

**Asymmetric information and countermeasures
in early 20c American microinsurance**

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For presentation at
Fifth International Microinsurance Conference
Dakar, Senegal
November 2009

For comments and suggestions I thank Ran Abramitzky, George Alter, Ben Chabot, Herb Emery, Tim Guinnane, Alfonso Herranz Loncan, Bob Margo, Javier Silvestre, Ken Snowden, Werner Troesken, and other participants in seminars at Stanford (SITE 2006), Michigan, George Mason, Barcelona, Zaragoza, Ball State, Southampton, and at the 2008 Economic History Association meetings and 2009 World Economic History Congress.

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ABSTRACT: According to standard economic theory, asymmetric information should characterize many insurance contracts. Empirically, efforts to test such hypotheses have been inconclusive. Using historical data, this paper takes a more direct approach in three ways. First, it tests for the presence of moral hazard and adverse selection in a straightforward type of insurance contract, for short-term disability insurance, in which microinsurance funds paid cash benefits to workers in ill health. Second, this paper avoids much of the endogeneity problems of recent studies because insured workers had no choice in their contract's premium and benefit structure. Third, insurers understood the importance of asymmetric information and included countermeasures in these contracts. This paper estimates the strength of such countermeasures. It concludes that evidence for the presence of adverse selection was stronger than that for moral hazard, but that both were present and that insurer countermeasures against each effectively reduced claims.

The ability of ordinary workers who were not insurance professionals to form and manage microinsurance funds was the rule rather than the exception for much of the history of health and disability insurance. Early twentieth century American workers operated hundreds of such sickness funds, in every region and in a variety of industries. These funds recognized the potential for sick pay to induce a moral hazard in their members that led to additional claims and paid days off, as well as the potential for adverse selection when membership was voluntary. In addition to such ex post strategies as close monitoring of claimants, disability microinsurers employed particular ex ante methods to limit claims that have not been carefully examined. This paper examines ex ante efforts to discourage opportunistic behavior by structuring insurance contracts so as to counter inherent incentives towards moral hazard and adverse selection.

Workers had operated such microinsurance funds for centuries. Many guilds had provided sickness benefits to members since the Middle Ages. By the turn of the twentieth century, friendly societies in Britain provided wage replacement benefits to perhaps two-thirds of workingmen (Riley 1997). In the United States skilled workers had organized the first sickness benefit societies in the eighteenth century, and after the Civil War the idea of mutual sickness insurance had spread to industries such as cotton textiles and ferrous metals (Murray 2007, 73-77). Nor does this organizational form belong exclusively to the past. The legal setting for Voluntary Employee Beneficiary Associations, recently adopted by American automakers and unions, was based on laws regarding mutual sickness benefit societies (Murray 2007b). West Africans tired of waiting for government programs to appear have begun their own mutual sickness societies that cover over 200,000 people (Lacey 2005). The notion of mutual

microinsurance against the costs of ill health is not a peculiarly American idea, then, but it is one that Americans built upon to create the largest extragovernmental network of health insurance in the world. The beginnings of that network can be traced back to the sickness funds of the early twentieth century.

Sickness insurance funds

In *Democracy in America* Alexis de Tocqueville observed that Americans were constantly forming associations to deal with collective problems (Volume II, Part 2, Chapter 5). Just so, when Americans recognized the feasibility and efficiency of mutual sickness microinsurance societies, they organized into groups to finance and operate them. By 1920 or so, these microinsurance funds covered about a third of the industrial labor force—a share that had been growing from the late nineteenth century as the labor force itself grew absolutely by some 27 million (Murray 2007, 91). Mutual sickness funds, sponsored by fraternal societies, employers, and labor unions, provided the lion's share of wage disability insurance in the United States until the mid- to late- 1930s, and did so effectively (Emery and Emery 1999; Emery 1996; Beito 2000; Murray 2007).

The numbers of members of these microinsurance funds could typically be counted in the dozens. A U.S. government survey of these funds in 1908, which will be discussed in more detail below, reported the number of members in each responding microinsurance fund. Figure 1 summarizes the results in terms of the share of all funds with the number of members falling in various categories. The long right-hand tail skews the average number of members towards the high side, so that the mean number of

