The Economics of Public Policy

7. Market Failures due to Asymmetric Information

Prof George Alogoskoufis
The US Constitution, the Role of Government and Social Insurance Programs

“We the People of the United States, in Order to form a more perfect Union, establish Justice, insure domestic Tranquility, provide for the common defence, promote the general Welfare, and secure the Blessings of Liberty to ourselves and our Posterity, do ordain and establish this Constitution for the United States of America.” (Preamble to the US Constitution, 1789).

For most of its history, the role of the government in the USA was limited to the provision of public goods, and in particular one of these goods, “common defense”. “domestic Tranquility” and “security” were also important.

As late as 1953, national defense accounted for 69% of federal spending. Only 4% was devoted to social security, and only 0,4% to health care.

By 2010, only 20% was devoted to national defense, another 15% was devoted to Social security, and 25% was devoted to health care, both examples of programs that “promote the general Welfare”.

Programs like social security and health care are labeled collectively as social insurance programs, government interventions to provide insurance against adverse events.

To understand the role of social insurance, one must understand choice under uncertainty, and also understand the role and failings of private financial and insurance markets.
The Role of Financial and Insurance Markets

- In financial markets, individuals and firms can borrow against their future income and lend if they have positive savings. Because financial markets match current lending with uncertain future income flows, they are characterized by uncertainty and differences in information between borrowers and lenders.

- In insurance markets, which are specialized financial markets, individuals and firms, or those acting on their behalf, pay money to an insurer, which may be a private firm or the government, and the insurer promises to make some payment to the insured party, or to others providing services to the insured party, in the case of an adverse future event or series of events.

- The return on savings or the cost of borrowing in financial markets depends on the interest rate, whereas payments to insurers are called insurance premiums. Insurance premiums are a form of payment to insurers, which is repaid if some adverse event takes place.

- Financial and insurance markets are valuable to individuals for two reasons. First, because of the diminishing marginal utility of consumption, and, second, because of uncertainty.

- Because of the diminishing marginal utility of consumption, individuals prefer a succession of years with average consumption, to a succession of years of relatively high consumption followed by a succession of years of relatively low consumption, or vice versa. Economists call this characteristic consumption smoothing.

- Because of uncertainty about future losses, individuals are thus prepared to pay to buy insurance to secure payments from insurers in times of loss of income (“bad times”).
Consumption Smoothing under Certainty

- There are fluctuations in income that are not characterized by a lot of uncertainty. For example, everybody knows that their income will go down when they retire, or that they will not be able to earn when in college or university. Everybody knows then that average earnings are on an increasing path until a certain age, and then they are on a declining path.

- Financial markets, through financial intermediaries like banks, help them smooth their consumption by lending to young households, to study or buy a house, and counting on their growing future income to repay their debts. They also provide assets for households whose income exceeds their spending, in order to get a return for their savings, in order to cope with the loss of income after they retire, or the expenses for the education of their children.

- The reason is that because of the diminishing marginal utility of consumption in every year, households prefer a consumption profile over time which is smoother than their income profile.
Consumption Smoothing
A Typical Earnings and Consumption Profile
The Simplest Two Period Model of Consumption Smoothing

Assume a household that lives for two periods, the “present” is period 1 and the “future” is period 2. Income in period 1 is $y_1$ and income in period 2 is $y_2$. Assume that $y_1 < y_2$.

The lifetime utility of the household depends on her consumption in period 1 and period 2, $c_1$ and $c_2$. It can be written as,

$$U(c_1, c_2) = u(c_1) + \frac{1}{1 + \rho} u(c_2)$$

where the per period utility function $u$ is characterized by diminishing marginal utility, i.e $u’ > 0$, $u’’ < 0$. $\rho > 0$ is the pure rate of time preference, which measures by how much the household prefers current to future utility.

The household is assumed to maximize this utility function, subject to the relevant budget constraint.
The Budget Constraint with and without Financial Markets

**Absence of Financial Markets:** Assume first that there are no financial markets, and that the household cannot borrow and lend. Thus, it will have to consume its current income in each period. The path of consumption will be determined by $c_1 = y_1$ and $c_2 = y_2$. Since current income is lower than future income, current consumption will be lower than future consumption, and the marginal utility of current consumption will be higher than the marginal utility of future consumption. The household would be able to increase its utility by increasing its current consumption and reducing its future consumption but it cannot do so because it cannot borrow against the future income.

