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More for less? Puzzling selection effects in the insurance market

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Abstract

We document a large and persistent anomaly in the UK car insurance market over the period 2012-13: insurance companies charged a higher premium for third-party (liability) insurance than comprehensive insurance (which includes third-party). Furthermore, some companies charged higher premiums for comprehensive policies with larger deductibles. In contrast with current theories of adverse or propitious selection, our evidence suggests both that consumers are too confused or too poorly informed to arbitrage between policy types and that sellers of car insurance do not implement the incentive-compatibility constraints at the heart of consumer demand theory. This particular insurance market is much less sophisticated than that characterized by modern microeconomic theory.

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1. Introduction

In this paper we document two significant anomalies in the advertized premiums for car insurance in the UK over the period 2012-13. First, we show that the premium for comprehensive insurance was substantially less than that for third-party (liability) insurance: since comprehensive insurance automatically includes third-party insurance as well as insurance of the buyer, *ceteris paribus* it must be strictly more valuable to the buyer and strictly more costly to provide by the insurer. Second, within the comprehensive insurance market, policies with higher deductibles are frequently more expensive than policies with lower deductibles, despite the fact that a higher deductible makes the policy less valuable.

These anomalies require a failure of arbitrage on behalf of buyers: for example, an individual who purchased third-party insurance[1] could have been strictly better off by choosing to buy comprehensive insurance from the same provider. Correspondingly the anomaly also requires a failure by insurers to provide menus of policies that satisfy an obvious incentive-compatibility constraint, although this need not be irrational so long as consumers persist in their current behaviour (i.e. there is no need to provide incentive-compatible menus of prices).

It might be thought that this anomaly must be a disequilibrium that would quickly be rectified as agents learned about it. In fact the anomaly has persisted for almost two years: our data were collected in June 2012 and June 2013; the anomaly continued into 2014 and 2015 (when it was slightly smaller). During this period, two long-anticipated changes affected prices. First, in April 2013 the UK law on personal injury claims was changed to reduce the cost of litigation and reduce fraudulent claims and it became harder to avoid insuring a vehicle.[2] Second, insurers were required to undertake a

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[1] Including one of the authors of this paper.

[2] Until April 2013 it was not necessary to insure an unused vehicle kept off the road and this made it easier to avoid the legal requirement to purchase insurance. Where an accident occurs and the guilty party does not have insurance (or cannot be traced after the accident), pay-outs to the injured party are made by the Motor Insurance Bureau, which raises its funds from a levy on insurance companies, so uninsured vehicles form an extra cost for insurance companies.

substantial re-pricing of all insurance products due to the ruling of the European Court of Justice (2011) *Test Achats,* which banned gender-specific pricing. The ECJ ruling was announced on 1 March 2011, but only became effective on 20 December 2012, allowing insurance companies plenty of time to reconsider optimal pricing policies. Many contemporary publications document the discussions within the insurance industry about how to implement the change.[3] The ECJ ruling was also widely reported in the British popular press at this time and so many relatively unsophisticated consumers are likely to have read advice that they should shop around to see how prices had changed. Yet the pricing anomaly in 2013 was quantitatively similar to that of 2012.

We dismiss at the outset the possibility that our price data are completely wrong. Our data consist of quotes downloaded by two different researchers at different points of time using dozens of different searches. We have also informally contacted companies to get quotes and later in the paper we provide some corroborative evidence from other publications. The anomaly is too large to be reversed by small differences between quoted prices and prices actually paid.

Nor is it the case that the quotes for third-party insurance apply to a market that does not exist. According to data provided by the Association of British Insurers, ABI (2014), in 2013 the comprehensive (henceforth CP) market was 93% of the market measured by premiums. The remaining 7% of policies are either third-party (henceforth TP) or third-party, fire and theft (henceforth TPFT). We do not have data on the breakdown of CP versus TP/TPFT policies by age, but are assured by individuals within the industry that TP/TPFT policies are predominantly purchased by the young. Back-of envelope calculations suggest that if TP/TPFT policies are only purchased by the young then the proportion of young drivers buying such policies may be about 10%, which is a significant minority of the market.[4] The ABI data also suggest that CP is becoming more popular:

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[3] The original Gender Directive is found in Council of the European Union (2004); the relevant ECJ ruling is Case C-236/09 *Association belge des Consommateurs Test-Achats ASBL*, initiated on 18 March 2009 and concluded on 1 March 2011. Guidance on the directive was issued on 12 December 2011 (European Commission, 2011). The UK position from July 2012 is described in HM Treasury (2012).

[4] Our calculations to reach the figure of 10% are described in the appendix.

the non-CP share of the market was twice as high in 2003 (14%). If we had data showing that the pricing anomaly were long standing, then a falling share of TP/TPFT might indicate that consumers were adjusting to the relative prices of CP and TP/TPFT, although the speed of adjustment would be very slow and the trend for CP policies to form a larger share of the market is also observed in other European countries where (so far as we can ascertain) there is no such pricing anomaly (European Economics, 2009).

One possible reason for third-party policies to be more expensive than corresponding comprehensive policies is a selection effect: suppose that the unobserved risk characteristics of TP policy holders are different from those of CP policy holders. If this is the case, then we can infer that CP policy holders are lower risk than TP from the prices of the different products,[5] which is the exact opposite of the separating equilibrium suggested by Rothschild and Stiglitz (1976) where high-risk types buy more insurance, often referred to as the *positive correlation property*. Chiappori *et al.* (2006) show that the positive correlation property is robust to changes in the precise assumptions about the insurance market and so forms an appropriate test of the theory, but the review of the empirical literature by Cohen and Siegelman (2010) finds little convincing evidence for adverse selection. Among the papers cited in their review, several find a statistically insignificant negative correlation (Chiappori and Salanié, 2000; Dionne *et al.* 2001) and one of the specifications in Saito (2006) has a statistically significant negative correlation. More recently, Shi *et al.* (2012) find evidence for positive correlation for some groups of drivers in the Singapore market, but not all. However, all of these papers are analysing situations where there is a trade-off: it costs more to buy more insurance, whereas in our data, it costs less to buy more insurance.