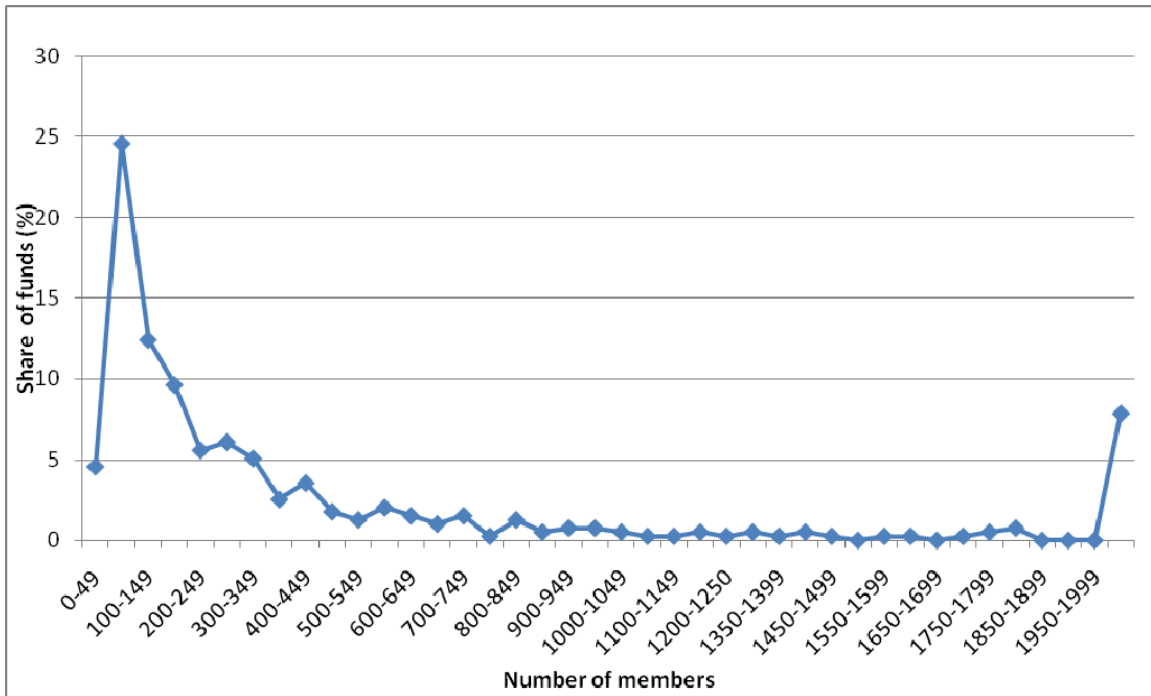


Figure 1. Distribution of sickness funds by number of members. Source: U.S. Commissioner of Labor (1911).

members is 712. However, the median number is just 186.5, and indeed 29 percent of funds had fewer than 100 members. Elsewhere I report on the lack of relationship between the number of members and financial stability (Murray 2007, 104-107).

Overall, these relatively small insurance societies demonstrated a remarkable level of skill in providing coverage to workers.

To initiate coverage, a new employee either applied to join his company’s fund or was automatically enrolled if the employer made membership compulsory. Sickness funds with voluntary membership set their fees and benefits so as to appeal to a wide range of workers. Early in the twentieth century, two-thirds of funds charged an entrance fee of just over a dollar on average. After acceptance into the society, members paid an average of 10 cents a week in “dues” (i.e., premiums). The level of dues and benefits

was tied to a worker-member's wage level (Murray 2007). The usual arrangement involved turning over a few coins on pay day directly to a collector from the fund. Dues were most often assessed as a flat rate per worker, not as a share of earnings. At average wages of 1909 manufacturing workers, dues cost about 1 percent of earnings.¹ Limiting benefits to a fraction of the worker's usual pay was an important principle. Employers that managed or advised sickness funds were acutely aware of the incentive to take extra time off created by a sick benefit nearly as valuable as an entire pay packet (NICB 1923, 106-110).

To make a claim, workers notified their fund upon becoming sick. The fund verified the claim by sending a physician or a committee of fellow members to investigate. Such monitoring was thought to be necessary to limit "malingering," or unnecessary claims: that is, moral hazard (Pauly 1968). After a waiting period of a few days, the ill worker received his sick benefit of about five dollars a week. Given turn of the century absence rates and pay scales, the expected value of the insurance turned out to be very close to the value of dues payments, making it a reasonably fair exchange. About a fourth of workers were sick enough in a given year to make a claim, and these conditions on average lasted about a month. The expected value of benefits would thus add up to $(0.25) * (4.5 \text{ weeks of illness} - 1 \text{ week waiting period}) * (\$5.00 \text{ per week sick benefit}) = \4.50 . Meanwhile the typical dime per week dues payment added up to a little over \$5.00 per year in dues, making the effective load of such a stylized insurance

¹ U.S. Bureau of the Census (1976), ser. D 802. Other sources yield similar estimates; see Costa (2000), 161.

contract about 10 percent (Murray 2007). Relative to self-insurance through savings or sick benefit riders on industrial insurance, the sickness funds seemed like a reasonable bargain to many workers.

Asymmetric information and countermeasures in sickness insurance funds

In early twentieth century America, insurance executives believed it was self-evident that moral hazard and adverse selection plagued health and disability insurance markets. As a consequence, insurance companies had by and large avoided insuring the risk of ill-health. Whether in the form of individual or group health policies, commercial insurers held only the smallest share of this business. At the root of their repeated losses in this market, they believed, was a fundamental inability to manage informational asymmetries. John F. Dryden of the Prudential predicted in 1909 that commercial health insurance would never displace the fraternal insurers that enjoyed “perfect knowledge of and complete supervision over the individual members” (Murray 2007, 33). Over time actuaries at insurance companies developed a more sophisticated understanding of informational asymmetries. E.E. Cammack, later a vice-president at Aetna, recognized that failing to account for moral hazard (a term he used) resulted in poorly estimated claims tables (Cammack 1921, 279). Actuaries also understood that adverse selection—again, using that term—was also a potential problem, although they disagreed on how to manage it (Craig 1920, 82).

