# Medicare and Medical Expenditure Risk*

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## Abstract

A key goal of health insurance is to hedge against the risk of high, unexpected medical expenses. However, the exiting literature has focused far more attention on the impacts of health insurance on health and health care utilization. We use data from the Medical Expenditure Panel Survey (MEPS) and the current discontinuity in Medicare coverage at age 65 to estimate the impact of Medicare on medical expenditure risk. We use a subsample of participants admitted to the hospital via the Emergency Room (ER) and another subsample of participants with non-deferrable medical conditions to identify those who cannot postpone health care spending until they become eligible for Medicare. Using these samples, we find large reductions in different parts of the distribution of out-of-pocket expenditures at age 65: mean expenditure drops by 40 to 67% ($670-$1,500) depending on the sample, while expenditures decline by 34 to 38% ($2200-2,500) for the top 5% of medical spenders. Our results suggest that Medicare offers significant protection against medical expenditure for the elderly.

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## I. Introduction

Over a quarter of individuals ages 19 to 64 and about half of those who were uninsured at some point in 2006 were unable to pay their medical bills (Collins et al. 2008). Medical bills contribute to 1 in 6 personal bankruptcies (Dranove and Millenson 2006) and some contend the contribution is much larger (Himmelstein et al. 2005). Likewise, out-of-pocket medical spending may be pivotal in 1 in 4 low income personal bankruptcies (Gross and Notowidigdo 2011). Despite these numbers and despite a large literature on the impact of health insurance on health (e.g., see Card et al. 2009; Polsky et al. 2009; Finkelstein and McKnight 2008; McWilliams et al. 2007; Levy and Meltzer 2008), we know remarkably little about the financial risk protection from health insurance (Finkelstein and McKnight 2008 is an important exception; Gruber and Levy 2009 review the broader evidence). This is surprising given that risk protection is the primary motivation behind any insurance scheme.

Recent work suggests that the risk protection from health insurance can have impostant implications for financial well-being, even among relatively young populations. Medicaid expansions reduce personal bankruptcies, out-of-pocket medical spending, debt, and collections activity (Finkelstein et al 2012; Gross and Notowidigdo 2011). Retiree health insurance lowers out-of-pocket spending by about 20% in the top 40% of the spending distribution (Strumpf 2010). And within 5 years of its introduction, Medicare decreased out-of-pocket medical spending by 40% among those previously in the top quartile of spending (Finkelstein and McKnight 2008). However, the role of health insurance in reducing exposure to catastrophic medical spending remains poorly understood generally and even more so for the elderly today, who have potentially much larger exposure to high medical spending due to advances in medical diagnostics and treatment that are increasingly expensive.

To fill the gap in our knowledge, we estimate the impact of health insurance on financial risk among the young elderly (ages 65-80) relative to the near elderly (ages 50-64). We focus on these groups for two reasons. First, this comparison lends itself to a credible research design – a regression discontinuity (RD) exploiting age-based eligibility for Medicare. Because Medicare provides nearly universal health insurance coverage for those ages 65 and over, it creates a discontinuity in insurance coverage and generates “as good as random” assignment of coverage for individuals near the age-eligibility threshold. Coupled with a focus on non-deferrable conditions to separate the impact of Medicare eligibility on financial risk from any effect on care-seeking, the discontinuity in insurance coverage at age 65 will allow for a credible empirical strategy. Second, health insurance has the potential to significantly affect exposure to financial risk for the elderly relative to the near elderly. The near elderly are ineligible for Medicare based on age but are more likely than the general population to have serious health conditions and thus be exposed to medical expenditure risk (Williams et al. 2010). While less than 1% of the elderly are uninsured, almost 15% of the near elderly lacked insurance in 2010 (KFF 2011b).

Ultimately, the impact of Medicare on financial risk is an empirical matter. On the one hand, by providing coverage for previously uninsured individuals, Medicare might decrease exposure to financial risk related to medical expenditure. On the other hand, if doctors respond to health insurance by overproviding expensive, high-tech care (Wagstaff and Lindelow 2008), then medical expenditure risk could increase with coverage. In addition, the transition to Medicare might represent greater exposure to financial risk for individuals who previously had generous employer sponsored health insurance, particularly those who lack retiree or other wrap-around Medicare coverage. For example, while Card et al. (2008) find that education and ethnic disparities in the probability of any coverage narrow with Medicare eligibility, disparities in at least one indicator of the generosity of coverage actually widen. Therefore, we interpret our findings as capturing changes in medical-related financial risk due to both the increase in coverage at age 65 and the transition to a new benefits package, where no specific effect sign is predicted by economic theory.

The primary contribution of this paper is to combine (1) a highly credible regression discontinuity (RD) research design with (2) high quality secondary and primary data to analyze the current impact of Medicare on exposure to medical expenditure risk. We use 14 years (1996-2009) of the Medical Expenditure Panel Survey (MEPS), the highest quality nationally representative data containing information on health insurance coverage, health conditions, and total and out-of-pocket medical spending. To operationalize expenditure risk, we analyze changes in the distribution of out-of-pocket spending (excluding premiums since this is a cost that occurs with certainty, i.e. involves no risk), which should provide individuals important information about their actual risk.

Our analysis of spending will focus primarily on individuals with non-deferrable conditions in order to separate the risk protective and utilization effects of insurance. We will take two approaches to defining samples with non-deferrable conditions – 1) individuals with an inpatient admission through the ER and 2) individuals with 1 of 22 acute conditions for which three physicians agreed that care cannot be postponed (see Appendix Table 1). While these groups yield our preferred samples, comparison with the whole sample will be made in order to understand the importance of the endogenous timing of care.

Even with the restricted sample sizes from our non-deferrable samples, we find large changes in insurance at age 65, virtually no change in the demand for care and a larger impact of Medicare on out-of-pocket health spending than in the full sample. For example, whereas mean out-of-pocket expenditures drop by about 20% ($200) in the full sample at age 65, the corresponding drops are 67% ($1500) for the sample admitted through the ER and 40% ($670) for the sample with acute non-deferrable conditions. Likewise, for the top 5% of medical spenders, out-of-pocket spending declines by 15% ($550) in the full sample at age 65 but by 34% ($2500) and 38% ($2200) in the ER and non-deferrable conditions sample respectively. The implication is that while there is considerable deferral of medical spending until individuals become eligible for Medicare at age 65, the program offers substantial protection against the large out-of-pocket costs associated with acute, unanticipated medical conditions. To interpret the economic significance of our estimates, future drafts will include a welfare analysis, similar to Feldstein and Gruber (1995) and Finkelstein and McKnight (2008), that combines an expected utility framework with the RD estimates of changes in out-of-pocket health spending at age 65 to calculate the welfare change from the effect of Medicare on financial risk.

The rest of the paper is organized as follows. Section II describes the data used, the construction of measures of insurance coverage and generosity, and measures of expenditure risk. Section III describes the method used, regression discontinuity design, as well as the construction of subsamples for the analysis of non-deferrable spending. Section IV presents the results. Section V describes the welfare analysis and section VI concludes.

## II. Study Data

We use pooled data from 14 years (1996-2009) of the Medical Expenditure Panel Survey (MEPS), a nationally representative two-year rotating household panel containing information on health insurance coverage, health conditions, and total and out-of-pocket medical spending. MEPS's main advantage is its high quality data on health care spending: in addition to a household survey, a provider component obtains additional health spending data. Moreover, the public version of the MEPS enables us to calculate age in quarters and thereby precisely estimate the age profiles of spending.

Unfortunately, because MEPS is a household survey, it misses extreme spending by individuals in institutional settings (Aizcorbe et al. 2010, Zuvekas and Olin 2009). Because this effect should not differ across the age 65 Medicare threshold, however, it will not bias our results but may understate the impact of Medicare on risk protection.

