The Effect of Supplemental Private Health Insurance on Health Care Purchases, Health, and Welfare in Brazil

John A. Nyman*
Nathan Barleen

University of Minnesota,
Minneapolis, Minnesota
USA

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ABSTRACT: The goal of programs to promote private health insurance in developing countries is often to allow citizens to gain access to additional health care, but according to conventional theory, this additional care–moral hazard–is welfare-decreasing. This paper uses a new theory and data from Brazil to estimate the gain in health-related quality of life that is caused by the additional care that is generated by health insurance. It finds that supplemental private health insurance generates significant increases in quality of life, and that the cost of the quality adjusted life year gains appears to be commensurate with cost-utility ratios that are deemed welfare-increasing.

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* Corresponding author. Tel: 612.626.4425; Fax 612.624.2196; Email: nyman001@umn.edu. Address: Division of Health Services Research and Policy, 420 Delaware St., SE, Box 729, Minneapolis, MN 55455-0392, USA. We are grateful to the World Bank for providing funding for this study, to Paul Glewwe for helpful comments on an earlier draft, and to Vijay Kalavakonda for making this study possible. Any remaining errors or oversights are solely those of the authors.

Introduction

The economic theory of the welfare implications of health insurance has changed dramatically over the years. Up until the late 1960s, health insurance was regarded as beneficial solely because of its ability to transfer financial risk, and as a result, it was associated with a welfare gain [1, 2]. This view changed, however, with the publication of the model of the welfare effects from the additional health care that is consumed because people have health insurance [3, 4]. According to this model, these additional health care purchases–termed "moral hazard" by the insurance industry–were all inefficient because the cost of producing them exceeded their value to consumers. Indeed, moral hazard generated such a large welfare loss that expansions of health insurance coverage, or even the purchase of a fair health insurance policy anew, were estimated to make the consumer worse off [4, 5, 6, 7, 8]. As a result of this theory, many insurers in developed countries adopted coverage-restriction policies–high coinsurance rates and deductibles, utilization review, capitated or bundled payments to providers, selection of those providers with restrictive practice styles–that were designed to reduce moral hazard and as a result, reduce the growth in health care spending that was deemed to be largely inefficient.

For policy analysts in developing countries, however, the conventional welfare theory of health insurance presented a fundamental inconsistency: health insurance was considered desirable in developing countries precisely because of the access to additional health care that it provided. As a result, development economists were often placed in the awkward and unsupportable position of claiming a new private insurance program to be a success because it helped citizens gain access to health care that they would not otherwise have purchased, while at the same time conventional theory unambiguously evaluated this additional health care use as reducing the welfare of society.

Recently, however, a new theory of the demand for private health insurance has suggested that an important welfare gain is missing from the conventional welfare analysis of health insurance [9, 10, 11,

12]. This gain is derived from the additional health care that is purchased because of the income that is transferred from those who remain healthy to those who become ill. These income transfers are effected by and contained within the price reduction that occurs when health insurance pays for an ill patient's care. That is, while everyone who purchases health insurance faces a reduced price for health care, in practice, it is typically only those who become ill who actually respond to it. For example, what healthy consumer would purchase a coronary bypass procedure or a leg amputation just because the price had fallen to zero? As a result, the price reduction is the vehicle by which income is transferred from the healthy to the ill, and the portion of the additional health care spending that is generated by this income transfer increases welfare. This implies that not only is the welfare loss from moral hazard smaller than was suggested by the conventional model [13], but also a portion of moral hazard (that was regarded as generating a welfare loss under conventional theory) must be recategorized as generating a welfare gain [12]. This re-designation of losses as gains dramatically alters the welfare implications of health insurance and is responsible for making the estimates of the welfare from health insurance generally positive again [11].

This revision of the welfare analysis of private health insurance has important implications for health policy in developing countries. It suggests that health insurance is beneficial not only because it "spreads the risk" of those health care expenditures that consumers would otherwise incur without insurance if ill–the conventional benefit from insurance–but also because it results in the purchase of additional health care that consumers would *not* otherwise purchase without the income transfer within insurance. Because of the welfare gain from access to otherwise unaffordable health care, those who view as beneficial the expansion of private health insurance in developing countries may be correct. Whether a welfare gain is empirically demonstrable is the subject of this paper.

This paper uses the Living Standard Measurement Study (LSMS) Survey for Brazil, sponsored by the World Bank, to determine the effect of supplemental private health insurance on health care purchases

and health status for a large sample of Brazilian households during 1996-7. Although Brazil has universal health care coverage in a system that is similar in intent to Canada's system, the Brazilian system at the time was neither comprehensive or uniformly available [14, 15]. Thus, for many Brazilians, access to health care depended on whether consumers were willing to pay for care privately out of pocket, or whether they had purchased a supplemental health insurance policy. About 24 percent of Brazilians held supplemental private health insurance contracts during this period [16]. Because this private insurance system is overlaid on a governmental health system that delivers some unknown level of effectiveness, this analysis provides an estimate of the marginal impact of this additional health insurance on the use of health care and on health. This implies that, if health insurance, public or private, were applied in a country without any public insurance program, the impact of insurance on access to medical care and health would likely be greater.

This paper uses the estimated relationship between supplemental health insurance and health to model the welfare implications of the additional health care generated by supplemental health insurance in Brazil. That is, this paper estimates and models the welfare change associated with moral hazard in Brazil. It is organized as follows. In the next section, the important features of the Brazilian health care system are briefly summarized. Then, the data and methods used to determine the impact of supplemental private health insurance on health care and health are described. In the fourth section, the results are reported and the welfare implications are modeled. In the concluding section, the results are placed in context and the implications for public policy are discussed.

Brazil's Health Care System

Brazil's health insurance system has been described as a "mix between a nominally comprehensive public system and a large and active private system" [14, p. 33]. The government system

that was in place in 1996-7 was the Sistema Unica da Saúde (SUS). The SUS contracted with a number of private and philanthropic providers–hospitals, clinics and others–to make available inpatient care, and a substantial portion of outpatient care, to all Brazilians [16]. Beginning in 1987, the Ministry of Health was in the process of slowly converting federal control of publicly owned facilities to control by states and municipalities.

