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INSURING CONSUMPTION AGAINST ILLNESS

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ABSTRACT

One of the most sizable and least predictable shocks to economic opportunities in developing countries is major illness, both in terms of medical care expenditures and lost income from reduced labor supply and productivity. As a result, families may not be able to smooth their consumption over periods of illness. In this paper, we investigate the extent to which families are able to insure consumption against major illness using a unique panel data set from Indonesia that combines excellent measures of health status with consumption information. We focus on the effect of large exogenous changes in physical functioning. We find that there are significant economic costs associated with these illnesses, albeit more from income loss than from medical expenditures. We also find a robust and striking rejection of full consumption insurance. Indeed, the deviation from full consumption smoothing is significant, particularly for illnesses that severely limit physical function; families are able to smooth less than 30 percent of the income loss from these illnesses. These estimates suggest large welfare gains from the introduction of formal disability insurance, and that the large public subsidies for medical care typical of most developing countries may improve welfare by providing consumption insurance.

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One of the most sizable and least predictable shocks to the economic opportunities of families in developing countries is major illness. There are two important economic costs associated with illness: the cost of the medical care used to diagnose and treat the illness, and the loss in income associated with reduced labor supply and productivity. The size and unpredictability of both of these costs suggests that families may not be able to smooth their consumption over periods of major illness, especially in developing countries where few individuals are covered by formal health and disability insurance (World Bank, 1993 and 1995a). While families with sick members in developed countries are able to access formal insurance markets, families in low income countries must rely on informal mechanisms such as drawing on savings, selling assets, transfers from their family and social support networks, and borrowing from local credit markets. The possibility that there is less than full consumption smoothing through these mechanisms suggests a potentially large loss in welfare from this shock to the household's resources.

In this paper, we investigate the ability of families in Indonesia to smooth consumption over periods of major illness, estimate the welfare loss from not being able to completely insure, and discuss the policy implications for insurance market reform. To do so, we use a unique panel data set from Indonesia which contains excellent measures of health status combined with data on consumption. We analyze consumption smoothing in the context of the theory of full insurance, as discussed in Cochrane (1991), Deaton (1992a), and Townsend (1994). This theory posits that households will fully share the risk of idiosyncratic shocks so that the growth in household consumption will not depend on changes in household resources once the change in aggregate community resources has been taken into account.

Tests of this theory using changes in household level income as a measure of idiosyncratic shocks in Townsend (1994) find that there is close to full insurance among households in India. Using data from the Cote d'Ivoire, Deaton (1992a) also finds substantial consumption smoothing, but rejects full insurance. Morduch (1990) finds extensive consumption smoothing among better-off farmers in India, but not among landless laborers or small farmers. Other studies employing the same framework have considered the effect of aggregate shocks. Townsend's (1995) evidence from village level data from Thailand shows much less than full consumption smoothing, as community level consumption significantly tracks community level income. In contrast, Paxson (1992) finds that households are able to smooth consumption across weather variability through savings decisions.[1]

The findings from studies, however, are unlikely to inform the question of smoothing health shocks for two reasons. First, as emphasized by Morduch (1995), income changes may not represent the type of large and unexpected shocks that are represented by changes in health status. Income is the outcome of a production process, and risk averse families will choose production processes which minimize idiosyncratic risk. As a result, any remaining variability in observed income after the production process has been chosen may be easily smoothed, so that tests such as Townsend's or Deaton's overstate the ability of families to smooth consumption. Second, while weather shocks are unpredictable at a given point in time, the magnitude and distribution of such shocks may be well understood by farmers, allowing them to make the kinds of savings offsets measured by Paxson. In contrast, major illness represents the type of large and extremely unpredictable change that is difficult to anticipate and therefore to smooth through savings.

Little explicit attention has been paid to smoothing health shocks within the context of this growing literature on consumption smoothing. Townsend (1994) includes in his regression analysis the "percentage of the year sick", and finds no effect on consumption changes. Kochar (1995)

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[1]For reviews of the consumption smoothing literature for developing countries, see Townsend (1995) and Morduch (1995). There is also a small literature on consumption smoothing in the U.S. See Cochrane (1991), Mace (1991), Nelson (1993), Attanasio and Davis (1996), Gruber (1996, 1997), and Dynarski and Gruber (1997).

models wage income and informal borrowing as a function illness in the family, as measured by a member of the family experiencing a loss of work due to illness. She finds that illness to the male lowers wage income and increases informal borrowing during peak periods in the agricultural cycle, but that there are no effects during slack periods and no effects of female illnesses. These studies appear to indicate that families living in low income countries are fairly well able to smooth illness shocks.[2]

A key limitation of past work, however, is that the measures of health employed may reflect only small, and even potentially anticipated, changes in health status, not the kind of large unexpected major illnesses that may be difficult to smooth. We are able to overcome these problems by using measures of individuals' physical abilities to perform activities of daily living (ADLs). ADLs have been proven reliable and valid measures of physical functioning ability in both developed and developing countries, and distinguish the type of serious exogenous health problems that are likely to be correlated with changes in labor market and consumption opportunities. (Stewart et al., 1990; Strauss et al., 1993).

Our analysis proceeds in six steps. First, in Part I, we discuss the institutional setting and our rich data source. In Part II, we describe the risk of ill-health using measures that captures increasing degrees of severity. In Part III, we document that severe illness has dramatic implications for family resources by reducing the labor supply and earnings of household heads, and (to a much lesser extent) by increasing medical spending.

In Part IV, we first describe our empirical strategy for testing whether households fully insure against major illness, and then implement the test using a battery of measures that represent

[2]In contrast, Cochrane (1991) finds that consumption in the U.S. is sensitive to major illness, defined as being ill for more than 100 days.

increasingly more severe illnesses. We find that while families are able to fully smooth minor illness measured by the types of indicators such as those used in previous work, they are not able to smooth illnesses that limit their ability to physically perform activities of daily living. The more severe the limitation, the less families are able to smooth consumption. And our results, particularly for the most severe illnesses, do not appear to be driven by changes in tastes associated with illness.

Fifth, we then combine the results from Parts III and IV to assess the magnitude of consumption smoothing; for each rupiah (Rp. 2000 ≅ $ 1) of income loss due to illness, how much does consumption fall? Unlike the previous literature, we find that the deviation from full consumption smoothing is significant, particularly for the most serious physical limitations; families are able to smooth less than 30% of the income loss from these illnesses. The fact that households cannot fully insure consumption against health shocks, however, is not in and of itself an indicator of severe loss in welfare. In Part VI, we investigate the potential welfare gains from providing income insurance against disability, by measuring the willingness to pay to eliminate the variation in consumption from ill-health. Our analysis suggests that these welfare gains are large: we estimate a willingness to pay of roughly 67 percent of the expected income loss. We also highlight that there are important welfare gains through the consumption smoothing aspects of medical care subsidies, which spread the medical costs of illness across healthy and sick times; taxes incurred when healthy finance medical care purchased when sick. We find that, in the absence of disability insurance (so that the marginal utility of consumption when ill is quite high), the willingness to pay to smooth consumption over medical care expenditures is 150 percent of expected medical care costs. In the final section of the paper, we summarize these results and their policy implications.

Part I: Institutional Setting and Data Source

The Setting

Indonesia is the fourth most populous country in the world with tremendous cultural and economic diversity. Though economic growth has been impressive with an average real per annual capita growth rate of 3.9% over the last 15 years, per capita incomes are still low, at $US 880 per year in 1996 (Asian Development bank, 1997). Indonesia had also seen remarkable improvements in health status (World Bank, 1993). The infant mortality rate fell by about 35 percent from 1965 to 1980. Between 1960 and 1990 life expectancy at birth has increased by 24 percent to 59 years and child mortality decreased 68 percent to 111 per thousand.

Indonesia has invested heavily to develop a comprehensive government-operated health care delivery system. Recent investments have focused on the primary care network. A wide range of primary care services are available from government health centers, including curative outpatient and limited inpatient treatment; maternal and child health care services; nutrition services; family planning services; community health education and outreach; and dental treatment. By 1991, there were at least one health center and several subcenters in each of Indonesia's 3400 subdistricts. Indonesia's large primary care system is backed up by a network of government-operated hospitals at the district, provincial and central levels. Despite the large increase in government spending on health care, however, Indonesia's health care expenditures remain low relative to those of its neighbors (World Bank, 1993). In 1990, annual expenditures on health care from both public and private sources are only about $12 per person which amounts to about 2 percent of GDP.

Few individuals in Indonesia are covered by health insurance other than the implicit insurance provided through the almost free public health care system; on average, user fees at public facilities amount to 5% of average costs (World Bank, 1995b). While the public health care system provides extensive primary care services, it's hospital care is more limited. Moreover, many individuals opt to pay out of pocket for higher quality private sector services as over half of all utilization is provided by the private sector (Gertler and Molyneaux, 1996). About 10 percent of the population is covered by health insurance provided to civil servants. However, this insurance only covers utilization at public facilities and, therefore, the benefit to the individual is to only cover the small user fees. An additional four percent of the population is covered by health insurance offered through employers, but this insurance typically has capped benefits, minimizing absenteeism from minor illnesses but not paying the costs of major illness (Dow and Gertler, 1997). Similarly, there is limited disability insurance as there is no government program, over two-thirds of workers are self-employed, and few firms provide extensive sick leave.

