Recession and Workers’ Health Benefits*

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Abstract

During a recession, employers may reduce labor costs. It appears that employers decreased costs associated with health benefits to offset downward rigidity of wages. Using firm-level health benefits survey data, I demonstrate evidence of an increase in the cost-sharing of employer-sponsored health insurance due to the recession in 2008-2009. I use the high deductible health plan (HDHP) enrollment rate as a measure for cost-sharing. This increase in the HDHP enrollment rate was driven mainly by changes in health plan offerings in industries that were disproportionately affected by the recent recession. Approximately half of the increase in the HDHP enrollment rate was explained by an increase in the proportion of employers offering only HDHPs to employees. Employers also made HDHPs relatively more affordable than low deductible plans. I find no evidence that the increase in out-of-pocket deductibles worsened the health status of workers. Thus, although HDHP enrollment rates may continue to increase as the cost of offering health insurance grows for employers under the Affordable Care Act, the health of workers may not necessarily deteriorate as a result.

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1. Introduction

During a recession, employers may seek to reduce labor costs in response to negative economic shocks. This can be accomplished not only by firing workers, but also by decreasing total compensation for employees. Employers may be limited in the size of the wages cuts they can implement due to a downward rigidity in nominal wages (Card and Hyslop, 1997; Kahn, 1997; Bewley, 1998; Altonji and Devereux, 2000; Lebow et al., 2003). Since a significant portion of total compensation is paid as non-wage benefits, employers may reduce benefits instead (Lebow et al., 2003; Babecký et al., 2012). In the United States, health benefits are a substantial part of total benefits. Hence, employers may change health benefit offerings in response to recessions.

In this paper, using employer-level health benefit survey data, I study changes in the cost-sharing (i.e. the share of health care costs that a beneficiary pays out of pocket) of employer-sponsored health insurance coverage during the recent economic downturn. I use high deductible health plans (hereafter HDHPs) as a measure of cost-sharing due to current policy interest (Newhouse, 2004; Lee and Zapert, 2005; Wharam et al., 2013).

To begin, I present evidence that the HDHP enrollment rate began to increase sharply after the official period of the Great Recession. Growth in the HDHP enrollment rate between 2009 and 2011 was twice as large as growth between 2006 and 2009. During the recession, the severity of economic shock varied across industries. There was a larger increase in the HDHP enrollment rate among firms in industries that experienced relatively more severe recession shocks compared to firms in industries that were not as deeply affected. I find little evidence that employers’ anticipation of the Affordable Care Act (ACA) caused the increased in HDHP enrollment rate.

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1 There are a number of explanations for the downward rigidity of nominal wage. For example, Campbell and Kamlni (1997) explained wage rigidity as a result of information asymmetry between employers and workers based on survey data from employers. Since employers do not want to lose high productivity workers or cause a decrease in workers’ effort, they cannot reduce wages as much as desired.


3 For example, Lee and Zapert (2005) described HDHPs as a new strategy for the “post-managed care era” by shifting more responsibility for medical spending from physicians to patients.
There are two mechanisms through which this increase may have been achieved. First, employers may have decided to offer only HDHPs. Second, they may have decreased the relative price of these plans to encourage enrollment in them. I find evidence for both mechanisms. Approximately 50% of the increase in the HDHP enrollment rate is explained by the growth in the proportion of employers that only offered HDHPs. When employers still offered multiple plan types, employers increased relative price of low deductible health plans (hereafter LDHPs) became by 60%, which incentivized them to enroll in HDHPs (Buchmueller and Feldstein, 1997; Cutler and Reber, 1998). I find evidence that these changes in the structure and cost of the health insurance plans offered to workers were more noticeable among firms in industries that were disproportionately affected by the recession.

On average, employers saved about $165 per worker by adjusting the intensive margins of health insurance (i.e., by increasing the HDHP enrollment rate and increasing the relative price of LDHPs to HDHPs between 2007 and 2010). This was larger than the amount ($113) that they saved by reducing the level of health insurance coverage offered to employees during the same period. In sum, they saved about $280 by reducing costs associated with health benefits compared to approximately $1,157 saved by reducing wages. This implies a ratio of health benefit cost reduction to wage reduction was of 1:6, while the ratio of health benefit costs to wages was about 1:9 in 2007, indicating a disproportionate decrease in health benefit costs compared to wages. This implies that employers may have decreased health benefit costs to offset downward rigidity of wages.

Given the findings of the RAND Health Insurance Experiment, an increase in health insurance cost-sharing may lead to reduced utilization of medical care and potentially worse health outcomes among workers (Keeler et al., 1985; Manning et al., 1987). I study how the increase in the HDHP enrollment rate affected workers’ health using the National Health Interview Survey (NHIS).

I first examine whether healthy workers were more likely to enroll in HDHPs when employers raised the relative price of LDHPs. Under the economic model of insurance choice, healthy workers are expected to choose HDHPs because they have lower demand for medical care (Rothschild and Stiglitz, 1976; Einav and Finkelstein, 2010); therefore, an increase in the HDHP enrollment rate is unlikely to worsen the health status of workers (Einav et al.,
Following Cutler and Reber (1998), I use workers’ age as a proxy for their underlying health condition, and examine trends of the average ages of covered workers by health insurance plan type. I do not find evidence that is consistent with the prediction of this theory (i.e. workers enrolled in HDHPs are younger than those enrolled in LDHPs). HDHP enrollees were not younger than LDHP enrollees, both before and after the increase in the relative price.

I also investigate effects on access to necessary medical care and workers’ health status. Following Finkelstein et al. (2012), I use the probabilities of unmet and delayed care, and self-reported general health status as outcomes, and examine time series trends of these outcome variables. There are no trend breaks for these outcome variables coinciding with the trend break in the HDHP enrollment rate. This implies that workers might not have experienced higher probabilities of unmet or delayed necessary medical care and worsened health status during the rapid increase in the HDHP enrollment rate. One possible explanation is that relatively healthy and wealthy workers kept their jobs during the economic downturn, and were not vulnerable to the increases in cost-sharing.

This study contributes to literature in two ways. First, I provide new empirical evidence of the change in the intensive margin of employer-sponsored health insurance, which provides a more complete picture of total compensation adjustments over the business cycle. Previous studies on the relationships between business cycles and benefit adjustments were focused on reductions in health insurance coverage (Lambrew, 2001; Cawley and Simon, 2005; Holahan and Cook, 2008; Holahan, 2010; Collins et al., 2011; Cawley et al., 2013).

Second, I provide some evidence of the effects of higher HDHP enrollment rate on obtaining necessary medical care and workers’ overall health. Given the findings of the Rand Health Insurance Experiment (Keeler et al., 1985; Manning et al., 1987), the impact of HDHPs on the health of beneficiaries has been attracting significant interest from policymakers (Bundorf, 2001; Cawley and Simon, 2005; Cawley et al., 2013) examined the negative relationship between state level unemployment rates and employer-provided health insurance coverage during the recession of the early 2000s and the Great Recession. Holahan (2010) provided a time series trend of health insurance coverage during the Great Recession. Lambrew (2001) and Collins et al. (2011) demonstrated that employers became less likely to offer health insurance during the recession of the early 2000s and the Great Recession. Holahan and Cook (2008) pointed out that employers were less likely to offer health insurance even after the recession of the 2000s subsided.
2012; Wharam et al., 2013). Little empirical research exists about the effects on access to necessary medical care and health outcomes (Robinson, 2005; Bundorf, 2012; Wharam et al., 2013).

The results of this paper have two policy implications. First, due to provisions of the ACA, the HDHP enrollment rate may increase as employers try to minimize costs of offering health insurance to workers (Wharam et al., 2013). Many employers are now required to provide health insurance to their full time workers due to the employer mandate. Second, the associated increase in the cost-sharing of health insurance may not worsen the health of workers, because workers (who typically are healthier and wealthier) are less vulnerable to changes in the costs of medical care.

This paper is organized as follows. In the next section, I provide a brief background of managed care health plans. In section 3, I described the data sources and variables used in the empirical analysis. Then, I present the empirical analysis of changes in the intensive margin of health insurance coverage and empirical evidence of effects on the health of workers in section 4 and 5. In section 6, I discuss the results before offering some concluding remarks.

2. Background on Managed Care Health Plans

In this paper, I consider only managed care plans. Fee-for-service (FFS) plans (also known as indemnity plans) used to be the dominant type of employer-sponsored health insurance coverage before managed care plans were introduced. However, managed care plans now comprise the majority of employer-sponsored health insurance coverage in the United States. For example, about 99% of workers were covered by managed care health plans in 2010 (The Annual Report of Employer Health Benefits Survey). Among managed care health plans, I simplified the types of health insurance into two categories, HDHPs and LDHPs, to capture differences in the costs of offering health insurance for employers mainly due to variations in deductible amounts.