### *Insurance Coverage and Generosity*

We investigate the relationship between Medicare eligibility and health insurance status in two main dimensions: coverage and generosity. Health insurance coverage is measured as an indicator for whether the respondent reported having any type of health insurance at any month during the year preceding the survey. Additionally, we follow the literature and measure health insurance generosity using an indicator for whether the respondent reported having two or more health insurance policies in the year preceding the survey (Card et al. 2008). This measure captures reported supplemental insurance coverage, which increases generosity by providing additional benefits and covering the relatively high cost-sharing in traditional Medicare.[1]

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[1] Because it does not capture Medicare Advantage (MA), however, this measure is likely to underestimate the generosity of insurance benefits at age 65. In 2006, for example, the average net value of anMA plan exceeded traditional Medicare by $55 to $71 per month, depending on the plan type (fee-for-service or managed care). See Merlis (2008) for details.

*Medical Expenditure Risk Measures*

We measure expenditure risk based on the empirical distribution of out-of-pocket spending in the MEPS. Although risk is fundamentally an ex-ante concept, the distribution of expenditure realizations is one way for an individual to understand the likelihood of facing extreme out-of-pocket costs. We will measure changes in the whole distribution of out-of-pocket spending at age 65, including the mean, different percentiles and the share of total expenditures that is paid out-of-pocket. Expenditures in MEPS are defined as the sum of direct payments for care provided during the year, including out-of-pocket payments and payments by private insurance, Medicaid, Medicare, and other sources. Payments for over-the-counter drugs are not included in MEPS total expenditures. All medical expenditures were corrected for inflation using the Consumer Price Index (CPI) and are expressed in 2010 dollars. All age-specific means were calculated taking into account survey design.

While the distribution out-of-pocket spending across ages provides individuals with a reasonable estimate of their ex-ante exposure to medical expenditure risk, it provides only limited insight into the medical-related financial stress faced by individuals. In future drafts, we will use The Health Tracking Household Survey (HTHS), formerly the Community Tracking Survey, a nationally representative survey conducted by the Center for Studying Health System Changes, to analyze measures of financial strain. Specifically, we will use three waves of the HTHS -2003, 2007 and 2010 – that include information on health insurance, use of services and medical-related financial strain, such as difficulty paying medical bills, contact with a collection agency, bankruptcy filings, and so on. We also will collect and analyze primary data on individual risk perceptions, measured as expectations of out-of-pocket medical spending as well as reports of ability to make these expenditures.

## III. Empirical Strategy: Regression Discontinuity Design

Our research is motivated by an interest in understanding the impact of health insurance on medical expenditure risk. In principle, we would like to estimate the following simple reduced-form equation:

$$y_i = a + f(age_i; l) + bI_i + X_i d + e_i \qquad (1)$$

where $y_i$ is a measure of financial exposure (e.g. out-of-pocket spending) for individual $i$; $X_i$ is a set of demographics characteristics of individual $i$; $f(age_i; \lambda)$ is a smooth function representing the age profile of outcome $y_i$; $I_i$ is an indicator for whether individual $i$ has health insurance coverage and $\varepsilon_i$ is an unobserved error. A fundamental and well-known problem in interpreting $\beta$ as the causal effect of health insurance on medical expenditure risk is that coverage is endogenous; it both affects and is affected by financial risk, confounding observational comparisons of people with different insurance status.

To circumvent this well-known empirical problem, we exploit the age 65 threshold for Medicare as a credible source of exogenous variation in insurance status We adopt a Regression Discontinuity (RD) design, exploiting the sharp, age-based eligibility criteria for Medicare, that takes advantage of the fact that individuals on either side of the age 65 Medicare threshold (e.g., 64 or 66) are likely equivalent on observable and unobservable dimensions that affect medical expenditure risk. This age 65 Medicare RD offers a well-established research design, albeit one that has been used largely to understand the impact of Medicare on health care use, diagnoses, mortality, and job lock (see, for example, Card et al. 2008; Card et al. 2009; Fairlie et al. 2012; Kadiyala and Strumpf 2012).

Using the 1996-2009 MEPS, we show below that rates of insurance coverage rise discontinuously from about 88 to 99% at age 65. For individuals admitted to the hospital through the ER or with non-deferrable conditions (discussed more below), the increase is similar, from about 90 to almost 100%. This discontinuous change in coverage allows us to identify the effect of health insurance on financial risk. Because the increase in coverage at age 65 comes through Medicare, we interpret this as the impact of Medicare rather than health insurance more generally on financial risk. Because those who had health insurance prior to transitioning on to Medicare experience some change in their benefits package, the analysis described below will capture a weighted average effect of the change in medical expenditure risk due to the increase in insurance coverage at age 65 and the change due to the Medicare benefits package, which for those who previously had employer-sponsored insurance may in principle be less generous. In practice, however, because most Medicare beneficiaries (90%) have supplemental insurance, the total package of health insurance at age 65 is likely to be quite generous.

Formally, health insurance coverage due to Medicare can be summarized by the following equation:

$$I_i = \gamma + g(age_i;\mu) + \pi T_i + X_i\varphi + u_i \tag{2}$$

where coverage depends on individual characteristics, a smooth function of age and an indicator $T_i$ for age 65 or older. Combining equation (2) with equation (1) the resulting reduced form model for outcome $y_i$ is

$$y_i = \omega + h(age_i;\varphi) + \tau T_i + X_i\theta + u_i \tag{3}$$

where $\omega = \alpha + \beta\gamma$; $h(age_i;\varphi) = f(\cdot) + \beta g(\cdot)$.[2] Assuming the age profiles $f(\cdot)$an $g(\cdot)$ are both continuous at age 65, any discontinuities in $y_i$ at that age can be attributed to discontinuities in insurance. In other words, if we assume that the age profiles of financial risk are continuous at age 65 in the absence of Medicare's age-based eligibility rule, then, once we empirically control for such profiles, any estimated discontinuity in our risk measures can be attributed to discontinuities in Medicare coverage. The magnitude of the treatment effect $\tau$ depends on the size of the insurance changes at age 65, $\pi$, and the causal effect of insurance on $y_i$, $\beta$.

Equation (3) is our main estimating equation. As discussed above, our estimates of the effect of insurance on financial risk of the elderly relative to near-elderly, $\tau$ , capture a weighted average of the change due to the increase in coverage at age 65 and the change due to Medicare (and supplemental insurance) benefits. For analyses of insurance coverage, mean out-of-pocket spending and the share of total spending paid out of pocket, we use Ordinary Least Squares (OLS) regressions. Analyses of different points in the distribution of spending – e.g., spending at the median, 75th and 95th percentile – are estimated using quantile regressions. Standard errors are estimated

[2] The validity of the RD requires smoothness in the covariates. Assuming smoothness holds, an assumption we partially test, individual characteristics, $X_i$ , are not needed but can be included to increase precision.

using a block bootstrap that randomly samples with replacement the data within each survey strata and estimates the models on these random samples (Efron and Tibshirani 1994). The standard errors are then calculated simply as the standard deviation of the coefficient estimates from 500 bootstrap samples. All regressions (OLS and quantile) employ survey weighting. In order to increase precision, we pool together several years of data, but samples in most years are not completely independent because households are drawn from the same sample geographic areas and many persons are in the sample for two consecutive years.[3] Despite this lack of independence, it is valid to pool multiple years of MEPS data and keep all observations in the analysis because each year of the MEPS is designed to be nationally representative. However, to obtain appropriate standard errors when pooling years of MEPS data, we specify a common variance structure that properly reflects the complex sample design of the MEPS.[4]

*ER and Non-Deferrable Conditions Samples*

A key concern in comparing the distribution of health spending above and below the age-65 threshold is that individuals may choose to defer some health spending until they become eligible for Medicare (or alternatively others with very generous insurance may schedule elective procedures prior to their transition to Medicare). Indeed, previous work demonstrates that hospitalizations increase once individuals transition to Medicare (Card et al. 2008). Although an increase in health care utilization, particularly costly inpatient stays, at age 65 biases us against finding an effect of Medicare on financial risk protection, it also limits our ability to make causal inference. To more credibly isolate the effect of health insurance on financial risk protection, our primary analysis will focus on individuals with unanticipated and non-deferrable health events.