The other main view of heterogeneous risk types is that there is 'propitious selection' (Hemenway, 1990, 1992; also referred to as 'advantageous selection' by De Meza and Webb, 2001), where agents have different attitudes to risk: in particular more risk-averse individuals may be naturally more careful and hence less likely to have an accident and this might result in a *negative correlation* (contra the suggested positive correlation for adverse selection). Evidence for risk heterogeneity has been found in the car insurance

[5] Our approach here is similar to that of Finkelstein and Poterba (2002), who infer the risk characteristics of different types of annuities from the prices.

market by Cohen and Einav (2007) and elsewhere by Finkelstein and McGarry (2006). De Meza and Webb (2001) show that the outcome of such a situation is a pooling equilibrium, where the more-risk-averse/low-risk individuals are happy to buy the same contract as the less-risk-averse/high-risk individuals because the higher utility value of the insurance policy to low-risk individuals offsets the actuarial unfairness arising from the cross subsidy to high-risk customers. However, De Donder and Hindriks (2009) suggest that a combination of propitious selection and moral hazard might result in a separating equilibrium displaying the positive correlation property. None of these models are consistent with the pricing anomaly that we observe.

An alternative approach to tackling the anomaly is that of Campbell (2006) who notes that households may face more complex constraints than financial firms and that apparently surprising behaviour may be due to those constraints. It is not clear what complex constraints exist in our scenario, so it is more likely that the anomaly is due to Campbell's other explanation for consumer behaviour, namely that they make mistakes. These mistakes could be due to bounded rationality along the lines of Kahneman (2003) or could be due to individuals not knowing the relevant prices (limited information). It is possible that bounded rationality leads to inadequate search for information and so the two effects are linked. Our data on car insurance premiums do not allow us to identify these explanations, but we shall provide information about the UK car insurance market that suggests both are important.

Our paper, in conclusion, provides an interesting case of an insurance market anomaly. The most recent literature on anomalies include Sydnor (2010) on homeowner's insurance, suggesting that consumers over insure by choosing low deductibles despite costs significantly above the expected value. Handel (2013) exploits a major change to insurance provision in a large firm to show that consumers suffer from inertia on health insurance plans, while Bhargava *et al.* (2015) find that employees at a large firm choose dominated health insurance options, resulting in substantial excess spending. Finally, Baker and Siegelman (2013) find irrationality in the purchasing of insurance for small value losses sold as an add-on to other products or services and Cutler and Zeckhauser (2004) document the existence of several insurance anomalies, reflecting a systematic tendency for insurance in practice to differ from insurance in theory.

The rest of our paper fills out the detail of our argument and is structured as follows. In section 2 we describe our data set and the two pricing anomalies, *viz.*, the relative price of TP and CP policies and the relationship between price and deductible in the CP market. Section 3 reviews some additional information about the UK car insurance market and suggests an explanation for the puzzle. Section 4 concludes.

2. Data for the UK Car Insurance Market

The car insurance industry is described in Office of Fair Trading (2011), which suggests that in many ways the industry is highly competitive: the five-firm concentration ratio is only 55% and the 'combined ratio', or ratio of claims-plus-administration to premiums was 117% in 2011, suggesting that the industry as a whole made an underwriting loss. Car insurers also receive revenue from the returns on the invested premiums, but in the light of low risk-free returns due to quantitative easing, it is likely that this translated into a loss overall. In recent years new providers such as supermarkets Tesco and Sainsbury's have joined the market. This suggests that the market is broadly competitive. Total premiums are just less than 1% of UK GDP.

Although OFT (2011) had concerns that consumers paid higher prices when they renewed a policy with an existing provider, the OFT's survey reported that 73% of responses had sought quotes from other insurers when renewing and 72% had used an internet search engine (37% had used two or more). There are currently four major internet search engines, of which three have links to an insurance provider and MoneySupermarket is independent. We collected data for firms that provide quotes via MoneySupermarket: some firms do not provide a quote or do not provide a quote for every type of policy. It is often possible to proceed directly from the internet search engine to an electronic form to purchase the insurance, or else the purchase can be made by telephone.

We collected data for male and female policies in 2012 and unisex policies in 2013, for two ages (23 and 44) and for three occupations (solicitors, where the proportion of men and women are approximately equal; civil engineers, who are overwhelmingly male; social service managers, who are overwhelmingly female). Our applications requested insurance cover for a 23-year old with a three-year no-claims bonus, who was single and had no children; 44-year olds with a nine-year no-claim bonus, were married and had

two children. Fifteen other pieces of information were required to obtain a quote such as type of car and mileage were held constant across all quotes and we requested quotes for a range of deductibles between zero and £500,[6] although the quotes we received often had a different deductible (as the voluntary deductible is added to a compulsory deductible for many companies).

There are three policy types in the United Kingdom: third party (TP), which is the minimum legal requirement; third party, fire and theft (TPFT) and comprehensive (CP). We have analysed a selection of insurance policy documents to confirm the precise differences between the policies, which is not always obvious from the summary provided by MoneySupermarket. In a representative example the policy document contains seven chapters: all seven chapters apply to comprehensive policies; chapters A (liability insurance), C (fire and theft) and G (driving outside the UK) apply to TPFT; only chapters A and G apply to TP. The chapters applying only to comprehensive policies in our example were B (damage to the car, to be repaired or replaced); D (repair or replace broken windscreen and windows); E (death and injury insurance to the driver and partner); F (miscellaneous items such as medical expenses arising from an accident and theft of personal belongings from the car); H (legal assistance in claiming expenses in accidents where someone else is at fault); and J (provision of courtesy car if own car is being repaired). Items D and F were not provided automatically by all insurers and sometimes could be purchased additionally to a more basic policy. The key point here is that the benefits of CP policies strictly exceed the benefits of TPFT, which strictly exceed those of TP. We only collect data for CP and TP: we should expect TPFT to be slightly more expensive than TP; from some less detailed analysis we have done TPFT is sometimes slightly cheaper than TP, consistent with the ranking of prices being anomalous. Nearly all TP quotes from MoneySupermarket had a compulsory zero deductible. This is unsurprising as any claim is paid direct to the injured party, so the insurance company would have to reclaim the deductible from the policy holder, which might prove difficult or expensive. Conversely nearly all CP policies had a minimum

[6] *N.b.* in British English a deductible is an 'excess'.

deductible: from reading the policy documents we know that this did not apply to the liability (TP) component of a CP policy (chapter A in the example given).

We summarize the raw data for price quotes in Table 1, which shows that TP premiums are much higher than CP.