5Employers with 50 or more full time workers are now required to provide health insurance to their full time workers as mandated by the Affordable Care Act, or they will pay penalties.
HDHPs are characterized by higher deductibles than other conventional managed care plans. HDHPs were established in the late 1990s (Bundorf, 2012), and began to be associated with tax-benefit savings accounts after the passage of the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 (Shenkin et al., 2014). HDHP enrollees are responsible for paying higher out-of-pocket deductibles before insurers reimburse for medical care expenditures, except for preventive care (Shenkin et al., 2014). For this reason HDHPs typically have had lower premiums than other managed care plans. As noted earlier, employers have an incentive to offer HDHPs to save labor costs (Lee and Zapert, 2005). HDHPs are usually managed by preferred provider organizations (PPOs), which have broader networks and less restrictions for medical services than health maintenance organizations (HMOs) or point-of-service (POS) (Robinson, 2005; Shenkin et al., 2014).

LDHPs include three types of conventional managed care health plans: HMOs, PPOs, and POS. HMOs provide the lowest cost-sharing plans with a limited number of providers. Insured patients are assigned to primary care physicians (PCPs) who refer patients to other doctors or hospitals within the network for additional medical treatments. PPOs do not force patients to have PCPs and allow patients to choose physicians or hospitals who are out of the network of providers. The patients are responsible for a greater share of costs when they receive care from out-of-network providers. POS plans are an extended form of HMOs that allow patients to obtain medical treatment from out-of-network providers, but at a greater share of costs. POS enrollees must obtain referrals from PCPs when they use network providers.\(^6\)

Table 1 summarizes HDHP and LDHP premiums based on data from the Employer Health Benefit Survey. Since total health insurance premiums are shared by employers and workers, I present the total premium, and the contributions of employers and workers to the total premium in each row. For simplicity, I calculated average premiums of single and non-single coverage (\(0.5 \times \text{single coverage premium of single coverage} + 0.5 \times \text{non-single coverage premium}\)). I converted nominal premiums for each year into real premiums in 2013 dollars using the Consumer Price Index for All Urban Consumers (CPI-U). Employers contribute

\(^6\)Refer to the following website: http://www.allbusiness.com/human-resources/benefits-insurance-health-types/770-1.html
a fixed percentage of total health insurance premium (Aragao and Ellis, 2015; Liu and Jin, 2015). Since total HDHP premiums are generally lower than LDHP total premiums, employers can save, on average, $1,000 when a worker enrolls in an HDHP instead of an LDHP.

Table 2 summarizes the average deductible and other markers of cost-sharing such as the proportion of patients who need to meet their annual deductibles before being eligible for reimbursement, coinsurance rates, and maximum out-of-pocket payments for HDHPs and LDHPs using the same data. In the interest of space, I only present aspects of cost-sharing for office visits to primary care physicians. I also compare cost-sharing of HDHPs and LDHPs for hospitalization and prescription drugs in Table A1. The differences in cost-sharing for these categories of care are similar. I also calculated the averages of deductibles and maximum out-of-pocket payments of single and non-single coverage ($0.5 \times \text{single coverage} + 0.5 \times \text{non-single coverage}$). As the name implies, HDHPs have higher deductibles than LDHPs. The average deductible of an HDHP is about $2,500 more than the average deductible of an LDHP. With respect to other markers, HDHPs require higher patient cost-sharing than LDHPs. For example, all patients who are enrolled in HDHPs are required to pay the annual deductible before becoming eligible for the reimbursement, and are also required to pay a higher percentage of total medical care expenditures out of pocket after meeting their deductibles than patients who are enrolled in LDHPs. The maximum out-of-pocket amounts are also larger for HDHP enrollees compared to LDHP enrollees.

3. Data

3.1 The Employer Health Benefit Survey

The Employer Health Benefit Survey (EHBS) is a repeated cross-sectional annual survey of employer-sponsored health benefits of nationally representative private and public (state and local government) employers with three or more workers, which is conducted by the Kaiser Family Foundation and the Health Research and Educational Trust (Kaiser/HRET). Kaiser/HRET interviewed benefit or human resource managers in each firm and collected
information on the health insurance plans offered by 2,000 firms. The survey samples were randomly selected within industries and among companies of similar size. Therefore the estimated results can be extrapolated to the national level. The EHBS provides detailed information on health insurance plans with the largest enrollments. Five types of health insurance plans are included in the survey: FFS, HMO, PPO, POS, and High-Deductible Health Plan with a savings option (HDHP/SO). The EHBS provides information of the types of health plans offered, total premiums and contributions of employers and workers to total premiums, the amount of employers’ contributions to savings accounts (HSA or HRA) for HDHPs, aspects of cost sharing (general annual deductibles, co-payments or coinsurance rates) for different types of medical services, enrollment rates in the health insurance offered, as well as basic characteristics of firms such as size, region, and industry. Although HDHPs are usually managed by PPOs, the EHBS has collected survey data on HDHPs as a separate health plan type since 2006. This enabled me to investigate how employers altered their health benefits offerings in response to a recession, which was an additional advantage.

In this paper, the most important outcome variable is the HDHP enrollment rate. To measure the HDHP enrollment rate, I used the following question from the EHBS: “Approximately what percentage of employees with health insurance is enrolled in high deductible plans with a savings account feature such as an HRA or an HSA?” High deductible health plans must meet the minimum deductible amounts to qualify for HSAs. The minimum deductible amounts changes over time, adjusting for inflation. The following are the minimum deductibles for single (non-single) coverage plans: $1,050 ($2,100) in 2006, $1,100 ($2,200) in 2007, $1,150 ($2,300) in 2009 and 2010, $1,200 ($2,400) in 2011 and 2012, and $1,250 ($2,500) in 2013. The NHIS used the same criterion.

I used industry information to examine the differential increase in HDHP enrollment rates by sector. The EHBS provided a variable with 9 industry categories based on the North American Industry Classification System (NAICS). To control for firm characteristics, I used a dummy variable indicating whether a firm had unionized workers, a categorical variable for firm size, a categorical variable for region, and the percentage of low-earning workers.

To examine employers’ responses to the Great Recession, I constructed two outcome vari-

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7Low response rate (less than 50%) is one limitation of this survey.
ables: a binary indicator of whether an employer only offered an HDHP, and contributions of workers to total health insurance premiums. First, I defined the indicating variable by combining two pieces of information: i) whether or not an employer offered an HDHP, and ii) the number of health insurance plans that the employer offered to workers. Second, I constructed contributions of workers to the total premiums of HDHPs and LDHPs by using information on annual health insurance premiums paid by workers. I used responses to the question “How much do you deduct from an active employee’s monthly paycheck for single (non-single) coverage in this HMO (PPO, POS, or HDHP) plan?” to construct a variable indicating workers’ contributions to total premiums. The smallest worker contribution among HMO, POS and PPO plans was used to define workers’ contributions to LDHPs

3.2 The Census

To measure the severity of recession shocks, I collected revenue information from the U.S. Census. I chose revenue based on typical profit maximization problems of employers. Although the EHBS provided nine industry categories, I was only able to collect revenue information on six industries: mining/construction, manufacturing, wholesale, retail, government, and health care. I used the Quarterly Financial Report to collect annual revenue information for the mining, manufacturing, wholesale, and retail industries, and used the Annual Service Report to collect annual revenue information for the health care industry. I approximated the annual revenue of the construction industry by aggregating monthly total construction spending. For the annual revenue of state and local governments, I aggregated quarterly national totals of state and local tax revenues.

I then constructed revenue growth rates for 2008 and 2009 when most of the decrease in annual revenue occurred in most industries. Table 3 demonstrates variation in the severity of recession shock across industries. The manufacturing, wholesale, and construction and mining industries experienced relatively severe negative revenue shock compared to state

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8Since HDHPs are cheaper than other managed care plans in general, I assumed that workers, who are sensitive to prices, would compare prices of HDHPs to the cheapest LDHP. The results were robust when I constructed a variable for workers’ contributions to the most expensive LDHP.

9The unemployment rate, which is an alternative measure of the severity of a recession shock, also exhibits a similar pattern across industries.
and local governments as well as the retail and health care industries.

### 3.3 The National Health Interview Survey

The National Health Interview Survey (NHIS) is an annual survey of the health of the civilian non-institutionalized population in the United States, which is conducted by the National Centers for Health Statistics (NCHS) and the Centers for Disease Control and Prevention (CDC). The NHIS contains a significant amount of information on approximately 100,000 individuals from 40,000 families. To obtain more detailed information, one sample child and one sample adult are randomly chosen from each family. The NHIS provides detailed information on health insurance coverage and type, medical care, health conditions, self-evaluated health status, and labor force participation, as well as demographics. One additional advantage of using the NHIS is that it provides information about HDHP coverage. The NHIS used the same definition of HDHP as the EHBS, which enabled me to understand how the composition of HDHP enrollees changed over the business cycle.

