gender mix in the insurance portfolio and/or attempt to bias the portfolio mix in favour of the lower-risk gender.

These effects can be expected to be particularly strong during the transition phase, when each insurer is uncertain about the adjustment strategy adopted by other insurers in the market; where insurers have a very unbalanced gender mix in their existing insurance book; when no single insurer can afford to over- or underprice the others and remain in the market; and where insurers are wary of attracting a higher-than-expected share of the higher-risk gender in their customer base. That is, given the competitive dynamics, individual insurers can be expected to take any of the above courses of action to mitigate either current or future anti-selection against their own insurance book—each action would adversely affect the prices paid by, or insurance cover available to, consumers.

- **Market-wide impacts**—a ban on the use of gender will have a different impact on different insurers (depending on their size, gender mix, distribution channels, etc). This could affect the competitive process in the market—in particular in the transition phase—requiring some insurers to adapt their business models or indeed even close their books or exit the market. Moreover, the introduction of unisex rates may change the demand of consumers: the lower-risk gender may purchase less insurance cover (because of the increase in the price compared with before), and/or the higher-risk gender may purchase more. The average risk in the market could therefore rise, and overall insurance coverage levels could fall. This adverse selection process would require average prices to increase further to cover the higher cost of provision for the remaining group of insured individuals. As a result, low-risk consumers may exit the market because the unisex rate represents such bad value to them. In practice, given the nature of the insurance products considered (eg, compulsory motor insurance), unisex pricing is unlikely to trigger such significant market-wide adverse selection effects. Nonetheless, some demand adjustments can be expected: for example, young females may delay the purchase of a car, whereas young male drivers may be induced to buy larger and more powerful cars than they otherwise would, with negative implications for road safety. Also, in the annuity market, concerns about adverse selection (in the form of men opting against annuitising their pensions) may increase in the UK if recent government proposals to abolish compulsory annuitisation are implemented.

Finally, a simple ban on the use of gender as a risk-rating factor in insurance pricing does not necessarily deliver gender-neutral insurance prices, raising the question of what the objectives of such a ban are in the first place. If there are any other factors in the insurance pricing models that are correlated with gender (including factors that are in their own right valid risk-rating factors), these will pick up gender-related risk in the resulting insurance prices. As a

result, achieving gender neutrality in insurance pricing would require the removal not only of the gender factor to obtain unisex prices, but also the removal of all rating factors that are correlated with gender in the pricing models. This would be very costly, if not impossible, to implement.

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1.0 INTRODUCTION

On behalf of the ABI, Oxera has conducted economic analysis into the current use of gender as a risk-rating factor in UK insurance pricing and the impact of a potential ban on using gender in this way. This report presents the findings of the analysis.

1.1 Background and objectives

When setting prices for insurance products, insurers take into account several factors to ensure that their prices reflect the risks and other costs of provision. Gender is one such factor and has long been used by UK insurers in pricing insurance products which cover risks that differ between men and women.

The EU Gender Directive of 13 December 2004 (Council Directive 2004/113/EC) provides for equal treatment between men and women in the access and supply of goods and services. While this Directive prohibits insurers from using gender in the calculation of premiums and benefits, it contains an exemption to this rule: under Article 5(2), Member States can opt out from banning the use of gender and can allow 'proportionate differences' in insurance premiums and benefits where the use of gender is a 'determining factor' in the assessment of risk 'based on the relevant and accurate actuarial and statistical data', provided that Member States ensure that such data is 'compiled, published and regularly updated'.

In the UK, the Gender Directive has been implemented through the Sex Discrimination (Amendment of Legislation) Regulations 2008, amending the Sex Discrimination Act 1975. The regulations came into force on April 6th 2008 and apply to insurance contracts entered from that date. Under the regulations, the use of gender as a factor in the assessment of insurance risk must be based on actuarial and statistical data published in accordance with guidelines issued by HM Treasury.¹ Hence, in the UK, insurers can continue to use gender as a risk-rating factor and differentiate by gender when pricing insurance policies, subject to meeting the requirement for objective justification.

Despite this objective justification, the use of gender in insurance pricing remains subject to debate at the European level, and claims of unfair, unequal treatment between men and women in insurance provision continue to be advanced against insurers by some stakeholders in the debate.

At the time of writing this report (summer 2010), the European Commission is reviewing the implementation of the Gender Directive across different Member States and may recommend changes to the Directive. Also, the European Court of Justice is expected to rule on the legitimacy of using gender in pricing insurance and whether such a clause contravenes European human rights legislation.

¹ See HM Treasury (2008).

Given the ongoing debate at the EU level, the ABI has commissioned Oxera to conduct an independent and objective economic study on the use of gender in insurance pricing. The purpose of the study is to contribute to the understanding of the issues, and in particular to evaluate the impact that a ban on the use of gender as a risk-rating factor might have on insurers and consumers.²

More specifically, the study presents comprehensive economic analysis by Oxera which addresses three main questions (with focus on the third question):

- how is gender currently used in insurance pricing?
- what explains the current use of gender?
- what is the impact of a ban on the use of gender as a rating factor, in particular for consumers?

Gender is not used across all insurance markets; rather, it is used in the provision of only those insurance products that cover risks which differ by gender—namely, accident risk, morbidity risk and mortality risk. This study covers the four main products where such differentiation applies in the UK insurance sector:

- motor insurance;
- PMI;
- term life insurance; and
- pension annuities.

1.2 Structure of report

The report is structured as follows.

- Section 2 presents the conceptual framework of analysis. It first sets out the basic economics of insurance and explains the efficiency and equity/fairness concepts that are core to much of the policy debate. It then explains the analysis of the current use of gender and the impact of a ban on the use of gender.
- Section 3 examines the status quo in the UK market, summarising how gender is currently used by insurers. It presents evidence on the differential prices paid by men and women, and on what drives those price differences for the four products.
- Sections 4 and 5 assess the impact of a potential ban on the use of gender as a risk-rating factor in UK insurance pricing. These sections examine the impact along different dimensions, drawing conclusions about the likely outcomes for consumers in particular. Section 4 presents the conclusions at a general level, whereas section 5 considers the impacts for each of the four products examined. Relevant academic literature is summarised in the Appendix.

² Similar issues arise in the debate around the use of age and other factors in insurance pricing. The use of age-based practices in UK insurance markets was assessed by Oxera in a previous study for the Government Equalities Office (GEO). See Oxera (2009).

2.0 RISK RATING AND INSURANCE PRICING

This section presents the conceptual background and framework of analysis. It sets out the economic principles underlying the supply and pricing of insurance (section 2.1). It then describes how the debate on the use of gender as a rating factor in insurance can be explained by different viewpoints on the concepts of economic efficiency and equity/fairness (section 2.2).

Against this background, the section summarises the structure and content of the analysis undertaken in this study (section 2.3).

2.1 Economic principles of insurance pricing³

Individuals pay for insurance in case an unfavourable event occurs. For example, they buy motor insurance to cover the costs arising from their liabilities if they cause an accident and injure a third party, or they buy life insurance to guarantee a payment to a beneficiary in the event of their death.

In private insurance markets, insurers need to earn sufficient income from premiums so that they can cover anticipated claims from the insured. This means that they must be able to calculate accurately the average expected loss, and charge a price for insurance accordingly.

There are therefore two basic principles of private insurance provision:

- **risk-based pricing**—insurers have to price insurance on the basis of the risk of the insured, including the probability of a claim being made against the policy and the cost of that claim;
- **risk solidarity within risk pools**—risk is shared between individuals within risk pools, and the premiums of the many pay for the losses of the few.⁴

By placing individuals into risk categories and pooling risks within these categories, insurers set prices such that they reflect the average of the expected claims cost within a risk category. This is illustrated in Figure 1.

Figure 1 Illustration of aspects of insurance pricing



Source: Oxera

³ The discussion here is based on Oxera (2009).

⁴ For further details, see ABI (2008).

The other costs include marketing costs, claims-handling costs and, importantly in this context, the costs of assigning potential customers into different risk pools based on their expected claims frequency and severity.

There is solidarity within risk categories or pools—those who are fortunate in the pool and do not suffer damage contribute to meet the cost of those who do.

Insurers form risk pools such that there is relatively low, predictable, within-group risk variation (ie, the group contains individuals with similar risk characteristics) and relatively large between-group risk variation. Insurers can use a range of characteristics to determine the risk profile of the individual, some of which are outside the individual's control, whereas others are controllable.

There is a large body of literature demonstrating that, in a competitive insurance market, prices reflect costs in each risk pool (ie, pricing is risk-based), and that such risk-based pricing is economically efficient. In addition, in private insurance markets, and where consumers have choice over their levels of coverage in taking out insurance, or their subsequent behaviour once they are insured, departing from risk-based pricing can cause significant problems. In the absence of risk-based pricing, two well-known sources of inefficiencies could arise.

- **Adverse selection**—if low- and high-risk individuals were grouped and charged an equal price based on the average risk in the group, the low-risk individuals would pay a price that is higher than their own risk would indicate and, correspondingly, subsidise the individuals in the group that have higher-than-average risk. This cross-subsidy may result in the low-risk individuals leaving the group as their own policies become too expensive. As they begin to leave, the average risk of the remaining individuals rises, and as more low-risk individuals drop out, this in turn may threaten the financial stability of the insurance activity and the insurer.⁵
- **Moral hazard**—if premiums are set too low (or coverage is too high) relative to what cost-reflective premiums for individuals with certain risk characteristics imply, moral hazard behaviour, in the form of excessive risk-taking by the insured, may arise, and overall risk levels may increase.⁶

In a competitive market, risk-rating factors will be used to separate consumers by risk type when the cost of doing this produces a net gain—ie, when the rating factor improves the insurer's ability to set cost-reflective prices and control the risk in its insurance portfolio. In a competitive market, for a new risk pool to be commercially viable, the additional costs of identifying the lower-risk group of consumers will have to be smaller than the savings that this group could make from being lower-risk. If this is not the case, the company offering the cover to the newly identified lower-risk group

⁵ For the seminal paper on adverse selection in insurance markets, see Rothschild and Stiglitz (1976).

⁶ For an overview of moral hazard, adverse selection and the economics of insurance more generally, see Rees and Wambach (2008).

would not be able to offer that group a lower price than the price the group of consumers could get when it is combined with the higher-risk group. The trade-off between the higher transaction costs to identify risk pools that are increasingly specialised and the need to recover these costs from premiums is a significant determinant (in an unrestrained market) of how the risk pools are constructed.

2.2 Efficiency versus social criteria for risk-rating in insurance

Risk-based, cost-reflective pricing is accepted as being a necessary condition to achieve the economically efficient functioning of private insurance markets. In the context of this study, the relevant question is whether gender is an efficient rating factor, or what the economic impact would be of removing the use of gender from insurance pricing. For a rating factor to be efficient, it must meet a range of actuarial and operational criteria:⁷

- **actuarial criteria**—a variable used for risk-classification purposes must be accurate in measuring risk and statistically reliable. It does not have to be causal, but only reliably correlated and reasonably stable over sufficiently long periods relating to the measurement of the correlated risk and the period of insurance cover that is then provided.⁸ Accurate individual risk assessment (ie, to achieve perfect correspondence between the price paid by an individual and their risk) is likely to be prohibitively costly. It can also be considered as too intrusive and contravening an individual's right to privacy. Efficient risk classification therefore seeks to be as accurate as possible, given the operational constraints.
- **operational criteria**—there are limits to the number and type of rating factors that can be used without making the measurement of the risk and the provision of insurance very costly. In particular, the rating factors used for risk classification should be objective, easy to verify, and overall involve low transaction costs. Gender (like age) is an excellent variable from an operational perspective, not least because it is objective, it is not costly to collate the data, and it can be readily verified from personal identification documents. As further discussed in section 3, from an actuarial perspective, gender is a factor that helps in predicting accident, mortality and morbidity risks and more accurately pricing the insurance policies that cover those risks.

However, the policy debate around the use of gender (like age) in insurance pricing is not so much about economic efficiency than about **notions of equity or fairness**—irrespective of the economic efficiency properties, some believe that differentiation on the basis of gender is not acceptable from a wider societal point of view.

⁷ For a discussion of the criteria for risk classification variables, see Kelly and Nielson (2006).

⁸ Causal factors (ie, where there is a causal relationship between the factor and the risk in question) are likely to have these characteristics, but not all accurate and statistically reliable risk factors are necessarily causal.

Relevant equity/fairness considerations that apply in this context include the following.⁹

- As noted, insurance works by pooling risks across individuals within the same risk group. The actuarially fair outcome is one where all insured in the same risk group pay for the insurance in proportion to the expected costs of insuring the group. What is 'fair' at the group level may not be considered fair at the individual level. That is, there is a distinction between **the group and the individualistic view of what constitutes fairness**. The latter focuses on the fair treatment in terms of individuals, whereas the former supports equal treatment between groups, such that, for each group, the group costs and the group benefits match. For example, in the case of life insurance and pension annuities, at an individual level, members of one gender pay a larger premium or receive fewer benefits than the other gender, on the basis that statistics show a higher average life expectancy for women, which may be explained by biological differences and social factors. Thus, individual men and women are offered significantly different deals. However, at the group level, the payments made by women pay for the benefits enjoyed by women, and the payments made by men pay for the benefits enjoyed by men.
- On a related issue, some may view as unfair the setting of premiums on the basis of **factors over which an individual has little or no control**, as is the case for the gender factor. Individuals within the high-risk gender group, in practice, have limited opportunity to become part of the low-risk group. This might be contrasted to lifestyle factors over which the individual has more choice. Nonetheless, whether certain factors are 'choice' or 'uncontrollable' variables is not clear-cut. Lifestyle, for example, will depend on upbringing and environmental factors, which will be beyond the individual's control to some degree. Furthermore, focusing on an individual's actual behaviour will involve more intrusion for the individual concerned, at least relative to simply observing their gender.
- Another concern about the use of gender as a rating factor is linked to the **stereotypes** or stigma associated with any form of gender differentiation, in particular in light of the inferior average socio-economic status of women. However, in the context of this study, the concern is diminished in that, for some insurance products, women are rated as lower risk and benefit from lower insurance rates. In a competitive market, pricing *arbitrarily* on the basis of gender would not be sustainable.

2.3 Overview of assessment in this study

The economic assessment starts with the current use of gender as a rating factor in UK insurance pricing (section 3). It focuses on the main products where gender is

⁹ For a detailed discussion, see Kelly and Nielson (2006), Thiery and Van Schoubroeck (2006), and Wiegerts (1989).

currently used in pricing (motor insurance, PMI, life insurance and pension annuities) and provides a short overview of:

- how gender is used in pricing, including the degree of the gender-based differentiation (in terms of insurance premiums or benefits for males and females); and
- the gender-based risk differences that underlie the differential pricing.

With UK gender discrimination legislation in place, the results of this analysis are clear from the outset—ie, any gender-based price differentiation must be risk-based and justified by the relevant and accurate statistical and actuarial data. The purpose of this study is not to assess compliance but to evaluate the status quo from an economic point of view and assess the market impacts of a potential ban on the use of gender.

As regards the status quo, there may be objections to the current use of gender even if it can be objectively justified. This study does not examine what is 'fair' or 'equitable', nor does it make any judgement on what distributional outcomes in the market are preferable from an overall societal point of view. These considerations are a matter for policy and cannot be answered by economic analysis.

However, one key economic principle applies irrespective of what views on equity/fairness are adopted: if gender is correlated with risk and improves the accuracy in insurers' pricing models then the removal of gender as a rating factor cannot make the provision of insurance more efficient. Without efficiency gains, any improvement in market outcomes for some individuals can only be achieved by making others worse off. For example, if men paid a lower price for insurance than women because they have lower risk, and if prices were fully cost-reflective, in order for the provision of insurance to remain economically viable overall, the price paid by women could be reduced only if there were a corresponding increase in the price paid by men. In other words, the price reduction for one group needs to be subsidised by another group. Such a cross-subsidy between groups (here, men and women) may be justifiable depending on societal views on equity/fairness and distributional preferences—ie, is £1 saved by one group valued more than £1 extra paid by another group?

All else being equal, and in the absence of any behavioural response, the combined total premiums paid by men and women, and the total combined benefits provided to men and women, do not change if gender is removed from the risk assessment—only the *distribution* of the costs and benefits changes. However, if, as a result of removing the gender factor, other risk-rating factors are now included, and if it is more expensive to assess these factors than to assess gender, then, for the same combined benefits, the combined premiums have to rise to cover this additional expense. Thus, taken together, the group of men and women combined may be worse off. In addition, behavioural responses to the changes in prices experienced by individuals will also change the overall welfare of consumers. It is these effects that are the main focus of this study.

The study evaluates the economic impact of a potential ban on the use of gender and describes the potential distributional and efficiency implications.

As set out in more detail in section 4, the assessment considers the following impacts:

- **the redistribution of insurance premiums and benefits**—this includes the direct redistribution between men and women that can be expected from a ban on the use of gender, as well as the wider distributional consequences brought about by the requirement to charge unisex rates;
- **the impact on insurance providers and their supply response**—this includes the adjustments to insurers' current pricing practices and the costs incurred in doing so, which can translate into further price and product changes for consumers;
- **the wider impacts on market functioning**—these include the consequences for pricing efficiency in the relevant insurance markets—in particular, potential adverse selection effects—and changes in the competitive dynamics of these markets.

These effects vary by insurance market. Hence, the general assessment (presented in section 4) is combined with a product-specific assessment for motor insurance, PMI, life insurance and pension annuities (in section 5). Some of the dimensions of impact are inherently difficult to quantify, so a combination of quantitative and qualitative evidence is used to assess the empirical significance of the impacts, based on Oxera's analysis of data provided by the industry, interviews conducted with insurance providers, a review of the academic literature, and other research methods.

3.0 THE CURRENT USE OF GENDER IN INSURANCE PRICING

An understanding of how and why providers currently use gender in the provision and pricing of insurance products is essential in order to assess current gender-based practices and the potential impacts of restricting providers' usage of gender in this way (which are discussed in sections 4 and 5).

Motor insurance premiums are linked to the risk of the policyholder being involved in an accident (accident risk); medical insurance premiums are linked to the risk of the policyholder falling ill (morbidity risk); and term life insurance premiums and pension annuity benefits are linked to the uncertainty around the timing of the eventual death of the policyholder (mortality risk). Given the differences in the products and the nature of the risks covered, the methods used by insurers to determine insurance premiums and benefits, and the use of gender as a factor, vary by product. Hence, the description in this section considers each of these four products separately.

3.1 Motor insurance

Motorists in the UK are legally obliged to be insured against the costs arising from their liability in the event of injuring others and damaging other people's property resulting from use of a vehicle. In practice, this means that it is compulsory for motorists to have—as a minimum—third-party liability insurance. Beyond this, motorists can choose higher levels of cover. For example, third-party fire and theft policies also cover losses in the event of fire or theft of the policyholder's vehicle. In addition, comprehensive policies tend to cover accidental damage to the policyholder's own vehicle, medical expenses, and loss of (or damage to) personal effects in the vehicle. Such policies may also provide a personal accident benefit, payable in the event of the death or permanent disablement of the policyholder.¹⁰

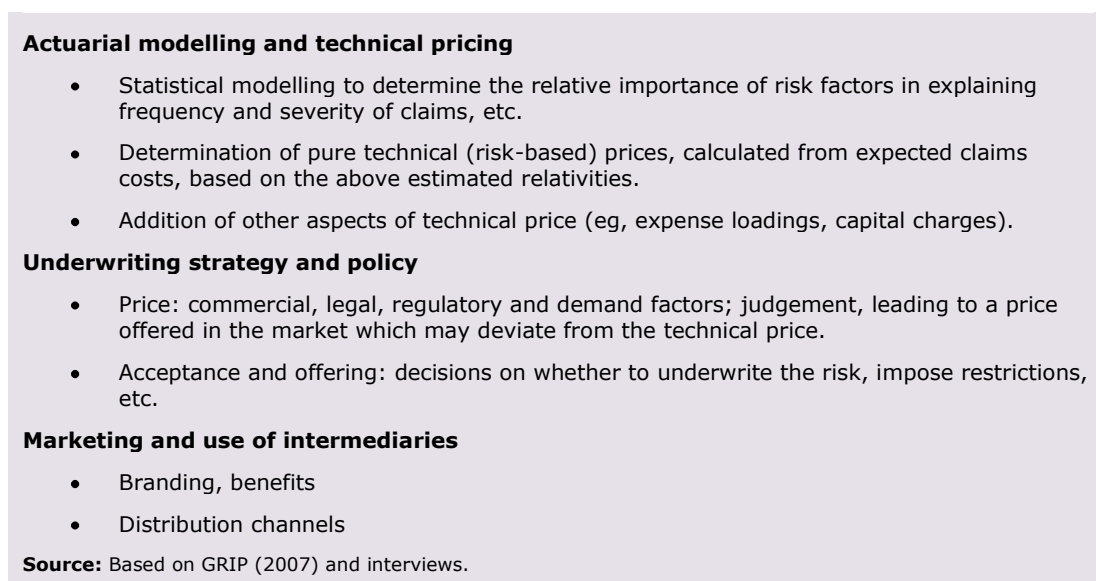
In total, based on ABI statistics, more than 60 companies are actively involved in providing motor insurance in the UK. Motor insurance constitutes the largest segment in the retail non-life insurance market for individuals.

3.1.1 How is gender used in motor insurance pricing?

The provision of motor insurance can be broken down into three key stages, as summarised in Figure 2. Other insurance products also follow these steps, although the exact application will vary according to the nature of the product.

¹⁰ See ABI website.
http://www.abi.org.uk/Information/Consumers/General/What_does_Motor_Insurance_Do.aspx

Figure 2 Three main stages of motor insurance provision



This study does not evaluate each of these stages in any detail, but focuses on explaining the use of gender as a risk-rating factor—ie, the first stage, ‘actuarial modelling and technical pricing’. This stage involves determining the expected claims costs and is typically the most demanding element in pricing insurance. It requires detailed statistical modelling of the frequency and cost (severity) of claims to ensure that risks are correctly priced.

In the case of motor insurance, a key risk is that the policyholder is involved in a traffic accident. Motor insurers need to understand the likelihood of this, and the severity of any claim arising.

