Can Employers Solve the Adverse Selection Problem for Insurers?

James Marton[*]

Georgia State University

Andrew Young School of Policy Studies

Department of Economics

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Abstract

Establishing the existence of equilibrium in insurance markets has always been a challenging task for economists due to imperfect information. As illustrated by Rothschild and Stiglitz (1976), imperfect information may lead to complete market failure. This paper extends the standard model of adverse selection by introducing employers that choose the set of policies that are offered to consumers. Introducing employers allows for the existence of multiple pooling and a unique separating equilibrium. The key to these results is that the financial incentives of the employers in the model differ from the financial incentives of the insurance companies. Data on age and insurance premiums from the 1987 National Medical Expenditure Survey provides evidence of pooling in the employer-provided health insurance market.

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1 Introduction

Establishing the existence of equilibrium in insurance markets has always been a challenging task for health economists. What makes an insurance market different from a standard purely competitive market is the information asymmetry that exists between insurance providers and those seeking insurance. Consumers typically have better information about their health type than insurance providers. This lack of information can lead to incorrect pricing and market failure.

The seminal paper on the existence of equilibrium in the market for health insurance is Rothschild and Stiglitz (1976). The primary results of the RS model are that a pooling equilibrium, in which each health type purchases the same policy, does not exist and that a separating equilibrium, in which each health type purchases a distinct policy, may not exist either if the proportion of low risk consumers in the economy is too large. What is the intuition behind the first result? Consider a pooling equilibrium with two health types. Here each type is purchasing the same policy and the high risks are being subsidized by the low risks. The insurance provider is breaking even from the sale of this policy to both types. In this situation, another insurance provider always has a financial incentive to offer a new low coverage policy targeted towards the low risk consumers. This new policy would only be purchased by the low risk consumers and would guarantee strictly positive profits. Thus, another insurance provider would offer this new policy and break up the pool.[1]

Given this adverse selection problem, how do insurance providers form risk-based pools? Governments can often use mandatory enrollment as a means of pooling health types. Countries such as Japan, Canada, and Germany use mandatory enrollment as a feature of their social insurance programs. In Germany and Japan risks are pooled in local "sickness funds" that often have ties to specific industries. In Canada risks are pooled at the province level. The United States uses mandatory enrollment in federal programs such as Medicare to pool risk. Although not a mandatory program, the poor in the U.S. have the option of enrolling in the state administered, federally co-funded Medicaid

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[1]A literature has developed attempting to alter the Rothschild and Stiglitz (1976) setup in an attempt to establish the existence of a pooling equilibrium. Wilson (1977) alters the RS equilibrium concept by allowing unprofitable plans to be withdrawn. This change allows for the existence of a pooling equilibrium. Dasgupta and Maskin (1986a, b) alter the RS equilibrium concept by allowing for mixed strategies. Using mixed strategies, they show that an equilibrium always exists. Encinosa and Sappington (1997) extend the RS model by considering fixed entry costs for new insurance firms. The introduction of fixed costs allows for the existence of a pooling equilibrium. Crocker and Moran (2003) show that pooling is a possibility when there is "job lock" - transaction costs involved in switching jobs (and thus insurance policies). Chernew and Frick (1999) extend the RS model by allowing insurance policies to assume HMO characteristics, such as degree of choice among providers. Jack (2002) extends the RS model by allowing ex post moral hazard. Here insurance providers do not observe the state of the world that occurs ex post. Neither the addition of HMO characteristics or ex post moral hazard solve the market failure problem.

program.

The vast majority of U.S. citizens are not covered by Medicare (because they are too young) or Medicaid (because they are too wealthy). Thus some other mechanism must be used in the U.S. to pool health types. It would appear as though, in the U.S., employers assume the role of the German or Japanese "sickness funds" and pool health types through the offering of employer-provided health insurance. Although employer-provided coverage is not mandatory, employees prefer employer-provided coverage because, in the U.S., employer-provided health insurance premiums are excluded from employee taxable income.

While the tax subsidy is not as explicit a form of government intervention in the health insurance market as the Medicare program, it has garnered a great deal of recent attention due to President Bush's proposal to cap this tax subsidy for employment-based health coverage and to extend similar tax benefits to those that purchase private health insurance. The President proposes eliminating the current tax subsidy and replacing it with a new $15,000 standard deduction ($7,500 for single taxpayers) in the federal income tax (as well as an exemption from payroll taxes) for all who obtain a qualifying health insurance policy through their employer or in the private market. One motivation behind the proposal is to attempt to "level the playing field" for consumers purchasing private health insurance relative to those that purchase insurance through their employer. An evaluation of the impact of such a reform would require an understanding of the role employers play in alleviating adverse selection in the employer-provided health insurance market and comparing that with outcomes in the private health insurance market.[2]

The primary purpose of this paper is to theoretically examine the role that U.S. employers play in facilitating risk based insurance pools. In order to analyze the role of the employer, I present a model that explicitly introduces employers into the RS framework. Employers attract workers by offering a menu of insurance policies that they select from an insurance company. It is assumed that both high risk and low risk workers have the same marginal product and that each worker will pay for the entire cost of their health insurance plan themselves. Despite a lack of cost sharing, workers will still prefer to purchase insurance through their employer in order to take advantage of the tax subsidy described earlier.

It is shown that if employers choose total compensation independently of insurance menus, then it is possible for multiple pooling equilibria to exist (along with a unique separating equilibrium). However, if this is not true, then the standard RS results hold. Under this independence assumption each employer has no preference between different insurance menus, because (as mentioned above) it does not have to pay any of the premiums and both health types are

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[2]For a more complete description of the President's proposal, see Burman et al. (2007).

equally productive and are paid their common marginal product.[3]

How does this compare to RS? Consider a pooling equilibrium with two health types. Here each employer is offering its workers the same policy. Some insurance company still has an incentive to offer the low coverage policy targeted toward the low risk workers and break the pool. The difference here is that, under the independence assumption, employers do not have anything to gain by altering the set of policies being offered. Therefore, if the insurance company is the agent picking the menu then it would deviate from the pool, but since the employers are the ones picking the menu there is no deviation and the pooling equilibrium holds. The key to this result is the difference between the financial incentives of the insurance company and the employer. This difference in financial incentives also ensures the existence of a separating equilibrium.

Therefore, the standard RS model and the theoretical model presented in this paper provide different testable implications regarding the nature of insurance market equilibria. The RS model seems better suited to explain private insurance markets, so we would expect to see evidence of a separating equilibrium in the private market. The model presented in this paper is better suited to explain employer-provided insurance markets, so we would expect to see either pooling or separating equilibria in the employer-provided market.

A secondary goal of this paper is to provide some basic empirical analysis of these testable implications using data from the 1987 National Medical Expenditure Survey. Data on self-reported health status, demographics, plan and employer characteristics are collected for single policyholders in both private and employer-provided insurance markets. Although strong evidence is not found using health status, the differential impact of age on insurance premiums in the two insurance markets suggests separation of health types in the private market and pooling of health types in the employer-provided insurance market. The relationship between these results and other studies of adverse selection, such as Cardon and Hendel (2001) and Cutler and Reber (1998), is discussed in detail.

The remainder of this paper is organized as follows: Section 2 presents the model and the existence results under the assumption that total compensation

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[3] There is some evidence that suggests there may be some independence between employer choices of total compensation levels and insurance menus. For example, consider a potential employee bargaining over the terms of employment with some employer. The potential employee may bargain with their superior for a certain level of total compensation. They can use some portion of this compensation to purchase an insurance plan from the menu offered by the employer. This menu was determined by the employer's human resources department through a bargaining process with several competing insurance companies. In general, there is probably much more room to bargain over total compensation relative to insurance options. Insurance menus are often set in advance and typically only change once a year. This suggests that fringe benefits such as health insurance may be more rigid than total compensation levels, especially at any point during a plan year. Any such rigidity will provide some independence between total compensation levels and insurance menus.

and insurance menus are selected independently. Section 3 examines what happens when this assumption is weakened. Testable implications of the theory are taken to the data in Section 4. Finally, Section 5 concludes the paper with a discussion of the policy implications of these results (both generally and as they relate to President Bush's proposed tax reform), some directions for future empirical research, and some possible extensions of the theoretical model. An appendix with outlines for proofs of theorems 1 and 2 follow Section 5.

