

Medical Insurance: Risk Spreading vs. Moral Hazard Revisited

by

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I. Introduction

Kenneth Arrow (1963) first discussed the role of uncertainty in the economics of medical care, including such fundamental ideas as moral hazard, demand inducement, and of course, the essential role of uncertainty in the demand for health insurance. Richard Zeckhauser (1970) first analyzed the tradeoff between risk spreading and moral hazard in a formal model, showing that this now-classic tradeoff was central to understanding the selection of health insurance coverage, since -- unlike almost all other types of insurance -- health insurance alters the price of an insured service (medical care) at the time of purchase. Thus, increasing coverage reduces financial risk (a welfare gain) while at the same time increasing the welfare loss due to excess consumption of medical care, the so-called moral hazard effect. In a general context, Isaac Ehrlich and Gary Becker (1972) modeled the optimal insurance choice when insurance can either alter the probabilities of some states of the world or the magnitude of loss when the "bad" state of the world occurs, although they did not specifically model the nature of the moral hazard effect in health insurance.

The central question addressed by Zeckhauser and Ehrlich and Becker forms the focus of this project -- understanding how the tradeoff between risk spreading and moral hazard affects the choice of optimal insurance. To achieve this goal, I employ a Taylor Series¹ expansion of the welfare losses involved, and by so doing, I place the discussion in terms readily understood in standard

¹ The Taylor Series, like most "named" ideas familiar to economists, was not first invented by Taylor, nor was its specific form of the MacLaurin Series first invented by MacLaurin. In his *Methodus incrementorum directa et inversa* (1715), Taylor described the now-famous series first published by James Gregory in 1688, apparently unaware of Gregory's earlier work. MacLaurin's *Treatise of Fluxions* (1742) cited Taylor's work, not attempting to claim credit for the idea of the MacLaurin series for which he is now famous. There is some ironic justice in all of this: MacLaurin invented the method for solving simultaneous linear equations now attributed to Cramer (Thomas and Finney, 1988).

economic analysis -- risk premiums and welfare losses arising from non-optimal levels of consumption. We will see that the tradeoff first specified by Zeckhauser involves a balancing of risk premiums and "moral hazard" welfare losses in a very simple way. Indeed, the optimal coinsurance rate for the consumer turns out to be a simple function of the risk premium and expected welfare loss from moral hazard.

II. The Model

I use a model where the only choice parameter in the health insurance policy is the coinsurance rate C . (This approach closely follows Zeckhauser's original modeling.) The insurance company charges a premium $R = (1 + \lambda)E\{(1-C)pm_i\}$ where λ is the loading fee charged by the insurer. (This implies full experience rating by the insurer, an issue that does not materially change the nature of the problem discussed here.)

I presume that the consumer seeks to maximize expected utility, where utility for the i^{th} state of health is found by $U_i = U_i(H_i, I - R - Cpm_i)$. Consumers experience random shocks to health, represented for state of health I by R_i . Health is produced by using medical care m , so that $H_i = H_0 - R_i + g(m)$, where $g(\bullet)$ transforms m into H . The optimum decision for purchasing medical care (Phelps, 1973, 1975) equates the marginal health gains -- $g'(m)U_H$ -- with the marginal cost of medical care -- Cp . In this setting, reducing the coinsurance rate C causes two changes in expected utility that move in opposing directions: declining welfare losses from financial risk arising from medical spending and increasing welfare losses from "moral hazard" -- the increased medical use arising from the price subsidy embedded in the insurance contract. In what follows, I develop Taylor Series approximations to these two components of the maximization problem, and in doing

so, derive a new expression for the optimal value of C that lends new insight into the balancing problem associated with selecting optimal coinsurance rates.

Financial Risk. Any classic risk (ignoring for a moment the effects of insurance on choice of m) can be approximated by a Taylor Series expansion, conveniently around the mean. Define a random variable z with density f(z) and mean $\mu = E(z)$. Suppose U is a function of z. Then the Taylor Series expansion of expected utility (EU) around the mean μ (with all derivatives of U evaluated at μ) is:

$$(1a) \quad EU = E[U(\mu) + U'(\mu)(z_i - \mu) + U''(\mu)(z_i - \mu)^2/2! + U'''(\mu)(z_i - \mu)^3/3! + \dots]$$

$$= U(\mu) + U''E(z_i - \mu)^2/2! + U'''E(z_i - \mu)^3/3! + U''''E(z_i - \mu)^4/4! + \dots$$

This is readily seen as an expression involving the utility function parameters at a specific point ($z=\mu$) and the central moments of the distribution of financial risk, f(z). It is convenient to normalize this expression around $U'(\mu)$ (or more compactly, U') giving:

$$(1b) \quad EU/U' = U(\mu)/U' + (U''/U')E(z_i - \mu)^2/2! + (U'''/U')E(z_i - \mu)^3/3! + (U''''/U')E(z_i - \mu)^4/4! + \dots$$

with all derivatives of U evaluated at μ .

John Pratt's classic work (1964) defined the local risk aversion measure for any utility function as $r = -U''/U'$.² Using this expression and defining central moments $\kappa^i = E(z - \mu)^i$, we can rewrite (1b) as:

$$(2a) \quad EU/U' = U(\mu)/U' + (U''/U') \kappa^2/2! + (U'''/U') \kappa^3/3! + \dots$$

so (see below³ for derivation), where in every case $r = r(z)$ is evaluated at μ :

² He also defined relative risk aversion $r^* = rY$, where Y is income, an expression that appears in a later section.

