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Adverse selection in the UK annuity market and the 1956 Finance Act

Abstract

This paper proposes a new price test for evidence of active adverse selection in the insurance market for longevity risks: the annuity market. The test is applied to the exogenous change in taxation of annuity payments following the UK's 1956 Finance Act using a unique dataset of individual annuity contracts, and provides a natural experiment of whether the fall in annuity prices caused by the tax change induced marginal annuitants with higher mortality into the market after the tax change. We find some evidence to support an adverse selection story that mortalities of the pool of annuitants after the change increased. However, we also find that the story is more complicated because the tax change stimulated the development of annuity products that allowed higher mortality individuals to signal their mortality to annuity providers, creating a separating equilibrium, where previously there had only been a pooling equilibrium.

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1. Introduction

The Rothschild and Stiglitz (1976) theoretical model of adverse selection in insurance markets demonstrates that different risk types select themselves into purchasing different quantities of insurance or different insurance products. However, the empirical evidence in support of adverse selection has yielded conflicting findings depending on the characteristics of the particular market (Cohen and Siegelman, 2010). In this paper we concentrate on one particular insurance product: the market for life annuities, where individuals with uncertain life times can insure against running out of resources in retirement by purchasing an annuity that pays an income stream for life. In the context of life annuities, where higher risk corresponds to higher life expectancy, the effect of asymmetric information about individual survival probabilities on annuity contracts has been analysed by Eckstein, Eichenbaum, and Peled (1985) and Abel (1986). There are three possible empirical approaches for assessing whether insurance markets in general and annuity markets in particular exhibit adverse selection. First, the positive correlation property (PCP), whereby higher-risk individuals buy more insurance (Finkelstein and Poterba, 2004; Einav, Finkelstein, and Schrimpf, 2010). Second, an indirect price test whereby insurers recognise adverse selection and affect relative prices of different insurance products, which can be assessed using the money's worth metric (MW) defined as the ratio of the expected value of annuity payments to the premium paid (Mitchell et al, 1999; Finkelstein and Poterba, 2002, 2004; Cannon and Tonks, 2004). Third, a direct price change such that there is an identifiable sorting of different risk types.

This paper adopts the third approach and examines whether the 1956 Finance Act in the UK which substantially reduced the tax liability on annuity income (the price change) had an effect on the composition of risk types buying life annuities. Our conjecture is that under adverse selection the reduction in taxes reduced the price of annuities, and at the margin induced annuitants with relatively high mortality, who had previously not annuitized their wealth, to purchase annuities. Hence the test is that under adverse selection the mortality of the pool of annuitants is higher after the 1956 Finance Act. Poterba (2001) draws a distinction between active and passive

adverse selection: active selection is when an individual acts on private information. In contrast, passive selection is when individuals of a particular type, such as the degree of carefulness, both purchase annuities and also behave in such a way to increase their longevity. We argue that the first two tests cannot distinguish between active or passive selection, but that the price test is able to so discriminate.

In the next section we discuss earlier research on the evidence for adverse selection in annuity markets. In Section 3 we describe the 1956 Finance Act, establish the hypotheses we wish to test and describe our data. We report the results of our analysis in Section 4. Section 5 concludes.

2. Tests for Adverse Selection

The simplest adverse selection model is that of Rothschild and Stiglitz (1976), which makes two related predictions: first, the "positive correlation property" (that high-risk individuals buy insurance products with greater coverage);[1] second, that there is an incentive compatibility constraint with the respective products designed for high-risk and low-risk individuals appropriately priced. However, De Meza and Webb (2013) argue that in the absence of heterogeneous preferences, heterogeneous costs or any other market failures or regulatory constraints, the provision of more than one insurance contract is a sufficient condition to demonstrate adverse selection. The issue is whether adverse selection can still be identified from these two conditions when other factors are taken into account. That other market failures are present in the annuity market is strongly suggested by the existence of the "annuity puzzle" (Diamond, 2004), i.e. that individuals tend to under-annuitise their wealth in retirement (Brown, 2001; Inkmann, Lopes and Michaelides, 2011).

Evidence for the positive correlation property in various insurance markets is mixed (Cohen and Siegelman, 2010). Evidence for the incentive compatibility constraint is found in Finkelstein and Poterba (2002), who note that there are two choices in the UK annuity market that could be used by individuals with lower life expectancy to

[1] Chiappori et al (2006) show that the positive correlation property characterises a range of adverse-separating insurance models which have slightly different specifications to that of the original Rothschild and Stiglitz (1976) model.

separate themselves from individuals with higher life expectancy. First, instead of purchasing a simple life annuity, an annuitant could purchase an annuity where the first five or ten years are guaranteed: so long as there is a bequest motive, this option would be more valuable to a shorter-lived individual. Second, annuity payments can be constant either in nominal terms (a "level" annuity) or real terms (indexed to the retail price index, or RPI). Since initial payments are lower for the RPI-linked annuity, shorter-lived individuals would choose the nominal annuity.