Generalised linear model (GLM) analysis is now the main method used to price risk and determine the relative rates by rating factor. In these models, gender appears both as a stand-alone variable, but also in various and potentially complex interaction terms with other factors (eg, gender in combination with age and vehicle type). For example, an 18-year-old male driver wishing to insure a high-performance car may be subject to high premiums, not so much because of gender per se, but because of the driver’s age and how gender and age interact with the type of car for risk-based pricing purposes.

Table 1 below summarises the risk-rating factors typically used in GLMs, and ultimately in the pricing of motor insurance.

Table 1 Typical risk-rating factors for private motor insurance

Driver characteristics	Driver experience factors	Vehicle factors	Environmental factors	Policy factors
Age	Length licence held	Vehicle group	Residency	Policy duration
Gender	Type of licence	Vehicle value	Rating area (postcode)	Excess (eg, level; mandatory or voluntary)
Marital status	Accidents/claims in the last x years	Immobiliser/ alarm status	Overnight parking arrangements	No-claims discount, and whether it is protected
Occupation	Convictions/ endorsements	Use (eg, maximum mileage)		

Source: Based on GRIP (2007).

Table 1 shows that, while gender is an important factor in motor insurance risk assessment and hence pricing, it is not the only factor—in practice, insurers consider a wide range of variables to predict claims frequency, severity and so on.

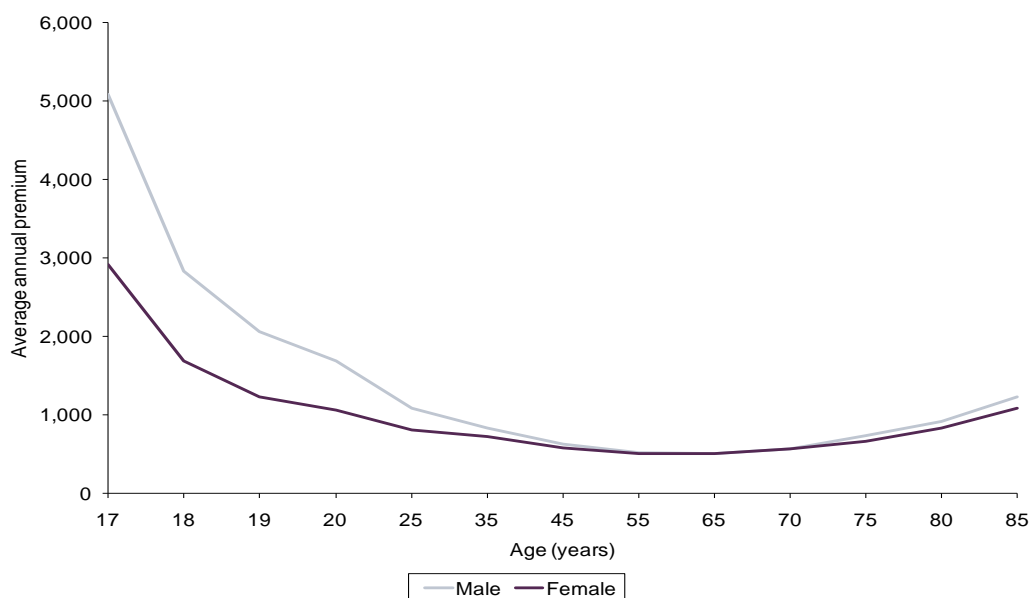
As discussed below, gender correlates with other, unobservable factors not included in the model, such as propensity to take risk, which are altogether more difficult to observe and measure. Based on the above actuarial models, where gender is found to be both material and statistically significant in explaining risk, it can then be used to determine expected claims costs and hence risk-based prices for insurance. Pricing on this basis ensures that differences in prices reflect differences in the expected costs of provision.

In addition to claims costs *per se*, insurers need to include within premiums additional costs, in order to determine final technical prices. These costs include expense (overhead) loadings, reinsurance costs, capital charges, and any provisions for delays in receiving payments (GRIP 2007). In practice, therefore, technical prices are the sum of risk-based prices plus other loading factors.

An illustration of the resulting market prices available for males and females is shown in Figure 3, which reports the average of the price quotes for comprehensive cover obtained from a price-comparison website, by gender and age (holding other factors constant).¹¹

¹¹ The quotes obtained from price-comparison websites (for motor insurance and the other products below) do not reflect prices across the whole market—eg, some insurers do not sell through this channel. However,

Figure 3 Average annual premium for motor insurance (£)



Note: The figure shows the average annual premium for males and females at different ages for insuring a Vauxhall Astra with comprehensive cover. Additional assumptions are made about other factors (eg, postcode) and held constant in the gender comparison. Data based on quotes in May 2010.

Source: Confused.com, and Oxera calculations.

Figure 3 shows that the gender differential is most apparent for young drivers—at ages 17 to 25 females pay significantly less than males. The gap narrows by age 25. Indeed, the price differential declines significantly and disappears for people aged 35 years or more. This pattern is well-established in other studies.¹²

3.1.2 Why is gender used as a rating factor in motor insurance pricing?

Figure 3 illustrates that it is not gender per se that drives differences in premiums, but the interaction between gender and age. In essence, the reason why young male drivers are charged higher premiums than young females is that they pose a higher risk, and higher cost, to insurance companies. Young males are more likely to claim on their policies, and the cost of these claims is higher than for female drivers.

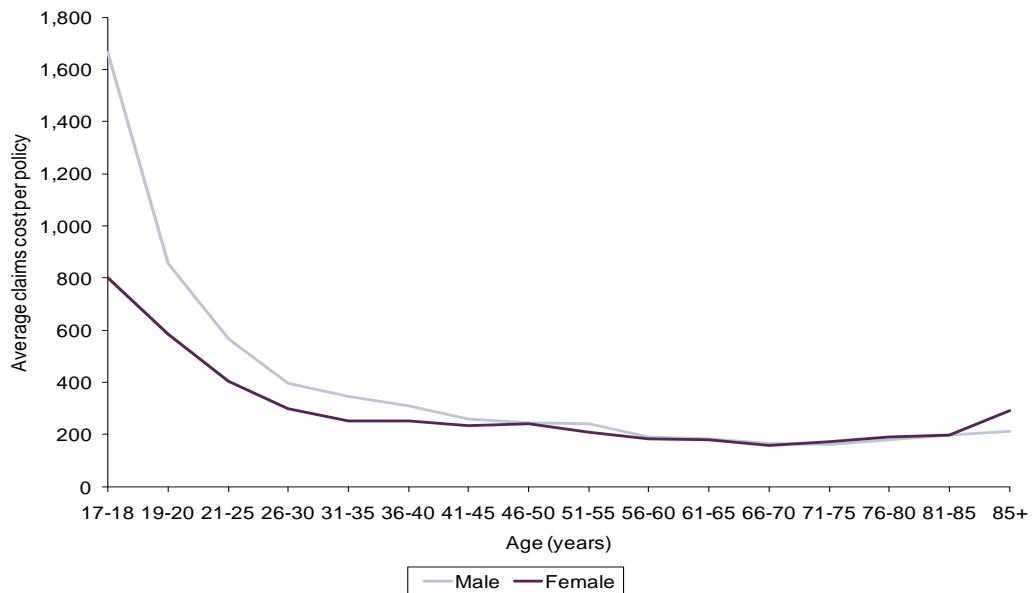
There is significant data to support the differences in claims costs. For example, Figure 4 presents the male and female average claims cost per policy based on aggregate motor insurance data collected by the ABI. The measure reflects both the differences in the frequency and the severity of claims between male and female drivers. It is

the aim of presenting this data here is not to provide a complete description of prices in the market, but to illustrate the direction of the gender pricing differentials.

¹² See Moneysupermarket.com (based on 2008 data) at <http://www.moneysupermarket.com/c/news/why-male-drivers-pay-more/0005450/>; and Swiftcover.com (based on 2008 data) at <http://www.swiftcover.com/about/press/stone-age-drivers-higher-insurance/>

based on 2006 motor insurance data covering approximately 90% of the UK motor insurance market.

Figure 4 Average claims cost per policy for motor insurance (£)



Note: This figure shows average claims cost per policy. Based on aggregate ABI market data for motor insurance in 2006, collected and published in accordance with HM Treasury guidelines.

Source: ABI.

Consistent with the pattern on gender price differences by age, Figure 4 shows that the average claims cost per policy issued is higher in the case of young male drivers than in the case of young female drivers.

These findings, based on insurance data, are also backed up by UK population statistics. For example, statistics from the Department for Transport (DfT, 2008) show that, where an accident was reported, the number of male drivers classed as exceeding the speed limit was more than six times the number of female drivers, and over three times as many male drivers were classed as travelling too fast for the conditions than females. Younger drivers—especially younger males—were in particular more likely to be exceeding speed limits. Similarly, according to the UK Ministry of Justice (2008), in 2006 male drivers were responsible for 80% of all speeding offences, and 90% of all driving offences.

This also links in with the number of casualties reported, and the severity of the accidents concerned. For example, the DfT finds that males accounted for 63% of casualties in accidents where speed was reported as a factor. In these accidents, 74% of serious injuries involved men and 80% of fatalities were male.

The DfT also highlights that women are much less likely to be involved in drink-driving accidents than men (although nearly one-third of all casualties in such accidents are women).

These trends are also observed in a study of international experience by the World Health Organization (WHO 2002). In the USA, where large numbers of teenagers drive motor vehicles, young men are at especially high risk, with road traffic fatality risks nearly twice those observed for young women. Alcohol use is a factor in one-third of all fatal crashes involving teenagers, with the risks highest among young males.

In line with these statistics showing gender risk differentials, the interviews conducted by Oxera with UK motor insurers also indicated that:

- age is a more important factor than gender in pricing motor insurance. However, in the GLMs, the interaction factor between age and gender as well as between gender and vehicle type for young drivers was important in the pricing models. Young males driving fast cars are a particular risk;
- the gap in terms of risk between male and female drivers, and hence the importance of gender (and its interactions with other factors), matters less from age 25 or 30 upwards;
- older females (above 75) tend to be of slightly higher risk than older males. For example, this may be due to a 'widow effect' where, in this generation, the husband would have been the main driver in the household;
- males typically have higher mileage and drive larger vehicles than females, which adds to the risks for males; and
- while young males are riskier than young females, females are also gradually becoming more risky over time.

Interviewees noted that underwriting judgement would often be used in serving the young end of the market. For example, an 18-year-old male driver wishing to insure a high-performance car may be subject to high premiums or indeed not be offered cover at all by some insurers, not so much because of his age but because of how gender interacts with both age and the type of car for risk-based pricing purposes. Also, some insurers applied restrictions for covering young males, such as imposing restrictions on what car types would be covered (ie, excluding high-performance vehicles), or requiring larger policy excesses for drivers under 25.

As noted above, a statistical association between a rating factor and risk response is sufficient for actuarial pricing of insurance. However, there is also a theoretical basis for why young male drivers present a higher risk than young females, and a growing empirical literature on this issue. There may be underlying physiological and psychological reasons why young males in particular present a higher risk. For example, the psychology literature on personality, as applied to motorists, reveals that, on average, young male drivers:

- are more likely to view driving as a challenge, and engage in riskier 'sensation-seeking' behaviour;

- have overconfidence in their ability to drive, in terms of their perception of risk relative to what constitutes objective risk;
- can be more aggressive, and are more likely to express aggression in an unconstructive way; and
- exhibit a greater likelihood of breaking the rules (eg, by speeding), while disregarding potential adverse outcomes (ie, accidents).

The Social Issues Research Centre (SIRC) (2004, 2008) and Hole (2007) summarise a number of studies that look into the above issues. However, studies vary in the extent to which gender is cited as determining personality.

SIRC (2008) proposes that evolutionary psychology provides useful insights into these issues. In particular, much of day-to-day human behaviour is determined by the older part of the human brain—that shared with our stone-age ancestors. In contrast, the human brain has not specifically evolved to drive motor vehicles. Young males may still be influenced by their male role as hunter-gatherers, which may therefore explain their greater likelihood of engaging in impulsive risk-taking, and aggressive driving behaviour.

On a related (physiological) issue, testosterone levels, which can fuel aggressive and sensation-seeking behaviour, are lower in females—and in older males—than in young males, which may further explain why male drivers take more risks than women.¹³

Men and women also appear to have different types of accident. While men are more likely to have an accident due to risk-taking and speed, owing to the factors discussed above, women are more likely to have an accident due to errors in spatial perception, such as when pulling out of a junction (SIRC 2004). This may also explain, in part, why claims severity is higher for male drivers than for female drivers: claims by female drivers may be for minor dents and scratches, whereas male drivers tend to have more major accidents.¹⁴

3.2 Private medical insurance

Private medical insurance (PMI) protects individuals from the risk of incurring medical expenses. In return for a premium, the insurance company pays the medical expenses, subject to specified exemptions (eg, pre-existing conditions).

In the UK, PMI is available for protection in addition to the publicly funded healthcare system, the National Health Service (NHS), which covers all UK residents. As a result, the use of this insurance product is not yet widespread: less than 8% of the population is covered by PMI. PMI provides voluntary, supplementary cover, and does not cover all health services, such as accident and emergency.

¹³ See Swiftcover.com (2008) and SIRC (2004).

¹⁴ See Swiftcover.com (2008).

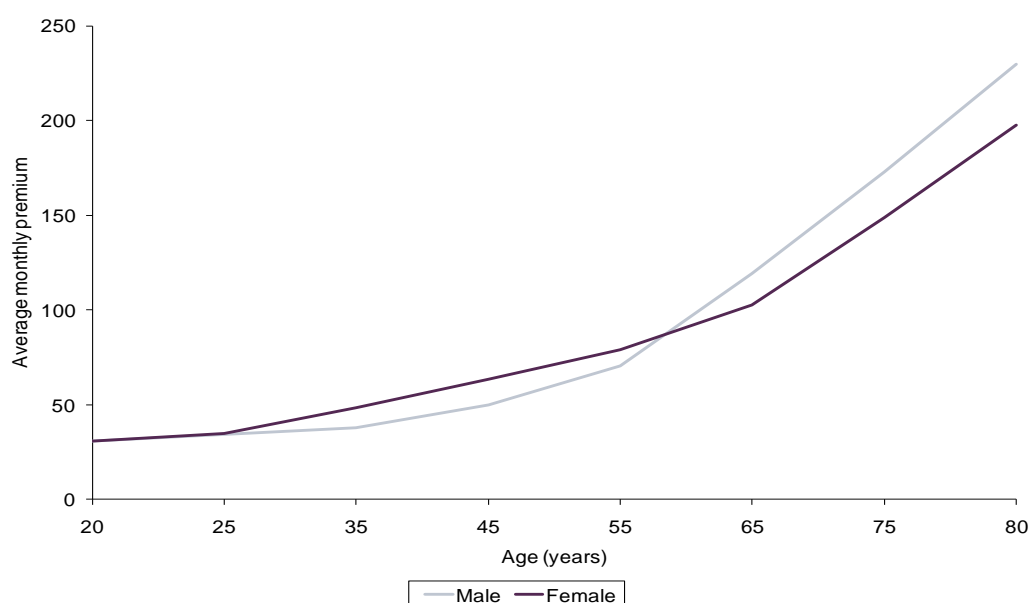
3.2.1 How is gender used in private medical insurance pricing?

The use of gender in insurance pricing is a relatively recent phenomenon, and a number of PMI insurance providers do not use gender in their pricing models. Instead, the key pricing factors used are age, postcode and level of coverage, as well as having a no claims discount in some cases.

In addition to pricing, the underwriting process is critical to control the risk of an insurer's PMI portfolio. There are two types of underwriting—full medical underwriting based on a detailed medical questionnaire or moratorium underwriting. In the latter case, when an applicant joins a plan, the insurer excludes any medical conditions for which advice, treatment or medication has been sought in the previous, say, five years before the start of the plan. If the condition does not occur again within a number of years, the terms may change and cover may apply. As such, health conditions will also affect the risk coverage.

Figure 5 shows the average monthly premiums by age and gender for mid-cover PMI quotes as available from a price-comparison website.

Figure 5 Average monthly premium for PMI (mid-cover) (£)



Note: This figure presents quotes for mid-cover PMI, which includes in- and out-patient benefits, but excludes certain treatments such as psychiatric treatment and physiotherapy. Based on quotes in May 2010.

Source: moneysupermarket.com.

Up to the age of 25, there is no differentiation by gender in the premiums offered. For older ages, the direction of the differentiation goes both ways—for ages between 35 and 55, the premium for females is higher than for males, whereas from age 65 onwards males pay more in PMI premiums. This result is driven by an insurer that offers gender-differentiated mid-cover PMI on this price-comparison website. For basic cover on this price-comparison website, for example, all insurers appear to set a unisex premium.

The use of gender can be justified as it enables technical pricing accuracy (see below). The actual use of gender in PMI pricing will be influenced by additional considerations:

- policies sold on a group rather than individual basis (eg, via the employer) have the overall policy priced on the basis of the gender mix in the portfolio rather than the individual risk;
- joint policies, taken out by the policyholder to cover their spouse and other dependants, are such that gender-specific pricing does not apply;
- pricing is evolving as the PMI market is growing and becoming increasingly sophisticated; insurers who currently do not use gender may adopt it as a rating factor in the future;
- medical underwriting excludes pre-existing health conditions, certain of which are gender-specific;
- some gender-specific risks are affected by the no-claims bonus, which means that premiums increase once a claim is made.

3.2.2 Why is gender used as a rating factor in PMI?

To date, the use of gender as a rating factor has not been as widespread in the pricing of PMI as in the other insurance products considered in this report. However, from a risk-based pricing point of view, its use is justified, and for those insurers that do use it, this is done in line with the differences in the costs of providing PMI to males and females.

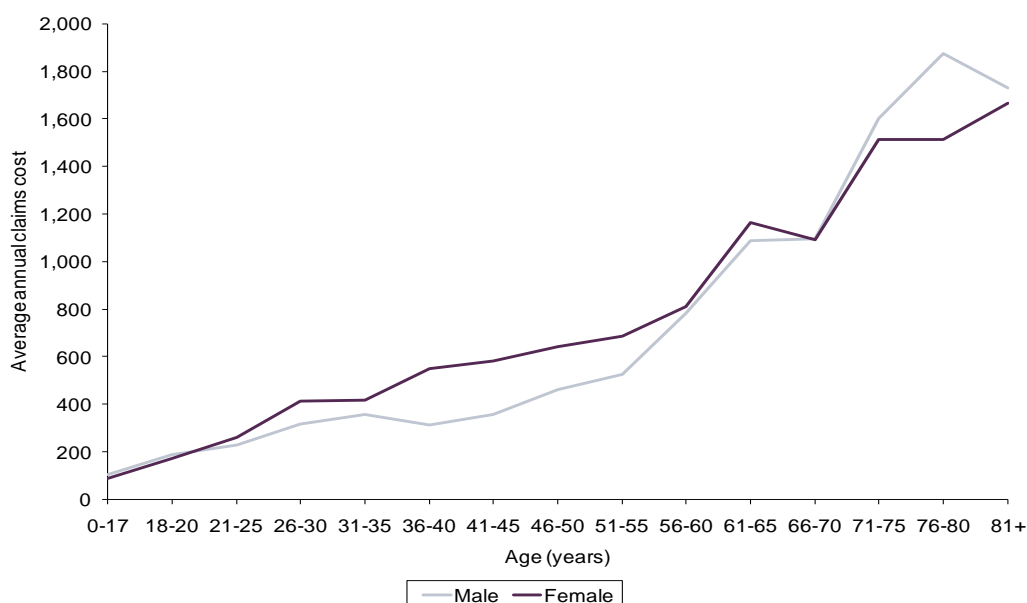
The cost differences arise from the fact that some medical conditions for men and women differ (in terms of the type of condition as well as the frequency and severity of the condition occurring). For example, in the UK, breast cancer is around 150 times more common in women than in men.¹⁵ In addition, given that different illnesses tend to happen at different times in life, the differences in costs between men and women vary for different ages. For example, heart diseases, which are more commonly suffered by men than women, also become more prevalent at older ages.

The average (annual) claims costs per PMI policy by gender and age are presented in Figure 6.¹⁶ For younger people, up to the age of 35, the costs of claims made by males and females seem to be broadly aligned; for ages between 35 and 55 or 60, females have higher claims costs than males; and the pattern reverses for older ages, when men have higher claims costs.

¹⁵ See, for example, the Cancer Research UK website, at <http://www.cancerhelp.org.uk/type/breast-cancer/about/types/breast-cancer-in-men>

¹⁶ Additional data was provided by individual insurers. For example, based on the data of one insurer, for policyholders aged 20–40, the average claims costs of females were around 35% higher than males. For females in this age range, 22% of claims costs were related to gender-specific conditions, whereas for males this was less than 2%. If gender-specific conditions were excluded from the analysis, claims costs for males and females would be more similar in magnitude.

Figure 6 Average annual claims cost per PMI policy (£)



Note: This figure shows average claims cost per policy. Based on aggregate ABI market data for PMI in 2006, collected and published in accordance with HM Treasury guidelines.

Source: ABI.

This aggregate cost data discussed above is in line with the premium structure illustrated in Figure 5 above. Put differently, price differentials between males and females can be explained by differences in costs.

It is not possible to map premiums exactly to costs (for PMI or for the other products considered in this section), for various reasons, including the following.

- The data on premiums is obtained from price-comparison websites and applies only to those insurers that appear on these sites, whereas the data on claims costs or risks is based on market averages. Individual insurers will price on the basis of their own portfolio, which may carry a different risk to that of the average in the market.
- The data on premiums compares prices by gender and age while holding other factors constant, whereas the data on claims costs refers to aggregate claims which may differ along other dimensions (eg, postcode, no claims discount, and level of cover).
- Premiums are set by taking into account not only the claims costs, but also other costs (eg, administration, distribution) and strategic considerations.

Overall, the use of gender in PMI pricing is more limited than for the other products, but where it is used, it can be justified by the underlying actuarial and statistical data, which is expected given the UK gender discrimination legislation in place.

3.3 Term life insurance

Life insurance is used to provide financial protection to beneficiaries in the event of death of the insured person. This study focuses on term life insurance, which provides coverage for a specified term of years. Typically, the insurer pays a lump sum of money if the insured person dies during the policy term. In return, the insured person pays a stipulated premium at regular intervals. Term life insurance policies do not accumulate cash value. In the UK, term life insurance is available for periods lasting anywhere from one to 30 years, and premium payments can be set up to be paid monthly or annually.

