NBER WORKING PAPER SERIES

EMPLOYMENT AND ADVERSE SELECTION IN HEALTH INSURANCE

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Working Paper 12430
http://www.nber.org/papers/w12430

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
August 2006

We thank the ERIU for grant support. In addition, we thank participants at two ERIU conferences, at the November 2003 NBER health care program meeting, at the 2005 NBER summer institute. We also thank seminar participants at Washington University in St Louis and at RAND. All errors remain the authors'. The views expressed herein are those of the author(s) and do not necessarily reflect the views of the National Bureau of Economic Research.

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JEL No. I1, J10, J33

ABSTRACT

We construct and test a new model of employer-provided health insurance provision in the presence of adverse selection in the health insurance market. In our model, employers cannot observe the health of their employees, but can decide whether to offer insurance. Employees sort themselves among employers who do and do not offer insurance on the basis of their current health status and the probability distribution over future health status changes. We show that there exists a pooling equilibrium in which both sick and healthy employees are covered as long as the costs of job switching are higher than the persistence of health status. We test and verify some of the key implications of our model using data from the Current Population Survey, linked to information provided by the U.S. Department of Labor about the job-specific human capital requirements of jobs.

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1 Introduction

Understanding the connection between health insurance provision and the labor market is important. The labor market is the principal source for the private provision of health insurance in the United States, presumably because of the large subsidy for it in the tax code.[1] A common justification for this system is that employer provision ameliorates the adverse selection problem in health insurance provision. A job is a place where people come together for reasons other than health insurance.[2] Though this is a widely held position among economists,[3] there has been very little theoretical work delineating the conditions under which the labor market solves the adverse selection problem in health insurance, and very little applied work measuring its empirical importance.

Here, we develop a simple theoretical model of adverse selection where employees can choose between employers that do and do not provide health insurance. In our theory, employers choose whether to provide health insurance without knowing whether workers are sick or healthy. Workers, knowing their current health status and the distribution over future health status changes, allocate themselves among employers. As workers transition among health states, they may change insurance status by switching among employers. However, friction (caused by the development of job-specific human capital) induces stickiness in the employment relationship, and creates costs for employees who want to switch jobs. Under certain conditions, there is a pooling equilibrium in which both sick and well workers choose jobs with insurance. The main conclusion from the theory is that the labor market solves the adverse selection problem if jobs are stickier than is health status.

In our empirics, we use the Current Population Survey (CPS) in conjunction with data from the U.S. Census and O*NET, a survey collected by the Dept of Labor, to explore the determinants of employer provided health insurance and to test our theory. We find that workers in industries characterized by fluid labor markets and lower requirements for job-specific human capital are less likely to have employer-provided health insurance. On the other hand, employees working

[1] The favorable tax treatment of employer health insurance provision results in an annual subsidy of over \$100 billion dollars (Gruber, 2001). Approximately 80% of the under-65 population who are insured receive their insurance through employers (their own or their spouse's). (Authors' calculations using Census Bureau (2003), Table 152). Of the 41 million uninsured, about three fifths are employed adults.

[2] We thank David Balan (repeating George Deltas) for this formulation.

[3] For example, the leading health economics text says "group purchase by employers addresses the problem of adverse selection," (Folland et al., 2004). This sentiment is repeated in many places (Cutler, 2002; Gruber and Levitt, 2000; Buchmueller et al., 2002).

in industries characterized by higher requirements for general human capital are no more likely than other employees to receive health insurance through their employers. Finally, job-specific human capital predicts employer-provided health insurance coverage only for healthy employees, not for unhealthy employees. These findings are consistent with the predictions of model and the combination of findings is difficult to explain without our model. Quantitatively, we find that adverse selection plays a small role in explaining why some employers do not provide health insurance to their workers.

2 Background

Many economists believe that adverse selection in health insurance leads to uninsurance. However, such equilibrium uninsurance is not consistent with traditional models of adverse selection (Rothschild and Stiglitz, 1976; Wilson, 1977). When equilibria exist in the traditional models, they call for separating equilibria in which both low and high risk types are insured, and low risk types are underinsured.

Because uninsurance is such an important phenomenon in health insurance markets and because traditional models do not accommodate uninsurance, we specify a model that is capable of generating uninsurance. Our theory differs from the traditional approach in our assumption of fixed insurance characteristics. Insurers are not permitted to offer less generous insurance: they may offer either full insurance or no insurance at all.

In fact, there is only limited heterogeneity in the financial characteristics of health insurance offerings, that is in deductibles, copayments, coinsurance, disease coverage exclusions, out of pocket maxima, and lifetime limits (Cutler and Zeckhauser, 2000). Furthermore, the plans that are most generous in financial characteristics are health maintenance organizations (HMOs), which are extensively documented to receive *favorable* selection (see Cutler and Zeckhauser, 1998).

There are several reasons for this limited heterogeneity. First, in order to qualify for favorable tax treatment, employers are limited in their ability to offer different health benefits to different employees (Gruber, 2001). Second, there is both federal and state legislation mandating the coverage of various conditions and procedures (Kaestner and Simon, 2002; Gruber, 1994). Finally, courts frequently fail to enforce exclusions in coverage (Epstein, 2000).

The model of adverse selection ours is most similar to is that of Cutler and Zeckhauser (2000). In their model, there are two fixed types of insurance, a generous type and a stingy type. Employees allocate themselves between these two types according to the employees' health status. They examine adverse selection in the choice of plans offered within the same employer; they do not examine adverse selection in the choice of employers. Empirical examinations of this model appear in Cutler and Reber (1998) and Buchmueller and DiNardo (2002).

Another closely related model is provided by Crocker and Moran (2003). They study the ability of labor market stickiness to solve the commitment problem discussed in Cochrane (1995). They find that increasing labor market stickiness increases the ability of the labor market to solve the commitment problem. However, they assume from the beginning that there is no asymmetric information problem.

Empirically, our approach bears some similarity to that of the job lock literature (Holtz-Eakin, 1994; Cooper and Monheit, 1994; Monheit and Cooper, 1994; Madrian, 1994; Gruber and Madrian, 1997). That literature documents a link between turnover and health insurance provision. Employees who receive health insurance from their employers are less likely to leave their jobs for new ones. By contrast with that literature, our work posits the inverse causal relationship: that employers in industries characterized by high rates of employment turnover are less likely to provide their workers with health insurance. Also, our empirical focus is not simply on the relationship between turnover and health insurance provision; in our main empirical work, we are more concerned with how job-specific human capital requirements affect health insurance coverage rates.

3 Model of Health Insurance in the Labor Market

Our goal is to construct the simplest possible model that demonstrates how adverse selection in health insurance interacts with job choice decisions in a setting where workers can only get health insurance through their employers. To this end, we construct a two period model of the labor and health insurance markets. In the first period, firms set wages and health insurance offerings and then workers choose among employers. Each worker (but no firm) can observe which of two types, sick or well, he is. After the job choice, each worker receives a health shock that induces a demand for medical care. Sick workers draw their health shocks from a worse distribution than do well workers. Uninsured workers pay for their use of medical care, while insured workers' employers pay for their use.

At the start of the second period, workers may change health states with some known probability. Then, each worker experiences involuntary turnover, again with some known probability. A turned over worker then may choose a new employer. Next, each worker who did not turn over involuntarily may choose to turn over voluntarily in order to change his health insurance status. To do so, he must incur a switching cost. Then, another health shock is realized and medical care consumption decisions are made again.