The EHBS does not provide much information on workers’ characteristics such as demographics, medical care and health outcomes. Use of the NHIS enabled me to overcome this limitation. To construct a sample from the NHIS that was comparable to the EHBS, I excluded federal employees and those working for small businesses with 1-9 employees using sample adult data. The EHBS conducts the survey during the first half of each year. Therefore, the change in HDHP enrollment over a 2-year period is the change during the second half of the previous year and the first half of the survey year. To reflect this, I combined observations in the second half of the previous year and first half of the current year. A comparison of HDHP trends between the two different data sources is shown in Figure A9 in the Appendix.

I used the NHIS to study time series trends of the average age of covered workers by plan type, medical care, and health outcomes. For medical care, I used binary indicators of unmet care and delayed care. I measured the two variables using the following questions: for unmet care, “During the past 12 months, was there any time when [person] needed medical care, but did not get it because [person] couldn’t afford it?”; and for delayed care, “During
the past 12 months, has medical care been delayed for [person] because of worry about the cost? (Do not include dental care)”. For health outcomes, I used following questions about self-reported general health status. The question about self-reported general health status asked, “Would you say your health in general is excellent, very good, good, fair, or poor?” I defined a dummy variable of “good health” if the respondent reported either excellent, very good or good. I also used responses to the following health status question to capture changes in self-evaluated health status, “Compared with 12 months ago, would you say your health is better, worse, or about the same?”

The descriptions and summary statistics of key outcome and control variables are presented in Table A2 in the appendix.

4. Empirical Analysis

4.1 Trends in health insurance cost-sharing

4.1.1 Trend in HDHP enrollment

Figure 1 presents the trend in the HDHP enrollment rate among workers covered by employer provided health insurance (hereafter, covered workers) over the period 2005-2013. In panel A, it is clear that the HDHP enrollment rate began to increase faster after the official period of the Great Recession. Between 2005 and 2013, it increased by 18%. There was a trend break between 2009 and 2010, and the HDHP enrollment rate increased more rapidly in the years that followed. The enrollment rate sharply increased by 9% over the period 2009-2011, which accounted for almost half of the growth in the HDHP enrollment rate from 2005 through 2013. Since cost-sharing in LDHPs also increased, this figure provides a lower bound for the increase in cost-sharing of employer-sponsored health insurance over the business cycle.

10 The National Bureau of Economic Research (NBER) Business Cycle Dating Committee officially defined the period of the Great Recession as December 2007 to June 2009 (http://www.nber.org/cycles/cyclesmain.html). Adjustments in health benefits could be lagged due to health insurance contracts. For example, health insurance contracts are typically renewed at the beginning of the year. Empirical evidence suggests that the reduction in the coverage of employer-sponsored health insurance lagged 1 or 2 years after the official recession periods in the 2000s.
In order to estimate the change in the HDHP enrollment rate compared to 2009, I used the following regression specification.

\[ y_{i,t} = \alpha_{2009} + \sum_t \beta_t \cdot 1(\text{year} = t) + X'_{i,t} \gamma + \epsilon_{i,t}, \]  

where \( i \) indicates an individual employer; \( t \) indicates the years 2005-2013 except for 2009; \( y_i \) indicates a share of the HDHP enrollment; \( \alpha_{2009} \) denotes the average HDHP enrollment rate in 2009; \( \beta_t \) represents changes in outcomes compared to 2009; and \( X_{i,t} \) represents firm characteristics such as a firm size dummy, region dummies, industry fixed effects, union status, and percent of low income workers. I plotted estimated \( \beta_t \)s and 95% confidence intervals in Figure A1. Filled squares represent changes in the HDHP enrollment rate compared to 2009 without control variables, and empty squares represent changes in the HDHP enrollment rate with control variables. This confirms that the HDHP enrollment rate began to increase rapidly. There is little difference in the change in the HDHP enrollment rate after controlling for firm characteristics.

The passage of the PPACA could lead to employers attempting to increase enrollment in HDHP. Since employers with 50 or more full time workers are required to provide health insurance to their full-time workers, this increases labor costs for many employers. The employer mandate was implemented in 2015. Even if the mandate was not yet implemented, employers may have anticipated it and attempted to increase enrollment in HDHPs beforehand. To test this, I plotted trends in the HDHP enrollment rate by firm size: 3-49, 50-199, and 200 or more. In panel B, I plotted the HDHP enrollment rate by firm size in order to test this alternative hypothesis. There is little differential increase in the HDHP enrollment rate by firm size, which contradicts predictions under the alternative hypothesis. Employers with 3-49 workers will not be required to provide health insurance to workers under the employer mandate. Employers with 50-199 should be more sensitive to the policy change than those with 200 or more because employers with 50-199 employees are less likely to offer health insurance to workers than those with larger employees in general.
4.1.2 Differential trends in HDHP enrollment by industry

(1) Differential trends in the HDHP enrollment rate

I examined differential trends in the HDHP enrollment rate by industry. During a recession, the severity of economic shock could vary across industries. Firms in industries that are experiencing a severe shock could have a stronger incentive to reduce labor costs. If the increase in the HDHP enrollment rate was driven by a recession, we would expect to see a differential increase in the HDHP enrollment rate by industry according to the severity of the recession shock for each.

Panel A of Figure 2 demonstrates the main finding of this subsection, which is the trend in the HDHP enrollment rate among covered workers by industry. The sample was restricted to the industries for which revenue information was collected from the U.S. Census. I categorized those industries into two groups, given the results shown in Table 3. Manufacturing, wholesale, and construction and mining industries were defined as industries that experienced severe recession shock (solid line), and state and local government, retail and health care were defined as industries that experienced mild recession shock (dashed line). From 2005 to 2009, there was little variation in the HDHP enrollment rate among covered workers between the two groups of industries. The HDHP enrollment rates began to diverge after 2010 when there was a trend break in the national HDHP enrollment rate. The HDHP enrollment rate increased by 16% between 2009 and 2012 among firms in industries that experienced severe revenue shock, and only increased by 4-5% during the same period among firms in industries that experienced mild revenue shock. These results provide consistent evidence that the Great Recession might have caused the increase in the HDHP enrollment rate.

State and local governments have weaker incentives to maximize profits than private firms. This may have mitigated the increase in the HDHP enrollment rate among firms in industries with mild shocks. To see if the differential increase in the HDHP enrollment rate was driven by state and local governments, I plotted the same trend after excluding state and local governments from the sample in panel B. There was a relatively larger increase in the HDHP

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11The EHBS provides nine industry categories for 2006 to 2013. The six industries comprise 53% of the whole sample.
enrollment rate among firms in industries with mild shocks after 2010. However, there was still significant variation in the increase in the HDHP enrollment rate by industry.

(2) Estimating differential increases in the HDHP enrollment rate

To estimate differential increases in the HDHP enrollment rate by the severity of recession shock, I used a difference-in-differences specification:

\[ y_{i,t} = \beta_0 + \beta_1 \times Severe_i + \beta_2 \times Post_t \times Severe_i + \lambda_t + X'_{i,t} \gamma + \epsilon_{i,t}, \] (2)

where \( i \) and \( t \) denote individual employers and years for 2005-2013; \( y_{i,t} \) denotes the share of the HDHP enrollment rate; \( Severe_i \) is a binary indicator of industries with severe recession shock, denoted as 1 if an employer was in manufacturing, wholesale, construction or mining, and 0 if the employer was in state or local government, retail, or health care; \( Post_t \) is 1 for the period after 2010, and 0 otherwise; and \( \lambda_t \) indicates year fixed effects. Instead of using a functional form of the time trend, I used fixed effects to provide more flexible control of the trend of the HDHP enrollment rate for industries with mild shock. The coefficient of interest is \( \beta_2 \), which represents the differential increase in the HDHP enrollment rate by industry type; and \( X_{i,t} \) includes firm characteristics such as industry fixed effects, region fixed effects, union status, a firm size dummy, and the percentage of low income workers.

Table 4 presents the regressions result. The estimated coefficient for the interaction terms in column 1, 0.064, means that there was a 6.4% larger increase in the HDHP enrollment rate for industries with severe shocks compared to industries with mild shocks. The magnitude of the coefficient is sizable compared to the average HDHP enrollment rate in industries with severe shock before 2010, which was 0.072, and is statistically significant at the 1% level. The results are robust when additional control variables are included. In column 2, \( Severe_i \) is replaced with industry fixed effects. In column 3, the aforementioned controls for firm characteristics are included. In column 4, state and local governments are excluded from industries that experienced mild recession shock to estimate differential increases in the HDHP enrollment rate in panel B. The coefficient value is slightly smaller in magnitude after excluding state and local governments. However its magnitude is still relatively large.
(3) Effect of the PPACA

Although I did not find evidence of employers’ anticipation of the health insurance mandate in panel B of Figure 1, the differential increase in the HDHP enrollment rate by industry could be due to differential anticipation of employers based on pre-recession characteristics.

In panel A of Figure 3, the distribution of firm size is plotted by industry type over the period 2005-2009. There is little difference in the distribution of firm size by industry. More importantly, there is little difference in the density of small or medium size firms (50-199 and 200-999 employees). Those firms were more sensitive to the passage of the employer mandate than larger firms (1,000+ employees) because the probability of offering health insurance is generally higher among large firms than small/medium size firms.