3.3.1 How is gender used in term life insurance pricing?

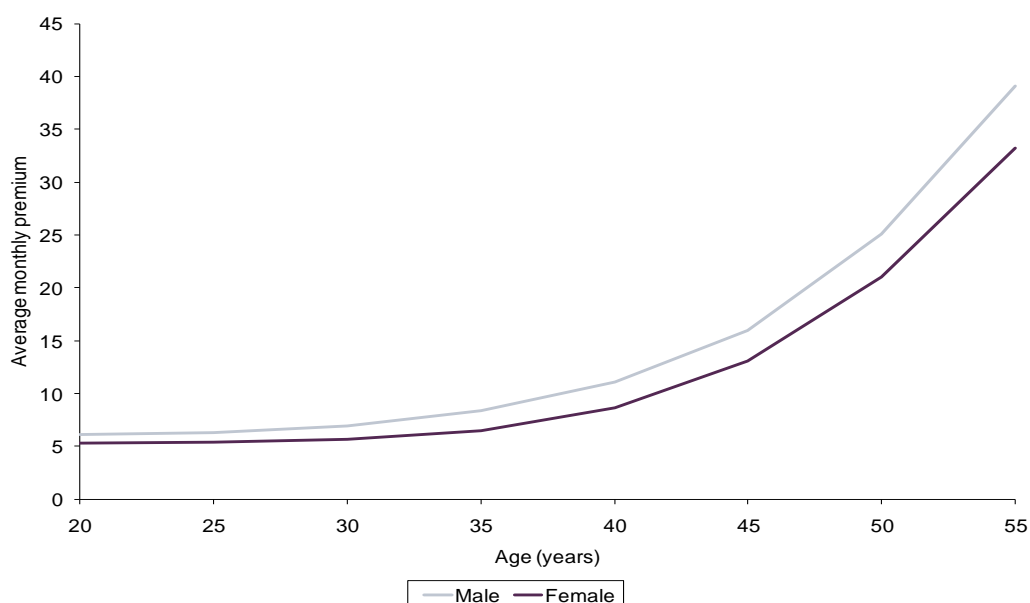
Given that, if the insured person dies, the insurer has to pay a lump sum of money to the policy-named beneficiaries, the probability of a person dying is the most critical factor in pricing life insurance policies.

Other than a person's age, gender is the second most important factor used in the pricing of term life insurance (as well as in pension annuities discussed in section 3.4 below). Other factors, such as smoking status or the postcode (which is a proxy to measure socio-economic status), have been added more recently to the pricing models. Nonetheless, age followed by gender remain the key factors considered.

As such, the pricing structure for life insurance is considerably more straightforward than that applied, for example, in motor insurance, where a significantly larger number of rating factors are used to price insurance. The simple pricing structure in life insurance (and pension annuities, as described below) works because it is combined with more detailed medical underwriting.

Figure 7 below illustrates, based on data from a price-comparison website, the market average monthly premium that men and women would pay for a ten-year term life insurance policy of £150,000 taken out at different ages.

Figure 7 Average monthly premium for life insurance (£)



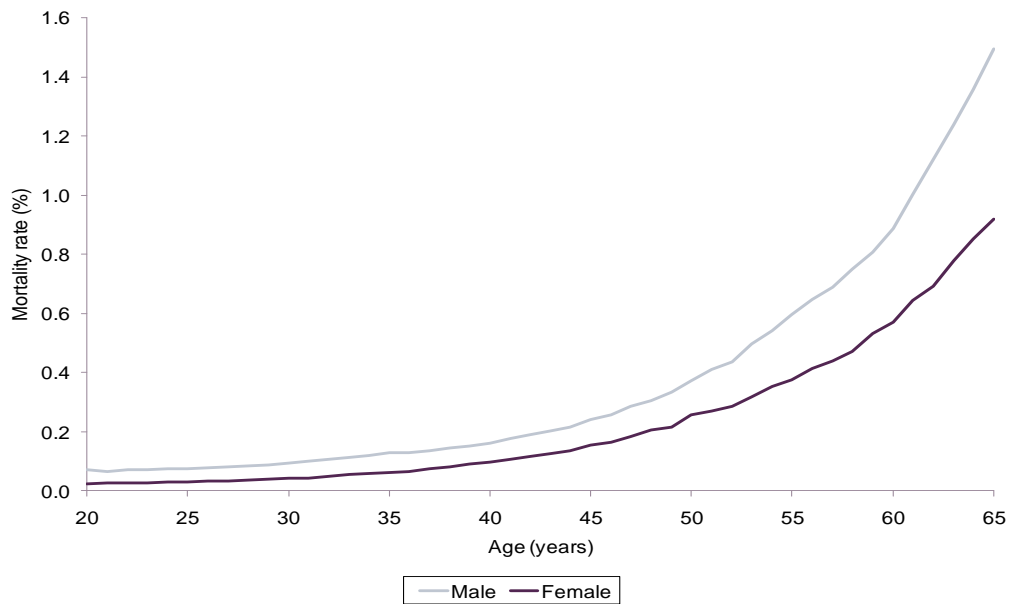
Note: This figure shows average monthly premium by gender and age for a life insurance policy with a value of £150,000 for a ten-year term (single, non-smoker). Based on quotes in May 2010.

Source: moneysupermarket.com.

Other than the steep rise with age (which illustrates the importance of age in life insurance pricing), Figure 7 shows that men pay more than women at every age. For example, in relative terms, a 35-year-old man would pay on average £8.40 a month, compared with the average female premium for the same policy of £6.50 a month—ie, a premium difference amounting to a 30% higher premium for men.

3.3.2 Why is gender used as a rating factor in term life insurance?

Gender is a key factor for estimating the probability of a person dying, as is evidenced by a range of mortality statistics. Figure 8 below presents UK mortality rates based on Office for National Statistics (ONS) data. These mortality rates indicate the probability of a person dying during the following year, at different ages and by gender.

Figure 8 Mortality rate in the UK (%)

Note: The mortality rate between age x and $(x + 1)$ is the probability that a person aged x exactly will die before reaching age $(x + 1)$. Based on ONS Interim Life Tables, using 2006 to 2008 data.

Source: ONS.

The mortality rate increases with age, and, for all ages, is higher for males than for females of the same age. Again, the similarity to the pattern of premiums suggests that the gender-based differentials in premiums can be explained by differences in the risks and costs of insurance provision. Due to their lower mortality risk, females benefit from lower premiums on life insurance.

The gender differences in mortality risk are further discussed below in the context of pension annuities—whereas life insurance protects against the risk of death, pension annuities protect against the risk of outliving one's financial resources.

3.4 Pension annuities

A pension annuity takes a lump sum, usually from a pension award, and converts it into a regular stream of payments from a given age over the remaining life of the policyholder. This product is most often used to provide stable income in old age. The stability is achieved because annuity payments continue until the death of the policyholder, insuring them against outliving their wealth in the event of living longer than expected.

In the UK, workers who have accumulated tax-preferred defined-contribution retirement savings are required by law to purchase an annuity when they retire, which must include savings accumulated through occupational pension schemes, to which an employer and employee both contribute. Here, the employer tends to choose the annuity provider, usually through an existing arrangement. Also included are savings

accumulated through personal or stakeholder pensions. Here, individuals have a choice of annuity provider.

Each year the UK annuity market attracts between £7 billion and £8 billion from maturing pension funds. While the vast majority of annuities sold are compulsory, this may change in the future as the new coalition government is considering changing the compulsory annuitisation requirement (HM Government 2010).

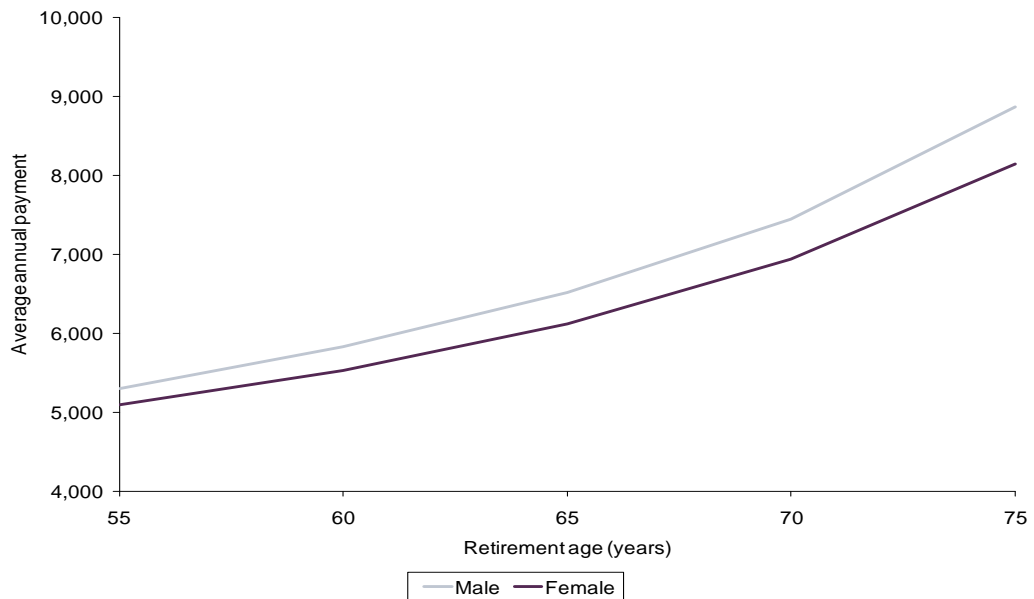
In the UK annuities market, the majority of annuities are bought on a single- rather than joint-life basis, where payments are based on the lives of two people, and continue until both die. The majority of annuitants are male (77% in the compulsory market) (Cannon and Tonks 2006).

There is a very small segment of the annuity market for which there is a unisex pricing requirement by law; namely, for protected-rights pensions, which are pensions that arise when the individual contracts out from the additional state pension scheme. The unisex requirement here corresponds to the unisex benefits available under the state pension (Equal Opportunities Commission 2004). This part of the market is small and is not considered further in the description below.

3.4.1 How is gender used in pension annuities pricing?

The use of gender in pricing annuities is very similar to that used in pricing term life insurance: a typical pricing model would use age as the most important variable, followed by gender, lifestyle (in the case of enhanced annuities) and medical conditions (in the case of impaired life annuities), with pricing according to postcode being a more recent innovation.

Based on data obtained from price-comparison websites, Figure 9 below shows the market-average annual payment that retired men and women would receive from converting a pension fund of £100,000 when they retire if they retired at different ages. Note that this amount of pension fund is significantly higher than the typical amounts converted in practice, but the focus here is on illustrating the benefit differential between men and women.

Figure 9 Average annual payment from pension annuity (£)

Note: The quotes are for an illustrative purchase price of £100,000 by a single non-smoker (although actual amounts currently tend to be considerably lower for most people). They refer to a standard single-life annuity, without escalation (ie, no option to adjust for inflation) and no guarantee (ie, payment is until death, rather than for a guaranteed period). Based on quotes in May 2010.

Source: Find.co.uk, and Oxera calculations.

On average, men can expect to receive a higher annuity payment than women for the same pension fund. This is observed across the ages.

These prices are illustrative for standard pension annuities. In addition, the market offers impaired-life annuities to people who suffer from certain serious medical conditions, such as cancer, heart disease, strokes, etc. Because of the reduced life expectancy associated with these conditions, insurers are able to pay a higher level of income than for a standard annuity. Normally, full medical details are required to obtain enhanced rates, and for this reason it usually takes slightly longer to obtain quotations. Although the insurer then obtains detailed medical information on the insured individual, gender remains an important rating factor. That is, impaired-life annuity prices still differ by gender, albeit to a lesser degree, given that pricing can occur on the basis of detailed individual risk information.

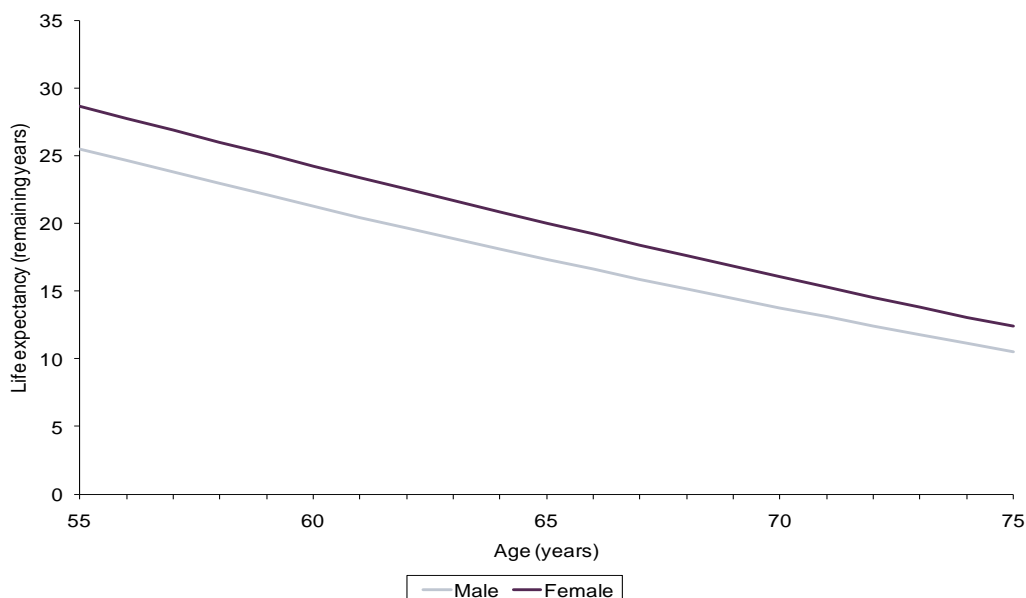
3.4.2 Why is gender used as a rating factor in pricing annuities?

Given that the duration of the payment stream in an annuity contract lasts until the death of the retired person, life expectancy is central to pricing annuities. Insurance companies charge more (ie, pay lower annuities for a given lump-sum upfront payment) to those who are more likely to live longer. As a result, understanding the drivers of longevity is essential to insurance companies when pricing annuities.

As already shown in section 3.3 above using mortality rates, gender is (after age) one of the most significant factors in determining how long someone is expected to live for.

Figure 10 shows life expectancy in the UK (in terms of how many more years a person will live for) for both genders at different ages.

Figure 10 UK life expectancy



Note: This figure shows life expectancy, in terms of remaining years, as the average number of years that those aged x exactly will live thereafter. Based on ONS Interim Life Tables, using 2006 to 2008 data.

Source: ONS.

The data shows that life expectancy depends on gender—ie, at every age, women can expect to live longer than men.

This data matches the pattern in annuity prices, as shown above in Figure 9. Females are expected to live longer than males, and hence receive lower annuity rates—ie, the same pension fund needs to be converted into a longer stream of regular annuity payments. For example, based on the ONS life expectancy statistics in Figure 10, a 65-year-old man can expect to live another 17.37 years, compared with another 20.4 years for a woman of the same age. The average annual annuity payment on a £100,000 pension fund (as per the data in Figure 9) would be £6,510 for a man and £6,111 for a woman. Table 2 below summarises the information and calculates a 'total expected lifetime annuity benefit'. This is obtained by simple multiplication of the annual annuity payment and the expected number of years over which it is paid, without any discounting or further adjustment. In addition, the table reports the net present value (NPV) after discounting the annuity payment stream by a 5% and 10% discount rate.

Table 2 Life expectancy and annuity benefit

	Annual annuity payment (£)	Number of years expected to live	Total annuity benefit (£)	NPV of annuity benefit (5%) (£)	NPV of annuity benefit (10%) (£)
Male	6,510	17.37	113,079	74,395	52,654
Female	6,111	20.04	122,464	76,244	52,059

Note: This table shows the average annual annuity payments for a 65-year-old man and a 65-year-old woman (as per Figure 9) and life expectancy (as per Figure 10). The total annuity benefit is calculated as the simple product of the annual annuity payment and the number of years expected to live, without discounting. The NPV refers to the net present value of the annuity payments, at different illustrative discount rates.

Source: Oxera calculation.

This illustration shows that the lower annuity rate for women (in terms of the level of payment *per year* while still alive) can be explained by the need for any given pension fund to be converted into a longer expected annuity stream, given the greater longevity of women. The result is that, for the same lump sum, females will on average receive a lower amount per year, but over more years—indeed, in this example based on average current UK annuity rates, females tend to get a higher-value annuity benefit on average.¹⁷

Although the existence of gender differences in life expectancy is clear, the precise reasons underlying those differences are not yet clearly understood. While some of these differences may be due to lifestyle, others may be explained by genetic differences. This issue is potentially important because if the differential is due to lifestyle, insurance companies could pick up the gender effect by using other lifestyle variables, such as drinking habits, or risky work conditions—albeit at greater cost (see section 2 on operational criteria for rating factors). (It should also be noted that if lifestyle factors could capture the risk differential that is currently captured by gender, the overall result for males and females would not change significantly—females as a group would still receive less per year for any given lump sum compared with men as a group. However, within the group of females (or males), there would be more variation at the individual level caused by the respective lifestyles of each individual.)

This debate between lifestyle and gender in terms of causality has been much discussed elsewhere,¹⁸ and is not repeated here. What seems to emerge is that, while behavioural and cultural factors partly explain men's higher mortality risk, genetic differences are also likely to be important—ie, there appears to be a fundamental difference in mortality risk between men and women which cannot be explained by lifestyle or other factors.

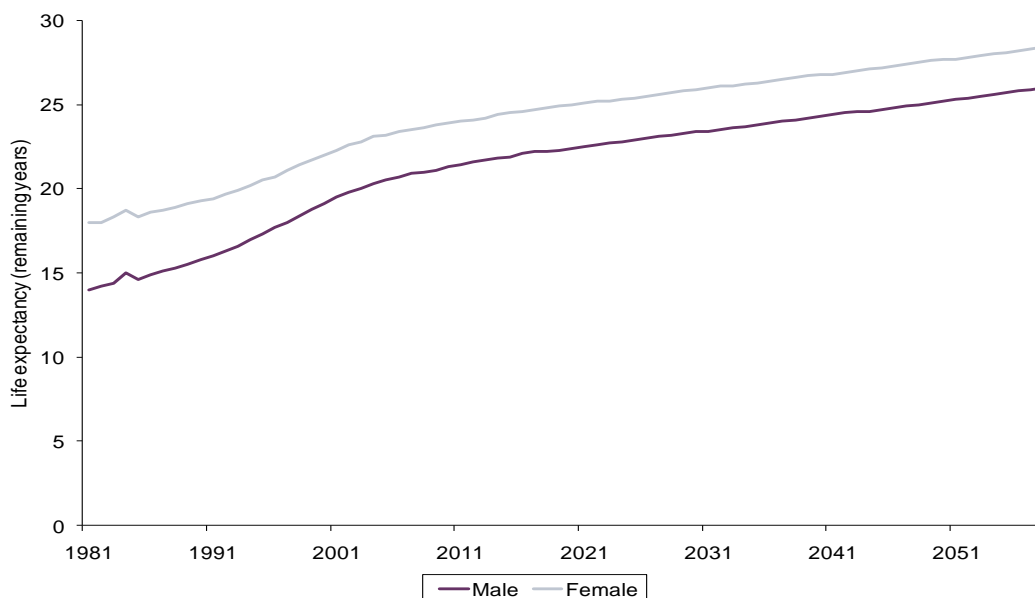
Regardless of the precise explanation for why males and females have differing life expectancies, the gap between the genders looks set to remain in place for some time. ONS (2010) Pension Trends forecasts that, in the UK, the gap between male and

¹⁷ In the example, the discount rate would have to rise to 10% before the total discounted annuity benefit for females falls somewhat below that of males.

¹⁸ See ONS (2005) and Hudson (2007).

female mortality will remain up to at least 2051. Based on this study, Figure 11 presents historical and projected life expectancy for males and females aged 65.

Figure 11 Historical and projected life expectancy at 65



Note: This figure shows life expectancy of a person aged 65 over time, with forecasts up to 2051.

Source: ONS.

The gender gap in life expectancy may have fallen over time and may continue to fall, and the gender differences in prices can be expected to all correspondingly. However, as long as there are differences in longevity by gender, using gender as a rating factor can be objectively justified and improves the accuracy of pricing.

3.5 Summary

On the basis of the above analysis, a number of general conclusions can be drawn that are relevant for the assessment of a potential ban on the use of gender in insurance pricing.

- The UK is generally considered to have healthily functioning, competitive private insurance markets. Risk-based pricing, using sophisticated risk-classification techniques and pricing models, is a key principle underlying the efficient operation of these markets.
- There are significant differences between females and males in their accident risk, morbidity risk and mortality risk. Hence, the costs of providing insurance products to cover these risks differ between men and women, including motor insurance, private medical insurance, life insurance and pension annuities.
- Gender is used as a rating factor only when it helps to price the risks covered by the insurance products in question. It is used in addition to (and in combination with) other rating factors in the pricing of the risks. Depending on the product in

question, gender presents an important risk factor and, for some products, it is the second most important factor used (after age).

- In the status quo, there is no systematic bias in the pricing of insurance against either gender, and no corresponding detriment for females or males in the sense of either gender being overcharged compared with the costs they impose on providers. Any such overcharging would not be sustainable in a competitive product market.
- The use of gender as a risk-rating factor in insurance pricing varies depending on the product and the gender risk differential. For example, for motor insurance, young female drivers currently pay significantly less than young male drivers; and in the annuity market, women may receive a lower annuity payment in any year, although this payment stream can, in general, be expected over a longer period of time, such that for the same amount of annuity purchased, women receive the same total annuity benefit as (or indeed higher than) men.
- In line with UK gender legislation (and the EU Gender Directive), the use of gender as a factor in insurance pricing is based on the relevant actuarial and statistical data on gender-related risk differences, which are published in accordance with HM Treasury guidelines.
- The removal of gender as a rating factor would therefore correspond to the removal of a relevant risk-rating factor and would reduce pricing accuracy. The consequences of this are discussed in sections 4 and 5.

4.0 THE IMPACT OF A BAN ON THE USE OF GENDER IN INSURANCE PRICING

This section examines the potential impact of banning the use of gender in insurance pricing. It first makes some general observations on the likely implications of a gender ban (section 4.1), drawing from the analysis of the status quo in section 3. It then examines each of the main impacts at the general level (sections 4.2 to 4.4). Section 5 then discusses in more detail the available evidence base for each insurance product.

