NBER WORKING PAPER SERIES

IMPACT OF PREMIUM SUBSIDIES ON THE TAKE-UP OF HEALTH INSURANCE: EVIDENCE FROM THE 2009 AMERICAN RECOVERY AND REINVESTMENT ACT (ARRA)

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Working Paper 20196
http://www.nber.org/papers/w20196

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
June 2014

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NBER Working Paper No. 20196
June 2014
JEL No. I13,J64

ABSTRACT

We study the impact of the 65-percent federal health insurance premium subsidy, which aimed to help unemployed workers retain coverage and was in effect from February 2009 to May 2010 through the American Recovery and Reinvestment Act (ARRA). In doing so, we also estimate the price elasticity of demand for health insurance using very recent public policy variation. Our research contributes to the evaluation of the ARRA subsidy's coverage impact and to a better understanding of consumer responses to subsidized coverage options through the Affordable Care Act. We find that the ARRA subsidy is associated with a 15.2-percent increase in the continuation of employer coverage. This translates into a price elasticity estimate of -0.24, which is towards the middle range of elasticities in existing studies. We also find evidence that part of the increase in the continuation of employer coverage was offset by a decrease in non-group insurance.

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Introduction

As health insurance is historically closely tied to employment in the U.S., with almost seventy percent of non-elderly employees being covered by employer plans in 2010,[2] job separation considerably reduces insurance coverage (Gruber and Madrian, 1997). To bridge coverage gaps between jobs, the Consolidated Omnibus Budget Reconciliation Act (COBRA) of 1985 requires most employers to offer coverage to former employees for up to 18 months after job termination. However, the take-up rate of COBRA coverage has been modest, likely due to high costs, as COBRA does not require any employer contribution (Lambrew, 2001).

Despite several prior policy attempts to add health insurance assistance to unemployment benefits, no comprehensive COBRA subsidy occurred until the American Recovery and Reinvestment Act (ARRA) of February 2009, which gave a 65-percent health insurance premium subsidy to workers who lost their jobs involuntarily between September 2008 and May 2010. [3] This subsidy substantially reduced the cost of continuation coverage through their former employers for up to 15 months following job loss; on average, the subsidy amounted to about $724 per month for family coverage and $261 per month for single coverage.[4] The size of the ARRA subsidy is well within the range of subsidies provided through new Health Insurance Marketplaces, which provide a premium subsidy of 65 percent for a family of four earning 250 percent of the Federal Poverty Level (FPL) (Fernandez and Gabe, 2012).

The generous ARRA subsidy could have had a direct and immediate impact on unemployed workers by increasing their take-up of health insurance, and thus it could have provided contemporary evidence on the price elasticity of demand for health insurance. Other than the extension of the tax deduction for health insurance to the self-employed (Gruber and Poterba, 1994), the ARRA was the only instance of government premium subsidy for the individual purchase of health insurance prior to the

[2] These are author calculations using the 2008 Survey of Income and Program Participation (SIPP) panel.
[3] PL 111-5, American Recovery and Reinvestment Act of 2009 (2009).
[4] These numbers are based on average monthly total premiums for employer-sponsored insurance (ESI) in 2009 ($1,115 for family coverage and $402 for single coverage) (Kaiser/HRET, 2009).

Affordable Care Act (ACA).[5] Through the ACA, state- and federal-based Marketplaces are expected to provide government subsidies of about $150 billion annually towards the purchase of non-group market coverage for approximately 26 million Americans (CBO, 2013).

The most influential existing study on the price elasticity of demand in health economics is the RAND health insurance experiment (HIE) (Manning et al., 1987), which provides randomized variation on the price of health care rather than on the price of health insurance plans. Since the RAND HIE, research on the price elasticity of demand for health insurance plans has used policy-based natural experiments and other study designs. This literature provides a wide range of values depending on the type of private insurance plan (non-group or employer), the study design, and the population considered. Studies on the elasticity of demand for employer-sponsored insurance (ESI) find values of less than -0.1 (Chernew et al., 1997; Blumberg et al., 2001; Cutler, 2003; Royalty and Hagens, 2005; Gruber and Washington, 2005); studies using the non-group market or a setting not specific to employers find larger elasticities in the range of -0.2 to -2.7 (Gruber and Poterba, 1994; Marquis and Long, 1995; Marquis et al., 2004; CBO, 2005; Heim and Lurie, 2009; Selden, 2009; and Krueger and Kuziemko, 2013).