**Existence of Financial Markets:** Assume now that there are well functioning financial markets, and that the household is able to borrow and lend at a market interest rate $r$, provided that it can repay its current loans in the future. Its current consumption no longer has to be equal to its current income, as it can spend more than its current income, provided that it spends less than its current income in the future, so as to repay its loans plus interest. Its budget constraint becomes,

$$ (1+r)(c_1 - y_1) = y_2 - c_2 $$

It can now afford to increase its utility by borrowing to increase its current consumption above its current income, and reducing its future consumption below its future income, in order to repay its loan in the future.
The Inter-temporal Budget Constraint

The budget constraint in the case where the household can borrow and lend is called the *inter-temporal budget constraint*. It can be rearranged as,

\[ c_1 + \frac{c_2}{1 + r} = y_1 + \frac{y_2}{1 + r} = W \]

The left hand side is called the *present value of consumption* and the right hand side is called the *present value of income* (or total household wealth).

If financial markets exist, the household can maximize its utility subject to the inter-temporal budget constraint, which is a much looser constraint than the constraint that your current consumption cannot exceed your current income, which applies in the absence of financial markets.

This allows households to achieve a higher level of utility, by engaging in *consumption smoothing*, i.e trading off current against future consumption, until the marginal rate of substitution between current and future consumption is equal to the relative price of current and future consumption, which is none other than one plus the interest rate. One can show that maximizing utility in this case implies that,

\[
(1 + \rho) \frac{u'(c_1)}{u'(c_2)} = 1 + r \\
\text{or that} \quad \frac{u'(c_1)}{u'(c_2)} = \frac{1 + r}{1 + \rho}
\]
Financial Markets and Consumer Welfare in a Two Period Model of Consumption Smoothing
Irving Fisher

Irving Fisher (February 27, 1867 – April 29, 1947) was an American economist, statistician, inventor, and Progressive social campaigner. He was one of the earliest American neoclassical economists, though his later work on debt deflation has been embraced by the Post-Keynesian school. Joseph Schumpeter described him as "the greatest economist the United States has ever produced", an assessment later repeated by James Tobin and Milton Friedman.

Fisher made important contributions to utility theory and general equilibrium. He was also a pioneer in the rigorous study of inter-temporal choice in markets, which led him to develop a theory of capital and interest rates.
Introducing Uncertainty: The Role of Insurance Markets

Let us now introduce uncertainty. A household has an income $Y$ but faces a probability $p<1$, of incurring a loss equal to $L$.

She can insure against this loss by buying a policy that will compensate her for the loss in the event that the loss occurs.

A policy that pays out $a$ in the event of a loss costs $qa$ dollars, where $q$ is the insurance premium per dollar of insurance. How much insurance will she chose to buy?

In the economics of uncertainty we assume that households maximize their expected utility. If $u(.)$ is the utility of the household as a function of consumption, the expected utility is given by,

$$U_E = pu(Y - L + (1 - q)a) + (1 - p)u(Y - qa)$$

Given that we have assumed that income $Y$, the size and the probability of the loss $L$ and $p$ and the insurance premium $q$ are exogenously given, the only choice variable for the household is the size of the insurance coverage $a$. 

The Optimal Demand for Insurance

The household will choose the amount of insurance coverage by maximizing her expected utility. The more coverage she buys, the less she will consume if the loss does not materialize, but the more she will consume if the loss materializes. Clearly there is a tradeoff.

The maximum occurs at the point where the effect of the size of the coverage on the marginal utility of consumption in the event of a loss, weighted by the probability of the loss $p$, is equal to the effect of the size of the coverage on the marginal utility of consumption in the absence of the loss, weighted by the probability of no loss $1-p$. This can be found by taking the first derivative of the expected utility function with respect to the insurance coverage $a$ and setting it equal to zero. This implies that,

$$pu'(Y - qa - L + a)(1 - q) = (1 - p)u'(Y - qa)q$$

or

$$\frac{p}{1 - p} \frac{u'(Y - qa - L + a)}{u'(Y - qa)} = \frac{q}{1 - q}$$
A Competitive Insurance Industry and Actuarially Fair Premia

Assume that the insurance industry is competitive and that premia are actuarially fair. An insurance policy is actuarially fair if the expected payout of the insurance company is equal to the cost of the insurance. Thus, an actuarially fair insurance policy implies that,

\[ pa=qa, \text{ which implies that, } p=q \]

This is more likely if the insurance industry is competitive and competition drives down premium.