4.1 Overview of potential impacts

The analysis of the status quo in section 3 shows that, where gender is used in insurance pricing, this can be objectively justified by the relevant statistical and actuarial data—ie, the use of gender improves risk-based pricing.

Some may consider gender differentials in insurance pricing to be unacceptable per se, even if this can be justified by objective evidence and is 'fair' from an actuarial perspective. Irrespective of what views are taken on what is 'fair' or socially acceptable (see also section 2), a ban on a relevant risk-rating factor such as gender cannot be achieved without costs. These costs can be high where gender is highly correlated with risk—where there is no correlation, there is no impact (and gender would not be used in product pricing in the first place).

This means that those who object to the use of gender as a rating factor on the grounds of fairness or other reasons would nonetheless need to take into account the full consequences of a gender ban. They would need to weigh the perceived benefits against the efficiency costs resulting from a restriction of risk-based pricing, as well as against the wider distributional impacts and other aspects of fairness that may be compromised.

In private insurance markets, any restriction on a relevant risk-rating factor cannot make the provision of insurance more efficient. Hence, any improvement in the insurance terms for one group of consumers (eg, females) can only be achieved at the detriment of other groups of consumers (eg, males). Within an insurance portfolio, for a given level of coverage, premium reductions for one part of the portfolio require premium increases for others so as to ensure that the activity remains economically viable overall. Moreover, to the extent that the provision of the insurance becomes less efficient, the higher cost of provision will also ultimately be borne by consumers.

The impact of a ban on the use of gender as a risk-rating factor varies by insurance product (also because of the variable degree of gender correlation with the risks being insured), but the same economic considerations apply. As illustrated in Figure 12, there are three broad categories of potential impact, each with detrimental consequences for consumers or the wider market.

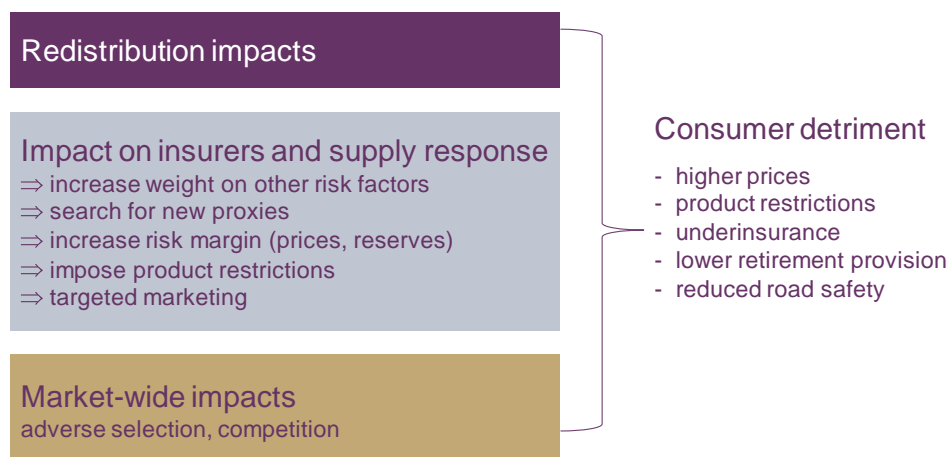
- **First-order redistribution impacts**—the first-order effect is largely redistributive, with unisex rates implying that the 'lower-risk' gender experiences increases in premiums (or reductions in benefits) to cross-subsidise the 'higher-risk' gender. This may be considered to result in a fairer outcome, or a less fair outcome, depending on the view taken on fairness. Over several different insurance products, the benefiting gender will vary: broadly speaking, in the case of motor and life insurance, females will be worse off, while in the case of pension annuities, males will be worse off. The impact depends on the importance of gender in the current pricing of the relevant products, the current and expected gender mix in the insurance portfolio, and other factors. In addition to the cross-subsidy effects between men and women, there can be wider distributional effects—for example, if more weight is placed on other rating factors as a result of gender being removed from the models. The redistribution effects are examined in more detail in section 4.2.
- **Impact on insurers and supply response**—a ban on a relevant rating factor such as gender corresponds to a restriction on risk-based pricing. From the perspective of an individual insurer, less accurate pricing increases the uncertainty and risk of insurance provision. Given the competitive dynamics in the industry (as is explained in more detail in section 4.3), insurers have a number of options available to respond to the uncertainty:
 - increase the weight assigned to the other risk-rating factors used in the pricing models (eg, age, engine size, occupation), in particular if any of these are themselves correlated with gender;
 - search for new risk factors or rating methods to proxy some of the gender-related risks—these other factors or methods are likely to be less accurate, more costly to include and/or potentially more intrusive than gender;
 - increase the risk margin either directly by charging higher premiums or indirectly through changes in the capital reserves (which will also tend to increase premiums)—a greater risk of insurance provision will require higher risk margins and additional capital, in particular under Solvency II;
 - impose product restrictions to limit the risk coverage (or potentially stop insurance coverage in the market segment altogether); and
 - target the marketing to attempt to bias the gender mix in the portfolio in favour of the lower-risk gender.

These effects can be expected to be particularly strong during the transition phase, when each insurer is uncertain about the adjustment strategy adopted by other insurers in the market; where insurers may have a very unbalanced gender mix in their existing insurance book; when no single insurer can afford to underprice the others; and where insurers are wary of attracting a higher-than-expected share of the higher-risk gender in its customer base. That is, given the competitive dynamics, individual insurers can be expected to take any of the above courses of

action to mitigate 'anti-selection' in their own book (eg, to avoid losses associated with charging a unisex price that leads to a change in the gender mix for the insurer concerned, such that the unisex premiums raised do not cover the expected costs of this new and unanticipated mix).

- **Second-order market-wide impacts (adverse selection, change in competition)**—in the wider market, the introduction of unisex rates can change the demand of consumers overall. Consumers of the lower-risk gender may purchase less insurance cover (because of the increase in the price compared with previously), and/or consumers of the higher-risk gender could purchase more. As a result, the average risk in the market could rise, and average prices would correspondingly need to increase to cover the higher cost of provision for the remaining group of insured individuals. Overall, coverage levels could fall. The likelihood and strength of market-wide adverse selection effects (as opposed to own-book anti-selection effects at the level of individual insurers) depends on several conditions and varies by product, as discussed in more detail in section 4.4. In addition, a requirement for unisex insurance pricing can have a different impact on different firms (depending on their size, gender mix, distribution channels, etc). This may affect the competitive process, possibly forcing changes in business models or indeed triggering exit of some insurers from the market. The potential competition impacts are also summarised in section 4.4.

Figure 12 Overview of dimensions of potential impact



Source: Oxera

4.2 Redistribution effects

The underlying principle of a sustainable insurance business is that the insurance costs of a pool of risks insured are matched by the insurance premiums. If the premiums are less than the costs, the insurer would incur losses, a situation that is not sustainable in the longer term. If premiums are excessive compared with those available in the market, in a competitive market the insurer would not sell any insurance, and would lose business to its competitors.

If a rating factor (such as gender) is removed from the calculations of premiums, this can be seen as the combination of two risk pools, and the recalculation of the premium to cover the totality of the costs of the two risk pools. Ignoring any potential supply responses or behavioural changes, and focusing on the first-order redistribution effect only, the result will be a change in the price and cross-subsidy between the two risk pools, with the direction and extent of the cross-subsidy depending on the product and relative size of the two risk pools.

To illustrate these effects for a ban on the use of gender, consider the following stylised example in Table 3, which assumes a motor insurer that charges £1,000 for a policy where the female is the main driver, but £2,000 for the same policy with a male main driver.

Table 3 Illustration of redistribution effect: motor insurance

	Current premium	Gender mix	Unisex premium Weighted average	Including risk margin	% change
Female	1,000	40%	1,600	1,600–2,000	60–100% increase
Male	2,000	60%	1,600	1,600–2,000	0–20% reduction

Note: Stylised illustration only. Current premiums (broadly) reflect actual premiums for 20-year-old female and male drivers with the same motor insurance policy. The unisex premium is calculated as the weighted average (plus risk margin), all else being equal. See section 5.1 below for a discussion on the impact of removing gender as a rating factor from an actual motor insurance pricing model.

Source: Oxera.

Given the insurer's gender mix to begin with, a unisex rate can be calculated as the weighted average (£1,600)—ie, it is more than halfway between the current male and female rates because of the higher share of males in the portfolio.

This assumes away any changes in demand that may be triggered by the price change. In practice, the insurer cannot be certain that the gender mix of its book going forward will be the same as that in its current book, or whether it will attract a higher share of male policyholders than it currently has. Given this uncertainty, and if there is a real possibility that the individual insurer concerned could end up with a mainly male portfolio, the company may decide on balance that the safest strategy is to adopt the male rate as the unisex rate for all policies, at least in the short run.

More generally, a risk margin may be applied to deal with the uncertainty, in which case, at least in the short run, the unisex rate will be higher than the weighted average rate. This is reflected in Table 3 by the range for the unisex premium that includes a risk margin (with the lower bound being the weighted average rate without risk premium, £1,600, and the upper bound being the higher-risk male rate of £2,000). Insurers' potential supply response, including the need to impose a risk margin, is further discussed in section 4.3.

To the extent that this happens, males and females, taken together, would be worse off—the combined risk of the two gender risk pools has not changed, but the total

premiums that they pay will have increased to compensate the insurers for the greater uncertainty in the marketplace.

This example illustrates the simple point that a ban on the use of gender in insurance pricing can have significant redistributive consequences. Since a ban cannot make the provision of insurance more efficient (rather, any restriction of a relevant rating factor will make it less efficient), benefits for one group of consumers can be achieved only at a cost to others.

As is further discussed in the product-specific analysis in section 5, the winners and losers of a gender ban vary by product, with the direction of the cross-subsidy going from lower-risk gender to higher-risk gender (eg, from females to males in the case of motor insurance). The extent of the cross-subsidy and the number of consumers in the group of winners and losers depends on the gender mix in the insurance portfolio.

4.2.1 A simple ban on gender does not necessarily achieve gender neutrality in insurance pricing

Gender discrimination legislation has been introduced in the UK and wider EU with the aim of ensuring that 'the use of sex as a factor in the calculation of premiums and benefits for the purposes of insurance and related financial services shall not result in differences in individuals' premiums and benefits' (see Article 5.1 of the EU Gender Directive), subject to the objective justification exemption.

For those who want to see the gender factor removed from insurance pricing (even if objectively justified), it is important to note that a simple ban on the use of gender as a risk-rating factor in insurance pricing models does not necessarily achieve full gender neutrality in insurance pricing. Put differently, if the policy objective is gender-neutral insurance prices, this is not necessarily achieved by a requirement for insurers to quote a unisex price for a particular insurance policy.

A requirement for unisex pricing in a private insurance market comprised of many insurers would most likely mean that, at the point of sale of a policy, an individual insurer would need to price the same insurance product for an individual male or female at the same price for the same level of cover. For example, a 27-year-old male driver from Swindon in the UK who drives a 2-litre BMW, and who travels 15,000 miles each year, would need to be offered the same premium as a 27-year-old female driver from Swindon who drives a 2-litre BMW, and who travels 15,000 miles each year. However, as an outcome, this does not mean that, on average, male drivers in the insurer's book would be charged the same premiums as females. It also does not guarantee across different insurers that males and females will be charged the same premiums.

As explained below, pure gender-neutral pricing would be very costly (if not impossible) to achieve, which then raises the question of what the policy objective of a removal of gender as a rating factor is (or can be) in the first place. A simple example may serve to illustrate this point.

Consider the pricing of motor insurance, with current premiums as set out in Table 4 below. There are two pricing factors: gender and engine size. Assume that motor insurance for a 3-litre car is twice as expensive as for a 1-litre car, and that males pay twice as much for motor insurance as females, which broadly reflects what is observed in the young driver segment of the market. Assume further that more young males drive high-powered cars, whereas more young females drive low-powered cars—ie, as is observed in practice, there is a correlation between gender and engine size (a similar example could be based on, say, mileage, which also tends to differ by gender). For simplicity, the assumption is that the insurance portfolio comprises 100 females and 100 males, of which 30 females drive a 1-litre car and 70 males drive a 3-litre car.

Table 4 Illustration using motor insurance: the impact of removing gender as a rating factor if gender is correlated with other rating factors

Engine size	Current premium		Gender mix		Weighted average unisex rate	Gender-neutral price (not sustainable)
	Female	Male	Female	Male		
1-litre	1,000	1,500	70%	30%	1,150	1,250
3-litre	2,000	3,000	30%	70%	2,700	2,500
Ratio	2	2			2.35	2

Notes: Stylised illustration only. The weighted average unisex rate is calculated by taking the gender proportions into account. The gender-neutral price removes gender risk from pricing (ie, it does not allow the factor, engine size, to pick up the gender risk differential.)

Source: Oxera.

First consider the scenario where the gender factor is removed from the pricing model and a unisex rate introduced, but risk-based pricing using engine size is allowed to continue. For the motor insurance provision to remain commercially viable, the prices have to be adjusted so that the 1-litre and 3-litre risk pools each meet their costs. Ignoring any risk margin, the new prices can be calculated as a weighted average unisex rate for each risk pool, with the weights determined by the gender mix in each pool. In Table 4, for example, the current premium for female drivers of 3-litre cars is £2,000 and for male drivers it is £3,000. For the insurer to earn the same amount in premiums to cover its cost on 3-litre cars, it needs to set a unisex price at £2,700 to account for the fact that there are 70% males and 30% females driving 3-litre cars.

Put differently, the new weighted average unisex prices take account of the gender mix and in doing so actually reflect part of the differences in risk that relate to gender. This is also reflected in the engine-size ratio (see 'Ratio' in Table 4). With the unisex rate, insurance for 3-litre cars is 2.35 times more expensive than for 1-litre cars, but this includes the gender risk differential. The true risk contribution of the factor—engine size—for a male or female driver would imply a price differential whereby the price of 3-litre car insurance exceeds that of insuring a 1-litre car by a factor of 2 (as per current gender-specific premiums in Table 4).

If, in the above example, the gender imbalance in each engine-size pool were even more extreme—say 99% males in the 3-litre pool and 99% females in the 1-litre pool—imposing unisex prices on these pools would have almost no impact on the price that males would be charged in the 3-litre pool and females charged in the 1-litre pool. As a result of the imposition of a ban on the use of the gender factor, most people would still be charged premiums that reflected gender-related risk—eg, 99 out of the 100 women would pay more or less what they paid before (just above £1,000) and the one female driver of the 3-litre car would pay considerably more (close to £3,000) because the premium is determined by the males in the portfolio.

In this example, there are two ways of removing the gender-related risk from being reflected in prices:

- ban the use of engine size because it is correlated with gender—the use of engine size as a rating factor could be banned so that all customers are charged the same irrespective of both gender and engine size. However, removing another relevant rating factor would increase the adverse consequence associated with a restriction of risk-based pricing, as discussed below.
- provide a transfer payment between the engine-size pools—risk-based pricing could be allowed along the engine-size dimension, but with gender neutrality imposed within each engine-size pool. The gender-neutral price in Table 4 above is calculated as the simple average price for each engine size, not taking into account the gender imbalance (ie, not allowing the engine-size factor to pick up the gender risk differential). However, while this pricing strategy would deliver full gender neutrality in the pricing, it would result in overcharging of the 1-litre pool and undercharging of the 3-litre pool—ie, the pricing would not be sustainable unless the excess premiums earned in the 1-litre pool were transferred to compensate the 3-litre pool. That is, the 1-litre engine-size pool pays out to the 3-litre pool to compensate for the gender imbalance (but not for the risk differential relating to engine size).

The above illustration has used engine size as an example of another rating factor which in itself has a legitimate risk- and pricing-related role in motor insurance. Unless this (or another) rating factor is completely uncorrelated with gender, the pricing of the risk pools using this factor will automatically include gender risk in the price. Addressing this remaining gender discrimination is complex.

While engine size and other factors have a legitimate use as a risk-rating factor, there may be factors which are also correlated with gender but themselves have no risk correlation. For example (and, like the above, this is taken to extremes to illustrate the point), suppose there were two colours of car—say red and blue—which have no impact on risk, but are correlated with gender (80% of red cars (all 1-litre) are driven by males, 80% of blue cars (all 1-litre) are driven by females). The pricing of insurance with respect to car colour when gender is allowed as a rating factor is set out in Table 5 below—females pay £1,000 and males pay £1,500 for motor insurance, irrespective of the colour of the car.

Now assume that the insurer used car colour as a rating factor even if it does not have in itself any risk correlation. The ban on the use of gender as a rating factor could then result in the creation of a red car pool and a blue car pool, with unisex rates determined by the gender balance in each pool, as shown in Table 5.

Table 5 Further illustration using motor insurance: the impact of removing gender as a rating factor if gender were correlated with other factors

Car colour	Current premium		Gender mix		Unisex rate
	Female	Male	Female	Male	
Red	1,000	1,500	20%	80%	1,400
Blue	1,000	1,500	80%	20%	1,100
Ratio	1	1			1.27

Notes: Stylised illustration only. The unisex rate is calculated as the weighted average for each car colour pool, with the weights determined by the gender mix in each pool.

Source: Oxera.

Again, the rating factor correlated with gender (here, car colour) would pick up the gender-related risks. If the correlation were perfect—ie, all females drove blue cars and all males drove red cars—the complete gender differentiation would be reproduced by using car colour as the rating factor.

In this example, because there is no risk attached to car colour, the use of this rating factor could easily be identified as indirect gender discrimination—and this could be banned, without having further implications for risk-based pricing. The issue is more complicated if the rating factor is a true risk factor in itself, and is also correlated with gender (eg, engine size). In this case, as explained above, there are two ways to remove gender risks from pricing—either the use of all gender-correlated risk factors also has to be banned, or transfer payments between risk pools are required. If neither of these is possible, pools with an above-average share of the higher-risk gender will be uneconomic to serve, while pools with a larger share of the lower-risk gender will be overly profitable.

An alternative approach would be to allow gender-correlated rating factors to be used (eg, engine size), and to accept that the pricing based on these factors will have to reflect both the risk impact of the factor itself and part of the gender risk differential. If such an allowable rating factor were perfectly correlated with gender then all the gender risk differential would still be included in the pricing.

While possible, this approach also creates some problems. For example, in the car colour illustration above, if car colour presented a small real risk factor (for which there is some evidence, but not along the red/blue dimension), and if there were a high correlation with gender, the resulting price differential between car colours would

reflect mainly the gender risk differential and would be much greater than was justified by the actual colour effect.

In policy terms, it would therefore be necessary to specify how significant the actual risk differential would need to be, combined with the level of gender correlation, to make a factor acceptable as a pricing factor. This level of intervention in the acceptable risk models that insurers can use would be significant. It could also create a high degree of uncertainty about what would constitute acceptable pricing (in the legal sense) and what would not.

For example, while shoe size might be easily identifiable as a factor that may not be allowed (given that, albeit a good proxy for gender, shoe size is unlikely to be a risk factor in itself), there may be a grey area around factors such as occupation (already used in motor insurance, because of the higher motor accident risk for certain occupations) or the insured's weight and height (not currently used in life insurance, but potentially a legitimate risk factor given the adverse health implications of a high body mass index). This issue relates to the question of suitable (and allowable) proxies if the use of the gender factor itself were banned, as further discussed in section 4.3.

Overall, a simple ban on the use of gender as a risk-rating factor in pricing models does not necessarily achieve gender-neutral prices. If there are good risk factors that are highly correlated with gender, the outcome for male and female consumers will be that prices still largely reflect the gender risk differential, raising questions about what the objective of the ban was in the first place. Greater gender neutrality in pricing would otherwise also require a ban on the use of factors that are correlated with gender. Many of these gender-correlated factors are themselves legitimate risk factors and improve pricing accuracy—a complete ban on these factors would have significant implications for the efficient functioning of insurance markets and, for some products, could indeed be very costly (if not impossible) to implement. Drawing a line between what are and are not legitimate factors can also be difficult and increase uncertainty, considering the spectrum of rating factors that are currently used or could be used if gender were banned.

4.3 Impact on individual insurers and responses in supply

The impact of the removal of a relevant risk-rating factor goes beyond the pure redistributive effects. It restricts the way in which insurers price risks and requires adjustments in the supply of insurance, with adverse consequences for consumers, who would ultimately bear any cost increases or other supply-side adjustments.

At the first level, a ban on the use of gender as a rating factor imposes compliance costs on insurers in the form of system changes, repricing, reprinting of documents, etc. These are mainly one-off costs, but can be significant (and, in a competitive market, would be passed on to consumers in the form of higher prices). More significant costs are likely to arise with respect to pricing risks and the unintended

adverse consequences that result from the less accurate pricing of risks in insurers' portfolios.

Pricing risks in insurance are significant. If an individual insurance provider sets premiums that are too low for a given risk (and lower than its competitors), it could face an anti-selection problem, and end up with a risk pool that is underpriced, reducing its financial viability.

As regards the potential ban on the use of gender as a rating factor, insurers would need to offer a unisex price based on an assumption about the gender mix in their portfolio.

As a simple example, consider a motor insurer that sets the unisex price on the assumption that it has a balanced (50:50) portfolio of young males and females—say it sets the unisex price at £1,500 because the previous male and female premium rates required to cover claims costs were £2,000 and £1,000 respectively. If it ends up with a greater than expected share of the higher-risk gender, the insurer could have a significant under-pricing problem and incur losses on the portfolio—in the extreme, if it ended up with male policyholders only, it would incur a loss of £500 per policy sold.

A particular problem arises for insurers with an unbalanced gender mix in their portfolio (or rather a portfolio that differs significantly from the market average). Extending the above example, and assuming that the market as a whole has 50% male and 50% female drivers, the market unisex price may be expected to stabilise in the long term at a uniform rate of around £1,500. However, in the short-term transitional phase, the problem for an individual insurer that does not have a 50/50 gender mix is as follows: if the insurer has an excess of the higher-risk gender (ie, more than 50% males in this example), the market unisex premium is too low to cover the insurer's costs if it keeps its existing customers. If the insurer's gender mix is more heavily weighted in favour of the lower-risk gender, the premium income based on the market unisex rate will be excessive relative to the insurer's costs.¹⁹

More generally, confronted with an uncertain gender mix in the portfolio and a requirement to set a unisex rate, in a competitive market individual insurers would seek to respond and mitigate the potential for anti-selection in their book. The main options for response, and their consequences for consumers, are described in turn below. There are variations in the likely responses of providers of different insurance products, so the product-specific effects are summarised separately in the evidence presented in section 5.