3.1 Assumptions

The timing of the model is:

1. Period 1

   i. Employers set wage and benefit levels

   ii. Workers see their health state (sick or well)

   iii. Workers choose their employer

   iv. Health shock realized, medical care consumption

2. Period 2

   i. Workers see their new health state

   ii. With probability τ workers involuntarily turn over and may seek a new employer

   iii. Workers who do not involuntarily turnover may choose whether to switch employers

   iv. Health shock realized, medical care consumption

3.1.1 Sickness Transitions

In period 1ii, workers are sick with probability P_S and healthy with probability $P_W = 1 - P_S$. Employers observe these probabilities, but not whether any particular worker is sick. In period 2i, healthy workers become sick with probability P_{SW} and sick workers become healthy with probability P_{WS}.

We assume that the original distribution of health states is the steady state distribution induced by these transition probabilities so that the fraction of sick workers, P_S, is the same in both periods. Thus, $P_S = \frac{P_{SW}}{P_{SW}+P_{WS}}$.

Furthermore, we assume that health is sticky; the probability of being sick in period 2 is higher for workers who were sick in period 1:

$$P_{WS} < P_{WW} \tag{1}$$

3.1.2 Consumers' Utility

Consumers derive utility from health, H and from the consumption of other goods, C according to a utility function $U(C, H) = u(C) + v(H)$. The initial health stock is H_0, and health is produced from medical care, m, by a health production function. The health production function is subject to a random shock, ϵ. For a consumer lacking health insurance, the utility maximization problem and its solution are:

$$max_m u(Y - m) + v(H_0 + f(m, \epsilon))$$
$$\overset{*}{m} \text{ given by } v' f_1 - u' = 0$$
$$\overset{*}{m} = \overset{*}{m}(Y, H_0, \epsilon)$$

We also consider a consumer covered by health insurance, and we model health insurance in a very simple way. We assume that health insurance is "first dollar" insurance and that no effort is made by the insurer to control moral hazard, so that the problem and solution for an insured consumer are:

$$max_m u(Y) + v(H_0 + f(m, \epsilon))$$
$$\hat{m} \text{ given by } f_1 = 0$$
$$\hat{m} = \hat{m}(\epsilon)$$

Now, we assume that there are two types of consumers, sick and well, and that these two types differ in their distribution functions for ϵ, so that F_S is larger than F_W in the sense of first order stochastic dominance. The cost of insuring a sick person is therefore $C_S = E_{F_S}(\hat{m}(\epsilon))$, while the cost of insuring a well person is $C_W = E_{F_W}(\hat{m}(\epsilon))$.

Finally, we make conventional assumptions on the utility and production functions:

1. $u' > 0$, $u'' < 0$, $v' > 0$, $v'' < 0$

2. $f_1 > 0$, $f_2 < 0$, $f_{12} > 0$, f concave.

3. $f_1 \leq 0$ for $m > \tilde{m}(\epsilon)$. The futility point is $\tilde{m}(\epsilon)$.

There are four possible combinations of sickness and insurance status, with four associated levels of utility:

$$\begin{aligned} U_{SU}(Y) &= E_{F_S} max_m U(Y - m, H_0 + f(m, \epsilon)) \\ U_{SI}(Y) &= E_{F_S} max_m U(Y, H_0 + f(m, \epsilon)) \\ U_{WU}(Y) &= E_{F_W} max_m U(Y - m, H_0 + f(m, \epsilon)) \\ U_{WI}(Y) &= E_{F_W} max_m U(Y, H_0 + f(m, \epsilon)) \end{aligned}$$

We denote the optimal levels of m conditional on ϵ for the insured and uninsured as $\tilde{m} = \tilde{m}(\epsilon)$ and $\overset{*}{m} = \overset{*}{m}(\epsilon)$, respectively.

Because $F_S \overset{FOSD}{>} F_W$ and by the assumptions on f and U, it is easy to see that:

$$\begin{aligned} C_S &\geq C_W \\ U_{SI} &\leq U_{WI} \\ U_{SU} &\leq U_{WU} \end{aligned}$$

Now, we argue for a single-crossing property for health insurance. Consider that health insurance is sold at a price p to an individual with income Y. We show here that a sick consumer has a higher value for insurance than a well consumer.

Consider, viewed as a function of ϵ, the *ex post* utility value of insurance:

$$max_m U(Y, H_0 + f(m, \epsilon)) - max_m U(Y - m, H_0 + f(m, \epsilon)) \tag{2}$$

The derivative of this expression is, by the envelope theorem:

$$v'(H_0 + f(\tilde{m}(\epsilon), \epsilon))f_2((\tilde{m}(\epsilon), \epsilon)) - v'(H_0 + f(\overset{*}{m}(\epsilon), \epsilon))f_2((\overset{*}{m}(\epsilon), \epsilon)) \tag{3}$$

We denote these $\tilde{v}'\tilde{f}_2$ and $\overset{*}{v}'\overset{*}{f}_2$. Since health is higher when insured and since v is concave, $0 < \tilde{v}' < \overset{*}{v}'$ Since $f_{12} > 0$ and since health care consumption is higher when insured $\overset{*}{f}_2 < \tilde{f}_2 < 0$. Combining these yields $\overset{*}{v}'\overset{*}{f}_2 < \tilde{v}'\tilde{f}_2 < 0$

Thus, the *ex post* value of insurance is increasing in ϵ. Now, since $F_S \overset{FOSD}{>} F_W$ we conclude that the *ex ante* value of insurance is higher for the sick than for the well. Furthermore, since income and premium played no role in the argument above (by virtue of the additive separability of U), this is true for any income level and for any insurance premium.

In the second period, each worker has an identical utility function, except that he suffers a switching cost of c utils should he choose to switch employers. Each worker's utility for the whole game is the first period utility plus a discount factor, β, times his second period utility.

Finally, we will assume that there are gains to insurance but that these gains are small enough that the well workers would prefer not to have insurance at the pooling price. Denoting the willingness to pay for insurance of type i, W_i, we assume

$$C_W < W_W < P_S C_S + P_W C_W < C_S < W_S \tag{4}$$

It is efficient for each worker to be insured, but at the one shot pooling price the well workers would choose not to be.

3.1.3 Employers

There are many identical, risk neutral employers, having access to a constant returns production function of a single input, labor. Each worker supplies a single unit of labor per time period, which has a marginal value product to the employer of M.

Each employer sets a wage and a benefits policy (health insurance or no health insurance) in the first period. The wages and benefits policy then applies to all workers who work for this employer in each of periods 1 and 2.

An employer not offering insurance and paying a wage of W earns profits of $M - W$ on each worker choosing him in period 1 and profits of $\beta(M - W)$ on each worker choosing him in period 2.

An employer offering insurance and paying a wage of $W - p$ earns a profit of $M - W + p - C_W - P_1(C_S - C_W)$ on each worker choosing him in period 1 and profits of $\beta(M - W + p - C_W - P_2(C_S - C_W))$ on each worker choosing him in period 2. The probability (in equilibrium) that a worker is sick given that they are working at an insuring employer at period 1 is P_1 and the probability that a worker is sick given that he is working at an insuring worker at period 2 is P_2.