Attempts to estimate the elasticity of demand for health insurance from observational data face a potential endogeneity problem because unobserved characteristics of individuals could affect both the characteristics of insurance plans, including the price, and the decision to purchase insurance. In the ESI context, workers' preferences for insurance could affect their choice of employer and hence the characteristics of ESI, including employee contribution. Some studies address this problem by estimating a model of job selection using the price of the lowest priced plan offered by employers (Blumberg et al., 2001) and by using hypothetical take-up choices based on survey questions (Royalty and Hagens, 2005). Blumberg et al. (2001) find the elasticity to be -0.04, while Royalty and Hagens (2005) find an estimate that is statistically insignificant from zero. Gruber and Washington (2005) use a policy-based natural experiment identification strategy by exploiting the introduction of tax deductibility for federal employee

[5] An exception is a very limited subsidy through the Trade Adjustment Assistance Reform Act (TAARA) of 2002 PL 107-210.

premium contributions. Using a detailed dataset of all federal employees over several years, Gruber and Washington (2005) estimate an elasticity in the range of -0.02. It bears mentioning that most studies of the price elasticity of demand for ESI use the employee portion of the premium as the relevant price. It is unclear how one should treat the full premium cost, an issue to which we will return later when we place our results in the context of the prior literature. However, COBRA coverage may be viewed as closer to non-group coverage in this regard because former employees are immediately responsible for the full premium.

The existing price elasticity estimates of demand for non-group health insurance are much larger than those for ESI. Most of the premium elasticity estimates in early studies are in the range of -0.2 to -0.6 (e.g., Marquis and Long, 1995; Marquis et al., 2004; CBO, 2005; the results from three studies are used in estimating the take up of non-group coverage in the CBO simulation model underlying the ACA projections (CBO, 2007)). A challenge in this literature has been obtaining exogenous sources of variation in the price of non-group health insurance policies; even when prices are accurately observed, they could be correlated with the design of the insurance plan and enrollee characteristics, information which is not always available to researchers. The studies mentioned above address these issues by using prices for a standard insurance product (Marquis and Long, 1995), estimating a model of insurance purchase (Marquis et al., 2004), and using imputed premiums (CBO, 2005). The elasticity estimates obtained in these studies could possibly be biased downwards due to price inaccuracies in the available data. Krueger and Kuziemko (2013) also make this point, and they overcome the problems of prior studies (including lack of precise data on premium and plan characteristics) by using survey data on self-reported willingness-to-pay for health insurance among the uninsured. They find an overall price elasticity estimate of -1.0.

Another way in which the literature has circumvented measurement and endogeneity problems is by using changes in the tax deductibility of health insurance premiums for self-employed individuals, stemming from the Tax Reform Act of 1986, as an exogenous source of price variation. These studies estimate the price elasticity to range from -0.3 to -2.7 (Gruber and Poterba, 1994; Heim and Lurie, 2009;

Selden, 2009). Gruber and Poterba (1994) and Selden (2009) use employed individuals as a control group and obtain higher elasticity estimates, while Heim and Lurie (2009) compare the changes within self-employed individuals by including individual-level fixed effects, and they obtain an elasticity estimate of -0.3. Thus, taken together, the ESI- and non-group-market-based literatures leave us with a wide range of estimated elasticities between zero (Royalty and Hagens, 2005) and -2.7 (Selden, 2009). Our analysis uses an approach similar to the set of papers using the Tax Reform Act and the tax treatment of health insurance for federal employees because we use exogenous sources of price variation provided by policy. Our analysis also differs from those papers because we use policy targeted at those affected by job displacement, rather than policy targeted at federal employees or the self-employed.

Many studies in the price elasticity of demand literature have also recognized that one might expect heterogeneity in response. For example, the RAND HIE found that the elasticity of demand for health care itself was mixed in terms of patient's income and that there was no evidence of differential response by health status. In the literature on the elasticity of demand for health insurance, Marquis et al. (2004) find that when they use Current Population Survey (CPS) and Survey of Income and Program Participation (SIPP) data, elasticity is highest for those with middle income (200-400 percent FPL), but that when they use National Health Interview Survey (NHIS) data, elasticity is highest for those with lower income (less than 200 percent FPL). Gruber and Poterba (1994) find that the effect of the Tax Reform Act is higher among single individuals and high-income individuals; however, the changes in prices induced by the act are also larger for single and high-income individuals. Heim and Lurie (2009) find that the effect is larger in magnitude and statistically significant only among single households. Krueger and Kuziemko (2013) find that elasticities are larger for younger (18-29 years old) individuals relative to older individuals; for individuals with family income in lower quartiles relative to those in the upper quartile (more than $54,000); and for those in better health relative to sicker individuals.