¹⁹ In addition, an insurer with an unfavourable gender balance may not be able to target the other gender to bring the gender balance in its insurance book into line with the market, because to do so would itself involve gender discrimination. Charging a price to reflect the risks in its current book will result in unisex prices above those available in the market, making that insurer uncompetitive, while charging market prices will not cover the insurer's costs. Market exit, and then possibly re-entering by building a completely new book with the market gender balance, may be necessary. On the other hand, insurers with a favourable gender balance will be keen to keep their existing clients, but less keen to obtain new clients where the gender mix is more likely to reflect the market average.

The response of providers and the impact on the market depend also on how the ban on using gender is implemented. Much of the discussion below focuses on a ban which removes gender as a rating factor from pricing models such that insurers are required to offer unisex rates. The likely impact on providers, consumers and the wider market would be stronger if the ban is implemented such that:

- *proxy factors correlated with gender are also banned*—as discussed in section 4.2 above, gender neutrality in insurance pricing would require that all factors correlated with gender are all removed from pricing models. The more rating factors are restricted or banned (be it because of concerns about indirect discrimination or to achieve fully gender-neutral prices), the more severe the consequences for the operation of insurance markets. Achieving full gender neutrality would often be very costly if not impossible to implement;
- *the use of gender is banned beyond pricing*—gender is currently used not only as a pricing factor in insurance, but also in marketing (eg, there are specialist providers which offer low-cost car insurance for females) and underwriting (eg, a motor insurer may decline insurance cover to very young males driving high-performance cars). A requirement to ban the use of gender beyond pricing would therefore require further adjustments, with corresponding costs. Indeed, the impact would be most severe if, as further discussed below, insurers were not allowed to collect gender information at the point of sale or use information about the gender mix to assess the overall risk in their portfolio and set premiums or reserves accordingly.

The pricing risks and uncertainty about the gender mix in an insurer's portfolio can be expected to be most significant in the transition phase. Even if insurers can ultimately be expected to build the experience that allows them to set unisex prices and control the gender risk in their portfolio, the transition phase to a new competitive equilibrium is likely to take some time, with potentially severe adverse consequences in the transition years. Some of these competitive dynamics are further discussed below.

Finally, the effects described below at the general level are likely to depend also on when unisex pricing is being phased in. For example, in a period where insurers are already exposed to greater pricing risks and poor underwriting performance, the response by insurers can be expected to be more cautious than in a period where performance is better.

4.3.1 Use other rating factors and proxies for gender risk

If the use of gender as a rating factor in insurance pricing models were disallowed, the first type of response by insurers to limit the consequences would be either to use other factors to proxy for the gender-related risks or to search for other ways of measuring the underlying risks. This response includes:

- placing increased weight on other risk-rating factors already used in existing pricing models; and

- searching for new rating proxies that pick up some of the gender risks, or attempting to measure the behaviour of the insured and the underlying risks directly through other methods.

If these alternatives were indeed to provide 'better' risk-classification or pricing methods, one would expect them already to be in use or be developed by insurance providers, given the competitive dynamics of the industry. Instead, from an efficiency point of view, one can expect that the alternatives to gender would be:

- **less accurate for risk-pricing purposes**—for example, even if some of the gender-related risks in motor insurance would be (automatically) picked up by other factors in the GLM models used by insurers (eg, age, the interaction factor between age and engine size, mileage, occupation, etc), the models would lose some of their predictive power compared with the status quo where gender is directly included as a factor. Similarly, to the extent that there is a fundamental difference in life expectancy between men and women (eg, after controlling for health and lifestyle), unisex pricing for life insurance would be less accurate than gender-differentiated pricing even if insurers started to use, say, detailed medical information for pricing purposes. As long as the gender factor has additional explanatory power that cannot be picked up by other factors, a ban on its use will reduce pricing accuracy. While it may be possible to find new rating factors or develop new risk-classification methods, this can take time. According to the insurance companies interviewed by Oxera, it can take years before the statistical evidence is gathered and sufficient actuarial experience is established to price risks accordingly. Also, for some risks, it is far from clear what the alternative factors or methods could be in the first place;
- **more costly**—gender is a simple and readily available factor that is correlated with risk (in some cases causally—eg, certain medical conditions apply only to males or females). Even if other rating factors or pricing methods were available, these could be more costly to use or implement, raising insurance prices for consumers. In life and health insurance, examples of costly alternatives include pricing on the basis of detailed medical or lifestyle questionnaires; in motor insurance, it is the use of telematics (a device fixed to vehicles that monitors individual drivers' behaviour on a continual basis).

In addition to efficiency or practicality considerations, there are concerns from a social point of view since the alternative methods can be:

- **more intrusive**—in addition to being significantly more costly, the alternative methods may require information that is more problematic for the insurer to monitor as well as more intrusive for the insured to disclose. For example, with gender, no real privacy concerns arise since most people do not mind revealing their gender to the insurer for risk-classification purposes. This may not be the case when it comes to the disclosure of detailed medical information or lifestyle choices and, in the case of motor insurance telematics, being tracked when driving;

- **perceived as 'unfair'**—if the removal of gender results in greater weight being placed on other rating factors or new risk-classification methods being introduced, this will result in redistribution along these other dimensions (eg, age, medical history, occupation, credit score), which may not be perceived as fairer than the gender-based differentiation, and it may compromise other aspects of individual rights;
- **not effective in achieving full gender neutrality**—a simple ban on the use of gender will not result in the removal of gender risks from pricing. As discussed in section 4.2, full gender neutrality in pricing would also require a ban on all gender-correlated factors from pricing, although this would have severe consequences for the functioning of the relevant insurance markets. As such, the continued use of proxies that correlate with gender is required in order to limit the adverse efficiency effects associated with a ban on the direct use of gender, but at the same time implies that a policy objective of gender neutrality in insurance pricing cannot be achieved.
- **indirectly discriminating by gender**—the use of proxies and other methods to control for gender risks also raises questions around what may or may not constitute indirect discrimination. For example, is the use of a rating factor allowed that is correlated with gender but has no direct risk correlation (eg, shoe size), or what about a factor that is correlated with gender but also has some independent correlation with the underlying risks (eg, factors such as engine size, mileage, occupation, or body mass index, as discussed further in section 5)? Drawing a line between what is and is not allowable can be difficult, and these questions are of a legal rather than an economic nature. Any uncertainty in the legal interpretation increases the risk from the perspective of insurance providers, resulting in a potentially more cautious approach to their choice of proxies. This in turn may require them to opt for the other adjustment options available to deal with the higher pricing risk, including, in particular, a risk margin in prices (see below).

The availability of proxies or new rating methods (and their suitability) varies by product, and section 4.5 below provides further discussion on a product-specific basis.

4.3.2 Increase risk margin in pricing and reserving

As set out above, given the risk differences between males and females, insurers would need to set unisex rates at a level that is consistent with the gender mix in the portfolio. Even if the current gender mix is known, there will be uncertainty about how it will develop once unisex rates are offered to consumers. From the perspective of an individual insurance company, this depends both on the aggregate market demand of males and females for the insurance product (this is discussed separately in section 4.4 below) and the relative demand for the insurer's products.

Given the uncertainty about the gender mix and the initial response to unisex pricing by competitors, the safe response for an insurer would be to apply a risk margin in the prices it charges. For example, in the case of motor insurance, rather than setting the

unisex rate as the simple weighted average between the current male and female rates, the insurer may choose to set a rate that is closer to the higher current male rate. This response reduces the possibility of losses if the insurer attracts a higher than current share of male drivers to its portfolio.

Similarly, in the case of life insurance, to the extent that the insurer knows that there is a good chance of selling policies to higher-risk males, the safest strategy would simply be to adopt the higher male rate as the unisex rate—by doing so, the insurer has eliminated all the gender risks from its portfolio, but at the cost of females paying the higher male rate. The reverse is the case for pension annuities—to eliminate the insurer’s uncertainty about the gender mix in its portfolio compared with that of its competitors, the insurer could simply set the unisex annuity rates at the level of current female rates.

Unless the uncertainty about the gender mix is eliminated through pricing, insurers will have to reserve for this greater risk and set aside capital accordingly. In particular with implementation of Solvency II, insurers will have to hold additional capital, not only because the risks will be more difficult to predict accurately without using gender, but also because insurers cannot anticipate accurately how potential customers might respond to changes in the pricing of products. In order to achieve an appropriate rate of return on the capital, premiums may need to increase to pay for the greater risk and the higher capital requirements. The reserving effects that apply in the case of long-term insurance policies are discussed in more detail for pension annuities in section 5.4.

The effects are likely to be strongest in the transition phase, until a new equilibrium is reached and there is less or no uncertainty about the gender mix at the level of the individual insurer. In this new equilibrium, prices may converge back to the weighted average rate between males and females. However, it may take some time for this new equilibrium to be reached.

4.3.3 Adjust product design and restrict cover

Instead of setting higher prices to deal with the pricing risks, insurers may respond to the removal of a relevant risk-rating factor by simply opting not to cover the risk at all or adjusting the design of the product such that the pricing risks for the insurer are more limited.

For example, in the short term, a motor insurer may simply consider the risk of insuring young males with high-performance cars too great, in which case it may pull back and not write this insurance for young males. If it is not allowed to use gender in the underwriting decision, it may need to go further and remove the offering for both young males and females. A less extreme response would be for insurers to impose certain other restrictions on the policy, such as requiring a higher excess for all young drivers.

As another example, in life insurance, one option available for insurance companies to limit the risks associated with underpricing is to adjust the terms and conditions in the policy such that they are more flexible and offer fewer guarantees. Whereas a mispriced policy would otherwise have a longer-term impact on the insurer, this option would allow the insurer to make adjustments during the term of the policy and reduce its pricing risks, but the result is greater uncertainty at the level of the insured consumers (and a lower-quality product, to the extent that a guarantee is a valued product feature).

4.3.4 Target marketing and distribution

If insurance companies cannot directly price on gender or adjust policy conditions depending on the gender of the insured, they may seek to control the gender mix through targeted marketing and distribution. For a given unisex rate, insurers can limit their expected claims costs if they manage to attract more customers of the lower-risk gender. They can try to achieve this, for example, by advertising in the relevant magazines, running promotional campaigns aimed at a particular gender, changing their distribution partners, or adjusting the terms of distribution.

Insurers' ability to achieve such gender selection may be limited, also depending on how the gender ban is implemented. If there is a simple ban on the use of gender as a rating factor from pricing models, such marketing is in principle still possible. However, an extension of the ban to gender-specific marketing would restrict this way of controlling the gender mix in the insurers' portfolio and consequently increase the pricing risks.

4.3.5 Transitional versus permanent effects

The supply responses and their consequences described above are likely to be more significant in the transition phase. The requirement for unisex pricing will imply an immediate disturbance to the pricing in the market, which is likely to trigger some overreaction. Over time, the effect may settle down and the pricing risks reduce as insurers learn about their competitors' responses and each firm's portfolio stabilises. Even if the market eventually settles into a new equilibrium (in which prices have risen for one gender to cross-subsidise the other), the transition phase may last for some time.

From the provider perspective, a firm that has underestimated the costs of provision in the transition phase may incur losses that jeopardise its financial viability and ability to compete in the market. For example, if an annuity provider prices on the basis of an assumed 70:30 male:female mix (eg, based on its assessment of the market average profile), but ends up with a balanced portfolio of males and females, it will make losses. It will need to adjust its unisex pricing and try to rebalance its portfolio, which will take time.

From the consumers' perspective, given the competitive dynamics in the market, this translates into several potentially adverse market effects, depending on how different insurance providers choose to respond to a ban on the use of gender. Even if the effects were mainly transitional, the group of consumers purchasing policies in the transition phase could be significantly affected. In the case of long-term policies (eg, pension annuities), the pricing disturbance may be temporary, but the consequences would be felt over the long term (eg, in the form of lower annuity payments throughout retirement).

4.4 Market-wide impacts

4.4.1 Adverse selection in the market

As noted above, were a ban on the use of gender to be introduced, insurers would be wary of how they set unisex rates. Each would be wary of the prospect of own-book anti-selection effects because individuals can choose which insurer to purchase cover from.

However, selection effects are not only driven by individuals choosing *which* insurer to purchase from (own-book anti-selection effects); there could also be effects at the level of the market as a whole, which could remain in the longer term. These would stem from whether, at the overall market level, high- and low-risk consumers react differently to unisex pricing in terms of *whether and how much cover* they buy. This will be affected by the market elasticity of demand²⁰ of high- and low-risk consumers, respectively, for the insurance product concerned.

In economic terminology, adverse selection occurs when buyers of insurance have more information about their expected risk of loss than the sellers of insurance—the insurance companies—and then act on this information in choosing their level of cover. Here, if insurers are not able to distinguish between higher- and lower-risk individuals, premiums would need to be averaged across individuals (based on the average expected loss). Adverse selection arises through higher- and lower-risk individuals responding differently at the market level. High-risk individuals may view the averaged market price as a good deal relative to their known risk, purchasing more insurance cover than low-risk individuals. In contrast, low-risk individuals will question whether taking out insurance represents good value, purchasing less insurance cover. If, therefore, adverse selection is present at the market level, it will manifest itself in the form of a positive observed correlation between insurance coverage and risk.

Exactly what is meant by higher-risk individuals buying more cover and lower-risk individuals buying less cover will vary by insurance market and by product. Essentially, adverse selection can occur in the following two ways:²¹

²⁰ This measures how responsive consumers are, in terms of the extent of coverage they purchase, to changes in overall market prices.

²¹ See, for example, Cohen & Siegelman (2009).

- **opt in/out**—where a simple single-price insurance contract is offered, individuals will make a ‘buy or don’t buy’ decision, with high-risk individuals tending to opt into buying insurance and lower-risk individuals tending to drop out of the market (assuming that risk appetite and other factors are constant). This is a more detrimental form of adverse selection; and/or
- **level of cover**—if individuals are given more flexibility, different effects may occur. Where insurers offer a menu of coverage levels for individuals to choose from—such as offering a choice of full versus basic cover, or a choice of excess, or ‘deductible’ (eg, in motor insurance and healthcare), there could be a tendency for higher-risk individuals to purchase more comprehensive cover than lower-risk individuals.

Over time, adverse selection could create a dynamic whereby expected losses to the insurance industry increase over time, raising the average premium charged. In the extreme, the process could escalate, with low-risk individuals leaving the market altogether, and a collapse of the risk pool. This ‘death spiral’ (to use the terminology in the literature—see Appendix) would make it very difficult for insurers to write business. Such effects are, arguably, more likely through the first form of adverse selection noted above—that is, when a number of individuals opt in or out of the market.

Alternatively, low-risk individuals may still take out cover, but opt for less than full cover. In particular, where a minimum level of insurance is compulsory (eg, motor insurance), individuals may not be very responsive to overall price movements at the market level.

Regardless of which of the above forms of adverse selection dominates, adverse selection reduces efficiency, with adverse consequences for consumers.

If markets do not collapse altogether, there can still be some form of ‘rationing’. Average premiums will be higher, and the quantity of insurance purchased (coverage) will be lower, than would otherwise be the case. The potential supply responses by insurers, which are necessitated to abate both own-book selection and adverse selection at the market level, will also potentially raise prices and reduce coverage levels.

Adverse selection can occur in the day-to-day functioning of insurance markets in the absence of legal restrictions on risk-rating factors—for example, if information problems prevent insurers from undertaking sufficient selection. However, in the context of the current study, adverse selection problems are likely to be *triggered* or *exacerbated* if insurers are banned from using certain rating factors in pricing. This is because insurers must price ‘as if’ they did not have information on the rating factors for the individual policyholder concerned, and instead charge a uniform rate across the banned risk characteristics.

The degree to which adverse selection problems occur in normal market operations, or would be expected to occur should a particular rating factor be removed, depends on the characteristics of the insurance product concerned.

In a recent study, Cohen and Siegelman (2009) examined a variety of empirical work across insurance markets (including motor, health, life and annuities) and tested the basic coverage-risk prediction of adverse selection theory. They found that the degree to which riskier policyholders purchase more insurance coverage varies by insurance market, and by pools of insurance policies. Other authors also outline various reasons why adverse selection would be expected in some but not all markets or risk pools.²²

This literature provides a first indication that the potential impact of removing gender as a factor is likely to vary across the four products considered in the current study.

The Appendix includes a review, by product, of the evidence base on adverse selection. Building on this, it is possible to outline five criteria in terms of whether a ban on the use of gender in insurance pricing would be expected to give rise to particularly severe adverse selection effects:

- individuals have an informational advantage over the insurer, and are able (and inclined) to act on this advantage;
- there is a sufficiently high proportion of individuals in the 'high-risk' group for the product concerned;
- the rating factor (here, gender) is a statistically significant, material driver of both risk and premiums, relative to other rating factors;
- where any increases in premiums mean that there is likely to be a price-elastic response at the overall market level by the low-risk group (especially drop-out) or high-risk group (especially opt-in);
- where the use of alternative policies or proxies by the insurer, to generate separate pools, is not permitted, or would be too expensive (transaction costs).

As described in the Appendix, the empirical evidence shows that the relevance of these criteria varies significantly by product.

Overall, a ban on the use of gender as a rating factor is unlikely to result in significant market-wide adverse selection effects. Nonetheless, there may be some demand adjustments. For example, young females may delay the purchase of a car, whereas young male drivers may be induced to buy larger and more powerful cars than they otherwise would, with potential implications for road safety. Also, in the annuity market, adverse selection effects might become more severe if part-annuitisation of pensions is no longer compulsory in the future, but may be more limited under current rules.

²² These include Hemenway (1990), Siegelman (2004) and Thiery and Van Schoubroeck (2006).

4.4.2 Competition

The impact of a gender ban can be expected to have different effects for different insurance providers, depending, for example, on:

- the current portfolio mix—insurers with a more balanced insurance book comprising males and females may find it easier to set a unisex rate than an insurer specialised in provision to either one sex. For example, in the transition phase, if an insurer's portfolio mainly comprised the higher-risk gender (eg, young male drivers), a unisex rate based on the current gender mix would result in the insurer losing its lower-risk customers to competitors with a more favourable gender mix. Required to increase the unisex rate further, the insurer would then lose more customers (including those with higher risk) and not be able to expand, or indeed maintain, its customer base. This might result in it having to exit the market, and then possibly re-enter by building a completely new book with a more balanced gender mix. Also, if a ban were implemented such that insurers would not be allowed to engage in gender-specific marketing, the specialist insurers (mainly seen in motor insurance) would need to change their entire business model and marketing strategy;
- the size of the insurer—larger insurers in the market can generally be expected to have greater capacity to deal with, and respond to, potential pricing risks—for example, because they have more statistical data to calibrate their models to the actual claims experience;
- the distribution channels—a direct insurer may be better able to control its insurance book than an insurer distributing through intermediaries. The latter arrangement often involves a two-month lead time from when the prices are set in the contractual arrangements with brokers to when the policy is sold and risk accepted, such that the insurer may be slower to respond to adverse developments in the gender mix of the policies sold.

The impact on individual insurers and the competitive process in the market will be particularly significant in the transition phase. Some insurers may find it particularly difficult to survive in the market and therefore have to change their business model, close their book and possibly exit the market. Any exit during the transition phase may increase concentration. In the longer term, the market would be expected to settle to a new equilibrium, however.

4.5 Summary

A ban on using a relevant risk-rating factor such as gender in insurance pricing cannot be achieved without cost. While it may be possible to make one group of consumers better off than before, this can be achieved only by making the other group worse off.

Three types of impact can be distinguished:

- redistribution—the first-order effect of imposing unisex rates is redistributive, increasing prices for the lower-risk gender (eg, young female drivers) to fund price reductions for the higher-risk gender (eg, male drivers);
- supply response by individual insurers—the removal of a relevant risk factor increases pricing risks (in particular during the short-term transitional phase). Individual insurers have a number of options available to limit this risk via adjustments in pricing, underwriting and marketing, each with (unintended) adverse consequences on consumers in terms of higher prices or restricted insurance cover;
- wider market impacts—these effects are amplified if unisex pricing changes the overall demand in the market, with the lower-risk gender opting out of insurance (or reducing coverage levels) and the higher-risk gender opting in, which could increase the overall risk in the market. While possible, there is mixed evidence that these effects would occur under a requirement for unisex pricing. Although significant market-wide adverse selection effects are unlikely, there may be some demand adjustments. The result is likely to be higher premiums, on average, and reduced overall coverage, but the question is one of degree, depending on the product (see section 5). In addition, a ban on the use of gender will have different impacts on different insurers. This could affect competition in the market, potentially requiring changes in the business models of some insurers or indeed triggering their exit from the market.

An important additional point is that a simple ban on the use of gender as a rating factor in insurance pricing does not necessarily deliver gender-neutral insurance prices, raising the question of what the objectives of such a ban are in the first place. Gender neutrality in insurance pricing would require removing not only the gender factor but all rating factors that are correlated with gender from the pricing models. This would often be very costly, if not impossible, to implement.

5.0 THE IMPACT OF A GENDER BAN BY PRODUCT

This section explores in more detail the potential impacts that a ban on the use of gender might have on each of the four insurance products, in terms of:

- first-order redistribution impacts;
- individual supplier response impacts; and
- second-order, market-wide impacts (focusing on adverse selection at the market level).

This builds on the following main sources of evidence reviewed: interviews with industry, existing policy papers, experience with unisex pricing elsewhere, and the academic literature (summarised separately in the Appendix).

In the search for available evidence, Oxera included a review of the experience in EU countries that have implemented the EU Gender Directive by imposing a ban on the use of gender for some or all insurance products in their national markets. However, the evidence base was limited, not least because few countries opted to impose a ban. More importantly, any response or impact was driven by the idiosyncratic characteristics of these markets and did not shed much light on the effects that a similar ban might have if implemented in the UK insurance markets.

The evidence available varies by product (for example, more evidence is available on motor insurance), and hence the detail covered also varies by product. The purpose of this section is not so much to quantify product-specific effects, but to illustrate the different dimensions of impact of a ban on the use of gender as a risk-rating factor using the product examples.