Table 1 (simple averages of prices) about here

Although these simple averages are not perfectly comparable because we do not take deductibles into account, they illustrate the broad picture fairly accurately. From the first part of the table we see that for a man aged 23 in 2012 the mean premium was £2,694, which is a sufficiently large sum of money that we would expect there to be strong incentives to devote effort to finding a lower price. To see how much the price could be reduced by switching, we compare the average TP price with the lowest-decile TP and CP prices (the lowest decile is used because the lowest price may be highly idiosyncratic). We note also that young women pay much lower premiums than men and that 44-year olds pay less again, although at age 44 the difference between premiums for men and women is much smaller: in a small number of cases women pay more than men. Unisex premiums in 2013 were lower but this might be due to successful reduction in fraudulent claims as noted in the introduction.

Both TP and CP policies had up to five additional extras, which are either included automatically in the policy or are available for a higher price. In Table 2, we use the instances where the price of the additional extras is reported explicitly to estimate the value of these components. For example, although based on only one quote, it appears that the value of windscreen cover is £20.

Table 2 (information on extras) about here

If we compare the corresponding CP and TP policies within the same provider, we find that the CP policy always contains weakly more extras automatically than the TP policy. For example, approximately 86% of insurers provide windscreen cover automatically in a CP policy but not in the corresponding TP policy, suggesting that on average the windscreen cover alone should mean that the CP policies are worth more than TP policies by about 0.86 × £20 = £17.27. Performing similar calculations for the other extras suggests that the on average figures in Tables 1 and 2 under-estimate the price of CP policies by just about £51 compared to TP policies: taking extras into account not only

does not explain the within-provider difference between TP and CP but makes it worse. Although there is wide variation between companies' prices for a given policy type, the presence of extras does not explain the between-provider variation in TP or CP premiums either: some of the cheapest policies have more extras.[7]

We now turn to a more formal comparison of TP and CP policies. For each policy type we create a data set of the TP policy and lowest deductible CP policy offered by each firm. We then estimate simple regressions of price on a constant and a dummy variable for a policy being TP for three sets of data: (i) the entire sample; (ii) the sub-sample of firms offering both TP and CP policies (matched pairs); (iii) the sub-sample of matched pairs for those firms whose prices were in the cheapest decile. Our results for Solicitors are reported in Table 3; results for Civil Engineers and Social Service Mangers reported in the Appendix are quantitatively similar.

Table 3 (comparison of TP and CP) about here

Positive figures in the table denote higher TP than CP prices and the figures are in pounds sterling. These statistics confirm the findings of Table 1: for example a male solicitor age 23 would have to pay one thousand pounds more to have a TP policy. More interesting we see that even buying a TP policy from the same firm would typically cost £1078 more and most firms would be charging between £803 and £1432 for TP. This conclusion is not due to the presence of firms charging very high prices: the firms with the cheapest policies similarly charge much more for TP. Recall that all of these differences may be under-estimated by approximately £51 due to the issue of extras. The anomaly is the same for men and women and persists from 2012 to 2013.

We know of no other studies that have collected data similar to our own, but at this point we provide some corroborative evidence for the anomaly. The UK's Automobile Association has provided us with data showing that average premia for CP policies have been lower than average premia for TPFT policies since at least 2010. However, this does

[7] A cross-section regression of 94 quotes (Female, Civil Engineer, age 23) on a constant and dummies for the five possible extras yields an R-squared of 0.043; none of the coefficients are statistically significant and some have the incorrect sign. The cost of extras does not appear to depend on age, gender or occupation.

not compare quotes for exactly the same risks and is not conclusive evidence for an anomaly.

A second piece of corroborative evidence is provided by the study of the European car insurance industry by Europe Economics (2009), which compares markets in Europe and the USA.[8] The study collected price quotes for six hypothetical individual profiles in 2008, three for TPFT and three for CP and again it is impossible to make a perfect comparison. However, profiles 1 (22-year old, three year's driving, no claims) and 5 (21-year old, three year's driving, no claims) are very similar on the factors with the largest effect on premiums: the average quote in the UK market for TPFT for profile 1 was £894 and the average quote for CP for profile 5 was £785 (figures taken from European Economics, 2009; Table 8.3, p.289, and Table 8.9, p.308). So TPFT was 14% more expensive than CP. Other than Italy (where the market for CP insurance is tiny, only about 1% of the market), no other European market had TPFT insurance more expensive than CP: on average it was 43% lower in the EU.

Since there is an anomaly between the TP and CP parts of the market, what can we say about the CP market, where we have information on deductibles? The deductible consists of a compulsory deductible plus a voluntary deductible: the presence of a compulsory deductible effectively creates a minimum and this was usually strictly positive: for 23-year olds it was most commonly £150 or £400 in 2012 and £200 or £350 in 2013; for 44-year olds the most common minimum deductibles allowed were £100 or £150 in both 2012 and 2013.[9]

We should expect that the higher the voluntary deductible, the lower the price: a negative price-deductible relationship is the relevant incentive compatibility constraint within the CP market. In our data we observe that this relationship holds most, but not

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[8] Among other things, the report also shows that competition (ie the five-firm concentration ratio) in the UK car industry and combined ratio are similar to those of other markets and so the UK market is not peculiar in other respects.

[9] One of the most important ideas of the adverse-selection models is that firms use deductibles to control the quantity of insurance purchased. Interestingly, if firms are using deductibles in this way, their approach is relatively simple: while the price of a policy depends upon gender and occupation, most firms have the same minimum deductible regardless of these two variables.

all of the time: a minority of providers charge a higher price for a policy with a voluntary deductible of £100 than for a policy with a voluntary deductible of zero. Table 4 illustrates the proportion of providers for which the policy with the higher deductible has the higher price. The sums of money are not huge: for 23-year olds the additional cost of a £100-deductible policy, where positive, averages £9.49 for men in 2012; £6.14 for women in 2012 and £6.06 for unisex in 2013.

Table 4 (anomalous price-deductible policies) about here

Clearly a policy with a zero deductible and a lower price is strictly superior to a more expensive policy with a deductible of £100, so the observations which do not satisfy a negative price-deductible relationship are not consistent with conventional models of adverse selection (or any rational informed behaviour). However, as with the TP-CP anomaly, an individual getting quotes for insurance policies would not immediately see the trade-off between deductible and price: when requesting a quote one has to choose a preferred deductible and then receives quotes on that basis. To see the full menu of deductibles and prices it would be necessary to undertake multiple searches on different deductibles.