The MEPS Household Component Event Files, which include hospital inpatient stay files, and the Medical Conditions Files, which ask about diagnoses, medical events, and disabilities, allow us to identify individuals with non-deferrable medical conditions. While the accepted approach to identifying these cases involves selecting diagnoses where inpatient admissions through the ED are close to 2/7 on the weekend, as in

[3] See MEPS-HC Methodology Reports for more details at http://www.meps.ahrq.gov
[4] For details, see http://meps.ahrq.gov/mepsweb/data_stats/download_data/pufs/h36/h36u10doc.shtml

Dobkin (2003), Card et al. (2009), and Doyle et al. (2011), the MEPS collapses ICD-9 codes for medical encounters down to a level (3 as opposed to 5 digits) that makes this exercise difficult. Consequently, we experiment with two alternative approaches to identifying individuals who have medical encounters that cannot be (1) those that suffered at least 1 of 22 acute conditions where selection into health care treatment is largely unavoidable, based on the opinion of three independent physicians (see Appendix Table 1) and (2) those that had an inpatient admission through the emergency department.[5] By focusing on individuals with non-deferrable conditions, we can isolate the effect of insurance on financial risk protection from any behavioral effect it may have on the timing of (and thus spending on) more elective care.

We estimate (3) restricting the sample to each of the non-deferrable samples. The underlying hypothesis is that unpredictable health events that require immediate care will best characterize the risk-reducing properties of health insurance since individuals may not delay care (Card et al. 2009) and thus spending for these conditions. The discontinuity in Medicare coverage at age 65 coupled with a focus on non-deferrable conditions will enable us to estimate the (local average) treatment effect of Medicare on financial risk protection. A comparison of the estimates from the full sample and those with non-deferrable conditions will enable us to gauge the extent to which individuals use health care in a forward-looking manner.

*Other Changes at Age 65*

A key assumption of the Regression Discontinuity design is that individuals on either side of the arbitrary threshold (age 65 for Medicare) are equivalent on observable and unobservable characteristics that affect outcomes. An obvious concern in our context is employment, since 65 is a traditional age of retirement. Card et al. (2008) demonstrates that the estimated jumps in employment-related outcomes at age 65 are small in magnitude and statistically insignificant in both the 1992-2003 NHIS and the 1996-2004 March CPS.

[5] Two of three physicians work in emergency medicine and the third is a general practitioner. To be conservative, we restricted to conditions that all three agreed required immediate attention.

In the MEPS, we find similar smoothness in racial and ethnic background and geographic location of residence and other important observed characteristics, such as marriage rates, educational attainment, as well as retirement and employment rates of the near and young elderly. In Figures 1, 2 and 3 we show these results graphically for the full sample, the sample admitted through the ER and the sample with non-deferrable conditions. Table 2 provides the regression estimates for the outcomes shown in these figures as well as for family size and the share of individuals living in the South. With the exception of the share of individuals in the non-deferrable conditions sample that have a bachelor's degree or higher, we cannot reject that there are no discontinuities at age 65 in any of the observed characteristics. Given this smoothness in the data, our analysis satisfies the continuity assumption of the RD design. Thus, we will attribute any discrete change in our measures of financial risk at age 65 to the change in Medicare eligibility at this age.

## IV. Results

*Medicare Eligibility and Health Insurance Coverage and Generosity*

Figure 4 shows the age profile of health insurance coverage and generosity for the unrestricted sample, the sample admitted via the ER and the sample with non-deferrable conditions. The figures also show smooth functions fitted to the data before and after age 65. As discussed above, Figure 1 demonstrates quite clearly that health insurance coverage rises discontinuously at age 65, from 87% to 98% for the unrestricted sample, from 90% to 98% for the ER sample and from 89% to virtually 100% for those with physician-identified non-deferrable conditions. There is also a positive and large increase in our measures of generosity at age 65. The fraction covered by two or more policies increases by approximately 45 percentage points for all samples, an increase of 225% relative to the pre-65 level. Moreover, as shown in Table 1, all these increases at age 65 are statistically significantly different from zero. We will use this discontinuous change in coverage and generosity at age 65 to identify the effect of Medicare on financial risk.

*Medicare Eligibility and Medical Financial Risk Exposure*

Next, we analyze the distribution of total and out-of-pocket medical spending for individuals just on either side of the age 65 Medicare eligibility cutoff (62 to 64 versus 65 to 67 year-olds). While below the median the distribution of total (and out-of-pocket) medical spending is virtually identical across these age-groups, Figure 5 shows that at higher percentiles, *total* health care spending is substantially higher for the older group. This is expected given the strong age gradient in health risk and consequently medical expenditures. More surprisingly, when we look at *out-of-pocket* medical expenditures this relation is reversed at high percentiles of the distribution. Figure 6 shows that the $80^{th}$ to $99^{th}$ percentiles of out-of-pocket spending are *higher* for those aged 62 to 64 than for those aged 65 to 67. Combined with the findings for total spending, this is strongly suggestive evidence of the medical expenditure risk protection afforded by Medicare.

To further explore this phenomenon, Figures 7, 8 and 9 present the regression discontinuity graphs for different parts of the distribution of spending, for the unrestricted, ER and physician-identified non-deferrable samples respectively. Figure 7 shows that I the full sample there is a discontinuous drop of approximately US$ 200 in the mean of out-of-pocket spending at age 65, a drop of 14% relative to the mean at age 64. This drop increases as we move to higher percentiles of the distribution. At the median and $75^{th}$ percentile, the declines are small – roughly US$ 42 and 60, respectively – and only marginally statistically distinguishable from zero at the median (see Table 3). It is US$ 330 at the $90^{th}$ percentile and US$ 550 at the $95^{th}$ percentile, representing about a 15% decline in out-of-pocket spending at age 65 for those at the tails of the out-of-pocket medical expenditure distribution. Moreover, when we analyze the share of total expenditures that are paid out-of-pocket there is a drop of approximately 1.5 percentage points at age 65 or about 4% off of the mean rate of out-of-pocket spending of 36.4% below age 65. This demonstrates that the drop is coming at least in part from the fraction that is paid by the patient and not just from changes in total medical expenditures at age 65.[6]

[6] Although prior work and our own data confirm that health care utilization overall does not change at age 65, except for some subgroups who were most likely to move from uninsured to insured status (Card et al. 2008), mean medical expenditure drops by almost $600 or about 10%. This suggests that Medicare may affect total spending at age 65 through lower prices

Table 3 shows that, with the exception of the change at the 75th percentile, all these declines are statistically significant. Of course, these changes should understate the effect of Medicare on changes in medical expenditure risk at age 65 if individuals choose to delay some care until they become eligible for the program. To help account for this issue, we return to the samples that faced a medical event that is not likely to be deferred. Figure 8 shows figures analogous to those in Figure 7 but for the sample admitted to the hospital through the ER.

Relative to the full sample, total medical expenditures are higher, as are the declines in out-of-pocket spending at age 65 for the ER sample. For mean out-of-pocket spending, for example, the decline at age 65 is almost $ 1,500 or 67% off the pre-age 65 mean ($2,216). This reinforces the notion that the financial protection is especially important for medical spending that occurs after an unexpected health event. At the median and 75th percentiles, the declines in out-of-pocket spending are more than an order of magnitude larger than for the whole sample – approximately $ 400 and $600, respectively. The change is $ 1500 at the 90th percentile and $ 2500 at the 95th percentile, about 5 times larger than for the full sample. These differences suggest that some medical spending is deferred until age 65 and that this deferral dominates any effort among those with generous coverage to use it for more elective services prior to age 65. Finally, the large decline in extreme out-of-pocket costs at age 65 – about $2,500 for the top 5% of medical spenders in our sample and nearly $22,000 for the top 1% of spenders (not shown and not statistically distinguishable from zero) – suggests that medical expenditure risk declines considerably at age 65. Expressed in terms of a change in the share of medical spending paid out-of-pocket, the transition to Medicare represents an almost 7 percentage point decrease for this sample. With an average share of spending paid out-of-pocket of about 20% at age 64, this represents a decline of about a third. Table 4 shows that despite the much smaller sample (about 6,600 as opposed to over 100,000 in the full sample), these declines are generally statistically distinguishable from zero at the 10 percent (75th percentile and 95th percentile change), 5 percent (90th percentile) and even 1 percent level (median and share out-of-pocket).