5.1 Motor insurance

5.1.1 First-order redistribution impacts

The key first-order impact of a ban on the use of gender as a rating factor would be a redistribution effect: with unisex rates, young females would pay more, whereas young males would pay less. The motor insurers interviewed for this study generally indicated that, since it would still be possible to measure and use age in insurance classification, redistributive effects would occur within age ranges, rather than between age ranges. For example, it would still be possible to isolate young drivers as a risk pool.

It is possible to calculate at a very basic level what the redistribution impact might be of a ban on the use of gender, by considering the current premiums offered to (say young) males and females, and the current mix of (young) males and females. Table 3 in section 3 provides such an illustration, showing the premium increase for young females and reductions for young males as a result of unisex pricing.

The analysis in section 3 was purely illustrative. In practice, insurers use sophisticated GLM models in pricing their premiums. Hence, the effect on risk premiums of removing gender as a rating factor will be partly determined by how these models respond when the gender factor (and its interactions with other factors in the model) is removed.

EMB, an actuarial consultancy firm specialising in non-life insurance, conducted an analysis for the purpose of this study to provide a better understanding of these effects in practice.

EMB undertook the analysis using the data previously contributed to the 2008 study of the working party of the Institute of Actuaries GIRO Age Discrimination in Financial Services, to investigate the potential impact of removing driver gender from UK motor rating structures. Several major insurers contributed data to this earlier analysis, including detailed policy data, together with the risk models used by the insurers concerned. These models are in all cases the GLMs produced by each insurer, created by analysing their own claims experience.²³

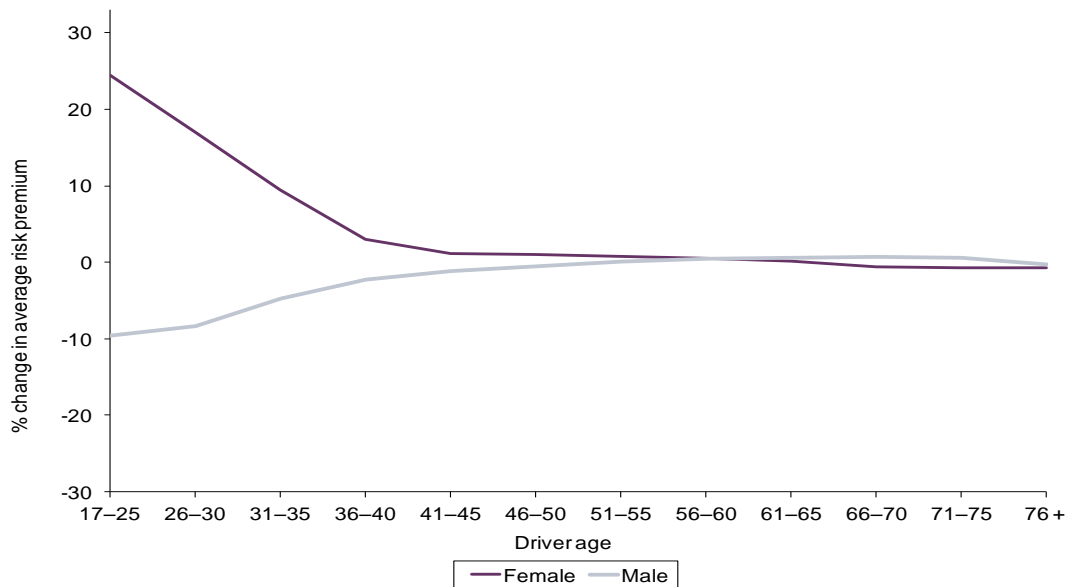
In the models provided by the contributor companies, driver gender factors, and any interaction effects between driver gender factors and other factors, were included in the model of estimated claims costs. Using these models, the implied expected claims cost was calculated for each policy.

A second version of each insurer's model was then developed, in which all gender factors and related interaction terms were removed. The corresponding individual expected claims costs were then recalculated using this revised model. This process was repeated separately for each insurer, with the results aggregated across insurers. The remodelling process did not consider actual claims experience, but instead the expected claims experience implied by the models provided by the contributing insurers.

Figure 13 presents the results in terms of the average percentage change that different age bands of policyholders would experience if premiums moved from rates wholly based on claims models using gender as a factor, to rates wholly based on claims models without gender. It can be seen that male drivers under the age of 25 would experience the largest average decrease (of up to 10%), with female drivers of the same age group experiencing the largest average increase (of up to 25%).

²³ EMB used a majority subset of the data to undertake the analysis. Since the data and models provided were originally submitted for the 2008 study, not all of these were necessarily representative of the models that are used in the current marketplace. EMB excluded models where the models appeared inconsistent with more recent and relevant examples with which EMB is familiar. Aside from this, the statistical models used were as provided by the contributing companies, and were not reviewed or enhanced by EMB. Another observation is that UK insurers do not use the same driver gender factors when modelling claims experience. Some use policyholder gender as an explanatory factor, whereas others use rated driver gender, and others use main driver gender. In its analysis, EMB adjusted the data where possible to increase the consistency of this definition, although this was not always possible. EMB does not regard this as materially affecting the overall conclusions. Note that all of the analysis undertaken by EMB considers statistical models of claims experience, and not actual premium rates charged by insurers.

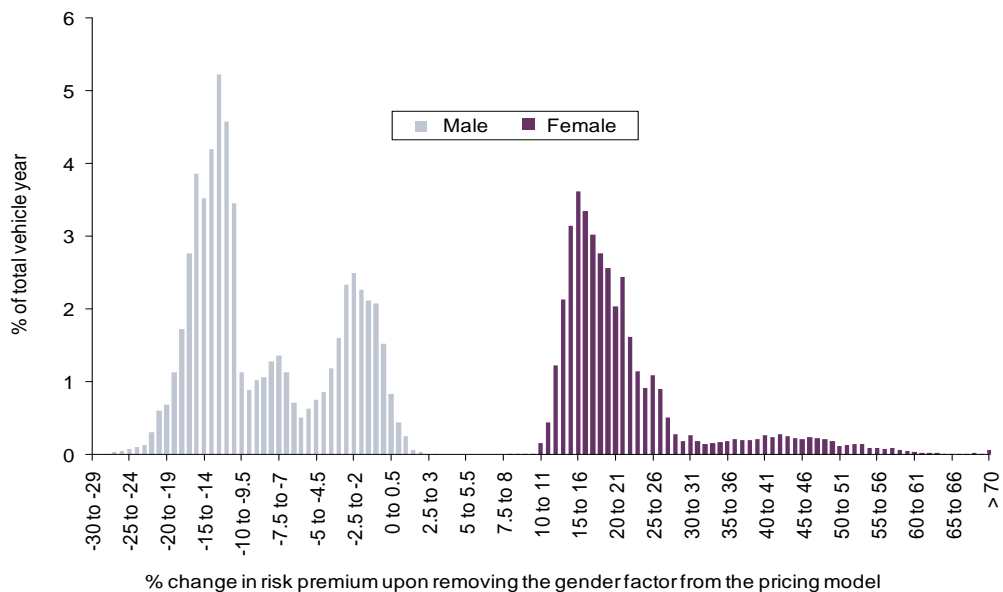
Figure 13 Changes in premiums after removing gender as a rating factor



Source: EMB modelling of gender-based rating versus unisex rating for motor insurance. Dataset based on information on policies and modelled claims costs provided by a significant sample of major insurers in 2008.

Figure 14 below considers policyholders under 25 only, and shows the number of policies that would experience different percentage changes in premium caused by removing driver gender as a factor (in the case of rates being wholly based on claims models). Each group is further broken down by driver gender. While Figure 13 demonstrates the average change in risk premium, Figure 14 shows the variation in risk premium changes, and demonstrates that some young males could receive a reduction of as much as 25%, and that some young females would receive an increase of more than 50%. This assumes a mix that may not be representative.

Figure 14 Distribution of expected premium change after removing gender as a rating factor



Source: EMB modelling of gender-based rating versus unisex rating for motor insurance. Dataset based on information on policies and modelled claims costs provided by a significant sample of major insurers in 2008.

EMB's analysis demonstrates a major redistribution effect on premiums when removing the gender factor, particularly for young drivers. The absolute level of premiums is much higher for younger drivers than for older drivers. As such, the main absolute (£) shifts in premiums would be expected for the younger driver group.

In addition, if younger male drivers opt to drive more powerful cars as a consequence of the reduced premiums, and this is not picked up adequately through adjustments to the models, claims costs might be expected to increase. For example, the above results indicate that, on average, young males (aged 25 and under) would benefit from approximately a 10% reduction of premium, all else being equal. It is therefore possible that younger males change their behaviour as a result of this reduction, choosing instead to insure a larger and/or more powerful vehicle. Based on a typical rating structure, this might mean that, for example, for a similar premium, a younger male may be able to move from insuring a Ford Fiesta Bravo 1.1 under a regime that rates on gender, to insuring a VW Golf GTI 2.0 under a regime that does not rate on gender. The potential for such effects is considered further below.

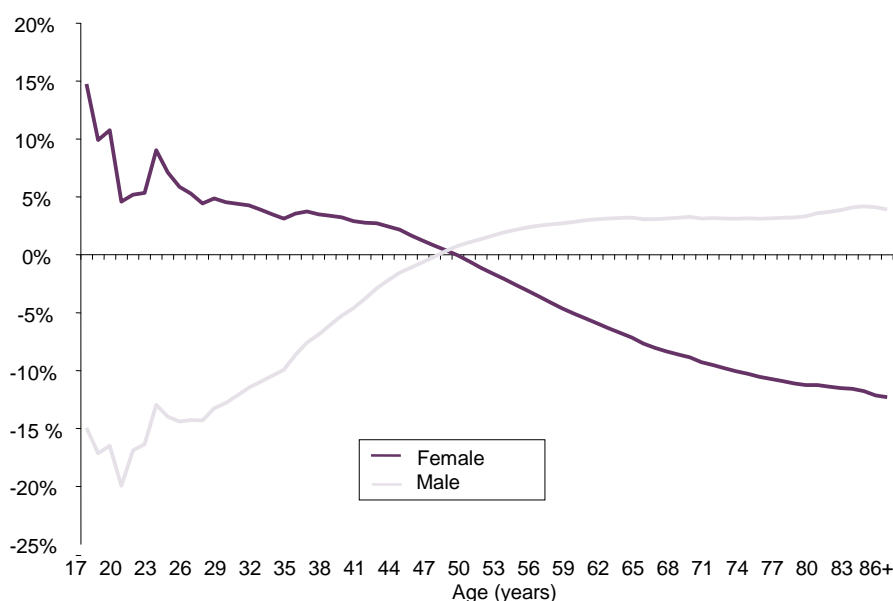
The nature of the analysis undertaken by EMB means that other variables in the model that are partially correlated with gender do not tend to pick up its influence when the variable is omitted, to the extent that would be possible given fuller data.²⁴

²⁴ Owing to the nature of the 2008 dataset, the analysis used 'fitted values' on claims costs. This limits the degree to which other variables still included in the models, and which are correlated with gender, pick up the effects of gender when this factor is removed. A more detailed GLM analysis, at a more disaggregated level, would be required to explore these effects further.

In addition, a large insurer provided Oxera with analysis of the effects of removing the gender factor, based on information from its own motor insurance book. This is shown in Figure 15. In this analysis, the modelling allowed other variables that remained in the model to pick up some of the effects of gender when the variable was removed. Note, however, that this was based solely on data for the insurer concerned. As such, Figures 13 and 15 are not strictly comparable since they do not cover the same insurance book.

Figure 15 shows that, for the insurer concerned, a 17-year-old female would face a 15% increase in her premium were unisex rating to be introduced. A 17-year-old male would face a 15% decrease in his premium. This redistribution effect reverses at around age 50, although the extent of movement is less than in the younger age bands. A male driver of 75 would experience an increase in premium of around 4%, whereas a female driver of the same age would face a decrease in premium of around 10%. However, the absolute level of premiums is much higher for younger drivers than older drivers. Hence, the main absolute (£) shifts in premiums would be expected for drivers under the age of 25.

Figure 15 Change in premiums (%) after removing gender as a rating factor



Notes: This figure shows the percentage change in premiums after removing gender (and interaction terms with gender) as a rating factor from the model. Other factors are allowed to pick up the gender risk. Note that the percentage changes imply significantly larger absolute changes for younger drivers, given the higher premiums.

Source: A large motor insurer.

Additional evidence on likely redistribution impacts is available from the experience of US states that have introduced a unisex rating requirement.²⁵ For example, in Montana, a ban on using gender or marital status in setting motor insurance premiums was introduced in 1985. The All-Industry Research Advisory Council (1987) surveyed 12 major motor insurers in Montana to explore what happened to motor insurance premiums for young drivers. It found that, while young, unmarried, male drivers saw a reduction in their premiums, young female drivers had to pay much higher rates, as did young married male drivers.²⁶ In summary:

- 23-year-old single males experienced a 27–28% reduction in premiums;
- 23-year-old married males experienced a 26–29% increase in premiums;
- 23-year-old single females saw a 18–20% increase in premiums;
- 23-year-old married females saw a 56–59% increase in premiums.

Wallace (1984), studying the effect of removing gender as a rating factor in pricing motor insurance in Michigan, found that:²⁷

- single males under 25 experienced a decrease in premiums of up to 15%;
- single females under 25 saw an increase in premiums of up to 21%;
- for adults over 25, the average increase in premiums was around 4%.

Other studies have sought to simulate the potential impact of a proposed ban on using gender as a rating factor. In 1990, highlighting the potential effects on young females of introducing a unisex rating requirement for motor insurance in Virginia, the National Association of Independent Insurers noted that young single women (39% of the young-driver population) would experience an increase in premiums of 12%, to subsidise a 6% decrease to young male drivers (61% of the young-driver population) (National Association of Independent Insurers 1990).

No evidence to track insurance premiums was available from the (few) EU countries which have opted to impose a ban on the use of gender for motor insurance pricing, following implementation of the EU Gender Directive.

5.1.2 Supplier response impacts

As noted above, in response to removing the gender factor from prices, the models used by insurers would automatically adjust, providing revised unisex premiums. However, this does not provide a complete picture of response at the individual insurer level. In particular:

²⁵ Whereas some US states introduced mandatory unisex pricing, this was explicitly rejected by other states. The debate is ongoing on whether unisex mandates should be introduced and, indeed, whether unisex mandates should be repealed in those states where they currently exist.

²⁶ For a discussion, see State Farm Insurance Companies (2005) and Society of Actuaries in Ireland (2004).

²⁷ See Hunstad (1995) for a discussion.

- individual insurers will be wary of pricing, at least during the transition period, in a way that attracts too many young male policyholders onto their books (anti-selection);
- removal of gender as a factor will make the pricing models less accurate, and a risk premium might be added to compensate for this additional risk;
- insurers might also adjust their underwriting policies and marketing methods to tackle anti-selection against their own book.

In a case where an insurer has more young females than males on its books (say 75:25), a weighted averaging of its current premiums, as offered to males versus females, would, in theory, result in a lower premium than the weighted average of premiums offered by insurers with a more balanced current portfolio of males and females (say 50:50). However, if the insurer with the 75:25 mix priced on this basis, it may attract more young males to its books. There could be adverse financial consequences for the insurer concerned since the risks posed by its outturn mix would not be covered by the premiums raised. Specialist providers (appealing to a specific gender) would therefore need to take particular care in applying unisex prices.

In the case where the insurer has more young males than females on its books, if it sets its premium to reflect its current mix, its (unisex) prices will be uncompetitive. However, if it sets its prices according to the overall market gender mix (to reflect the likely mix of its *future* customers), it will underprice its current book, which may not be viable.

Interviewees noted that, in practice, individual insurers might seek to mitigate these potential anti-selection effects, at least within their own book.

From a pricing perspective, at least in the transition phase, it is likely that individual insurers would include a risk premium, over and above the weighted average of their current male and female rates. The average unisex rates might therefore be somewhat higher than as suggested in Figures 13, 14 and 15, at least in the transition period for the individual insurer. Hence, young males might gain less, while young females might be penalised more, than suggested by a pure redistribution effect alone.

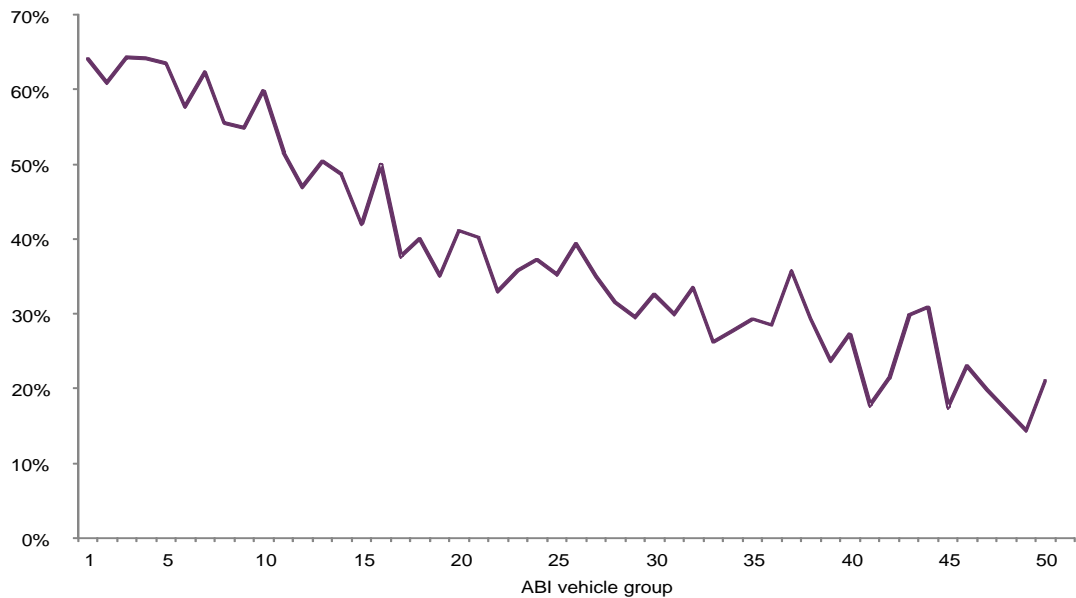
Insurers also noted that removing gender as a rating factor would harm model accuracy. Gender was a statistically significant rating factor in the current models, and was a fairly costless and robust variable to observe. Removing the gender factor would result in a decline in model accuracy per se, and might also lead to more emphasis being placed on softer, less robust factors—such as reported mileage, if used in the models already. This could have implications for capital requirements and lead to a further risk premium in prices, in particular in the presence of anti-selection risk.

It was generally thought by the interviewees that most rating factors that could be included in the pricing models were already included, and that alternative measures for gender would not necessarily be incorporated should the use of gender as such be disallowed.

As explained in section 4.2, removing gender as a factor in the models would not completely remove its influence in pricing, since gender is correlated with a number of other factors used by insurers to price motor insurance. A ban on the use of gender in these models would, therefore, result in these other variables automatically picking up cross-correlation effects with the omitted gender factor.²⁸ Figure 15 above implicitly includes these effects, albeit averaged over males and averaged over females.

For example, males tend to drive larger cars, and prefer certain types of car. One insurer provided information on the car types within its own book: around 70% of Mini drivers within its book were female, whereas females accounted for 50% of Nissan drivers and only 30% of BMW drivers. In addition, there was a close association between the vehicle group and the percentage of female drivers, as illustrated below in Figure 16.

Figure 16 Gender-vehicle group relationship (% of female principal drivers by vehicle group)



Source: A large motor insurer.

²⁸ 'Where a particular rating factor can not be used the theoretical models can be adjusted by removing the factor and where possible including other rating factors which are correlated with the factor and therefore may be used as a proxy. The other factors in the model can then be left to absorb the particular effects of that factor.' See GRIP (2007), D.176.

Table 6 Correlation of other rating factors with gender

High correlation	Medium correlation	Low correlation
Driver age	Restrictions on drivers (eg, driver only, driver + spouse, etc)	Type of cover
Occupation	Use (eg, domestic and social versus business)	Geographic area
Car group, vehicle type		Vehicle age

Source: A large motor insurer.

Therefore, a unisex pricing requirement does not mean that gender is completely removed in pricing, either at the level of an insurer's overall book or at the individual policyholder level. For example, given that car group is highly correlated with gender, young males and females who seek insurance for higher-powered cars (which young males have historically preferred) are likely to pay premiums closer to the current male rate (see also section 4.2).

However, insurers may not be able to eliminate entirely the impacts, in pricing, of younger male drivers seeking to insure more powerful cars. First, as shown above, the correlations between gender and preferred car type are imperfect. Second, it is possible that pricing on the basis of some of the correlated variables might also be disallowed. For example, as shown in Table 6, occupation is second only to age in terms of the strength of its correlation with gender. This is because some occupations have a greater proportion of males to females (eg, construction) or vice versa (eg, nursing). Some interviewees highlighted that, since occupation might be viewed as a 'surrogate' proxy for gender, as opposed to an alternative choice variable (such as car type), restrictions might also be placed on using occupation as a rating factor. If a very restrictive ban were introduced where cross-correlations with gender were removed completely, the redistribution effects highlighted in Figure 15 would be even larger.

Another issue discussed with insurers is how their underwriting policy might change. For example, under unisex pricing, younger male drivers might still opt for more powerful cars than before since the correlations between car type and gender are less than perfect. Hence, to mitigate this, one insurer suggested that it might re-classify its car groupings so that those vehicles that, beyond some cut-off point, tend to be preferred by males are placed in a higher car class (insurance group). More generally, inaccuracy in the models generated by removing the gender factor, and the potential for anti-selection effects in an insurer's own books, could mean more reliance on underwriting judgement than before. For example, some insurers might decide not to write policies for people under a certain age (eg, 21).

Marketing could also play an important role. Given that motor insurance is a highly visible product, and is often directly sold to individuals, there is also the potential for insurers to influence their mix through targeted marketing. Specialist providers already

exist who sell policies to both men and women, but who advertise and brand in a way that is more attractive to females than males. Such insurers have a higher proportion of females on their books than males, with premiums charged at gender-specific rates. With a unisex rating requirement in place, insurers might seek to use branding, advertising, and affinity deals in a way that influences their out-turn mix—for example, by advertising in women’s magazines only.