Even if the distribution of firm size is similar, firms in industries that experienced severe recession shocks may have had a lower likelihood of offering health insurance to employees compared to other industries. Therefore, those firms would have been more strongly incentivized to adjust health benefits beforehand. To test this hypothesis, the percentage of workers who were offered health insurance before 2010 was plotted by industry type in panel B. In every size category, firms in industries with severe recession shocks were more likely to offer health insurance than those in industries with mild shocks.

These results imply that different levels of anticipation about the employer mandate were less likely to cause differential increases in the HDHP enrollment rate by industry.

4.2 Responses of employers to the Great Recession

When employers decide to offer HDHPs to save costs, there are two margins that they can adjust in their health insurance offerings. First, employers could only offer HDHPs. This is the easiest way for employers to force workers to enroll in HDHPs. Second, employers could make HDHPs relatively more attractive to workers. Total health insurance premium is paid by both employers and workers. The amounts that workers contribute to total health insurance premiums are determined by employers before health insurance options are offered.
During economic downturns, the cost of sponsoring health insurance becomes relatively more expensive for employers. Employers can raise contributions to save on costs (Bewley, 1998). If employers offer both an HDHP and an LDHP, there is a chance that workers will want to enroll in the LDHP. Employers can increase workers’ contributions such that the LDHP becomes relatively more expensive for workers compared to the HDHP (Miller, 2005).\(^\text{12}\) Since the HDHP becomes relatively more affordable, this incentivizes workers to enroll (Cutler and Reber, 1998; Buchmueller and Feldstein, 1997).

4.2.1 Limiting the health benefits offered to HDHP

In this subsection, I examine the trend in the proportion of employers that only offered HDHPs. If employers offered HDHP to save costs, then the proportion would increase as the HDHP enrollment rate increases. I used a binary indicator of whether an employer only offered an HDHP to workers as an outcome variable.

Figure 4 presents the trend in the proportion of covered workers whose employers only offered HDHPs. The proportion of employers who only offered HDHPs increased faster as the HDHP enrollment rate increased more rapidly. It increased about 8% between 2006 and 2012 which explains about 50% of the growth in the HDHP enrollment rate during the same time period. This implies that at least 50% of the increase in the HDHP enrollment rate was driven by employers, rather than workers’ preferences for these plans. There is no trend break between 2009 and 2010, probably because employers gradually decreased the number of plan offerings.

In order to estimate the change in the proportion of employers offering only HDHPs compared to 2009, I used regression specification (1), where \( t \) indicates the years 2006-2013 except for 2009; \( y_i \) is a binary indicator of whether an employer only offered an HDHP to workers; the same notations are used for \( i \) and \( \alpha_{2009} \); and \( \beta_t \) represents the change in the proportion of employers offering only HDHPs compared to 2009. I plotted estimated \( \beta_t \)'s and 95% confidence intervals in Figure A2 in the Appendix. Filled squares represent changes in the HDHP enrollment rate compared to 2009 without control variables, and empty squares

\(^{12}\)Miller (2005) explained that this is possible because employers can exercise monopolistic power over workers who will be covered by employer-sponsored health insurance.
represent changes in the HDHP enrollment rate with control variables. This confirms that
the proportion of employers offering only HDHPs began to increase rapidly when the HDHP
enrollment rate increased. There are few differences in the changes in the proportion of
employers offering only HDHPs after controlling for firm characteristics.

4.2.2 Health insurance premiums

(1) Trend in the HDHP take-up rate

I also examined the trend in the HDHP enrollment rate among firms offering both HDHPs
and LDHPs. Figure 5 presents the trend in the HDHP enrollment rate among these firms.
This can be interpreted as the trend in the HDHP take-up rate, because workers could choose
between the two health insurance options. There is a clear structural break in the HDHP
take-up rate between 2009 and 2010 when the national trend of the HDHP enrollment rate
began to increase sharply. It increased by 10 percentage points from 20% to 30%. The lower
take-up rates imply that HDHPs were generally less preferred than LDHPs by workers. If
employers incentivized workers to enroll in HDHPs, we should see a trend break in workers’
contribution to total health insurance premiums between 2009 and 2010.

In order to estimate the change in the HDHP take-up rate compared to 2009, I used
regression specification (1), where \(y_i\) indicates the share of workers enrolled in HDHP; the
same notations were used for \(i, t, \) and \(\alpha_{2009}\); and \(\beta_t\) represents the change in the HDHP
take-up rate compared to 2009. I plotted estimated \(\beta_t\)s and 95% confidence intervals in
Figure A3 in the appendix. Filled squares represent changes in the HDHP take-up rate
compared to 2009 without control variables, and empty squares represent changes in the
HDHP enrollment rate with control variables. This confirms that the HDHP take-up rate
increased discontinuously in firms offering both plan types when the HDHP enrollment rate
began to increase rapidly. There are few differences in the changes in the HDHP take-up
rates after controlling for firm characteristics.

(2) Trends in workers’ contributions

Next, I plotted trends in workers’ contribution to total health insurance premiums in firms
offering both plan types. Figure 6 presents the average dollar amounts of workers’ annual

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contribution to LDHPs (solid line) and HDHPs (dotted line). The difference in workers’ annual contributions to LDHPs and HDHPs (dashed line) is also plotted. It represents the relative prices between two plan types for workers. I converted nominal premiums for each year into real premiums in 2013 dollars using the CPI-U. Trends in the contributions of workers and the relative prices between the two plan types for single and non-single coverage were plotted separately in panels A and B. In both panels, there are trend breaks in the relative price difference between LDHPs and HDHPs that coincide with the trend break for the HDHP take-up rate. The price of health insurance for workers increased during the economic downturn with the price of LDHP increasing relatively more than the price of HDHP. The relative price increased by $200 for single coverage, which was a 70% increase compared to the average relative price prior to 2009. The relative price increased by $500 for non-single coverage, which was approximately a 50% increase compared to the average relative price prior to 2009.

In order to estimate changes in the relative prices of LDHPs for workers compared to 2009, I used regression specification (1), where \( y_i \) indicates the relative price of LDHP; the same notations are kept for \( i, t \), and \( \alpha_{2009} \); and \( \beta_t \) represents the change in the relative price of LDHP compared to 2009. I plotted estimated \( \beta_t \)'s and 95% confidence intervals in Figure A4 in the appendix. I separately plotted estimation results for single-coverage and non-single coverage plans in panels A and B. Filled squared represent changes in the HDHP enrollment rate compared to 2009 without control variables, and empty squares represent changes in the HDHP enrollment rate with control variables. This confirms that the relative prices of LDHPs increased discontinuously, which coincides with the trend break for the HDHP take-up rate. There are few differences in the changes in the relative prices of LDHPs after controlling for firm characteristics.

(3) Trends in total health insurance premiums

I then plotted trends in total health insurance premiums for LDHP and HDHP to examine whether employers tried to save costs associated with LDHPs. I also examined the trend in the difference between the total premiums for LDHPs and HDHPs to see if employers

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\(^{13}\)Single coverage plans only cover policyholders (typically workers), and non-single coverage plans cover workers and their dependents.
saved additional costs by making workers pay relatively more for health insurance when they enrolled in LDHPs. The increase in relative prices for workers could also be due to increases in relative total premiums. Employers might have increased relative prices because total premiums for LDHPs increased more than total premiums for HDHPs (Kosteas and Renna, 2014).

Figure 7 presents trends in the average annual total premiums for LDHPs (solid line) and HDHPs (dotted line). I also plotted the trend in the difference in total premiums between LDHPs and HDHPs (dashed line) to examine if there were differential increases for LDHPs and HDHPs. I converted nominal premiums for each year into real premiums in 2013 dollars using the CPI-U. I plotted trends in the total premium and the difference in total premium for single and non-single coverage separately in panels A and B. As shown in both panels, total health insurance premiums for both LDHPs and HDHPs increased during the economic downturn. However, the difference in total health insurance premium between LDHPs and HDHPs did not increase when there was a trend break in the relative prices between LDHPs and HDHPs.

In order to estimate the change in the difference in total health insurance premiums compared to 2009, I used regression specification (1), where \( y_t \) indicates the difference in the total health insurance premium; the same notations are used for \( i, t, \) and \( \alpha_{2009} \); and \( \beta_t \) represents the change in the total health insurance premium compared to 2009. I plotted estimated \( \beta_t \)s and 95% confidence intervals in Figure A5 in the Appendix. I separately plotted estimation results for single-coverage and non-single coverage plans in panels A and B. Filled squares represent changes in the difference in total health insurance premium compared to 2009 without control variables, and empty squares represent changes in the difference in total health insurance premium with control variables. This confirms that the difference in total health insurance premiums did not increase when the relative prices of LDHP discontinuously increased. There are few differences in the difference in total health insurance premium after controlling for firm characteristics.

These results imply that employers raised the share of workers’ contributions to total health insurance premiums more for LDHPs than HDHPs to save costs in response to the Great Recession (Aragao and Ellis, 2015) regardless of workers’ health insurance choices.
while incentivizing workers to enroll in HDHPs.