Unlike the TP-CP comparison, this anomaly is confined to a minority of providers; from the second part of Table 4 we can see that very few of the cheapest providers displayed this anomaly and these were all for 23-year olds in 2012. Also, it is interesting to notice that the anomaly is substantially smaller for 44-year olds than 23-year olds. This could be related to the fact, documented for example by Cohen (2005), that a coverage-risk correlation exists only for experienced drivers. If this were the case, older drivers who have had an opportunity to learn about their risk type, would purchase a level of deductible which depends on their own risk, that is high-risk types would choose a low deductible and be associated to more accidents. Insurers should, of course, sell such a policy at a higher price than another with higher deductible. Inexperienced drivers, on the other hand, still have to learn about their risk type and are more likely to purchase an incoherent insurance coverage. Thus, if there is an anomaly such as the one we observe, it is more likely to arise in this subset of insurers.

However, in general since the proportion of policies that potentially satisfy the incentive compatibility constraint is large, it is possible that behaviour by most agents within the CP market is consistent with adverse selection models. We are able to say a little more

than this, as the ECJ ruling on unisex pricing is a natural experiment resulting in increased asymmetry of information due to the fact that a major risk factor could no longer be used to price policies in 2013.[10] This increase in asymmetry of contractible information should result in a decrease in the trade-off between price and deductible. To see this consider first Figure 1, which shows the market for male policies in 2012 when firms sell different policies to men and women and where, for simplicity of exposition, we assume that there are only two risk types for each gender. Within the male market there is still adverse selection as there are both high-risk and low-risk men. In the Rothschild-Stiglitz version of the market, if the proportion of high risk individuals is high enough, a separating equilibrium is achieved by high risk males buying full insurance (the contract on the 45° line) and low-risk males buying the partial insurance contract where the indifference curve of the high risk males cuts the low-risk break-even condition for providers.[11] On the figure we highlight the difference in the price of the two policies and the difference in the deductible, which should be negative. We are interested in the ratio of the difference-in-deductible to the difference-in-price :

(1) $$\left(\frac{\Delta \text{Deductible}}{\Delta \text{Price}}\right) \equiv \left(\frac{0 - \text{Deductible}^{\text{Low risk}}}{\text{Price}^{\text{High risk}} - \text{Price}^{\text{Low risk}}}\right)$$

which is the slope of a line drawn between the two contracts.

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[10] Finkelstein *et al.* (2009) discuss the possible consequences of banning gender-based insurance in the UK annuity market (where, like the car insurance market, it is compulsory to purchase insurance), but in their model there is no price anomaly. Buzzacchi and Valletti (2005) provides some evidence of the effects of a move in the opposite direction, namely the change to gender-priced car insurance permitted in Italy after 1995. Schmeiser *et al.* (2013) discuss other possible consequences of the abolition of gender-based pricing in the European Union.

[11] If the proportion of high risk individuals is low, then the separating contracts cannot be an equilibrium and the equilibrium may not exist at all, although this depends on the responses of firms to each others' contracts (Wilson, 1977) in which case there may be a pooling equilibrium. It is also possible for there to be a separating equilibrium with contracts still obeying the positive correlation property but with cross subsidisation (Miyazaki, 1977; Spence, 1978).

Figure 1 (price and deductible in the male-only market) about here

Now consider the imposition of unisex pricing, which will introduce two new types: high-risk females and low-risk females. The pricing of female and male policies in 2012 suggests that high-risk females are less risky than high-risk males and it seems reasonable to assume that they are riskier than low-risk males, so they will be an intermediate risk type. For these three risk types the insurance provider must provide three policies illustrated in Figure 2. Figure 2 is the same as Figure 1 except for the addition of a further break-even condition (denoted by a dashed line) and indifference curve for the high-risk females.[12]

Figure 2 (price and deductible in the unisex market) about here

From Figure 2 we can see that the trade-off between deductible and price is larger both if we compare high-risk males and low-risk males or high-risk males and high-risk females. The trade-off between high-risk males and low-risk males becomes larger because the old low-risk male policy is no longer available and low-risk males have to buy the new policy where the high-risk female indifference curve cuts the low-risk break-even condition. Since (with indifference curves satisfying the single-crossing property) this is further down the break-even condition, it is clear that the trade-off is now larger.

To compare high-risk males with the high-risk females, note that the contract for high-risk females must lie on the indifference curve for high-risk males at the point shown. Since the indifference curve is convex to the origin, it follows that this new policy also has a higher trade-off.

To see the effect of unisex pricing we estimate regressions for each CP policy type (age-occupation-gender) of the form

$$(2) \qquad \left(\text{Deductible}_{i,j} - \text{Min Deductible}_{j}\right) = \beta_0 + \beta_1 \left(\text{Price}_{i,j} - \text{Price}_{j}^{\text{Min Deductible}_{j}}\right) + \varepsilon_{i,j}$$

[12] We omit low-risk females from the diagram for simplicity: their contract would be somewhere above the male low-risk contract line. Note that the non-existence problem becomes more severe in this case, since pairs of cross-subsidising contracts could be profitable deviations from the separating contracts.

where Min Deductible_j is the lowest excess allowed by provider j, $\text{Price}_j^{\text{Min Deductible}_j}$ is the corresponding price and $\left\{\text{Price}_{i,j}, \text{Deductible}_{i,j}\right\}$ are all of the price-deductible combinations offered by provider j for that policy type. Equation (2) is similar to estimating the relationship with fixed effects; given the anomaly already mentioned, we know that there is some reason to suspect non-linearity but, given the small range of deductibles, we do not attempt to identify this.

Since the price and deductible are presumably set simultaneously by providers on the basis of unobserved random variables also correlated with the error term $\varepsilon_{i,j}$, the least squares estimator of β_1 maybe an inconsistent estimator of the true price-deductible relationship and we do not have any excludable instruments to attempt to identify the trade-off. However, as a check we also estimate

$$(3) \qquad \left(\text{Price}_{i,j} - \text{Price}_j^{\text{Min Deductible}_j}\right) = \alpha_0 + \alpha_1\left(\text{Deductible}_{i,j} - \text{Min Deductible}_j\right) + \varepsilon'_{i,j}$$

We report our results of the regressions for Solicitors in Table 5: results for other occupations are similar.