Finkelstein and Poterba (2004) use a data set of annuity contracts over the period 1980-98 from a single UK life insurer to show that UK pensioners who purchase an annuity with a guarantee have a lower life expectancy than those without a guarantee and those who purchase an inflation-protected annuity have a higher life expectancy, consistent with the positive correlation property. However, from data on another life insurer for 1988-94, Einav Finkelstein and Schrimpf (2010, pp. 1037-38) have more ambiguous results: while annuitants with a five-year guarantee have lower life expectancy than those without, annuitants with a ten-year guarantee have life expectancy similar to that of those with no guarantee at all. Furthermore, the vast majority of annuitants choose the five-year guarantee annuity, which is the "middle option" between no guarantee and ten-year guarantee, a choice which could also be due to a framing effect similar to those raised by Benartzi, Previtero and Thaler (2011) and Beshears, Choi, Laibson, Madrian and Zeldes (2013). This is potentially problematic as the welfare consequences of market failure or government attempts to overcome it depend upon the precise nature of the failure (Chalmers and Reuter, 2012).

Finkelstein and Poterba (2002) evaluate the incentive-compatibility constraint by analysing annuity rates of different products using the "money's worth", based upon semi-official projections of life expectancy made by the United Kingdom's Institute of Actuaries and published in 1999. They find evidence that differences in annuity rates are consistent with a selection effect. However, Cannon and Tonks (2013) note that identifying the selection component of price differences is potentially problematic in any insurance market, but the problem is particularly acute in annuity markets as the products are so long term: predictions of survival probabilities for an

annuitant are needed for forty or fifty years into the future. F&P takes no account of the uncertainty over the projection and Cannon and Tonks (2013) show that taking account of the uncertainty of the projections is a major factor for both the choice of guarantee and the choice of real versus nominal.

A third possible test for adverse selection is to examine the implications of a direct price change on the sorting of different risk types. Eckstein et al (1985) and Abel (1986) have developed models of adverse selection in annuity markets, and the important difference between them is whether the quantity of annuities purchased is observable by the annuity supplier. Eckstein et al (1985) identify the conditions for a separating equilibrium where long-lived and short-lived individuals purchase different price-quantity pairs. However if quantities are unobservable (which in the case of annuity markets is likely to be the case, because annuitants are at liberty to purchase an annuity from more than one provider), Abel (1986) shows that there will be a pooling equilibrium with all individuals purchasing annuities, but with short-livers buying smaller quantities of annuities than long-livers who are fully insured.

In reality not all individuals do purchase an annuity, a phenomenon referred to as the "annuity puzzle". A variety of reasons for not annuitising are reviewed in Cannon and Tonks (2008). Suppose that there is more than one potential reason for not purchasing an annuity (so that some individuals purchase an annuity and some do not) and that one of the reasons for non-annuitisation is adverse selection. Now consider the effect of an exogenous change in the price of an annuity, or equivalently an increase in annuity payments at the same price: since long-livers are already fully annuitized they continue to buy the same quantity as before, but short-livers will now purchase more annuities, and hence the average mortality of the pool of annuitants will increase after the price change because short-livers are sucked into the market: this is the price test for adverse selection. This is illustrated in figure 1: notice that only some individuals purchase annuitants and mortality would typically only be observed for the actual annuitants.

Figure 1 about here.

This suggests the third test for adverse selection: if there is an exogenous change to annuity prices then the mortality of annuitants should increase. A necessary

condition for this to happen is that annuity demand is responsive to the price and several papers have suggested that the elasticity of demand is quite low (Brown, 2001; Bütler and Teppa, 2007; and Chalmers and Reuter, 2012). However, all of these studies were for fairly small changes in annuity value: when analysing the effect of a large change in price, Bütler, Staubli and Zito (2013) found that the elasticity was much higher.

Poterba (2001) draws a distinction between active and passive adverse selection. Active adverse selection is where an individual has private information about his or her type, and takes a decision to exploit this information. In the context of annuity markets, this active selection is represented by an individual with private information about their life expectancy being more likely to buy an annuity. However, Poterba (2001) suggests that a correlation between annuitants and mortality could also arise if annuitants had particular attributes which were also correlated with mortality risk. For example, an individual may be a "careful-type", and careful types may be both more likely to buy and annuity and more likely to have lower mortality. This would be an example of passive selection, in which there is a correlation between annuity buyers and mortality risk, even though the annuitant may be unaware of the correlation. Both the positive correlation property tests and the money's worth tests are unable to distinguish between active and passive selection. It is only the third test: the price test, that can distinguish between active and passive selection, since following a change in price there is no reason for the individual's attribute to be affected by this exogenous shock. We now turn to identify an exogenous price shock.