3.2 Solution

We next search for conditions under which there is a "pooling" equilibrium. For us, a pooling equilibrium is a symmetric subgame perfect Nash equilibrium in pure strategies with the properties that:

1. In period 1, both sick and well workers choose an employer offering insurance
2. In period 2, neither sick nor well workers *voluntarily* turn over to change their insurance status

By symmetric, we mean that all sick consumers play the same strategy, all well consumers play the same strategy, all insuring firms pay the same wages, and all non-insuring firms pay the same wages.

Our strategy will be constructive. We will build the equilibrium, noting as we go conditions sufficient to induce the desired behavior. Then, we will argue that no firm and no consumer has any incentive to deviate from the constructed equilibrium. Finally, we will argue that if any of our sufficient conditions fail then some firm or consumer will have an incentive to deviate, and this will allow us to conclude that our conditions are necessary and sufficient.

Because there is Bertrand competition among firms in period 1i, firms will earn zero profits, $W = M$, and p will be set at the average discounted cost of providing insurance. In a pooling equilibrium, in the first period, all workers are insured. In the second period, all non-turned-over workers are insured and all turned-over workers who are sick are insured—the only uninsured workers are involuntarily turned-over workers who are well. With competitive conditions among employers offering insurance, employers will earn zero profits on insurance:

$$\begin{aligned}\hat{p} + \beta\left[(1-\tau)\hat{p} + \tau P_S \hat{p}\right] &= P_S C_S + P_W C_W + \beta\left[(1-\tau)(P_S C_S + P_W C_W) + \tau P_S C_S\right] \\ \hat{p} &= \frac{(1+\beta(1-\tau))(P_S C_S + P_W C_W) + \beta\tau P_S C_S}{1+\beta(1-\tau)+\beta\tau P_S} \qquad (5)\end{aligned}$$

3.2.1 Workers, Period 2

Consider a worker in period 2ii who has involuntarily turned over. Let W be the highest prevailing wage at a firm not offering insurance and p be the difference between W and the highest prevailing wage at a firm offering insurance. Then, the turned-over worker will choose an employer with insurance if:

$$\text{if well} : U_{WI}(W-p) > U_{WU}(W) \qquad (6)$$

$$\text{if sick} : \; U_{SI}(W-p) > U_{SU}(W) \qquad (7)$$

By the assumptions already made, at the pooling price, $\hat{p}$, the turned-over sick worker chooses insurance and the turned-over well worker does not.

Now, let's consider an insured worker who is not involuntarily turned-over but is considering turning over. This worker will turn over if:

$$\text{if well} : U_{WU}(W-p) - c > U_{WI}(W) \qquad (8)$$

$$\text{if sick} : \; U_{SU}(W-p) - c > U_{SI}(W) \qquad (9)$$

By the single crossing property, it will be enough to argue that the well worker will not turn over in this situation in order for the sick worker also not to turn over. To get the well worker not to turn over here, we do need to assume that the switching cost is great enough:

$$U_{WU}(W-p) - c < U_{WI}(W) \qquad (10)$$

Therefore, a sufficient condition for pooling behavior in period 2 at the pooling equilibrium price is for equation 10 to hold at a price $\hat{p}$.

3.2.2 Workers, Period 1

Next, we seek conditions to ensure that both sick and well workers will choose insurance in period 1. We will first develop the relevant value functions for the decision, then we will argue that if the well workers choose insurance then so will the sick workers. Finally, we will derive conditions sufficient for the well workers to choose insurance.

Consider the value of the game at the start of period 2ii, after the determination of the period 2 health state but before it has been determined whether a worker will turnover:

$$\begin{aligned} V_{WI} &= \tau U_{WU} + (1-\tau) max\left\{U_{WU} - c, U_{WI}\right\} & (11) \\ V_{WU} &= \tau U_{WU} + (1-\tau) U_{WU} & (12) \\ V_{SI} &= \tau U_{SI} + (1-\tau) U_{SI} & (13) \\ V_{SU} &= \tau U_{SI} + (1-\tau) max\left\{U_{SU}, U_{SI} - c\right\} & (14) \end{aligned}$$

Now, consider a well worker in period 1iii, who is considering which employer to choose. If he chooses an employer with insurance (that is, the insuring firm with the highest $W - p$), he will receive:

$$U_{WI}(W-p) + \beta\left[P_{WW}V_{WI} + P_{SW}V_{SI}\right] \tag{15}$$

And, if he chooses an employer without insurance (that is, the non-insuring firm with the highest W), he will receive:

$$U_{WU}(W) + \beta\left[P_{WW}V_{WU} + P_{SW}V_{SU}\right] \tag{16}$$

Therefore, he will choose insurance if:

$$U_{WI}(W-p) - U_{WU}(W) + \beta\left[P_{WW}(V_{WI} - V_{WU}) + P_{SW}(V_{SI} - V_{SU})\right] > 0 \tag{17}$$

Similarly, a sick worker will choose to be insured if:

$$U_{SI}(W-p) - U_{SU}(W) + \beta\left[P_{WS}(V_{WI} - V_{WU}) + P_{SS}(V_{SI} - V_{SU})\right] > 0 \tag{18}$$

Next, we show that if well workers choose insurance, then so do sick workers. As we argued above, single crossing implies $U_{SI}(W-p) - U_{SU}(W) > U_{WI}(W-p) - U_{WU}(W)$. Furthermore, the only difference in the terms under the β is that, for the sick, higher weight is placed on $V_{SI} - V_{SU}$ relative to $V_{WI} - V_{WU}$, by inequality 1. Thus, the term under the β is bigger for sick workers if $(V_{WI} - V_{SU}) - (V_{WI} - V_{WU}) > 0$, but this is clearly the case since $(V_{WI} - V_{WU}) < 0$ and $(V_{SI} - V_{SU}) > 0$.

Therefore, we will only seek conditions which guarantee that well workers choose insurance. Again, the well worker chooses insurance if inequality 17 holds. Since $U_{WI} - W_{WU} < 0$ and $V_{WI} - V_{WU} < 0$ at the pooling price, we need:

$$\begin{aligned} P_{WW} &< \frac{\frac{1}{\beta}(U_{WI} - U_{WU}) + V_{SI} - V_{SU}}{V_{SI} - V_{SU} + V_{WU} - V_{WI}} \\ &= \frac{V_{SI} - V_{SU}}{V_{SI} - V_{SU} + V_{WU} - V_{WI}} - \frac{\frac{1}{\beta}(U_{WU} - U_{WI})}{V_{SI} - V_{SU} + V_{WU} - V_{WI}} \end{aligned}$$

So, the conditions we have derived thus far call for the following inequalities to hold at the pooling price, $\hat{p}$:

$$U_{WU} - c < U_{WI} \tag{19}$$

$$P_{WW} < \frac{V_{SI} - V_{SU}}{V_{SI} - V_{SU} + V_{WU} - V_{WI}} - \frac{\frac{1}{\beta}(U_{WU} - U_{WI})}{V_{SI} - V_{SU} + V_{WU} - V_{WI}} \tag{20}$$

3.2.3 Sufficiency and Necessity

Next, we show that no firm and no worker has an incentive to deviate from the putative pooling equilibrium given our assumptions and conditions 19 and 20. In the case of workers, that there is no incentive to deviate follows directly from the construction of the equilibrium. We thus need only demonstrate that firms face no incentive to deviate.