Table 5 (price-deductible relationship) about here

From the first panel of the table, we compare the coefficients for the male and female quotes in 2012 and the unisex quotes in 2013. The trade-off between price and deductible is larger in 2013 for both 23- and 44-year olds, but the effect is neither large nor statistically significant. However, this is estimated for all providers and we know that some firms are offering much higher prices than others: if the prices represent monopoly power, then the break-even constraint is not binding and it may be less important for such firms to separate out the risk types. So in the second panel we repeat the analysis for just those firms whose prices are in the lowest quartile and where separating out the two risk types is presumably more important. The effect for 23-year olds is now very large – whereas the deductible rises by £1.73 or £1.34 for every reduction in premium in 2012, in 2013 it rises by £4.36, and the difference is statistically significant. We recognize that there may be endogeneity bias, but estimating the regression in the other direction leads to a statistically significant fall in the price-deductible ratio.

The effect for 44-year olds is smaller and remains statistically insignificant in regression (2). However, this is less surprising. The difference in the level of prices for 44-year old males and 44-year old females from the same provider is small, suggesting that the difference in risk between males and females at this age is very low: it may be that high-risk males are similar risk to high-risk females and similarly for the low risks. In which case, losing the ability to price off gender for 44-year olds makes little difference and hence there is no need to increase the trade-off between price and deductible.

3. Discussion and Interpretation

We now turn to possible explanations of our data. We do not present a formal model, but instead discuss what conditions would need to be met for agents' actions in the insurance market to result in an equilibrium such as the one we observe. We need to consider three groups of actors: consumers, insurers and other agents who might provide information.

3.1 Behaviour of consumers

We start with the consumers of car insurance, since their behaviour is the crux of the matter: why would they buy TP insurance if it were dearer than CP? We suggest that there are three necessary conditions: first, many consumers do not initially believe that TP is dearer than CP; second, that search behaviour is insufficient to reveal the anomaly to more than an insignificant group of consumers; and third, that high-risk types have different search behaviour from low-risk types.

A prior belief that CP is dearer than TP is reasonable: *ceteris paribus* CP insurance should be dearer. The way that internet search engines were configured during this period would not necessarily disabuse a consumer of this belief, since search results presented a comparison of either all TP or all CP policies, depending on an initial choice: to compare TP and CP one would need to do two searches. Furthermore there is independent evidence that price comparison websites were confusing to many consumers and could be manipulated by insurers: websites '… did not present sufficient product information in a clear and consistent way to ensure consumers were given appropriate information to allow them to make informed decisions … This finding applies to both the core policy and add-on products' (Financial Conduct Authority, 2014, p.4).

Advice in magazines and on MoneySupermarket's own website did not draw attention to the anomaly between TP and CP.[13] For example, the MoneySupermarket website dated 25 June 2013 had an article listing five ways to reduce one's premium: (i) shop around; (ii) protect one's no-claim discount; (iii) increase security of one's car by keeping it off the road or in a garage; (iv) manage one's policy (e.g. by adjusting reported miles driven so that it is not too high); (v) use telematics (i.e. have a black-box recorder in the car to monitor driving behaviour). The possibility of switching from TP to CP was not mentioned. We also looked at other contemporary websites to see what information was in the public domain. The strongest suggestion that we could find that CP might be cheaper than TP was in the 'This Is Money' website associated with the newspaper the Daily Mail (circulation 1.8 million), which said 'Although third party insurance should be cheapest for young drivers as it offers a lower level of cover, this isn't always the rule.'

There is independent evidence that consumers are generally confused about car insurance policies and so consumers may be unclear what they are buying or may not get the best advice possible from car insurers. The most extreme case is 'mis-selling' which, in the UK context, is the use by insurance providers of aggressive sales techniques (frequently involving mis-information) to sell products that are unsuitable: one of the companies in our sample, Swinton, was fined £7 million and required to set aside £11 million compensation on policies totalling £93 million during this period (Financial Conduct Authority, 2013).

Confusion may arise due to differences in policies offered by insurers: since insurance companies offer up to five 'extras', we know that the policies cover different things. One of the five extras in our data set is 'legal cover', but it is probably unclear what this means when using a search engine. Financial Services Authority (2013) explains that the full name for 'legal cover' is Motor Legal Expenses Insurance (MLEI) and that it provides extra legal assistance in recovering losses when the fault is that of *another* party and

[13] In 31 July 2013 the MoneySupermarket website page discussing whether to buy TPFT or CP stated 'Third party, fire and theft cover is usually cheaper than comprehensive cover, but it doesn't cover your own car'. Since we finished writing this paper the webpage has been amended to say that 'in some cases, especially those involving young drivers, fully comprehensive insurance cover can be cheaper than third party insurance'.

there is difficulty in claiming from that other party's TP insurance. If the other party is not insured or cannot be traced then the injured party is refunded by the Motor Insurance Bureau, so MLEI is only relevant in a small number of cases where the guilty party is known but the insurer will not pay. However, four-fifths of the 1021 respondents in the FSA's survey of policy holders thought that MLEI paid legal costs when it was the insured party (i.e. themselves) that was at fault rather than the other party. The overall conclusion of the FSA survey was that many purchasers of car insurance did not really know what they had purchased: for example the quote from a respondent described as aged 40-60 years, higher financial confidence, with MLEI: 'You see all these options but you don't really know what they are for' (FSA, 2013, p. 15). In further comments in the survey, the FSA noted that those who purchased MLEI tended to be more cautious while those who did not tended to be more optimistic.

All of this qualitative evidence is corroborative evidence for the first two conditions that we have stipulated that many consumers might not realize that TP was dearer than CP and that searching for prices using information available might not make this clear.

The third condition is that search behaviour of high- and low-risk individuals must be different: if search behaviour were the same then the two types would compare the same set of policies and hence presumably purchase the same policies. In particular high-risk types (or most high-risk types) must search only within TP policies, since they would deviate from purchasing TP if they saw CP prices.