2 The Health Insurance Model (with the Independence Assumption)

1. Overview of the Game

This model is best seen as a game with three stages. These stages are described briefly as follows:

Stage One: Risk neutral insurers each offer a menu of policies to employers. Employers choose one of these menus to offer potential risk averse workers.

Stage Two: Employers offer workers a total compensation level equal to their marginal product and a menu of insurance policies to choose from. Potential workers decide which employer to work for based upon the menu of policies offered.

Stage Three: Workers allocate some of their total compensation from working towards the purchase one policy from their employer's menu to consume.

Suppose that there are two identical insurance firms. These insurance firms move first by offering menus of policies to two identical employers. Assume that the insurance market is perfectly competitive. Each insurance firm will offer a menu of policies that maximizes its expected profits.

The two employers produce numeraire with constant returns to scale technology. Each chooses a profit maximizing menu from one of the insurance firms to offer its potential workers. Competition for workers takes place in a perfectly competitive labor market. Workers are compensated according to their marginal product and use this money to purchase an insurance policy from the menu offered by their employer.

Their are two types of workers (low risk and high risk), each of whom inelastically supplies one unit of labor to one of the two potential employers. Assume

that both health types have the same marginal product of labor.[4]

2. Some Features of the Players

A. Workers and Insurance Policies

States of the World and Health Types

Suppose that there are two states of the world. In state one no medical care is required and in state two $L \in R_{++}$ dollars must be spent on medical care. Employees are classified as one of two health types, either type 1 (relatively healthy, low risk) or type 2 (relatively sick, high risk). A health type is defined by the probability of state two occurring. Denote by $\pi_i \in (0,1) \subset R_{++}$ the probability of state two occurring for type i ($i = 1, 2$). Assume $0 < \pi_1 < \pi_2 < 1$. This says that low risks face lower expected medical expenses than high risks. Assume that there are a total of $n \in I_{++}$ workers and that there are an equal number of high risks and low risks in the economy.

Insurance Policies

An insurance policy consists of a benefit payment (denoted by B) and a premium (denoted by $P \in R_+$). The benefit payment is the amount of money the insurance company would pay in medical expenses if state two occurred. It should be clear that $B \in [0, L] \subset R_+$.

Worker Productivity and Total Compensation

Both health types have an identical marginal product, denoted by $MP \in R_{++}$, in terms of their production of numeraire. Because workers are compensated according to their marginal product in Stage Two, both types enter Stage Three with the same endowment of initial income or wealth, denoted by $TC = MP \in R_{++}$. Workers use TC to buy an insurance policy in Stage Three. Assume $0 < L < TC$.

Residual Income

Type i's residual income in each state with insurance policy (P, B) is defined in Table 1. Workers take P dollars of their total compensation in insurance and $(TC$ - $P)$ dollars of their total compensation in salary / wages. Notice that type i will be fully insured whenever $B = L$. When this is true, in either state of the world type i will have residual income equal to TC - P.

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[4]If each worker has the same marginal product of labor, then the total compensation paid to each worker is identical. Some workers may take a higher share of their total compensation in insurance than others, giving the appearance of different wages.

Table 1: State Dependent Residual Income

State	Residual Income
1	$I_{i1} = TC - P$
2	$I_{i2} = TC - P - L + B$

The Allowable Set of Insurance Policies

The set of policies considered in this model will be restricted to those that generate non-negative levels of residual income. Define the allowable set of policies as follows:

$$AP = (\ (P, B) \in R_+ \times [0, L] \mid TC - P \geq 0 \text{ and } TC - P - L + B \geq 0\ ).$$

Figure 1 illustrates AP. It should be clear that AP is a compact set. Let M^t denote the subset of AP offered by insurance firm t ($t = 1, 2$). Assume that M^t is compact and includes 0. Numeraire firm q chooses either menu M^1 or M^2 in order to attract workers. Denote by $M_q \in \{M^1, M^2\}$ the menu selected by firm q. In Stage Three, the employees of numeraire firm q can choose between the premium, benefit payment pairs contained in M_q.

Preferences

Each employee is assumed to be risk averse and to possess the Von Neumann-Morgenstern sub-utility function $U: R_+ \rightarrow R$ defined over income. Assume that this sub-utility function is twice continuously differentiable and strictly concave. Now define type i 's expected utility function with policy j as follows:

$$EU(\pi_i, P_j, B_j) = (1 - \pi_i) \times U(TC - P_j) + \pi_i \times U(TC - P_j - L + B_j).$$

B. Insurance Firms

Assume that there exist two risk neutral insurance firms that operate in a perfectly competitive insurance market.

Expected Profits

Suppose that insurance firm t sells policy (P_j, B_j) to type i workers. Denote by $n_{ijt} \in R_+$ the number of type i workers purchasing policy j from firm t. The expected profits from this sale are:

$$E(Profits)_{ijt} = n_{ijt} \times (P_j - \pi_i \times B_j).$$

Aggregating over both health types gives the expected profits for firm t from selling policy j:

$$E(Profits)._{jt} = n_{1jt} \times (P_j - \pi_1 \times B_j) + n_{2jt} \times (P_j - \pi_2 \times B_j).$$

Aggregating over all plans offered by firm t (all $(P_j, B_j) \in M^t$) gives insurance firm t's total expected profits from offering menu M^t. Each insurance firm t offers a profit-maximizing menu, given the menu offered by its rival. Because this is a perfectly competitive insurance market, each insurance firm t will break even from its sale of insurance in equilibrium. For this reason, the plans that break even when sold to each health type are of interest.

Break Even Sets of Policies

The set of policies that break even when sold to a type 1 worker can be described by the following equation:

$$P = \pi_1 \times B.$$

This set of polices is represented by the line labeled 1 in figure 2. Any policy above this line would generate strictly positive profits when sold to a type 1 worker. Any policy below this line would generate strictly negative profits when sold to a type 1 worker. Also represented in figure 2 is the set of policies that break even when sold to a type 2 worker.

C. Employers

The two numeraire firms simultaneously pick a menu of insurance policies from one of the insurance firms in Stage One. In Stage Two, each firm q competes for workers in a perfectly competitive labor market by offering each worker a total compensation level TC based on their marginal product and the choice of one policy from some menu M_q that the worker must pay for out of their total compensation. Workers choose which firm q to work for based upon these offers.

Each firm q has the same constant returns to scale production function $F \colon R_+ \to R_+$ with labor as the only input and no fixed costs of production. Numeraire firm q hires n_q workers. The composition of this group of workers depends upon the portfolio of insurance options offered. This portfolio depends on the portfolio offered by the other firm.

Labor Demand

Define the total labor input used by numeraire firm q, TL_q, as:

$$TL_q(n_q) = MP \times n_q.$$

Firm q produces $F(\, TL_q(n_q)\,)$ units of numeraire. The total cost of production for firm q, $COST_q$, is:

$$COST_q(n_q) = TC \times n_q = MP \times n_q.$$

In order to simplify things, assume that the production function for each firm can be described as:

$$F(\ TL_q(n_q)\ ) = TL_q(n_q).^5$$

Numeraire firm q chooses a menu M_q, given the menu offered by the other firm, that produces a profit maximizing number of workers, n_q. There are two points to be made here. First, each numeraire firm is unconcerned about the costs associated with the provision of health insurance for its employees, because each employee pays for all of the costs associated with their coverage themselves. Despite this fact, employees still prefer to acquire health insurance through their employer because of the tax subsidy on employment-based health insurance premiums.[6] Second, each numeraire firm is not concerned about which types of workers are attracted to the policies it offers. This is because both health types have the same marginal product and each worker is paid their marginal product.

The discussion above implies that each numeraire firm will make zero profits in equilibrium no matter which insurance portfolio it offers and no matter what its level of production of numeraire.

3. Examining the Game - Backwards Induction

Now that the game and each player has been described, the optimal behavior for each player is examined using backwards induction.

A. Stage Three

In Stage Three each firm q has some number of workers $n_q \in I_+$. Each of these workers is going to use their endowment of total compensation, TC, from supplying labor in Stage Two to purchase a policy from their employer's menu M_q that maximizes their expected utility.

