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Abstract

It is shown that unidimensional adverse selection may result in market expansion beyond the full-information level. Although bad types tend to drive out good, enough good types may remain to draw in excessive numbers of bad types. As a result, the welfare loss from adverse selection is potentially underestimated. Applications are made to insurance, credit and the used car market.

Keywords: asymmetric information; adverse selection; welfare.

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1 Introduction

Adverse selection is virtually synonymous with inefficient market shrinkage, including complete market collapse. Akerlof (1970) is the seminal paper with the leading example the market for used cars. Owners of the better cars will only sell at higher prices, with only the lemons traded in the asymmetric-information equilibrium. The possibility of market expansion under these circumstances never seems to be contemplated. This paper shows that relative to full information, adverse selection may result in more trade.[1] As in the standard case, good types tend to exit, but enough of them may remain to draw in bad types that would be out of the market were their characteristics known. The welfare loss from adverse selection is therefore underestimated by studies that only measure the consequences of too few good types traded.

We illustrate how market expansion can arise with the useful diagrams of Einav, Finkelstein and Cullen (2010), and Einav and Finkelstein (2011). Insurance, credit market and used car applications are covered. Whether the results are merely theoretical curiosa is discussed in a brief conclusion.

2 The analysis in pictures

2.1 Insurance

We follow the graphical exposition of Einav and Finkelstein (2011). They set the analysis in terms of insurance which, through risk aversion, places more structure on configurations than applies to many selection markets.

Each member of a population has wealth, m, and may suffer financial loss, L. Loss probabilities are distributed in the population according to $F(p)$.There is a common increasing and concave utility of wealth function, $U(\cdot)$. A single insurance policy that covers the loss is offered by risk-neutral competitive insurers.[2] Willingness to

[1] Adverse selection is characterized by the least profitable of the informed types valuing the product most. Advantageous selection, as in de Meza and Webb (1987), involves the opposite and leads to market expansion. The novelty is showing adverse selection can have a similar effect.

[2] As Einav and Finkelstein (2011) concede, the assumption of an exogeneous contract is a drawback. Rothschild and Stiglitz (1976) endogenize contracts for the adverse selection case, and de Meza and Webb (2001) for advantageous selection. Azevedo and Gottlieb (2017) provide an innovative multidimensional model of insurance with endogeneous contracts and a continuum of types with pooling in equilibrium.

pay (WTP) for the policy by individual i, ω_i, satisfies

$$(1-p_i)U(m)+p_iU(m-L)=U(m-\omega_i), \tag{1}$$

yielding

$$\frac{d\omega_i}{dp_i}=\frac{U(m)-U(m-L)}{U'(m-\omega_i)}>0. \tag{2}$$

The number of policies demanded is decreasing in the premium and, as WTP is increasing in loss probability there is adverse selection under asymmetric information.

The cost of supplying a policy to individual i is

$$C_i=p_i(L+c_1)+c_2$$

where $c_1 \geq 0$ is claim processing cost, and $c_2 \geq 0$ is the cost of issuing a policy.[3] In Figure 1a, the vertical axis measures price and the cost of providing the contract, and the horizontal the number of policies. Marginal cost is drawn monotonically falling, reflecting adverse selection. As the premium falls, better risks are drawn in. Linearity applies if the distribution of loss probabilities is uniform. Average cost is derived from marginal cost in the usual way. To see the properties of demand, suppose the support of the probability distribution is $[0,1]$. At both extremes, there is no risk so from (1), $\omega_i=p_iL<p_i(L+c_1)+c_2$. At intermediate probabilities, from (1), the concavity of utility implies that $\omega_i>p_iL$. The positioning and shape of the functions in Figure 1 then follows. It is those with middling loss probabilities for whom WTP exceeds MC.

Under asymmetric information, buyers know their loss probabilities, but sellers only know the population distribution. Everyone must be offered the same premium. Assuming Bertrand competition, equilibrium involves zero profit with no price deviation increasing profit. These requirements are only satisfied at the price P^*, resulting in two distortions. There are FG individuals for whom the cost of providing the contract is exceeded by willingness to pay for it so they would be insured under full information but are excluded under asymmetric. This is the standard underinsurance of good types. In addition, 0E bad risks are now insured that value the policy less than its cost so would not be insured under full information. It is ambiguous

[3] These costs should include the hassle costs of the insured in claiming and applying for contracts (or else deducted from WTP). Administrative costs of insurers are often high. Examining individual insurance returns lodged with the then UK regulator, the FSA claims management costs for non-life lines of insurance are reported at between 8% and 12% of claims paid. See also KPMG (2011), which put the average loss ratio (net claims and claims expenses as a percentage of net earned premiums) for UK general insurance at 63%. Total expenses (not just claim processing costs) are some 32% of income.