In equilibrium, insuring firms pay wages $M - \hat{p}$ while non-insuring firms pay wages M. All firms are earning zero profits (by construction of $\hat{p}$). Since firms are indifferent between offering and not offering insurance at these prices, there is no incentive for any firm to switch from offering to not offering or vice versa.

Among non-offering firms, a wage increase would result in either negative profits (if any workers subsequently chose them) or zero profits (if no worker did). A wage decrease would result in zero profits since no workers would continue to choose them.

Among offering firms, a wage decrease would result in zero profits, as all workers would choose other offering firms instead of the wage decreasing one. A wage increase would result in all workers choosing the now higher-wage firm in period 1. Period 2 behavior by workers would also be the same, except possibly for turned-over well workers. By reducing $\hat{p}$ below the pooling price, it is conceivable that the deviating firm could induce turned-over well workers to choose to be insured. However, to do this, $\hat{p}$ would have to fall below W_W and this would ensure that the firm earns negative profits.

Since neither firms nor consumers have an incentive to deviate under conditions 19 and 20, we conclude that these conditions are sufficient for the pooling equilibrium. Furthermore, the conditions are plainly necessary. Without condition 19, well workers will not pool *ex post* and without condition 20, well workers will not pool *ex ante*.

3.3 Comparative Statics of Pooling

Consider the role of switching costs, c, in conditions 19 and 20. Obviously, the higher c is, the more likely it is that condition 19 holds.

Consider condition 20. The quantity $V_{SI} - V_{SU} = (1-\tau)\left[U_{SI} - max\left\{U_{SU}, U_{SI} - c\right\}\right]$ is increasing in c. On the other hand, the quantity $V_{WU} - V_{WI} = (1-\tau)\left[U_{WU} - U_{WI}\right]$ is invariant under changes in c. The second term in condition 20 is decreasing in c since the numerator is positive and does not change with c while the denominator is positive and increasing in c. Since the second term is subtracted, raising c tends to increase the right-hand-side of the condition. The first term is increasing since, as c increases, the numerator and denominator both increase by the same amount and the numerator is smaller than the denominator (and both are positive). Thus, the higher is c the more likely is a pooling equilibrium.

Turning to τ, it is easy to see that the first term of condition 20 is invariant to τ, as $(1-\tau)$

factors out of both numerator and denominator. The second term is increasing in τ since the denominator is proportional to $(1-\tau)$ and the numerator is invariant to τ. Since the second term is subtracted, its effect is decreasing in τ. So, as τ increases it is less likely that there is a pooling equilibrium.

Next, consider P_{WW}. It is straightforward to see that an increase in P_{WW} makes it less likely that condition 20 will hold (by increasing the left-hand side), and hence for there to be a pooling equilibrium. Intuitively, this makes sense. A high probability that a well worker may become sick next period gives him an extra incentive to pool with sicker workers in both this period and next. When health is "sticky" this extra incentive is blunted and well workers will less willingly pool with sick workers.

Finally, consider the effect of a frictionless labor market on the possibility of pooling. The labor market is frictionless if either $c = 0$ or $\tau = 1$. As c falls to zero, condition 19 fails to hold and the well workers fail to pool in period 2. In addition, as c falls to zero, the right-hand-side of condition 19 goes to minus infinity as the differences in V but not $\frac{1}{\beta}(U_{WU} - U_{WI})$ go to zero. Thus, there is no pooling equilibrium with c near zero.

Similarly, as τ goes to 1, the right-hand-side of condition 19 goes to minus infinity as the differences in V but not $\frac{1}{\beta}(U_{WU} - U_{WI})$ go to zero. Thus, there is no pooling equilibrium with τ near 1.

So, a pooling equilibrium is more likely when there are:

- high job switching costs, c
- low exogenous turnover rates, τ
- low levels of health state persistence, (P_{WW} close to zero)

We end this section by belaboring one implication of these comparative static conditions that will become important in our empirical work. All else equal, in industries where jobs tend to have high switching costs (and pooling is more likely), healthy and sick workers alike will tend to have health insurance coverage through their employers. In industries with low job switching costs, it will be the healthiest workers who end up at firms where health insurance is not provided; sick workers will choose the firms that provide insurance anyway.[4] Thus, the effect of switching cost on

[4] We thank Neeraj Sood and Douglas Staiger for helping us see this point.

insurance will be greater for healthy than for sick workers.

4 Empirical Tests

We examine how industry level turnover, health state persistence, and switching costs affect the probability that workers are covered by employer provided health insurance. We test both the direct implications (high τ, low c, and high P_{WW} increase health insurance coverage probabilities) and the interaction implications (the change in coverage occurs disproportionately among well workers) of the model.

4.1 Data

We use data from the 1995-2005 March Current Population Survey (CPS) Supplements merged with information from the Occupational Information Network (O*NET). The CPS is collected every month by the Census Bureau, with over 50,000 respondents each month. The O*NET data are collected occasionally by the U.S. Department of Labor, and are intended to provide information about skill requirements and occupational characteristics for a comprehensive set of occupations. The O*NET database supersedes the *Dictionary of Occupational Titles*, which was last updated in 1991. We use version 5.1 of the O*NET database, which was last updated in 2004.[5]

The O*NET data include a wide variety of information about what sorts of skills are required and what sorts of activities are performed in each job. We focus, however, on measures of human capital necessary to perform a job. In particular, the O*NET questionnaire assesses the number of months of formal on-site or in-plant training required to do the job (ost), as well as the number of months of informal on-the-job training required (ojt). We view these two variables as measures of specific human capital (Becker, 1994). In addition, the O*NET questionnaire assesses the number of years of formal education (required education) and related work experience in other jobs (related work) required to perform the job. We view these as measures of general human capital.[6]

While the O*NET data are measured at the occupation level, to conduct our tests, we need measures of employment stickiness at the industry level. Since our theory is about the provision of

[5]Detailed information about the O*NET database can be found at http://www.doleta.gov/programs/onet/

[6]O*NET reports the values of these human capital variables in ranges, along with the probabilities that employees in each occupation fall within these ranges. We construct means by taking the mid-point of each range as the value for each range as a whole.

health insurance by firms and since IRS regulations require significant uniformity across occupations within firms in health insurance provision, an occupation level measure of "stickiness" would be inappropriate. To convert the O*NET variables to the industry level, we use information on the proportion of workers in each industry in every occupation. We derive this information from the 5% Census 2000 Public Use Microdata Sample (PUMS).[7] Because of the large sample sizes in the PUMS data, we can derive precise industry level occupation weights.[8] Using these occupation weights, we calculate *ost*, *ojt*, required education, and related work at the industry level separately for each of the four major Census regions.

In some of our analyses, we use information on industry cross region level job turnover rates. Unfortunately, this information is not available in the O*NET database and cannot be derived from the PUMS data, as these data are a cross section. Instead, we use merged CPS data from November 1994 through December 2005 to calculate job turnover rates (Fallick and Fleischman, 2004).[9] We present results using job turnover measured at three months, but our qualitative results remain the same if we use one, two, or three month turnover.[10]

Using this same merged CPS sample, we construct measures of industry and region level health status persistence (P_{WW}). CPS respondents are queried about their general health on a five point scale (where 1 is excellent health, 2 is very good health, 3 is good health, 4 is fair health, and 5 is poor health). We define a transition from a well to a sick state as when a respondent reports excellent health in year t, and then reports less than excellent health in year $t+1$.[11] We link the

[7]We thank the Minnesota Population Center at the University of Minnesota (http://www.ipums.umn.edu) for making these data available.