The SUS reimburses hospitals on a diagnosis basis for inpatient care, and clinics on an ex post per capita basis for ambulatory care. The low level of provider payments is an issue, and so are the wide disparities across geographic regions in the amount of funding that SUS provides. Observers have suggested that these problems have resulted in an unpredictable flow of funding to providers in the various regions, a deterioration of the health infrastructure, and "moonlighting" by physicians who hold multiple jobs in order to obtain sufficient income [16]. Low hospital payments have resulted (1) in "upcoding" of diagnoses, where coders specify a diagnosis for an individual patient at a more lucrative level than the actual physical disease would warrant, and (2) in the selection of low cost patients, making for long lines for hospital services [16]. The SUS is viewed as being particularly incapable of meeting the needs of the poor [14].

The problems of the SUS have led many Brazilians to purchase private health insurance [16]. These insurance plans were completely unregulated at the time that the LSMS data were collected, resulting in insurance policies of varying financial reliability and quality: some insurers were profitable and offered "world class" care, and others offered care of dubious quality and were barely able to remain solvent. In general, however, the private insurers provide only limited coverage. Indeed, private insurers have been engaged in political dispute with the SUS over coverage responsibility: the SUS wanted the private plans to pay for inpatient and catastrophic care, while the private plans argued that if they were forced to do so, the increase in premiums would render the private insurance too expensive and many would drop their coverage, thus increasing the pressure on the already overburdened SUS [16].

In 1994, total health expenditures in Brazil were estimated at about US$21.1 billion, or US$136 per capita, or 4.4 percent of gross domestic product (GDP). Of this amount, expenditures by the federal government accounted for US$10.4 billion or US$67 per capita; states and municipalities spent US$4.1 billion or US$26 per capita; and private expenditures–comprising private health insurance, pre-paid programs, medical cooperatives and firm-based health systems, but no out-of-pocket expenditures–accounted for US$6.6 billion or $43 per capita [15]. This third spending category represents the supplemental health insurance spending that is the subject of this paper. Out-of-pocket expenditures are estimated to represent an additional 14 percent of the total calculated health expenditures [15].

Data and Methods

Data. Data come from the World Bank's LSMS Survey, which was conducted during 1996-97 by the Brazilian Geographical and Statistical Foundation Institute (IBGE), Research Department (DPE), Polulation and Social Indicators Department (DEPIS). This Survey collects information from Brazilian households on their place of residence, those who reside therein, their education, their health and health care use, their work and income, their expenditures on goods and service, their standard of living, and some basic anthropometry, such as height and weight. The data we used contains responses from 19,401 individuals in all, both adults and children. The descriptive statistics for the variables collected in the Brazilian LSMS have been reported in Rose [17].

In our sample of respondents, about 24 percent of individuals (4,577 out of 19,401) reported that they had experienced an illness within the 30-day period prior to the survey, and about 43 percent of these individuals reported that they received medical care for this health problem. The specific acute illnesses that were queried in the Survey included: (1) flu/cold/pneumonia, (2) infection, (3) accident/injury, (4) digestive problem, (5) pain, (6) myocardial infarction, (7) dental problem, or (8) other.

Of those respondents aged 18 and older, about 16 percent (3,015 out of 19,401) reported that they had a chronic health problem that required constant monitoring, and of those, about 73 percent were receiving medical care for this problem. The chronic conditions that were specified in the Survey included: (1) a heart problem, (2) high blood pressure, (3) diabetes, (4) respiratory problems, (5) digestive problems, (6) gynecological problems, (7) prostate problems, (8) allergy, (9) cancer, (10) bone/muscle/joint problems, (11) neuro-psychiatric problems, (12) high cholesterol, or (13) other.

Respondents of the LSMS were asked to assess the status of their own health by indicating their choice of health statuses, translated from Portuguese into English as representing "excellent," "very good," "good," "average," and "poor." Rose (1998) reported that, if these responses were assigned numerical values according to the scale, excellent = 5, very good = 4, good = 3, average = 2 and poor = 1, the average score reported in the survey was 2.75, for those over age 18.

Respondents were asked the Portuguese equivalent to the English question, "Do you have any health insurance or agreement aside from government welfare?" This was interpreted as asking whether the respondent had private health insurance in addition to the SUS program that was in theory provided and available to all Brazilians. Although 24 percent responded affirmatively, there were wide disparities in the response rate across demographic characteristics. For example, whites were over twice as likely to have private insurance than other racial groups. Similar disparities occurred by education level and by total health expenditure level [17].

Methods. There are two main methodological challenges for any study that attempts to estimate the effect of health insurance on health care use and health [18]. One is the issue of *causality*. Studies like the present one are based on the theory that health insurance results in greater access to health care when ill, and that this greater health care improves health. That is:

$$\text{health insurance} \rightarrow \text{health care} \rightarrow \text{health}.$$

But, some who purchase health insurance do so *because* they are in poor health. Therefore, overlaid on this is a possible correlation between *lower* health and the purchase of insurance, essentially representing the existence of an arrow that points in the opposite direction and that exhibits a correlation that is opposite to the one that is expected. This selection effect, to the extent that it exists, reduces the estimate of the intended effect of health insurance on health. Selection of this type was regarded as the central problem posed by many of the early studies of the impact of health insurance on health care use in the U.S. This bias provided the primary impetus for the only U.S. health insurance study–the RAND Health Insurance Study–to randomize consumers into arms that differed by health insurance coverage [6, 19], thereby eliminating this bias, at least in theory.

The second major methodological challenge is that any statistical association between health insurance and health could be due to the influence of a *third variable* that is correlated with both health insurance and health. For example, in the U.S., health insurance may generate gains in health, but also health insurance may be correlated with health simply because those who hold jobs are likely to be both healthy and also have employer-provided health insurance. Thus, we might observe a relationship between health insurance and health, but if we did not also hold constant employment status in a U.S. study, we could not be sure that the improvement in health status stemmed only from health insurance. This problem can be fixed by including variables suspected of being correlated with the dependent variable in the regression equation. However, it is possible that some of these variables are unobserved and, therefore, omitted from the analysis. As a result, the estimated relationship between health insurance and health may still be biased.