³ Define $r = -U''(z)/U'(z)$. Then $dr/dz = [-U'U''' + U''U'']/(U')^2 = -U'''/U' + r^2$. Thus $U'''/U' = r^2 - dr/dz$. Similarly, taking the derivative of dr/dz gives $d^2r/dz^2 = [-U'U'''' + U''U''']/(U')^3 + 2r(dr/dz)$.

$$(2b) \quad EU/U' = U(\mu)/U' - r\sigma^2/2 + (r^2 - dr/dz) \kappa^3/6 + (-r^3 + 3r(dr/dz) - d^2r/dz^2)\kappa^4/24 + \dots$$

For constant absolute risk aversion (CARA) utility functions, dr/dz and all higher derivatives of r equal zero, which simplifies the Taylor Series expansion to:

$$(2c) \quad EU/U' = U(\mu)/U' - r\sigma^2/2 + r^2\kappa^3/6 - r^3\kappa^4/24 + \dots$$

or alternatively

$$(2d) \quad EU/U' = U(\mu)/U' - r\sigma^2/2 + r^2\sigma^3\text{Skew}/6 - r^3\sigma^4(\text{Kurtosis} + 3)/24 + \dots$$

The first term involving r replicates Pratt's conclusion that the risk premium for a random income stream changes in direct proportion to the variance of the risk (using the second order Taylor Series expansion).. The higher order terms matter not at all for normally distributed risks (since the skewness and kurtosis terms vanish), as indeed they would for any Taylor series expression (not simply limited to CARA functions). However, many distributions of medical spending show both a considerable skewness and kurtosis, so these terms may importantly matter, depending primarily on the order of magnitude of the product $r\sigma$. A later section evaluates this matter.

It is also easy to show that if the individual has insurance paying $(1-C)$ percent of any loss (excluding for the moment any effect of the insurance on the magnitude or frequency of the losses), then the risk falls to $C^2\sigma^2$ and the incremental risk premium to further insure against the risk falls commensurately. Put differently, the marginal risk premium will be inversely proportional to C^2 .

Moral Hazard Welfare Loss. Next, I characterize the welfare loss from excess medical care purchases. Consider Figure 1, showing parallel demand curves arising from two different states of the world. (Making the demand curves parallel simplifies the exposition slightly.) For a market

$$U''''U''/(U')^2 + 2r \, dr/dz = -U''''/U' - rU''''/U' + 2r \, dr/dz = -U''''/U' - r(r^2 - dr/dz) + 2rdr/dz = -U''''/U' - r^3 + 3rdr/dz. \text{ Thus } U''''/U' = -d^2r/dz^2 + 3r \, dr/dz - r^3.$$

price p , and a coinsurance rate C , the rational consumer will shift along the illness-specific demand curves from m_1 to m_2 for "mild" illness 1, and from m_3 to m_4 for "serious" illness 2. (This generalizes to many states of health and state-specific demand curves.) Concentrating on the "mild" illness, it is easy to portray the component parts of the Taylor Series expansion of the change in welfare as measured by the equivalent variation (McKenzie and Pearce, 1982). The first order TS term is $-mdp + dY$, where Y is income. In this world, $-dY = dR$, so (ignoring the loading fee for insurance, which offsets the risk spreading considered separately), the insurance premium must on average capture rectangle A plus triangles B and C in Figure 1. Thus the first order Taylor Series terms are $A - (A + B + C) = - (B+C)$

Figure 1 here -- demand curves

The second order Taylor Series terms are $\frac{1}{2}(mMn/MY - Mn/M\phi)(dp)^2 - (Mn/MY)dYdp$. The first expression is obviously just the normal uncompensated demand curve effect, and it adds back triangle C, making the net welfare loss to this point the familiar "welfare triangle" B. The one remaining component is shown on the "serious" illness demand curve as the inward shift in the demand curve due to the income paid out in advance for the premium ($dY(Mn/MY)$), times the change in price (dP). The dashed demand curve shows the quantity shift, and the hatched rectangle the final relevant area. *Both of these effects occur for all demand curves; I show the welfare loss triangles for one demand curve and the hatched rectangle on the other only to relieve clutter on the figure.*

When we move from no insurance to a policy with coinsurance C , $dp = -(1-C)p$, so the welfare change when moving from m_1 to m_2 in the mild illness (with the convenience of straight line demand curves) is $\frac{1}{2}(1-C)^2 p^2 dm/dp = \frac{1}{2}(1-C)^2 pm_1(\eta_1)$ where $\eta_1 = (dm/dp)(p/m_1)$ the usual definition

of the uncompensated elasticity of demand, here evaluated at m_i . This ignores the shaded rectangle area, which (as I show in an appendix) is typically small relative to the triangle welfare loss. Thus we can approximate the *ex ante* expected value of such "moral hazard" losses with::

$$(3) \quad E(\text{MH}) \approx \frac{1}{2}(1-C)^2 E(p m_i \eta_i)$$

where in every case, the elasticity η_i is evaluated at the full-price demand for each illness m_i . This illuminates the well-understood phenomenon that the welfare losses from reimbursement insurance increase in direct proportion to the magnitude of the price responsiveness of the demand for medical care (η) and in proportion to the square of the insurance coverage $(1-C)$ selected (since the welfare loss triangles get increasingly larger with smaller values of C).