Figure 9 and Table 5 show a similar analysis for the physician-identified non-deferrable conditions sample. Similar to the ER sample, this sample has higher levels of out-of-pocket spending and larger discontinuities at age 65 than the full sample. Table 5 shows that all the discontinuities, except for the share out-of-pocket, are statistically significant. For mean out-of-pocket spending, for example, the decline at age 65 is almost $670 or almost 40% off the pre-age 65 mean ($1,176). At the median and 75$^{th}$ percentiles, the declines in out-of-pocket spending are approximately $220 and $850, respectively. The change is $1570 at the 90$^{th}$ percentile and $2200 at the 95$^{th}$ percentile, again about 5 times larger than for the full sample. Most interestingly, the estimated effects in the physician-identified non-deferrable and ER samples are very similar in magnitude and each about 5 times the magnitude of the full sample at the high end of the distribution, which reinforces the importance of focusing on unexpected health events to avoid biases from the strategic timing in health care utilization and spending.

## V. Welfare Calculation (To be Completed)

To interpret the economic significance of the RD estimates, in future drafts we will use a stylized expected utility framework to simulate the insurance value of the estimated change in medical expenditure risk exposure associated with Medicare. This approach is similar to Feldstein and Gruber (1995) and Finkelstein and McKnight (2008). It assumes a utility $u(c)$ where $c$ is non-health consumption and a budget constraint of $c = y - m$, where $y$ is income and $m$ out-of-pocket expenditure. $m$ is a random variable with probability density function $f(m)$ which depends both on random health shocks and health insurance held. Expected utility is given by

$$\int_0^m u(y-m) f(m) dm \qquad (5)$$

To calculate the welfare change associated with Medicare, we will compare individual's risk premium under the pre- and post-65 spending distributions $f(m)$. Following the literature, f(m) will be based on the empirical distribution of medical spending in the MEPS. The risk premium $(\pi)$ is the maximum amount that a risk averse individual would be willing to pay to completely insure against the random variable m:

$$u(y-\pi) = \int_{0}^{m} u(y-m)\, f(m)dm \qquad (6)$$

A decrease in risk exposure for the elderly relative to the near elderly due to Medicare would appear as a decline in the risk premium; this decline provides a dollar measure of the insurance value (and hence welfare gain) from Medicare coverage. We will use quantile estimates of the parameters in (3) to simulate the expenditure distribution faced by individuals just below and above age 65 and to calculate the risk premium for both groups using (6). We will follow the literature and specify a constant relative risk aversion (CRRA) utility function, we will test the robustness of the estimates for different values of the coefficient of relative risk aversion.[7] The net effect of Medicare is then just this social value minus the social cost, which includes: (1) the cost of raising revenue for the program and (2) the efficiency costs from the moral hazard effect of health insurance. Estimates of these two costs are available in the literature (Finkelstein and McKnight 2008).

## VI. Conclusion

We use the discontinuity in Medicare coverage at age 65 to estimate the impact of Medicare expenditure risk among those just eligible versus just ineligible for the program based on age. Our analyses suggest that Medicare plays an important role in protecting against medical expenditure risk for those aged 65 and older. We find that those just eligible for Medicare based on age are 18% more likely to have health insurance and 6 times more likely to be covered by two or more policies than those just ineligible (i.e. slightly younger than 65). As a consequence, they face substantially lower levels of *out-of-pocket* medical expenditures even though—consistent with the strong negative age gradient in health--their *total* medical expenditure is higher than the total expenditure for the younger group.

The discrete change in out-of-pocket expenditures at age 65 is especially large for the sample who suffered unanticipated health events for which treatment and medical expenditures could not be deferred. This is consistent with the already

[7] There is no consensus of what the risk coefficient is; we will show results for coefficients of 1 to 5.

documented fact that those below age 65 delay some types of care until they are eligible for Medicare. Moreover, the difference between the results for the full sample and those with emergency inpatient admissions or with physician-identified non-deferrable conditions indicates that the financial protection afforded by Medicare is especially important for catastrophic medical spending due to an unexpected health shock. For these samples, mean out-of-pocket expenditure drops at age 65 by 40 to 67% relative to the pre-age 65 means or $670 to $1,500. The declines are even more extreme at tails of out-of-pocket spending distribution--about $2,500 (or 34%to 38% of the pre-65 means) for the top 5% of medical spenders in our sample. Moreover, the share of medical expenditures paid out-of-pocket drops by almost 7 percentage points at age 65 for the ER sample (and an insignificant 2.5 percentage points for the physician-identified non-deferrable conditions sample), demonstrating that the overall decline represents a change in who bears the medical expenditure and not just on how much is spent.

These findings have important implications for policy. Specifically, several recent proposals to address rising Medicare spending and long-term federal budget shortfalls have involved increasing the Medicare Eligibility age (MEA) (see, for example, Emanuel 2012, Murray and King, 2012 annd Herger 2012. Based on our findings, if this policy is implemented, those 65 and 66 year-olds who are no longer eligible for Medicare could face substantial drops in insurance coverage and large increases in out-of-pocket expenditures. This is especially true for those in the right tail of the expenditure distribution who, according to our estimates, would see an increase of several thousand dollars in out-of-pocket medical expenditures. If we take into account the persistence in health status, something we do not do here, those faced with a negative health shock might face even large expenditures for multiple years, increasing the policy's financial consequences. While the medical expenditure risk consequences of increasing the MEA might be attenuated if the Affordable Care Act (ACA) is fully implemented, some large states such as Texas and Louisiana continue to maintain that they will opt-out of the Medicaid expansion. If those individuals who would have become eligible via Medicaid expansions are unable to afford private options, increasing the MEA would increase their exposure to medical expenditure risk.