Data and Sample.

The data used in our analyses, collected as part of the Indonesian Resource Mobilization Study (IRMS), come from a panel survey of households designed to evaluate an experimental increase in user fees charged at public medical care facilities in two of Indonesia's 27 provinces. The data were collected in 1991 and 1993, allowing us to examine health, income, and consumption changes over a two year period. The data were collected for each household at the same point in the year in both waves, so that we condition out seasonality effects in our differences models.

The two study provinces are West Nusa Tengarah (NTB), which is comprised of the two Islands just east of Bali, and East Kalimantan (KalTim) which is located on the east coast of the Island of Borneo. Together they account for about six million residents. KalTim has the third highest per capita income among all 27 provinces, while NTB is ranked twenty-second. The median real per capita household expenditure for KalTim is about 20 dollars per month, which is approximately one-third higher than NTB's. Despite the higher incomes in KalTim, NTB residents have better physical access to modern medical providers. NTB residents travel less than half the distance residents of KalTim travel to reach a medical provider. In fact, NTB residents also have much higher utilization rates than KalTim residents, which may in part be explained by the higher monthly illness rates in NTB.

Our sample consists of all household heads who were in the survey in both rounds, who are at least 18 years old in the second round, and who have non-missing data on the health measures described below. Gertler and Molyneaux (1996) and Dow et al. (1997) discuss attrition from this sample, and conclude that it does not cause significant sample selection problems. In addition, we condition on work in the first round, which is defined as spending at least 20 hours in the week of the survey either working for others, working for oneself, or farming. In this way, we focus on the population for which we expect a sizable effect of illness on household resources. In a specification check below, we also show the results for non-workers.

Part II: The Risk of Illness

The key to our analysis is that we have unusually good measures of the change in the health status of household members. We explore the effects of two types of health measures: self-reported illness symptoms (symptoms) and limitations in the physical ability to perform activities of daily living (ADLs). Self-reported illness symptoms are similar to the measures of health status used by the previous literature. Illness symptoms are measured by a dummy for whether the individual reports any symptom (ill), and a dummy for whether they report a symptom that has lasted more than one month (chronically ill). This measure aggregates the 10 categories of self-reported specific symptoms (e.g. fever, respiratory congestion, etc.) for adults.

There are three important problems with these measures. First, as noted above, these symptoms may not represent the type of major health changes which impinge on consumption decisions. Second, as highlighted by both Strauss and Thomas (1996) and Bound (1991), using these self-reported symptoms may overstate the effect of health status on labor supply because individuals who have left their jobs for other reasons may justify this decision by reporting a deterioration in health. To the extent that the labor force transition was planned, families may have already accounted for it in their consumption decisions at period t-1, so that there is no effect on the change in consumption and as a result spurious evidence of consumption smoothing. Third, there is substantial evidence that wealthier and more educated individuals have different definitions of illness as these types of individuals are more likely to report having an illness symptom in the last month (e.g Sindelar and Thomas, 1991; Schultz and Tansel, 1997).

As an alternative we therefore rely on a second measure that assesses an individual's physical ability to perform activities of daily living (ADLs). These physical functioning measures are based on individuals' self-ratings of ability to engage in specific activities, not based on general assessments of illness symptoms which are more likely to be endogenous to labor supply decisions. Initially developed for studying levels of disability among the elderly, these measures are used increasingly to study the health status of all adults. Physical functioning measures have been tested extensively for reliability (consistency between tests and interviewers) and validity (consistency between individual assessments of different skills). In the United States and South East Asia, they have been found to be reliable and valid self-assessments with a high degree of internal consistency (Andrews et al. 1986; Guralnik et al. 1989; Ju and Jones 1989; Strauss, et al., 1993; Ware, Davies-Avery, and Brook 1980). They are routinely used in studies of labor supply in the US (e.g. Bound, 1991; Bound et al., 1995; Stern 1989), and are the key measures of health status in the new Health and

Retirement Survey (Wallace and Herzog, 1995). In addition, in contrast to self-reported symptoms, these measures tend to be negatively correlated with income and education in both US and low income samples (e.g. Strauss et al., 1993; Kington and Smith, 1996; Gertler and Zeitlin, 1996).[3]

Activities of daily living are divided into two categories. Intermediate ADLs consist of ability to: carry a heavy load for 20 meters; sweep the floor or yard; walk for 5 kilometers; take water from a well; and bend, kneel, or stoop. Basic ADLs consist of ability to: bathe yourself; feed yourself; clothe yourself; stand from sitting in a chair; go to the toilet; and rise from sitting on the floor. A limitation in any of these activities, particularly basic ADLs, clearly represent a major change in health status.

The responses to these questions on the survey are coded as: can do it easily (a value of 1); can do it with difficulty (2); and unable to do it (3). The responses to these questions were then combined in accordance with the following algorithm developed for the RAND Medical Outcome Study (Stewert et al., 1990):

$$Health = \left(\frac{Score - Min\ Score}{Max\ Score - Min\ Score}\right) \qquad (1)$$

so that the ADL index takes on a value of 1 if the individual can perform all ADLs without difficulty, and zero is the individual cannot perform any ADLs. We will present results for both the intermediate ADL index and basic ADL index, separately and combined into one regression. We will also show results where we focus only on downward movements in ADLs, and where we disaggregate the index into its component ADLs. Our findings are robust to these variations in the

[3] ADLs have been used in a number of studies of the relationship between health and labor market outcomes. See Strauss and Thomas (1996) and Bound (1991) for reviews of the developing country and US applications, respectively.

specification of changes in physical limitations.

The means and standard deviations of the health outcome measures are presented in Table 1a. The left hand panel shows the means for period 1 levels, while the right hand panel shows them for changes from period 1 to period 2. In period 1, a large proportional of adults, 24 percent, reported some intermediate ADL limitation. However, only 2% report having the more severe basic limitations; since basic ADL limitations represent more severe health problem than intermediate, they are less common. In addition, there is substantial change in health status over time. Between 1991 and 1993, over 27% of the sample reported changes (either upwards or downwards) in intermediate ADL limitations and almost 4% reported a change in the more severe basic ADL problems.

Despite their severity, changes in basic ADLs do not appear to be permanent on average: there are roughly as many upward movements as downward movements in the basic ADL index. This reflects an important difference in the interpretation of ADLs, and in particular basic limitations, in developed and developing country contexts. In wealthier more developed countries such as the US, limitations in the ability to feed oneself, bathe and toilet indicate a severe incapacitation that would make one close to bed-ridden and may reflect long-term disability. However, in a developing country setting such as Indonesia, performing basic physical activities requires more ability than in developed countries. For example, bathing in Indonesia generally requires going to the river and bathing using a sarong (large tubular like fabric) to maintain modesty. This requires much more effort and coordination than bathing in ones house. Also, toileting requires the use of eastern as opposed to western toilets, which are many times located in outside the main living quarters. Hence, basic indicators capture less severe limitations in developing country settings than in developed settings. As a result, it is not surprising that as many people recover from basic limitations as develop them, suggesting that we are indeed measuring severe temporary changes in health as opposed to permanent deterioration.

Turning to the self-reported symptom measures, more than one-half of the sample reported an illness symptom last month in the first survey round. This raises questions about the usefulness of this indicator for investigating consumption smoothing as its huge frequency indicates that is picking up many minor health problems that do not need expensive medical care or affect labor supply. However, a much smaller share report chronic symptoms lasting more than one month. While there is some reduction in symptoms across these two years, there is a very large increase in chronic symptoms which may be expected to some extent as this cohort ages.

Part III: The Cost of Illness

A prerequisite for there to be an effect of illness on consumption through imperfect consumption insurance is that there must be a sizable cost of illness. In this section, we quantify the cost of illness in terms of reduced labor supply, lost earnings and increased medical spending.

We estimate labor supply, earnings and medical care spending equations using the following fixed effects specification:

$$\Delta L_{ij} = \beta \Delta h_{ij} + \upsilon_j + \epsilon_{ij} \qquad (2)$$

where ΔL_{ij} is the change in labor supply (or earnings, or medical care spending) for individual i living in community j, Δh_{ij} is the change in health for that individual, and υ_j is a community-level error component. Equation (1) therefore regresses first differenced labor outcomes and medical care spending against the change in health and aggregate determinants of labor supply (or medical spending). We include a full set of community dummies to control for these aggregate determinants.[4] We also include demographic controls to capture other secular trends in the labor supply of household heads: the head's sex, age, education, and marital status; the wife's age and education; and the change in log family size. To measure a change in the indicator variables for symptoms, we define a variable which is 0 if there is no change, 1 if the person moves from ill to healthy, and -1 if the person moves from healthy to ill. The change for ADLs is simply the change in the ADL index value.

The model is a fixed effects specification, and as such, controls for unobserved heterogeneity. In particular, it sweeps out correlation from omitted unobserved individual characteristics (such as preferences and health endowments) that confound identifying the effect of illness on labor market outcomes. However, there may be unobserved correlates of income and health outcomes that confound identification. We control for one major source of spurious correlation, shocks to the local community economy such as weather that affect both permanent income and health, by including a set of community fixed effects.