4.2.3 Responses of employers by industry

In this subsection, I examine employers’ responses by industry. If employers tried to increase HDHP enrollment during the economic downturn, a larger increase in the probability of offering only HDHPs would be expected, in addition to a larger relative price difference among employers in industries that experienced severe economic shocks compared to those in industries that experienced mild shocks. However there would be little differential increase in the difference in total health insurance premiums by industry. I used regression specification (2) to derive estimates associated with three outcome variables: a binary indicator of whether an employer only offered an HDHP, relative price, and the difference in total health insurance premiums. In this specification, $t$ denotes years 2006-2013. I converted nominal premiums in each year into real premiums in 2013 dollars using the CPI-U. The estimated coefficient of interest is $\beta_2$. $X_{i,t}$ includes controls for firm characteristics described in section 5.1.2.

Regression estimates are presented in Table 5. Each cell represents the result of a separate regression. In panel A, the regression specification does not include any controls. In panel B, the aforementioned firm characteristics are included as controls. For the regression specifications in columns 1, 2, and 3, the outcomes used are a binary indicator of whether an employer only offered an HDHP, the relative price, and the difference in total health insurance premium, respectively.

The estimated coefficient associated with the interaction term in column 1 of panel A, 0.041, indicates that the probability of only offering HDHPs increased 4.1% more in industries that experienced severe economic shocks compared to industries that experienced mild recession shocks. The magnitude of this coefficient value is relatively larger than the average of probability of offering only HDHPs prior to 2010 in industries with severe shocks, which was 2.6%. The estimate is statistically significant at 1% level. The estimated coefficient value in column 2 of panel A indicates that employers in industries that experienced severe economic shocks increased the relative price $437 more than employers in industries that experienced mild shocks. This is approximately 80% of the average relative price before 2010.
in industries that experienced severe shocks, which was $558. The estimate is significant at the 5% level. The coefficient value in column 3 of panel A indicates that the difference in total health insurance premiums between LDHPs and HDHPs increased $130 more in industries that experienced severe shocks than in industries that experienced mild shocks. This is less than 10% of the average difference in total health insurance premiums prior to 2010 for industries that experienced severe shocks, which was $1,413. The estimate is not statistically significant. The regression results in columns 2 and 3 imply that employers in industries that experienced severe economic shocks made workers pay $300 more to enroll in LDHPs instead of HDHPs. In panel B, the results are quantitatively the same after including controls.

4.3 Reductions in workers’ compensation

To examine reductions in workers’ compensation, I calculated reductions in wages and health benefits in 2007 and 2010, the years immediately before and after the official dates of the Great Recession. Panel A of Table 6 presents compensation reductions among workers. All the savings presented in this section are per worker and per year. To calculate reductions in annual wages, I used the Current Population Survey Annual Social and Economic Supplement. Annual wages of workers decreased by $1,157. During the same time period, health benefits among workers were reduced by $280. All nominal dollars in each year were converted into 2013 dollars using the CPI-U.

The total reduction in health benefits can be attributed to either the reduced proportion of employers offering health insurance or adjustments to the intensive margins of health insurance. First, there was a 1.6% reduction in the number of offering health insurance. The average cost of offering health insurance for employers was $7,038 (The EHBS) in 2013 dollars. This reduction in the proportion of companies offering health insurance led to a decrease of $113 in health benefit costs. Second, in addition to decreasing extensive margins (coverage), employers adjusted the intensive margins of health insurance among 60%

\[14\] I used the NHIS to calculate the trend in the proportion of workers whose employers offered health insurance.
of workers who were covered by employer-sponsored health insurance: the HDHP enrollment rate increased, and employers made workers who enrolled in LDHPs pay $280 more. Since employers can save about $1,000 if a worker switches from an LDHP to an HDHP and there was a 8% increase in the HDHP enrollment rate between 2007 and 2010; the reduction in health benefit costs due to the intensive margins was $48 per worker. Employers saved about $118 per worker by raising the relative prices of LDHPs. Interestingly, health benefit costs were reduced more by adjusting intensive margins compared to extensive margins. As many employers could not adjust extensive margins due to the employer mandate under the ACA, intensive margins would become a more important mechanism for saving costs associated with offering health insurance to workers.

The ratio of health benefit cost reductions to wage reductions was 1/6, while the ratio of health benefit costs to wages was about 1/9 in 2007 (Employer Costs for Employee Compensation 2007 December, The Bureau of Labor Statistics), indicating a disproportionate decrease in health benefit costs compared to wages. This implies that employers may have decreased health benefit costs to offset downward rigidity of wages.

As shown in panel B, I also calculated compensation reductions among covered workers. Since those workers are covered by employer-sponsored health insurance, employers only adjusted the intensive margins of health benefits. Employers saved $277.\textsuperscript{15} Since employers did not decrease labor costs by reducing health insurance coverage, they may have decreased wages more for covered workers than for non-covered workers. However, they only decreased wages by $536, half compared of the wage reduction for non-covered workers.\textsuperscript{16} One possible explanation is that workers covered by employer-sponsored health insurance had higher productivity than non-covered workers, so it was more restrictive for employers to reduce total compensation by decreasing wages.

\textsuperscript{15}I obtained this number by removing the proportion of workers covered by employer-sponsored health insurance from the calculation of intensive margin among workers ($1,000 \times 0.08 +$280 \times 0.87$).

\textsuperscript{16}The average wage of covered workers in 2010 was even higher than the average wage in 2007. I chose the lowest wages for 2007-2010 to be conservative.
5. Effects on the health of covered workers

I also studied the effects of increased HDHP enrollment on workers’ health outcomes using the NHIS. The increase in the HDHP enrollment rate implies that the costs of medical care increased during the economic downturn. This might have prevented workers from obtaining necessary medical care and worsened workers’ health. The results of the Rand Health Insurance Experiment (HIE) from the 1970s suggest that an increase in cost-sharing leads to a reduction in medical care expenditures and worsens the health status of beneficiaries (Keeler et al., 1985; Manning et al., 1987). Since an increase the HDHP enrollment rate is expected if the costs of providing health insurance increase for employers due to provisions of the ACA (Wharam et al., 2013), the impact on access to necessary medical care and health have attracted substantial interest from policymakers (Lee and Zapert, 2005; Robinson, 2005). In recent studies, researchers have focused mainly on the impact of HDHP on medical care expenditures, but there is little empirical evidence of the effects on access to necessary medical care and the health status of workers (Bundorf, 2012).

5.1 Average age of covered workers by plan type

I examined whether healthy workers were more likely to enroll in HDHPs as the HDHP enrollment rate increased. Under the economic model of insurance choice, healthy workers are expected to choose high cost-sharing health insurance because they have lower demand for medical care (Rothschild and Stiglitz, 1976; Einav and Finkelstein, 2010). Therefore an increase in the price of medical care is less likely to worsen the health status of those workers (Einav et al., 2013). In previous studies, researchers investigated this adverse selection behavior of workers using firm-worker matched data (Cutler and Reber, 1998; Einav et al., 2013; Aragao and Ellis, 2015); I extrapolated those results to the national level. Following Cutler and Reber (1998), I used workers’ age as a proxy for the underlying demand for medical care, because older workers generally have greater demand for medical care.

The adverse selection theory predicts the following. First, HDHP enrollees would have been younger than LDHP enrollees. Second, relatively younger LDHP enrollees would have switched to HDHPs when employers increased the relative prices of LDHPs. As a result,
the average age of LDHP enrollees would increase. If those workers who switched health plans were older than HDHP enrollees in general, the average age of HDHP would increase as well.

Panel A of Figure 8 presents the average ages of covered workers by plan type. The average age of HDHP enrollees increased when the relative prices of LDHPs increased between 2009 and 2010. However, HDHP enrollees were not noticeably younger than LDHP enrollees. These mixed results do not provide clear evidence of adverse selection at the aggregate level.

Furthermore, employers in smaller firms are more likely to only offer HDHPs because it costs more for them to offer health insurance to workers. A necessary condition of the adverse selection hypothesis is that workers are offered multiple plan types. Therefore I restricted the sample to workers in larger establishments with 1000 or more workers, because the employees of these firms were more likely to be offered multiple plan types. Panel B of Figure 8 presents trends of the average ages of covered workers in establishments with 1,000 or more workers by plan type. The results are similar to those presented in panel A.