One possibility is that different risk types initially search among the policy types that they eventually purchase. We have already noted that attitudes towards risk and underlying risk characteristics might be correlated (De Meza and Webb, 2001; De Donder and Hindriks, 2009) and that low-risk individuals are probably more risk averse. In which case low-risk individuals might be more likely to look purely at CP policies (since they have a greater desire for insurance) while high-risk less-risk-averse individuals might just look at TP (since they wrongly anticipate that the additional cost of CP would be higher than would be merited by their lower utility from insurance). The other possibility is that risk-averse low-risk individuals might have other character traits (such as searching more carefully or at greater length) so that they would collect more information and thus be more likely to find CP was cheaper than TP. High-risk types who assumed TP was cheaper than CP would search in TP and then not bother to search

in CP (given the high cost of TP they might reasonably assume that CP would be unaffordable).

3.2 Behaviour of insurers

We now turn to the behaviour of sellers of car insurance. Given the magnitude of the difference in price for TP and CP policies it is implausible that differences between advertized and actual prices could lead to the ordering of prices actually paid being reversed. Furthermore it is not clear that firms have any incentive to quote prices which are the reverse of what they actually charge.

Assuming that the advertized prices are indicative of actual prices, insurance companies are offering prices that do not satisfy an incentive compatibility constraint. Given consumers' behaviour this need not matter, but we still need to ask whether firms have incentives to deviate from existing prices.

If an individual insurer raised prices of CP policies, then this would be visible to consumers since the web search engine shows the prices for all firms for a given policy type. This means that if an insurer raises price it will sell fewer policies. The fact that firms charge different prices suggests that they have some market power: well-known firms may be able to trade on their brand, perhaps because they are believed to offer a better service. Overall, it is highly likely that the demand curve for each firm is downward sloping. Many insurers will not wish to lose market share: for those firms (such as supermarkets) who are trying to break in to the market, this would be the opposite of what is wanted.

Alternatively an insurer could lower TP prices, which presumably would increase the insurer's share of the TP market. There are two reasons to think that this might not be optimal. If TP policies are priced appropriately on actuarial grounds, then lowering prices too much would lead to policies making losses. In addition, insurers might not wish to increase the proportion of their policies which are TP policies because TP policies might be riskier and there is some evidence to suggest that the largest claims tend to be made on TP policies.[14] During the period we are analysing insurers were

[14] Informal discussion with people who work in the industry suggests that car insurers believe this to be the case. For example, one individual said: 'I think that most companies

beginning to be affected by Solvency II regulation which explicitly required firms to hold more capital against riskier policies and hence firms might decide that CP policies were less expensive.[15]

So it is plausible that firms have no incentive to raise CP prices or lower TP prices: so long as consumers do not change their behaviour, the fact that prices are inconsistent with the incentive-compatibility constraint is irrelevant. We can go further than this and suggest how such a pattern of prices might arise in the first place. Ania *et al.* (2002) describe a model where car insurers have bounded rationality and do not know risk probabilities. In this model firms offer a menu of contracts, withdrawing unprofitable contracts and occasionally experimenting with new contacts: so long as consumers are rational and make appropriate choices, the market evolves to a unique equilibrium which is the same as Rothschild and Stiglitz (1976). Ania *et al.* (2002) do not discuss what would happen if consumers' behaviour were also characterized by bounded rationality, but it is plausible that one potential outcome would be the pattern of prices that we observe in the UK.[16]

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now would prefer not to write TP/TPFT. It attracts the most risky business as I intimated – either young drivers who are most likely to make a serious injury claim (claims in excess of £4m are not unknown by any means) or people driving very old, poorly maintained cars which by definition are more likely to end up having a crash perhaps due to a fault and the attitude of the driver who perhaps doesn't really care if his clapped out old banger ends up in a collision.' However, it should be noted that our CP and TP quotes were for the same car, so the last selection effect (quality of car) does not affect our data.

[15] Solvency II regulation is described in European Parliament (2009): article 101 notes that value-at-risk measures affect the amount of capital that needs to be held. Policies with potentially large claims would be the riskiest on the value-at-risk definition. The precise details of how this would affect an insurer depend upon whether or how the Modigliani-Miller assumptions were violated, but we should expect all prices to include a risk premium, with a higher premium for riskier TP policies. Cannon and Tonks (2013) discuss the effect of Solvency II legislation on tests for adverse selection in the annuity market.

[16] Yet a further possibility analysed in Villeneuve (2005) is that the adverse selection is the other way around, i.e. that sellers have more information than purchasers, but the result of that model is that high-risk types purchasing no insurance at all, consistent

As we have seen, the pricing anomaly is not confined to the comparison between the TP and CP market: there are also a small number of providers who charge more for a higher deductible. As with the TP-CP phenomenon, it is possible that most consumers think that asking for a deductible is a good way to reduce the price: indeed money advice columns explicitly say this. Since the desired voluntary deductible is one of the pieces of information that must be provided on an internet search engine, a consumer would never see the prices for alternative deductibles unless they conducted a selection of searches which would have to include a zero deductible (as there is a negative relationship between price and deductible for all other deductibles). It is possible that only the most risk-averse and hence cautious drivers would ask for a zero deductible, in which case charging a lower price would adequately reflect the risk.

3.3 Behaviour of other agents

We have discussed why both consumers and insurers might continue in an equilibrium where TP prices are higher than CP. This raises the question of whether any other agents could undermine the equilibrium by appropriate arbitrage. In principle newspapers or advice columns could provide such information, but we have already noted that they seem not to have done so. An alternative possibility is that insurance brokers (i.e. financial advisors) could have acted as arbitrageurs. However, it is unsurprising that they did not do so. First, the consumers who would benefit from arbitrage are the purchasers of TP policies, and this was a relatively small part of the market, so potential demand would have been relatively low. Second, this was a period when insurance broking was in decline because consumers were by-passing brokers and using comparison websites. If consumers believed that the additional fees charged by brokers would exceed any benefit from better search and knowledge by brokers then it would not be irrational to use a website and not pay a broker.

4. Conclusion

We have shown that there are substantial, persistent and durable anomalies in the pricing of the UK car insurance market: in particular, CP policies are cheaper than TP

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with evidence from New Zealand, where car insurance is voluntary (Blows *et al*, 2003), but not with the pattern of prices we observe.

policies. This is even true when comparing policies that are otherwise identical (quotes for the same individual with same characteristics for the same car from the same provider). Despite the anomaly, the TP and TPFT policies form a significant minority of the market. There is also evidence for a smaller anomaly within the CP market in that the price of a policy with a £100 deductible is more than for one with no deductible.