A related source of concern is idiosyncratic changes in household income that feedback into health; for example, job loss that results in a deterioration of health (perhaps through mental depression). But our pattern of results suggest that this alternative explanation does not account for our findings. In particular, we find that larger health shocks are associated with bigger income losses and larger consumption losses. Therefore, if our results reflect effects of labor supply on health, this feedback mechanism would have to operate more strongly the larger the negative income shock. This means, for example, that the effect on health from a job loss would be bigger for high

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[4]Communities for our purposes as defined as IRMS "enumeration areas", which are village sampling clusters.

wage individuals than low wage individuals. This type of feedback seem to us to be unlikely.[5]

Labor supply is measured in two ways: as the change in hours worked; and as a dummy for non-participation (working less than 20 hours). The non-participation dummy is in essence a change, since our sample is all working at least 20 hours per week in period 1. Earnings and wages are only reported in the IRMS data for the one-third of heads who work in the market. We therefore impute wages to all workers based on these market rates. This imputation proceeds by first taking an average of hourly market wages by province (NTB or KalTim), age (<25, 25-49, 50+), education (the four categories denoted at the bottom of Table 1b), and sex. This cell-specific average wage is then matched to all persons in the cell, regardless of whether or not they worked in the market.[6] This imputed hourly wage is then multiplied by hours per week to get a weekly earnings, and by 4.3 to get monthly earnings, in order to match our monthly consumption figures.

The means and standard deviations of the labor supply and earnings variables are reported in Table 1b. Earnings is measured in real per capita terms, in order to match our consumption specification below.[7] Among working heads, average hours of work are almost 50 per week.[8]

Spending on medical care is measured as the product of reported medical utilization and prices from the sites at which medical care was delivered, following Gertler and Molyneaux (1996).

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[5]In addition, our findings below that the effects of illness on consumption are differentially strong for families who are not well insured are inconsistent with an idiosyncratic feedback explanation.

[6]The valuation of non-market work at the market wage is only appropriate if labor markets clear; this assumption is supported for Indonesia by Pitt and Rosenzweig (1986) and Benjamin (1992).

[7]All figures are reported in 1991 urban NTB rupiah.

[8]We have chosen a 20 hour per week cutoff in period 1 to capture consistent attachment to the labor force. We have also replicated our results using as our sample selection rule any work at all over the month before the survey. Our inferences are similar using this sample, but the estimated effects are only about 80% as large. As described below, this finding is consistent with the notion that the effect of illness on consumption operates through reduced labor supply.

Descriptive statistics are reported in Table 1b. Spending on medical care is quite low, averaging less than 1% of non-medical consumption. This reflects both low levels of utilization and the extensive subsidization of medical care costs by the public sector.

Table 2 reports the full regression specification for our first measure of labor supply, change in hours worked. For symptoms, there is a negative effect of becoming ill on hours of work, but neither coefficient is significant. The result suggests that having chronic symptoms is associated with a 1 hour per week reduction in labor supply. As the third column of Table 2 shows, these results are basically the same whether or not the two measures are included together in the regression (with change in any symptoms set to zero whenever change in chronic symptoms is non-zero).

The next set of columns shows the results for the ADL measures; here, illness is represented by a reduction in the index, so that positive coefficients indicate that illness reduces labor supply. There is a sizable and significant effect of both measures. For the change in intermediate ADLs, the coefficient implies that moving from completely healthy (index=1) to completely sick (index=0) would lower hours of work by 23.1 per week. In other words, if the head moved from able to perform all of the intermediate ADLs to unable to perform one ADL, his hours of work per week would fall by 4.6 hours (9.4% of baseline hours for this sample). For the change in basic ADLs, the effect is more sizeable, with a movement from completely healthy to unhealthy associated with a 29.3 hour per week reduction in work. Once again, the result is very similar if the two measures are included together in the final column. The control variables are uniformly insignificant.

Table 3 presents the coefficients of interest for other measures of labor supply. The first row replicates the findings from Table 2. The next row shows the results for participation in period 2. The finding parallels that of Table 2: positive effects of symptoms (becoming ill raises non-participation), and negative effects of ADL changes (improved physical functioning lowers non-participation). In this case, the effects are significant for all of our health status measures. Once again, the effects are much stronger for basic ADL changes than for intermediate ADL changes. Indeed, moving from being able to perform all of the basic ADLs to being able to perform none implies a 73% likelihood of becoming a non-participant.

The fourth row of the table shows the effect on imputed earnings, expressed in 10,000 Rupiah units. Surprisingly, the effect of chronic symptoms on earnings is actually lower than for non-chronic symptoms, despite a larger effect on hours worked. This implies that the population for which chronic symptoms are associated with reduced work is a relatively low wage population. This is consistent with the notion that individuals who are marginally attached to the labor force are justifying their exit from the labor force by reporting a chronic symptom.

For the ADL measures, in contrast, the coefficients line up in the expected way, with a much larger effect of basic ADL changes on earnings. The coefficients imply that moving from completely able to perform ADLs to completely unable to perform ADLs would lower earnings by R. 18,600 for intermediate ADLs, and by R. 26,300 for basic ADLs. The latter figure is roughly 100% of mean baseline earnings, suggesting that such a shift would leave the head with little earnings.

Finally, the last row of Table 3 shows the effects of illness on medical spending, once again in 10,000's of Rupiah. There are significant effects in the expected direction for all four measures (having symptoms = more spending; lower ADLs = more spending). There are two interesting points to note about the pattern of coefficients. First, the effects are fairly similar across symptoms and chronic symptoms, and across intermediate and basic ADLs. This suggests that medical spending per se may be a poor indicator of the severity of the health shock, a point which has important implications for the discussion of user fees below. Second, for ADL changes the effects are trivially small relative to the effects on earnings. This is not surprising since publicly provided medical care is heavily subsidized (i.e. user fees well below the cost of care).

Part IV: Do Households Fully Insure Consumption?

In the previous sections we demonstrated that major illnesses as measured by changes in basic ADLs are associated with large financial costs to households. In this section, we test whether households are insuring consumption against these unexpected costs of illness.

Empirical Specification

Our empirical specification is derived from the theory of full insurance whose key insight, for our purposes, is that mechanisms for pooling risks will equalize the growth in the marginal utility of consumption across households within communities. Following Cochrane (1991), Deaton (1994) and Townsend (1994), the easiest way to derive this condition is from the first order conditions to the central planner's problem of allocating resources under uncertainty given a set of household social weights.

The first order conditions in logarithmic form are:

$$\ln(MU(C_{ijt})) = \ln(\lambda_{jt}) - \ln(\omega_{ij}) \tag{3}$$

where $MU(C_{ijt})$ is marginal utility of consumption of household i living in community j, λ_{jt} is the Lagrange multiplier associated with the aggregate resource constraint for community j in period t, and w_{ij} is the social weight associated with the household which does not vary over time and therefore is just a household fixed effect. Taking differences to eliminate the fixed effect, we find that with full insurance, the growth rate of each household's marginal utility within a community is equalized:

$$\Delta \ln(MU(C_{ijt})) = \Delta \ln(\lambda_{jt}) \tag{4}$$

The empirical analogue to (4) depends on the shape of the marginal utility function and other factors that affect intertemporal and interhousehold differences in tastes. We use a form of the constant relative risk aversion utility function suggested by Deaton (1994) where the utility of per capita consumption is multiplied by the size of the family. Letting n_{ijt} be the number of household members, the utility function is:

$$U_{ijt}(C_{ijt}) = \frac{\theta_{ijt} n_{ijt} \left(\frac{C_{ijt}}{n_{ijt}}\right)^{1-\rho}}{1 - \rho} \tag{5}$$

where θ_{ijt} is an unobservable taste parameter that account for other variations in preferences.

In this case, (4) becomes:

$$\Delta \ln\left(\frac{C_{ij}}{n_{ij}}\right) = -\frac{1}{\rho}(\Delta \ln(\lambda_j) - \Delta \ln(\theta_{ij})) \tag{6}$$

which can in turn be expressed as:

$$\Delta \ln\left(\frac{C_{ij}}{n_{ij}}\right) = -\frac{1}{\rho}\Delta \ln(\lambda_j) + \epsilon_{ij} \tag{7}$$

so that while the growth in the marginal utilities of consumption are constant within a community, the growth in household consumption will differ due to intertemporal and interhousehold differences in preferences (due, for example, to aging or change in family size). Therefore, the theory of full insurance implies that the growth in each household's consumption will not depend on changes in household resources that are uncorrelated with shifts in preferences once the growth in community resources has been taken into account.

Identification

Using the above results we can test whether families are able insure consumption against illness by estimating the following equation:

$$\Delta \ln(\frac{C_{ij}}{n_{ij}}) = \alpha \Delta \ln(C_j) + \beta \Delta h_{ij} + \epsilon_{ij} \tag{8}$$

which is a regression of the growth in per capita (non-medical care) consumption against the change in health (h_{ij}), controlling for the growth in community resources by including the change in community level consumption. In addition, we control for preference shifts associated with changes in family size or structure by including the change in log family size and a series of measures of the change in the share of the family that is male and female family members ages 0-5, 6-17, 18-49, and 50 plus. And, as above, we also control for other potential taste shifters that might be correlated with illness: the head's sex, age, education, and marital status; and the wife's age and education.