To estimate differential increases in the average age of workers by plan type, I used the following regression specification:

\[ y_{i,t} = \sum_{t=2008}^{2013} \alpha_t \cdot 1(year = t) + \sum_{t=2008}^{2013} \beta_t \cdot 1(year = t) \cdot HDHP_i + X'_{i,t} \gamma + \epsilon_{i,t}, \]  

where \( i \) and \( t \) denote individual covered workers and years 2008-2013; \( y_{i,t} \) denotes the age of a covered worker; \( HDHP_i \) is a binary indicator of whether a covered worker enrolled in an HDHP; \( \alpha_t \) represents the average age of workers covered by LDHPs; \( \beta_t \) represents the relative age of workers covered by HDHPs; and \( X'_{i,t} \) includes worker characteristics such as industry fixed effects, region fixed effects, gender, a race dummy (white=1), education attainment level, establishment size fixed effects, and occupation fixed effects. I plotted estimated \( \beta_t \)s and 95% confidence intervals in Figure A6 in the Appendix. I separately plotted estimation results using the entire sample of covered workers and covered workers in large establishments in panels A and B. Filled squares represent trend of the relative age of HDHP enrollees without control variables, and empty squares represent the same trend.
after including control variables. This confirms that HDHP enrollees were not significantly younger than LDHP enrollees before employers changed the relative prices, and their average age was older than that of LDHP enrollees after the relative prices changed. There is little difference in the trend in the relative age of HDHP enrollees after controlling for worker characteristics.

One possible explanation for the findings is that employers with older workers may have been more likely to offer HDHPs to their workers. Since older workers have higher demand for medical care in general, those employers face higher costs associated with offering health insurance, and have a stronger incentive to encourage workers to enroll in HDHPs. Another possible explanation is that people became less risk averse during the economic downturn. However, Cohn et al. (2015) provide evidence of the opposite scenario using experimental data. Advantageous selection (Finkelstein and McGarry, 2006; Fang et al., 2008) could be an alternative hypothesis as well. In my context, if older workers were less risk-averse, they were more likely to enroll in HDHPs, despite their higher demand for medical care. Figure A10 in the Appendix, however, provides a counter-example that employer-sponsored health insurance coverage increased with the average age of workers.

5.2 Effects on the health of covered workers

I also studied the effects of the increase in the HDHP enrollment rate on access to necessary medical care and health outcomes of covered workers. Following Finkelstein et al. (2012), I used binary indicators to represent whether a worker forewent or delayed necessary medical care and his or her self-reported health status as outcomes. Figure 9 presents time series trends of the proportion of covered workers who ever forewent or postponed necessary medical care due to concerns over the costs of care. There was an increase in the likelihood of unmet or delayed care during the official period of the Great Recession. However, there was no trend break when the HDHP enrollment rate sharply increased.

Figure 10 presents the time series trend of the self-reported health status of covered workers. In panel A, the proportion of those who reported their health status as good, very good, or excellent was plotted. Overall about 95% of covered workers reported their health status
as good or better. There was little change in the proportion over time. In panel B, the proportion of covered workers who reported their health status as worse than the previous year was plotted. Only 5% of covered workers reported that their health status was worse than the previous year. There was also little change in the proportion over time. These results imply that the increase in the HDHP enrollment rate did not worsen the health status of covered workers.

In order to estimate the change in medical care and the health status of covered workers compared to 2009, I used regression specification (1), where $y_i$ is a binary indicator of necessary medical care and self-evaluated health status; the same notations are used for $i$, $t$, and $\alpha_{2009}$; $\beta_t$ represents the change in outcome variables compared to 2009. I plotted estimated $\beta_t$s and 95% confidence intervals in Figure A7 and A8 in the appendix. Filled squares represent changes in outcomes compared to 2009 without control variables, and empty squares represent changes in outcomes with control variables. This confirms that there was no increase in the likelihood of unmet or delayed care (Figure A7) and no deterioration in workers’ health (Figure A8) when the HDHP enrollment rate increased rapidly. There are few differences in the changes in necessary medical care and workers’ health after controlling firm characteristics.

To examine a confounding factor, I demonstrate the time series trend of the average number of hours worked per week among covered workers in Figure 11. During the economic downturn, workers might work less and spend more time on healthy behaviors to improve their health (Ruhm, 2000). There was a 1-hour reduction in the average number of hours worked among covered workers between 2009 and 2010. However the magnitude was small compared to the average number of hours worked prior to 2009. This implies that the reduction in the number of hours worked may not have played a significant role in improving the health of covered workers during the economic downturn.

One possible explanation of these findings is that workers who kept their jobs and employer-sponsored health insurance during the recession may have been healthier and wealthier than the average population, and therefore less vulnerable to increases in cost-sharing.
6. Discussion and Conclusion

In this paper, I have demonstrated evidence of an increase in the HDHP enrollment rate during the recent economic downturn. There was a larger increase in HDHP enrollment among firms in industries that experienced severe economic shocks. About 50% of the growth in the HDHP enrollment rate is explained by the increase in the proportion of employers that only offered HDHPs. Among firms offering both HDHPs and LDHPs, the HDHP take-up rate discontinuously increased when the HDHP enrollment rate began to increase sharply. In response to the Great Recession, employers differentially increased workers’ contributions to LDHPs and HDHPs. This led to an increase in the relative prices of LDHPs and incentivized workers to enroll in HDHPs. Costs associated with workers’ compensation were reduced, but health benefit costs were reduced relatively more than wages.

The effects of the increase in the HDHP enrollment rate on workers’ health are non-trivial, although an increase in the HDHP enrollment rate implies an increase in the costs of medical care. Workers who kept their jobs and health insurance coverage during the economic downturn may have been healthier and wealthier, and thus less vulnerable to the increase in the costs of medical care. Under the adverse selection theory, the increase in the HDHP enrollment rate may not have affected the health of workers because healthy workers would be more likely to enroll in HDHPs since they have lower demand for medical care. However, I did not find evidence supporting adverse selection at the aggregate level. I also could not find evidence suggesting that the increased HDHP enrollment rate led to increases in the likelihood of unmet or delayed care, or worse health status.

Due to the employer mandate under the PPACA, the HDHP enrollment rate may increase since an increasing number of employers may limit their health insurance offerings to these plans and incentivize workers to enroll in them. However, this may not necessarily affect the health of workers, because they are less vulnerable to cost increases than the average population.

It is important to investigate how the welfare of workers changed during the recent economic downturn as a future avenue of research. To do this, it will be necessary to investigate the relationships among different margins of labor costs. For example, there could be a
negotiation process between employers and workers when labor costs are reduced during a recession. Workers may be willing to enroll in HDHPs or give up health benefits in order to keep their jobs (Summers, 1989). This negotiation process may depend on multiple factors such as the severity of recession shocks, legal or institutional bindings (e.g., minimum wages, union contracts), firm characteristics, or workers’ health insurance preferences (Summers, 1989; Gruber, 2000; Baicker and Chandra, 2006). Studying this issue may become an important way to understand welfare consequences of the ACA, because labor demand could be reduced as a result of the employer mandate.
References


Figures and Tables

Figure 1. Trend in the HDHP enrollment rate

A. Trend in the HDHP enrollment rate

B. Trends in the HDHP enrollment rate by firm size

Data source: The EHBS, 2005-2013
Note: The Y-axis represents the proportion of covered worker who enrolled in HDHP. I used the number of workers who were covered by employer-provided health insurance as a probabilistic weight.
**Figure 2. Differential trends in the HDHP enrollment rate by industry**

**A. Differential trends in the HDHP enrollment rate by industry**

![Graph showing differential trends in the HDHP enrollment rate by industry.]

**B. Excluding state and local governments**

![Graph showing differential trends in the HDHP enrollment rate by industry, excluding state and local governments.]

*Data source:* The EHBS, 2005-2013

*Note:* The Y-axis represents the proportion of covered worker who enrolled in HDHP. Industries with severe recession shock include mining, construction, wholesale, and manufacturing, and industries with mild shock include retail, health care, and state and local governments. I used the number of workers who were covered by employer-provided health insurance as a probabilistic weight.
Figure 3. Characteristics of industries

A. Distribution of firm size by industry

B. Health insurance offer rate by industry

Data source: The EHBS, 2005-2009
Note: The Y-axis in panel B represents the percent of worker who are offered employer-sponsored health insurance. Industries with severe recession shock include mining, construction, wholesale, and manufacturing, and industries with mild shock include retail, health care, and state and local governments. I used the number of workers as an analytical weight for panel B.
Figure 4. Trend in the proportion of employers only offering HDHP


Note: The Y-axis represents the proportion of covered worker whose employer offered only an HDHP. I used the number of workers who were covered by employer-provided health insurance as a probabilistic weight.
Figure 5. Trend in the HDHP take-up rate

Note: The Y-axis represent the proportion of covered workers enrolled in HDHP. I restricted the sample to firms offering both HDHP and LDHP. I used the number of covered workers as a probability weight.
Figure 6. Trends in workers’ contributions

A. Single Coverage Plans

B. Non-Single Coverage Plans

Note: The outcome variables are worker’s contributions to LDHPs, HDHPs, and difference in workers’ contributions between LDHPs and HDHPs. I restricted the sample to firms offering both plan types. I converted nominal premiums for each year into real premiums in 2013 dollars using the Consumer Price Index for All Urban Consumers (CPI-U). I used the number of covered workers as a probability weight.
Figure 7. Trends in the total health insurance premiums