Define $(P_i^*(M_q),\ B_i^*(M_q))$ as a premium and benefit payment that solve the following optimization problem for type i:

$$\max EU(\pi_i,\ P_j,\ B_j) \text{ such that } (P_j,\ B_j) \in M_q.$$

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[5]The intuition here is that firm q uses only labor to produce numeraire with no fixed costs and a constant returns to scale technology. If firm q hires a worker and each worker's marginal product is five, then this worker will produce five units of numeraire. Firm q can sell these five units for five dollars, which it must pay to the worker for their labor.

[6]There is a large literature that attempts to estimate the tax price elasticity of demand for employer-provided health insurance. For early work in this literature, see Long and Scott (1982), Woodbury (1983), and Taylor and Wilensky (1983). For more recent work, see Royalty (2000).

B. Stage Two

In Stage Two each firm q is offering workers a total compensation level equal to their marginal product and some menu of insurance policies M_q. Workers must choose which employer to sell their endowment of labor to. They do so by evaluating the utility they would receive in Stage Three with the M_q offered by each employer.

Given the definition of $(P_i^*(M_q), B_i^*(M_q))$ above, one can define the indirect utility function of type i as follows:

$$IU_i(M_q) = EU(\pi_i, P_i^*(M_q), B_i^*(M_q)).$$

In Stage Two, worker i chooses to work for the firm q that offers the menu M_q that maximizes their indirect utility.

C. Stage One

Stage One begins with each insurance firm t simultaneously offering a menu of policies $M^t \subset AP$. An insurance company's optimization problem is to choose a menu of policies such that its expected profits are maximized when the menu is offered to both types. Because there are only two health types, the maximum number of non-zero plans each firm will offer in its menu, in equilibrium, is two. Due to the assumption of a purely competitive insurance market, the maximum profits that can be achieved by each insurance firm, in equilibrium, is zero.

Each numeraire firm q chooses one menu $M_q \in \{M^1, M^2\}$ to offer potential workers in Stage Two. Firm q will choose the menu, given the menu selected by its rival, that produces a profit-maximizing group of workers. As mentioned, the maximum profits that can be achieved by each numeraire firm, in equilibrium, is zero.

4. Nash Equilibrium

Definition: A pure strategy Nash equilibrium for this game consists of a set of menus $\{M_1, M_2\}$ and a partition of the set of workers $\{n_1, n_2\}$ such that:

- for each worker i and each firm q, if worker i is hired by firm q, then firm q offers an $M_q \in \{M^1, M^2\}$ that maximizes worker i 's indirect utility in Stage Two:

$$IU_i(M_q) = EU(\pi_i, P_i^*(M_q), B_i^*(M_q)).$$

- each numeraire firm q offers a set of policies $M_q \in \{M^1, M^2\}$ and hires a number of workers n_q that maximizes its profits in Stage Two:

$$Profits(n_q) = F(\ TL_q(n_q)\ ) - TL_q(n_q).$$

- each insurance company t breaks even from its sale of insurance menu M^t.

As mentioned previously, the maximized level of profits that each numeraire firm q can hope to achieve in equilibrium is zero. In principle, there are two types of possible pure strategy Nash equilibria for this game. The first is a pooling equilibrium, where each type purchases the same policy. The second is a separating equilibrium, where each type purchases a distinct policy.

A. Pooling Equilibria

Define the average health type, π^*, as follows:

$$\pi^* = (\pi_1 + \pi_2) \, / \, 2.$$

Define the set of policies that make zero expected profits when sold to the average health type as follows:

$$A = \{ \, (P_j, \, B_j) \in AP \mid P_j = \pi^* \times B_j \, \}.$$

Theorem 1 *There exist multiple pooling equilibria under the independence assumption as long as insurance firms cover representative samples of workers. Any policy in the set A described above constitutes a pooling equilibrium if it is the only policy offered in the model besides no coverage.*

Proof. See Appendix.

For each policy $a = (P_a, \, B_a) \in A$ there are multiple pooling equilibria involving different insurance firms producing policy a, different numeraire firms offering policy a, and different distributions of workers to the numeraire firms in representative samples. For example, consider the menu $M_a = \{ \, (0, 0), (P_a, B_a) \, \}$. A pooling equilibrium exists where both insurance firms produce M_a. A pooling equilibrium also exists where one firm produces M_a and the other produces nothing. This is also true with respect to numeraire firms. A pooling equilibrium exists where both numeraire firms offer M_a. One also exists where one firm offers M_a and the other offers no coverage. Finally, there can be different distributions of workers to employers within a pooling equilibrium involving plan a. For example, suppose that both numeraire firms offer menu M_a. As long as workers are allocated to firms in representative samples it does not matter how many workers end up at each firm. With an equal number of high types and low types, this means that workers must be allocated to firms in a one to one ratio. Therefore, a pooling equilibrium exists where 1 pair of high and low types work for firm 1 and the rest work for firm 2. Another exists where all workers work for one of the two firms.

Discussion of one Pooling Equilibrium

Consider policy $A_3 = (P_3 = \pi^* \times L, B_3 = L) \in A$ as illustrated in figure 3.[7] This policy constitutes a pooling equilibrium. Suppose that both insurance firms offer the same menu $M_3 = \{ (0, 0), (P_3, B_3) \}$. Given that there are no other choices, assume that each numeraire firm will choose menu M_3 in order to attract employees. It does not matter if both numeraire firms acquire M_3 from the same insurance firm or if each numeraire firm acquires M_3 from a distinct insurance firm. Suppose that numeraire firm 1 acquires M_3 from insurance firm 1 and numeraire firm 2 acquires M_3 from insurance firm 2.

Suppose that workers allocate themselves so that there is a one to one ratio of high types to low types at each firm. For example, assume that each employer hires half of the high risks and half of the low risks in the population. Each worker will choose policy A_3 from menu M_3, because this will give them higher expected utility than no coverage. Therefore, workers are maximizing their expected utility given the choices available to them. Under these conditions, each insurance firm will break even from its sale of insurance and the numeraire firms will break even as well. Thus all of the equilibrium conditions are satisfied.

As is discussed in Encinosa and Sappington (1997) policy A_3 is the "socially preferred" policy in the sense that it would be the one selected by a social planner who had complete information about health types and who valued each type's utility equally. Both types fully insure and the high risks are not penalized with higher premiums due to their health status. Therefore, one of the results of the model presented in this paper is that, under the independence assumption, the "socially preferred" outcome is an equilibrium, despite the information asymmetry with respect to health types.

Why is A_3 sustainable as a pooling equilibrium in this model, but not in RS model?

In the RS model, insurance policies are sold directly to consumers. Suppose that two insurance firms are offering menu M_3 directly to consumers and that each insurance firm has a one to one ratio of high types to low types as customers. As above each consumer is maximizing their expected utility by choosing policy A_3, given that their alternative is no coverage. Each insurance firm is breaking even from its sale of insurance. Why is this not sustainable as an equilibrium in the RS model?

Consider policy $X = (P_X, B_X)$ in figure 3. This policy generates strictly positive profits if purchased only by low risks. If given a choice between policy

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[7]Because the benefit payment is on the X axis and the premium is on the Y axis, the direction of increasing utility for consumers is down (lower premiums) and to the right (higher coverage). Notice that consumer preferences satisfy the single crossing condition. The line labeled A represents the set A defined above.

X and policy A_3, low risks prefer policy X and high risks prefer policy A_3. This implies that any firm introducing policy X to the insurance market attracts only low risks and is guaranteed strictly positive profits. Therefore some new insurance firm has an incentive to step in and offer policy X. The firm selling policy X captures all of the low risk consumers and destroys the pooling equilibrium at policy A_3. Therefore it is the financial incentives of the insurance firm that destroys the pooling equilibrium in the RS model.

Why won't this happen in the model described in this section? Consider the pooling equilibrium described above at A_3. In this section (as in RS) each insurance firm still has a financial incentive to deviate from menu M_3 and offer policy X. However, this deviation will not increase the profits of either numeraire firm. Because each health type has the same marginal product (and each gets paid that marginal product regardless of the menu offered), an employer is not concerned about whether or not the menu it offers attracts a certain type of worker. An employer is also unconcerned about the costs associated with the menu it offers, because the workers pay all of the costs associated with their insurance coverage themselves. Each numeraire firm will make zero profits if it offers menu M_3 or if it offers policy X to its workers. Thus employers have no incentive to deviate from offering menu M_3. This implies that neither numeraire firm will change its menu choice from M_3 to X when X becomes available and the pooling equilibrium holds.