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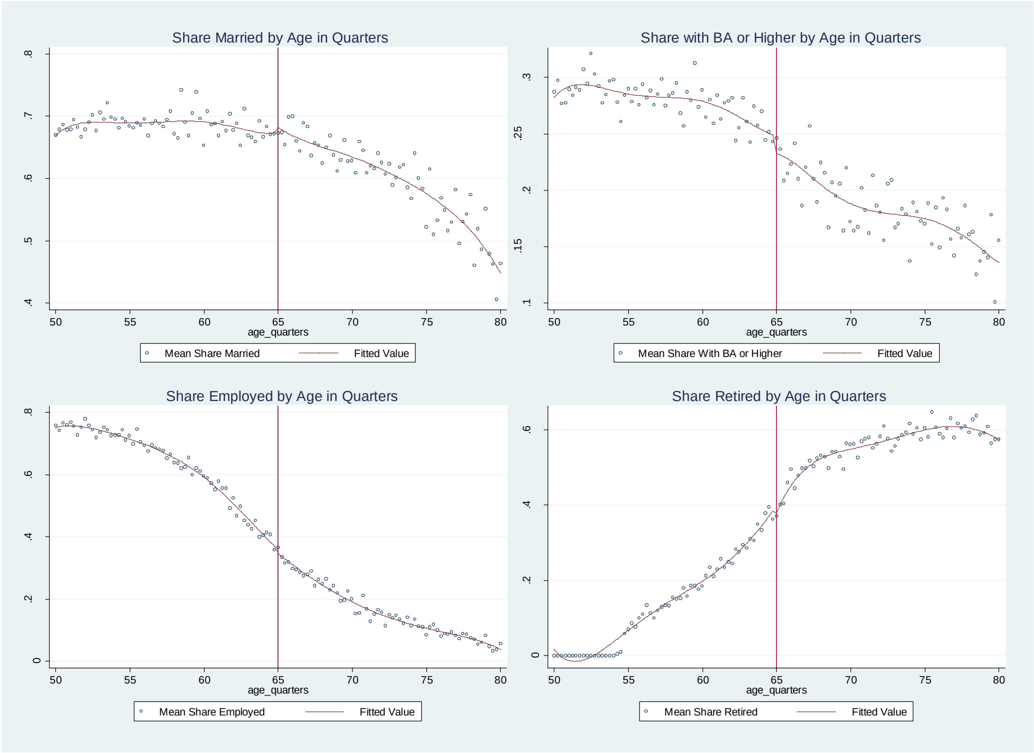
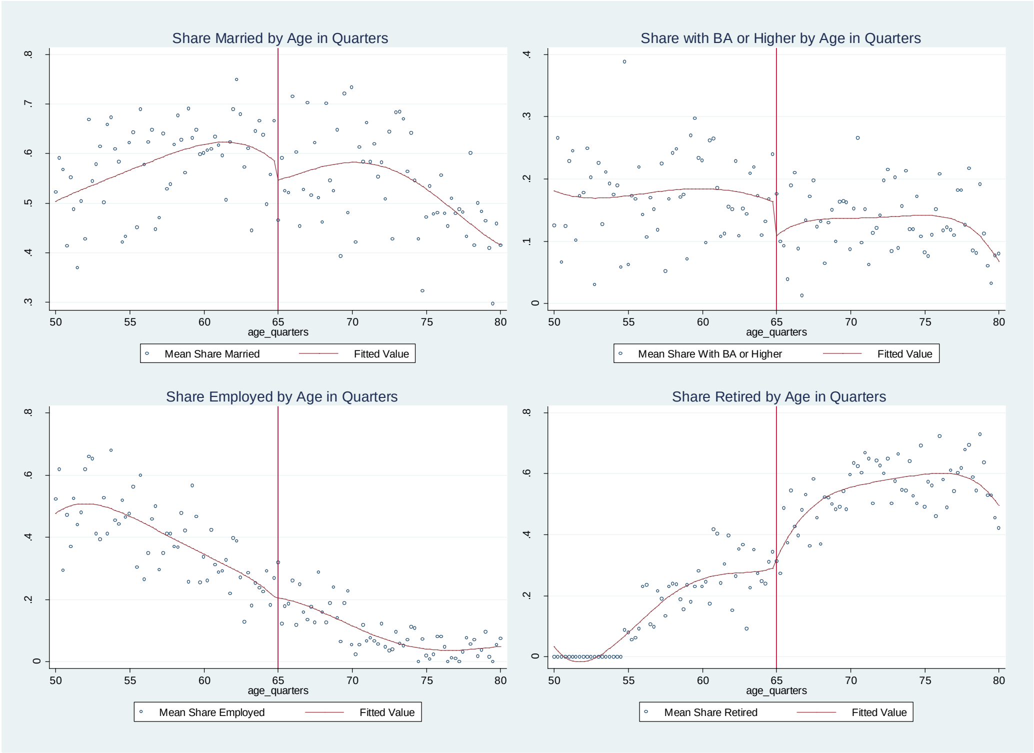
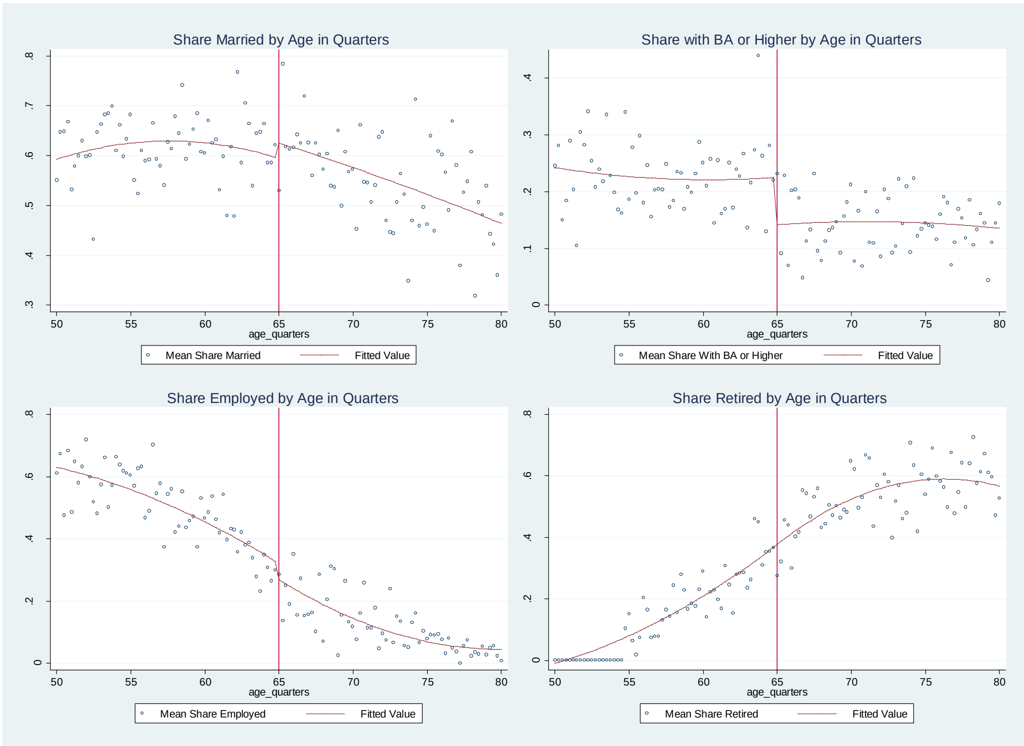
## Figure 1: Smoothness of Covariates, Full Sample