3. Changes in UK pensions as a natural experiment

3.1 The 1956 Finance Act

By the middle of the twentieth century UK pension policy was evolving to meet the challenges of a population that was increasingly rich and increasingly long lived. The 1918 Income Tax Act, the 1921 Finance Act and the 1947 Finance Act combined to result in a complicated set of tax exemptions for private occupational schemes,[2]

[2] The complication partly arose because there were at least two ways (insured schemes and trusts) in which companies could set up a pension scheme but, due to the details of the

which meant there were significant advantages to both employers and employees from remuneration being in the form of a pension and public service workers also received pensions (Hannah, 1986). However, self-employed workers, encompassing a range of individuals from small tradesmen through to senior professionals, received no tax exemptions at all from pensions in either the accumulation or decumulation phase.[3] A particularly iniquitous problem was the way that life annuities were taxed: UK law treated the entire annuity payment as income and hence liable for income tax, despite the fact that part of an annuity payment represents a notional return (run-down) of capital. The inconsistency with respect to life annuities was highlighted by the fact that term-certain annuities were taxed differently: where an annuity was term certain the payments were explicitly treated as part return of capital, which was untaxed, and part interest, which was taxed (see the Appendix A for an example of such a contract).

Formed in 1949 the Millard Tucker committee,[4] reported on 23 December 1953 on a variety of pension issues and recommended that the taxation of annuities be changed so that only the interest element was taxed (*Report of the Committee on the Taxation Treatment of Provisions for Retirement,* 1954): this was achieved by treating the "capital element" of the annuity payment as non-taxable, where the "capital element" was the purchase price divided by the life expectancy of the annuitant.[5] The

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legislation, it was not always clear which was the better. However, there were many inconsistencies in the way that different pensions were treated (examples are provided in *The Economist,* 19 August 1950), arising from piecemeal legislation and an unwillingness to simplify the issue via consolidating legislation, which did not arrive until the 1970 Finance Act specified that different pension funds should be brought under a unified system by 1978.

[3] This problem had been exacerbated by the increasing coverage of income tax arising from the Second World War; in the tax year 1938/9 fewer than ten million individuals were liable for income tax, but by 1949/50 this had doubled (*Annual Abstract*, 1959, pp.257-60).

[4] The full name of the committee was the *Committee on the Taxation Treatment of Provisions for Retirement*, but it is almost always referred to by the name of its chair, James Millard-Tucker, a lawyer who served simultaneously on the Royal Commission on taxation.

[5] Purchase price divided by life expectancy was the formula proposed by Millard-Tucker (¶.505); the 1956 Finance Act expressed the same idea differently as purchase price divided by actuarial value of annuity payments with no time discounting of future payments (4&5 Elizabeth II, cap 54, §.27). Where annuities included guarantees, had a term limit or was based on joint lives a more complicated formula would be needed, as was explicitly recognised by the 1956 Finance Act.

Chancellor of the Exchequer announced that the government was accepting this recommendation in the budget of 17 April 1956: importantly it was retrospective and applied to annuities already in payment.

However, to be consistent with the pension framework of both the 1956 Finance Act and earlier legislation, the exemption of the capital element only applied where the annuity was purchased from funds which had not previously been exempt from taxation (i.e. it during the accumulation phase of the pension). This laid the framework for the division of the annuity market into a (voluntary) purchase annuity market where the pension was taxed in the accumulation phase but not the decumulation phase and a compulsory purchase annuity market where the pension was exempt from tax in the accumulation phase but taxed in the decumulation phase.[6]

The 1956 Finance Act potentially offers a natural experiment of the effect of a change in price on the demand for annuities, and the sorting of risk types. Under the null hypothesis of adverse selection the effective fall in price of an annuity induced by the reduction in tax payable on annuity payments, will increase the demand for annuities by those short-lived individuals who were either not annuitizing or only previously purchasing small quantities of annuities. Therefore after the price change, the average mortality of the population of annuitants should rise, as short-lived annuitants are sucked into the market. This is the price test for adverse selection.