The smaller disability microinsurance funds, many with decades of rule-of-thumb experience, understood both the effects of informational asymmetries and how to mitigate them (Smith and Stutzer 1995). For example, some funds aimed to thwart selection bias

by screening on the observable characteristic of the applicant's age. These funds refused to accept applicants above the age of 45 or 50 in order to prevent less healthy workers from joining. The limit applied only to potential members; those already in the fund who reached these age limits remained covered until their retirement.

Another strategy to limit adverse selection, which this paper considers in some detail, was to require new hires to wait some weeks before accepting them as members. Table 1, Panel A, shows that more funds imposed such probationary periods than did not, with a median period of four weeks. The intention behind these probationary periods was specifically to force applicants to reveal any chronic conditions, which would then lead to the applicant's exclusion. While some employers required new hires to join their insurance fund, others made membership voluntary. Selection bias was a particular problem among funds with voluntary membership, and so voluntary funds were twice as likely as compulsory funds to impose probationary periods. When the National Industrial Conference Board (NICB) studied disability microinsurance societies they observed that making membership voluntary (NICB 1923, 6) "tends to include chiefly those who feel the need of provision, and so makes for an unfavorable selection of risks." To mitigate the problem, an Illinois state commission observed (Illinois 1919, 537), "in the voluntary associations a period of probation may be set up by the older employees in the association in order to discover what sort of risk a new employee promises to be, before he is admitted to membershipBy this means [the employer's insurance fund] is freed from risk of sickness benefits arising in connection with the casual and shifting body of his employees."

A separate strategy to mitigate moral hazard imposed a waiting period between the onset of ill-health and the beginning of benefits. Table 1, Panel B, shows that the most common duration was one week, which effectively created a deductible of a week's pay. As a consequence, workers were less likely to take time off for transient conditions. The Illinois commission (1919, 539) assessed the likely results of this strategy: "The establishment of a waiting period before a sick member is entitled to benefits is an additional check on malingering." The NICB concurred (1923, 11): "[T]he waiting period should be long enough to discourage malingering and at the same time should not be so long as to work a hardship on those who suffer from minor injuries and illnesses." Even a brief waiting period might work, according to a publishing firm in Pennsylvania (NICB 1923, 143): "The fact that [workers] must themselves carry the first two days of illness...has greatly decreased the non-attendance at work."

Further evidence that disability microinsurance funds were aware of moral hazard appears in differential claiming rules for injury and illness. To the extent that injury risk was associated with operation of large and dangerous machines at work, funds anticipated that insurance coverage would not induce an injury moral hazard, although an illness moral hazard was quite possible. Therefore, the NICB observed (1923, 127), relative to sickness claims, "there is not the same reason for the postponement of benefits in case of accidents. An accident is not preceded by symptoms that may be detected after the lapse of a certain period. Neither do members join an association in order to obtain benefits for an anticipated accident. Benefits should therefore be paid for accidents occurring on the day the member joins the association." While some sickness funds reported no waiting period at all for injury benefits, other funds decided to reduce the

waiting period for injuries to less than that for sickness. These funds too thought that benefits were less likely to induce a moral hazard in the case of injury than in the case of sickness (NICB 1923, 134).

Whether moral hazard and adverse selection presented serious problems in disability microinsurance was the subject of public debate as well. Progressive promoters of compulsory government insurance schemes claimed, reasonably enough, that it would avoid problems that private insurance had with adverse selection, by encompassing the entire risk pool (Cheney 1919). I. M. Rubinow, a physician, economist, and leader of the American Association for Labor Legislation, dismissed moral hazard concerns with a wave of his hand (Rubinow 1904, 371): “We must think the workingman a great deal less susceptible to physical discomfort and bodily pain than ourselves, if we believe that the few dollars of weekly allowance will reconcile him to disease or injury.” Claims that the health insurers of the early twentieth century encountered asymmetric information can be tested. Whether insurance actually is subject to these problems in the present is an open empirical question.

Asymmetric information in historical and present day studies of insurance

While the presence of moral hazard or adverse selection follows more or less directly from standard economic analyses of insurance markets, empirical evidence to support their existence has been hard to come by. Health economists typically infer moral hazard from the existence of a downward sloping demand curve. In this view the availability of insurance benefits does not change the insured’s underlying risk-taking behavior. Rather, the insured purchases more medical care (i.e., the insured against event) at the lower

prices that insurance coverage makes possible. The classic demonstration of demand for medical care holding selection biases constant appeared in the famous RAND experiment that randomly assigned participants to different kinds of insurance (Manning et al. 1987), thus making exogenous what had previously been an endogenous decision. These researchers estimated a price elasticity of demand for health care services of 0.2.