In such a case, the marginal utility of consumption in the two states will be equalized, which means that consumption in the two states will be equal. Thus we shall have that,

\[ Y-qa-L+a=Y-qa, \text{ which implies that } a=L \]

Our household will choose to be fully insured for the loss, and this is the socially optimal outcome because this maximizes her expected utility.
The Private Insurance Industry in the United States

It is clear that individuals and firms value insurance. The size of the private insurance industry in the United States attests to that:

- Health insurance ($849 in premiums in 2010).
- Casualty and Property Insurance ($502 billion).
- Auto insurance ($160 billion).
- Life insurance ($105 billion).

The question that arises is why is there a need for social insurance. Why cannot individuals buy insurance in the private insurance market? Why has the size of federal expenditure in social insurance programs risen so much?

The answer is again market failures. Market failures in a market such as insurance, which is characterized by uncertainty and imperfect information, have to do with so called asymmetric information.
Eminent Economists (and Mathematicians)

John von Neumann

John von Neumann (December 28, 1903 – February 8, 1957) was a Hungarian-American mathematician, physicist, inventor, computer scientist, and polymath. He made major contributions to a number of fields, including mathematics (foundations of mathematics, functional analysis, ergodic theory, geometry, topology, and numerical analysis), physics (quantum mechanics, hydrodynamics, and quantum statistical mechanics), economics (game theory), computing (Von Neumann architecture, linear programming, self-replicating machines, stochastic computing), and statistics.
Asymmetric Information: Adverse Selection and Moral Hazard

- One of the parties in a market exchange sometimes has better information about the characteristics of the product or service being exchanged than the other. For example, a seller of a second hand car has better information about the quality of the car than the prospective buyer. A job seeker may have better information about her productivity than the prospective employer. A borrower may have better information about the riskiness of the project she is about to undertake than the lender. Somebody who buys health insurance may have better information about the state of her health than the insurance company selling the insurance. These types of problems of asymmetric information are called adverse selection problems and may lead to suboptimal provision or even a total breakdown of voluntary exchange in a market.

- In addition, in many situations after a transaction has been agreed, one side of the market cannot fully monitor the behavior of the other is fulfilling the agreement. A employee may be pretending to work hard at her workstation, while in fact she is playing computer games at the expense of the employer. A borrower might go on an expensive vacation after having borrowed money from the bank to improve her business or her house. Somebody who has bought health insurance might relax and start smoking again, increasing the risk of heart disease or lung cancer. These types of problems of asymmetric information are called moral hazard problems and may again lead to suboptimal provision or even a total breakdown of voluntary exchange in a market.

- Examples or markets where asymmetric information problems exist are insurance markets, financial markets, labor markets and markets for goods with uncertain characteristics, such as the second hand car market. However, it is no accident that the terms adverse selection and moral hazard were first used in insurance markets.
Eminent Economists

George Akerlof

George Arthur Akerlof (June 17, 1940-) is an American economist who is a University Professor at the McCourt School of Public Policy at Georgetown University and Koshland Professor of Economics Emeritus at the University of California, Berkeley. He won the 2001 Nobel Memorial Prize in Economic Sciences (shared with Michael Spence and Joseph E. Stiglitz).

Akerlof is perhaps best known for his article, "The Market for Lemons: Quality Uncertainty and the Market Mechanism", published in Quarterly Journal of Economics in 1970, in which he identified certain severe problems that afflict markets characterized by asymmetric information, the paper for which he was awarded the Nobel Memorial Prize. In Efficiency Wage Models of the Labor Market, Akerlof and coauthor Janet Yellen (his wife) propose rationales for the efficiency wage hypothesis in which employers pay above the market-clearing wage, in contradiction to the conclusions of neoclassical economics.
The Problem of Adverse Selection in Insurance Markets

- **Adverse selection** is a problem created by asymmetric information before the transaction takes place.

- Whereas buyers of insurance have relatively good information about the idiosyncratic risks that they face, insurance companies may only have information about the risks associated with the average prospective customer.

- Assume that there are two types of buyers, *high* and *low risk*.

- If the insurance company had full information, it would set two types of premium. One for the high risk individuals and one for the low risk individuals. Everybody would then buy the optimal amount of (full) insurance.