As an insurance source COBRA shares some characteristics with ESI because it is bought through employers; but it also shares similarities with non-group coverage because individuals are

responsible for the full premium cost. Research on the effects of federal and state COBRA laws that exploits variation across states and over time in the introduction date and the generosity of these laws finds that the policy has increased private sources of coverage. Gruber and Madrian (1997) use those who lost their jobs and did not have ESI at their previous job as the control group and find, using the 1984-1988 panels of the SIPP, that COBRA laws of one year increase the rate of insurance coverage among those non-employed and eligible for COBRA by 4.2 percent (or 2.5 percentage points). This implies a price elasticity of demand for COBRA coverage of about -0.1 because, on average, non-group coverage tends to be about 40 percent more expensive than employer policies.

Although there is a prior literature on the elasticity of demand for private health insurance and on the impact of COBRA coverage on insurance rates, no study thus far has considered the responsiveness of workers to an exogenous price change in COBRA coverage. This is important because there are often calls for policies to assist with health insurance costs for the unemployed (e.g. CBO, 1998; Families USA, 2009). The ACA has implications for COBRA, as regulations issued in the Code of Federal Regulations determined that an offer of COBRA coverage does not disqualify individuals from receiving exchange subsidies (Code of Federal Regulations, 2013). To the best of our knowledge, ours is the first paper to obtain an estimate of the price elasticity of health insurance demand, using the ARRA subsidy implementation as a policy-based natural experiment. In addition, this is the first paper to evaluate the direct impact of the policy on health insurance coverage sources for displaced workers using a nationally representative dataset.

In understanding the lessons to be drawn for the ACA from the elasticity estimates in this and prior studies, it is important to consider how the source of identifying variation in these studies differs from the context of the ACA subsidies that started in 2014. First, since the ARRA subsidy was made available for only up to 15 months, individuals may have reacted differently to this subsidy compared to the subsidies available for an indefinite period of time. A second issue to consider is the salience of price differentials to the consumer; for example, when changes in tax codes are used for identification, one might be concerned that price variation was not visible to the consumer as a direct premium subsidy

under the ARRA and ACA and thus may have led to a different responsiveness from the consumer. Third, the price variation analyzed in the prior literature tends to be much smaller than that found in the ARRA subsidy, and it is possible that the small size of the price variation could also mean a less salient price change. Fourth, since COBRA targets individuals who have maintained ESI while employed and have recently experienced job loss, they might react more to price changes (since they already had opted into health insurance in the past) or less (since they have recently experienced a large income loss, which may reduce their responsiveness) than someone receiving ACA subsidies. Lastly, the ACA also introduced penalties for being uninsured in addition to the income-based subsidies for purchasing insurance, and individual reactions to fines may be non-symmetric relative to subsidies (CBO, 2010; Baicker et al., 2012).

We estimate the impact of the ARRA subsidy on health insurance by comparing COBRA take-up during the subsidy time period to take-up outside the subsidy period among the treatment group, controlling for a comprehensive list of demographic, socioeconomic, and job characteristics. We supplement the single-difference analysis by using two additional control groups in double-difference strategies to account for contemporaneous changes and trends in insurance coverage. We conduct our empirical analysis using data from the SIPP, a nationally representative panel study of households. The information on insurance status and labor market characteristics in the SIPP allows us to identify those eligible for COBRA as well as those specifically eligible for the ARRA subsidy towards its purchase.

We find that the 65-percent premium subsidy is associated with a 3.4-percentage-point increase (15.2 percent relative to base) in the take-up of COBRA coverage, implying a price elasticity estimate of -0.24. This finding is higher than the elasticity estimates of ESI but close to the lower limit of the estimates for non-group health insurance in prior studies. We find evidence that uninsurance decreased and that the increase in COBRA coverage was partially offset by a decrease in non-group insurance. In closing, we discuss the lessons that can be learned from the ARRA subsidy for the implementation of ACA subsidies.