The key to this result is that the financial incentives of the insurance firms differ from the financial incentives of the numeraire firms. Therefore, collusion between the two types of firms is prohibited.[8] In Section 3, the assumptions that imply that numeraire firms are indifferent between different health plans (including the independence assumption) are weakened and the existence question is again addressed.

B. The Separating Equilibrium

First the (unique) set of policies that are offered in the separating equilibrium is derived. The set of policies is derived by first assigning type 2 workers their most preferred policy, among those which earn non-negative profits for type 2 workers. Type 1 workers are next assigned their most preferred policy from among those that earn non-negative profits for type 1 workers AND which are not preferred by type 2 workers.

Define the set of policies that make non-negative expected profits when sold to health type 2 as:

$$S_2 = \{\ (P_j,\ B_j) \in AP \mid P_j \text{ - } \pi_2 \times B_j \geq 0\ \}.$$

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[8]This suggests that a numeraire firm "self-insuring" its own employees may create problems in this framework. It depends on whether or not the numeraire firm is interested in making money off of the policies sold to its workers.

S_2 is a compact set. Define policy $(P_2^*, B_2^*) \in S_2$ as the policy in S_2 that maximizes type 2 's expected utility. As in Wilson (1977), $(P_2^*, B_2^*) = (\pi_2 \times L, L)$.

Define the set of policies that make non-negative expected profits when sold to type 1 workers AND which are not preferred by type 2 workers as:

$$S_1 = \{ (P_j, B_j) \in AP \mid P_j - \pi_1 \times B_j \geq 0 \text{ and } EU(\pi_2, P_j, B_j) \leq EU(\pi_2, P_2^*, B_2^*) \}.$$

Define policy $(P_1^*, B_1^*) \in S_1$ as the policy in S_1 that maximizes type 1 's expected utility. In other words, $EU(\pi_1, P_1^*, B_1^*) \geq EU(\pi_1, P_j, B_j)$ for every $(P_j, B_j) \in S_1$.

Denote the set of policies described above (including zero) as follows:

$$S = \{ (0, 0), (P_1^*, B_1^*), (P_2^*, B_2^*) \}.$$

The following Lemma is a re-statement of Lemma 9 of Wilson (1977).

Lemma 1 *The following properties hold with respect to the set of policies S described above:*

- $(P_2^*, B_2^*) > (P_1^*, B_1^*) > 0$.

- $P_1^* - \pi_1 \times B_1^* = 0$.

- $EU(\pi_2, P_2^*, B_2^*) = EU(\pi_2, P_1^*, B_1^*)$.

- (P_1^*, B_1^*) *is unique.*

The first condition says that the optimal policy for type 2 in S_2 has a higher benefit payment and premium than the optimal policy for type 1 in S_1. The second condition says that an insurance firm will make zero profits from selling type 1 their optimal policy in S_1. The third condition says that the utility that type 2 receives from their optimal policy in S_2 is equal to the utility they would receive from type 1's optimal policy in S_1. Finally, the last condition says that type 1's optimal policy in S_1 is unique.

Theorem 2 *There exists a unique separating equilibrium under the independence assumption. The set S of insurance policies described above constitute this unique separating equilibrium. This equilibrium is unique up to which insurance firms and which numeraire firms offer the plans in S.*

Proof. See Appendix.

As mentioned in the theorem, there are different distributions of policy offerings across insurance firms / numeraire firms and different distributions of

workers to employers that satisfy the requirements of a separating equilibrium. The key is that the union of the different policies offered to workers must equal S. A separating equilibrium exists where one or both insurance firms and numeraire firms agree on menu S. If both numeraire firms offer S, then any distribution of workers to numeraire firms will satisfy the requirements of a separating equilibrium. If only one firm offers S, it will attract all of the workers. A separating equilibrium also exists where insurance firm 1 and numeraire firm 1 agree on menu $M^1 = \{ (0, 0), (P_1^*, B_1^*) \}$ and insurance firm 2 and numeraire firm 2 agree on menu $M^2 = \{ (0, 0), (P_2^*, B_2^*) \}$. Here $M^1 \cup M^2 = S$. In this case, numeraire firm 1 will attract all of the type 1 workers and numeraire firm 2 will attract all of the type 2 workers.

Discussion of the Separating Equilibrium

Suppose that insurance firm 1 offers menu M^1 described above and insurance firm 2 offers menu M^2 described above. In addition, assume that numeraire firm 1 chooses menu M^1 and numeraire firm 2 chooses menu M^2. Suppose that all of the type 1 workers go to work for numeraire firm 1 and choose policy (P_1^*, B_1^*) and that all of the type 2 workers go to work for numeraire firm 2 and choose policy (P_2^*, B_2^*). In this situation, each insurance firm will break even from the sale of insurance. Each numeraire firm will break even from offering these menus. Workers have no incentive to deviate to the other numeraire firm / insurance policy because they cannot increase their utility by doing so. Therefore, the conditions for a separating equilibrium are satisfied. See figure 4 for an illustration of this equilibrium. Notice that there is no policy that would be strictly prefered by both types and that would make strictly positive profits for any insurance firm. This implies that no agent has an incentive to deviate, not even an insurance firm. The separating equilibrium described here corresponds to the RS separating equilibrium.

Compare this separating equilibrium to the pooling equilibrium at A_3 described earlier. In both situations, the high risks fully insure. The high risks pay a higher premium in the separating equilibrium because they are not subsidized by the low risks. In the pooling equilibrium, low risks are penalized by having to subsidize the insurance purchases of the high risks, but they get to fully insure. In the separating equilibrium, low risks don't have to subsidize the high risks (so they pay lower premiums), but they cannot fully insure.

Failure of the Separating Equilibrium in the RS Model

As mentioned before, there is no policy in figure 4 that would be strictly prefered by both types and that would make strictly positive profits for an insurance firm. However, in certain situations, depending on the proportion and preferences of the low risks, such a policy may exist. Consider policy Y in figure 5. Each type would strictly prefer Y to their separating equilibrium policy

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and Y would generate strictly positive profits if sold to each type. In the RS model, some insurance firm would step in and offer policy Y in this situation and destroy the separating equilibrium. This is why a separating equilibrium sometimes fails to exist in the RS model. In the model presented in this section, this separating equilibrium is sustained even in the presence of a policy like Y. Even if an insurance firm has an incentive to offer Y and destroy the separating equilibrium, it does not make either numeraire firm better off. Numeraire firm q has no incentive to deviate from offering M^q when policy Y is made available by some insurance firm. As with the pooling equilibria, the existence of equilibrium is guaranteed because the financial incentives of the employer differ from the financial incentives of the insurance firm.

3 Modifying the Assumptions of the Model

In this section some of the assumptions made in Section 2 will be weakened and the existence question will again be addressed. First the assumption of independence of total compensation levels and insurance menus will be dropped. As mentioned previously, without this independence assumption, the results of this model are the same as those of the RS model. Next the assumption of equal marginal productivity among health types is weakened and the results are discussed.

1. Dependence of Total Compensation and Insurance Menus

Now suppose that numeraire firms may pay workers a total compensation level other than their marginal product. Making this change brings the results of the model presented in this paper back to the classic RS results. Consider the pooling equilibrium illustrated in figure 3. Suppose that one of the insurance firms introduces policy X. A numeraire firm can offer a slightly lower total compensation level, say TC - ϵ, along with policy X and attract all of the low risk workers. Low risk workers are willing to take the lower level of total compensation (TC - ϵ) in order to have the opportunity to purchase policy X. This numeraire firm would make a profit of ϵ on each worker it hires. Now both the insurance firm and the numeraire firm have an incentive to deviate from the pooling equilibrium and it is destroyed.

Consider the separating equilibrium illustrated in figure 4. As before, because there is no policy that would be strictly prefered by both types and that would make strictly positive profits for an insurance firm, the separating equilibrium holds (as it does in the RS model). What about the separating equilibrium illustrated in figure 5? Suppose that one of the insurance firms introduces policy Y. A numeraire firm can offer a slightly lower total compensation level of TC - ϵ along with policy Y and attract all of the workers. Again this firm would make a profit of ϵ on each worker it hires. Both the insurance firm and the numeraire firm have an incentive to deviate from the separating equilibrium and it is also

destroyed.