- If the insurance company had asymmetric information and could not distinguish between high and low risk individuals, and set its insurance premium in between the high premium appropriate for the high risk individual and the low premium appropriate for the low risk individual, it would induce adverse selection. All the high risk individuals would buy full insurance, as the premium is lower than the actuarially fair premium for them, while the low risk individuals would not, as the premium is higher than the actuarially fair premium for them. As a result, the level of insurance coverage would be sub-optimally low.

- Adverse selection can then lead to market failures in insurance. A suboptimal provision of insurance, even a full collapse of the market.

- It has to be noted that there are market solutions to the adverse selection problem, such as dual pricing and the like, but these do not completely solve the problem. Hence the need for government provided or sponsored social insurance.
The Problem of Moral Hazard in Insurance Markets

- Moral hazard is the problem created by asymmetric information after a transaction has been agreed upon.
- It is the risk (hazard) that one of the parties might ex post engage in activities that are undesirable (immoral) from the viewpoint of the other, because one of the parties cannot monitor the behavior of the other.
- Hence, again, voluntary exchange may break down ex ante because of this risk.
- For example, think of someone who after having bought health insurance increases the daily number of cigarettes he smokes and thus increases the risk of heart disease or lung cancer.
- The insurance company may anticipate this, charging higher premiums and thus causing people to underinsure.
- Again, there is a market failure, due to the sub-optimally low level of insurance.
- Moral hazard problems also arise following government interventions to mandate insurance or provide social insurance. Suppose the government provided the optimal amount of health insurance through a social insurance program. The moral hazard problem is exacerbated. All those participating in the program may start neglecting their health, as they are now fully insured.
The Problem of Adverse Selection in Financial Markets

- Whereas borrowers have relatively good information about the idiosyncratic risks of their project, banks may only have information about the risks associated with the average project of this type.

- Assume that there are two types of projects, high and low risk.

- If the bank had full information, it would set two types of interest rates. One for the high risk projects and one for the low risk projects. The high risks projects would then have to pay a premium over the interest rate of the low risk projects. Everybody would then engage in the optimal amount of borrowing.

- If the bank had asymmetric information and could not distinguish between high and low risk projects, and set its interest rate between the high rate appropriate for the high risk project and the low rate appropriate for the low risk project, it would induce adverse selection. All the high risk projects would seek finance, as the interest rate is lower than there expected rate of return, while the low risk projects would not, as the interest rate is higher than the rate of return of the project. As a result, the level of bank lending would be sub-optimally low.

- Adverse selection can then lead to market failures in financial markets too. A suboptimal provision of credit, even a full collapse of the market.

- It has to be noted that there are market solutions to the adverse selection problem, such as dual interest rates, information gathering and the like, but these do not completely solve the problem.
The Problem of Adverse Selection in Labor Markets

- Whereas prospective job seekers have relatively good information about their individual productivity and skills, prospective employers may only have information about the productivity of the average job seeker.

- Assume that there are two types of job seekers, high and low productivity.

- If the prospective employer had full information, she would set two types of wages. A high wage for the high productivity job seeker, and a low wage for the low productivity job seeker. Everybody would then engage in the optimal amount of employment.

- If the employer had asymmetric information and could not distinguish between high and low productivity worker, and set the wage between the high wage appropriate for the high productivity worker and the low wage appropriate for the low productivity worker, she would induce adverse selection. All the low productivity workers would accept the job offer, as the wage is higher than their productivity, while many of the high productivity workers would not, for the opposite reason. As a result, the level of employment would be sub-optimally low.

- Adverse selection can then lead to market failures in labor markets markets too. A suboptimal level of employment, even a full collapse of the labor market.

- It has to be noted that there are market solutions to the adverse selection problem, such as dual wages, information gathering and the like, but these do not completely solve the problem.
Market Failures and Government Interventions in Insurance Markets and other Markets Characterized by Asymmetric Information

There are four basic conclusions from this analysis:

First, individuals value insurance and financial markets, because they would ideally like to smooth their consumption across time and across states of the world.

Second, there are a number of reasons why such markets, and the labor market may fail to provide the optimal level of insurance coverage, credit or employment, but problems of asymmetric information are significant in such markets.

Third, even if the market fails to provide the optimal level, one should first examine how the functioning of the market can be improved by addressing the asymmetric information problems.

Fourth, social insurance can improve welfare, provided it does not crowd out private insurance, and does not create additional moral hazard problems.

This is more likely to happen when social insurance is reserved for non predictable events, and does not fully compensate those who suffer unexpected loss of income.