[8]In the 2000 Census, industry is classified using the North American Industrial Classification System (NAICS) and occupation is classified using the Census 2000 occupational coding system. We use a standard crosswalk, available at the Bureau of Labor Statistics (BLS) website to translate between the NAICS and earlier systems for classifying industries used in the 1995-2002 CPS. We use similar crosswalks (also available at the BLS website) to translate between the occupation coding system in the Census and the occupation coding in the CPS.

[9]The sampling strategy of the CPS involves administering four monthly questionnaires (Months 1-4) to a family, followed by an eight month recess, and then four more months of interviews (Months 5-8). Because of this sampling technique, all households who are interviewed in March through June, say, of year t are also interviewed in March through June of year $t+1$. People who report employment in Month 1 are asked if they have the same job in each of Months 2, 3, and 4 Similarly, people who report employment in Month 5 are asked if they have the same job in each of Months 6, 7, and 8. Using unique household identifiers provided in the CPS data, and a probability match within each household based upon the age, sex, and race of the respondents, we merge CPS monthly samples from November 1994 to December 2005. We use so many years of data because the sample sizes in the industry and region cells would be too small with fewer years.

[10]Turnover rates over longer intervals are not available in the CPS.

[11]We experimented with alternate definitions of well and sick, In particular, we estimated our models defining a respondent as well if in excellent, very good, or good health, but there were no qualitative changes in our results using this alternate definition of health status.

industry and region level variables (*ost*, *ojt*, required education, related work, P_{WW}, turnover, and mean industry earning) to the 1995-2005 CPS March Supplements.

Health insurance coverage is measured using the March CPS. We code both uninsured individuals and individuals who are covered by health insurance not through their employer as not being covered by employer-provided health insurance.[12] We exclude people from our sample who are under age 18 and those who are unemployed or out of the labor force. All of our tests of the hypotheses involve individual-level regressions using this data set. Table 1 shows means and standard deviations, using CPS sample weights, for all of the variables included in our models.

4.2 Results

Figures 1 and 2, show the average level of human capital required to perform jobs in each industry plotted against the probability of employer-provided health insurance coverage. Each point in these graphs represents an industry. We also plot three month turnover rate against health insurance coverage. In each graph, we plot the best fitting line representing the relationship between these points. Our motivation in presenting these graphs is to give the reader a sense for how strongly the data support our hypotheses in the absence of statistical adjustments.

Figure 1 shows our two measures of specific human capital (*ojt* and *ost*), as well as turnover, plotted against employer health insurance coverage. Consistent with our hypothesis that high turnover reduces the likelihood of pooling, workers in industries in which there is high turnover are substantially less likely to be covered. In industries where job-specific human capital requirements are highest, workers are most likely to be covered by their employers. The results from these graphs are consistent with our hypothesis that pooling is more likely in industries where the costs of job switching are higher.

Figure 2 plots our two measures of general human capital (required education and related work) against employer health insurance coverage. These two figures show that in industries that require high levels of general human capital, workers are more likely to be covered by their employers. These results are not predicted by our theory of adverse selection and seem more consistent with a

[12]We considered using employer offers of insurance as our principal independent variable; however, the CPS does not generally collect this information. Our results are not sensitive to defining employer health insurance coverage differently within the constraints of the CPS data. For example, we obtain qualitatively similar results when we drop people who who receive insurance through their spouse, other private sources, Medicare, or Medicaid from the analysis.

Table 1: Descriptive Statistics

Variable	Mean	S. Dev.	Measurement Level
Health Insurance Coverageby Employer	58.39%	49.29	Individual×Year
Female	45.61%	49.81	Individual×Year
Age	38.77%	12.00	Individual×Year
Employer Size: 10-24	9.32%	29.07	Individual×Year
Employer Size: 25-99	12.89%	33.51	Individual×Year
Employer Size: 100-499	13.82%	34.51	Individual×Year
Employer Size: 500-999	5.80%	23.19	Individual×Year
Employer Size: 1000+	38.82%	48.73	Individual×Year
Health: Very Good	35.83%	47.95	Individual×Year
Health: Good	23.00%	42.08	Individual×Year
Health: Fair	4.63%	21.02	Individual×Year
Health: Poor	0.77%	8.77	Individual×Year
Black	10.43%	30.57	Individual×Year
Non-White, Non-Black Race	4.67%	21.10	Individual×Year
Total Earnings (000s of $)	32.48	36.99	Individual×Year
Mean Industry Earnings(000s of $)	29.52	11.22	Industry×Region
P_{WW}	52.37%	8.40	Industry×Region
Marginal Tax Rate (%)	18.25%	6.08	Individual×Year
Three-Month Turnover Rate	6.39%	2.77	Industry×Region
Pension Plan Coverage	80.23%	39.82	Individual×Year
Req. OJT (yrs)	0.78	0.44	Industry×Region
Req. Education (yrs)	13.04	0.76	Industry×Region
Req. Related Work (yrs)	2.14	0.80	Industry×Region
Req. In-Plant Training (yrs)	0.78	0.53	Industry×Region
N	542,711		

Note: Only 310,358 workers in our sample answered questions about employer pension plan coverage.