A major assumption of the full insurance interpretation is that the utility function is separable in consumption and health, and in consumption and leisure. As a result, the marginal utility of consumption does not depend on the state of health directly, nor indirectly through induced changes in leisure. If this is not true, then even with full insurance the growth of consumption will vary with the state of health. That is, in the formulation above, Δh_{ij} will be correlated with omitted preferences and thereby with the error term, biasing the estimated coefficient β in equation (8). An important feature of our empirical strategy is a number of tests for such "state dependence" in consumption behavior. We uniformly reject that state dependence can explain much of our finding of less-than-full consumption smoothing, particularly for the most severe changes in physical functioning.

The theoretical model developed above is cast in terms of consumption insurance through interhousehold risk sharing. In practice, our empirical analysis follows the previous developing country literature in examining consumption smoothing, either through insurance from others or through self-insurance (ie. savings).[9] Our tests do not distinguish between these two channels for consumption smoothing, although our results below (examining the effects of health differentially by ex-ante asset holdings) suggest that much of consumption smoothing is occurring through self-insurance, and not transfers from others.

Results

The dependent variable for our analysis is the change in the log of monthly non-medical consumption per capita. The means for consumption expenditures are shown in Table 1b. Like earnings, consumption is reported in real terms by deflating for price differences across locales and over time. Roughly two-thirds of expenditures are on foodstuffs.

Our estimates of equation (8) are presented in Table 4. For illness symptoms, we cannot reject the hypothesis of full insurance. The coefficients on both measures are insignificant; indeed, they are wrong-signed, indicating that illness is associated with higher levels of consumption, not lower.

In contrast, when we use the ADL measures, we strongly reject the full insurance hypothesis. Changes in the ADL index have a significant and sizeable effect in the expected direction; negative

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[9]One recent article in the U.S. context, Hayashi (1996), presents an approach for distinguishing these two modes of consumption smoothing, using information on the consumption of related households; but this type of information is not available in our Indonesian data.

increments to health are associated with reductions in consumption. The effect of basic ADL changes is much larger than that of intermediate changes. Moving from being able to perform all intermediate ADLs to being able to perform none of them would lower consumption by 14%, while moving from being able to perform all basic ADLs to being able to perform none of them would lower consumption by almost 60%. A move from completely able to unable to perform one ADL would lower consumption by 1.4% (intermediate) or 9.9% (basic). When we combine the two measures in the final column, the results are similar.

The control variables show the expected pattern of effects. Consumption growth rates are higher for male heads, for older heads (although the effect increases with age at a diminishing rate), and for more educated heads. Per capita log consumption changes fall with the change in log family size, indicating some economies of scale in consumption; there is no clear pattern to the (unreported) coefficients on the changes in demographic shares, which are mostly insignificant. And there is a strong positive association with community consumption, but the estimated coefficient is much less than one. This is consistent with the rejection of full consumption smoothing at the community level in Townsend (1994) and Deaton (1992a).

These findings suggest two conclusions. First, traditional measures of illness change using illness symptoms, while weakly associated with labor supply changes, are not associated with consumption changes. There are two possible interpretations for this finding. On the one hand, there may be full consumption insurance against relatively minor health changes. Alternatively, as suggested by Bound (1991) and Thomas and Strauss (1996) these types of self-reported symptom measures may in fact be endogenous to labor supply decision-making.

Second, the more severe illnesses measured by ADL changes, and in particular basic ADL changes, are very strongly associated with consumption changes. This provides a striking refutation of the full insurance hypothesis at the household level. These latter types of illness changes appear to represent shocks to a family's opportunity set that cannot be smoothed.

Sensitivity to Specification

In Table 5, we explore three alternatives to our empirical specification (8); we show the coefficients of interest from regressions such as those show in Table 4. First, we replace the change in community consumption with a set of community-level dummies, paralleling the labor supply models. This is the more flexible specification suggested by Morduch (1990) or Deaton (1994). In fact, this change has relatively little effect on our coefficients of interest; they drop slightly, but the basic pattern of effects is intact. The standard errors also rise somewhat.

Second, we assess the sensitivity to our controls for family size. A potential concern with our model is that family size is endogeneous to illness; family members may be more likely to come or go when there is illness to the head. In this case, by controlling for family size we are conditioning out a potential source of insurance, thereby overstating the effects on consumption of illness. In fact, however, as the next row of Table 5 shows, our results are very similar if we use the log of total consumption (not per capita) and don't control for family size.[10]

Finally, we consider the possibility that the propensity to report illness is correlated with underlying family resources or tastes for consumption, as has been suggested for traditional measures of ill-health such as self-reported symptoms (e.g Sindelar and Thomas, 1991; Schultz and Tansel, 1997). Reporting bias should not be a problem when we consider changes in health status, since we difference out the underlying permanent health endowments and the propensity to report oneself

[10]This should be expected, as a regression of change in family size on the illness of the head yields a small and insignificant coefficient.

healthy or ill. Nevertheless, to control for this possibility, we have estimated models including lagged (period 1) earnings of the head. As the next row of Table 5 shows, including this regressor has no effect on our results. Thus, our results are very robust to variations in specification.

State Dependence?

An alternative interpretation of our reduced form consumption results, however, is state dependence: the types of serious illnesses which drive our consumption findings may be associated with changes in underlying preferences of the head. It seems unlikely that state dependence could account for the very large family consumption effects that we find, given that we are measuring illness to the head only, and the average family size in our data is almost five. For example, if consumption is distributed equally across family members, a movement in intermediate ADLs from 1 to 0 would have to lower the head's consumption by 70% to explain our result. Of course, due to differential economies of scale, the head may account for more than 20% of family consumption. But, even in this case, it is very difficult to see how a movement of the basic ADLs of the head from 1 to 0 would lower the entire family's consumption by almost 60%. This suggests that there are effects on the consumption of other family members, operating through the budget constraint and not through state dependence.[11]

While we think that state dependence is an unlikely candidate to explain our very large effects, particularly for basic ADLs, in this section we nevertheless propose a series of tests to demonstrate that state dependence is not driving our findings. Each of these tests has some

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[11]One state dependence related explanation would be that illness of the head is correlated with illness of other family members, so that the large percentage effect on family consumption reflects family-wide changes in tastes. In fact, controlling for changes in the ADLs of other adult members (we do not have ADL data for children) has no effect on the results.

limitations, together they confirm our contention that state dependence does not account for our results.

(1) Types of Consumption

A natural form of state dependence is through tastes for food consumption. Individuals who fall ill may have much less demand for food consumption, lowering family expenditures on food. We investigate this proposition in the first panel of Table 6, by dividing total non-medical consumption into its food and non-food components. In fact, the effect of ADL changes on consumption appears to be roughly equal across the two types of consumption. In percentage terms, this represents a much larger effect for non-food consumption, which is only one-third of the ex-ante budget. Thus, our findings are not driven solely by a decreased taste for food consumption upon illness.

(2) Non-Workers

The assumption underlying our discussion is that illness affects consumption by lowering the earning potential of workers. On the other hand, state dependence through illness should affect workers and non-workers equally. Thus, a test of our view versus the alternative is to consider the effects of illness on non-workers. There will be some effect on this sample through medical spending, but as we demonstrated in Table 3 the effects of ADLs on medical spending are trivial relative to their effects on earnings.

We examine the effects on non-workers in the second panel of Table 6. In fact, the estimates for this control group are insignificant and small. For intermediate ADLs, the effect is less than one-third as large as for workers, although we cannot statistically reject the contention that the effect is the same for workers and non-workers. For basic ADLs, however, the coefficient is very close to zero, and is statistically significantly different from the coefficient for workers.[12] For the symptoms measures, the coefficients are statistically zero.

The problem with this test, however, is that while it rules out state dependence through changes in health, it does not rule out state dependence through health-induced changes in leisure. That is, for the working sample, but not for the non-working control group, their hours of work are changing dramatically when they become ill. This could lead to lower consumption, for example, through lower work-related consumption purchases (ie. bus fare or new clothes). Once again, it seems unlikely that complementarities between work and consumption could explain the very sizeable effects that we see for total family consumption. But this suggests the value of additional tests.

(3) Self-Insurance

Our final test for distinguishing state dependence is to assess how our effect varies with the ability of families to self-insure health shocks. Families that are better able to self-insure illness should see a smaller effect of illness on consumption. However, there is no reason why state dependence should be smaller for these well self-insured families. Thus, if the effect of illness is much larger for poorly self-insured families, it suggests that these effects are operating through the budget constraint (and not through state dependence). Our test therefore consists of estimating equation (8), but including an interaction of illness with the indicator for ability to self-insure. A negative interaction suggests that the effect of health shocks is mitigated by having self-insurance, which would be consistent with our hypothesis of imperfect insurance but inconsistent with state

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[12]Similarly, when we consider individuals who worked at all in the first year and interact our measure of ADL changes with the number of hours worked, there is a positive (and significant for basic ADLs) interaction with hours worked. This is consistent with the notion that illness has more important implications for consumption the more work that is lost.

dependence.[13]

We use two different measures of self-insurance in carrying out this test. The first is own asset holdings in period 1. The IRMS collected two measures of the liquid asset holdings of families: savings, jewelry, stocks, and bonds; and accounts receivable. Fifty four percent of our sample has zero liquid assets, but the top quartile of the sample has median liquid assets per capita of Rp. 83,333, which is over twice annual non-medical per capita consumption. We therefore measure the absence of liquidity constraints by a dummy variable for being in the top quartile of the liquid assets per capita distribution.[14]

In fact, as the third panel of Table 6 shows, there is evidence of much smaller effects on those families who can self-insure illness. For both the intermediate and basic ADLs, the interaction is negative, although once again it is only significant for the basic ADL sample. The coefficients indicate that being in the top quartile of the wealth distribution is sufficient to completely remove any consumption effects of illness, although the estimates are fairly imprecise. For the other illness measures, the interactions are insignificant.