Combined Welfare Losses. These two ideas -- the relationships of the risk premium and moral hazard welfare loss to C -- take us back to the problem first illuminated by Zeckhauser, namely the balancing of the welfare loss from risk bearing and the welfare loss from moral hazard. Here, the problem of selecting the optimal insurance coverage C is seen to directly affect both components: smaller C decreases the risk losses quadratically and at the same time increases the moral hazard welfare losses quadratically. The optimal balance minimizes the sum of these two types of risks.

Now consider the sum of these Taylor Series expansions of these two sources of welfare loss (with signs specified so that both sources of loss are positive, and limited to the second order terms for expositional convenience):

$$(4) \quad \text{WL} \approx \frac{1}{2}[r\sigma^2 C^2 - (1-C)^2 E(p m_i \eta_i)]$$

Minimizing the expected welfare loss with respect to C gives the first order condition:

$$(5a) \quad r\sigma^2 C + (1-C) E(p m_i \eta_i) = 0$$

which solves for the optimal C as:

$$(5b) \quad C^* = -E(p_{m_i}\eta_i)/[r\sigma^2 - E(p_{m_i}\eta_i)]$$

Since $r > 0$ and $-\eta > 0$, necessarily $0 < C < 1$. As moral hazard goes to zero (demand elasticities become very small), so does C. In other words, the smaller the price responsiveness of the demand for medical care, the lower the optimal value of C. Similarly, given any value of η , the larger the variance of uninsured risks, the smaller the optimum value of C.⁴

The basic insight of this approach is that the optimal coinsurance rate is the simple ratio of these two expressions involving the risk premium and moral hazard effects. In words, the optimal value of C is found by:

$$(6) \quad C^* = (\text{Moral Hazard Loss}) / (\text{Moral Hazard Loss} + \text{Risk Premium})$$

The same basic idea continues to hold no matter what the degree of the Taylor Series expansion, and no matter what the nature of the family of demand curves for different illnesses looks like (parallel vs. not⁵, curved vs. straight line). Adding terms to the expansions of these welfare losses would simply reflect additional terms that varied with C, but the collection of such terms (and their eventual interpretation) would match that given in Equation 6.

⁴ In the simplest analysis, the second order condition is fulfilled fundamentally by the downward sloping demand curve: the derivative $dm/dC < 0$ makes the second order condition positive, as required for optimization. More complex issues arise if the shape of the risk distribution, and hence the variance of the risks, changes with C, which can occur either through C altering the probabilities of various illnesses or because of the shapes of the family of demand curves for different illnesses. I ignore these issues here.

⁵ Intuition, at least, prohibits certain patterns of demand curves. For example, the demand curve for a less serious illness should not cross that of a more serious illness. This obviously does not preclude the *elasticity* of the various demand curves continuing to fall as illness severity increases. Indeed, if the elasticity of demand at a given coinsurance rate (say, $C = .2$) were the same for all illnesses then demand curves would have to "fan out" by having flatter slopes as illness severity increased.

An alternative formulation will also prove useful assuming a constant value of η :

$$(7) \quad C^* = \frac{-\eta}{(-\eta + \omega \text{COV}^2 r^*)}$$

where $\text{COV} = \text{Coefficient of Variation} = \sigma/\mu$, $r^* = rY = \text{relative risk aversion}$, $\omega = E(pm)/Y$, and $Y = \text{income}$. This expression highlights the crucial aspects of the balancing act involved in selecting C^* . The larger the demand elasticity for the insured service (η), the larger the optimal coinsurance. Similarly, optimal coinsurance falls (for a given η) with more risk aversion, with more variable risks (higher COV), and with a larger share of the budget at risk.

III. Measuring Welfare Losses and C^*

To bring these ideas to life, we can consider how the various components of welfare loss appear for various types of medical illness risks (and their comparable alternative types of medical care). To do this, I bring together data from a variety of sources to estimate the necessary components of the model.

For the crucial risk aversion parameter r (or more directly, $r^* = rY$), we can turn to studies of the behavior of individuals in risky settings, including purchases of insurance and investment portfolios. Numerous estimates in this literature give estimates of r^* from 1 to 4, centering on approximately 2.0 (Garber and Phelps, 1997), implying that, for an income of \$20000, the relevant measure of r is approximately .0001; I will use this value initially, with later sensitivity analysis.⁶

⁶ Zeckhauser (1970) used a utility function for his example that had constant absolute risk aversion with a parameter such that, at the income he used (\$10000), the relative risk aversion measure was 20, an order of magnitude too large according to the studies of risk aversion cited in Garber and Phelps (1997). Two other studies (Marquis and Holmer, 1986, Manning and Marquis, 1989) have investigated the insurance selection decision using responses of participants in the RAND Health Insurance Experiment to *hypothetical* questions about their choices of insurance, obtaining relative risk aversion estimates (at \$20,000 income) of about 8

The RAND Health Insurance Experiment provides key information on all other relevant parameters. Demand elasticities differ for most services depending on the level of coinsurance, but for this study, the relevant range is the "no coverage" to $C = .25$ range. For these, the relevant demand elasticities vary from $-.15$ for hospital care to $-.3$ for outpatient care to $-.4$ for dental and well care (Newhouse and the RAND Experiment Group, 1993). The means and variances and higher moments of distributions of various types of medical spending come from data collected during the Experiment (Peterson, Nelson and Bloomfield, 1986). Table 1 portrays key data for each type of medical care discussed here, and calculates the optimal coinsurance rate C^* for each case.