There has been much discussion as to whether using reported mileage would be a more appropriate approach to pricing risk, rather than using gender per se. Proponents of the gender ban often argue that one of the main reasons why males have more accidents is that they drive more, and that using mileage would be a fairer approach at the individual level than pricing on the basis of gender. However, collecting accurate information on mileage is more difficult than using gender as a rating variable, since mileage is a self-reported (and estimated) variable.²⁹ In addition, the effect of mileage is not constant across different driver classes. Importantly, even after accounting for the effect of mileage in the risk models, gender remains an important explanatory factor of risk. Section 3.1 further illustrates that the reason why young male drivers are higher-risk than females is explained not just by mileage, but also by psychological factors that affect driving behaviour.

In the longer term, pricing insurance based on real-time observed behaviour might become an alternative to using pre-reported factors such as gender. However, interviewees revealed that while ‘pay-as-you drive’ technologies have been experimented with in the UK and elsewhere, and might become more commonplace in the longer term, there are currently major hurdles to using these technologies in the short and medium term. They would involve monitoring individuals’ driving behaviour on a minute-by-minute basis. Since this would be more intrusive, there could be major problems in achieving widespread acceptance of these technologies. Furthermore, from a cost-effectiveness perspective, widespread deployment of pay-as-you-drive telematics may not be feasible until the technology, and logistics, become lower-cost—in terms of both installing the equipment and creating a monitoring network. The technology would probably only achieve critical mass, at lower cost, if telematic devices were fitted to new vehicles in the factory.

5.1.3 Second-order market-wide impacts (adverse selection)

Unisex pricing could result in the lower-risk gender reducing their coverage by dropping out of the market or opting for less than full cover. This would generate further inefficiencies, and prices at the overall market level that are higher than a weighted average of current male and female rates. However, because motor insurance is compulsory in the UK, it is not clear that the imposition of unisex pricing would lead to policyholders dropping out of the market altogether. Rather, some might be expected to reduce their coverage—for example, by purchasing third-party rather than comprehensive cover, or choosing a higher excess (deductible).

²⁹ See Nova Scotia Insurance Review Board (2004).

Nonetheless, under unisex pricing and given the sharp rises in premiums, young female drivers who pass their test aged 17 or 18 might choose to delay purchasing a car until their 20s. Were this to occur, at least some young females would drop out of the market. This would lead to higher average premiums for drivers aged below 20 in the longer term. This would be a market-wide effect, and would depend on the proportion of females who defer taking out cover.

There is some evidence in the literature of young females buying less cover under unisex pricing (see the literature review in the Appendix). There is also evidence to substantiate the importance of adverse selection effects more generally, although the direct evidence on the impact of removing gender as a rating factor is more mixed and overall limited.

Overall, based on the redistribution effects modelled above, which show that young male drivers may expect premiums to decline by up to 10%, on average, and more in individual cases, there is a risk that this will affect their incentives to opt for a higher-powered car, with corresponding adverse consequences for road safety. Similarly, it is not unreasonable to assume that some young females may delay driving or opt for reduced cover in response to premium increases of up to 25%, on average. While no direct evidence on the actual demand response of young drivers to unisex pricing is available, such adverse selection effects need to be considered a possibility.

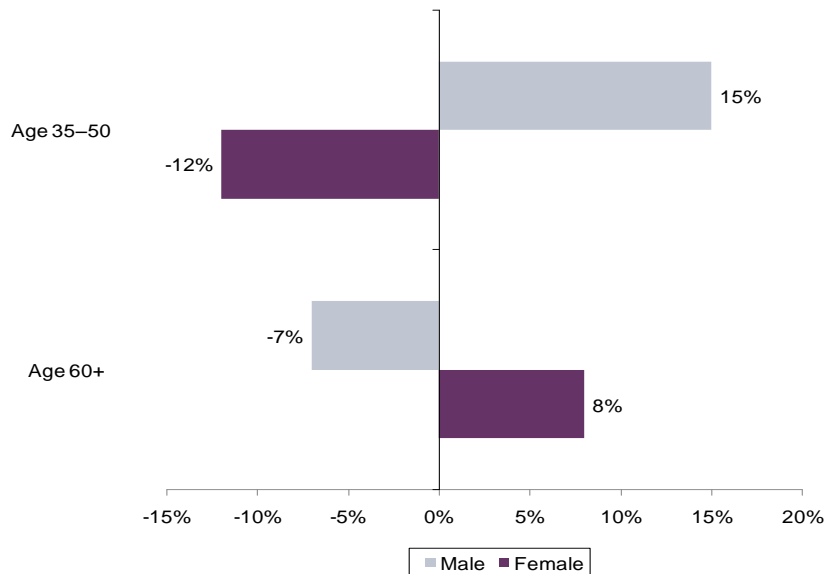
5.2 Private medical insurance

5.2.1 First-order redistribution impacts

For PMI in the UK, the main effects of unisex pricing would be redistributive in nature, with a shift to a weighted average unisex rate, and possible anti-selection in individual schemes. Across the UK PMI market, these effects will be more muted than for the other insurance products considered here, such as motor insurance. One reason is that gender is a relatively new rating factor in health insurance pricing, with some established insurers in the market not pricing on the basis of gender. As products develop and customers are offered more choice of cover, this could change.

For insurers that currently differentiate on the basis of gender, unisex pricing would lead to a redistribution between males and females, depending on their age. One PMI provider that uses gender-based rating estimated what the impact would be of imposing unisex rates (see Figure 17). Given its mix, all else being equal, premiums for males aged 35–50 might increase by up to 15%, whereas for females in this age group they might fall by up to 12%. For males aged over 60, premiums would decrease by 7%, and for females in this age group they would increase by up to 8%.

Figure 17 Change in PMI premiums (%) after removing gender as a rating factor



Source: A large PMI provider.

In the market, another factor that might result in the redistribution effects being muted for individuals is that around half the policies are issued via employers at the group level, and some individual policies are offered to married couples on a joint basis.

If unisex rating were introduced, the above redistributive changes in premiums between males and females would feed through directly to some customers with PMI—namely those with single individual healthcare policies with insurers that currently differentiate on the basis of gender.

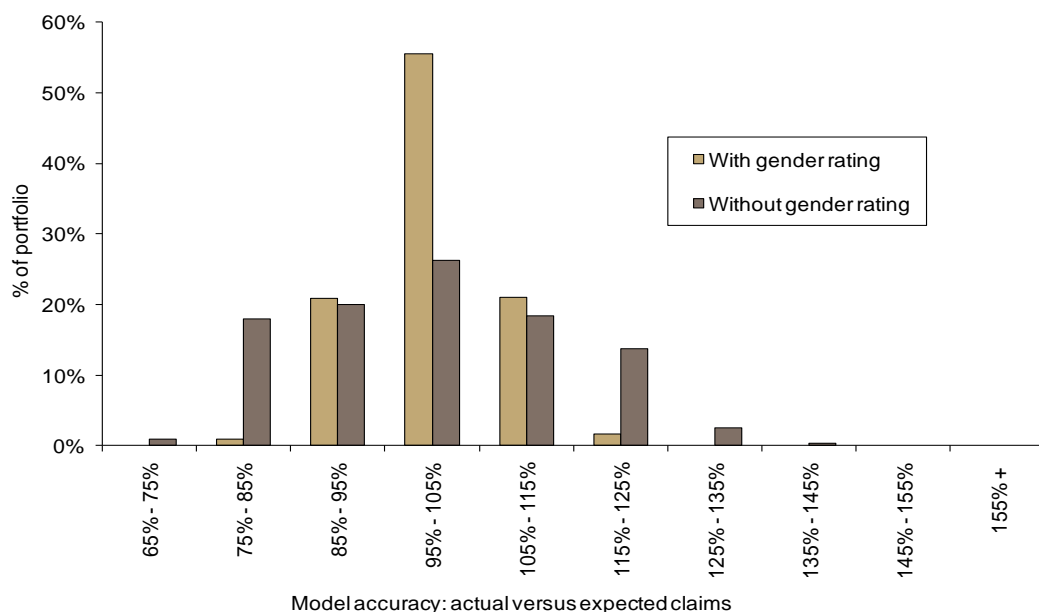
5.2.2 Supplier response impacts

UK PMI providers that do not use gender as a rating factor in PMI might not be affected by the introduction of unisex rates to a great extent, given their book mix and existing pricing behaviour. However, other firms that do use gender in pricing may seek to mitigate the own-book effects of a ban.

One insurer presented evidence to Oxera showing that its model accuracy for predicting claims costs would deteriorate if gender were not permitted as a rating factor. Without gender rating, and all else being equal, the insurer's actual claims will be considerably more variable than what it expected and priced for when using gender, as illustrated in Figure 18. With gender included as a rating factor, actual claims would be within 15% of the expected claims (ie, what is priced for) for 97% of the portfolio. By comparison, without gender rating, the claims from only 65% of the

insurer’s portfolio would have been within 15% of what has been priced for. This illustrates that a requirement for unisex pricing would reduce accuracy.

Figure 18 Model accuracy: actual versus expected claims with and without gender rating



Note: This figure is calculated for segments of the insurer’s portfolio using claims data for 2006–08 and setting actual claims against what would have been expected (ie, priced for in the model).

Source: A large PMI provider.

This uncertainty in modelling would mean uncertainty in pricing, which, in turn, may require the individual insurers to incorporate a higher risk margin and hold additional capital to cover the greater risks. However, as noted by a number of insurers, healthcare policies are reviewable annually and premiums can be adjusted. This reduces insurers’ exposure to uncertainty in pricing gender-based risk.

Some PMI providers noted that some companies in the market might seek to change their approach to marketing, target alternative rating factors, or engage in more detailed forms of medical screening, in order to abate own-book selection effects. This is likely to result in a rise in premiums. However, a mitigating factor is that the price sensitivity of people who take out single individual PMI cover may be low. This might limit own-book selection effects and adverse selection at the market level, as discussed next.

5.2.3 Second-order market-wide impacts (adverse selection)

In interviews, providers offered different opinions on the severity of adverse selection effects for PMI in the UK as a consequence of introducing unisex pricing. Not all insurers use gender in pricing, and around half the policies are offered at a group or married-couple level. In these cases there could be limited demand responsiveness to changes in price, and limited potential for higher-risk individuals to opt in (or lower-risk individuals to drop out) of the market if there were a unisex rating requirement.

PMI in the UK is a voluntary purchase that supplements universal NHS cover. Policyholders who purchase single individual cover do so for many reasons, including the timeliness of access and quality of healthcare. These preferences may to some extent limit the demand sensitivity of these consumers to any changes in prices if unisex rates were introduced. Increases or decreases in male and female premiums, stemming from unisex pricing, could nonetheless lead to some adverse selection in the single individual cover market.

The different effects mean that the long-term adverse selection impacts stemming from a simple ban on the use of gender in the UK PMI market are unlikely to be severe overall. However, if insurers were simultaneously required to include maternity and childbirth cover in any unisex cover, the risk differential between males and females would widen considerably. Under these circumstances, the adverse selection problem would be likely to become more significant. Absent this outcome, any effects are likely to be mainly redistributive for single individual policyholders. Any risk margins built in by providers to abate anti-selection within their own book might be transitional.

Most existing studies of adverse selection in healthcare are based on experience in the USA (see Appendix). They show evidence of adverse selection effects in the individual (non-group) healthcare market, but, as expected, not so much for group schemes. In the UK context, this would suggest that unisex pricing could have longer-term adverse selection impacts mainly on the individual market, but is unlikely to result in such effects in the group PMI market.

5.3 Term life insurance

5.3.1 First-order redistribution impacts

The main first-order impact on life insurance of a unisex pricing requirement would be that females pay more and males pay less, depending on the gender mix in the portfolio. Since more males than females buy life insurance, if the use of the gender factor were banned, premiums for females would be expected to move significantly towards the present male rate—ie, the unisex rate would be higher than the simple average between the current male and female rates. An illustration is provided in Table 7 below.

Table 7 Illustration of redistribution effect: term life insurance

	Current premium	Gender mix	Unisex premium		% change
			Weighted average	Including risk margin	
Female	25	30%	28.5	~30	14–20% increase
Male	30	70%	28.5	~30	0–5% reduction

Notes: Stylised illustration only. Current premiums (broadly) reflect actual annual premiums for male and female (non-smoking) policyholders, assuming a 15-year term and a guaranteed amount of £150,000 (single cover). The unisex premium is calculated as the weighted average (plus risk margin), all else being equal.

Source: Oxera

With the current annual life insurance premiums assumed to be £25 for females and £30 for males, holding all else constant, the unisex premium cannot be lower than the weighted average between the current male and female rates, with the weights determined by the gender mix. As a result of more males buying life insurance, the resulting minimum unisex rate is closer the higher male rate—ie, females would see their premiums increase to more than halfway between the current female and male rates.

Given the prominence of males in the portfolio (and especially if accommodating the possible need for a risk margin to take into account the uncertainty in the future gender mix), an insurer may well adopt the male rate for the entire portfolio—after all, the weighted average unisex rate is not too different from the male rate.

As discussed below, this could result in fewer women taking out insurance, potentially increasing the underinsurance problem for women.

Many life insurance policies are sold to married couples on a joint basis, including as a stand-alone product, and in terms of cover offered alongside mortgages.³⁰ Premiums for these policies would be expected to be less affected. Instead, it is single females taking out individual policies who would be most adversely affected by a ban on the use of gender as a factor.

5.3.2 Supplier response impacts

Although it is not entirely clear how insurers would respond to the greater pricing risks associated with the requirement to set a unisex rate, the options include the following, as discussed with a number of life insurers active in the UK market.

- Proxies: for single policies, insurers may try to use proxies for gender. For example, insurers noted occupation or indeed measures such as body mass index as possible proxies. However, these measures are not perfect proxies for gender

³⁰ The mix between joint and single policies varies by insurer. Based on the data of one insurer, the joint:single split in its term insurance book is 25:75. Of the single policies, the majority (more than 60%) are for male policyholders.

risk, and detailed medical testing to achieve more accurate pricing at the individual level may be too costly and intrusive an alternative. Moreover, medical conditions do not fully explain differences in expected claims costs—gender is still important in explaining life expectancy.

- **Risk margin:** insurers may need to increase their capital reserves to protect themselves against the increased pricing risk, or simply include a risk margin in prices. In either case, in the short term, they would be expected to set unisex premiums at the current male rate (see Table 7). Insurers noted that, while a ban on using gender as a rating factor could lead to such short-term effects, the impact would be even worse if insurers were not allowed to collect information on the gender mix in their insurance books. Unisex prices would most likely remain at, or close to, the higher male rate until individual insurers had gained sufficient experience in the new pricing environment of the gender mix and claims experience of their book. Larger insurance companies, with more data and sophisticated pricing models, might also be able to adjust more quickly than smaller providers, with consequences for the competitive position of different providers in the market.
- **Product design:** one insurer noted that, instead of increasing prices, insurers might consider changing the structure of the product offered. At present, most life insurance products are priced on a long-term basis, with stable premiums guaranteed over the term of the policy. However, given the greater uncertainty introduced by unisex pricing, and the potential for anti-selection effects in the insurers' own books, insurers might switch to variable rates, or to shorter-term products with renewable options. In effect, rather than fixing into set prices for a period of, say, ten years, and then pricing to incorporate uncertainty in out-turn mix (through reserves or a risk margin in prices), insurers might instead seek to share some of this risk with policyholders by allowing for greater variability in prices over time. In either case, both males and females would be faced with a fall in product quality to the extent that guaranteed premiums are a valued product feature.
- **Marketing:** while insurers might try to adjust their marketing to appeal to females rather than males, it was highlighted in discussions with insurers that life insurance tends not to be sold directly to consumers, but rather through intermediaries. This lack of a direct relationship between the insurer and the end-consumer may limit the scope for targeted marketing, and it is not clear to what extent an insurer is able to change its distribution terms for brokers or agents to control the gender mix in its portfolio. On the other hand, insurers would have a significant incentive to try to influence the pattern of sales through their brokers so that the gender balance turned out favourable to them. This potentially creates a misalignment of incentives between the end-customer and the broker if the latter is rewarded by the insurer to bias the gender mix—eg, by using different commission rates.

5.3.3 Second-order market-wide impacts

The above describes effects that might occur at the individual insurer level, at least in the short term. In the longer term, there could be adverse selection effects at the market level, as females drop out of the market. In particular, an insurer noted that there could be 'selective lapsing'—ie, with single female policyholders 'lapsing' when their policy comes up for renewal.

Term life insurance coverage tends to be voluntary. While single females might be able to afford life insurance, and would benefit from it, an increase in price at the time of renewal might lead them to stop buying it. This would also depend on how renewals under unisex pricing were dealt with. In the longer term, any selective lapsing by females could give rise to higher premiums (with premiums closer to male rates), and more (single) females dropping out of the market.

As noted above, many policies are joint life policies and/or related to mortgages, which reduces the likelihood of significant market-wide adverse selection effects. Also, there is limited evidence in the literature that adverse selection effects in life insurance are significant, and there is no direct evidence available on what the impact of a ban on using gender as a rating factor would be in this market (see Appendix). Overall, the long-term impact of unisex pricing in this market may well be mainly redistributive—ie, females pay more for term life cover and males less.

5.4 Pension annuities

5.4.1 First-order redistribution impacts

The first-order impact of banning the use of gender in annuity pricing is that males would receive a lower annuity payment for a given pension pot. Given the current gender mix (ie, most annuities are for male policyholders), this implies a reduction in annuity income for the majority of annuitants. Table 8 provides an illustration of this redistribution effect.

Table 8 Illustration of redistribution effect: pension annuities

	Current annual annuity paid	Gender mix	Unisex annuity payment Weighted average	Including risk margin	% change
Female	5,500	30%	5,850	5,500–5,850	0–6% increase
Male	6,000	70%	5,850	5,500–5,850	3–8% reduction

Notes: Stylised illustration only. The current annuity payment (broadly) reflects the annual payment received by male and female pensioners on a pension fund of £100,000 converted at age 60 (single, non-escalating, etc). The unisex rate is calculated as the weighted average (plus risk margin), all else being equal.

Source: Oxera.

The introduction of a unisex annuity rate benefits females, but at the cost of males. With males being the lower-risk group that dominates the portfolio in this illustration

(and in practice in the market), the maximum annuity payment implied by the weighted average is closer to the higher male rate. That is, females may benefit more than the simple average between the current male and female rate would suggest, but at the cost of the majority of annuitants, who see their payment decline. If insurers adopt a risk margin, to mitigate within-book anti-selection, this would reduce the benefits for females and further increase the cost to males.

The redistribution effect of unisex annuity rates for the UK has previously been quantified in a report for the Equal Opportunities Commission (EOC 2004). This research is somewhat dated as the market has evolved since. Nevertheless the findings of this study are still broadly relevant. Following a modelling exercise, the study concluded that, in the compulsory market, the unisex annuity rate would settle around one-quarter of the way below the male rate currently offered (or three-quarters of the way above the current female rate). However, the outcome would vary by policyholder. For example, it would depend on whether the policyholder had a single or joint policy with their partner, and the size of the pension pot (which would influence whether the annuitant could secure the 'best rates' by purchasing an annuity on the open market):

the best rates could improve by up to 10% for women, and worsen by up to 3% for men. The best joint life annuities for men could fall by 1%. These are the maximum changes expected, so they are not likely to be large. However, 80% of people have small pension funds worth less than £30,000. It is difficult for people with small funds to benefit from open market rates as most providers have a minimum fund value below which they will not accept a transfer, so the majority of people are likely to remain with their existing pension provider when purchasing an annuity. They will not, therefore, have access to the best rates. Women in this situation may see no change in annuity rates compared with today, while men could see a fall in rates of up to 13%. Joint life annuities for men could fall by 4%

The study also found that although there was no reason why unisex rates could not be introduced, they were 'unlikely to be of significant or widespread benefit'. In part, this was because, for those who could see a change in their annuity rates, more than three times as many pensioners—not just males, but also their spouses or widows—could see a lower income rather than benefit from a higher one.

In conclusion, taking into account the findings of this study and the above illustration, and focusing purely on first-order redistribution impacts, females may gain from unisex pricing. However, this increase would come at the cost of the majority of male annuitants (and their dependants), who would see their annuity income fall to subsidise the higher female benefits.

5.4.2 Supplier response impacts

Moving beyond pure first-order impacts, unisex annuity pricing increases pricing risks. Insurers would seek to mitigate the increased uncertainty and to avoid anti-selection within their own book if they priced unisex rates at a level that attracted too many females at the given unisex rates.

As a 'boundary condition', insurers interviewed by Oxera thought that, in the immediate short term, the unisex rate would simply reflect current female rates—ie, rather than the females experiencing a rise in premium rates, the male rates would fall to the female level to control for the uncertainty in the gender mix in the portfolio.³¹ Over the medium to longer term, this might change as insurers built up more experience in their book and observed the pricing approach adopted by other insurers in the market.

A move towards unisex pricing would make insurers wary of underpricing female annuities. Writing an annuity can represent a commitment to paying out an income to the policyholder until they die—which can be for a long time (eg, 30 years or more). If the insurer were to set rates at a simple weighted average of the current male and female rates, this would run the risk of attracting too many females onto the books of the insurer concerned, with the provider committing to paying out more annuity income than it had bargained for when setting the rate. Small changes in the gender mix could mean large changes in expected profitability.

While the open market for annuities used to be smaller than the internal market, it is growing. Insurance companies would be particularly wary of obtaining too many female policyholders from this growing marketplace.

Insurers interviewed for this study noted that they would need to make provision for the liability they may face from getting their mix wrong, and that this would be in the form of additional capital reserves. The additional reserving provisions would place downward pressure on the unisex annuity rates offered by individual insurers.

A feasible outcome, at least in the short term, would be that unisex rates would simply reflect the current female rate, in which case the risk associated with uncertainty about the gender mix in the portfolio would be eliminated. Males would be worse off and females would be no better off. Removing gender-based pricing would not, therefore, lead to 'cheaper annuities'.