Another form of family self-insurance is spousal labor supply. For families where spouses are providing a large share of income in the first period, then the effects of reduction in the labor supply of the head should have much less severe implications for family consumption opportunities. On the other hand, there is once again no reason to believe that state dependence would operate more strongly in these types of families.

We investigate this proposition in the fourth panel of Table 6, using the same interactive

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[13]Similar considerations of differential consumption smoothing by the ability to self-insure are discussed in Morduch (1990).

[14]This test is in the spirit of Zeldes (1989) test for liquidity constraints in the U.S.

framework as in the previous test; but we restrict the sample to married couples. We measure insurance through spousal labor supply as the ratio of imputed spousal earnings to the imputed earnings of the head in period 1; a value of one indicates that spouses earn as much as the head in period 1, so that the family has substantial self-insurance against illness to the head.

In fact, there is a sizable and (for basic ADL) significant negative interaction. The interaction is surprisingly large, in that it indicates that if wives' imputed earnings was the same as that of their husbands, there is essentially no effect of the ADL change. This is surprising because even in this case the husband is providing a large share of family labor income, so we might expect some effect on consumption. This might indicate that it is only when there is a severe shock that is completely uninsurable, such as basic shocks to heads with low-earning spouses, that we see consumption effects.[15] Once again, the interactions for our other illness measures are insignificant.

These findings strongly refute the contention of state dependence, unless that state dependence somehow operates more strongly for families with low assets or spousal labor supply. In addition, they also serve to address concerns over reverse causality, with shocks to consumption opportunities driving both consumption *and* health (*idiosyncratic* health feedbacks). This alternative explanation is inconsistent with our differential effect on insured/uninsured heads; there is no reason why this reverse causality should operate differentially for one group and not another.

One potential limitation with this test, however, is that the magnitude of the earnings loss

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[15]A natural question that this exercise raises is whether we see changes in these forms of self-insurance in response to the illness of the head. We have examined the effect of illness on change in assets, following Paxson's (1993) work on weather shocks and asset changes. We find a large response of assets (estimating a tobit model of change in log assets), indicating that moving from completely able to perform ADLs to completely unable lowers per capita assets by 54% (intermediate) to 100% (basic). But the estimates are very imprecise; both coefficients are only roughly as large as their standard errors. For changes in spousal labor supply, the coefficients are actually wrong-signed, but they are once again highly insignificant.

attributed to illness may vary by underlying insurance status as well; if illness shocks cause a smaller earnings reduction for the self-insured, this could drive our findings, and invalidate this as a test of self-insurance. For example, those with high asset levels may have disability insurance on their jobs (an admittedly extremely rare occurrence in Indonesia), so that the income effects of illness are much smaller; this, and not the insurance per se, could explain the smaller effects of illness on consumption.

We can test this alternative by reestimating the models in Table 6 using change in earnings as the dependent variable; such an alternative explanation would suggest that there is also a significant negative interaction between self-insurance and earnings. In fact, however, in none of the cases using ADLs is there a significant negative interaction; the interactions for the wealth measures are negative but insignificant, and the interactions for spousal labor supply are positive and insignificant. Thus, this test demonstrates fairly convincingly that the effects of the income loss from illness are larger for well-insured groups, which is consistent with the notion that illness is a shock to the household's opportunity set, but inconsistent with state dependence.

Part V: How Incomplete is Insurance?

We view our results in Tables 4-6 as a convincing demonstration that there is incomplete consumption smoothing of illness in Indonesia. A natural next question to ask is: how incomplete is this insurance? This magnitude is critical for assessing the importance of our findings for welfare and considering the policy implications. We therefore measure the magnitude of lack of consumption smoothing against illness as the share of the costs of illness that are financed out of consumption. To do so, we follow the previous consumption smoothing literature by estimating a model of the effect of changes in (net of medical spending) income on the growth of non-medical care consumption:

$$\Delta \ln(\frac{C_{ij}}{n_{ij}}) = \alpha \Delta \ln(C_j) + \mu \Delta \ln(n_{ij}) + \gamma \Delta y_{ij} + \epsilon_{ij} \tag{9}$$

where y_{ij} is earnings minus medical care expenditures. Then the share of the costs of illness that are financed out of reduced consumption is simply γ/C_{ij}.[16]

Estimating equation (9) by OLS forms the basis for Townsend's (1994) and Deaton's (1992a) test of full insurance. The results from this estimation are shown in the first column of Table 7. We show only the coefficient of interest - that on change in income - from regressions that include all of the regressors shown in Table 4; income is expressed in units of Rp. 10,000. In fact, we find that there is only an insignificant relationship between income changes and consumption changes, which is consistent with Townsend's results. A Rp. 10,000 increase in income is estimated to increase consumption by only 0.6%, or Rp. 225. That is, as we show in the last column, this implies that for each rupiah that income falls, consumption falls by only Rp. 0.023. This is a trivial change, which would indicate full consumption smoothing.

However, there are two potential problems with estimating equation (9) by OLS, both of which would bias towards a finding of consumption smoothing. The first, as noted by Morduch (1990), is that the growth in income is correlated with the error term through the production process; the variation in income may be chosen by risk averse families so that consumption can be smoothed using available mechanisms. The second is measurement error in the growth of income, particularly since we have imputed earnings in our data.

In order to solve these problems, we employ an instrumental variables approach which use

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[16]We use the level of income, instead of the log, since roughly one-quarter of cases where there is a change in the ADL index have zero earnings in one period, and we do not want to exclude these cases.

the change in the illness variables to instrument for the change in income. This instrument is valid given that the utility function is not state dependent, that there is no feedback from changes in consumption to changes in health, and that measurement error in health changes is uncorrelated with measurement error in income changes. The first two of these conditions are demonstrated by our tests above, while the last seems reasonable. In this case, this regression allows us to assess whether the major changes in income due to illness are smoothed differently than average income changes.

Once we instrument income by the change in ADLs in the second column of Table 7, the coefficient rises dramatically and becomes significant. Instrumenting by intermediate ADLs, the estimate indicates that for every 10,000 Rp. of income lost due to illness, there is a fall in consumption of 7.9%, or Rp. 2960. That is, for each rupiah that income falls, consumption falls by Rp. 0.3 (as shown in the third column). This suggests that families are able to smooth only 70% of the loss in income from intermediate ADL changes.

This effect is even more dramatic when we move to the more severe basic ADL changes. Here, each Rp. 10,000 loss in income lowers consumption by almost 20%, implying that families can only smooth 27% of the loss in income from severe illness shocks. This is substantially below the benchmark of full smoothing supported by previous work. In the third row, we include in our instrument set both of our two ADL measures, once again setting the change in intermediate ADLs to zero when there is a change in basic ADLs. Overall, the results indicate that families can smooth less than one-half of the income loss due to ADL changes.

In the remaining rows, we use our other illness measures. As one could infer from Tables 3 and 4, the estimates here are actually wrong-signed. Clearly, these measures are not legitimate instruments for this exercise.

The results thus far have imposed two restrictions on the ADL measures: we have assumed a particular form for the ADL index, and we have imposed symmetric effects of positive and negative health shocks. We relax these assumptions in the Appendix in two ways; by using only downward movements in the ADL index to identify our estimates; and by using individually each of the component ADLs that comprise the index. The results are quite robust to these alternative specifications of our model: we once again conclude that there are significant deviations from full smoothing for intermediate, and particularly for basic, ADLs.

Part VI: Insurance Market Policies

The results thus far demonstrate that families are not able to smooth the economic costs arising from serious illness to the head, and we have documented the extent to which smoothing is imperfect. This incompleteness in private insurance markets suggests the potential for welfare gains from government provision of insurance against income loss and medical illness. In this section, we consider the magnitudes of these welfare gains. We abstract from the fundamental issue of the justification for public intervention, except to note that there is a substantial and well-known literature on insurance market failure in this context (e.g. Rothschild and Stiglitz, 1976). In addition, we focus solely on the welfare gains from more complete insurance and abstract from other important potential welfare gains such as improvements in health status and gains in social welfare from redistribution. We begin by discussing the measurement of the welfare loss from not being able to insure consumption. We then turn to estimating the gains from formal disability and medical care insurance.

Welfare Measurement

One measure of the welfare cost of not being able to fully insure the costs of illness is the amount that households are willing to pay to eliminate consumption variability due to illness. This measures households *ex ante* valuation of insurance that would fill the gap in existing insurance markets for the income loss due to illness, arising either through reduced earnings or increased medical expenditures.

We calculate the willingness to pay in a certainty equivalence framework. Let C^* be consumption when healthy and $L(H_i)$ be the economic cost of illness with severity H_i which occurs with probability π_i. Then the welfare loss from uncertain illness is the amount, W, such that the welfare from getting C^* - W with certainty is equal to the expected welfare when the loss is uncertain:

$$U\left(\frac{C^* - W}{C^*}\right) = E\left[U\left(\frac{C^* - \gamma L(H_i)}{C^*}\right)\right] \tag{10}$$

where γ is the share of the loss that cannot be smoothed.