Because of these issues, it was necessary to specify carefully the data and regression equation that would test these relationships. We were able to establish the causality (from health insurance to an increase in health care and health) by conducting our analysis on only those respondents who indicated a specific acute illness. That the illness had only recently been diagnosed (that is, within the past 30 days)

would presumably eliminate the influence of illness on the decision to become insured. This strategy has been used in other studies to eliminate selection bias [20]. Thus, we estimated the effect of health insurance on use of health care and on health, contingent on the respondent reporting the occurrence of an *acute* medical problem within the last 30 days.

We also conducted the same type of analysis using the *chronic* conditions as the screen, and using treatment for the specific chronic condition as the dependent variable in the health care equation. A person with a chronic illness, however, has an incentive to seek out private health insurance coverage. As a result, it is possible that the impact of health insurance on health we observe here is biased. On the other hand, insurers do screen new customers for chronic health conditions and often deny coverage because of preexisting conditions. Therefore, a person with, say, diabetes or cancer would probably find it difficult to obtain health insurance coverage for treatment of that disease if they had that condition. More importantly, by including the type of chronic illness in the regression equation and using only those respondents who indicated that they had a chronic illness in the regression, the analysis holds constant that disease variable so that the effect of supplemental health insurance on health care use and health is largely unbiased by this factor. Thus, we determined whether supplemental health insurance generates additional health care or an improvement in health status, conditional on the respondent having a *chronic* health problem that required periodic monitoring.

With regard to the methodological issue of the third variable, we included a number of demographic and other variables in the regression: male, age, a series of race indicator variables where white is the reference group, rural residence, married, highest educational grade completed, and the natural log of household spending as a proxy for income. We considered using an instrumental variable approach but were not able to find a suitable identifying variable in the LSMS data set that would allow us to do so. As a result, the regression results could be biased because of the potential omission of unobserved variables.

Health insurance and health care. One set of regressions concentrates on the relationship between health insurance and health care. These regressions are intended to establish the basis for interpreting any relationship that we later find between health insurance and health. That is, if health insurance causes better health, we will be able to attribute it to the additional health care received, if it has first been established that those with health insurance also consume more health care.

As mentioned above, one equation includes only those respondents who indicated that they had an acute health care problem (one that occurred within 30 days of the interview) and uses whether or not the respondent received medical treatment for that specific acute health problem as the dependent variable (the variable is coded 1 if the individual reports receiving treatment, otherwise 0) in a logistic regression. This regression controls for the demographic variables mentioned above, for the type of acute health care problem (in a series of dummy variables that use "other acute care problems" as the reference category), and for whether the respondent also had a chronic problem and the type of problem. The variable of interest is whether or not the respondent had any health insurance or similar agreement, aside from the government program. This variable will henceforth be referred to as "supplemental private insurance."

A second logistic regression equation investigates the determinants of treatment for chronic illness (treatment = 1, otherwise 0), based on only those respondents who indicated they had a chronic illness. Again, health insurance is the variable of interest, and demographic variables, variables indicating the type of chronic illness (again as a series of dummy variables excluding the "other" chronic problems as the reference category), and variables indicating whether the respondent also had one of a series of acute illnesses are included.

Health insurance and health. The health variable used in this analysis is self-reported health status, translated from Portuguese into English as: "excellent," "very good," "good," "average," and "poor." An ordered probit regression is used to model the effect of health insurance, demographic variables, and other control variables (condition type and other health problems reported in last 30 days)

on health status. A finding that better self-reported health status is associated with health insurance, given the presence of acute or chronic conditions or other health problems, might reflect better control of symptoms or quicker recovery associated with the increased access to health care that is available with health insurance.

For this analysis, the health statuses were coded as: poor = 1, average = 2, good = 3, very good = 4, and excellent = 5. Given this arbitrary but monotonically increasing coding scheme for the self-reported health status variable, if there is a positive relationship between health insurance and health status, then the probability of reporting "excellent" health status should increase while the probability of reporting "poor" health status should decrease when an individual has health insurance, compared to not having health insurance. The effect of health insurance on the probability of reporting an intermediate health status category ("average," "good," or "very good") is not apparent and the marginal effect of health insurance on each health status category must be examined separately. This ordered probit analysis was performed on the two sets of observations–respondents who reported acute health problems, and those who reported a chronic condition.

Results

The first two parts of this section are organized according to the set of observations–acute and chronic–used in the analysis. For each set, health care use equation results are paired with the health equation results for comparison. The probit results from the health equation are then used to simulate the effect of supplemental health insurance on changing the probability of being in the various health status categories. The welfare analysis is contained in the next subsection. Health-related quality of life weights are applied to the various health status levels to determine the gain in quality of life attributable to supplemental insurance. Assumptions are made regarding the length of time spent in these states during

the year in order to arrive at an estimate of the gain in quality-adjusted life years (QALYs). Published data on the portion of total health care expenditures in Brazil that are derived from supplemental private insurance are used to determine estimates of the costs of the additional health care spending, and thus to estimate an incremental cost-utility ratio (ICURs) for moral hazard. The ICURs are compared to standard estimates of the value of a QALY to determine whether the additional healthcare consumption generated by supplemental insurance increases welfare. In the final subsection, a sensitivity analysis is presented.

Acute health problems. Table 1 shows the names and definitions of the variables used in the results tables. Table 2 reports the health care utilization equation results for those who reported having a specific acute health care problem within the last 30 days prior to the LSMS survey interview. The odds ratio for the health insurance variable indicates that the ratio of the probability of receiving treatment to the probability of not receiving treatment (for those with an acute health problem) is about 1.77 times greater for those with health insurance than for those without health insurance. This variable is significant and indicates that private health insurance increases access to treatment of acute health problems. Note that 0 failures and 4 successes were completely determined. These four respondents reported a heart attack within the last 30 days and all received treatment, as would be expected.