This implies that the assumption that employers choose total compensation and insurance menus separately is the key to the existence results in the previous section. Without this assumption, employers have a preference for certain insurance menus, despite the fact that each worker is equally productive and that each employer pays none of the costs associated with insurance coverage for its workers. One might think that these two assumptions alone are enough to ensure that employers are indifferent between different insurance menus. The model from the previous section illustrates that, in addition, one must assume that total compensation is set independently from insurance menus in order to achieve indifference among employers with respect to insurance menus. This model thus provides the motivation for further empirical research to examine the relationship between employee choice of total compensation levels and insurance. In addition, the model motivates a comparision of its equailibrium predictions with the RS model's equilibrium predictions. This comparison is presented in the next section.

2. Allowing Different Levels of Marginal Productivity

Suppose that the marginal product of type 2 workers is $MP_2 > L$ and that the marginal product of type 1 workers is $MP_1 = 2 \times MP_2$. This implies that there is a perfect correlation between marginal product (which is observed) and health type (which is unobserved). In this case, there is no more information asymmetry and the adverse selection problem is avoided.

What if employers and the insurance company could not observe this correlation? If this were the case, then employers would still be indifferent between different workers and the existence results presented in the previous section would hold. Suppose an employer hires a type 2 worker. This worker would produce MP_2 units of numeraire for the firm. The firm would sell each unit of numeraire and earn MP_2 dollars, which it must pay to the worker for their labor. Thus the firm receives zero profits from a type 2 worker. Suppose instead that an employer hires a type 1 worker. This worker would produce MP_1 units of numeraire for the firm. The firm would sell each unit of numeraire and earn MP_1 dollars, which it must pay to the worker for their labor. Thus the firm receives zero profits from a type 1 worker. Therefore, given the simple production technology the firm possesses, it is indifferent between workers with different levels of marginal productivity. Because this firm is indifferent between workers, it will be indifferent between insurance menus, as was the case in Section 2.

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4 Comparing Data on Employer-Provided and Private Health Insurance Plans

A. Description of Testable Implications

A comparison of the RS Model and the model described above provide potentially differing testable implications that are examined in this section using data from the 1987 National Medical Expenditure Survey (NMES). The RS model suggests that if health is unobservable, then the only possible equilibrium outcome is one in which higher health risks pay more for coverage than lower health risks (separating). The model of employer-provided health insurance described in Section 2 suggests that with employers acting as intermediaries in the insurance market, if health is unobservable we may see either pooling or separation of health types in equilibrium (under the independence assumption). Thus if pooling is observed in the employer-provided insurance market and separation in the private insurance market, then the data support the theoretical role of employers as an intermediary that allows for pooling of health types to overcome the adverse selection problem.

B. Data

In order to look for evidence of pooling versus separating equilibria in private and employer-provided health insurance markets, data on insurance premiums and the health status of consumers are needed. The 1987 NMES, which was administered by the Agency for Health Care Research and Quality (AHRQ), is an ideal data set for such purposes because it contains both a Household Survey and a Health Insurance Plans Survey (HIPS). The Household Survey contains detailed demographic information on over 13,000 households for the year 1987. Households were asked to provide the identity of their employer(s) and insurer(s). The HIPS collected detailed information on insurance plan options, characteristics, and choices for these households directly from their employers and insurers.[9] Thus separate datasets can be constructed for consumers who purchase private health insurance and for consumers who purchase employer-provided coverage. Another good reason to use the 1987 NMES is that two recent studies, Cardon and Hendel (2001) and Crocker and Moran (2003), use this same survey to test different theoretical predictions about employer-provided health insurance. The relationship between this study and others in the literature is discussed in some detail below.

Following Cardon and Hendel (2001), I restrict attention to single individuals. This allows me to avoid having to decide on the best way to aggregate

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[9]Despite the fact that the survey is almost 20 years old, many portions of the HIPS results were not released until the mid-1990's. This can in part be attributed to the amount of time it takes to compare and rectify the sometimes contradictory information coming from workers, their families, their employers, and their insurers.

individual characteristics such as health status and insurance preferences to the family level. The subsample that is used to analyze singles with employer-provided coverage contains 788 individuals between the ages of 18 and 64 (with no missing information) that hold one employer-provided health plan and no supplemental public coverage.[10] The subsample that is used to analyze singles with private (non-employer-provided) coverage consists of 107 individuals between the ages of 18 and 64 (with no missing information) that hold one private health insurance plan with no supplemental public coverage.[11]

Descriptive statistics for the two subsamples are presented in Table 2. Self-reported health status is used as a proxy for an individual's health type.[12] Among the privately insured, 15% report being in fair or poor health, while only 9% of those with employer-provided coverage report being in fair or poor health. The privately insured are older on average, more likely to be white, and have a lower average annual income. The privately insured are also much more likely to live in a rural area. The average annual total premium for those with employer-provided coverage is $1,060 (1987 $), while the average annual total premium for those with private coverage is $814. For those with employer-provided coverage, the number of employees at their job location is used as a proxy for group size. Table 2 shows that 21% of those with employer-provided coverage work at a job location with over 500 employees.

For the privately insured, the 1987 NMES provides a direct measure of the number of policyholders in their group. The average number of policyholders per group in the privately insured sample is 1,866. Because the primary focus in this section is on the relationship between health status and the size of a consumer's premium, I control for the generosity of coverage associated with each policy. The proxy for generosity used is the percent of the cost of an inpatient hospital stay the plan will cover. Table 2 illustrates that the average coverage level for employer-provided plans is 91%, while it is only 83% for private plans. Finally, for the employer-provided insurance sample, employer characteristics which might also influence premiums are used as controls in the analysis. These include the number of plans offered by the employer, whether or not the plan is self-insured, and whether or not the employer is a non-profit. On average, employers offer 3.2 plans. Self-insured plans make up 34% of all employer-provided plans and 17% of employers are non-profits.

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[10]This compares well with the sample size of 826 individuals of working age who are employed that is used by Cardon and Hendel (2001).

[11]This sample size may seem small, but this is a result of the trade-off associated with having such detailed consumer level data combined with matched employer and insurer level data for a relatively small group (the privately insured).

[12]Butler et al. (1987) examines the relationship between self-reported health status and clinical indicators of health and find strong correlation between the two. Cardon and Hendel (2001) also use self-reported health status in their analysis, so following their approach will allow for easier comparison.

C. Models

In order to test for a separating equilibrium in the private insurance market (the RS prediction), an OLS regression using self-reported health status to predict private insurance premiums is estimated using the private insurance sample. Individual demographics and plan characteristics are controlled for as well in the model. Denote by H_i a private policyholder's vector of health-status indicators. A policyholder's vector of individual demographics is denoted by DEM_i and a policyholder's vector of plan characteristics is denoted by $PLAN_i$. The demographic and plan characteristic variables used are the ones reported in Table 2 for the privately insured sample. Thus the private insurance regression is given by:

$$PREMIUM_i = \alpha + \beta' H_i + \gamma' DEM_i + \delta' PLAN_i + \epsilon_i. \qquad (1)$$

The RS model predicts that lower self reported health status should raise premiums, everything else being equal. This implies that the coefficient associated with H_i is of particular interest. Here ϵ_i is a standard white noise error term.

A similar regression is used to test for pooling versus separating equilibria in the employer-provided insurance market using the employment-based insurance sample. The main difference in the employer-provided regression is that a separate vector of controls for employer characteristics for worker i, EMP_i, is also included:

$$PREMIUM_i = \alpha + \beta' H_i + \gamma' DEM_i + \delta' PLAN_i + \theta' EMP_i + \epsilon_i. \qquad (2)$$

My model (in Section 2) predicts that self reported health status should not have an effect on premiums in a pooling equilibrium, holding everything else constant. In a separating equilibrium, the model predicts that those with worse health will pay higher premiums, everything else being equal.

D. Results and Discussion

Table 3 presents the results of the private insurance regression. Surprisingly, none of the health status indicators have a statistically significant impact on premiums. In fact, only two of the variables in the model, age and years of schooling are statistically significant. At first glance, it may appear as though these empirical results contradict the predictions of the RS model. However, as is discussed in more detail below, the fact that age has a positive and statistically significant correlation with premiums in the private market may suggest that insurers use age as a proxy for health. Thus, without employers as an intermediary, older policyholders in the private market may be being charged higher premiums due to the correlation between age and unobservable health status, as predicted by the RS model.