However although this would appear to be a very clean test of adverse selection there are a number of confounding factors. First of all, it is a tax change rather than a price change, and it is possible that tax effects will have disproportionate effects on wealthy individuals who are most likely to be the main beneficiaries (non-taxpayers are unaffected by the change). Wealthy individuals are likely to have lower mortality than

[6] The purchase life market was a pension that was TTE (since taxes had potentially been levied on both income and investment returns) whereas the compulsory purchase market was EET. Of course, there was no guarantee that tax had been paid on the money used to buy a purchase life annuity (since it might have been accumulated by someone not liable for tax); a further possibility was that an EET scheme allowed for a withdrawal at retirement of a 25% tax free lump sum and this could also be used to buy a purchase life annuity.

the poor, and if enough wealthy individuals start purchasing more annuities the net effects of the tax change may be to reduce mortality.

Second, prior to the 1956 Act and given the disadvantaged tax treatment of annuity payments, the financial services industry had developed a product (a Special Deferred Annuity, SDA) that enabled annuitants to avoid paying the high tax rate on regular annuities. The SDA consisted of two separate contracts: a term-certain annuity (where the capital was not taxed and the interest was) and a deferred annuity which started payment when the term-certain annuity ceased (where the whole payment was taxed). Typically the SDA was configured so that the post-tax payments on the term-certain annuity and the deferred annuity were approximately equal.

The SDA was a compromise product that provided a degree of longevity insurance where partial insurance was accepted because of the reduction in tax. However, ignoring tax, the payment stream was identical to that of a guaranteed annuity. Recall that in Finkelstein and Poterba (2002, 2004), low-life expectancy individuals could buy a guaranteed annuity to signal their life expectancy. However, in a market combining heavily-taxed guaranteed annuities and less-heavily-taxed SDAs, even an individual with very low life expectancy would prefer the SDA as the tax advantage would be larger than any price difference due to mortality. Thus, prior to 1956, it is unlikely that there would be much separation based on guarantees. However, after 1956, when more individuals entered the annuity market, the mortality of the marginal annuitants would be higher (as these were marginal annuitants) and these annuitants might purchase guaranteed annuities to signal low life expectancy. This is illustrated in Figure 2.

Figure 2 about here.

From this diagram it can be seen that the increase in mortality would be for the marginal guaranteed annuitant after 1956 relative to the marginal annuitant pre-1956.

3.3 Description of the data

Our data are drawn from the annuity registers of a medium-sized life insurer for the 1950s and contain details for policies sold between 15 January 1952 and 14 March 1962. An example of the information contained in this policy-based data is given in the

Appendix. We did not code multi-premium policies for deferred annuities as these are pension policies, nor a small number of reinsurances to policies for other companies (typically for very large premium purchases). This leaves single-premium policies for annuities that may be immediate, deferred without return (typically part of a "split") or deferred with return. The latter type of deferred annuity is sometimes part of more complicated pension provisions; it is often for individuals of relatively young ages; and frequently it is noted that the policy was surrendered rather than paid out: all such policies are ignored. The remaining policies that we do analyse can be further divided in two further dimensions, both of which deserve some explanation:

Single versus joint life: in principle it should be simple to distinguish single and joint life annuity purchases. However, there are fourteen instances of a couple simultaneously purchasing an immediate annuity on the husband's life and a reversionary annuity on the wife's life with the husband as the counter-life: the resulting combination of the two policies is identical to a joint life annuity. Since we are generally excluding joint life policies, we estimate our regressions excluding these immediate policies (although we also estimate regressions with the joint policies as a robustness check).

Guarantee periods: policies can be with or without a guarantee. However, before the 1956 Finance Act only six annuities are sold with a guarantee period, whereas there are 394 special deferred annuities (recall that these are a tax avoidance measure of a deferred life annuity without return combined with a term-certain annuity). After the 1956 Finance Act our life assurer fairly quickly stopped selling Special Deferred Annuities but guaranteed annuities became more popular. Table 1 shows the breakdown of the number of single-life policies.

Table 1 about here

Each policy contains information about the date of purchase, the premium and annual income, the birthday and age of the annuitant. Where the annuitant has died the date of death is recorded, although in some cases only the month is available. In a very few cases the death is noted but not the date. Deaths stopped being recorded after about 1983, when the policies were computerised and the paper books were no

longer the main source of reference. It would have been very difficult to obtain the date of death for annuitants who died after 1983 and so this was not attempted, which means that our sample is truncated: however, the proportion of individuals for which the date of death is unobserved is about a fifth, so there is enough observed variation in our data to provide meaningful estimates.

A further issue is that some policies were purchased by an individual other than the annuitant or by a firm as an employee pension: unless the purchaser were a spouse, we treat these data separately. We refer to these annuity sales as pensioner-annuities, as they are purchased as part of an occupational pension scheme. These observations are interesting for two reasons. First, since they are purchased by someone other than the annuitant they are unlikely to be affected by private information about mortality. Second, such annuity purchases were unaffected by the 1956 tax changes, since occupational pensions had already benefited from tax-exempt status during the accumulation phase, and therefore taxation was payable on all the annuity income before and after 1956. Some annuities are Hancock annuities, which are a different sort of pension policy, but we group these with annuities purchased by an employer.