Table 3 presents the results of the ordered probit model estimating the effect of having private health insurance on self-reported health status for these same respondents. These results were used to predict the probability that a typical person in the sample would report each health status category if they are insured or uninsured using the approach of Kane and Spizman [21]. In this approach, all variables other than health insurance are held equal to their sample mean and the probability of reporting each category of health status is predicted with and without private insurance. Table 4 shows that for those respondents with acute health problems, insurance increases the probability of reporting a health status that is “good,” “very good,” or “excellent,” and decreases the probability of reporting a health status that

is "poor" or "average," compared no insurance. These results are consistent with the theoretical expectation that health insurance increases health through the use of additional health care.

Chronic health problems. A similar analysis was conducted for those who reported that they had one of several chronic health problems. The effect of having private health insurance on whether the respondent received treatment for that chronic illness is presented in Table 5. The odds ratio of 2.45 on the supplemental health insurance variable shows that those with private health insurance have significantly greater access to health care treatments than those with only public health insurance.

Table 6 reports the ordered probit analysis of the impact of health insurance on self-reported health status for those reporting having any chronic health problem. These results are then converted into the marginal change in the probability of being in the various health states, due to having private health insurance. Table 7 shows that health insurance increases the probability of being in the better health states and reduces the probability of being in the lower health states, as hypothesized.

Welfare effects. The goal of the study is to produce a meaningful measure of the welfare impact of moral hazard (generated by supplemental private health insurance) on health, based on a calculation of the incremental cost-utility ratio (ICUR) associated with health insurance in Brazil. The ICUR would represent an estimate of the cost of the additional health care consumed when insured–a measure of the cost of all moral hazard expenditures, both efficient and inefficient–divided by the utility gains measured by the quality-adjusted life years (QALYs) that were generated by being insured, again assuming that the health gains are derived from the additional health care consumed–that is, from the moral hazard. Once calculated, this ICUR is compared to the value of a QALY. If the cost of the gain in QALYs from health insurance (the ICUR) is less than the estimate of the value of the gain in QALYs, then it would represent evidence that the additional health care generated by supplemental health insurance is overall efficient or welfare increasing.

While information was available regarding the expected gain in health status based on Brazilian data, unfortunately, we could find no information on: (1) the health-related quality of life weights that Brazilians would associate with the various health statuses, (2) an estimate of the cost to Brazilians of the additional health care consumed when covered by supplemental health insurance, or (3) an estimate of the value of a QALY to Brazilians. Therefore, we modeled the welfare effects based on data from the U.S.

The health-related quality-of-life weights used to calculate the gain in quality of life associated with insurance were obtained from the preliminary findings of an ongoing Agency for Healthcare Research and Quality-funded study to estimate nationally representative quality of life weights for the U.S. population [22]. This study uses a time tradeoff estimate of the quality-of-life weights for the health statuses in the Euroqol survey [23], and the responses from the Medical Expenditure Panel Survey to the Euroqol survey to estimate quality-of-life weights for the various self-reported health statuses ("excellent," "very good," "good," "fair" or "poor") that are representative of the U.S. population [22]. Recall that the LSMS translated the fourth health status category from Portuguese into English as "average." For the "average" health status category, we substituted the U.S. weight for those who reported their health status to be "fair."

Table 8 shows the expected quality of life gains for respondents with acute health care problems and chronic problems based on the changes in the probabilities reported in Table 4 and Table 7, respectively. For those with acute health care problems, the expected gain in quality of life from becoming insured is from 0.806 to 0.819, or an increase of 0.013. If an acute care problem occurred only once annually per respondent and the increase in quality of life lasted only 1 month because of the acute nature of the health problem, it would result in an expected gain of 0.001 QALYs, because (0.013/12) = 0.001. However, on the day that the Survey was administered, approximately 1/4 of the participants, [(4,577/19,401) = .236], responded that they had one of 9 acute care problems (ranging from colds and digestive problems to injuries and myocardial infarctions) during the last 30 days. If an acute health

problem lasts 1 month and the incidence is uncorrelated in the population, and if about 1/4 of the population indicated that they had an acute health care problem on the day of the Survey, we would expect that a typical respondent in Brazil would experience about 3 such month-long episodes of acute health problems in a year. Therefore, the expected gain in QALYs would be 3 times 0.001, or 0.003 QALYs. This would represent the expected gain per person from insurance coverage that is attributable to better treatment of acute care illnesses.

Table 8 shows the quality of life gain to be from 0.720 to 0.741 for those with a chronic disease, or an expected increase of 0.021. Because chronic health problems are "chronic," it is assumed that this increase would last for a year, suggesting an expected QALY gain of 0.020 for a respondent with a chronic disease. Because about 16 percent of respondents, [(3,015/19,401) = 0.155], indicated that they had a chronic health problem, insurance generates expected gain in QALYs from better treatment of with chronic diseases of about 0.003 QALYs, that is, (0.155* 0.021 = 0.003). Thus, assuming again that the incidence of acute and chronic disease in this population is uncorrelated, it would be reasonable to add the expected QALYs from acute and chronic health care problems and conclude that the expected annual health gain from supplemental private insurance coverage in Brazil is about (0.003 + 0.003 =) 0.006 QALYs.

To our knowledge, no information exists on the cost of the additional health expenditures associated with supplemental private health insurance in Brazil. Recall, however, that on a per capita basis, US$43 was spent in 1994 in total on health care by private health insurers, pre-paid programs, medical cooperatives and firm-based health systems [15]. This is a reasonable measure of the per capita spending by "any health insurance or agreement aside from government welfare," the question in the LSMS Survey used to determine whether the respondent had supplemental health insurance. Recall also that 24 percent of respondents in our sample had health insurance. If this percentage generalizes to the

population, then annual spending by private insurance per insured person is US$179, since (US$43/0.24) = US$179.

The Medical Expenditure Survey in the U.S. found that insured persons in the U.S. spend twice as much on medical care as uninsured persons [24], implying that about half of total spending would represent moral hazard, both efficient and inefficient combined. Applying the U.S. rate to Brazil suggests that persons with supplemental health insurance incurred about US$90 of moral hazard spending, (US$179*0.5 = US$90), in 1994.