Background

The COBRA of 1985 offers employees and their families the opportunity to continue ESI after employment has been terminated. COBRA requires employers with 20 or more employees to make health insurance coverage available for up to 18 months after job termination. Almost all states have extended these provisions to employers with fewer than 20 employees through "mini-COBRA" laws.[6] COBRA does not require employers to pay for the cost of health insurance; as a result, unemployed individuals who elect coverage often pay the entire premium, plus up to 2 percent more for administrative costs. Since the employers usually pay a portion of the premium for current employees, the premium under COBRA is four to six times the contribution individuals made while they were employed.[7] Although ESI is generally less expensive than private non-group health coverage, take-up of COBRA has been modest. Using data from the most recent period of June 2010 to March 2012 (during which time the subsidy was not available), we find that 19.4 percent of eligible individuals elected for COBRA coverage following job loss,[8] 32.3 percent of eligible workers became uninsured, and the remainder obtained other forms of coverage.[9]

Many proposals have been advanced to increase the take-up of COBRA, such as offering subsidies, tax credits, and a loan program (CBO, 1998; Rice, 1999; Lemieux, 2001; Gruber, 2001). The

[6] As of 2009, forty states and the District of Columbia had expanded COBRA regulations to small employers, according to the data collected by the National Conference of State Legislatures, which is available at http://www.ncsl.org/issues-research/health/state-cobra-expansions-for-small-businesses408.aspx (last accessed April 1, 2013). During our data period, Pennsylvania implemented a "mini-COBRA" law in June 2009 (Pennsylvania Act 2 of 2009) and Connecticut extended the maximum duration of COBRA coverage from 18 months to 30 months (Connecticut Public Act 10-13). We test the robustness of our results to the exclusion of these states. Massachusetts provides health insurance assistance (either premium assistance or direct coverage) to unemployment insurance claimants whose family income is less than 400 percent of the federal poverty limit through the Medical Security Program (MSP). The MSP was applicable to those who took up the ARRA subsidy, and it reduced the costs of COBRA coverage to 7 percent of the premium.

[7] On average, the employer pays 83 percent of the premium costs for single coverage and 73 percent for family coverage (Kaiser/HRET, 2009), although in theory, employees pay the costs in their entirety through reduced wages to the extent they value those benefits (Summers, 1989).

[8] Berger et al. (1999) estimates the COBRA take-up rate to be 24.6%, using the April 1993 CPS Employee Benefit Supplement (this supplement is not available for more recent years).

[9] Other forms of coverage are ESI in own name (through new employers) (30.7 percent), ESI as dependents (10.1 percent), non-group private insurance (5.1 percent), government-provided insurance (4.2 percent), and unknown sources (1.1 percent).

House and the Senate repeatedly considered proposals for premium subsidies for COBRA coverage between 1996 and 2001, but no such attempts became law.[10] The Trade Adjustment Assistance Reform Act (TAARA) of 2002 established a very limited health care tax credit (HCTC) for the purchase of qualified health insurance by displaced workers, which includes COBRA coverage. It is mainly available to workers who can prove they have been adversely affected by foreign trade. According to GAO (2010), HCTC participation is very limited: the average total HCTC participation amounts to 26,000 individuals per year.

The ARRA of 2009 was the first policy measure aimed at increasing the take-up of COBRA coverage applicable to a broad population. Under this act, individuals were eligible for the 65-percent subsidy if they lost their jobs involuntarily between September 1, 2008, and May 31, 2010 and if they were ineligible for other group health coverage (such as a spouse's plan or new employer's plan) or Medicare. Those who were eligible for state "mini-COBRA" laws were also eligible for the subsidy. Individuals were ineligible for the subsidy if their adjusted gross income was more than $145,000 (or $290,000 for joint filers) for the tax year in which the subsidy was received. For those whose adjusted gross income was between $125,000 and $145,000 (or $250,000 and $290,000 for joint filers), the amount of the subsidy was reduced proportionately.

The ARRA premium subsidy became available on February 17, 2009, and could be drawn for up to 15 months. Those who lost their jobs before the law was enacted but who became eligible for the subsidy retroactively (those who lost their jobs involuntarily on or after September 1, 2008 but before February 17, 2009) were given a second chance to elect COBRA coverage. Employers covered by federal or state COBRA laws were mandated by the ARRA to send announcements to former employees who were eligible for COBRA, that is, those who had enrolled in their employer's group plan while they were active employees. Those who took up the subsidy paid 35 percent of the premium, and their former employers paid 65 percent of premiums and received reimbursement in the form of federal tax credits. If

[10] See the Transitional Health Insurance for Workers Changing Jobs Act of 1996, S. 2149, 104th Cong. (1996) and the Economic Recovery and Assistance for American Workers Act of 2001, S. 1732, 107th Cong. (2001).

individuals failed to notify their former employer that they or their families were eligible for other group health coverage or Medicare and still received the subsidy, they were subject to penalties of up to 100 percent of the subsidy received, although it is unknown how well this provision was enforced.