## Figure 2: Smoothness of Covariates, ER Sample



## Figure 3: Smoothness of Covariates, Non-Deferrable Conditions Sample



## Figure 4: Impact of Medicare on Insurance Coverage

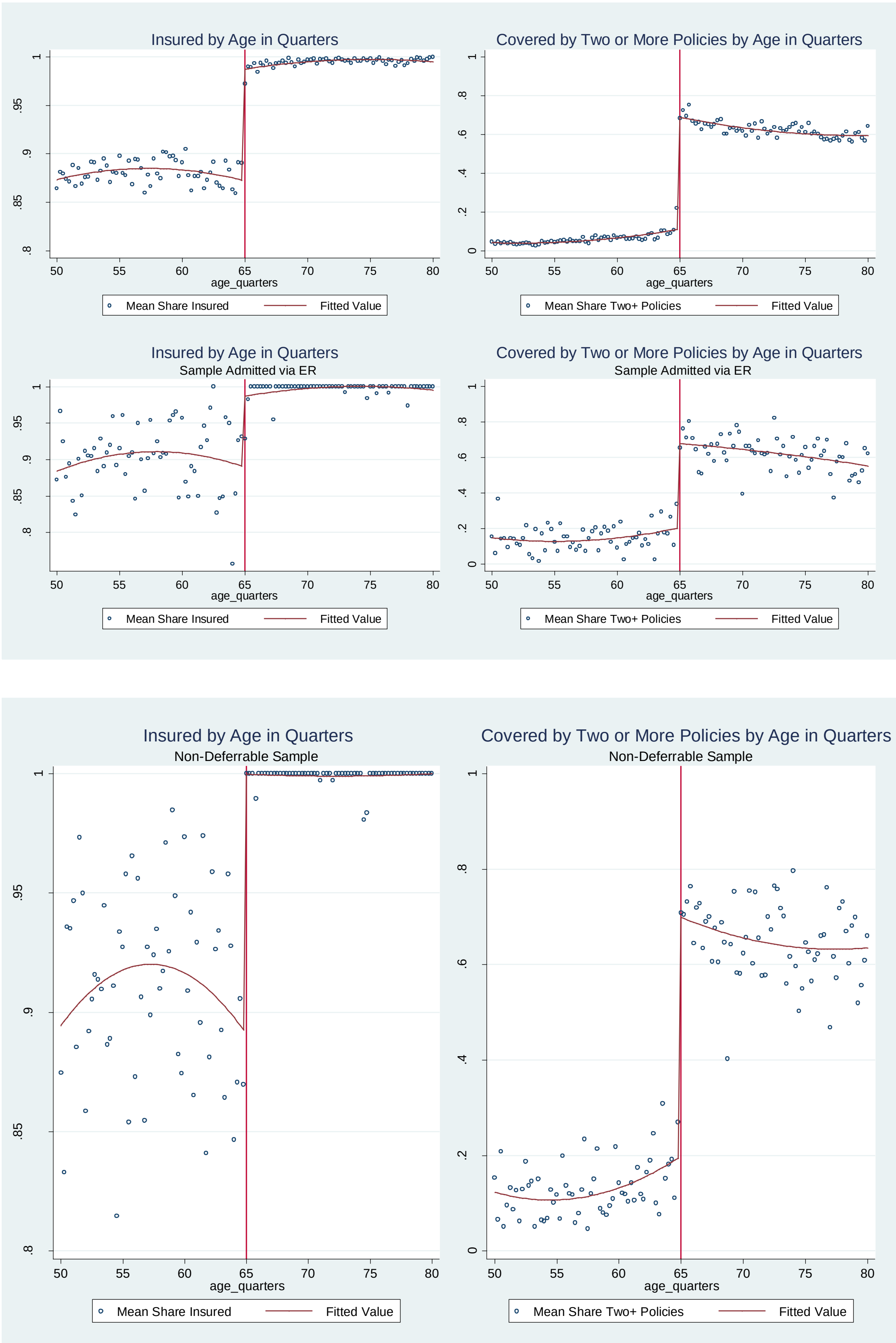


**Figure 5**

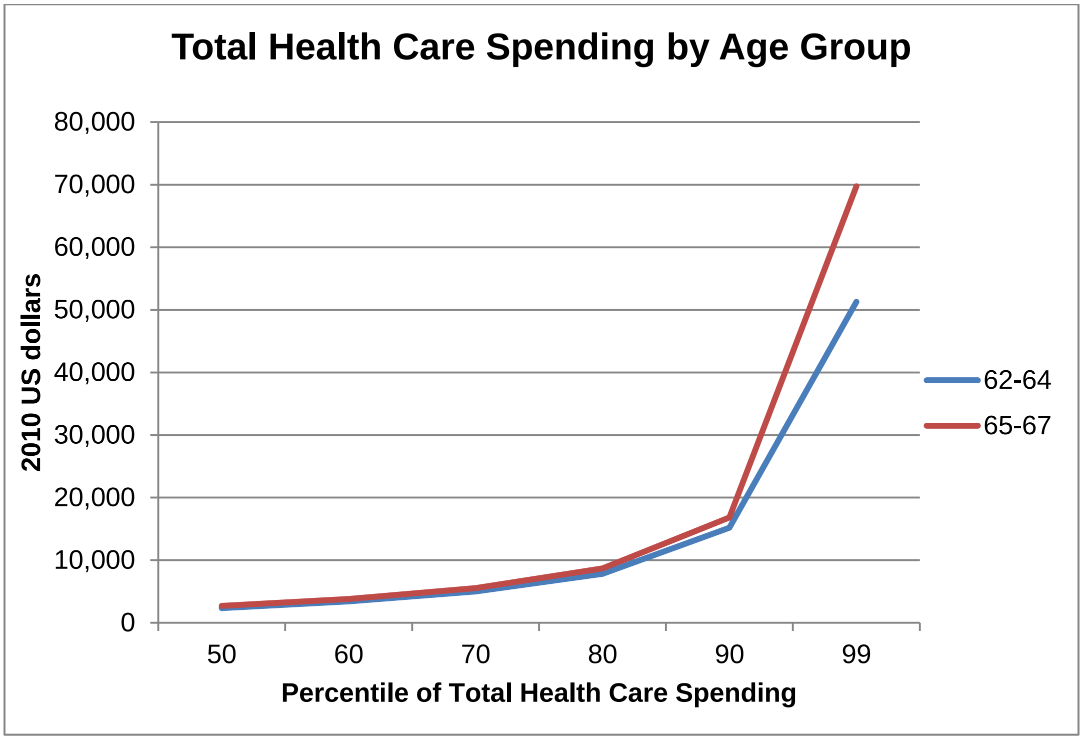
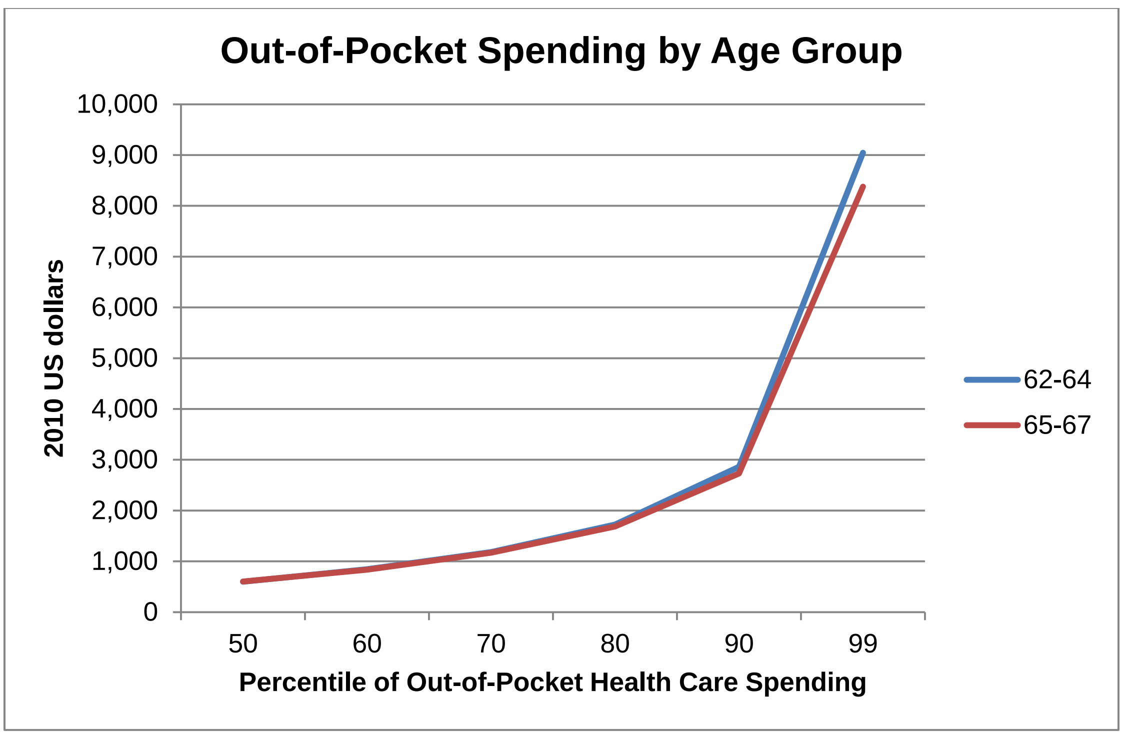
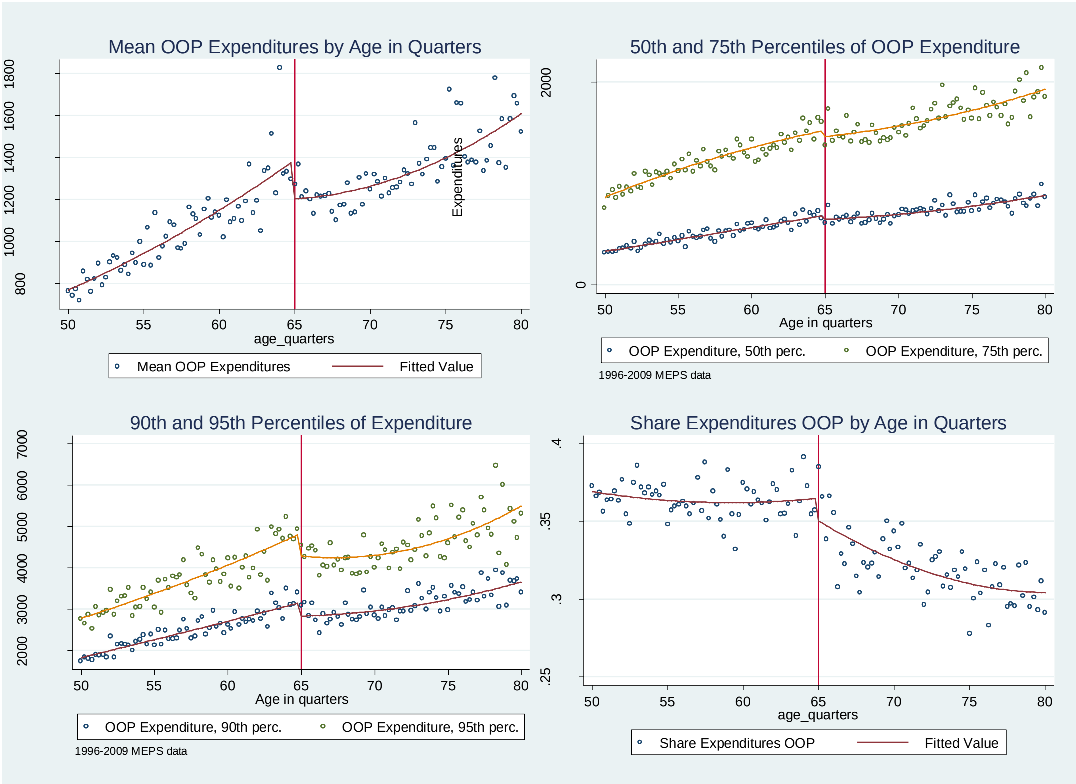