The incremental cost-utility ratio can therefore be calculated by dividing the US$90 cost of the additional health care consumed in 1994 by the QALY gain, assuming that supplemental health insurance was as effective in 1994 as it was in 1996-97, when the Survey data were collected. This results in an ICUR of US$15,000 per QALY, [(US$90/0.006) = US$15,000], implying that the moral hazard from supplemental health insurance generates an expected quality adjusted life year at a cost of US$15,000.

Whether this increases welfare or not depends on the value of a QALY in Brazil. Again, we could not locate information on the value of a QALY in Brazil at the time. In the mid 1990s, cost-utility analysts in the U.S. were transitioning from using US$50,000 as a rule-of-thumb value of a QALY to using US$100,000. Indeed, data from that period in the U.S. could be used to justify a value of a QALY as high as US$265,000, or higher [25]. Comparing these estimates of the value of a QALY to the US$15,000 cost of obtaining a QALY through the additional health care expenditures generated by supplemental health insurance–that is, to the cost of the moral hazard–suggests that the moral hazard was welfare increasing, at least by U.S. standards.

Sensitivity analysis. A degree of uncertainty exists in these estimates and Table 9 shows the sensitivity analysis related to this calculation. ICURs were calculated for the various possible rates at which acute care problems occurred in the population in a year were assumed. Also, ICURs were calculated assuming alternatively that all of insurance spending and 25 percent of insurance spending

represented moral hazard, rather than 50 percent, as was assumed in the original reference case estimate. Finally, we obtained preliminary estimates of quality of life weights for the various health statuses based on a sample of Argentines [26]. These visual-analogue-scale-derived weights had to be combined for the two highest health categories and their use resulted in higher ICURs compared with the U.S. weights.

Probably the most tenuous assumption is that the value of a QALY in Brazil is the same as in the U.S. The values used by U.S. analysts are derived primarily from labor market studies that find the additional wages require for a U.S. worker to accept a more dangerous job. For example, if it is found that a worker requires an additional US$500 in wages to accept a job that increases his chance of dying that year by 0.0001, then it is concluded that 0.0001 of a life is valued at US$500, and a whole life is valued at (US$500/0.0001) = US$5,000,000. The value of one year of life–assumed to be the value of a QALY–is determined by dividing the value of a life by the years of life expectancy of the typical worker, discounted and often adjusted for the decline in health-related quality of life that occurs with aging [25]. It is unlikely that a similar labor market study in Brazil would generate comparable numbers. On the other hand, there is also the normative issue of whether a human life in a developing country should be worth less than one in a developed country. This issue, however, is beyond the scope of the present paper. The reader can draw one's own conclusions regarding the correct efficiency conclusions using the reader's own estimate of the value of a QALY and parameter values that seem most appropriate from Table 9.

Conclusions

This paper presents evidence that the addition of supplemental private health insurance increases consumption of health care for those Brazilians who are ill. This increase in health care also improves health, as is evidenced by the increase in the probability of reporting the higher health states ("excellent,"

"very good" or "good") that is associated with supplemental private insurance, and the decrease in the probability of reporting lower health ("average" or "poor"). Thus, supplemental private health insurance increases both access to health care and health.

These estimates, however, may be biased because some explanatory variables are omitted. The most troublesome of the variables that are commonly excluded from analyses of this type are the variables that capture the respondent's diseases or other health conditions. For example, a person with asthma would be more likely to purchase insurance and would also exhibit a lower health status, and as a result, not including this variable in the analysis would bias the insurance variable coefficient downward. (As mentioned above, this was the main bias that the RAND Health Insurance Experiment, the most expensive social experiment ever conducted in the U.S., was designed to correct.) Our approach, however, of focusing our statistical analysis exclusively on those with acute and chronic diseases, and of including variables that represent the type of acute or chronic disease in the analysis has largely eliminated this source of bias.

Still, other variables have been omitted that could potentially be correlated with both insurance and health status. For example, one possible omitted variable is individual tastes. One could hypothesize that individuals who are prudent by nature might both be more likely to purchase insurance and to take better care of their health at the same time. If so, the observed relationship between insurance and health status overstates the causal relationship, and the estimated effect of health insurance on health status is too large. On the other hand, those who obtain supplemental health insurance may have worse health because their jobs are dangerous. (As the U.S. was developing its industrial capacity in the early 20th century, some of the first health insurance plans were purchased by workers in the dangerous logging industry of the Pacific Northwest because of the high incidence of accidents in that industry.) Omitting a "dangerous employment" variable might therefore bias the coefficient of the insurance variable downward, making it too small. The cumulative effect of these omitted variables on the insurance coefficients is unclear.

An instrumental variable approach was considered but, as mentioned, no good instrument could be identified in the data. Rather than risk the consequences of using weak instruments [27, 28], we decided to rely on the argument that we have already included the most important explanatory variables—income, education, gender, race, age—in the regressions.

Although we had no information from Brazil on (1) quality of life weights for self-reported health status, (2) the cost of moral hazard, or (3) the value of a QALY in Brazil, we modeled the welfare gain based on U.S. values. We found that, based on quality-of-life improvements alone, the value of the moral hazard was likely to exceed its cost, and therefore be efficient or welfare increasing. To determine the total gain in QALYs from moral hazard spending, it would be necessary to add the gain from any reduction in the mortality rate attributable to supplemental health insurance (and its effect on QALYs) to the gain from the reductions in morbidity that are captured here. The mortality gain from moral hazard was not available in the Brazilian data. In the U.S., one study found that having health insurance reduced mortality rates by 25 percent [29]. Arguments can be presented that the U.S. percentage could either underestimate and overestimate the effect of supplemental health insurance in Brazil on mortality. Nevertheless, its omission from the estimate of the gain in QALYs suggests that the welfare gain from moral hazard derived from the change in health status of the living is too low, and that the true cost of the quality of life gains from supplemental private insurance would likely be substantially lower than US$15,000 per QALY estimated here if effect of the reduction in mortality were also included in the denominator of the ICUR.