Figures 1 - 4 show the component parts of the welfare loss (moral hazard, risk bearing, and total) for four exemplary types of care: well care (very low risk, high demand elasticity), dental care (low risk, high demand elasticity), physician care (medium risk, medium demand elasticity), and hospital care (high risk, low demand elasticity). As one might expect, the optimal insurance coverage differs greatly across these types of risks. For hospital care, the optimal coinsurance rate is $.07$, dominated by the risk bearing losses. At the other extreme, for well care, the optimal coinsurance rate is $.96$ -- essentially making insurance irrelevant -- because the moral hazard component dominates. For physician care, C^* is near 0.5 and for dental care, C^* is $.67$.

Figures 2 - 5 here

and 4 respectively, above the range of studies cited in Garber and Phelps. I prefer the estimates from actual behavior (derived from portfolio choices of actual investors) to the studies relying on hypothetical choices that these two larger estimates rely upon, even though I was instrumental in designing the questionnaire that led to the data used in these studies. An earlier study (Friedman, 1974) studied actual health insurance choices of federal employees and found a similarly large risk aversion measure, but as is now well recognized, that study confounded risk aversion and self selection.

The optimal coinsurance rates are sensitive to the degree of risk aversion imputed to individuals. Table 2 shows the optimal rate for the baseline risk aversion parameter ($r = .0001$) and for values half, twice, and five times that high. (Recall that these all derive from the second order Taylor Series, and hence are not "exact.")

Table 2 here -- sensitivity to risk aversion

In the "extreme" cases of well care and hospital care, the optimal coinsurance rate is not very sensitive to the degree of risk aversion, since the decision is dominated either by the moral hazard loss (well care) or the risk loss (hospital) over all chosen values of r . For the "intermediate" cases, the optimal coinsurance rate is fairly sensitive to the chosen value of r . In the range of values encompassing most of the relevant literature (r^* varying from 1 to 5) the comparable range of measures for r is from .00005 to .0002; the value of .0005 ($r^* = 10$ for \$20000 income) can best be thought of as an extreme value for purposes of anchoring the discussion. Even in the range supported by empirical studies, the optimal coinsurance rate for dental care ranges from about three quarters to one half, and for physician care, it ranges from two thirds to one third. These results emphasize the importance of further empirical work to assess more accurately the degree of risk aversion that people actually exhibit.

IV. The Role of Higher Moments in the Taylor Series Expansion

Most distributions of medical expenses are heavily skewed to the right (long right tail), with measures of skewness (3rd central moment divided by σ^3) in the range of 6 to 12 (where 0 indicates a symmetric distribution such as for the normal), and the kurtosis can exceed 100 for some types of medical risk (Peterson, Nelson and Bloomfield, 1986). How do these terms affect the estimate of

the risk premium, and more importantly, our understanding of the optimal coinsurance rate C^* ?

To understand these issues better, return to Equation (2d), showing the Taylor Series expansion for a CARA utility function (from which we can generalize momentarily). The ratio of the third order term to the second order term in the expansion is $-\rho\sigma\text{Skew}/3$. Thus the primary question is the order of magnitude of the product $-\rho\sigma\text{Skew}$. If that product is of order small, then the third order term will be of order small, and if that product is of order 1 or larger, the skewness term can take on considerable importance. Similarly, the ratio of the fourth order to the third order terms is found by $-\rho\sigma(\text{Kurtosis} + 3)/(4\text{Skew})$.⁷ Table 3 shows both the estimated risk premiums and the optimal coinsurance rate C^* when using the second, third, and fourth order terms from the Taylor Series expansion, all relying on the second-order expression for moral hazard loss, and all using the base line value of $r = .0001$.

Table 3 here -- 3rd and 4th order Taylor Series Terms

As these data show, only for hospital inpatient care do the third and fourth order terms matter in any meaningful way, since for all other types of medical care, the third and higher order terms rapidly become vanishingly small. In the case of hospital care, the estimated skewness and kurtosis in the RAND data are sufficiently high that these terms are of the same order of magnitude as the original "Pratt" variance term, but -- having alternating signs -- contribute little at the fourth order to the estimated welfare loss from risk. Obviously, for data like these, the Taylor expansion can be unstable even to the fourth term, but the optimal coinsurance rate is little different at the second and fourth order approximations of risk.

⁷ The reader is cautioned that empirical estimates of kurtosis are highly unstable, and quite sensitive to single observations even when the sample size numbers in the many thousands.

What about non-CARA functions? Equation 2b tells us that if risk aversion is not constant, the weights on various higher order terms change. The effects will depend on the specific utility function chosen for illustration, and no generalization can be made here. Of course, none of this matters if the risk distribution is normal, but all evidence shows that risks of medical care spending are more closely approximated by lognormal distributions, with large skewness and kurtosis.