An obvious question to ask is how the life assurer priced its annuities. We know that it was capable of fairly sophisticated pricing because of the existence of at least one very strange annuity contract: on 22 February 1957 a 59-year old male life purchased an annuity which had been valued on 12 February 1957 and was due to start making quarterly payments of £75 on 12 February 1959. The purchase price of the annuity was £200, so the annuity rate was 150 per cent, which is incredibly high unless there was some health condition or other reason to believe that the annuitant's mortality would be very high (in fact the annuitant died on 16 April 1957, only 55 days after the purchase and before receiving a payment).

4. Estimation and empirical results

4.1 Methods

Our empirical model is a proportional hazards model (similar to that of Finkelstein and Poterba, 2004); we estimate a survival model where mortality (i.e. the hazard)

increases according to Gompertz's Law. More specifically, denote the time to death after annuity purchase as T and suppose the probability of dying before t is $F(\mathrm{T} \leq \mathrm{t})$. Then we define the survival function and density functions respectively as

(1)
$$S(t) \equiv 1 - F(t) = \Pr(T > t)$$
$$f(t) \equiv \frac{dF(t)}{dt}$$

and the hazard function (which in actuarial terms is the force of mortality) as

(2)
$$h(t) \equiv \frac{f(t)}{S(t)dt}$$

A proportional hazard model for a set of individual annuitants $i \in \{1, \ldots, n\}$ is of the form

(3)
$$h(t_i) \equiv g(x_i\beta)h_0(t_i)$$

where h_0 is the baseline hazard function and g is a function of parameters β and explanatory variables $\mathbf{x}$, which in our case are observed at $T_i = 0$. Gompertz's Law is an empirical observation that for older ages the log of mortality is approximately linear in age and we also assume that mortality is declining linearly with date of birth. Combining these two assumptions in our model this is achieved by having $h_0(t_i) = \exp(\gamma t_i)$ and $g(x_i\beta) = \exp(x_i\beta)$ where we include the annuitant's age and date of birth among the explanatory variables $\mathbf{x}_i$.

4.2 Results

We present our initial results from estimating a basic version of the proportional hazards model in Table 4. We have estimated the model for both men and women together (the All sample with a female dummy), men only, women only, and women split by single and married status. The results by gender are so different that it would seem appropriate to estimate these samples separately. The large number of single women in the sample may be a consequence of this cohort's marital status being affected by the consequences of the First World War. In all of the regressions below we consider only immediate annuities purchased by annuitants age 50 or more with an annual annuity income of £2,000 or less, since £2,000 was approximately the point

at which surtax became payable. This cut-off removes some very high annuities – there is one of £10,000 per year. Income is measured in hundreds of pounds; age is measured in years and yob is year of birth (so we are assuming a linear cohort effect), and we include a dummy variable to represent the 1956 Finance Act tax change which takes on the value of zero for annuities purchased before budget day 17 April 1956, and unity thereafter. The precise dating of the change is difficult:[7] publicity material of the annuity provider shows that advertisements for the new personal pensions (which involved much bigger changes than the tax change to voluntary annuities) were available in May 1956; on the other hand, special deferred annuities were still being sold in August 1956, several months after their *raison d'être* had disappeared. In our main analysis we have used the date of the original announcement.

Table 4 illustrates hazard regressions using data for annuitants alone. The coefficients in the tables are the estimated betas in equation (3), and in order to interpret their effect on mortality it is necessary to convert these coefficients to the equivalent hazard ratio (ie force of mortality) which is the instantaneous death probability in equation (2). So in the first column of Table 4, the coefficient on the guarantee dummy has a value of 0.494 which is positive and significant. This means that someone who purchases an annuity post-1956 has a mortality of exp{0.494} = 1.639 more than one-and-a-half times higher than someone purchasing an annuity pre-1956.

The gamma in the table is the slope of the log mortality: for the All sample, every additional day after purchasing an annuity, one's mortality rises by 0.000264 or about 0.03%: this is because the annuitant is getting older over time. The gamma parameter shows how mortality rises over time as the annuitant ages: the initial mortality of an annuitant depends upon the age at which the annuitant purchased the annuity and this is captured by the variable "age". Finally the variable "yob" is the year of birth and captures the fact that succedding cohorts have lower mortality. Notice that we have assumed linearity in both the effect of age and year-of-birth on mortality, rather than following the approach of Finkelstein and Poterba (2004) in having

[7] Two alternative places to put the cut-off are the publication of the Millard Tucker report (23 December 1953) or the date of the sale of the final split (2 August 1956).

quinquennial dummies: but our data set is much smaller and this non-parametric approach would lose too many degrees of freedom (especially since we have a much wider range of ages). The final demographic control is the female dummy in column 1 where men and women are pooled. However, the differences in the other parameter estimates suggest that pooling men and women is not necessariily appropriate.