Estimates of the number of individuals who received the ARRA subsidy are available through U.S. Treasury Department (2010b). Internal Revenue Service (IRS) data shows that two million households claimed the subsidy in 2009, at a price tag to the government of $2 billion; there is concern that the estimate of the number of households could be imprecise due to multiple counting of employees whose former employers filed tax returns on a quarterly basis (Fronstin, 2010). Fronstin (2010) estimates that 700,000 nonworking adults received the subsidy by August 2009, which was the middle of the implementation period. There are also estimates of the take-up rate of COBRA during the subsidy period. A study by the U.S. Treasury Department (2010a), using a sample of unemployment insurance recipients in New Jersey, estimates that between 25 and 33 percent of those who were eligible for the subsidy elected for COBRA coverage. A study by Graetz et al. (2012) estimates COBRA take-up rate to have been 38 percent during the subsidy period, using survey data from Kaiser Permanente-Northern California, an integrated healthcare delivery system. Since none of these studies compare the COBRA take-up rate during the subsidy period to the rate when the subsidy is not available, they do not investigate the effect of the subsidy on the take-up of health insurance per se; many of these individuals may have elected COBRA even without the subsidy. In the only prior report that compares COBRA take-up during the subsidy period to other periods, Bovbjerg et al. (2010) use information from various sets of employers and find that the subsidy increased the take-up rate by 2 to 20 percentage points, depending on the employers considered. The wide range of estimates in these prior studies suggests the need for research using national representative data and a policy-based natural experimental study design.

Hypotheses

To provide context for our hypotheses regarding the effect of the premium subsidy on the take-up of health insurance, we first discuss a conceptual framework for insurance decisions made by COBRA-eligible individuals. In our simple framework, individuals value the reduction in financial risks provided by health insurance and maximize their utility subject to the available set of insurance options that differ in price, given exogenous individual characteristics that affect the demand and availability of insurance, such as productivity, risk preferences, age, marital status, and health status. The comprehensive set of other insurance options potentially available to COBRA-eligible individuals include obtaining coverage from a spouse's employer, purchasing private non-group health insurance, obtaining ESI from a new employer, obtaining public insurance, or becoming uninsured. Once the ARRA subsidy is introduced, we expect that COBRA take-up would increase substantially as its marginal cost decreases by 65 percent. The only alternative source of coverage we expect would decrease unambiguously in response to the ARRA subsidy is non-group coverage, which is much more expensive for a policy of similar quality. We may also see some reduction in other forms of coverage, but generally those are much lower in marginal costs to the enrollee than COBRA, and thus we think this unlikely to happen.

Because of differences in the availability of alternative sources of coverage and differences in demand for health insurance, we expect that responsiveness to a price reduction in COBRA will depend on individual demand factors. The relationship is likely an inverted U shape, where those with high demand for COBRA may always purchase it, and those with very low demand for COBRA may never purchase it, regardless of the subsidy, but those in the middle are likely to be on the margin and influenced by the substantial price reduction. As in prior papers on price responsiveness in health care and health insurance, we conduct subgroup analyses along dimensions of income, marital status, health status, and age, which likely proxy for differences in demand.

Data

We examine the impact of the ARRA subsidy on insurance outcomes using data from the Waves 1 to 11 of the 2008 panel of the SIPP, which conducted longitudinal interviews with approximately 50,000 households between August 2008 and March 2012. This data enables us to compare outcomes both during and outside the implementation of the subsidy. Interviews were conducted every four months. The respondents were asked about their insurance coverage and labor market status, among other questions, for each of the four months since the preceding interview. Monthly information on health insurance status enables us to measure the impact of the subsidy more precisely than information from other surveys, such as the CPS, which only contains yearly information.[11]

The SIPP data is also advantageous because its longitudinal structure and rich set of labor market questions allow us to identify COBRA-eligible populations (that is, workers who held ESI at jobs they subsequently lost) during periods with and without the subsidy in effect, and also to identify those who elected for COBRA coverage at different points in time. More specifically, we identify those who elected COBRA coverage using a point-in-time monthly variable that indicates whether individuals obtained health insurance through their former employers. Further, we can identify those who were eligible for the ARRA subsidy using a variable that indicates their reason for leaving their job; only those who lost a job involuntarily were eligible for the subsidy, but all workers who left their jobs were eligible for COBRA, as long as they held ESI while employed. To reduce recall bias, we only use data on insurance coverage collected on the most recent reference month of the wave. We measure whether COBRA coverage was held as of the end of the wave in which an individual lost his or her job. Thus, the main outcome we study is COBRA take-up within the first four months after job loss.