V. Concluding Remarks

The question of decision making under uncertainty has long attracted attention of economists, beginning with Daniel Bernoulli three centuries ago. In the modern world, a particularly interesting problem has arisen through the development of medical insurance that subsidizes the purchase of medical care rather than offering traditional state-dependent income transfers. This insurance creates a welfare loss at the point of consumption of medical care, by inducing consumers to purchase medical care beyond the point where marginal value exceeds marginal cost. This traditional "moral hazard" loss (Arrow 1963, Pauly 1968) has formed the focus of many insightful essays. Prominent among those, Zeckhauser (1970) assessed how the gains from risk spreading and the losses from moral hazard offset. Here, I develop an alternative approach to portraying these losses that provides a highly intuitive and readily understandable way to think about the optimal coinsurance as a balancing of these forces: The optimal coinsurance rate is found by the ratio of (Moral Hazard Loss)/(Moral Hazard Loss + Risk Premium).

In considering insurance for various types of medical problems, calculations using observable demand elasticities, risk aversion measures, and measures of the various central moments of the distribution of risks for various types of medical care all suggest that the optimal coinsurance

rate will differ hugely for different types of medical risks. At one extreme, hospital care (very high risk, low demand elasticity) is characterized by optimal coinsurance near zero. At the other extreme, insurance for such things as well care (low risk, high demand elasticity) should have optimal insurance coverage with C near 1.0. In a world with transactions costs and loading fees for insurance, it should then come as no surprise that voluntary health insurance choices seldom incorporate preventive care as an insured service.

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Table 1
Parameters for Base-Case Calculations
and Optimal Coinsurance (C*)
(Figures 1 - 4)

Type of Care	μ	η	σ^2	C*
Well Care	120	.4	150 ²	.96
Dental	300	.4	300 ²	.65
Physician	500	.3	1250 ²	.49
Hospital	500	.15	3150 ²	.07

Note: $r = .0001$ in all base case calculations

Table 2
Optimal Coinsurance (C*) for Differing Risk Aversion Parameters

Type of Care	Risk Aversion Parameter (r)			
	.00005	.0001	.0002	.0005
Well Care	.97	.96	.90	.87
Dental	.79	.65	.48	.27
Physician	.65	.49	.32	.16
Hospital	.13	.07	.04	.01