Further controls are non-demographic. The income variable shows the effect of the purchase size (based on annual income rather than premium) and suggests a small positive effect for men only, which is not expected. Dummy variables for frequency of payment are not reported. The variable "apport" shows whether an annuity's payments were apportionable: ie whether a final proportional payment was made to the annuitant's estate representing the time that the annuitant survived from the previous payment to death.

We now turn to the dummy variables connected with the policy change. The dummy variable "sda" represents whether a variable was a special deferred annuity. This does not correlate with mortality, which is unsurprising since the tax benefits of having a special deferred annuity were sufficiently large to swamp any effects due to mortality differences.

The dummy variable "d1956" represents the policy change and shows the difference between annuitants before 1956 and annuitants who purchased an annuity without a guarantee after 1956. As illustrated in Figure 2, it is ambiguous whether the effect of more annuitants would raise this mortality or not since marginal annuitants who joined the market after 1956 could purchase annuities with a guarantee. Our evidence suggests that the annuitants who purchased annuities without a guarantee were similar before and after the policy change.

The final policy variable is the dummy "Guarantee", which takes the value one if an annuity had a guarantee and was purchased after the 1956 Act. We have already seen from Table 1 that only five annuities were purchased with guarantees before 1956. including a dummy variable for annuitants with a guarantee before 1956 effectively excludes these individuals from the regression by dummying them out and so we do not include a dummy for before 1956.

Annuitants who purchased an annuity after 1956 had higher mortality. This is true for both men and women. Splitting the women into married and single women results in smaller samples and so the parameter estimates are statistically signficant.

A potential criticism of the results in Table 4 is that other unobservable factors were also occurring around 1956 that is contaminating the demand for annuities. One way round this problem is to consider a control group who were buying annuities before and after 1956 who were not affected by these tax changes. One such group identified in our data sample are companies who were buying annuities on behalf of individuals: pension annuitants, although unfortunately our data set contains relatively few of these after the policy chage. We may compare the mortalities of ordinary annuitants and pension annuitants before and after 1956: a difference-in-difference test.

Table 5 reports the results of this diff-in-diff analysis for the full sample and sub-groups by gender. We include a dummy variable for the 1956 Finance Act (d1956FA); a dummy variable (annuity) which takes the value zero if the annuity is a pension annuity and the value unity if an ordinary annuity; and an interaction term which picks up the diff-in-diff effect between the d1956FA dummy and the annuity dummy. Additional control variables include whether the contract includes a guarantee (gteeA); whether the contract is apportionable (apport); year-of-birth (yob); age of annuitant when contract purchased (age); whether the contract is a special deferred annuity (sda); and annuitant annuity income (incA) which proxies for annuitant wealth, since we would anticipate that richer annuitants purchase more annuities.

Focusing on the coefficients in the first column of Table 5, ordinary annuitants pre-1956 (annuity=1, d1956FA=0) had a negative but insignificant effect on mortality (b_2= -0.172), relative to pension annuitants pre-1956 (annuity=0, d1956FA=0). Post-1956 ordinary annuitants (annuity=1, d1956FA=1, did=1) had a negative effect on mortality (b_2+b_3= -0.233), relative to pension annuitants pre-1956 (annuity=0, d1956FA=1, did=0). These negative differences are mildly supportive of adverse selection, because ordinary annuitant mortality is lower than pension annuitant mortality. The change in annuitant mortality around the 1956 Finance Act is positive ($b_1 + b_3$ = 0.0548) for the full sample, and positive for men (b1 +b3 = 0.168) and wives (b1 +b3 = 0.056), but negative for women overall (b1 +b3 = -0.023), and for single women (b1 +b3 = -0.0857).

5. Summary and conclusions

The UK's annuity market is the largest in the world with sales of over £14 billion in 2012 due to the compulsory annuitisation requirement that had been in place for over fifty years on pension savings through tax exempt schemes. However, in March 2014 the UK government announced the relaxation of compulsory annuitisation, and the UK annuity will move back to a purely voluntary market from 6th April 2015. In voluntary annuity markets there is evidence of selection effects, and in this paper we have devised a test for active adverse selection, whereby individuals who have private information about their long longevity are more likely to purchase annuities, and in larger quantities than individuals who have information about their short longevity. We argued that our "price test" is able to detect active adverse selection in contrast to PCP and MW tests that are not able to distinguish between passive and active selection. We applied this price test around the time of the 1956 Finance Act which provided a natural experiment for the effect of a price change, through a reduction in tax rates, on the types of individuals purchasing annuities.