Difficulties with unobserved heterogeneity in nonrandomized trials can be seen in two studies. Puelz and Snow (1994) aimed to show that auto insurance buyers would select into multiple equilibria according to their expected accident probabilities. The categories of insurance were determined by the amount of deductible, so that the self-identified safer drivers were willing to accept a higher deductible while the riskier drivers wanted a lower deductible. Chiappori and Salanie (2000) objected that Puelz and Snow's models used functional forms that were too restrictive, relied on too few independent variables and thus might suffer from omitted variable bias, and did not control for the insured's driving history—information that was in fact available to the insurer. Chiappori and Salanie reported that using a nonlinear measure of deductible choice reduced the effect of accident risk to insignificance. Their own model produced no evidence of asymmetric information in the French market for auto insurance.

Concerning health insurance in particular, Cardon and Hermalin (2001) proposed a model which linked consumer choice of policies in terms of premiums and out of pocket expenditures with later health outcomes via private (unobservable) information on the insured's health. This model provided separate estimated variance parameters for signals and noise that could potentially test for adverse selection. The variance of the signal parameter indicated that private information was too limited to account for much

claiming behavior, according to the authors. They found no evidence of superior information on the part of insurance buyers. Instead, observable demographics accounted for a sufficient share of claims variability to rule out asymmetric information.

Two recent historical studies found a limited role for asymmetric information in health insurance. Gottlieb (2006) took the test statistic introduced by Chiappori and Salanie (2000) and estimated its values with late nineteenth century individual level data from the Historical Labor Statistics Project of the University of California. This statistic was formed by a ratio of residuals from two probits, one for insurance coverage and the other for sickness or injury. Under the null of no correlation between the two, this statistic should be distributed as a $\chi^2(1)$. His estimations accepted the null, indicating no evidence of asymmetric information. Thomasson (2004) relied on differences in premium setting between commercial insurers and Blue Cross in her study. Blue Cross largely but not exclusively relied on community rating, while commercial insurers employed experience rating. She hypothesized that if adverse selection were a problem, Blue Cross should attract those more likely to make claims by charging them less than the value of their expected losses. Using 1957 survey data she found weak evidence of such behavior in individual policies and no evidence in group policies.

It seems odd that such an intuitively appealing phenomenon cannot be supported empirically. It is particularly baffling since, as one prominent health economist has stated (Cutler 2002, 2145), “Adverse selection is empirically very important.” One problem with recent studies may be that the test statistics on which they depend are less powerful than advertised. It may also be that present-day insurance markets that allow

customers to choose a combination of premiums, deductibles, and coinsurance that suits them leads to insurmountable endogeneity problems.

The present paper offers four advantages over previous efforts to test for asymmetric information. First, as previously noted, the potential moral hazard is a relatively direct one. It is easier to imagine staying home from work an extra day or two in order to receive cash benefits than it is, as in present day studies, to imagine that insurance benefits could raise the probability of an event (an auto accident) with potentially disastrous health consequences. Instead, it considers cash payments to workers who stayed home, which provided a direct source of utility in addition to the time off work. Historically, a combination of cash and leisure would have been plenty attractive relative to a full day of hard labor. In those days a sick worker looked forward to “blessid idleness,” according to the fictional Mr. Dooley (Dunne 1902, 142), since “no matther what’s th’ matther with him, he don’t suffer half as much pain as he would in pursoot iv two dollars a day.”

Second, the complicating role of consumer choice in policy characteristics is not present in this sample. Workers at firms with disability microinsurance funds faced a take-it-or-leave-it decision; some funds charged differential premium rates based on the worker’s wage, but in no case could the worker choose differential probationary periods, waiting periods, or wage replacement levels.

Third, the dataset used here provides variables that allow for a clean distinction between adverse selection and moral hazard, which is ordinarily difficult in cross sections that propose to test for correlations between insurance status and claim behavior. Fourth, this dataset also provides variables on countermeasures that insurers used to mitigate each

kind of adverse selection. Thus, for the present results to be spurious, they would have to be so both in the direction of the incentives provided by the insurance coverage and in the direction of the disincentives provided by these claim requirements.

Data source

This study relies on a survey of wage replacement microinsurance funds from the early twentieth century. The United States Commissioner of Labor canvassed some 1,200 insurance societies in 1908, collecting information for fiscal year 1907 for most societies, 1906 for some, and for a few from 1905 or 1908. The survey seems to have been conducted carefully, since the bureau reported having sent special agents to particular firms, unions, and sick fund offices to inquire about their benefit operations. Funds sponsored by employers, called establishment funds, provided the most detailed data. Of these establishment funds, 429 provided the temporary disability benefits of interest, and within this set, 370 funds provided a complete set of necessary responses (U.S. Commissioner of Labor 1909). The Commissioner of Labor's *Report* published line by line responses from each microinsurance fund to questions including the year of the fund's founding; number of members; values of entrance fees, dues, and benefits; durations of probationary and waiting periods; and availability of medical benefits. The median fund had fewer than 200 members, which suggests that the typical fund member personally knew a large share of the society's membership.