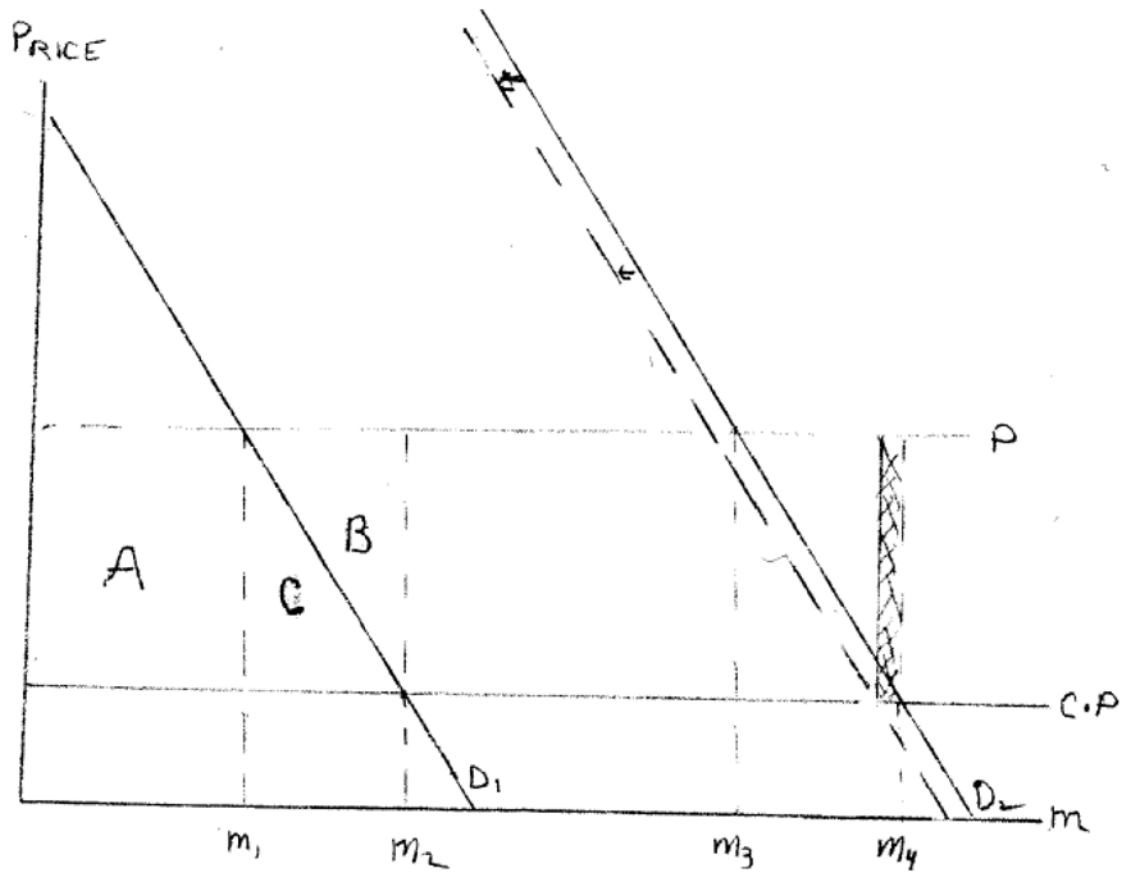


FIGURE 1

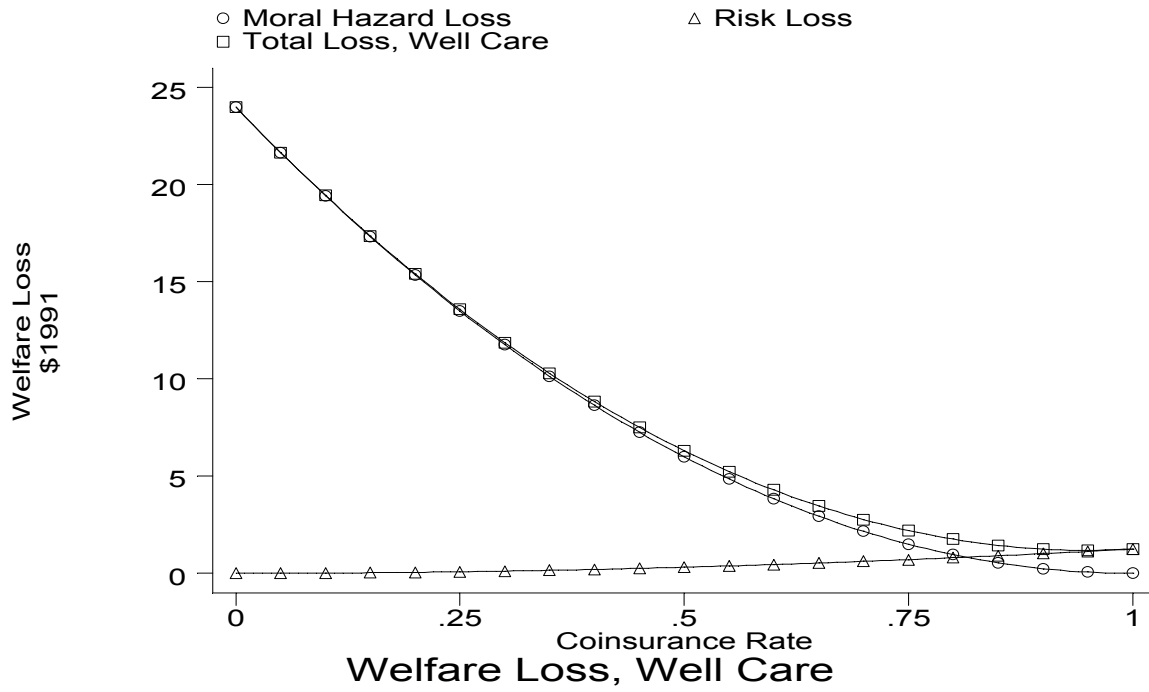


Figure 2

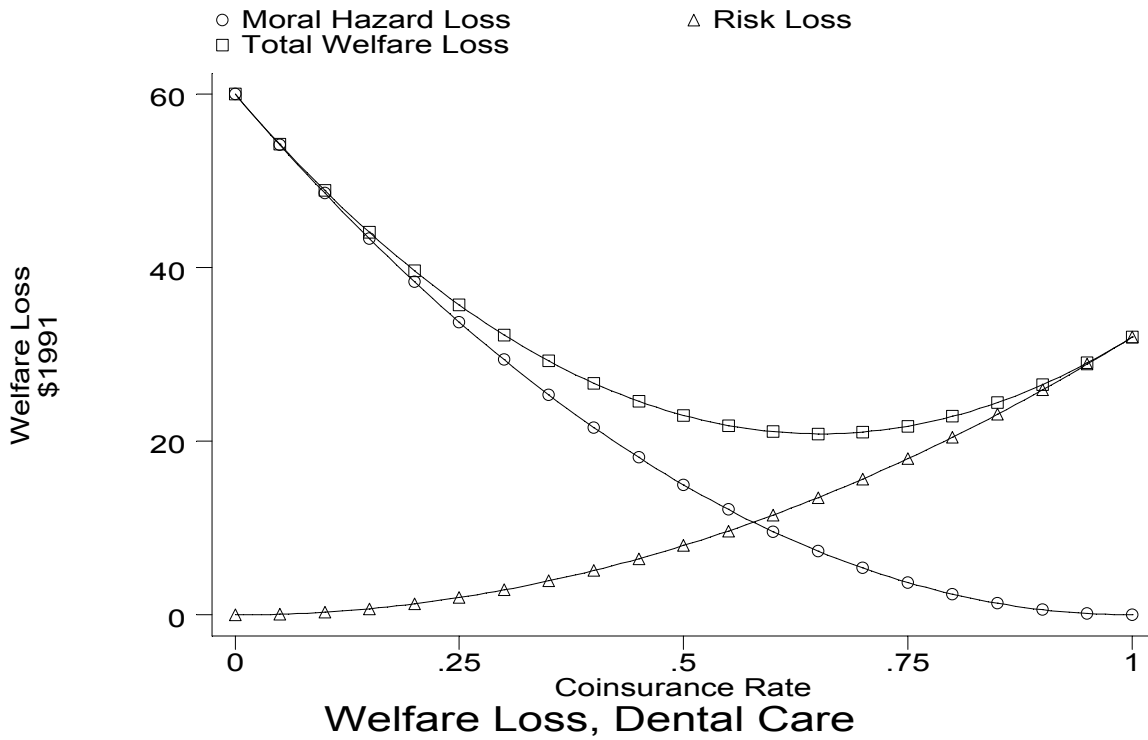


Figure 3

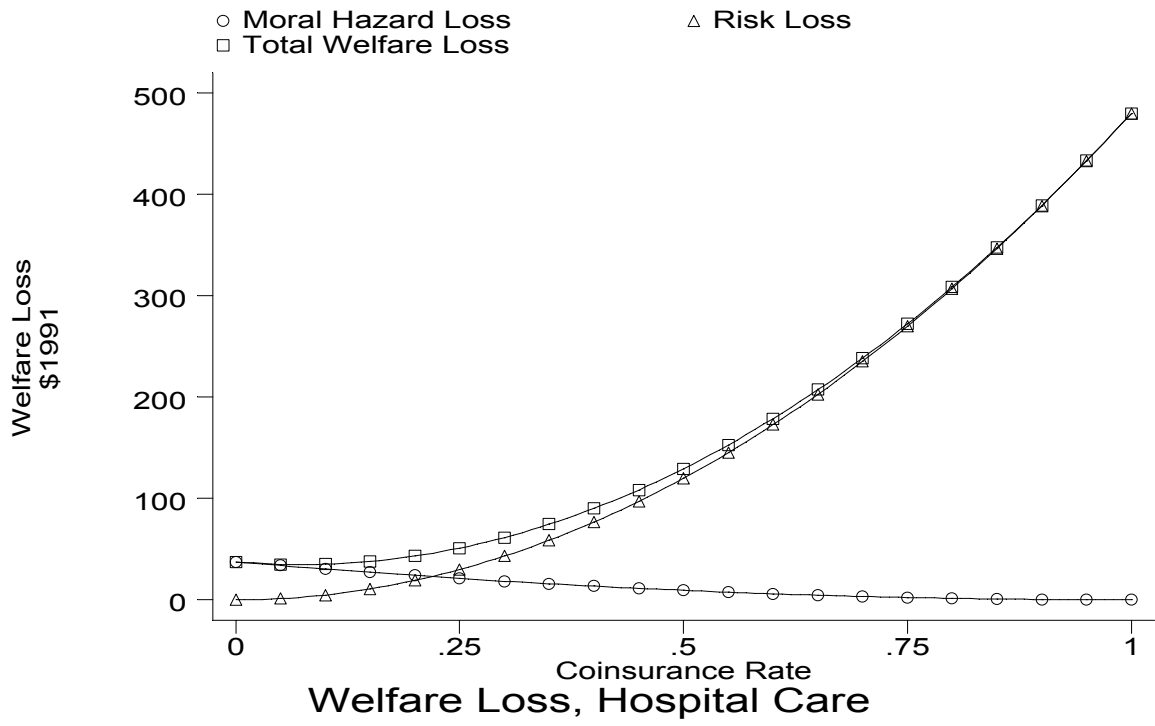


Figure 4

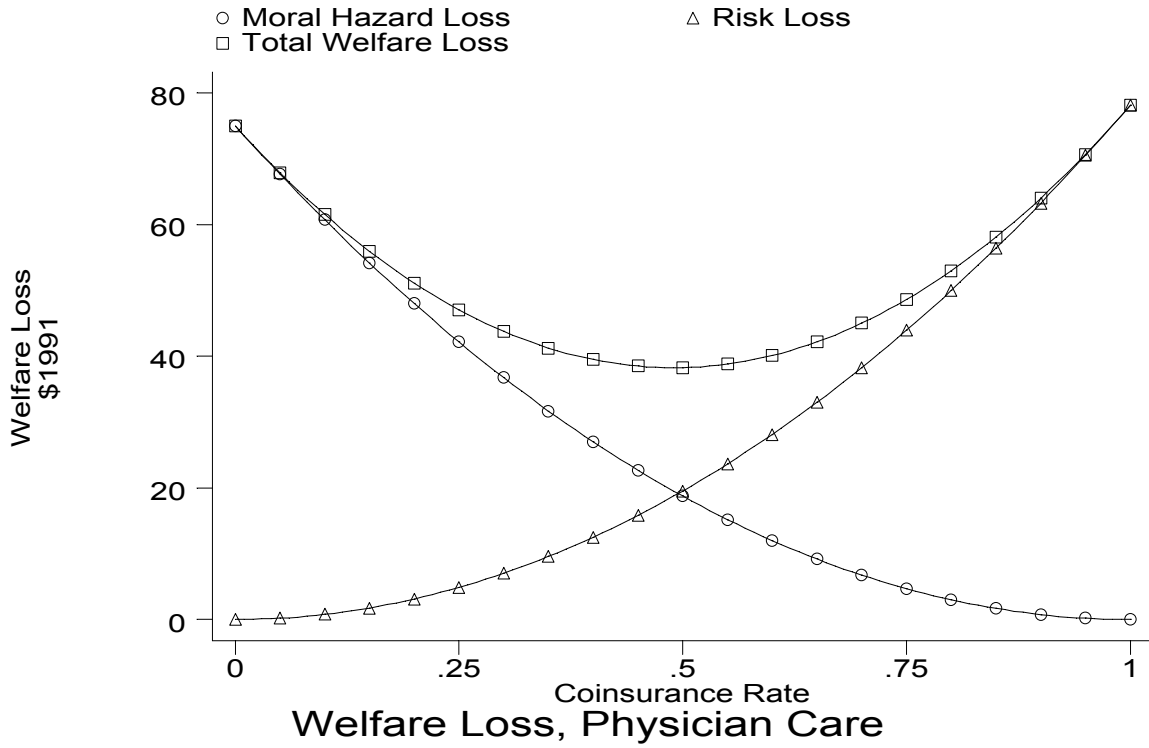


Figure 5

Appendix: McKenzie and Pearce "Money Metric" Welfare Measure

G.W. McKenzie and I.F. Pearce (1982) developed a utility index called the "money metric," which is a Taylor Series expansion of utility centered at base prices, income, and consumption, and measuring the welfare effect of any set of changes in prices and income. In the case of a single price change (the issue considered in this paper), the Money Metric becomes

$$\begin{aligned}
 du = & \quad -mdp + dY && \text{(first order terms)} \\
 & + \frac{1}{2}(\frac{M}{MY} - \frac{M}{M})dp^2 - \frac{M}{MY}dpdY && \text{(second order terms)}
 \end{aligned}$$

The discussion in the main text shows how the first and second order terms can be portrayed in demand space. In this appendix, I study the magnitude of the two expressions in the second order terms, assessing the degree to which omitting the final term (for convenience of expression) distorts the overall measure of welfare. The first set of the second order terms is the "traditional" welfare loss triangle using the uncompensated demand curve. The second term is the additional income-price interaction term of interest here. In the context of the problem in this paper, we must define the change in income appropriately. When the insurance contract is purchased, the consumer exchanges the previous income Y for a new income $Y - R$, and then purchases of other goods and medical care take place during the year. Thus, $dY = -dR$ in this context. Now, dR represents the discrete change in the premium associated with changing the coinsurance. For a contract specified as $R = (1 + \lambda)(1 - C)E(pm)$, the effect of changing coverage $(1 - C)$ on the premium is found by $dR/d(1 - C) = (1 + \lambda)E(pm)(1 - \eta(1 - C)/C) = \Lambda E(pm)$, where Λ incorporates both the loading fee (λ) effects and the demand-altering effects (η). For a modern group health insurance policy (e.g., $\lambda = .15$, $C = .25$, and $\eta = -.2$) Λ will vary in the range of 1.5 to 2.5 for relevant combinations of C , λ and η . Thus, for discussion purposes, we can state that $dY/d(1 - C) = -2E(pm)$ where $E(pm)$ is the expected value of uninsured medical care. Shifting from no insurance to coverage of C means that $d(1 - C) = (1 - C)$, for example, so $dY = .8 \times .2 \times E(pm) = 1.6 E(pm)$. As an alternative way of reaching the same estimate,

note that in simulations of spending in the RAND Experiment, people with $C = .25$ health insurance spend about 33 percent more than those without health insurance (Keeler et al, 1988, from data in Table 5.7), which, when "loaded" by the ratio 1.15 gives the ratio 1.53, close to the 1.6 multiplication factor as the above formula gives. (Differences arise because the demand elasticity falls as one moves up the demand curve.)

We can now turn to the various terms in the McKenzie and Pearce expression for the equivalent variation change in well being in the medical care market. The first order terms are $-mdp + dI = -mdp - dR$ in our context. (This adds the welfare gain of the change in price times the original consumption, since m is always evaluated at full price.) These terms