Table 4 presents the results of the employer-provided insurance regression. Again, none of the health status indicators have a statistically significant impact on premiums.[13] As is the case in the private market, age is statistically significant. However, the impact of age is much smaller here than in the private market. In addition, gender and living in the west are statistically significant demographics. Among plan characteristics, the hospital coverage rate is positive and statistically significant, suggesting that more generous hospitalization benefits are correlated with higher premiums. Among employer characteristics, the number of plans offered by the employer and whether the plan is self-insured are statistically significant.

The insignificance of the health status indicators in the employer-provided insurance regression may, at first glance, seem to support the prediction that employers pool health types (Theorem 1). However, the fact that these same indicators are not significant in the private insurance regression may cast some doubt on the use of the relationship between self-reported health status and premiums to make inferences about the nature of insurance market equilibria.

That being said, the difference in the relationship between age and premiums in the private insurance market and the employer-provided market may still provide support for the notion that when health is unobservable, private insurance contracts tend to separate health types (as in the RS model) and employer-provided contracts tend to pool health types (Theorem 1). In 2005 dollars, the employer-provided insurance model predicts that a 64 year old would have an annual insurance premium that is only $292 higher than an 18 year old, everything else constant. The private insurance model predicts the difference to be $949. An argument can be made that health is unobservable, so when faced with this problem private insurers use age as a signal about a consumer's health. This results in "separation" according to a characteristic (age) that is correlated with health. Separation is the theoretically predicted outcome in the private market.

In the employer-provided market, these numbers seem to suggest much less sorting according to age, which perhaps can be taken as evidence of pooling. These results certainly imply that controlling for a number of other factors, age plays a different role in the private insurance market than in the employer-provided market. My model suggests that there are two possible outcomes in the employer-provided market when health is unobservable, pooling and separating. One factor that may play a role in determining which outcome is likely to occur is the fact that the provision of fringe benefits in the U.S., such as health insurance, must be "non-discriminatory" to full-time workers within a firm in order for those benefits to qualify for preferential tax treatment.[14] This implies

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[13]This regression also includes a series of controls for industry and occupation. They are not presented in the table in order to economize on space.

[14]Scott, Berger, and Black (1989) discuss the potential inefficiencies of this tax rule in great detail.

that insurers may not be able to behave the same way in the employer-provided market as they do in the private insurance market. Given that separating is not an option, that leaves pooling as the only possible outcome. Therefore, the empirical result that the relationship between age and premiums differ in the employer-provided and the private insurance market supports the notion that employers play a special role that allows for the pooling of types, just as the model in Section 2 suggests.

At this point, some discussion of how this result fits in with other studies in the literature is appropriate. Using the same dataset, Cardon and Hendel (2001) find no evidence of adverse selection in the U.S. employer-provided health insurance market. They test the RS result that high risks buy more coverage and, on average, end up using more care. Their specific result is that consumer behavior in the employer-provided market can be explained by observable characteristics. Therefore, they conclude that unobservable characteristics (such as health type) are not important. On the other hand, Cutler and Reber (1998) find evidence of adverse selection as a result of a pricing change for employee insurance policies at Harvard University.

The primary difference between the Cardon and Hendel (2001) paper and the work presented here is that, from a conceptual perspective, they are implicitly assuming that the only possible outcome in the employer-provided insurance market when health status is private information is separation of health types. My model suggests that pooling is also a possibility. When their empirical test does not support the RS prediction that health type and insurance plan selection are correlated, they take that as evidence that there is no adverse selection problem. In other words, insurance plan selection can be explained using observable factors. An alternative interpretation of their results, which would be consistent with my model, is that there IS an adverse selection problem in the sense that health is unobservable, but that is overcome in the employer-provided market because employers function as intermediaries that pool health types.[15] In a pooling equilibrium everyone purchases the same plan, so unobservable differences between workers, by definition, do not help to explain the type of plan each worker purchases. Therefore, the Cardon and Hendel (2001) results can also be interpreted as evidence of a pooling equilibrium. An interesting extension of their paper would be to replicate their analysis on the privately insured in order to see if unobservables influence health plan choice in that setting.

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[15]Note that the model estimated in Cardon and Hendel (2001) suggests that adding five years of age implies 10% higher health care expenditures for workers in their sample. Despite this fact, when they estimate the probability of being offered insurance with a probit model, the coefficients on age and age squared are not statistically significant (see their Table 7, specifications (1) and (2)). Although older workers are more expensive to cover, these results suggest that they are not less likely to be offered employer-provided insurance. This probably reflects the "non-discriminatory" nature of employer-provided coverage and also seems to support the role of employment as a pooling mechanism.

The discussion of the relationship between insurance premiums and age in the employer-provided insurance market above is supported by the results of Cutler and Reber (1998). As described in their paper, most of the changes in policy selection made by Harvard employees can be explained by their age. This implies that age is a good proxy for health in this case. Because Harvard does not vary its premium contribution based on age, it is as if this correlation is unobserved. This again points towards the special role employers play in facilitating risk based pools. Thus the results of Cardon and Hendel (2001) and Cutler and Reber (1998) can be viewed as providing empirical support for the model of employer-provision of health insurance presented in Section 2.

5   Conclusion

In this paper it is shown that the existence of multiple pooling and a unique separating equilibrium can be established through the introduction of employers into the Rothschild and Stiglitz (1976) model of health insurance provision under the assumption that employers choose total compensation levels and insurance menus independently. Data on the relationship between age and insurance premiums from the 1987 NMES suggest pooling as the equilibrium outcome observed in the employer-provided market and separation in the private market. In this section the policy implications of these results are discussed, along with avenues for future empirical research, and potential extensions of the model.

These results are of interest to policymakers for several reasons. First, these results provide the potential for multiple solutions to the adverse selection problem. Avoiding adverse selection is an important component in designing a stable insurance market. Consider the Rothschild and Stiglitz (1976) model. It suggested only one possible solution to the adverse selection problem - risk segmentation. For this reason risk segmentation was originally seen as a desirable goal to economists. More recently, risk segmentation has come to be viewed as leading to inefficient limitations on coverage and services for low risks. In addition, risk segmentation also forces high risks to pay more for a given level of coverage than low risks. Given other attributes that may be associated with being a high risk, this might not be attractive to policymakers.[16] My model suggests that employment-based pooling is also a viable solution to the adverse selection problem. A "full insurance" pooling equilibrium exists in this model without the need for a social planner. Thus my model supports a solution that we observe in the real world, pooling of health types.

Another policy concern deals with the tax subsidy on employment-based insurance premiums. Many economists have pointed out that this tax subsidy creates a distortion in health insurance, labor, and medical care markets. In addition, it provides larger subsidies to those who are less in need of financial

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[16]See Feldman and Dowd (2000) for a discussion of the pros and cons of risk segmentation.

assistance (those with higher marginal tax rates). Despite these criticisms, this paper suggests that the tax subsidy may play an important role in the health insurance market. It seems to be the primary mechanism by which pools are created in order to deal with the adverse selection problem in the United States. As mentioned in the introduction, employers act as the U.S. equivalent of German and Japanese sickness funds. If the tax subsidy in the U.S. were eliminated, then a new pooling (or sorting) mechanism may need to be created.

In this context, it may be the case that the President's tax reform proposal may have the unintended consequence of weakening the employer pooling mechanism. If younger, healthy workers were to receive equal tax treatment from the purchase of a private health insurance plan, then they may leave their employer-sponsored pooling plan. Private insurers may use this opportunity to target specific plans for such workers. This would increase the average premium for the older, less healthy employees that remain in the employer-provided insurance pool. An older, less healthy worker is less likely to find an attractive private health insurance plan, since, as illustrated, private plan premiums are based in part on the age of the consumer. In addition, there are pre-existing condition issues that must be contemplated when switching insurers for less healthy consumer. Therefore, the stronger the propensity for young, healthy workers to leave their employer-provided health insurance pools, the weaker the employer pooling mechanism becomes. A careful analysis of the Bush proposal would have to consider the consequences of such behavior.