Within the CP market there is evidence for pricing consistent with the adverse-selection of the Rothschild-Stiglitz model after the ECJ ruling: if firms had responded to the inability to price separately for the two genders by merely averaging the two policy types, the deductible-price trade-off would have been an average of the male and female trade-offs, but in fact they responded by increasing the deductible-price trade-off for 23-year-olds (where gender is a strong indicator of risk). The fact that CP policies are cheaper than TP policies is so surprising that many readers will have difficulty in believing it.[17] So it is likely that unsophisticated consumers have similar prior beliefs that CP policies are more expensive. So long as aversion to risk is negatively correlated with risk type (propitious selection) and car insurers respond merely by offering menus of contracts which are profitable (as in Ania *et al.*, 2002), this could result in low risk types buying more insurance and, in the most extreme cases, result in TP policies being more expensive for car insurers due to TP policy holders being so much more risky than CP policy holders. This appears to be what has happened in the UK car insurance market.

We should expect such an anomaly not to persist for long periods of time, but this anomaly has existed for almost two years in the UK and persisted despite a large shock to the market that might have been expected advice columns in newspapers and magazines to notice the anomaly and draw it to consumers' attention. How much longer the anomaly will last is anyone's guess.

Supplementary material

Supplementary material (the Appendix) is available online at the OUP website.

[17] Although only anecdotal, we observe that seminar participants and colleagues have found it difficult to believe.

Tables and Figures

Table 1: Average car insurance premiums

	2012				2013	
	Male Age 23	Female Age 23	Male Age 44	Female Age 44	Unisex Age 23	Unisex Age 44
Third-party policies						
Mean premium	2694	1816	797	704	1894	686
Cheapest decile premium	1541	627	326	269	1348	345
Standard deviation	894	652	291	270	478	181
No. of observations	*153*	*180*	*180*	*182*	*113*	*132*
Comprehensive policies						
Mean premium	1533	1142	453	425	1122	375
Cheapest decile premium	1047	826	313	309	786	267
Standard deviation	395	290	118	103	270	194
No. of observations	*1067*	*1176*	*1275*	*1311*	*726*	*868*

Statistics are calculated across all occupations and levels of deductible and are in pounds sterling rounded to the nearest pound. Not all companies quoted for both TP and CP and some companies only quoted for women in 2012.

Table 2: Average prices of extras where available as an option

Extra	sample size	price (£)	proportion of CP policies that automatically include extra vis-á-vis corresponding TP policy not automatically including extra
Windscreen	1	20.00	86%
Courtesy car	3	18.29	86%
Breakdown	71	42.41	2%
Personal accident	6	21.11	82%
Legal cover	57	27.50	0%

'Windscreen' refers to insurance against a broken windscreen from any cause. 'Courtesy car' means that the insurer provides a car while the insured's car is being mended. 'Breakdown' refers to on-road repairs being provided. 'Personal accident' provides compensation for injury or death after a vehicle accident when the insured cannot claim from a third party. 'Legal cover' is discussed in section 3.

Table 3: Comparison of TP and CP prices for Solicitors

		All quotes	Matched pairs		Cheapest
Age	Gender, year	Mean difference	Mean difference	Inter-decile range	Mean difference
23	Men, 2012	1150	1078	803 – 1432	1359
		(73)	(76)		(286)
	Women, 2012	818	775	0 – 1133	695
		(55)	(59)		(224)
	Unisex, 2013	770	790	343 – 1114	1057
		(79)	(77)		(102)
44	Men, 2012	384	354	100 – 556	381
		(24)	(25)		(61)
	Women, 2012	302	287	112 – 457	279
		(24)	(22)		(52)
	Unisex, 2013	308	368	25 – 487	415
		(34)	(26)		(42)

All figures are in pounds sterling. The first column reports the difference in the mean price of all third-party and all comprehensive policies: sample sizes range from 113 to 143 and standard errors are clustered by provider (of which there are between 78 and 92). The second and third columns are based on price differences between third-party and comprehensive for those providers that quote both policy types, with sample sizes ranging from 34 to 48. In all cases the comprehensive policy used to compare the third-party and comprehensive policy is the one with the minimum excess. The fourth column uses the subset of the matched-pairs data for which prices are in the cheapest quartile.

Table 4: Proportion of policies with anomalous price and deductible (Solicitors)

	Male, 2012	Female, 2012	Unisex, 2013
	All policies		
Age 23	0.377	0.300	0.179
	(0.059)	(0.060)	(0.047)
Age 44	0.076	0.134	0.042
	(0.030)	(0.038)	(0.024)
	Cheapest policies		
Age 23	0.067	0.267	0
	(0.067)	(0.118)	(-)
Age 44	0	0	0
	(-)	(-)	(-)

Figures show the proportion of policies where the price for a £100-deductible policy is more expensive than the price for the corresponding zero-deductible policy; standard errors of the proportions are in parentheses to assist comparison of different proportions with each other. Cheapest policies are defined as those in the cheapest quartile. Figures for Civil Engineers and Social Service Managers are very similar and differ mainly due to occasional missing data.

Table 5: Relationship between price and deductible (Solicitors)

	Male, 2012	Female, 2012	Unisex, 2013
Regressions of deductible on price (equation 2) – all policies			
Age 23	-0.978	-1.015	-1.280
	(0.117)	(0.108)	(0.124)
Age 44	-2.944	-2.969	-3.200
	(0.391)	(0.422)	(0.626)
Regressions of deductible on price (equation 2) – cheapest policies only			
Age 23	-1.730	-1.342	-4.361
	(0.238)	(0.214)	(0.514)
Age 44	-4.794	-3.866	-6.121
	(1.035)	(0.585)	(3.542)
Regressions of price on deductible (equation 3) – all policies			
Age 23	-0.273	-0.204	-0.205
	(0.030)	(0.026)	(0.034)
Age 44	-0.092	-0.085	-0.078
	(0.010)	(0.009)	(0.009)
Regressions of price on deductible (equation 3) – cheapest policies only			
Age 23	-0.295	-0.194	-0.100
	(0.046)	(0.039)	(0.032)
Age 44	-0.080	-0.086	-0.035
	(0.011)	(0.012)	(0.010)

Each cell shows the parameter estimate from a different regression of the forms specified in equations (2) or (3). Standard errors in parentheses are robust to heteroskedasticity and clustered by provider. Cheapest policies are defined as those in the cheapest quartile. Figures for Civil Engineers and Social Service Managers are very similar.