These microinsurance survey data allow testing for correlations between membership requirements and the value of benefits on the one hand, and claiming behavior on the other. "The main hurdle to empirical work," Cardon and Hendl (2001,

409) wrote, “is the lack of appropriate data on contracts as well as on performance.” The data examined here concern just such contracts, and include information on the frequency and process of making a claim. In early disability insurance, contracts were characterized by just a few parameters, and the survey examined in this paper recorded virtually all possible variables that might describe contracts and performance both.

Table 2 reports the set of variables used in this analysis as well as their means and, for continuous variables, the standard deviations. All regressions in this study examine a measure of claim probability on the left hand side: the log of the number of claims in a fund divided by the number of members. Twenty two percent of workers in sampled funds made claims against their fund for sickness benefits in the surveyed year. The number of members itself also provides a measure of scale, and the regressions were weighted by this variable to account for the wide variety in the size of funds. The smallest had only 26 members while the largest had 27,585, a difference of three orders of magnitude. In addition, sixteen percent of funds provided medical benefits, which generally meant free attention by a physician employed by the insurer.

An important characteristic of establishment funds was whether membership was compulsory or voluntary for the firm’s employees. Historians have asserted that compulsory membership was typical. Tone (1997, 59) criticized such “so-called benefits” as “coercive.” According to her view, “employee participation in [benefit] programs was usually mandatory.” However, the Commissioner of Labor survey found voluntary membership in nearly nine of ten funds. Because these funds were smaller than average, only 70 percent of covered workers in this sample belonged to voluntary funds. Either way, a large majority of insured workers had joined their benefit societies

voluntarily. Progressive critics further complained that workers had no say in their insurance fund's operations (Murray 2007, 96-97). In fact, employees alone operated over a third of compulsory funds with no help from management, and the figure for voluntary funds was over four-fifths. Historians who have not baselessly criticized sickness funds have ignored them (Klein 2003, Quadagno 2005; cf. Murray 2007). As important early providers of health insurance, they deserve a closer look.

An important characteristic of early twentieth century labor markets was a high rate of turnover among workers at particular establishments (James and Thomas 2003). By one estimate two-fifths of manufacturing workers had been on the job less than a year (Jacoby and Sharma 1992, 173-174). The Commissioner of Labor survey allows for estimation of turnover, as it asked about the number of new members in the previous year in each fund and the number of members who left the fund for any reason. The sum of these divided by the number of members at the end of the year became the turnover rate. Table 2 shows that this rate was much higher at the compulsory funds (75 percent) than the voluntary funds (47 percent).

As previously noted, contemporaries believed that voluntary microinsurance funds were more likely to attract poor risks, and thus encounter adverse selection, than were compulsory funds. In fact, voluntary funds experienced a claim rate that was 20 percent higher than compulsory funds (23 percent making a claim vs. 19 percent), but this could have been due to other factors than adverse selection, such as the distribution of each type of insurer across industries with different baseline health and accident risks. However, to the extent that probationary membership periods aimed at reducing selection bias, clearly it was voluntary funds that were most likely to require such probationary

periods. Only 22 percent of voluntary funds admitted newly employed members immediately, while 65 percent of compulsory funds did so (Table 2). Thus, the mean number of weeks before full membership was just two among compulsory funds but nearly seven among voluntary funds.

The most important benefit to insured workers, according to contemporary commentary, was the cash payment from the fund that was intended to replace lost wages when he was physically unable to work. Almost 70 percent of the responses reported one level of benefit payments in dollars, while 30 percent reported a range of benefits. According to logistic regressions not reported here, larger funds were more likely to report benefit levels as a range—consistent with these funds serving large plants with workers who had a wider range of skill and wage levels. Where the range was reported, the present analysis used its minimum and maximum values, and where a single value was reported the present analysis assigned it to both the maximum and minimum values. Unfortunately, the survey did not report any information regarding wages, so that it is not possible to estimate a replacement rate for benefits as a share of weekly earnings. The mean value of weekly benefits for funds that reported a single level of benefits was \$5.41, and among those reporting a range the average minimum benefit was \$2.92 and the average maximum benefit was \$6.71.

To counter the moral hazard of disability benefits, as noted, most microinsurance funds imposed a waiting period between the onset of the medical condition and benefit payments. Only about ten percent of funds provided immediate benefits upon illness or injury (Table 1). The modal length of waiting was a week (7 days), which 70 percent of funds required. Other funds imposed waiting periods as short as one day (0.5 percent)

and as long as 14 days (5 percent). Minor differences in waiting periods appeared in voluntary and compulsory funds; 10 percent of voluntary funds and 12 percent of compulsory funds had no waiting periods. The share of funds with one week waiting periods was 63 percent among compulsory funds and 71 percent among voluntary funds. However, funds that paid less than five dollars per week in benefits were much more likely to pay benefits immediately than funds offering more generous benefits (14 percent versus 9 percent), suggesting a role for waiting periods in mitigating moral hazard.