Assuming a constant relative risk aversion form for the utility function, where ρ is the coefficient of relative risk aversion, (10) can be rewritten as:

$$\frac{\left(\frac{C^* - W}{C^*}\right)^{1-\rho}}{1 - \rho} = \sum_j \pi_j * \frac{\left(\frac{C^* - \gamma L_j}{C^*}\right)^{1-\rho}}{1 - \rho} \tag{11}$$

where there are j discrete health states. Rearranging terms, we can express the certainty equivalent as a percentage of consumption when healthy:

$$\frac{W}{C^*} = 1 - \left[\sum_j \pi_j * \left(\frac{C^* - \gamma L_j}{C^*}\right)^{1-\rho}\right]^{\frac{1}{1-\rho}} \tag{12}$$

W/C^* measures the value of insurance that fully smooths consumption across illness states, as a percentage of baseline consumption. This measure is a lower bound of the willingness to pay for insurance, however, since it is calculated based on the variation in consumption due to illness after families have already used informal mechanisms to smooth some of the costs of illness. These smoothing activities themselves have costs that are not reflected in the calculation. For example, there is some cost to family and friends from private transfers of resources to the ill household head; similarly, if consumption smoothing is occurring through increased labor supply by family members, the value of the reduced leisure to those family members is not reflected here.

Disability Insurance

In this section, we contrast the benefits and costs of formal disability insurance that fully smooths consumption over the loss in earnings arising from illness. The *gain* to the household from such insurance is the expected value of the transfer from the insuring agency, plus the welfare gain from consumption smoothing. The *cost* to the government is the expected value of the transfer, plus (i) a markup for administrative costs, (ii) the cost of moral hazard through increased reported illness in response to the existence of this program, and (iii) any deadweight loss from financing these benefit payments. That is, the expected benefit payout is just a transfer from the government to households; the ultimate efficiency of disability insurance policy rests on a comparison of the welfare gains from consumption smoothing and the inefficiencies inherent in operating a disability insurance program. Measuring these inefficiencies is beyond the scope of our paper. But, by comparing the welfare gain from consumption smoothing to the expected benefits payout (the transfer), we can offer a sense of how large these costs would have to be in percentage terms to offset the consumption smoothing benefits of disability insurance.

We begin by estimating the expected payout from a disability insurance policy that fully replaces the earnings loss to those who become ill by our ADL metric. We measure the loss in earnings from an illness, L_j, by using the estimates of equation (2) reported in the third row of Table 3 to predict the loss in earnings from downward movements in the ADL indexes.[17] We measure the probability of experiencing the loss, πj, using the observed frequency distribution of downward movements in the ADL indexes. The expected loss in earnings, then, is the of sum the π_j times L_j.

It is important to note that the cross-sectional frequency distribution is not the theoretically appropriate set of probabilities π_j to use for this exercise; we should be using the longitudinal probabilities for each individual in our data set, not the cross-sectional distribution of risk. Unfortunately, however, we only have two observations on each individual, so we must rely on this cross-sectional distribution. This will lead us to understate somewhat the welfare loss from illness with concave utility, since we are using the average risk rather than the underlying distribution. Moreover, we are assuming that individuals know the true underlying distribution of risk; if individuals overstate/understate the probabilities of serious illness, they may value more highly/less highly having insurance against a bad health state.

The estimated insurance payouts, which are equivalent to overall expected earnings losses from illness, are reported in the first column of Table 8. The expected payout for moderate illness, as measured by movements in intermediate ADLs, is about 1 percent of consumption. The expected payout for more serious illnesses, as measured by movements in basic ADLs, is 0.32 percent of consumption. If we combine basic and intermediate ADLs, to compute the average expected payouts from any ADL change, we obtain an income loss of 0.9 percent of consumption. These results are

[17]It is inappropriate to incorporate the consumption increases from upward movements in health, which simply reflect recovery from earlier downward shifts. As we show in the Appendix, our results for the consumption smoothing effects of changes in ADL index are very similar if we just use downward shifts to identify our estimates.

quite small as a share of consumption. Despite the fact that the expected earnings loss conditional on occurrence of an ADL change is very high, the frequency of occurrence of serious illness is very low, so that overall expected insurance payouts are low as well. Similarly, the expected payouts for more serious illnesses are much lower than for less serious illnesses; this reflects the fact that more serious illnesses are only about 50% more costly in terms of earnings loss, but they occur with much less frequency.

We next use equation (12) to estimate the private willingness to pay to eliminate the variation in consumption do the income loss from serious illness. We have already discussed how we measure π_j and L_j. We use the coefficients reported in the second column of table 7 as estimates of γ. Since we do not have a direct estimate of the coefficient of relative risk aversion, we evaluate (12) for a range of values of ρ from 2 to 3; this is the range estimated by most previous studies using individual micro-data (Zeldes, 1989; Engen, 1993).

The results of this exercise are presented in Table 9. We first show the welfare loss from illness, which is (as noted above) a lower bound on the willingness to pay for insurance, as a percentage of *ex-ante* consumption. The estimates range from 0.23 to 0.68 percent of consumption. These are once again quite small, despite the large economic cost of these rare illnesses, due to the infrequency of illness. But, while these welfare losses are small as a share of baseline consumption, they are fairly large relative to expected insurance payouts, as we show in the second column of Table 9. For moderate illness, as shown in the first panel, the welfare gain from insurance amounts to roughly one-third of insurance payouts. For more serious illness, as shown in the second panel, the gain is 89-105% as large as insurance payouts. Averaging over all ADL changes, the welfare gains are roughly two-thirds as large as insurance payouts.

These findings of large welfare gains from insurance, relative to expected payouts, suggest the potential for welfare improvements from government insurance provision. Only if the deadweight loss of government provision, through administrative costs, moral hazard, and the marginal cost of public funds, amount to more than two-thirds of expected payouts, will there be no welfare improvement from formal disability insurance.

The Insurance Value of Public Medical Care Subsidies

Our findings also are potentially important for the debate over public health care subsidies. There is a heated policy debate in developing countries about raising user fees for services obtained at public health care facilities. Governments have or are actively considering raising user charges at public facilities as a means of financing improvements in the health sector and improving the efficiency with which medical care is delivered (e.g. World Bank, 1987; Jimenez, 1994). Vocal opponents are concerned that increased fees will adversely affect the poor's access to medical care and, consequently, their health outcomes (e.g. Cornia, Jolly and Stewart, 1987; Ready, 1996). This debate, however, has ignored the possible role of public subsidies as consumption insurance. Subsidies reduce risk by spreading the medical costs of uncertain illness across healthy and sick times; taxes incurred when healthy finance medical care purchased when sick. As a result, raising user fees in a world of imperfect consumption insurance has an important welfare cost: higher user fees "tax families while they are down", imposing higher costs at exactly the point where the marginal utility of consumption is highest. Thus, given the imperfect consumption smoothing that we document, there may be an additional consumption smoothing motivation for low user fees.

In this section we estimate the insurance value of these public medical care subsidies. First, we estimate what medical care expenditures would be in a world with no subsidies. User fees at public facilities are estimated to be about 10 percent the cost of providing care (World Bank, 1995).

Using these same data, Gertler and Molyneaux (1996) estimated the price elasticity of demand for medical to be -0.4. Therefore, if prices were increased to the full costs of care - a ten fold increase - this would raise medical spending by 600%. The unsubsidized medical care expenditures for each change in ADLs is measured by the subsidized expenditure predicted from Table 3, increased by a factor of 6.

Using our estimates of π_j, we calculate the expected unsubsidized medical care expenditures arising from ADL changes. The results are reported in the last column of Table 8. Even unsubsidized, expected medical care expenditures are only about 15 percent of the expected loss in earnings from illness.

The willingness to pay to eliminate the variation in consumption due to medical care expenditures, in a world with no formal disability insurance, is reported in Table 10. The willingness to pay computation follows that above, but uses the unsubsidized value for medical care expenditures in addition to the earnings loss, raising the welfare cost of imperfect consumption smoothing. We then take the difference between the willingness to pay to insure total income loss, including unsubsidized medical spending, and the willingness to pay to insure the earnings loss only.

Not surprisingly, as we show in the first column of Table 10, the welfare gain as a percent of consumption is small. However, the welfare gain as a percentage of expected medical care expenditures is quite large. For moderate illness, the gain is roughly 60% as large as expected medical expenditures. For more serious illness, it is 173-298% as large. Averaging across all ADLs, the gain is roughly 150% of expected medical expenditures.

These welfare gains are enormous, relative to the extra insurance expenditure incurred by subsidizing medical care prices. The reason for these large welfare gains relative to payouts is that the unsubsidized medical care losses are incurred on top of income losses. This is the point where the marginal utility of consumption is highest and, therefore, the welfare loss per dollar is highest. On the other hand, while the welfare gains are particularly large here, the inefficiencies from subsidizing medical care may be particularly large as well. This is especially true when one recognizes that raising user fees will mostly tax high frequency illnesses that individuals are able to smooth well; as shown in Table 3, medical spending is a poor instrument for discriminating more serious health shocks. Thus, while suggestive, our results do not prove that government subsidies of medical care expenditures are efficient, at least on consumption smoothing grounds.