A. Single Coverage Plans

B. Non-Single Coverage Plans

Note: The outcome variables are total premiums of LDHPs, HDHPs, and the difference in total premiums between LDHPs and HDHPs. I restricted the sample to firms offering both plan types. I converted nominal premiums for each year into real premiums in 2013 dollars using the Consumer Price Index for All Urban Consumers (CPI-U). I used the number of covered workers as a probability weight.
Figure 8. Trends in the average ages of covered workers by plan type

A. All covered workers

B. Covered workers in large establishments (1,000+)

Note: Y-axis represents the average age of covered workers. I restricted the sample to workers covered by employer-sponsored health insurance. I used the sample person weight from the data as a probability weight.
Figure 9. Trends in unmet and delayed necessary medical care of covered workers

A. Unmet Care

B. Delayed Care

Data source: The NHIS, 2005-2013.
Note: Y-axis represents the proportion of covered workers who experienced unmet (panel (a)) or delayed (panel (b)) necessary medical care. I restricted the sample to workers covered by employer-sponsored health insurance. I used the sample person weight from the data as a probability weight.
Figure 10. Trends in self-evaluated health status of covered workers

A. General Health Status

B. Worse health than the previous year

Note: Y-axis represents the proportion of covered workers whose self-reported general health status was either excellent, very good or good (panel A), and whose self evaluated health status was worse than the previous year (panel B). I restricted the sample to workers covered by employer-sponsored health insurance. I used the sample person weight from the data as a probability weight.
Figure 11. Trend in the average number of hours worked of covered workers


Note: The outcome variable is average number of hours worked per week. I restricted sample to worker covered by employer-sponsored health insurance. I used the sample person weight as a probability weight.
### Table 1. Costs of employer-sponsored health insurance

<table>
<thead>
<tr>
<th></th>
<th>HDHP</th>
<th>LDHP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Premium</td>
<td>$7,833</td>
<td>$9,421</td>
</tr>
<tr>
<td>Employer’s contribution</td>
<td>$6,059</td>
<td>$6,999</td>
</tr>
<tr>
<td>Worker’s contribution</td>
<td>$1,774</td>
<td>$2,422</td>
</tr>
</tbody>
</table>


*Note:* I calculated total premiums, premiums paid by employers and workers by calculating average values between single and non-single coverage (0.5 ∗ single coverage + 0.5 ∗ non-single coverage). I converted nominal premiums for each year into real premiums in 2013 dollars using the Consumer Price Index for All Urban Consumers (CPI-U).

### Table 2. Cost-sharing markers - Primary physician office visit

<table>
<thead>
<tr>
<th></th>
<th>HDHP</th>
<th>LDHP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual General Deductible</td>
<td>$2,931</td>
<td>$427</td>
</tr>
<tr>
<td>Does Annual Deductible Apply?</td>
<td>100%</td>
<td>51.8%</td>
</tr>
<tr>
<td>Co-insurance rate</td>
<td>11.8%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Co-insurance rate (out-of-network)</td>
<td>40.3%</td>
<td>53.6%</td>
</tr>
<tr>
<td>Out of Pocket Maximum</td>
<td>$5,489.2</td>
<td>$3,156.9</td>
</tr>
</tbody>
</table>


*Note:* I calculated the average general deductible amounts of single and non-single coverage (0.5 ∗ single coverage + 0.5 ∗ non-single coverage). For most of HDHPs, the co-insurance rate was applied for physician office visit. LDHP includes HMO, POS, and PPO. I converted nominal premiums for each year into real deductibles in 2013 dollars using the Consumer Price Index for All Urban Consumers (CPI-U). Some HMOs do not have limitation on out-of-pocket spending because they have almost zero cost-sharing for medical care.
<table>
<thead>
<tr>
<th>Industry</th>
<th>Annual Revenue (Millions of Dollars)</th>
<th>Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008</td>
<td>2009</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>6,374,121</td>
<td>5,109,827</td>
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<tr>
<td>Wholesale</td>
<td>1,953,330</td>
<td>1,658,058</td>
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<td>Construction and Mining</td>
<td>1,070,445</td>
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<tr>
<td>State and Local Government</td>
<td>1,319,551</td>
<td>1,265,020</td>
</tr>
<tr>
<td>Retail Sale</td>
<td>2,094,339</td>
<td>2,031,647</td>
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<tr>
<td>Health Care</td>
<td>1,757,926</td>
<td>1,842,674</td>
</tr>
</tbody>
</table>

*Data source:* The Census Quarterly Financial Report, the Annual Service Report and the Quarterly National Tax Revenue.

*Note:* I used the Quarterly Financial Report to collect annual revenue information of mining, manufacturing, wholesale, and retail industries, and used Annual Service Report to collect annual revenue information on the health care industry. Those two sources do not provide revenue information for the construction and state and local government industries. I proximate the annual revenue of the construction industry by aggregating monthly total construction spending. For annual revenue of state and local government, I aggregated the quarterly national totals of state and local tax revenues.
Table 4. Estimating differential increase in the HDHP enrollment rate

<table>
<thead>
<tr>
<th>Dep Var: %ENROLLMENT_{HDHP}</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post × Severe</td>
<td>0.064***</td>
<td>0.075***</td>
<td>0.072***</td>
<td>0.057**</td>
</tr>
<tr>
<td></td>
<td>[3.17]</td>
<td>[4.19]</td>
<td>[3.49]</td>
<td>[2.50]</td>
</tr>
<tr>
<td>Mean of Dep Var</td>
<td>0.072</td>
<td>0.072</td>
<td>0.072</td>
<td>0.072</td>
</tr>
<tr>
<td>Observations</td>
<td>8,127</td>
<td>8,127</td>
<td>8,127</td>
<td>6,609</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.186</td>
<td>0.191</td>
<td>0.216</td>
<td>0.223</td>
</tr>
<tr>
<td>Industry FE</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Firm Characteristics</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excl State and Local Gov</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Note: The outcome variable is the percent of covered workers who enroll in HDHP. Each column estimates separate regressions. I estimate year fixed effects instead of a dummy variable indicating years after 2010 for a more flexible control of the time trend of mild shock industries. Industries with severe recession shock include mining, construction, wholesale, and manufacturing, and industries with mild shock include retail sale, health care, and state and local government. I use the number of workers who are covered by employer-provided health insurance as a probabilistic weight. In column (2) I substitute a dummy indicating severe shock industry for the industry dummies. In column (3), I include region dummies, large firm dummy(200+), union status, and percentage of low earning workers (earnings below the 25th percentile) as controls for firm characteristics. In column (4) I excluded state and local government from sample. Average of the dependent variable is HDHP enrollment before 2010 in industries with severe shock. Standard error are corrected for heteroskedasticity. Absolute values of t-ratios are in brackets. *** p<0.01, ** p<0.05, * p<0.1.
Table 5. Responses of employers by industry

<table>
<thead>
<tr>
<th>Dep Vars</th>
<th>ONLY OFFER&lt;sub&gt;HDHP&lt;/sub&gt;</th>
<th>ΔWORKERCONTRIBUTION</th>
<th>ΔTOTAL PREMIUM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
</tbody>
</table>

A. Baseline Specification

<table>
<thead>
<tr>
<th>Post × Severe</th>
<th>0.041***</th>
<th>437**</th>
<th>130</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[2.70]</td>
<td>[1.98]</td>
<td>[0.32]</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.08</td>
<td>0.29</td>
<td>0.32</td>
</tr>
</tbody>
</table>

B. Adding Controls

<table>
<thead>
<tr>
<th>Post × Severe</th>
<th>0.042**</th>
<th>357*</th>
<th>33</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[2.86]</td>
<td>[1.67]</td>
<td>[0.08]</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.12</td>
<td>0.3</td>
<td>0.34</td>
</tr>
<tr>
<td>Mean of Dep Var</td>
<td>0.03</td>
<td>$558</td>
<td>$1,413</td>
</tr>
<tr>
<td>Observations</td>
<td>8,127</td>
<td>1,225</td>
<td>1,225</td>
</tr>
</tbody>
</table>


Note: The three outcome variables are a dummy indicating if an employer offers HDHP only for column (1), the relative price between LDHP and HDHP, and difference in total premium of health insurance between LDHP and HDHP. I used average difference in workers’ contributions and total premiums of single and non-single coverage (0.5×single+0.5×non-single). LDHP include HMO, PPO, and POS. I included year fixed effects instead of a dummy variable indicating years after 2010. Industries with severe recession shock include mining, construction, wholesale, and manufacturing, and industries with mild shock include retail sale, health care, and state and local government. In panel B, I substitute the severe shock dummy into industry dummies, and include region dummies, large firm dummy(200+), union status, and percentage of low earning workers (earnings below the 25th percentile) as controls. Averages of dependent variables are the average probability of only offering HDHP (column (1)), average relative price (column (2)), and average difference in total premiums before 2010 in industries with severe shock. I converted nominal premiums for each year into real premiums in 2013 dollars using the Consumer Price Index for All Urban Consumers (CPI-U). I used the number of workers who are covered by employer-provided health insurance as a probabilistic weight. Standard error are corrected for heteroskedasticity. Absolute values of t-ratio in brackets. *** p<0.01, ** p<0.05, * p<0.1.
Table 6. Reductions in worker’s compensation between 2007 and 2010

<table>
<thead>
<tr>
<th>A. Among workers</th>
<th>2010-2007($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages</td>
<td>-$1,157</td>
</tr>
<tr>
<td>Health benefits</td>
<td></td>
</tr>
<tr>
<td>Extensive margin</td>
<td>-$113</td>
</tr>
<tr>
<td>Intensive margin</td>
<td>-$166</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Among covered workers</th>
<th>2010-2007($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages</td>
<td>-$536</td>
</tr>
<tr>
<td>Health benefits (only intensive margin)</td>
<td>-$277</td>
</tr>
</tbody>
</table>

Data source: The CPS ASEC, the NHIS, and the EHBS, 2007 and 2010.