Modeling influences on claims and countermeasures

A critical econometric issue in modeling insurance markets is the endogeneity of coverage and claim behavior. Considerable effort has gone into approaches that avoid this problem, whether by comparing residuals (Chiappori and Salanie 2000, Gottlieb 2006) or two stage dynamic models (Cardon and Hendel 2001). The present approach begins with testing for the presence of simultaneity between a variety of coverage related variables and the log claim rate. This requires a relatively simple Hausman-Wu test, which proceeds by regressing the coverage related variable on a set of exogenous variables (here, membership, turnover, a dummy for employee management of the fund, the age of the fund, and two industry dummies, for mining and manufacturing). The residuals from this regression are then used as a right hand side variable in a regression of the log case rate on the number of members, turnover rate, the employee management dummy, the age of the fund, the maximum number of weeks of benefits the fund would provide in a year, the coverage variable itself, and a vector of 28 industry dummies. The test considers the coefficient estimate of the residual; if it is significantly different from

zero, then endogeneity may be said to be present. Table 3 presents t statistics for several such tests, in which White heteroskedasticity consistent standard errors were used in estimating the t statistic. None of the insurance coverage related variables was found to be significant, so it appears in this sample of funds that there is no endogeneity between claiming behavior and several measures of insurance status. The perhaps counterintuitive insignificance of this test may follow from the workers' lack of choice regarding benefit levels.

The next step was to estimate a series of regressions of log claim rate on various characteristics of disability microinsurance funds, each of which was weighted by the number of members in the fund (Table 4). The first two specifications (4.1 and 4.2) include voluntary status as a measure of adverse selection and benefit payment levels as sources of moral hazard. The voluntary funds paid out, holding membership characteristics and industry constant, 39 percent more claims than did compulsory funds. Further, higher levels of the minimum benefit payment, but not the maximum benefit payment, were associated with more claims, consistent with the moral hazard hypothesis. In 4.3 the two asymmetric information variables both entered the regression. While the magnitude and significance of the voluntary coefficient was similar to that in 4.2, the magnitudes of the benefit level coefficients declined to the point of insignificance. Thus, the econometric models suggest the presence of both kinds of asymmetric information, especially adverse selection.

Contemporary descriptions of the purpose of various contract characteristics as countermeasures makes testing their effectiveness relatively straightforward. Models 4.4 and 4.5 enter dummy variables for these countermeasures against each type of

asymmetric information. The probationary period variable was set equal to one for funds that imposed probationary periods before admitting new hires to membership, and the waiting period variable was set equal to one for funds that imposed a waiting period between the onset of the medical condition and the beginning of benefit payments. Motivation for using a dummy here is provided in the next set of regression results. According to 4.4, funds that imposed a waiting period saw a decline in claim rates of about five percent. In 4.5, funds that used a probationary period saw a decline in claim rates of 18 percent. In 4.6 both countermeasure dummies enter the regression, and provide parameter estimates very close to those in 4.4 and 4.5.

Finally, the countermeasures may have had different effects on claiming behavior depending on the strength of the incentives towards moral hazard or adverse selection. That is, a probationary period (as hypothesized at the time) should have a stronger effect on a fund with voluntary membership than one with compulsory membership. A waiting period might have had a different effect on members of a fund with generous benefits compared to members of one with low levels of wage replacement benefits. Therefore, in models 4.7 and 4.8, interaction variables enter the regressions in which each incentive and its countermeasure were interacted. In 4.7, the moral hazard effect shifted from the minimum to the maximum benefit payment, but there were no further statistically significant effects. In 4.8, all coefficients regarding the effects of voluntary membership were significant: voluntary membership, the probationary period dummy, and the interaction between the two. In addition, the moral hazard effect of the minimum wage payment and the countereffect of the waiting period were both significant and signed as expected.

Model 4.9 presents the results with all relevant variables included. It demonstrates that all of the effects of asymmetric information and the countermeasures employed by the insurance funds against those effects were present in this sample. Regarding adverse selection, as in Model 4.8, the coefficients of the voluntary membership variable, the dummy for use of a probationary period, and the interaction between the two were all significant and signed as expected. The magnitudes of these effects were meaningful. A voluntary fund that imposed a probationary period experienced a claim rate 33 percent less than one without a probationary period, comparable to the magnitudes implied by other models discussed above. Regarding moral hazard, an increase in the maximum benefit level by itself significantly increased the claim rate, and the interaction of the maximum benefit level and the waiting period dummy was associated negatively with the claim rate. As an example of these effects, consider the impact of a waiting period on two funds that offered maximum weekly benefits differing by one standard deviation. Thus, the higher (maximum) benefit would be worth \$7.03 and the lower one \$4.57. Imposing a waiting period on the lower benefit fund would reduce sick claims by six percent. Imposing a waiting period on the fund offering more valuable benefits would reduce sick claims by nine percent. Relative to an increase in the claim rate of 19 percent in the no waiting period case and 16 percent in the waiting period case, the decreases in claim rates attributable to the waiting periods were considerable, on the order of one-third to one-half. In both cases the countermeasure effects were noticeable, and corroborated statements made by contemporaries about their effectiveness and purpose.