[11] The Medical Expenditure Panel Survey (MEPS) provides monthly insurance information, including information on COBRA coverage; however, its sample size is small. The MEPS Household Component contains about 12,000 families per year relative to the approximately 50,000 households in the SIPP.

Method

To understand how the provision of a 65-percent subsidy to the premium affects take-up of health insurance, we first compare COBRA take-up, the holding of any insurance, and type of insurance, during and outside the subsidy period among the population deemed eligible for premium subsidy, controlling for various factors that could affect an individual's choice of insurance status. This single-difference strategy allows us to separate the effects that always accompany job loss (such as income reduction) from the effects of the ARRA subsidy, but assumes that there are no confounding time trends in COBRA take-up, and that individuals who lose jobs before and after the subsidy period are similar in unobserved insurance demand; we return to these points later. Our first specification below includes data on all individuals who lost jobs involuntarily and became COBRA eligible sometime within the last four months. The outcome Y measures insurance coverage as of the end of the wave in which the job was lost.

$$[1]\ Y_{ist} = \alpha + \delta\, Subsidy_t + Z_{ist}\beta + J_{ist-1}\gamma + Unemp_{st}\rho + \zeta_s + \varepsilon_{ist}$$

where Y_{ist} represents outcome variables for individual *i* in state *s* and time *t* (employment-related COBRA, and other types of coverage) and $Subsidy_t$ represents an indicator for the period during which the ARRA premium subsidy was available; thus δ is our main parameter of interest. Z_{ist} represents demographic and socioeconomic characteristics for the individuals that capture demand for health insurance, and includes measures for age and its square term, gender, race/ethnicity, marital status, highest education attained, and whether the individual has children younger than eighteen years old. J_{ist-1} represents job characteristics during the previous wave, which pertain to the job that was lost. The variables included are log of hourly wage, union membership, length of job tenure, industry fixed effects, and occupation fixed effects.[12] Including job characteristics as well as individual sociodemographic characteristics is important because the types of workers losing jobs during different time periods may differ in ways that affect their demand for health insurance. $Unemp_{st}$ is the monthly state unemployment

[12] See Tables A1 and A2 in Appendix for details about industry and occupation categories included in the analysis.

rate, which captures economic conditions at the local level. Improved economic conditions could make the individuals more likely to take up COBRA coverage because their prospect of future income is higher. On the other hand, when the economy is better, individuals are more likely to find jobs without lapses in insurance coverage. We include state fixed effects (ζ_s), and we cluster standard errors at the state level. Although we include time varying state (monthly) unemployment rates, due to the short time period of analysis, we are unable to include year fixed effects in our main specification, as they would be highly collinear with the subsidy period indicator. We later include time-fixed effects when we expand our analysis to a double-difference strategy using additional control groups. We use a linear probability model for ease of interpretation, although the results hold when we use both Logit and Probit models.

Often when a national-level health insurance policy change occurs, as in 2014 under the ACA, researchers must rely on an appropriate control group to account for contemporaneous changes in coverage caused by other elements of the shared national environment. An ideal control group would have the same observable and unobservable characteristics as the treatment group but be unaffected by the implementation of the ARRA subsidy. In theory, individuals who have adjusted gross incomes above $145,000 (or $290,000 for joint filers) but would qualify for a subsidy in all other ways could serve as a control group. There are very few such individuals in the SIPP, however, and those with such high incomes are unrepresentative of all workers who have lost their jobs. Instead, we use those who are similar to the treatment group but continue their employment as one control group. This control group is suitable for looking at employment-related insurance, but not for looking at other types of insurance as dependent variables. For other types of insurance, we use a control group of workers who look similar to the treatment group but do not qualify for the ARRA subsidy because they did not have ESI on the job that was lost. We analyze the changes during and outside the subsidy period between the treatment group and those in the control groups in double-difference specifications.[13] Fortunately, our results are similar

[13] The following is a list of possible alternative control groups that we have considered but cannot use due to small samples or measurement issues in the SIPP: those who were eligible for COBRA coverage and lost their jobs voluntarily; those who work for small firms in the ten states that did not extend the COBRA law to them; and those whose income is too high to qualify for the full ARRA subsidy.

between the two alternative double-difference strategies as well as between the single- and double-difference strategies, suggesting that the scope for bias from unobserved differences in individuals and time periods is limited.