To determine the total welfare gain from supplemental private health insurance in Brazil, it would also be necessary to add the value of risk spreading and the value of the external benefit from access (that is, the benefit that individuals receive when another member of society becomes ill and has access to the health care they need because they have health insurance) to the individual's expected gain from the moral hazard measured above. These factors would also increase the welfare gain from supplemental

health insurance compared to the present estimate. Generating an estimate of the total welfare gain from supplemental health insurance in Brazil is, however, beyond the scope of the present paper.

The probit analysis of the self-reported health status and the calculation of the marginal effects for each health status using the approach of Kane and Spizman [21], to our knowledge, represent a methodology that has not previously been applied to determine the welfare gain from changes in self-reported health status. This methodology has a number of potential applications, especially in the U.S., because of the many large, nationally-representative, U.S.-government-sponsored surveys that collect information on self-reported health status. This study, therefore, represents a pattern for future studies of the welfare consequences of various health interventions.

The expansion of private health insurance programs is perhaps one of their most pressing issues in developing countries. The welfare gain from private health insurance is no longer associated with a financial benefit alone–the spreading of the risk of financial losses. A new theory of the demand for health insurance [11, 12] suggests that private health insurance is also a vehicle for gaining access to health care when ill—health care that would normally be beyond the resources of the individual or household. As a result, much of the additional care that is caused by private health insurance is efficient because much of it is generated by a transfer of income to the ill. That is, it is theoretically worth more to the individual or household than it costs to produce it and, thus, it increases welfare. In contrast, conventional theory holds that all additional health care that is consumed because of insurance reduces welfare.

As a result of the new theory, whether moral hazard increases or decreases welfare is now an empirical question. Therefore, to determine whether health insurance increases welfare, it is first necessary to determine whether the total moral hazard spending increases or decreases welfare. The findings of this study suggest that the welfare gain from the efficient moral hazard spending exceeds the welfare loss from the inefficient spending, and that moral hazard spending in Brazil is on net welfare

increasing.

The new theory and results like these provide a solid justification for government programs to promote private health insurance in developing countries. Government intervention is justified because private health insurance allows consumers to gain access to the care they need when they become ill. The private and external benefits that developing countries reap from assuring access to health care represents a major source of value associated with private health insurance that has been overlooked by economic theorists. This is a source of welfare, however, that many who work in this area have long understood.

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Table 1
Variable Names and Definitions

Variable name	Variable definition
rural	Whether the respondent's household was in a rural area (=1) , v. urban (=0)
married	The respondent's marital status was married (=1), v. single, legally separated, divorced, or widowed (=0).
grade	The highest grade of education that the respondent has achieved (1 = nursery school, through 9 = university)
lnspend	The natural log of total spending on goods and services in the last 30 days (R$)
male	Whether the respondent is male (=1), v. female (=0).
age	The age of the respondent in years.
race-b	Whether the respondent is black (=1), v. white (=0).
race-m	Whether the respondent is mulatto (=1), v. white (=0).
race-indian	Whether the respondent is yellow/Indian (=1), v. white (=0)
cc-heart	Whether the respondent has a chronic condition that was a heart problem (=1)
cc-hbp	Whether the respondent has chronic high blood pressure (=1)
cc-diabetes	Whether the respondent has chronic diabetes (=1)
cc-resp	Whether the respondent has chronic respiratory problems (=1)
cc-digestive	Whether the respondent has chronic digestive problems (=1)
cc-allergy	Whether the respondent has chronic allergies (=1)
cc-musc	Whether the respondent has chronic bone or muscle or joint problems (=1)
cc-neuro	Whether the respondent has chronic neurological or psychiatric problems (=1)
cc-chol	Whether the respondent has chronic high cholesterol (=1)
cc-gyn	Whether the respondent has chronic gynecological problems (=1)
cc-pros	Whether the respondent has chronic prostate problems (=1)
cc-cancer	Whether the respondent has chronic cancer (=1)
cc-other	Whether the respondent has some other chronic condition not otherwise specified (=1)
prbtype-gre	Whether the respondent had any health problem in the last 30 days related to the flu, a cold, or pneumonia (=1)
prbtype-inf	Whether the respondent had any health problem in the last 30 days related to infection (=1)
prbtype-act	Whether the respondent had any health problem in the last 30 days related to an accident or injury (=1)
prbtype-die	Whether the respondent had any health problem in the last 30 days related to digestion (=1)
prbtype-paid	Whether the respondent had any health problem in the last 30 days related to pain (=1)

prbtype-MI	Whether the respondent had any health problem in the last 30 days related to a myocardial infarction (=1)
prbtype-del	Whether the respondent had any health problem in the last 30 days that was dental (=1)
prbtype-otr	Whether the respondent had any other health problem in the last 30 days (=1)
medcare	Whether the respondent sought medical care to treat the health problem that occurred in the last 30 days (=1)
cond-tx	Whether the respondent is receiving care for the chronic health problem specified (=1)
health-status	Whether the respondent's self-reported health assessment is "excellent," "very good," "good," "average," or "poor."
hlthins	Whether the respondent has health insurance or any agreement aside from government welfare (=1)

Table 2
Health Care Utilization Equation Results:
Respondents with Acute Health Problems