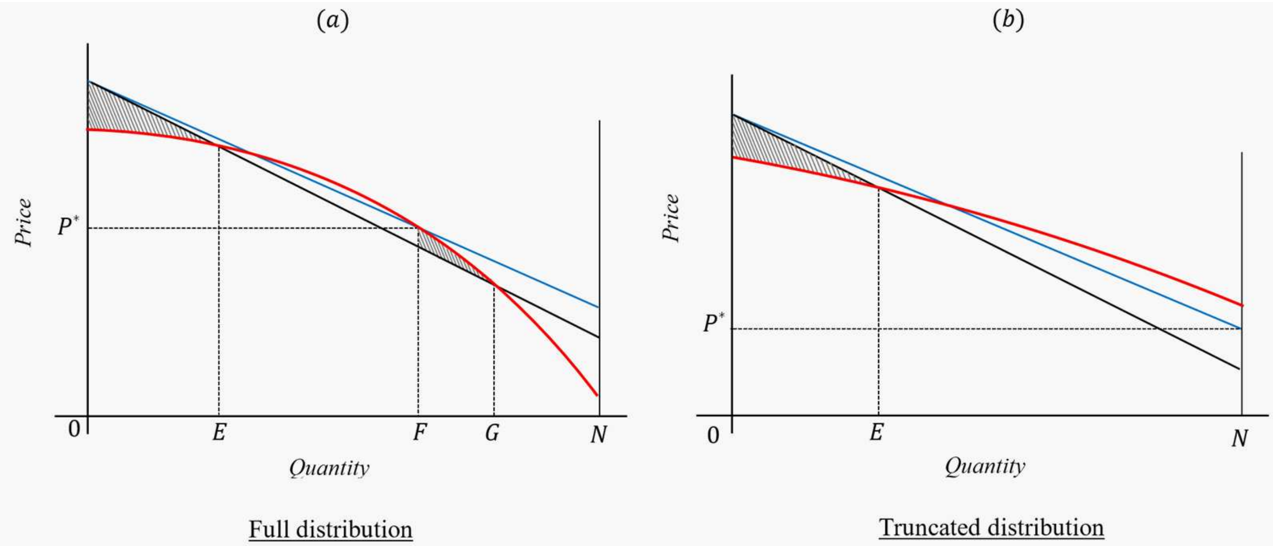


Figure 1. Insurance

Black: expected cost of marginal policy
Blue: expected cost of average policy
Red: demand

whether more are insured than under full information but, even if the number of policies remains the same or falls, there are two sources of welfare loss.[4]

Figure 1b presents a slightly different configuration that arises if the upper support of the probability distribution is sufficiently below one. Now the equilibrium involves all insured although, under full information, 0E individuals would not be insured.

Proposition 1 *Adverse selection involves some negative surplus trade when administrative costs are positive but are not so high as to preclude all trade. The volume of trade may then exceed the full-information level.*

2.2 Credit

Consider the classic credit market analysis of Stiglitz and Weiss (1981). A mass of entrepreneurs, each endowed with a single indivisible project, require external

[4]The positive correlation test of Chiappori and Salanie (2000) is satisfied. Those buying insurance are more likely to suffer a loss. Limits to this test for adverse selection are discussed in de Meza and Webb (2017), and Fang and Wu (2018).

funding to proceed. Gross return is binary. Failure yields no revenue and occurs with probability p_i, whilst success yields output y_i. All agents are risk neutral.

Projects differ by mean preserving spreads, so

$$(1 - p_i)y_i = \overline{y}. \tag{3}$$

The highest repayment, r_i, a borrower will accept satisfies

$$(1 - p_i)(y_i - r_i) = u, \tag{4}$$

where u is the opportunity cost of running the project. So,

$$r_i = \tfrac{\overline{y}-u}{1-p_i}, \tag{5}$$

which means that the maximum acceptable repayment is increasing in p_i, the project risk.

For the lender to break-even on a loan to borrower i, the repayment, r_i^*, must satisfy $(1 - p_i)r_i^* = A$, where A is the advance (for simplicity, the safe interest rate is zero). The supply of funds to lenders is perfectly elastic, so rationing cannot arise.

Under full information the competitive repayment on a loan to borrower i is

$$r_i^* = \tfrac{A}{1-p_i}. \tag{6}$$

Low-risk projects break even at lower interest rates. So (5) and (6) imply this is an adverse selection market. As interest rates rise, it is the most profitable low-risk types that drop out.