Figure 1: Employer HI Coverage, Turnover, and Specific Human Capital

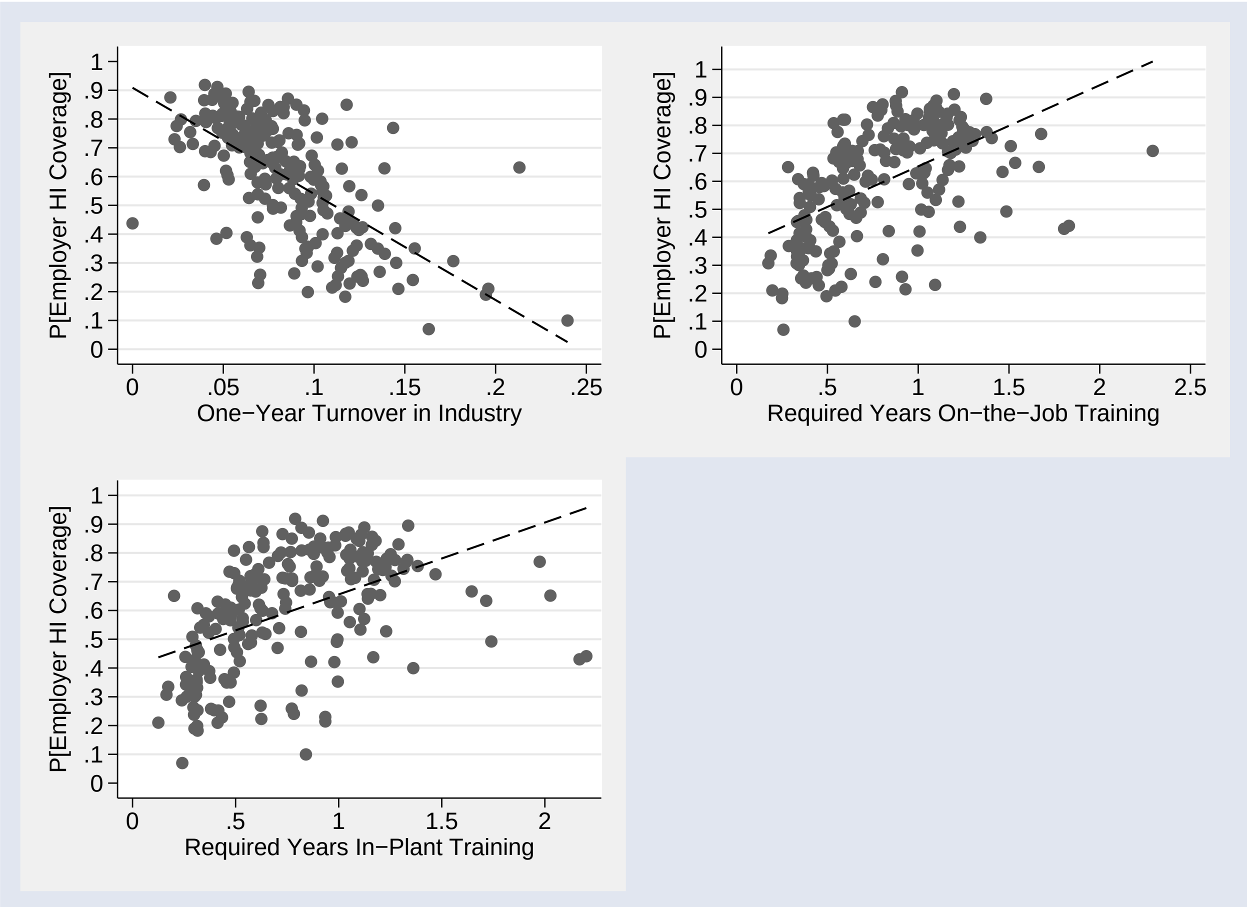
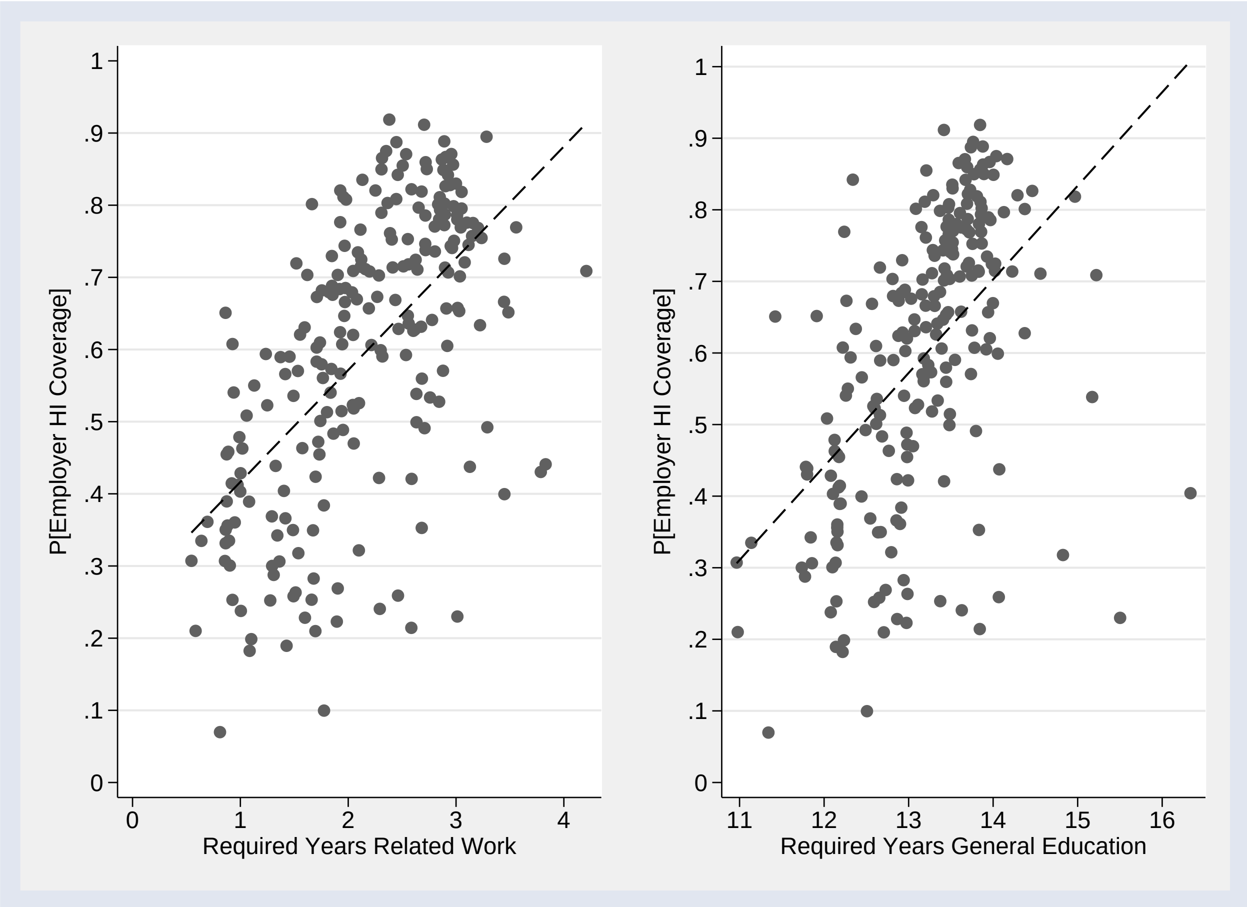


Figure 2: Employer HI Coverage and General Human Capital



story of a segmented labor market, where mainly workers in high-skill-requiring industries receive health insurance coverage.

Table 2 contains regression coefficients from linear probability models.[13] The first two columns show how the probability of having employer-provided health insurance coverage varies with our measures of human capital (*ojt*, *ost*, related work, and required education). We include a number of variables in all three regressions as controls. For all but the smallest employers, health insurance provided to workers is not taxed. Workers in higher marginal tax brackets benefit more from the exemption of health insurance from taxation, thus, workers' *income* is an important control

[13]We present linear probability models throughout rather than probits or logits to facilitate interpretation of the coefficients (which can be read as marginal effects). The mean marginal effect estimates are substantially the same whether we use the LPM, probits, or logits. We adjust all standard error estimates for clustering at the industry, region, and year level.

variable, as is employer size.[14] The regressions also include demographic variables—female, age, general health status, and race dummies. These regressions directly test our hypothesis that the probability of employer insurance provision should increase with the costs of switching jobs, since high levels of job-specific human capital requirements will increase the costs of switching and decrease with turnover.

We run two separate regressions, one with and one without turnover, because it is likely that our measure of turnover is endogenous. In particular, our measure of turnover does not distinguish between job changes caused for exogenous and for endogenous reasons. For example, there is a large literature arguing that unhealthy workers with health insurance delay job changes because they would have difficulty finding coverage at the same level of benefits and at the same price in a new job (c.f. Gruber and Madrian, 1997).

These regressions provide confirmation for our basic theoretical predictions. Increases in both measures of specific human capital, ojt and ost, lead to substantial increases in employer health insurance coverage (though the coefficient on ojt is not statistically significant). By contrast, increases general human capital lead to either less coverage (related work) or a small and statistically insignificant increase in coverage (required education).