Part VII: Conclusions

Using reliable and valid measures of ill-health that distinguish varying degrees of severity, we find that Indonesian households are not able to fully insure consumption against the economic costs of illness. We find that the more severe the illness, the less households are able to insure. Households are able to smooth 70 percent of the costs resulting from illnesses that moderately limit an individual's ability to function physically, but only 27 percent of the costs from illnesses that severely limit physical functioning.

Our strong rejection of consumption smoothing identified from low frequency shocks contrasts dramatically with previous work that finds a large degree of consumption smoothing over higher frequency income variation. It is important to highlight, however, that our estimates using very low frequency, high risk, events, potentially offer little insight into consumption smoothing of more likely and less costly risks. In a sense, tests such as Townsend's (1994) offer an upper bound on the ability of families to smooth their consumption, due to potential problems such as endogeneous income determination and measurement error. On the other hand, our test provides a lower bound, since the events that we examine (particularly basic ADL changes) are extremely low probability and very high cost. A useful direction for future work would be to consider instrumental variables for idiosyncratic income variation which surmount the problems of endogeneity and measurement error, but which represent higher frequency shocks to income.[18]

Our analysis of the welfare loss from not being able to smooth consumption suggests that there may be gains from introducing formal disability insurance. In particular, averaging over all ADL changes, we find that the welfare gain from insuring earnings loss due to major illness is roughly two-thirds as large as the expected insurance payouts (expected income loss). This suggests that unless the deadweight loss from providing disability insurance is 67 cents for each dollar of insurance payout, there will be efficiency gains from government provision of such insurance. Future work could usefully extend our calculations by considering the true longitudinal probabilities of illness, and by measuring the inefficiencies inherent in government provision of disability insurance. Moreover, group-specific analyses of the tradeoffs between costs and benefits would be useful; it may be that for particular sectors of the economy that have high injury risk, or for particular age groups such as older workers, the insurance value of this program is much higher and would justify a more targeted government intervention.

Finally, our analysis has suggested an additional rationale for subsidized medical care prices in developing countries: consumption insurance. We find that the consumption smoothing gain from subsidizing medical expenditures for major illness, given that there is no insurance against income losses, is roughly 150% of expected payouts. This suggests that there may be an important welfare cost to raising user fees at public medical care facilities. Governments

[18]Deaton (1992a) suggests such an instrumental variables strategy to deal with measurement error, but not with endogeneity.

considering raising user fees must consider how to insure the medical care costs of large illnesses, for example through caps on fees for inpatient hospital stays, or by developing prepayment schemes in conjunction with reducing subsidies.

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Table 1a: Means of Health Measures

Period 1 Levels		Changes	
Intermediate ADL Index	0.958 (0.099)	Change in Intermediate ADL Index	0.009 (0.123)
Basic ADL Index	0.997 (0.027)	Change in Basic ADL Index	-0.002 (0.049)
Some ADL Limitations - Intermediate	0.24	Any Intermediate ADL Change	0.273
Some ADL Limitations - Basic	0.02	Any Basic ADL Change	0.039
Illness Symptoms	0.58	Change in Illness	-0.006
Chronic Illness Symptoms	0.12	Change in Chronic Illness Symptoms	0.155

Table 1b: Means of Other Variables in Period 1

Head's Hours of Work	49.0 (16.9)
Head's Earnings per capita	23515 (19601)
Non-Medical Consumption per capita	37469 (33593)
Food Consumption per capita	24447 (19180)
Family Medical Spending per capita	336 (1026)
Male	0.91
Married	0.84
Spouse's Age	35.0 (11.0)
Family Size	4.93 (2.08)
No Education	0.30
1-5 Years	0.34
6 Years	0.19
7+ Years	0.18

Notes: Tabulated by authors from IRMS data. Standard deviations in parentheses. N=2817.

Table 2: Illness and Change in Hours Worked

Change in Symptoms	-0.52 (0.80)		-0.51 (0.93)			
Change in Chronic Symptoms		-1.04 (1.02)	-1.03 (1.02)			
Change in Intermed. ADLs				23.1 (4.03)		21.3 (5.37)
Change in Basic ADLs					29.4 (10.0)	29.1 (9.97)
Sex of Head	4.34 (2.82)	4.36 (2.82)	4.36 (2.82)	5.15 (2.81)	4.26 (2.82)	4.96 (2.83)
Age of Head	-0.02 (0.26)	-0.02 (0.26)	-0.02 (0.26)	-0.05 (0.26)	-0.02 (0.26)	-0.06 (0.26)
Age Squared/ 100	-0.07 (0.26)	-0.07 (0.26)	-0.07 (0.26)	-0.04 (0.26)	-0.07 (0.26)	-0.03 (0.26)
No Education	0.83 (1.76)	0.80 (1.76)	0.81 (1.76)	0.75 (1.75)	0.86 (1.76)	0.80 (1.76)
1-5 Years Education	1.51 (1.57)	1.51 (1.57)	1.51 (1.57)	1.61 (1.56)	1.48 (1.57)	1.55 (1.57)
6 Years Education	2.68 (1.73)	2.63 (1.73)	2.65 (1.73)	2.74 (1.72)	2.66 (1.73)	2.70 (1.72)
Single	-1.99 (3.74)	-1.92 (3.74)	-1.87 (3.74)	-1.61 (3.71)	-1.90 (3.73)	-1.62 (3.72)
Wife's Age	-0.08 (0.08)	-0.07 (0.08)	-0.07 (0.08)	-0.07 (0.08)	-0.07 (0.08)	-0.06 (0.08)
Change in log Family Size	-3.63 (2.62)	-3.56 (2.62)	-3.53 (2.62)	-3.70 (2.60)	-3.62 (2.61)	-3.68 (2.61)
Number of Obs	2817	2817	2817	2817	2817	2817

Notes: Standard errors in parentheses. Estimates are from models such as (2) in text.

Table 3: Illness, Labor Supply, and Medical Spending

	Symptoms	Chronic Symptoms	Intermediate ADLs	Basic ADLs
Change in Hours	-0.52 (0.80)	-1.04 (1.02)	23.1 (4.03)	29.3 (10.0)
Stop Working	0.028 (0.013)	0.036 (0.017)	-0.462 (0.065)	-0.728 (0.162)
Change in Earnings (in R. 10,000)	-0.128 (0.060)	-0.060 (0.076)	1.86 (0.30)	2.63 (0.75)
Change in Medical Spending (in R. 10,000)	0.022 (0.004)	0.015 (0.006)	-0.071 (0.023)	-0.086 (0.056)

Notes: Standard errors in parentheses. Coefficient is that on health change in regression that includes all covariates shown in Table 2.

Table 4: Reduced Form Non-Medical Consumption Results

Change in Symptoms	0.009 (0.013)		-0.005 (0.015)			
Change in Chronic Symptoms		0.020 (0.017)	0.020 (0.017)			
Change in Intermed. ADLs				0.137 (0.068)		0.144 (0.089)
Change in Basic ADLs					0.591 (0.169)	0.590 (0.169)
Sex of Head	0.063 (0.047)	0.062 (0.047)	0.062 (0.047)	0.069 (0.047)	0.062 (0.047)	0.067 (0.047)
Age of Head	0.011 (0.004)	0.011 (0.004)	0.011 (0.004)	0.011 (0.004)	0.011 (0.004)	0.011 (0.004)
Age Squared/ 100	-0.012 (0.004)	-0.012 (0.004)	-0.012 (0.004)	-0.012 (0.004)	-0.012 (0.004)	-0.012 (0.004)
No Education	-0.053 (0.026)	-0.054 (0.026)	-0.054 (0.026)	-0.054 (0.026)	-0.051 (0.026)	-0.053 (0.026)
1-5 Years Education	-0.037 (0.025)	-0.037 (0.025)	-0.037 (0.025)	-0.036 (0.025)	-0.036 (0.025)	-0.036 (0.025)
6 Years Education	0.005 (0.028)	0.005 (0.028)	0.005 (0.028)	0.005 (0.028)	0.006 (0.028)	0.005 (0.028)
Single	0.086 (0.063)	0.084 (0.063)	0.084 (0.063)	0.090 (0.063)	0.089 (0.062)	0.092 (0.062)
Wife's Age	-0.0001 (0.001)	-0.0001 (0.001)	-0.0001 (0.001)	0.0001 (0.001)	0.0001 (0.001)	0.0001 (0.001)
Change in log Family Size	-0.510 (0.044)	-0.512 (0.044)	-0.512 (0.044)	-0.509 (0.044)	-0.508 (0.044)	-0.507 (0.044)
Community Cons. Change	0.361 (0.040)	0.361 (0.040)	0.361 (0.040)	0.366 (0.040)	0.370 (0.040)	0.373 (0.040)

Notes: Standard errors in parentheses. Estimates are from models such as (8) in text. Coefficients on change in share of family in age/sex groups not reported.