The difference between the highest repayment the borrower will accept and the breakeven repayment is

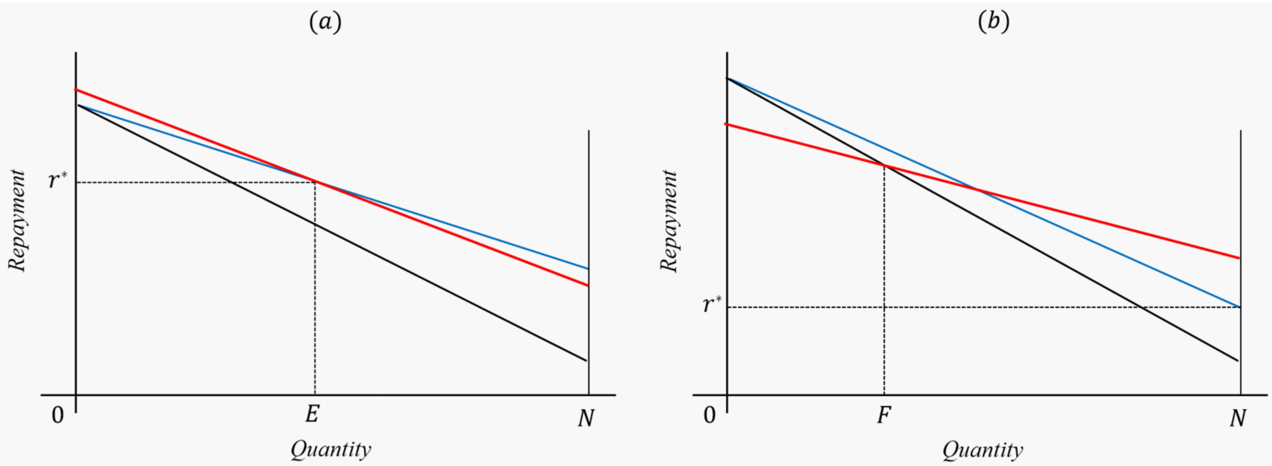
$$r_i - r_i^* = \tfrac{\overline{y}-u-A}{1-p_i}, \tag{7}$$

where the numerator in (7) is the net gain from each project.

Figure 2a illustrates equations (5) and (6), and the associated curve showing the breakeven repayment if all projects riskier than the n_{th}-safest are funded. Under full information all projects are funded but, under asymmetric information, only the 0E riskiest projects are. This is the familar lemons result: inefficient market shrinkage under asymmetric information.[5]

Now introduce risk aversion. Every entrepreneur has the concave utility of income function $U(\cdot)$. At a given interest rate, there are offsetting effects on the expected

[5]Each project contributes $\overline{y} - u - A$ to total welfare. Notice the gain is not the vertical difference $r_i - r_i^*$.



Risk neutrality

Risk aversion

Figure 2. Credit

Black: breakeven repayment on marginal loan
Blue: breakeven repayment on average loan
Red: borrowers' willingness to repay

utility of having a riskier project. The entrepreneur's expected income is higher, but the extra risk lowers expected utility. If risk aversion is high, greater risk may lower expected utility resulting in advantageous selection. Specifically, writing expected utility as $(1-p_i)U(y_i - r) \equiv EU$, the condition for adverse selection is $dEU/dy_i > 0$, which holds iff

$$\frac{U'(y_i-r)}{U(y_i-r)} > \frac{1}{y_i}. \tag{8}$$

Risk aversion lowers an active entrepreneur's expected utility and therefore the highest interest rate they will pay. The effect is greatest for the riskiest projects, making Figure 2b possible. Here the equilibrium is that all get loans under asymmetric information, but the riskiest 0F individuals are excluded under full information.[6]

Proposition 2 *Adding risk aversion to the Stiglitz-Weiss model may generate advantageous selection. Even if adverse selection remains, there may be more lending under asymmetric information than symmetric.*

2.3 Used cars

This is the original Akerlof setting. Each of a mass of individuals owns a single car. Quality is distributed according to $F(q)$. An owner's willingness to accept for a car is $v(q)$ with $v'(q) > 0$, so under asymmetric information adverse selection applies. The willingness to pay of the identical risk-neutal potential buyers for a car with quality q is $\omega(q)$ with $\omega'(q) > 0$.

If choosing at random a car from all those with quality at or below q, willingness to pay is

$$W(q) = \frac{\int_0^q \omega(q)dF(q)}{\int_0^q dF(q)}. \tag{9}$$

The standard case is is shown in Figure 3a. Under full information, all cars are traded but, under asymmetric information, only 0A are, with the highest quality cars out of the market. In Figure 3b, all cars are traded under asymmetric information though, under full information, low quality cars in the range BC would not be traded. This configuration requires that, for owners, the value of a low-quality car relative to a high quality is higher than for buyers. Standard theory does not impose any restriction on preferences, but this property seems reasonable. Owners of impaired items may have learned to live with the problem whereas buyers are apprehensive.