Other coefficients also are consistent with our theory. For instance, turnover has a strong negative association with employer-provided health insurance coverage, and health persistence (P_{WW}) is negatively associated with insurance provision (though the coefficient is not statistically significant). The probability of employer-provided health insurance is increasing in individual and industry mean income as well as in individual marginal tax rate. However, for reasons we will discuss in the next paragraph, we do not view these coefficients as providing an entirely convincing test of our theory.

Columns (3) and (4) in Table 2 show the results of a falsification exercise, in which we run the same regressions as in columns (1) and (2) except that the dependent variable is an indicator for whether a worker is covered by a pension plan through his employer. Presumably, our theory of adverse selection in health insurance should not apply in the case of pensions, where health is a less important driver of pricing. In these pension regressions, none of the human capital measures have a statistically significant effect. Some of the other coefficients, such as turnover and P_{WW},

[14] In the CPS, employer size is reported as a series of dummy variables, with category 1 representing the smallest employers (< 10 employees) up to category 6 representing very large firms ($> 1,000$ employees).

Table 2: Switching Costs, Turnover, and Health Insurance

	(1)	(2)	(3)	(4)
	HI	HI	Pension	Pension
Female	-4.12^{**}	-4.12^{**}	-0.553^{**}	-0.548^{**}
	(0.186)	(0.186)	(0.194)	(0.194)
Age of person	5.15^{**}	5.15^{**}	7.80^{**}	7.80^{**}
	(0.101)	(0.101)	(0.136)	(0.136)
Emp. Size: 10-24	17^{**}	17^{**}	1.03^{*}	1.03^{*}
	(0.375)	(0.375)	(0.502)	(0.502)
Emp. Size: 25-99	28.3^{**}	28.3^{**}	1.7^{**}	1.71^{**}
	(0.405)	(0.405)	(0.439)	(0.439)
Emp. Size: 100-499	34.3^{**}	34.3^{**}	3.22^{**}	3.22^{**}
	(0.395)	(0.395)	(0.434)	(0.433)
Emp. Size: 500-999	36.7^{**}	36.7^{**}	3.97^{**}	3.97^{**}
	(0.463)	(0.463)	(0.476)	(0.476)
Emp. Size: 1000+	37.9^{**}	37.9^{**}	4.59^{**}	4.59^{**}
	(0.400)	(0.400)	(0.402)	(0.402)
Health: Very Good	0.369^{*}	0.370^{*}	-0.523^{**}	-0.523^{**}
	(0.161)	(0.161)	(0.181)	(0.181)
Health: Good	-1.79^{**}	-1.79^{**}	-2.49^{**}	-2.49^{**}
	(0.198)	(0.198)	(0.220)	(0.220)
Health: Fair	-3.87^{**}	-3.87^{**}	-5.42^{**}	-5.42^{**}
	(0.367)	(0.367)	(0.427)	(0.427)
Health: Poor	-6.75^{**}	-6.74^{**}	-8.31^{**}	-8.29^{**}
	(0.801)	(0.801)	(1.05)	(1.05)
Black	0.472^{+}	0.471^{+}	0.565^{+}	0.569^{+}
	(0.263)	(0.263)	(0.304)	(0.304)
Non-White, Non-Black Race	-1.44^{**}	-1.43^{**}	-0.564	-0.555
	(0.370)	(0.370)	(0.406)	(0.406)
Income (000s of $)	1.72^{**}	1.72^{**}	1.35^{**}	1.35^{**}
	(0.0454)	(0.0454)	(0.0378)	(0.0378)
Mean income in Ind.	1.88^{**}	1.71^{**}	1.09^{**}	0.98^{**}
	(0.376)	(0.373)	(0.341)	(0.338)
P_{WW}	-1.89	-1.5	-2.13^{+}	-1.81
	(1.756)	(1.87)	(1.27)	(1.28)
Marg. tax	53.5^{**}	53.6^{**}	44.9^{**}	44.9^{**}
	(1.52)	(1.52)	(1.38)	(1.38)
Req. OJT (yrs)	3.26	3.25	-4.86	-4.76
	(4.46)	(4.48)	(4.17)	(4.16)
Req. In-Plant Training (yrs)	13.4^{**}	14.3^{**}	2.83	3.86
	(4.59)	(4.59)	(4.22)	(4.22)
Req. Related Wrk (yrs)	-5.12^{*}	-6.02^{*}	3.50	2.54
	(2.54)	(2.52)	(2.24)	(2.21)
Req. Educ. (yrs)	0.643	0.939	-1.37	-1.14
	(0.912)	(0.902)	(0.897)	(0.889)
Turnover		-0.337^{**}		-0.285^{**}
		(0.0696)		(0.0751)
Constant	-15.3	-15.5	43.3^{**}	43.4^{**}
	(10.5)	(10.4)	(10.6)	(10.5)
Observations	542,711	542,711	310,358	310,358
R-squared	0.26	0.26	0.16	0.16

Notes: Linear probability regressions. Industry, year, and region cluster adjusted standard errors in parentheses. Regressions include a full set of industry, year and region dummies (results not shown).
+ significant at 10%; * significant at 5%; ** significant at 1%.

do have significant effects with directions that would be predicted by our theory were it to apply to pensions. Our interpretation of this is that we should not take the coefficients on turnover and P_{WW} in the health insurance regressions of columns (1) and (2) as serious tests of our theory—they may be explained by other labor market forces that we do not model.

We turn next to the interaction test of adverse selection discussed at the end of Section 3.3. Recall that our theory implies that adverse selection should have its largest effect on healthy workers in industries with low job switching costs. Sicker workers, regardless of switching costs, and healthy workers in high switching cost industries should be affected less by adverse selection. This reasoning suggests a straightforward test: in a regression of employer-provided health insurance, the coefficient on an interaction term between worker health and our measures of job-specific human capital should have a positive sign.

In Figure 3 we plot the predicted values from a bivariate linear regression of employer health insurance coverage on *ojt* separately for healthy workers and sicker workers over the full range of *ojt* values in our data. Sick workers in industries with high on-the-job training requirements are just as likely as sick workers in industries with low on-the-job training requirements to be covered. Healthy workers, by contrast, are about 8 percentage points more likely to be covered in the industry with the highest on-the-job training requirements than in the industry with the lowest such requirements. This pattern of results is as our theory predicts.

In Table 3, we conduct the interaction test more systematically. First, we regress health insurance coverage separately on each of the four human capital measures and an interaction term with health, while controlling for the same demographic and industry level variables shown in Table 2. These results are shown in column (1) of Table 3: that is, column 1 presents the results from four separate regressions, one each for *ojt*, *ost*, related work experience, and education. The interacted job-specific human capital measures have the expected signs: for healthy workers, a one year increase in *ojt* increases employer coverage by about 3.3 percentage points relative to sick workers; a one year increase in *ost* increases it by 3.1 percentage points. By contrast, the interaction results for general human capital are inconsistent: for healthy workers, a one year increase in related work experience increases employer coverage by 1.7 percentage points, while a one year increase in required education actually decreases employer coverage by 1.2 percentage points.