Before the tax change, annuities with guarantee periods were barely sold and this is almost certainly because special deferred annuities offered similar payment streams plus tax advantages that swamped any possible differences in mortality. Due to this confounding factor, there was no real possibility of selection on guarantee period as found in Finkelstein and Poterba (2004). Following 1956, the mortality of annuitants went up, consistent with the price change. Simultaneously, purchasers of annuitants started to select on guarantee period, consistent with evidence of active adverse selection. We find that the mortality of annuitants relative to pension annuitants increased slightly after the introduction of the tax change. But this effect is also attenuated by the characterstics of individuals buying annuities (their average age increased), and by the development of new products: it appears that annuities with guarantees became more popular after the 1956 Act, enabling high mortality individuals to signal their type, and hence enforce a separating equilibrium.

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Tables and graphs

Table 1: Number of policies sold with different guarantee periods

	Pre 1956 Finance Act			Post 1956 Finance Act		
Guarantee period, either explicit or implicit in a SDA (years)	Ordinary annuity	Special deferred annuity	Pension annuity	Ordinary annuity	Special deferred annuity	Pension annuity
0	316		225	225		48
5	4	2	109	12		14
10	1	247	14	18	6	3
15		134		1	4	
20		43				
other		7	4			
Proportion with guarantee	1.6%		36.1%	12.1%		26.2%

Data for ordinary annuities and special deferred annuities are for both single-life and joint-life annuities purchased by the annuitant, where only annuitants over the age of 50 are included. Data for pension annuities are for both single- and joint-life annuities where the purchaser was the employer: these data also include Hancock annuities. The last special deferred annuity was sold on 2 August 1956.

Table 2: Number of policies sold with different income levels

	Pre 1956 Finance Act			Post 1956 Finance Act		
Annual income	Ordinary annuity	Special deferred annuity	Pension annuity	Ordinary annuity	Special deferred annuity	Pension annuity
£0 - £180	231	206		130	7	
£180 - £500	83	158		51	2	
£500 - £1000	7	53		14	4	
£1000 - £2000		16		5		
£2000 - £10000	1	9		10		

Data are for the same policies as in Table 1.

Table 3: Age at time of purchase of annuitants

	Pre 1956 Finance Act	Post 1956 Finance Act
Ordinary Annuitants		
Men	65.9	73.4
	(0.41)	(1.07)
Women	65.8	69.3
	(0.38)	(0.82)
Pension-annuitants		
Men	63.5	65.0
	(0.47)	(0.31)
Women	60.2	62.5
	(1.16)	(1.36)

Data are for the same policies as in Table 1. Standard errors of the mean in parentheses.

Table 4: Regression results for annuitants

	(1) All	(2) Men	(3) Women	(4) Wives	(5) Single women
1956 dummy	0.0327	0.0159	0.0834	0.131	0.0408
	(0.1443)	(0.2203)	(0.1886)	(0.3928)	(0.2204)
guarantee	0.494**	0.541*	0.597*	0.531	0.463
	(0.1691)	(0.2437)	(0.2495)	(0.3776)	(0.3064)
yob	-0.0498***	-0.0540**	-0.0457*	-0.0505	-0.0465*
	(0.0142)	(0.0196)	(0.0200)	(0.0484)	(0.0224)
age	0.0457**	0.0301	0.0577**	0.0473	0.0599**
	(0.0154)	(0.0207)	(0.0217)	(0.0512)	(0.0228)
sda	0.0167	0.166	-0.0622	-0.319	0.0118
	(0.1029)	(0.1816)	(0.1280)	(0.3044)	(0.1399)
income (£100)	0.00372	0.0131**	-0.00225	-0.00331	-0.00169
	(0.0046)	(0.0049)	(0.0058)	(0.0120)	(0.0072)
apport	0.0156	0.0266	0.0107	-0.313	0.0926
	(0.0937)	(0.1316)	(0.1327)	(0.2558)	(0.1398)
female	-0.474***				
	(0.0871)				
constant	81.28**	90.52*	71.76	82.41	73.55
	(27.5888)	(38.0389)	(39.0664)	(94.4110)	(43.5490)
gamma	0.000264***	0.000249***	0.000275***	0.000252***	0.000281***
	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0001)