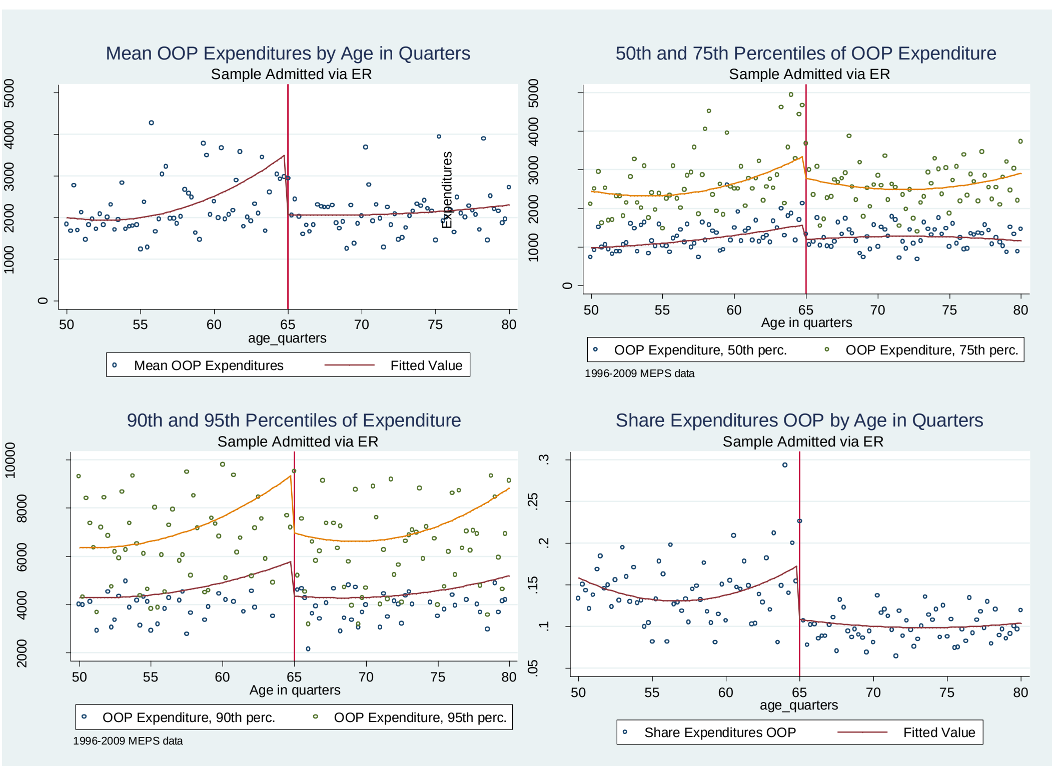

**Figure 6**



## Figure 7: Impact of Medicare on Out-of-Pocket Spending in the Full Sample




## Figure 8: Impact of Medicare on Out-of-Pocket Spending in Sample Admitted through ER



# Figure 9: Impact of Medicare on Out-of-Pocket Spending in Non-Deferrable Sample

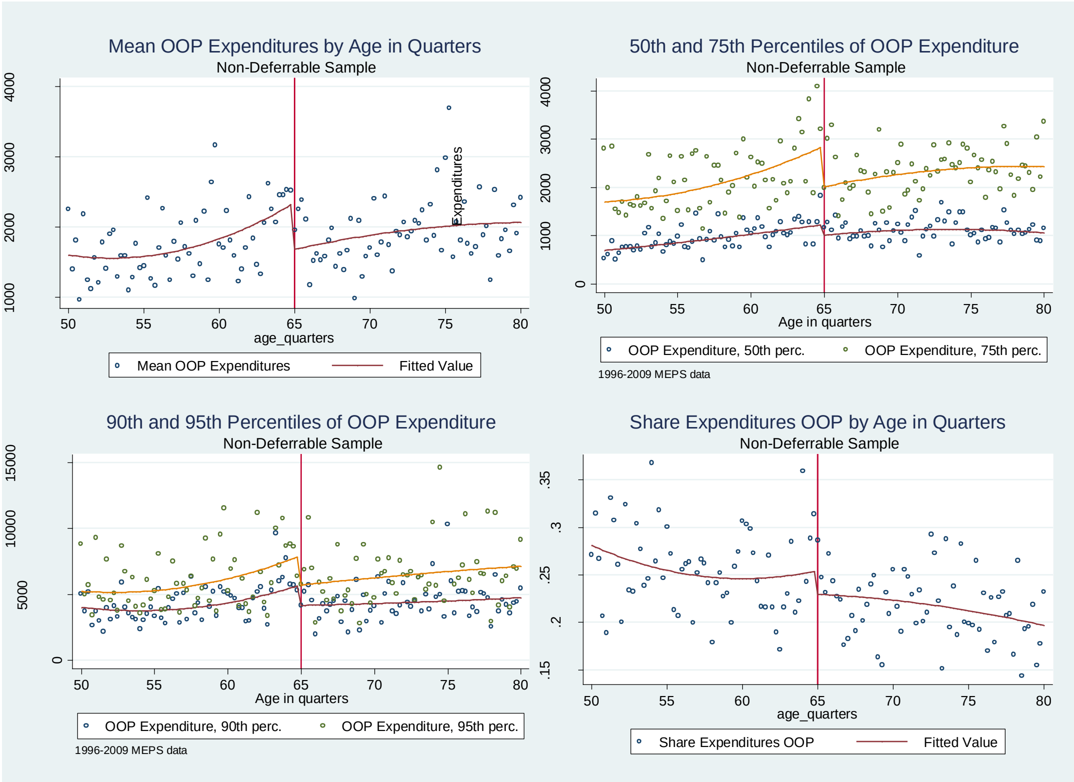


**Table 1: Impact of Medicare Health Insurance coverage and generosity**

| | Insured | Medicare Covered | Covered by 2+ Policies |
|---|---|---|---|
| *Panel A: Full Sample* | | | |
| Age 65 and over | 0.115** | 0.765** | 0.577** |
| | (0.005) | (0.007) | (0.009) |
| Mean Pre-age 65 | 0.88 | 0.06 | 0.06 |
| R-squared | 0.042 | 0.737 | 0.393 |
| Observation | 101545 | 101545 | 101545 |
| *Panel B: Sample Admitted Through the ER* | | | |
| Age 65 and over | 0.098** | 0.627** | 0.472** |
| | (0.020) | (0.031) | (0.035) |
| Mean Pre-age 65 | 0.903 | 0.17 | 0.15 |
| R-squared | 0.051 | 0.584 | 0.235 |
| Observation | 6599 | 6599 | 6599 |
| *Panel C: Sample with Non-deferrable Conditions* | | | |
| Age 65 and over | 0.109** | 0.669** | 0.500** |
| | ( 0.017) | (0.026 ) | (0.033) |
| Mean Pre-age 65 | 0.911 | 0.15 | 0.13 |
| R-squared | 0.045 | 0.610 | 0.297 |
| Observation | 7801 | 7801 | 7801 |

Notes: * significant at 5%; ** significant at 1% Data are from the 1996-2009 Medical Expenditure Panel Survey. Panel A captures all respondents ages 50 to 80. Panel B restricts to those ages 50 to 80 with an inpatient admission through the ER in the survey year. All regressions include a constant, an indicator for ages 65 and above and a quadratic in age in quarters that is allowed to vary on either side of age 65. Standard errors are bootstrapped using 500 draws of the data with replacement.