[6] The essential property is that at high y_i, $r_i - r_i^* < 0$, but at lower y_i, $r_i - r_i^* > 0$. This can be confirmed by example. Let $U(m) = 0.1m - 0.1m^2$. At fixed r, EU is increasing in y_i and with $A = 1.8$ and $u = 0.014$, between $y_i = 2.8$ and $y_i = 3.2$, the inequality reversal occurs.

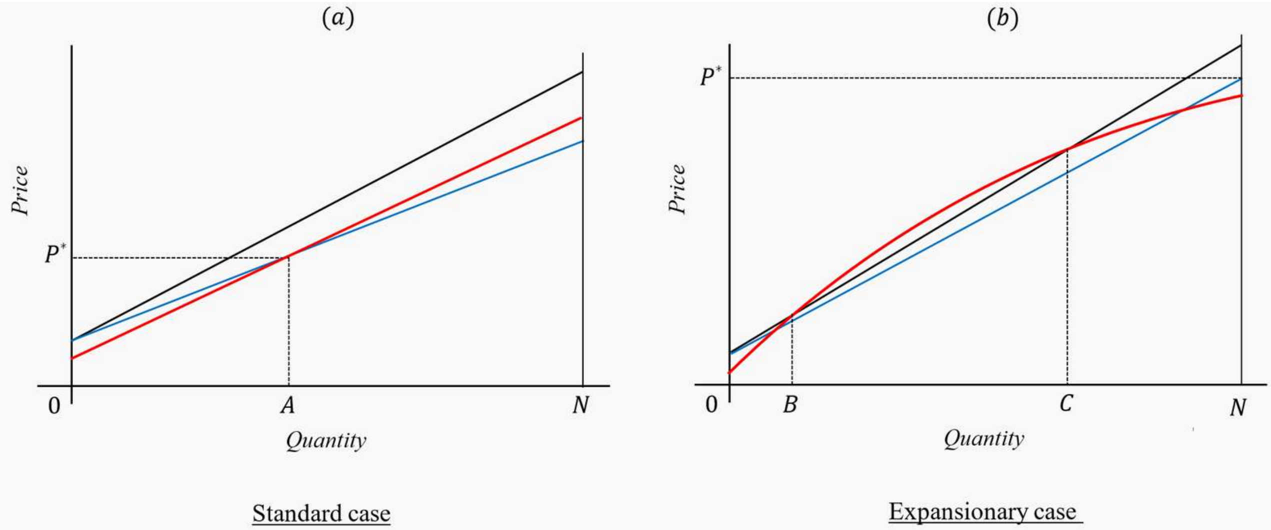


Figure 3. Used cars

Black: buyers' valuation of a car with quality q
Blue: buyers' valuation of cars with quality q and lower
Red: supply

Also, behavioral effects may come into play such as the "disposition effect", which may imply owners are reluctant to take an exceptional financial loss on the item.[7]

3 Conclusion

In the standard analysis of adverse selection, all the trades that occur generate positive surplus. The problem is that not all the potentially positive-surplus trades happen. We show that under seemingly mild assumptions, some negative-surplus trades take place. That is, adverse selection does not preclude inefficient trades leading to excessive market widening. Whether this arises in practice cannot be determined by the usual tests for adverse selection. As the insured have higher loss probabilities than the uninsured, the positive correlation test of Chiappori and Salanie (2000) will be passed. Einav, Finkelstein and Cullen (2010) use exogenous price variation to estimate demand and costs. At first sight, what matters is getting

[7]For example Genesove and Mayer (2001) find that for housesellers willingness to accept is increasing in purchase price.

slopes right in the region of equilibrium, but this is not the case. To identify the overinsurance zone requires observation of prices far from equilibrium. Such prices are not observed in the study, and it will generally be difficult to obtain such prices naturally.

The most promising test method is perhaps to look at the effects of varying the provision of information. For example, the rise of Big Data provides granulated risk assessment. Typical is the website of Big Data Scoring:

> "*We develop and deploy custom scoring models that combine a lender's internal data with thousands of pieces of external data such as location based information, web search results, behavioural tracking, device technical details, mobile app data and much more. This enables lenders to accurately predict borrower payment behaviour, helping them make informed and more profitable credit decisions in real time.*"

In the standard adverse selection model, a move to full information increases the price charged to bad types but does not precipitate their non-participation. If instead it is the bad risks that no longer obtain loans, as in our analysis of Stiglitz-Weiss under risk aversion, that suggests overlending under asymmetric information.

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