As is described above, one potential focus of future empirical research is to expand upon the use of the private insurance market to help better explain how the employer-provided market works. For example, applying the Cardon and Hendel (2001) methodology to the private insurance market, while beyond the scope of this paper, may provide an interesting contrast to their work on the employer-provided market. If unobservables were found to "matter" in the private market, then that may change the interpretation of their original results and provide support for the role of employment-based coverage as a means to solve the adverse selection problem by pooling health types.

There are several extensions that will be the focus of future research. What happens if employers share the cost of insurance premiums? What if employers have an increasing returns to scale technology? The key to each extension is to examine if employer preferences over workers change. If the extension doesn't change employer preferences over workers, then it will not change employer preferences over insurance policies and the results presented above will hold. For example, it seems as though providing a small uniform employer subsidy towards the purchase of an insurance policy will not change employer preferences over workers. The cost per worker will increase by the same amount regardless of the worker's health type or their insurance choice. On the other hand, providing a proportional subsidy would probably make it more expensive to hire high risks relative to low risks. This could alter the results presented above.

6 Appendix

Proof of Theorem 1

Consider policy $a = (P_a, B_a) \in A$. Assume that each insurance firm offers menu $M_a = \{ (0, 0), (P_a, B_a) \}$. Given that this is the only menu offered, assume that each employer offers menu M_a to its potential workers. Assume that workers allocate themselves to employers in representative samples and that each worker chooses policy a from menu M_a.

Workers have no incentive to deviate since policy a maximizes their utility, given that it is the only choice besides no coverage. Each employer is achieving its maximum profit level from the production of numeraire (zero), so no employer has an incentive to deviate to a different menu. Each insurance firm is breaking even from its sale of insurance, because workers are grouped in representative samples.

Therefore all of the conditions for a pooling equilibrium are satisfied.

Proof of Theorem 2

Suppose that the union of the menus offered by the two insurance firms equals $S = \{ (0, 0), (P_1^*, B_1^*), (P_2^*, B_2^*) \}$. In addition, assume that the union of menus selected by each employer equals S. Each worker i will work for the firm which offers policy (P_i^*, B_i^*).

Workers have no incentive to deviate, because they cannot increase their utility by switching insurance policies / employers. Each employer is achieving its maximum profit level from the production of numeraire (zero), so no employer has an incentive to deviate to a different menu. Each insurance firm is breaking even from its sale of insurance, because each health type i is consuming the policy that breaks even when sold to type i.

Therefore all of the conditions for a separating equilibrium are satisfied.

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Figure 1: The Allowable Set of Policies
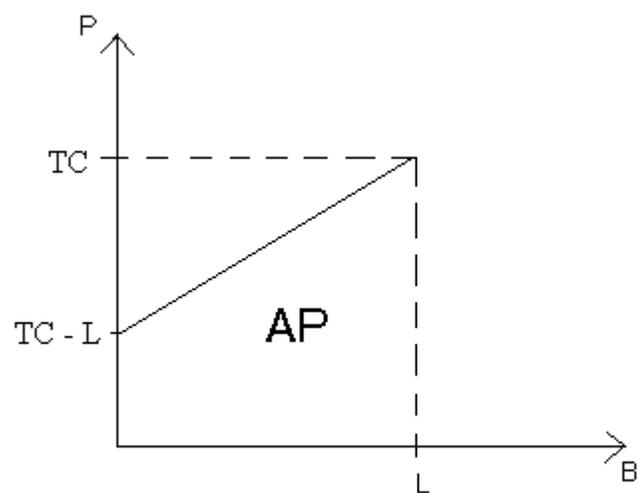
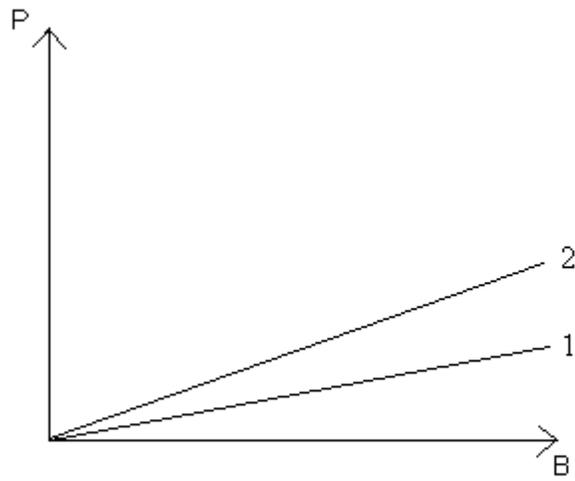**Figure 2: The Sets of Break Even Policies for Types 1 and 2**
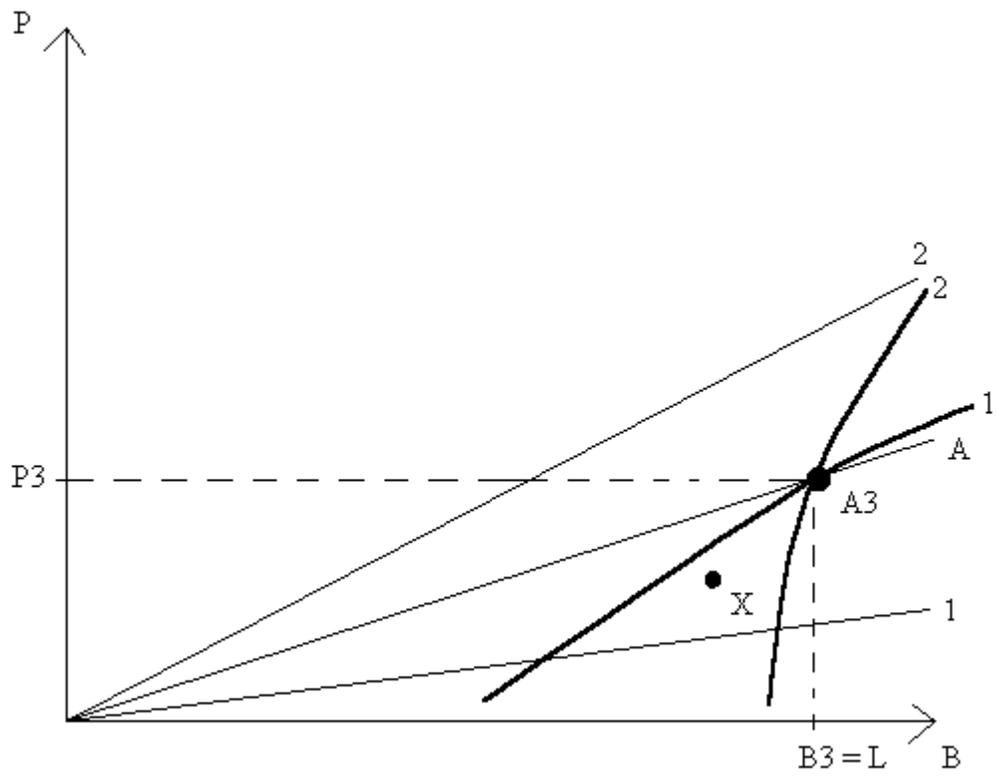
Figure 3: A Pooling Equilibrium