Table 5: Varying the Specification

	Intermed ADL	Basic ADL's	Symptoms	Chronic Symptoms
Community Dummies	0.125 (0.071)	0.519 (0.175)	0.009 (0.014)	0.015 (0.018)
No Family Size	0.131 (0.069)	0.571 (0.172)	0.013 (0.014)	0.028 (0.017)
Include Lagged Income	0.139 (0.068)	0.590 (0.169)	0.008 (0.013)	0.020 (0.017)

Notes: Standard errors in parentheses. Models include all controls shown in Table 4, and noted in footnote to that table. The first row replaces change in log community consumption with a set of community dummies. The second row uses as the dependent variable the log change in total (not per capita) consumption, and excludes the control for change in log family size. The third row includes lagged (period 1) income.

Table 6: State Dependence?

	Intermed ADL	Basic ADL's	Symptoms	Chronic Symptoms
Types of Consumption				
Food Consumption	0.064	0.409	0.014	0.020
	(0.070)	(0.175)	(0.014)	(0.017)
Non-Food Consumption	0.103	0.466	0.013	0.068
	(0.105)	(0.261)	(0.020)	(0.026)
Non-Workers				
Change In Illness	0.042	0.028	-0.041	0.014
	(0.079)	(0.163)	(0.030)	(0.031)
Asset Interactions				
Change in Illness	0.188	0.696	0.010	0.025
	(0.076)	(0.179)	(0.015)	(0.019)
Assets > 75th percentile?	0.021	0.017	0.019	0.023
	(0.020)	(0.020)	(0.020)	(0.021)
Interaction	-0.237	-1.020	-0.004	-0.025
	(0.162)	(0.545)	(0.003)	(0.040)
Lagged Spousal Work Interactions (Married Heads Only)				
Change in Illness	0.260	1.114	0.011	0.007
	(0.103)	(0.271)	(0.018)	(0.024)
Spousal Period 1 Earn / Head Period 1 Earn	0.033	0.032	0.033	0.027
	(0.017)	(0.017)	(0.017)	(0.018)
Interaction	-0.190	-1.049	0.013	0.026
	(0.150)	(0.361)	(0.027)	(0.033)

Notes: Standard errors in parentheses. Models include all controls shown in Table 4, and noted in footnote to that table. Second panel restricts sample to non-workers. Third and fourth panels show coefficients of interest from models that include interactions of change in illness with measures of self-insurance.

Table 7: Estimating Magnitude of Consumption Insurance

	OLS	IV	γ/C_{t-1}
Intermediate ADL	0.006 (0.004)	0.079 (0.041)	0.30
Basic ADL		0.199 (0.074)	0.73
Both ADL Measures		0.153 (0.050)	0.57
Symptoms		-0.050 (0.076)	--
Chronic Symptoms		-0.159 (0.167)	--
Both Symptoms Measures		-0.026 (0.073)	--

Notes: Standard errors in parentheses. Regressions include all of controls shown in Table 4 and footnote to that table. Coefficient is that on change in earnings of head minus change in medical spending from regressions of the form of (9). First column estimates this model by OLS, while second column estimates 2SLS model, where the instrument is listed in the left hand column. Final column shows implied effect of income changes on consumption changes.

Table 8: Expected Insurance Payouts as a Percentage of Per Capita Consumption

Type of Illness	Insuring Income Loss	Subsidizing Medical Expenditures
Intermediate ADL	0.32%	0.06%
Basic ADL	1.01%	0.14%
Combined Intermediate & Basic ADL	0.90%	0.11%

Table 9: Welfare Gains from Insuring Earnings Loss Due to Illness

Type of Illness	ρ	Willingless to Pay/ Baseline Consump	Willingess to Pay/ Expected Payout
Intermediate ADL	2	0.33%	32.6%
	2.5	0.33%	32.8%
	3	0.34%	33.2%
Basic ADL	2	0.34%	89.0%
	2.5	0.37%	95.8%
	3	0.40%	105.1%
Combined Intermed & Basic	2	0.59%	65.0%
	2.5	0.61%	67.3%
	3	0.63%	69.9%

Table 10: Welfare Gains from Insuring Medical Spending Increase Due to Illness

Type of Illness	ρ	Willingless to Pay/ Baseline Consump	Willingess to Pay/ Expected Payout
Intermediate ADL	2	0.08%	57.1%
	2.5	0.08%	59.3%
	3	0.09%	61.7%
Basic ADL	2	0.10%	173.2%
	2.5	0.13%	223.8%
	3	0.18%	298.1%
Combined Intermed & Basic	2	0.16%	140.9%
	2.5	0.17%	154.1%
	3	0.19%	168.9%

Notes: All tables based on calculations described in text. Table 8 shows expected insurance payouts as percentage of baseline consumption. Tables 9 and 10 show willingness to pay as percentage of consumption (first column) and expected payout (second column).

Appendix: Varying the Specification of Illness

As noted in the text, our models restrict the specification of ADL changes by incorporating them into a particular index form and imposing symmetry. We relax these assumptions in Table A1, by varying the instrument set used to estimate equation (9) by IV. That is, all of the coefficients in this table are estimates of the effect of income variation on consumption, but where the instrumental variables set is specified in a number of different ways. This provides a natural basis for comparing the sensitivity of our key finding to the specification of the illness instrument.

First, in the last two columns of the top panel, we show the effect of just using downward movements in the ADL index as instruments; that is, the change in the ADL index is set to zero if it either does not change or if it moves upwards. This corresponds to examining the effects of only health deterioration, as opposed to any change in health. In fact, the results are very similar to our overall findings; for basic ADLs, for example, we find that households can smooth 30% of the income change due to downward movements in the index.

Second, in the second and third panels of the table, we show the result of using changes in each of the separate ADL measures that comprise the indices as instruments. We first create a measure which is the change in the value for each individual ADL over the categories of able to perform (1), able to perform with assistance (2), and unable to perform (3). We then use each ADL change separately as an instrumental variable in the first set of columns. We also show, in the second set of columns, the effect of using as an instrument just a dummy for a downward movement in each ADL, from able to perform the ADL (1) to at least somewhat unable (2 or 3). We present the results separately for intermediate and basic ADLs; within each panel, the ADLs are presented in order of their frequency (ie. inability to walk long distances occurs in 11% of our cases, while inability to carry a heavy load occurs in only 5.2%).

In fact, the results using these separate components largely line up with expectations based on the overall index. The effects of the individual intermediate ADLs are positive but relatively small. The final row in the second panel shows the effect of using the full set of individual intermediate ADL changes as instrumental variables; this parallels our results in Table 7, but does not restrict the ADLs to enter in the index form (1). We set each ADL change to zero if there is a change in a more severe (defined as less frequent) intermediate ADL. We find a result that is very similar to Table 7, although a bit larger. But the result is much weaker if we use the set of downward movements only as instrumental variables; improvements in intermediate ADLs appear to be somewhat important in identifying our effects here.

Repeating this exercise for basic ADLs, we find that the coefficients on the individual ADLs are uniformly larger. Moreover, the coefficients line up in inverse order of frequency; the largest effects are associated with the least frequent ADL changes.[19] It is also true that the results here are more similar for the symmetric change and the downward movement dummies. Overall, if we use the separate changes in each basic ADL component as a set of instruments in the final row of the table, we get a somewhat smaller coefficient than in Table 7, but of the same order of magnitude.

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[19]Indeed, for the most extreme basic ADL changes the coefficients imply a fall in consumption of more than 1% for each 1% change in income, but the standard errors are very large here.

Table A1: Alternative Specifications of ADLs - Effects on Magnitude of Consumption Smoothing

	ADL Change		ADL Worsens	
	Coefficient	γ/C_{t-1}	Coefficient	γ/C_{t-1}
Indices				
Intermediate ADL Index	0.079 (0.041)	0.30	0.073 (0.038)	0.27
Basic ADL Index	0.199 (0.074)	0.73	0.186 (0.064)	0.70
Intermediate ADLs				
Can't Walk 5 Km.	0.035 (0.078)	0.13	-0.014 (0.054)	---
Can't Carry Heavy Load	0.093 (0.043)	0.35	0.068 (0.047)	0.25
Can't Take Water from a Well	0.114 (0.047)	0.43	0.059 (0.045)	0.22
Can't Bend, Kneel, or Stoop	0.074 (0.061)	0.28	0.021 (0.054)	0.08
Can't Sweep Yard	0.071 (0.054)	0.27	0.053 (0.054)	0.20
All Intermediate (Conditional)	0.093 (0.043)	0.35	0.038 (0.037)	0.14
Basic ADLs				
Can't Rise from Sitting on Floor Without Help	0.147 (0.085)	0.55	0.093 (0.058)	0.35
Can't Stand from Sitting in Chair Without Help	0.185 (0.082)	0.69	0.184 (0.076)	0.69
Can't Bathe Self Without Help	0.163 (0.070)	0.61	0.140 (0.059)	0.52
Can't Go to Toilet Without Help	0.217 (0.096)	0.81	0.150 (0.066)	0.56
Can't Feed Self Without Help	0.367 (0.210)	1.38	0.421 (0.184)	1.58
Can't Clothe Self Without Help	0.483 (0.363)	1.81	0.486 (0.292)	1.82
All Basic (Conditional)	0.123 (0.062)	0.46	0.083 (0.042)	0.31

Notes: Standard errors in parentheses. Each regression includes controls shown in Table 4 and noted in footnote to that table. Coefficient in columns (1) and (3) is that on change in earnings of head minus change in medical spending from regressions of the form of (9), where instruments are listed at left. Figures in columns (2) and (4) are implied effects of income changes on consumption changes.