Over time, whether the additional reserving provisions would need to remain in place would depend on the experience gained by insurers in a unisex pricing environment, and whether they can adjust rates quickly enough in view of their experience. In

³¹ In this context, some insurers highlighted that, for individuals in the compulsory market who convert their private pension pot into an annuity, it is currently mandatory for any 'protected rights' element (any opt-out part of the state pension) to be priced on a unisex basis. In practice, this already includes a risk premium since the unisex rate tends to be based on female mortality tables, and is often priced at the lower female rates. This market is small and not a main focus for providers and, in practice, unisex rates may be better than those for protected rights. See also EOC (2004).

interviews, several insurers noted that this would depend on whether they would still be allowed, for reserving purposes, to collect information on gender at the point of sale. If so, insurers would be able to monitor, based on their pricing policy, what mixture of females and males they attract from year to year. They might then adjust their unisex rates based on this experience. As their book settles in the new environment, the need to make additional provisions for future liabilities stemming specifically from unisex rating could fall. Unisex rates might then start to improve again. However, this process could take as long as ten years as insurers seek to gain enough experience in the new environment. Even then, some risk margin might still be included in annuity rates. Even when insurer books settle in the new environment, there would still be the legacy of annuities sold during the transition period where some of the annuities sold will have been priced to the detriment of the customer and others will be loss-making for the insurer.

If insurers were not permitted to collect information on gender mix for reserving purposes, interviewees pointed out the likelihood that they would continue to need to set aside additional capital to cover the risks associated with gender mix, in particular under Solvency II. Rates would then remain above the weighted average between current male and female rates over the medium to longer term.

EOC (2004) considered the impact on reserving requirements for insurance companies stemming from the increased uncertainty regarding the mix of males and females. The study noted:

a broader pooling of risk increases the uncertainty faced by annuity providers, as they have less information about the individuals they are insuring. A higher risk would need to be covered by a higher return, in order to continue to attract capital to back annuities. An uncertainty margin in annuity products would be needed... which would be higher than just the average of male and female rates... This would mean that the amount paid out in retirement income would reduce, leaving all annuity purchasers worse off in retirement. [However,] annuity rates can be adjusted quickly to new information, such as changes in life expectancy or interest rates. As providers build up information on their unisex client base, they will be able to adjust rates to reflect more accurately the proportion of annuity business with men and women respectively.

As such, the study considered that increased reserving requirements would be transitory, rather than a permanent feature of a unisex annuity market, since insurers would gather any new information on mix over time (which also assumes that insurers can indeed still collect information on gender mix at the point of sale).

No annuity providers interviewed as part of this study had explicitly modelled the impact of a unisex pricing requirement on capital reserves and pricing. One insurer provided some evidence on the increased reserving requirements to which unisex rating might lead. This modelling showed that if unisex annuity rates were set at lower

current female rates, there would be very little change in capital reserving requirements. If, however, unisex rates were set at the weighted average of male and female rates, this would lead to a 1.3% decrease in reserving requirements for males but a 5.6% increase in reserving for females.

Although proxy factors such as occupation and weight/height were discussed, the insurers considered it less likely that they would use new rating variables in response to a ban on the use of gender.³² Also, it was considered unlikely that, in order to abate own-book selection effects, targeted marketing aimed at males would work in annuities. As such, the main response to a unisex pricing requirement would be through a risk margin, either directly in pricing or indirectly through reserving.

5.4.3 Second-order market-wide impacts (adverse selection)

Under present regulations in the UK, part-annuitisation of defined-contribution pensions is compulsory. This limits the extent to which male annuitants would drop out of the market altogether under unisex pricing—the compulsory annuitisation means that they have no direct choice about taking up the product.

Nonetheless, there is evidence that, in the compulsory market, there can be an adverse selection effect if policyholders opt for certain types of annuity, with lower-risk annuitants, in effect, buying less coverage. There may also be some effect in the form of a disincentive to save for a pension in the first place.

In addition, under the plans of the new coalition government, compulsory annuitisation may be abolished. There could then be more severe adverse selection problems in the annuity market, with males opting not to take out annuities. Here, there would be a risk that unisex rates would be priced closer to the lower female rate, even over the long term. In the meantime, such outcomes might also be expected in the small voluntary annuity market in the UK.

There is some literature to support adverse selection effects in annuities, in particular in the voluntary market (see Appendix). The evidence also suggests that imposing restrictions on the use of certain rating factors—such as gender—might reinforce such adverse selection effects.

Overall, while not as severe as in the case of a ban on using age in annuity pricing, the adverse selection effects of a gender ban may nonetheless be significant, in particular if annuitisation in the UK were no longer compulsory in the future (as per recent proposals)—this would make the market less efficient, with implications for consumer welfare.

³² Recent developments over the past ten years, such as enhanced annuities for people with different lifestyles, and impaired life annuities that offer better annuity rates for people with illnesses and reduced life expectancy, rely less on gender, and more on further screening of the individual concerned, to set annuity rates. However, any move towards this for standard annuities would imply additional costs and result in more intrusive medical underwriting than at present.

A1 ACADEMIC LITERATURE

This appendix provides a short summary of the relevant literature on adverse selection effects in insurance, supporting the product-specific impact analysis presented in section 5. For existing reviews of the literature on adverse selection and insurance, see for example Cohen and Siegelmann (2009).

Motor insurance

In a seminal study, Dahlby (1983) examined what the impact might have been of prohibiting gender-based pricing in the Canadian motor insurance market in 1978. He shows that while premiums for young males would decrease slightly, premiums paid by females would increase substantially. In addition, the proportion of young males purchasing collision insurance would increase slightly, while the percentage of females purchasing this insurance would decline considerably.

The Dahlby study was the first to illustrate that adverse selection is a real-world phenomenon in motor insurance, and the further detrimental impact that unisex rating could have on adverse selection.

Puelz and Snow (1994), using policyholder data from the USA, found adverse selection in (optional) collision insurance, but of a different type to that cited by Dahlby. The authors showed that, if insurers suspect the presence of adverse selection, they aim to mitigate its impact by offering a menu of policies. This is in the hope that high- and low-risk individuals will self-select via their choice of policy—here, through their choice of voluntary excess. This signal can then be used by the insurer in pricing different levels of voluntary excess. The authors indeed observed that, while higher-risk drivers tend to opt for full cover, lower-risk drivers opt for a larger excess. While lower-risk drivers take out less cover per policy (and hence overall levels of cover are reduced), they do not subsidise the higher-risk drivers. This is somewhat different to Dahlby's findings, although low-risk drivers are still worse off than they would otherwise be.

However, in studying the Quebec motor sector, Dionne et al. (2001) modify Puelz and Snow's approach. They find that insurers do not need individuals' choice of excess to perform the function of reducing adverse selection. This is because, if insurers have a long list of rating factors available, their risk-classification processes should be sufficient to produce no residual adverse selection within each risk class. Chiappori and Salanié (2000) also examined the motor insurance market in France, focusing on drivers with less than three years' experience, and the choice made between purchasing mandatory (minimum) coverage and optional (more comprehensive) coverage. The authors again found that riskier individuals do not buy more insurance—in this case, optional cover.

While these later studies disagree on the extent and form of adverse selection under normal market conditions, they do not directly model what might then happen if a ban on the use of particular rating factors were introduced. Indeed, the studies do not preclude adverse selection effects occurring following such a ban. For example, in the Puelz and Snow framework, if choice of excess is used by insurers as a signal in order to abate

adverse selection, insurers might rely on excess choice even more were a relevant rating factor to be banned—premiums for different levels of voluntary excess might then widen. The Dionne et al. (2001) study finding of no residual adverse selection crucially relies on there being a sufficient number of relevant rating factors at the insurers' disposal. Removal of a relevant rating factor might therefore be expected to result in some form of adverse selection, with low-risk drivers buying less cover (eg, by opting for a higher excess, or through fewer low-risk drivers buying optional cover). Insofar as gender is a relevant rating factor, its removal might then lead to some kind of adverse selection effects.

Other studies are available which, while not testing individual policyholder choices, compare premiums in regions with a ban on the use of certain rating factors versus those without, or the before-and-after effects of introducing a ban on using certain rating factors. These studies examine more directly the question of whether legal restrictions on rating factors are associated with higher claims costs. Such studies focus on the more general introduction of rating factor restrictions—such as community rating—rather than just a ban on the use of gender in pricing.

In studies of the Canadian motor insurance market, insurance premiums in provinces with state monopoly provision of motor insurance have been found to be higher than in markets where private insurance companies are allowed to compete. Skinner (2008) finds that, in 2007, three of the four highest average premiums were observed in the three public insurance provinces. In contrast, five of the six provinces with the least expensive premiums were in private-sector competitive markets.

Skinner (2008) offers several explanations for why premiums are higher in public systems, a key one being that, in provinces with public motor insurance, coverage and pricing decisions are politicised, whereas in private competitive markets insurance premiums are calculated using a mix of rating factors. As such, in public systems, premiums for high-risk drivers are set below the actuarial cost of insuring them, raising all other premiums. Arguably, this effect alone would simply result in a first-order redistribution impact. However, the author also notes that provinces that suppress their rates in this way may also have increased frequency and risk of collisions.

Mullins (2003) finds that Canadian provinces with public motor insurance systems have a higher motor collision, death, injury and property damage frequency (per driver) than those provinces with market-based insurance. Crucially, death, injury and property damage frequency are even higher for young drivers in these provinces, being highest for males aged between 16 and 25. The explanation offered by Mullins is that it is 'social risk pricing' in provinces with public insurance provision that drives these differences in accident rates, since this produces 'too many subsidised higher risk drivers'. Mullins also proposes that 'moral hazard' may be at work—potentially meaning that young males drive more dangerously than they otherwise would.

Another potential effect is that community rating affects the decisions of young males and females on when to start driving, or what types of car to drive. Indeed, Brown et al. (2004) interpret the findings of Mullins as being consistent with the notion that: 'if poorer

drivers are charged less than the cost of the risk they bring to the insurance pool, then more of them will buy insurance or they will buy more insurance than if they paid the true actuarial expected cost. With more of these higher risks in the pool, one would expect accident frequency and severity to rise.'

In a recent study of the USA, Derrig and Tennyson (2008) examined the introduction of rate regulation in the private motor insurance market in Massachusetts. The study is one of the few to examine the relationship between cross-subsidy levels in insurance and lost costs, as opposed to choices by individuals. A multitude of regulations were introduced in Massachusetts in 1978. These banned the use of age, gender and marital status in the pricing of car insurance, and required all insurers to use the same nine driver classification categories in pricing insurance (encompassing driver experience, drivers' training and use of car). The regulations also restricted differentials in premium levels across the prescribed driver classes ('tempering'), and annual increases in premiums for each driver class relative to the average state-wide premium across classes ('capping'). This instilled a wide range of cross-subsidies between driver classes.

Two key findings are presented. First, claims costs and premiums escalated in Massachusetts. Prior to 1977, virtually no difference in costs was observed between Massachusetts and other states. However, over the 1978–1995 period, claims cost levels in Massachusetts were 44–50% above what they might otherwise have been. Second, the authors examined the profile of claims cost levels in individual towns within Massachusetts over the 1997–2007 period. Growth in costs was much higher for towns where, given the nature of the rating regulations and the demographics of the town concerned, insurance for the sub-population concerned was underpriced relative to the risks (towns that the authors call 'subsidy receivers'). Overall the strict regulation of classification and pricing of the Massachusetts private passenger automobile insurance after 1977 instilled cross-subsidies which, in turn, resulted in excessive cost and premium growth. The authors note that this is consistent with incentive effects on entry into driving (adverse selection) and/or riskier driving behaviours (moral hazard).

While the above (Canadian and USA) studies concern the introduction of fuller community rating, rather than a ban on the use of gender alone, they do illustrate how the removal of relevant rating factors from insurance pricing can lead to higher premiums, higher premium growth, higher accident rates, less road safety, etc. Moreover, they illustrate that if gender were to set a precedent for other uncontrollable factors to be removed from pricing insurance, the results would be likely to be highly significant.

Medical insurance

Most studies of adverse selection in healthcare are based on experience in the USA. This differs from the UK system in many respects, in particular in terms of the levels of universal healthcare provision. However, it is of interest to examine the extent to which adverse selection in US healthcare has been triggered by a ban on using certain rating factors. The studies might be regarded as offering an indication of the adverse selection effects that might occur in the UK PMI market.

Studies consider the impact of community rating rather than just a ban on the use of gender as a risk factor. Severe implications were highlighted by Chuffart (2007) re the case of New York, where a requirement was introduced in 1993 for all insurance companies selling health insurance to individuals, or employee groups with fewer than 50 employees, to accept all applicants at flat community-rated premiums (specifically regardless of age, gender or pre-existing medical conditions, with adjustments for geographic location only). The author noted that some private insurers in the state left the individual health market, and those that remained immediately increased their excess levels from \$1,000 to at least \$2,500, with further limits in their policies to cap benefits. One local company, Empire Blue Cross Blue Shield (EBCBS), sought approval to increase its excess or limit its benefits in other ways, but this was not granted. This placed the company at a competitive disadvantage and gave rise to strong anti-selection because some of its lower-risk individuals either dropped out of the market altogether or purchased coverage from competitors. Most of its high-risk policyholders stayed with EBCBS, and other private companies' higher-risk policyholders migrated to EBCBS. As a result, EBCBS's net enrolment dropped rapidly by up to 15% each year, while its members' average age rose from 44.2 years in 1992 to 49.8 years in 1994, leading to more than 60% higher expected morbidity costs.

However, the above analysis concerned mainly the case of a single insurer, rather than the market as a whole. At the market level, Buchmueller & DiNardo (2002) examined whether community rating leads to adverse selection in this market by comparing three states in the USA: New York, which had imposed pure community rating in its small group (and individual) health insurance markets; Connecticut, which had introduced more modest rating restrictions; and Pennsylvania, which had no new regulations. The authors found that the proportion of individuals in small firms covered by group insurance did not fall in New York relative to Pennsylvania or Connecticut. While there was a small decline in small-firm group cover, the authors did not find significant evidence of the death spiral effects predicted by more severe models of adverse selection. The authors highlighted, however, that the reforms in New York induced a structural change in the supply of healthcare, with an increase in activity in the health maintenance organisation (HMO) sector, and a shift away from traditional indemnity insurance.

In another study of small-firm group healthcare, Simon (2005) found only a small reduction in worker coverage as a consequence of community rating. In states introducing full reforms, the analysis indicated that the number of employers who offered coverage was not affected, but that the number of workers covered by the plans fell, with the low-risk workers experiencing a greater impact. There was little difference in states

introducing partial reform. Those introducing full reform saw a \$7.80 increase per person in monthly premiums, with a \$5.10 increase in the employee contribution to the premium.

Compared with the above study on group health insurance, Lo Sasso & Lurie (2009) focused specifically on the individual (non-group) healthcare market to examine whether state community rating regulations passed in the 1990s led to adverse selection. Using data from national surveys, they found that, where community rating was introduced for non-group healthcare, this led to a decline in the health of the pool of individuals insured, with healthier individuals leaving the pool and less healthy individuals opting in. Specifically, community rating made healthy people 20–60% less likely to be insured by non-group health insurance, while those in poor health were 35–50% more likely to be insured in the non-group market.

A US study of the non-group healthcare market was undertaken by the Congressional Budget Office (2005). In this comparative study of different states, it was found statistically that individuals forgo cover in states with strict community rating laws. Based on earlier studies, a 30% 'adverse selection premium surcharge' was assumed in those states with more stringent forms of community rating (where all applicants must be offered the same premium), with a lower premium proportionately assumed in states with lesser restrictions—ie, strict community rating was expected to result in 30% higher premiums. The resulting effect on insurance take-up from changes in overall premiums (ie, the number of people taking out insurance) was considered to be limited, however, due to a low take-up elasticity of demand at the market level.

Life insurance

Pauly et al. (2003) examined the price elasticity of demand for term life insurance and its relationship with adverse selection. The authors estimated two types of elasticities of demand for those purchasing at least some level of cover: the responsiveness of individuals' choice of coverage level to changes in price; and the responsiveness of coverage level to people's mortality risk (as assessed by the insurer). They found that the elasticity of coverage with respect to premiums was much higher than the coverage elasticity with respect to people's risk of death. While people responded to some extent to price changes for life cover, those with higher risk did not then take out significantly more cover. The authors note that the price elasticity, in the range of -0.3 to -0.5, is sufficiently low that adverse selection in term life insurance is unlikely to lead to a major death spiral, and may not even lead to significant effects for total purchases of life cover.

This would suggest that a ban on the use of gender as a rating factor—which would potentially entail the higher-risk gender (males) paying lower premiums in transition than otherwise—would not necessarily lead to opt-in to the market by those with higher mortality risk (ie, males), or drop-out by those with lower mortality risk (ie, females). This may be because people are not very good at predicting their own probability of death over the next few years (for example, the ten-year period covered by many term life policies), relative to their knowledge of their average longer-term life expectancy. It may also be due to the strong effect that risk-averse people are more likely to take out life cover, which in turn dampens the price-responsiveness of policyholders overall to changes

in prices, and the degree to which higher-risk people would actually seek to take out more life cover were this to become cheaper.

However, very few studies explore explicitly what the impact on life insurance markets would be of removing relevant risk-rating factors. For example, Viswanathan et al. (2007) examined whether insurers' inability to use genetic information as a rating factor leads to adverse selection, and concluded that although such a restriction has an effect, the problems are not so severe and should be manageable for insurers.

Overall, while there is no explicit evidence on the impact of banning the use of gender as a rating factor on the likelihood of adverse selection in term life insurance, the effects may be limited, in terms of both the number of people taking out life cover and the levels of cover sought per policy, even though life insurance cover is voluntary.

Pension annuities

There is some literature on adverse selection in annuities. For example, Finkelstein & Poterba (2002) found that, in terms of the decision on whether to purchase an annuity, UK annuitants typically live longer than non-annuitants with similar characteristics. Life expectancy for a typical 65-year-old male voluntary annuitant is 20% longer than for a typical 65-year-old male in the general population. McCarthy & Mitchell (2010) also reported that death rates for male (voluntary) annuitants were lower than for the general population of the same age in the USA and the UK.

Finkelstein & Poterba (2004) suggested that this is one potential explanation for why, at present, voluntary annuity markets in both the USA and UK are small. For voluntary annuities, the authors calculate that a typical individual would face a 'money's worth' of only 80–85%—ie, their expected present (discounted) value of payouts, given the annuity rates, represents only 80–85% of the annuity's initial premium. One of the reasons is adverse selection. As noted by Cannon & Tonks (2006), who subsequently reviewed in more detail international evidence on annuities markets, individuals who expect to live longer are more likely to purchase annuities, but annuity providers then recognise these incentives and price accordingly to accommodate these adverse selection problems. This results in some individuals with shorter life expectancy being excluded from the market. Cannon & Tonks (2006) also listed a range of reasons why annuities may be less popular, at least in voluntary markets.

A natural extension of this argument, therefore, is that imposing restrictions on the use of certain rating factors—such as gender—might lead to further adverse selection effects, and could make annuities less attractive to the general population than they currently are.

Finkelstein & Poterba (2004) also noted that there are many dimensions in which adverse selection occurs in the annuity market. They examine three dimensions: quantity of cover purchased; degree of back-loading of payouts; and whether the annuitant selects a policy that provides payments to their estate in the event of their death. The study finds that there is little difference in the quantity of cover purchased by high- and low-risk individuals. However, strong evidence is uncovered that annuitants do select along

features of the contracts offered by insurance companies. Annuitants with longer expected lives are more likely to purchase a policy that back-loads their annual payout (since they will expect to live longer), and are much less likely to select a policy that provides a guaranteed payout to their estate in the event of their death (since this is of less value to them). The authors noted the differences in the way that such adverse selection effects would be expected to occur in the compulsory versus voluntary annuity markets in the UK:

Adverse selection is expected to operate differently in these two markets. In the voluntary market, low risk individuals, those with high expected mortality, have the option of not buying at all. As a result, selection on [buying or not buying], between annuitants and non-annuitants, should be larger in the voluntary market than in the compulsory market ... Because low-risk individuals can opt out of the voluntary market, however, the voluntary annuitant population will be more homogenous than the population in the compulsory market. This could lead to more adverse selection *across product types* within the compulsory than the voluntary annuity market.

Hence the logic of this argument is that, in the far larger compulsory annuity market in the UK, selection effects on the decision to buy (or not buy) an annuity may be small given the compulsory nature of the product. Indeed, Finkelstein & Poterba (2002) presented evidence that adverse selection on the buy (or not buy) decision is roughly half as great in the compulsory market as in the voluntary market. However, this constraint in the compulsory market means that selection effects are more likely to arise elsewhere in areas where annuitants *do* have a choice—such as in choosing the contract type.

Finkelstein et al. (2009) then built on the above study to explore specifically what might happen in the compulsory retirement annuity market in the UK if a ban were introduced on the use of gender in setting annuity rates. This acknowledged the constraints on annuitants' decision-making, while allowing annuitants flexibility over the exact annuity policy chosen. Having constructed a model of the UK annuity market, the authors found that a ban on the use of gender in pricing would result in a 7.1% redistribution of annuity payouts from males to females. However, they argue that insurance companies may respond by altering their menu of contracts to abate adverse selection, which in turn may reduce the redistribution from males to females to 3.4% under unisex pricing. Hence, by recognising that insurers can vary the menu of contracts they offer, the redistribution from men to women under a ban on gender-based pricing is reduced by as much as 50%. The findings therefore highlight the importance of considering the response of insurance contracts to regulatory restrictions.

The authors also noted that, although there is a net redistribution impact, there is relatively little loss in efficiency in the compulsory market. The compulsory nature of the market means that people do not drop out of it to any significant extent and, since insurers can adjust their contracts, residual adverse selection effects are mitigated to some degree. However, Finkelstein et al. (2009) noted that inefficiencies stemming from a ban on the use of gender in pricing could be much larger in voluntary annuity markets,

or if individuals instead 'draw on unobservable savings as a substitute for buying annuities'.

Overall, this would suggest that, if annuitisation in the UK were no longer compulsory in the future (as per recent proposals), the adverse selection effects of a ban on the use of gender would be greater (ie, going beyond the effects already present in the currently small voluntary market).

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Aims and scope: The Association of British Insurers (ABI) is the trade body representing the UK's insurance industry. The ABI Research Paper series is used to publish the research that the ABI carries out on behalf of its members in order to help inform the insurance industry and contribute to public policy debate.

Series Editor: Rebecca Driver, Director of Research and Chief Economist, ABI

Author: This paper was written by Oxera. The ABI project manager was David O'Neill.

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ISBN 978 1-903193-55-9

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