	(1) All	(2) Men	(3) Women	(4) Wives	(5) Single women
N	874	339	535	113	422
Deaths	745	312	433	86	347

Standard errors in parentheses. For regressions (1), (2), (3) and (5) dummy variables are included to indicate the frequency of payment (annual, bi-annual, quarterly or monthly): these dummies were not included in regression (4) as there was no variation. Significance levels are denoted by: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Difference-in-difference results

	(1) All	(2) Men	(3) Women	(4) Wives	(5) Single women
d1956FA	0.116	0.436	-0.195	-0.652	-0.107
	(0.2564)	(0.3247)	(0.4218)	(0.9178)	(0.4875)
annuity	-0.172	-0.266	-0.0335	-0.248	-0.00140
	(0.1142)	(0.1561)	(0.1951)	(0.5664)	(0.2013)
d1956FA×annuity	-0.0612	-0.268	0.172	0.708	0.0213
	(0.2692)	(0.3542)	(0.4399)	(0.9502)	(0.5076)
gteeA	0.298*	0.193	0.710***	0.482	0.744**
	(0.1384)	(0.1807)	(0.1891)	(0.3186)	(0.2566)
apport	-0.0799	-0.0782	-0.0429	-0.372	0.0428
	(0.0803)	(0.1083)	(0.1203)	(0.2518)	(0.1234)
yob	-0.0424**	-0.0596**	-0.0296	-0.0302	-0.0269
	(0.0142)	(0.0187)	(0.0210)	(0.0589)	(0.0225)
age	0.0459**	0.0174	0.0704**	0.0706	0.0752**
	(0.0143)	(0.0182)	(0.0219)	(0.0611)	(0.0233)
sda	0.0397	0.106	-0.0182	-0.274	0.0327
	(0.0918)	(0.1504)	(0.1197)	(0.3028)	(0.1234)
incA	0.00379	0.0132**	-0.00245	-0.00466	-0.00139
	(0.0042)	(0.0051)	(0.0047)	(0.0121)	(0.0058)
female	-0.488***				
	(0.0751)				
_cons	67.69*	102.1**	41.32	42.91	35.81
	(27.7091)	(36.3357)	(41.0107)	(114.8882)	(43.9506)
gamma	0.000236***	0.000237***	0.000240***	0.000241***	0.000244***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
N	1091	492	599	125	474
Deaths	930	458	472	92	380

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 1: Effect of price change on annuity purchases.

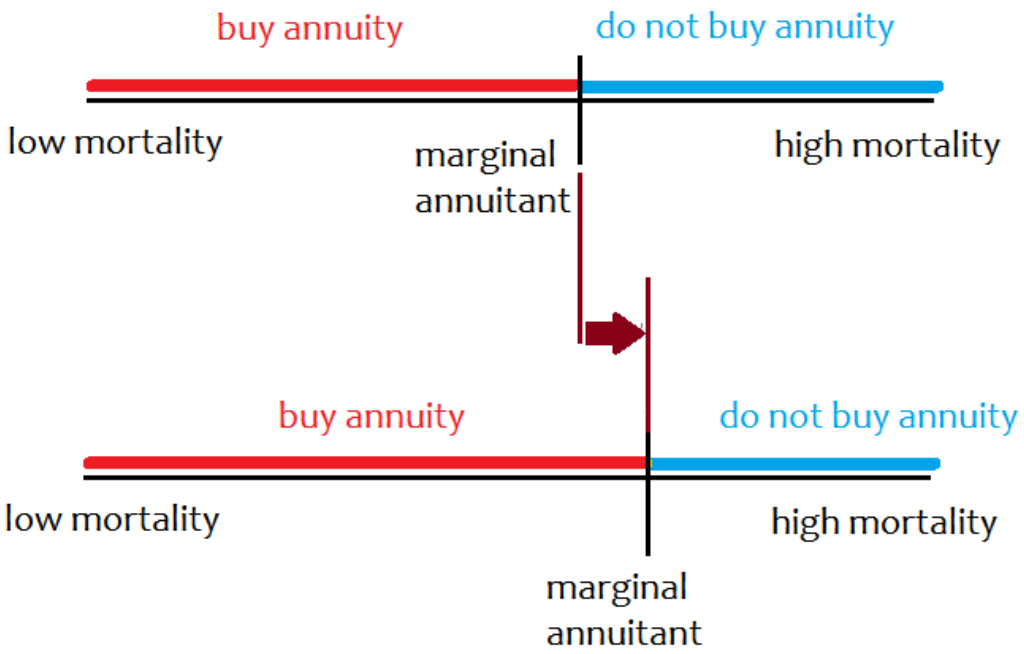

Figure 2: Effect of price change when annuities with guarantees are introduced