Variable	Odds ratio	s.e.	t	p	95% Confidence interval
hlthins	1.773	0.157	6.452	0.000	1.490,2.110
rural	0.791	0.064	-2.914	0.004	0.676,0.926
married	1.271	0.105	2.910	0.004	1.081,1.493
grade	0.937	0.013	-4.820	0.000	0.913,0.962
lnspend	1.139	0.044	3.349	0.001	1.056,1.229
male	0.841	0.056	-2.611	0.009	0.738,0.958
Age	0.991	0.002	-4.815	0.000	0.987,0.994
race_b	0.763	0.106	-1.938	0.053	0.581,1.003
race_m	0.784	0.054	-3.535	0.000	0.685,0.897
race_indian	0.870	0.801	-0.152	0.879	0.143,5.283
cc_heart	2.330	0.504	3.911	0.000	1.525,3.560
cc_hbp	1.387	0.225	2.020	0.043	1.010,1.906
cc_diabetes	2.683	0.766	3.459	0.001	1.534,4.695
cc_resp	2.184	0.346	4.936	0.000	1.602,2.978
cc_digestive	1.670	0.476	1.798	0.072	0.955,2.921
cc_allergy	1.955	0.476	2.753	0.006	1.213,3.150
cc_musc	1.239	0.214	1.243	0.214	0.884,1.737
cc_neuro	0.846	0.175	-0.810	0.418	0.564,1.268
cc_chol	1.042	0.573	0.074	0.941	0.354,3.061
cc_gyn	0.743	0.384	-0.574	0.566	0.270,2.047
cc_pros	2.461	2.439	0.909	0.364	0.353,17.172
cc_cancer	1.007	0.773	0.009	0.993	0.223,4.539
cc_other	1.152	0.208	0.787	0.431	0.810,1.640
prbtype_gripe	0.178	0.018	-16.836	0.000	0.146,0.218
prbtype_inf	0.531	0.066	-5.123	0.000	0.417,0.676
prbtype_accident	1.296	0.249	1.348	0.178	0.889,1.889
prbtype_digestive	0.442	0.076	-4.753	0.000	0.316,0.619
prbtype_pain	0.385	0.046	-7.998	0.000	0.305,0.487
prbtype_MI	1.170E+08	.	.	.	.
prbtype_dental	0.699	0.162	-1.549	0.121	0.444,1.100
_cons	1.652	0.414	2.006	0.045	1.012,2.699

Table 3
Health Status Equation Results:
Respondents with Acute Health Problems

Variable	b	se	t	p	95% Confidence interval
hlthins	0.168	0.044	3.800	0.000	0.082,0.255
rural	-0.183	0.040	-4.601	0.000	-0.261,-0.105
married	0.050	0.041	1.202	0.230	-0.031,0.131
grade	0.053	0.007	7.901	0.000	0.040,0.066
lnspend	0.138	0.019	7.275	0.000	0.101,0.176
male	0.035	0.033	1.067	0.286	-0.029,0.099
Age	-0.017	0.001	-16.746	0.000	-0.019,-0.015
race_b	-0.198	0.069	-2.890	0.004	-0.333,-0.064
race_m	-0.166	0.034	-4.832	0.000	-0.234,-0.099
race_indian	-0.040	0.444	-0.090	0.928	-0.910,0.830
cc_heart	-1.382	0.110	-12.602	0.000	-1.597,-1.167
cc_hbp	-0.961	0.084	-11.406	0.000	-1.127,-0.796
cc_diabetes	-1.371	0.146	-9.417	0.000	-1.656,-1.086
cc_resp	-1.358	0.082	-16.627	0.000	-1.518,-1.198
cc_digestive	-1.130	0.152	-7.428	0.000	-1.428,-0.832
cc_pros	-1.634	0.511	-3.197	0.001	-2.635,-0.632
cc_allergy	-1.173	0.125	-9.373	0.000	-1.418,-0.927
cc_cancer	-2.139	0.430	-4.975	0.000	-2.982,-1.297
cc_musc	-1.065	0.090	-11.848	0.000	-1.241,-0.889
cc_neuro	-1.406	0.107	-13.142	0.000	-1.616,-1.197
cc_chol	-0.847	0.286	-2.962	0.003	-1.408,-0.287
cc_gyn	-1.095	0.263	-4.170	0.000	-1.610,-0.580
cc_other	-1.283	0.095	-13.557	0.000	-1.469,-1.098
prbtype_gripe	0.456	0.050	9.036	0.000	0.357,0.555
prbtype_inf	0.282	0.063	4.497	0.000	0.159,0.405
prbtype_accident	0.461	0.092	5.015	0.000	0.281,0.642
prbtype_digestive	-0.003	0.090	-0.037	0.971	-0.180,0.173
prbtype_pain	0.071	0.061	1.159	0.247	-0.049,0.191
prbtype_MI	-0.735	0.658	-1.117	0.264	-2.024,0.554
prbtype_dental	0.468	0.120	3.902	0.000	0.233,0.703
_cut1	-1.663	0.127			
_cut2	-0.030	0.123			
_cut3	1.234	0.124			
_cut4	2.009	0.126			

Table 4
Effect of Health Insurance on Probability of Reporting Various Health Statuses: Respondents with Acute Health Problems

Health status category	Probability that health Status category i is reported, Given no health insurance	Marginal effect of health insurance	Probability that health status category i is reported, Given health insurance
Poor	0.0218430	-0.0074133	0.0144297
Average	0.3285957	-0.0527040	0.2758917
Good	0.4600893	0.0112126	0.4713019
Very Good	0.1405226	0.0293225	0.1698451
Excellent	0.0489495	0.0195822	0.0685316

Table 5
Health Care Utilization Equation Results:
Respondents with Chronic Health Problems

Variable	Odds ratio	s.e.	t	p	95% Confidence interval
hlthins	2.454	0.305	7.211	0.000	1.923,3.132
rural	0.909	0.094	-0.925	0.355	0.742,1.113
married	0.906	0.086	-1.039	0.299	0.751,1.092
grade	0.960	0.018	-2.180	0.029	0.925,0.996
lnspend	1.172	0.060	3.100	0.002	1.060,1.296
male	0.776	0.068	-2.871	0.004	0.653,0.923
age	1.002	0.002	0.737	0.461	0.997,1.006
race_b	0.738	0.129	-1.737	0.082	0.523,1.040
race_m	0.644	0.058	-4.853	0.000	0.539,0.769
race_indian	0.129	0.138	-1.916	0.055	0.016,1.048
cc_heart	3.077	0.700	4.940	0.000	1.970,4.806
cc_hbp	1.524	0.243	2.642	0.008	1.115,2.084
cc_diabetes	3.557	0.962	4.691	0.000	2.093,6.045
cc_resp	0.734	0.119	-1.907	0.057	0.534,1.009
cc_digestive	0.790	0.162	-1.147	0.252	0.528,1.182
cc_allergy	0.684	0.142	-1.829	0.067	0.456,1.028
cc_musc	0.667	0.107	-2.516	0.012	0.487,0.914
cc_neuro	1.337	0.227	1.711	0.087	0.959,1.866
cc_chol	1.395	0.590	0.786	0.432	0.608,3.198
cc_gyn	1.177	0.456	0.420	0.675	0.550,2.515
cc_pros	3.288	2.609	1.500	0.134	0.694,15.574
cc_cancer	8.625	8.965	2.073	0.038	1.125,66.141
prbtype_gripe	0.852	0.103	-1.320	0.187	0.672,1.081
prbtype_inf	0.661	0.135	-2.022	0.043	0.442,0.987
prbtype_accident	1.679	0.765	1.138	0.255	0.688,4.099
prbtype_digestive	1.162	0.366	0.476	0.634	0.626,2.154
prbtype_pain	1.111	0.176	0.665	0.506	0.815,1.515
prbtype_MI	1.057	1.321	0.044	0.965	0.091,12.253
prbtype_dental	0.867	0.459	-0.270	0.787	0.307,2.447
prbtype_other	1.431	0.228	2.249	0.025	1.047,1.956
_cons	1.133	0.378	0.374	0.709	0.589,2.179