Our first control group (hereafter termed the "ESI control group") is obtained by propensity-score matching based on observable characteristics from the population who had own-name ESI in the previous wave and remained continuously employed during the current wave.[14] This approach allows us to separate out contemporaneous time trends in employer-related coverage; doing so is important because of the declining take-up of ESI in general (Vistnes et al., 2012). Since COBRA is essentially ESI but through a former rather than current employer, we expect the time trends in COBRA coverage to mimic trends in ESI more generally, had no ARRA subsidy occurred. We use this control group to estimate the effect of the ARRA subsidy on COBRA (employer) coverage but not on other insurance outcomes because those with own-name ESI who remain employed very rarely switch to other forms of coverage.

We obtain a double-difference estimate of the effect of the subsidy on any source of insurance and on other specific types of coverage using a control group of those who had lost a job involuntarily but did not have own-name ESI prior to job loss (hereafter, the "unemployed control group"). This approach to finding a control group is similar to the one used by Gruber and Madrian (1997) in their study of the effect of the COBRA law itself; it enables us to control for the shocks that affected unemployed workers during our time period, such as tighter financial constraints and fewer job opportunities. We do not use propensity score matching due to the small number of such control observations in the SIPP. Our double-difference analyses that use the two control groups are straightforward extensions of our initial framework, adding the following right-hand-side variables: an indicator variable for the treatment group, an interaction of the treatment-group indicator and subsidy-period indicator (the key variable), and indicator variables for calendar month and year.

[14] We match individuals based on the following variables: demographic, socioeconomic, and job characteristics that are included in our main specification; monthly state unemployment rate; and state and year fixed effects. We use the nearest neighbor one-to-two matching with replacement as a matching method.

Our examination of results from the double-difference specification for the main regressions shows that they are quite similar to the single-difference results. We use our single-difference specification in the main analysis because using two different control groups in the double-difference specification precludes us from comparing interpretations of the two results: we do not expect the estimated effects of the subsidy on each insurance type category, including COBRA coverage, to add up to the estimated effect of the subsidy on any source of coverage.

Results

Graphical Presentation

As our first approach to investigating the changes in COBRA coverage during and outside the subsidy period, we plot in Figure 1 the time trend in COBRA coverage among the treatment group, conditional on observables included in our model. The first data point in Figure 1 represents the conditional COBRA take-up rate, within four months of job loss, for those who lost jobs between September and December 2008.[15] Among this group, those who lost their jobs in November or December 2008 could have recorded a COBRA answer that reflected the effect of the subsidy if their take-up was measured after February 17, 2009, because the subsidy became available retroactively then to those who lost their jobs involuntarily on and after September 1, 2008. Thus, even the first data point may partially reflect the effect of the subsidy. The second data point represents the first half of 2009; since the subsidy became available on February 17, 2009, most of the individuals included in that take-up calculation provided answers that reflected the effect of the subsidy's availability. The first vertical line represents a half-year when the subsidy became available, and the second vertical line represents the last half-year in

[15] We use insurance status information only in the last (fourth) month of the wave to reduce recall measurement error; thus the first month for which we observe whether an individual had ESI before job loss is August 2008 and the first month an individual can be eligible for COBRA in our dataset is September 2008, if the individual lost a job in that month.

which the subsidy (which ended on May 31, 2010) was in effect. All points thereafter do not reflect the effect of the subsidy.

Figure 1 shows very clearly that the COBRA coverage take-up rate is higher, on average, during the subsidy period compared to the post-subsidy period, and that it decreased sharply in the second half of 2010 when the subsidy ended. Figure 2 shows that the conditional rate of *any* insurance coverage among the treatment group was higher, on average, during the subsidy period compared to the post-subsidy period, which corresponds to the changes in the COBRA take-up rate. However, the pattern among any insurance coverage is not as clear as it is for COBRA coverage specifically, which is unsurprising because for some individuals, subsidized COBRA coverage likely replaced alternative forms of coverage.