## Table 2: Estimated Gap in Observable Characteristics at Age 65

| | Share Married | Share With BA or Higher | Share Employed | Share Retired | Family Size | Share living in South |
|---|---|---|---|---|---|---|
| *Panel A: Full Sample* | | | | | | |
| Age 65 and over | 0.0085 | -0.016 | -0.0164 | -0.0167 | 0.056 | 0.014 |
| | (0.0127) | (0.012) | (0.0193) | (0.020) | (0.045) | (0.016) |
| Mean below 65 | 0.687 | 0.281 | 0.651 | 0.178 | 2.42 | 0.355 |
| F-statistic | 1.63 | 1.126 | 1.15 | 0.935 | 1.14 | 1.56 |
| *Panel B: Sample Admitted Through the ER* | | | | | | |
| Age 65 and over | -0.032 | -0.053 | 0.005 | 0.026 | 0.210 | 0.022 |
| | (0.064) | (0.048) | (0.062) | (0.057) | (0.130) | (0.075) |
| Mean below 65 | 0.581 | 0.177 | 0.397 | 0.214 | 2.25 | 0.383 |
| F-statistic | 1.51 | 1.53 | 1.93 | 1.01 | 1.10 | 1.46 |
| *Panel C: Sample with Nondeferrable Conditions* | | | | | | |
| Age 65 and over | 0.031 | -0.084* | -0.052 | 0.0003 | 0.028 | 0.011 |
| | (0.041) | (0.039) | (0.039) | (0.039) | (0.059) | (0.031) |
| Mean below 65 | 0.617 | 0.227 | 0.505 | 0.199 | 2.23 | 0.367 |
| F-statistic | 1.35 | 1.26 | 1.54 | 1.10 | 1.07 | 1.17 |

Notes: Regressions in panel A include a fifth order polynomial in age that is allowed to vary on either side of age 65. Regressions in panel B include a fourth order and in Panel C a 2nd order rather than a fifth order polynomial because of the sparser data and what appeared to be better parametric fits. Standard errors are clustered at the level of age in quarters. The F-statistic, which is based on Lee and Card (2008) is a test of the null hypothesis that the polynomial model has as much explanatory power as the fully flexible plot of the average covariates by age in quarters. In the full sample, only in the case of the share married can we reject the null. However, as the graph suggests this is likely due to the choice of polynomial rather than any actual gap in the data. The fits tend to be poorer in the sub-samples though this may be due to the sparser data.

**Table 3: Impact of Medicare on Out-of-Pocket Spending: Full Sample**

| | Mean | Median | 75th Percentile |
|---|---|---|---|
| Age 65 and over | -184.90** | -41.90+ | -59.66 |
| | (70.64) | (23.9) | (112.6) |
| Mean Pre-age 65 | 954.19 | 418.4 | 1112.76 |
| Observation | 101545 | 101545 | 101545 |

| | 90th Percentile | 95th Percentile | Share of total paid out-of-pocket |
|---|---|---|---|
| Age 65 and over | -331.38** | -546.293** | -0.0154** |
| | (131.8) | (217.89) | (0.007) |
| Mean Pre-age 65 | 2308.86 | 3527.46 | 0.364 |
| Observation | 101545 | 101545 | 101545 |

Notes: + significant at 10%; * significant at 5%; ** significant at 1%. Data are from the 1996-2009 Medical Expenditure Panel Survey and include all respondents ages 50 to 80. All regressions include a constant, an indicator for ages 65 and above and a quadratic in age in quarters that is allowed to vary on either side of age 65. Standard errors are bootstrapped using 500 draws of the data with replacement.

**Table 4: Impact of Medicare on Out-of-Pocket Spending: Sample Admitted Through ER**

| | Mean | Median | 75th Percentile |
|---|---|---|---|
| Age 65 and over | -1480.03 | -395.090** | -611.84+ |
| | (907.93) | (167.85) | (330.5) |
| Mean Pre-age 65 | 2216.49 | 1141.29 | 2506.7 |
| Observation | 6599 | 6599 | 6599 |

| | 90th Percentile | 95th Percentile | Share of total paid out-of-pocket |
|---|---|---|---|
| Age 65 and over | -1488.61* | -2477.83+ | -0.066** |
| | (736.69) | (1904.5) | (0.019) |
| Mean Pre-age 65 | 4704.51 | 7208.49 | 0.143 |
| Observation | 6599 | 6599 | 6599 |

Notes: + significant at 10%; * significant at 5%; ** significant at 1%. Data are from the 1996-2009 Medical Expenditure Panel Survey and are restricted to respondents ages 50 to 80 who had an inpatient admission through the ER in the survey year. All regressions include a constant, an indicator for ages 65 and above and a quadratic in age in quarters that is allowed to vary on either side of age 65. Standard errors are bootstrapped using 500 draws of the data with replacement.

**Table 5: Impact of Medicare on Out-of-Pocket Spending: Sample with Non-Deferrable Conditions**

| | Mean | Median | 75th Percentile |
|---|---|---|---|
| Age 65 and over | -667.79** | -223.31+ | -845.71* |
| | (213.91) | (128.07) | (339.95) |
| Mean Pre-age 65 | 1756.74 | 929.84 | 2104.84 |
| Observation | 7801 | 7801 | 7801 |

| | 90th Percentile | 95th Percentile | Share of total paid out-of-pocket |
|---|---|---|---|
| Age 65 and over | -1573.05** | -2230.68* | -0.025 |
| | (496.19) | (1048.96) | (0.019) |
| Mean Pre-age 65 | 4269.51 | 5830.81 | 0.255 |
| Observation | 7801 | 7801 | 7801 |

Notes: + significant at 10%; * significant at 5%; ** significant at 1%. Data are from the 1996-2009 Medical Expenditure Panel Survey and are restricted to respondents ages 50 to 80 who experienced a nondeferrable condition within one year of the survey. All regressions include a constant, an indicator for ages 65 and above and a quadratic in age in quarters that is allowed to vary on either side of age 65. Standard errors are bootstrapped using 500 draws of the data with replacement.

Appendix Table 1 List of Non-deferrable Conditions, MEPS 1996-2009

| Clinical Classification Code (CCC)* | Conditions | Cases |
|---|---|---|
| 2 | Septicemia (except in labor) | 119 |
| 60 | Acute Posthemorrhagic Anemia | 0 |
| 76 | Meningitis | 27 |
| 77 | Encephalitis | 28 |
| 100 | Acute myocardial infarction | 1231 |
| 107 | Cardiac Arrest and ventricular fibrillation | 135 |
| 109 | Acute cerebrovascular disease | 1567 |
| 112 | Transient cerebral ischemia | 224 |
| 116 | Aortic and peripheral arterial embolism or thrombosis | 923 |
| 129 | Aspiration pneumonitis; food/vomitus | 3 |
| 131 | Respiratory failure; insufficiency; arrest (adult) | 37 |
| 142 | Appendicitis and other appendiceal condition | 92 |
| 221 | Respiratory distress syndrome | 0 |
| 226 | Fracture of neck of femur (hip) | 218 |
| 227 | Spinal cord injury | 105 |
| 230 | Fracture of lower limb | 1349 |
| 231 | Other fractures | 895 |
| 234 | Crushing  injury or internal injury | 195 |
| 241 | Poisoning by psychotropic agents | 1 |
| 242 | Poisoning by other medications and drugs | 859 |
| 243 | Poisoning by nonmedicinal substances | 458 |
| 662 | Suicide and intentional self-inflicted injury | 39 |

Notes: * The Clinical Classification Codes aggregate 5-digit ICD-9-CM condition and V-codes to a smaller number of clinically meaningful categories. The 5-digit codes are not available in the MEPS. Some respondents have more than one condition so the sum of cases does not represent the sum of individuals with non-deferrable conditions.