A final set of regressions indicates how the duration of waiting and probationary periods affected claim rates (Table 5). Models 5.1 and 5.2 separately enter vectors for probationary period lengths in weeks and waiting period lengths in days, respectively, and then model 5.3 enters both vectors. The results suggest that any waiting period, even one as short as a day, significantly reduced claim rates by nearly half, thus corroborating the previous statement that two day long waiting periods seemed effective. This result further justifies use of a dummy variable for any waiting period at all in Table 4. Probationary periods that lasted 13 or more weeks definitely reduced claims by about a third, and there is some weak evidence that even very short probationary periods of one to five weeks may also have reduced claims as well. Collectively these regressions suggest that the imposition of probationary and waiting periods was about as important as their length; perhaps they signaled to members and prospective members that the fund was serious about limiting unnecessary claims.

Conclusions

This paper provides evidence that early disability microinsurance funds in the United States faced both moral hazard and adverse selection. These findings suggest that it is too early just yet to conclude that insurance markets do not suffer from asymmetric information. The failure of other studies to find evidence of informational asymmetries may be due to technical problems with the power of proposed test statistics. On the other hand, the present results could have been spuriously generated by unobservable characteristics of workers in relatively poor health who selected into firms in the sample. But the unobserved heterogeneity story cannot explain why voluntary microinsurance

funds experienced much higher claim rates than compulsory funds. Even if the relatively ill selected into firms with sickness funds, that process should have led them to the compulsory funds which would have been easier to join. But that apparently did not happen.

Whether disability microinsurance was subject to informational asymmetries might best be addressed by considering such insurance as a game. Stopping the game to collect data at a stage before the end of both parties' moves can give an observer an incomplete picture. When microinsurers offer insurance, it is reasonable to suppose not just that they would attract disproportionately high risks among their policyholders, and that the prospect of a benefit payment might well change the behavior of policyholders, but that these microinsurers would expect both of those processes to occur and offer contracts that would take such problems into account. And in fact, founders and managers of early disability microinsurance funds correctly anticipated the rise such problems and created solutions that effectively mitigated them. Microinsurance fund managers in early twentieth century America were not well meaning amateurs, but capable administrators who used their intuitive understanding of incentives and disincentives to create safe and marketable insurance contracts.

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Table 1. Distributions of countermeasure magnitudes

Panel A. Probationary periods.

Weeks before full membership	Number of insurers	Share
0	144	39%
1-3	8	2
4	50	14
5	39	11
6-8	6	2
9-12	29	8
13	53	14
15-17	11	3
26	27	7
39	1	0.27
52	2	0.54

Panel B. Waiting periods

Days between claim and payment	Number of insurers	Share
0	36	10%
1-3	21	6
4-6	23	6
7	261	71
8-12	8	2
14	21	6

Table 2. Mean values in 1908 Commissioner of Labor survey (standard deviations in parentheses)

Variable	Voluntary	Compulsory	Pooled
Claim rate = Claims/members	0.19	0.23	0.22
Number of members	546 (1,908)	1,784 (2,989)	667 (2,067)
Turnover = (new members + members lost)/members at end of year	0.47 (0.50)	0.75 (0.65)	0.50 (0.52)
Share of funds managed solely by members	0.85	0.36	0.80
Share of funds with voluntary membership	1.00	0.00	0.90
Share of funds with any probationary period	0.65	0.22	0.61
Trial period before membership begins (weeks)	7.03 (8.42)	2.08 (5.35)	6.55 (8.30)
Maximum weekly benefit payment (\$)	5.88 (2.51)	5.07 (1.78)	5.80 (2.46)
Minimum weekly benefit payment (\$)	4.86 (1.81)	3.71 (1.86)	4.75 (1.85)
Share of funds with any waiting period	0.90	0.89	0.90
Waiting period before benefit payment (days)	6.50 (2.95)	5.92 (2.89)	6.44 (2.95)
Share offering any medical benefits	0.14	0.31	0.15
N	334	36	370

Source: U.S. Commissioner of Labor (1909).

Table 3. Hausman tests for endogeneity of incentives and countermeasures

Potentially endogenous variable	t-statistic
Voluntary membership	0.03
Probationary period	-1.10
Maximum benefit	-0.95
Minimum benefit	-0.61
Waiting period	-1.45
Medical benefits	-1.12

Comment: t statistics corrected for heteroskedasticity.