Table 6
Health Status Equation Results:
Respondents with Chronic Health Problems

Variable	b	se	t	p	95% Confidence interval
hlthins	0.219	0.054	4.080	0.000	0.114,0.324
rural	-0.062	0.053	-1.184	0.236	-0.165,0.041
married	-0.029	0.045	-0.640	0.522	-0.117,0.059
grade	0.069	0.009	7.805	0.000	0.052,0.087
lnspend	0.162	0.024	6.609	0.000	0.114,0.210
male	-0.018	0.043	-0.413	0.680	-0.101,0.066
age	-0.012	0.001	-10.762	0.000	-0.015,-0.010
race_b	-0.075	0.085	-0.877	0.381	-0.242,0.092
race_m	-0.116	0.043	-2.692	0.007	-0.201,-0.032
race_indian	0.037	0.543	0.068	0.946	-1.027,1.101
cc_heart	-0.160	0.093	-1.722	0.085	-0.342,0.022
cc_hbp	0.065	0.077	0.841	0.400	-0.086,0.216
cc_diabetes	-0.122	0.104	-1.177	0.239	-0.326,0.081
cc_resp	0.112	0.082	1.374	0.170	-0.048,0.273
cc_digestive	-0.103	0.107	-0.964	0.335	-0.312,0.106
cc_pros	-0.392	0.322	-1.218	0.223	-1.022,0.239
cc_allergy	0.272	0.104	2.608	0.009	0.068,0.476
cc_cancer	-0.335	0.259	-1.293	0.196	-0.842,0.173
cc_musc	-0.046	0.083	-0.552	0.581	-0.208,0.117
cc_neuro	-0.220	0.085	-2.604	0.009	-0.386,-0.054
cc_chol	0.067	0.186	0.360	0.719	-0.297,0.431
cc_gyn	-0.051	0.186	-0.277	0.782	-0.415,0.312
prbtype_gripe	-0.222	0.060	-3.699	0.000	-0.340,-0.104
prbtype_inf	-0.283	0.102	-2.764	0.006	-0.483,-0.082
prbtype_accident	-0.081	0.192	-0.423	0.672	-0.458,0.296
prbtype_digestive	-0.723	0.152	-4.741	0.000	-1.021,-0.424
prbtype_pain	-0.426	0.078	-5.472	0.000	-0.579,-0.274
prbtype_MI	-1.571	0.652	-2.408	0.016	-2.849,-0.292
prbtype_dental	-0.523	0.265	-1.977	0.048	-1.042,-0.004
prbtype_other	-0.591	0.071	-8.265	0.000	-0.731,-0.451
_cut1	-0.727	0.161			
_cut2	1.040	0.161			
_cut3	2.090	0.165			
_cut4	2.833	0.172			

Table 7
Effect of Health Insurance on Probability of Reporting Various Health Statuses: Respondents with Chronic Health Problems

Health status category	Probability that health status category i is reported, Given no health insurance	Marginal effect of health insurance	Probability that health status category i is reported, Given health insurance
Poor	0.13716063	-0.042372	0.09478863
Average	0.61253544	-0.0319261	0.58060934
Good	0.2079125	0.0505171	0.2584296
Very Good	0.03556677	0.0183079	0.05387467
Excellent	0.00682466	0.0054731	0.01229776

Table 8
Estimates of Expected Gain in Quality of Life

Health Status	Quality of life weight	Probability without health insurance	Probability with health insurance	Expected change in health status	Expected quality-weighted health status
Respondents with acute health problems					
Poor	0.498	0.022	0.014	-0.007	-0.004
Average	0.711	0.329	0.276	-0.053	-0.037
Good	0.844	0.460	0.471	0.011	0.009
Very good	0.903	0.141	0.170	0.029	0.026
Excellent	0.941	0.049	0.069	0.020	0.018
Sum		1.000	1.000	0.000	0.013
Respondents with chronic health problems					
Poor	0.498	0.137	0.095	-0.042	-0.021
Average	0.711	0.613	0.581	-0.032	-0.023
Good	0.844	0.208	0.258	0.051	0.043
Very good	0.903	0.036	0.054	0.018	0.017
Excellent	0.941	0.007	0.012	0.005	0.005
Sum		1.000	1.000	0.000	0.021

Table 9
Sensitivity Analysis

Assumptions	Expected annual gain in QALYs	ICUR (Assuming 50 percent of insurer spending is moral hazard)	ICUR (Assuming 25 percent of insurer spending is moral hazard)	ICUR (Assuming all of insurer spending is moral hazard)
Using U.S. QOL weights				
3 acute episodes per year lasting 1 month each (Reference Case assumptions)	0.006	US$15,000	US$7,500	US$30,000
1 acute episode per year lasting 1 month	0.004	US$22,500	US$11,250	US$45,000
5 acute episodes per year lasting 1 month each	0.009	US$10,000	US$5,000	US$20,000
Using Argentine QOL weights				
3 acute episodes per year lasting 1 month each	0.004	US$22,500	US$11,250	US$45,000
1 acute episode per year lasting 1 month	0.002	US$45,000	US$22,500	US$90,000
5 acute episodes per year lasting 1 month each	0.005	US$18,000	US$9,000	US$36,000