offset, except for the loading fee on the insurance policy: the lower price (on average) from the first term is offset by the change in income due to the lower coinsurance. What McKenzie and Pearce give, the Insurance Company taketh away. Ignoring the final term involving $dYdp$, the second order McKenzie and Pearce terms give the traditional welfare loss triangle $\frac{1}{2}\Delta dp\Delta m = -\frac{1}{2}(\%dp)^2\eta pm$. The final term involving the product $dYdp$ can be shown to equal $(\%dp)^2 pm\Lambda\omega E$, where ω is the budget share of average spending and E is the partial income elasticity.

We can now assess the relative importance of the second order terms, to see how much violence is done to the full expression when using (for expositional convenience) the traditional welfare triangle. This all hinges on the relative magnitude of $-\frac{1}{2}\eta$ vs. $\Lambda\omega E$. The RAND Health Insurance Experiment places η near $-.2$, and E near $.2$ to $.4$, depending on C (Newhouse et al, 1993). I will use a value of $E = .3$ for discussion here. As discussed above, Λ is approximately 2 for relevant levels of coinsurance. For budget shares of total medical care (0.05 for persons under 65) the final term is about one-fifth the value of the welfare triangle. Of more relevance in the discussion in the text is the selection of C for various component parts of medical care, e.g., hospital care, dental care, prescription drugs, etc. There, except for hospital care, the relevant budget share is on the order of

0.01, making the final McKenzie-Pearce term on the order of 0.005, compared with the welfare triangle term of magnitude 0.1. Thus, can ignore the final terms in the text.