Table 4. Dependent variable = log of claim rate (claims/members)

	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
Intercept	-2.46*** (0.23)	-2.36*** (0.17)	-2.49*** (0.22)	-2.04*** (0.24)	-2.36*** (0.20)	-1.91*** (0.22)	-1.91*** (0.26)	-1.98*** (0.22)	-2.20*** (0.26)
Voluntary		0.39*** (0.11)	0.36*** (0.12)	0.29** (0.11)	0.40*** (0.12)	0.33*** (0.12)	0.27*** (0.12)	0.55*** (0.12)	0.50*** (0.11)
Any probationary period					-0.18** (0.09)	-0.18** (0.08)	-0.19** (0.08)	0.28* (0.16)	0.33*** (0.14)
Voluntary* Any probationary period								-0.60*** (0.17)	-0.66*** (0.15)
Maximum benefit payment	0.016 (0.022)		0.010 (0.023)	0.008 (0.02)	0.010 (0.02)	0.008 (0.02)	0.065* (0.039)	0.004 (0.02)	0.08** (0.04)
Minimum benefit payment	0.041* (0.025)		0.0237 (0.0219)	0.03 (0.021)	0.023 (0.02)	0.029 (0.02)	-0.035 (0.045)	0.034** (0.020)	-0.0002 (0.04)
Any waiting period				-0.047*** (0.015)		-0.046*** (0.016)	-0.035 (0.03)	-0.044*** (0.013)	0.004 (0.03)
Maximum benefit* Any waiting							-0.010 (0.0068)		-0.014*** (0.006)
Minimum benefit* Any waiting							0.011 (0.007)		0.006 (0.006)
Years since founding	0.015*** (0.005)	0.010** (0.004)	0.011** (0.004)	0.011** (0.004)	0.011*** (0.004)	0.011*** (0.004)	0.011*** (0.004)	0.005 (0.004)	0.004 (0.004)
Number of members	0.017 (0.11)	0.044 (0.093)	0.045 (0.088)	-0.039 (0.086)	0.0007 (0.09)	-0.08 (0.09)	-0.10 (0.09)	-0.07 (0.08)	-0.06 (0.08)
Turnover per year	0.18* (0.09)	0.15* (0.085)	0.146* (0.0875)	0.150* (0.084)	0.13 (0.09)	0.13 (0.08)	0.12 (0.08)	0.13 (0.08)	0.12 (0.08)
Managed by	0.20	0.14	0.12	0.065	0.11	0.06	0.07	0.06	0.07

employees	(0.13)	(0.14)	(0.14)	(0.13)	(0.14)	(0.13)	(0.40)	(0.12)	(0.12)
Medical benefits available	-0.19* (0.11)	-0.09 (0.10)	-0.11 (0.10)	-0.09189	-0.11 (0.10)	-0.095 (0.10)	-0.05 (0.10)	-0.05 (0.10)	-0.02 (0.06)
Maximum duration of benefits (weeks)	0.0015 (0.0036)	-0.0004 (0.004)	-0.001 (0.004)	-0.001 (0.004)	-0.0024 (0.0043)	-0.0029 (0.004)	-0.0025 (0.004)	-0.003 (0.004)	-0.003 (0.004)
Adjusted R ²	0.45	0.49	0.49	0.52	0.51	0.53	0.53	0.56	0.57

Heteroskedastic-consistent standard errors in parentheses. N=370. Turnover defined as (number of new members + number of exiting members)/number of members at close of the (fiscal) year. Each regression included a vector of 28 industries, results of which were not reported here. ***=significant at 0.01 level; **=at 0.05 level; *=at 0.10 level.

Table 5. Regressions of claim rates on categorical countermeasures

	Mean value	5.1	5.2	5.3
Voluntary	0.89	0.35*** (0.12)	0.30*** (0.11)	0.31*** (0.10)
Trial period length: 0 weeks	0.39	Omitted		
1-5 weeks	0.27	-0.16 (0.10)		-0.18** (0.09)
6-12 weeks	0.10	0.03 (0.17)		-0.005 (0.17)
13-26 weeks	0.17	-0.32*** (0.12)		-0.32*** (0.11)
Over 26 weeks	0.08	-0.28* (0.15)		-0.29* (0.15)
Maximum benefit payment	\$5.80	0.02 (0.02)	0.02 (0.02)	0.02 (0.02)
Minimum benefit payment	\$4.67	0.02 (0.02)	0.03 (0.02)	0.02 (0.02)
Waiting period length: 0 days	0.10	Omitted		
1-3 days	0.06		-0.47** (0.22)	-0.44* (0.23)
4-7 days	0.75		-0.48*** (0.18)	-0.49** (0.19)
Over 7 days	0.08		-0.57*** (0.19)	-0.47** (0.20)
Adjusted R ²		0.51	0.52	0.54

Dependent variable = log of claim rate (claims/members). Heteroskedastic-consistent standard errors in parentheses. Regressions were weighted by number of members. Other independent variables included an intercept, number of members, age of the fund in years, the maximum number of weeks' benefit per member, a measure of turnover, dummies set to 1 if the fund was operated by its members and if it paid for medical benefits, and a vector of 28 industries. ***=significant at 0.01 level; **=at 0.05 level; *=at 0.10 level.