Figure 1: Price and deductible in male-only market

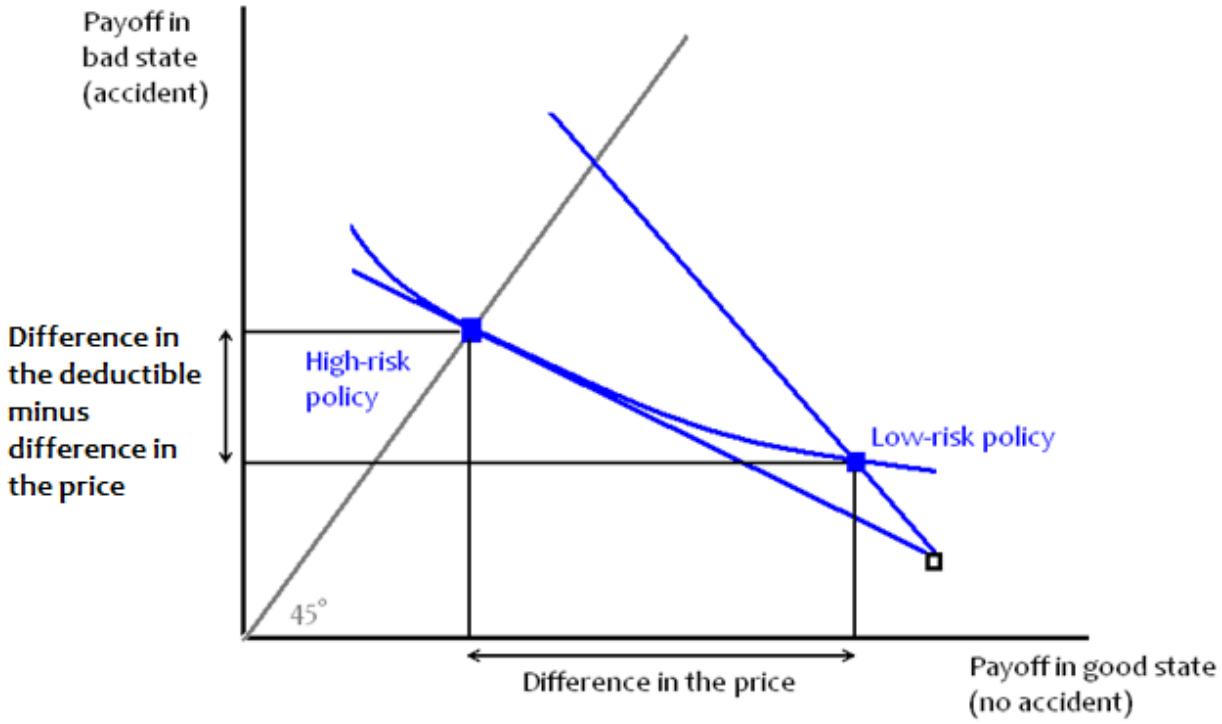
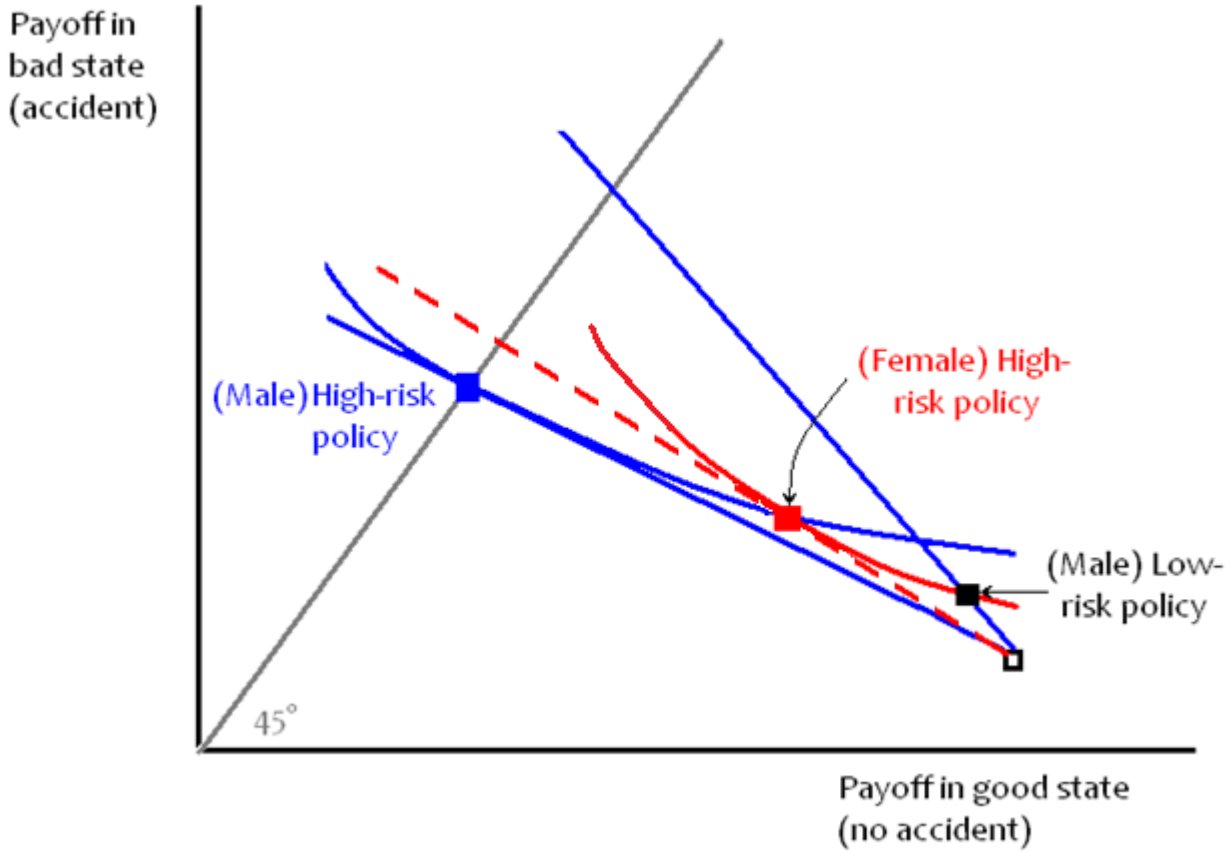


Figure 2: Effect on price-deductible relationship with unisex pricing



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