Note: The average of costs of offering health insurance for employers was $7,038 in 2013 dollars. The extensive margin means a reduction in health insurance offering rate by employers. Since there was a 1.6 percentage point reduction in the offer rate, employers saved about $7,038 \times 0.016 = $113 per worker per year. The intensive margin includes both a decrease in the LDHP enrollment rate and an increase in the relative price, $280 among 60% of workers who were covered by employer-sponsored health insurance. Employers saved about $1,000 if a worker switched from LDHP to HDHP and there was a 8 percentage point increase in HDHP enrollment rate. Therefore, they saved about $0.6 \times $1,000 \times 0.08 = $48. By raising the relative price for workers with LDHP (87% of covered workers), employers saved by $0.6 \times $280 \times 0.87 = $118. I did not multiply 0.6 when calculating cost-savings from the intensive margin among covered workers. I converted nominal premiums for each year into real deductibles in 2013 dollars using the Consumer Price Index for All Urban Consumers (CPI-U). The average wage of covered workers in 2010 was even higher than the average wage in 2007. I chose the lowest wages for 2007-2010 to be conservative.
Appendix

1. Appendix Figures

Here, I plotted estimated coefficient values with 95% confidence interval from the regression specification (1) from A1 through A8. Coefficient values represent the change in dependent variable compared to 2009. I included industry fixed effects, region fixed effects, large firm dummy(200+), union status, and percentage of low earning workers (earnings below the 25th percentile) as controls for firm characteristics, and industry fixed effects, region fixed effects, age, gender, race dummy (white=1), education attainment level, establishment size fixed effects, and occupation fixed effects as controls for worker characteristics. Standard error are corrected for heteroskedasticity. I use number of covered workers and sample person weight as probabilistic weights for the analysis using the EHBS and the NHIS, respectively.

Figure A1. Change in the HDHP enrollment rate since 2009
Figure A2. Change in the proportion of employers only offering HDHP since 2009

Figure A3. Change in the HDHP take-up rate since 2009
Figure A4. Change in the relative price since 2009

A. Single Coverage Plans

B. Non-Single Coverage Plans
Figure A5. Change in the difference of total premiums since 2009

A. Single Coverage Plans

B. Non-Single Coverage Plans
Figure A6. Difference in the average ages by plan types

A. All covered workers

B. Covered workers in large establishment (1,000+)
Figure A7. Change in necessary medical care since 2009

A. Unmet care

B. Delayed care
Figure A8. Change in the health status since 2009

A. General health status

B. Worse health than the previous year
Figure A9. Comparison of trends in HDHP enrollment rate

Note: In order to construct a comparable sample to the EHBS, I exclude federal employees and those in establishment with 1-9 workers using sample adult data from the NHIS. Then, I combine observations in the second half of the previous year and first half of the current year. I use the number of covered workers as a probability weight for the EHBS, and use sample-person weight as a probabilistic weight for the NHIS.

Figure A10. Age profiles of Employer-Sponsored Health Insurance Coverage

Data source: The NHIS, 2008-2013.
Note: I restricted the sample to workers. I used the sample person weight as a probabilistic weight.
2. Appendix Tables

Table A1. Quality Markers by Plan Type for other types of medical care

<table>
<thead>
<tr>
<th></th>
<th>HDHP</th>
<th>LDHP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Hospital Admission</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does Annual Deductible Apply?</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Co-insurance rate</td>
<td>10.9%</td>
<td>6.4%</td>
</tr>
<tr>
<td><strong>B. Prescription Drug</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does Annual Deductible Apply?</td>
<td>54.3%</td>
<td>42.7%</td>
</tr>
<tr>
<td>Co-insurance rate</td>
<td>9.7%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Co-payment</td>
<td>$11.2</td>
<td>$4.2</td>
</tr>
</tbody>
</table>


*Note:* I calculated average general deductible amounts and co-payments of single and non-single coverage (0.5×single coverage+0.5×non-single coverage). LDHP include HMO, POS, and PPO. I converted nominal premiums for each year into real values in 2013 dollars using the Consumer Price Index for All Urban Consumers (CPI-U).
Table A2. Summary statistics

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The EHBS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%ENROLLMENT$_{HDHP}$</td>
<td>The percentage of employees enrolled in HDHP</td>
<td>4%(17%)</td>
<td>8%(22%)</td>
<td>17%(33%)</td>
</tr>
<tr>
<td>ONLY OFFER$_{HDHP}$</td>
<td>1 if a firm $i$ offers HDHP only</td>
<td>2%(12%)</td>
<td>3%(18%)</td>
<td>8%(28%)</td>
</tr>
<tr>
<td>WORKER CONTRIBUTION$_{LDHP}$</td>
<td>Employee’s annual contribution to a LDHP(2013$) in firm $i$</td>
<td>$2,245(1,476)$</td>
<td>$2,408(1,532)$</td>
<td>$2,887(1,798)$</td>
</tr>
<tr>
<td>WORKER CONTRIBUTION$_{HDHP}$</td>
<td>Employee’s annual contribution to a HDHP(2013$) in firm $i$</td>
<td>$1,515(1,297)$</td>
<td>$1,540(1,416)$</td>
<td>$2,051(1,593)$</td>
</tr>
<tr>
<td>TOTAL CONTRIBUTION$_{LDHP}$</td>
<td>Total HI premium of LDHP(2013$) in firm $i$</td>
<td>$9,337(2,337)$</td>
<td>$9,875(2,462)$</td>
<td>$11,009(2,825)$</td>
</tr>
<tr>
<td>TOTAL CONTRIBUTION$_{HDHP}$</td>
<td>Total HI premium of HDHP(2013$) in firm $i$</td>
<td>$7,832(2,086)$</td>
<td>$7,723(2,381)$</td>
<td>$9,565(2,492)$</td>
</tr>
<tr>
<td>SMALL FIRM</td>
<td>1 if a firm’s total number of workers is 199 or less</td>
<td>34%(47%)</td>
<td>34%(47%)</td>
<td>33%(47%)</td>
</tr>
<tr>
<td>UNION</td>
<td>1 if a firm has any unionized workers</td>
<td>36%(48%)</td>
<td>34%(47%)</td>
<td>35%(48%)</td>
</tr>
<tr>
<td>%LOW INCOME</td>
<td>The percentage of low income workers in firm $i$</td>
<td>13%(19%)</td>
<td>15%(20%)</td>
<td>12%(17%)</td>
</tr>
<tr>
<td><strong>The NHIS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENROLLMENT$_{HDHP}$</td>
<td>1 if a worker enroll in employer-sponsored HDHP</td>
<td>-</td>
<td>14%(35%)</td>
<td>22%(42%)</td>
</tr>
<tr>
<td>UNMET CARE</td>
<td>1 if a worker did not get necessary medical care because of cost concern last 12 months</td>
<td>3%(18%)</td>
<td>4%(21%)</td>
<td>4%(20%)</td>
</tr>
<tr>
<td>DELAYED CARE</td>
<td>1 if a worker delayed necessary medical care because of cost concern last 12 months</td>
<td>6%(24%)</td>
<td>7%(26%)</td>
<td>7%(26%)</td>
</tr>
<tr>
<td>GOOD HEALTH</td>
<td>1 if a worker’s self-evaluated general health status is either excellent, very good or good</td>
<td>95%(22%)</td>
<td>95%(22%)</td>
<td>95%(22%)</td>
</tr>
<tr>
<td>WORSE HEALTH</td>
<td>1 if a worker reported that his or her health status is worse than the previous year</td>
<td>7%(25%)</td>
<td>7%(20%)</td>
<td>7%(25%)</td>
</tr>
</tbody>
</table>


Note: Numbers in parentheses are standard deviation. I calculated average premiums of single and non-single coverage (0.5×single coverage+0.5×non-single coverage). HDHP coverage information is available since 2007. I converted nominal premiums for each year into real premiums in 2013 dollars using the Consumer Price Index for All Urban Consumers (CPI-U). I used the number of workers who are covered by employer-sponsored health insurance as an analytical weight to calculate summary statistics of variables constructed by the EHBS. I used the sample person weight (sample adult file) to calculate summary statistics of variables from the NHIS.