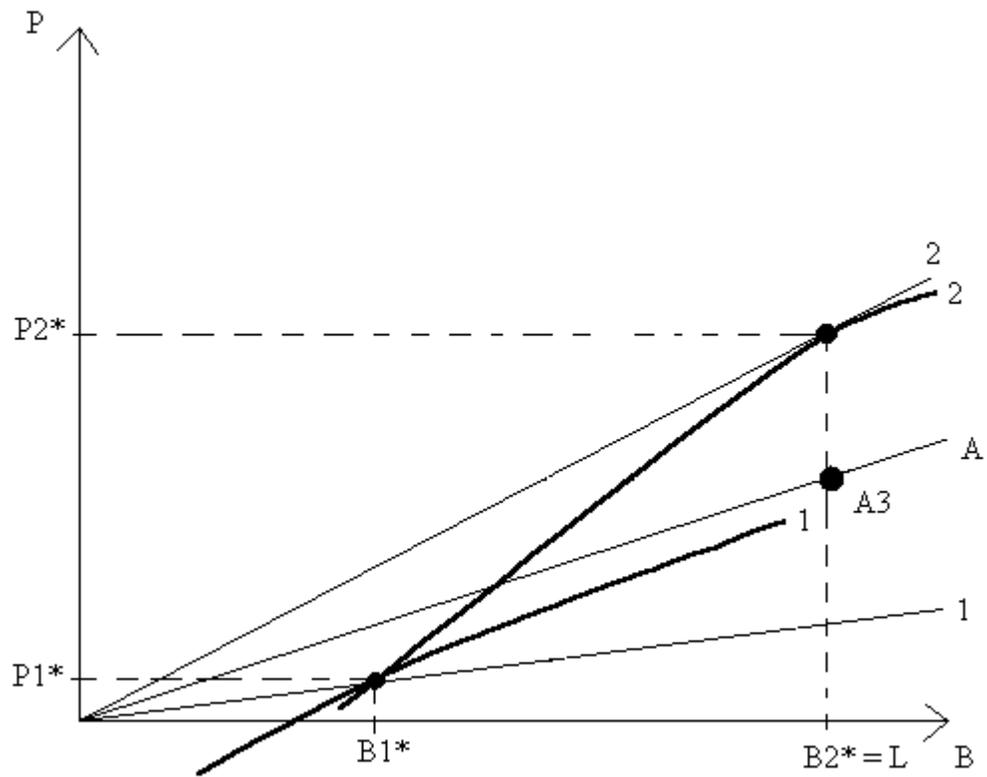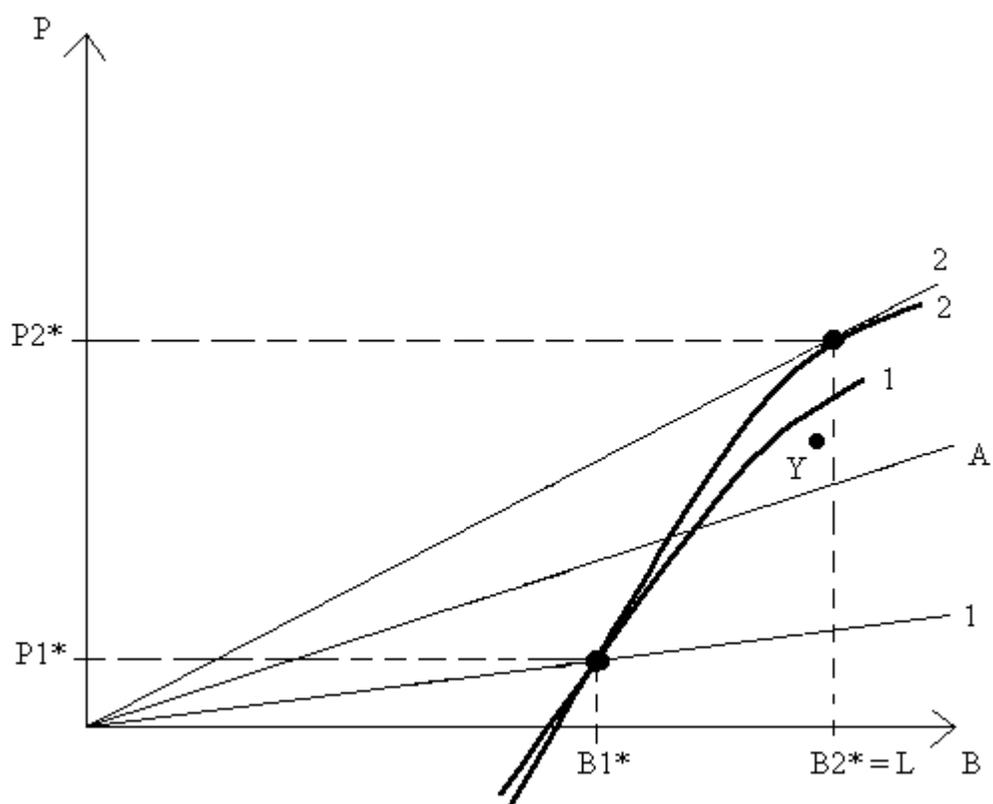**Figure 4: The Separating Equilibrium**

Figure 5: No Separating Equilibrium in the RS Model

Table 2: Descriptive Statistics

Variable	Private Insurance Sample (n = 107)	Employer-Provided Insurance Sample (n = 788)
Health Status Indicators:		
% excellent health	34%	36%
% good health	50%	55%
% fair health *	12%	8%
% poor health ***	3%	1%
Individual Demographics:		
Avg. Age at the end of 1987 ****	42.31	34.88
% Female	56%	56%
% Non-white ***	12%	21%
Avg. Annual Income (1987 $) ****	17,138	21,211
Avg. Years of School	13.25	13.44
% Unemployed	23%	N/A
% Northeast	18%	22%
% Midwest	28%	27%
% West	22%	18%
% South	33%	33%
% Rural ****	28%	16%
Plan Characteristics:		
Avg. Total Annual Premium (1987 $) ****	814	1,060
% Size of Workplace - less than 10 workers	N/A	11%
% Size of Workplace - 10 - 25 workers	N/A	16%
% Size of Workplace - 26 - 100 workers	N/A	28%
% Size of Workplace - 101 - 500 workers	N/A	24%
% Size of Workplace - over 500 workers	N/A	21%
Avg. Number of policyholders in group	1,866	N/A
Avg. Hospital Coverage Rate ****	83.33%	90.94%
Employer Characteristics:		
Avg. Number of Plans Offered	N/A	3.20
% Plan Self-Insured by Employer	N/A	34%
% Non-Profit	N/A	17%

**** = difference significant at 1%

*** = difference significant at 5%

** = difference significant at 10%

* = difference significant at 15%

Table 3: Private Insurance Regression

(dependent variable: annual total private insurance premium)

Variable	Coefficient	Robust Standard Error	P - value
Health Status Indicators:			
excellent health	(excluded)		
good health	-5.04	101.71	0.96
fair health	-15.23	144.33	0.92
poor health	222.51	277.03	0.42
Individual Demographics:			
Age ****	12.00	3.46	< .01
Female	139.56	142.44	0.33
Non-white	-189.01	153.00	0.22
Annual Income (1987 $)	-0.002	0.002	0.32
Years of School **	38.67	20.36	0.06
Unemployed	-111.07	109.50	0.31
Northeast	-54.41	159.63	0.73
Midwest	-76.59	139.60	0.59
West	-47.77	148.15	0.75
South	(excluded)		
Rural	88.59	111.06	0.43
Plan Characteristics:			
Number of policyholders in group	0.004	0.005	0.38
Hospital Coverage Rate	-0.68	2.68	0.80
Constant	-139.35	293.17	0.64

number of observations = 107   R squared = 19%

**** = coefficient significant at 1%
*** = coefficient significant at 5%
** = coefficient significant at 10%
* = coefficient significant at 15%

Table 4: Employer-Provided Insurance Regression

(dependent variable: annual total employer-provided insurance premium)

Variable	Coefficient	Robust Standard Error	P - value
Health Status Indicators:			
excellent health	(excluded)		
good health	-7.23	39.74	0.86
fair health	96.04	108.21	0.38
poor health	-38.19	179.26	0.83
Individual Demographics:			
Age **	3.69	2.10	0.08
Female *	-93.90	58.69	0.11
Non-white	-33.38	43.38	0.44
Annual Income (1987 $)	0.003	0.001	0.06
Years of School	-8.40	8.47	0.32
Northeast	67.53	50.83	0.18
Midwest	43.06	48.81	0.38
West ***	120.59	55.28	0.03
South	(excluded)		
Rural	-27.15	61.30	0.66
Plan Characteristics:			
Size of Workplace – less than 10 workers	(excluded)		
Size of Workplace – 10-25 workers	25.15	81.14	0.76
Size of Workplace – 26-100 workers	-53.65	59.49	0.37
Size of Workplace – 101-500 workers	0.11	64.01	0.99
Size of Workplace – over 500 workers	97.11	71.84	0.18
Hospital Coverage Rate ****	4.15	1.53	< .01
Employer Characteristics:			
Number of Plans Offered **	3.19	1.80	0.08
Self-Insured ****	-308.94	34.05	< .01
Non-Profit	30.71	55.68	0.58
constant ****	734.53	220.17	< .01

number of observations = 788   R squared = 15%

**** = coefficient significant at 1%   Note that 12 industry and 11 occupation
*** = coefficient significant at 5%   indicators are also included in this model,
** = coefficient significant at 10%   but the results are not presented.
* = coefficient significant at 15%