The results in column (2), representing a single regression in which all the human capital and

Figure 3: Worker Health, Specific Human Capital, and HI Coverage

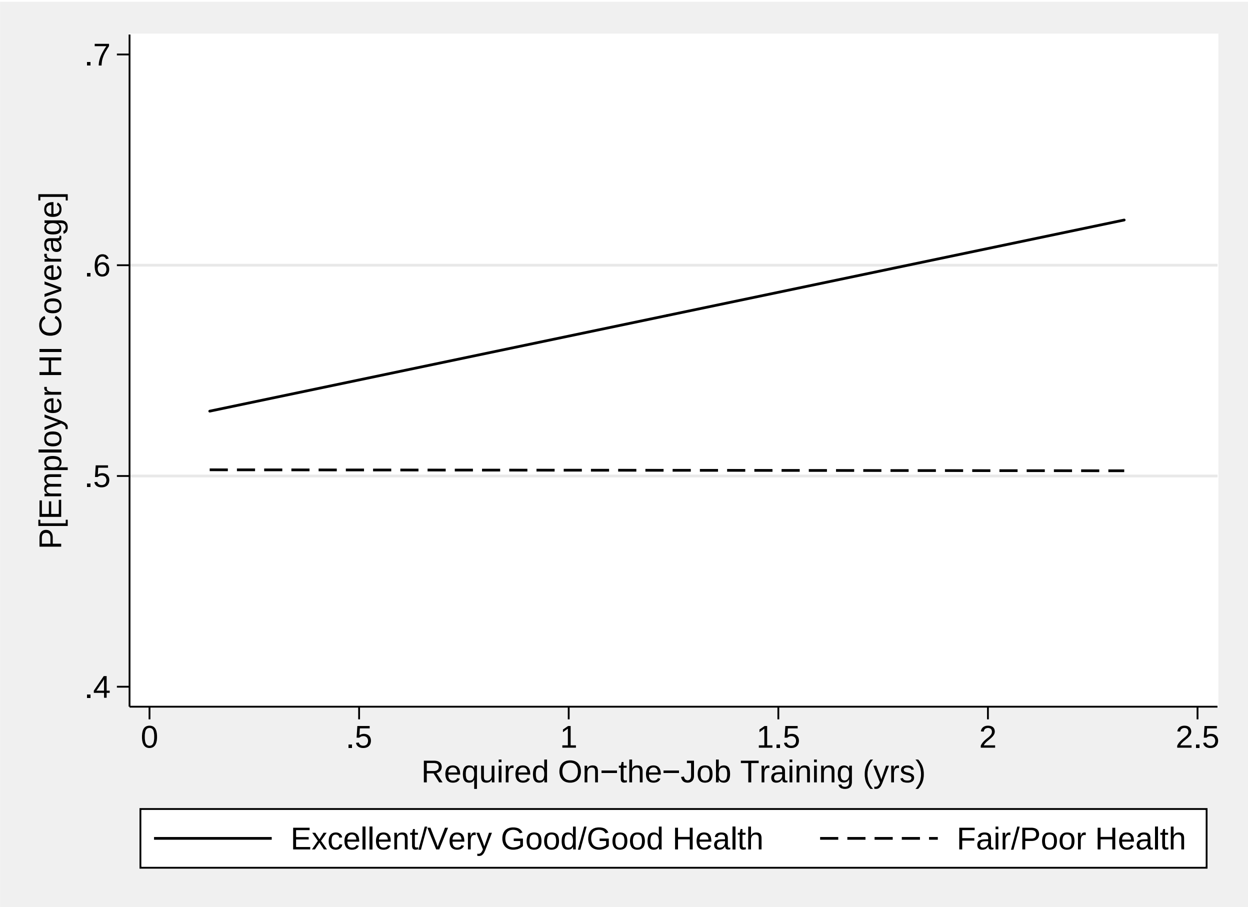


Table 3: Health and Job-Specific Human Capital Interactions

	HI	HI	Pension	Pension
	(1)	(2)	(3)	(4)
Req. ojt.	5.50**	5.93	4.65**	-6.43
	(1.46)	(5.41)	(1.65)	(5.47)
Health is E/VG/G * Req. ojt.	3.35**	-2.86	-0.588	1.57
	(0.650)	(3.22)	(0.956)	(3.75)
Req. plant trn.	5.46**	8.06	4.98**	6.15
	(1.31)	(5.27)	(1.46)	(5.78)
Health is E/VG/G * Req. plant trn.	3.05**	5.73*	-0.710	-3.34
	(0.508)	(2.79)	(0.783)	(4.02)
Req. related work	1.96*	-4.77	2.52**	2.50
	(0.781)	(3.12)	(0.881)	(3.03)
Health is E/VG/G * Req. related work	1.67**	-0.415	-0.296	0.914
	(0.368)	(2.02)	(0.527)	(2.21)
Req. educ.	-0.317	0.982	-1.08	-1.05
	(0.712)	(1.14)	(0.813)	(1.29)
Health is E/VG/G * Req. educ.	−1.20**	-0.347	0.218	-0.317
	(0.426)	(0.723)	(0.552)	(0.964)
Observations	542,711	542,711	310,358	310,358
R-squared		0.26		0.16

Notes: Linear probability model results. Year, region, and industry cluster adjusted standard errors in parentheses. In columns (1) and (3), each pair of cells in the table (human capital measure and the interaction between human capital and health) are coefficients from a different regression. In addition to the terms reported in the table, the regressions include a full set of industry, year, and region dummies as well as controls for age, sex, race, health, employer size, earnings, average industry earnings, P_{WW}, marginal tax rate (results not shown).
+ significant at 10%; * significant at 5%; ** significant at 1%.

interaction terms are entered together, are even more striking. The only statistically significant result among the interaction terms is for required in-plant training. Among healthy workers, a one year increase increases employer coverage by 5.7 percentage points relative to sicker workers. Neither of the interaction terms involving the general human capital measures are statistically significant and their point estimates are negative. The same is true for the *ojt* interaction term. Generally speaking, these results provide some confirmation for our theory—presumably multicollinearity explains the insignificance of the *ojt* interaction term.

Finally, columns (3) and (4) in Table 3 replicate the specification in columns (1) and (2), except we use pension plan coverage rather than health insurance as the left-hand-side variable. This falsification test is analogous to the one we show in columns (3) and (4) of Table 2. In these regressions, none of the health and human capital interaction terms are statistically distinguishable from zero. As in Table 2 these results fail to falsify our predictions on the effect of human capital.

5 Conclusion

The literature on adverse selection commonly asserts that one benefit of employer provided health insurance is that it enforces pooling of risks across sick and well people within a firm. This allows the "insurance" aspect of health insurance to work, so long as people do not decide where to work based upon their health status.

Our theoretical section develops this idea and examines the conditions under which the labor market can solve the adverse selection problem in health insurance. In a frictionless labor market, the adverse selection problem from the health insurance market simply "spills over" into the labor market, rendering employer provision impotent as a corrective. By contrast, if it is costly to switch jobs and if health status is not too sticky, then employer provision can solve the adverse selection problem. Furthermore, when employer provision fails to solve the adverse selection problem, the theory predicts that the increased uninsurance will fall disproportionately on healthier workers.

We take this theory to data from the Census's Current Population Survey and the Dept of Labor's O*NET database. Our estimates reveal that, controlling for several salient variables, industries with stickier labor markets (jobs requiring more specific human capital) have statistically significantly higher rates of health insurance. Furthermore, it is primarily healthy workers who see increasing coverage rates. However, the effect sizes we measure are modest. According to our estimates, moving a worker from an industry with the average level of required on-the-job training (0.8 years) to the industry with the maximum (2.3 years) would increase coverage by 5.6 percentage points. On average, coverage rates in our data are 56% (and 57% for healthy workers).

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