Descriptive Statistics

Comparing the take-up of COBRA among the treatment group before and after subsidy availability may cause concern because the characteristics of individuals who are displaced may change substantially even over a short time frame. To address this question, Table 1 shows the means of key variables for the treatment group during and outside the subsidy period. Individuals in the treatment group are statistically significantly more likely to be White, less likely to be Hispanic, less likely to be married, and more likely to have some college degree during the subsidy period compared to outside the subsidy period; it is not a priori clear whether these characteristics indicate lower or higher demand for health insurance on net. The monthly unemployment rate is higher during the subsidy period than outside the subsidy period, reflecting the fact that the subsidy became available when the state of the job market was especially weak. These differences in observable characteristics during and outside the subsidy period emphasize the importance of controlling for the observable characteristics of workers in our analysis, as their influence on coverage may otherwise be attributed to the subsidy itself. The rate of COBRA coverage is statistically significantly higher—and the rate of non-group coverage is lower—among the subsidy-eligible population during the subsidy period relative to outside the subsidy period. However,

controlling for observables still leaves open the possibility that some of the difference in insurance outcomes that we observe is due to differences in unobservables between displaced individuals in the two time periods. This underscores the importance of testing whether the single-difference results are consistent with double-difference estimates, working under the assumption that those displaced workers who are ineligible for the subsidy because they did not have ESI as active workers are likely to display similar differences in unobservable factors across the two time periods.

Regression Results

Effect on COBRA Take-up and Other Insurance Outcomes

The first column of Table 2 shows the effect of the ARRA subsidy on COBRA take-up among the treatment group using our single-difference strategy. The first set of rows presents the estimate of the average effect of the subsidy when we do not control for observable characteristics, and the second set of rows presents the estimate when we do control for observable characteristics (corresponding to Equation [1]). Controlling for observable characteristics leads to a larger estimate, although the two estimates are not statistically significantly different. These estimates suggest that those who lost their jobs during the subsidy period had on net a lower propensity to take up COBRA coverage compared to those who lost their jobs outside the subsidy period. Failing to account for these characteristics gives us underestimates of the true effect of the subsidy.[16] The estimate with controls shows that the implementation of the ARRA subsidy is associated with a 3.4-percentage-point increase in the take-up rate, which amounts to a 15.2-percent-increase from the base; dependent variable means are presented towards the bottom of the table and show that the mean take-up rate when the subsidy is not available is 0.22. This 15.2-percent increase in take-up implies a -0.24 price elasticity of demand, as the subsidy reduces the price by 65 percent.

[16] As mentioned, we remain concerned about the role of unobservable differences for which we cannot control in this specification and will address this with our control groups in the next specifications, but these results indicate that if anything our results from the single-difference specification may be an underestimate if unobservables act in the same direction as observables.

The remaining columns in Table 2 also show that the inclusion of controls has a meaningful effect on the single-difference estimate for other forms of coverage as well, and that part of the difference between the two time periods is explained by the changing characteristics of the workers. The second column of Table 2 indicates that the implementation of the subsidy is associated with a 2.9-percentage-point increase in any source of insurance coverage ($p<.10$). This is equivalent to a 7.7-percent decrease in uninsurance from the base of a 0.38 mean of uninsurance (1-0.623 since means shown are for the complement of uninsurance) when the subsidy is not available. This finding suggests that the premium subsidy decreased uninsurance among the treatment group, but that part of the increase in COBRA coverage was offset by a decrease in the availability of other sources of coverage. The third and fourth columns show that while the effect on ESI-dependent coverage is statistically insignificant, non-group insurance decreases by 1.1 percentage points ($p<.10$).

COBRA Take-up by Subgroup

In Table 3, we analyze whether the subsidy had different impacts on COBRA take-up among demographic and socioeconomic groups that likely differ in their demand for such coverage. We perform this analysis by running a regression separately for each subgroup, defined along income, marital status (as well as availability of spousal employer insurance), health status, and age dimensions.[17] We separate the observations into those with monthly family income <250 percent, 250-400 percent, and >400 percent of the federal poverty level (FPL) to have roughly equally-sized groups as well as to stay close to relevant policy parameters: eligibility for the Children's Health Insurance Program (CHIP) is at 200 percent of FPL or above depending on the state, and the Marketplace subsidies phase out completely at 400 percent of FPL. Because of the income drop that happens after job displacement, we form these categories based on family income in the month before job loss, working under the assumption that this is a better measure

[17] We test the statistical significance of the differences in estimated coefficients between subgroups and find that most of the differences are not statistically significant, possibly due to small sample sizes, except for a few cases, which we mention in the text.

of long-run income than income immediately post job loss. The estimated effect in the first set of rows in Table 3 shows that the subsidy increases the take-up by 7.3 percentage points (37.4 percent) among those whose family income before job loss is between 250 and 400 percent of FPL; the implied price elasticity is -0.58 among them. The effects among those whose family income before job loss is less than 250 percent and more than 400 percent of FPL are statistically insignificant. In results available upon request, we find that the implied price elasticity is -0.37 among those whose income is between 138 and 400 percent of FPL; 138 percent of FPL is the cutoff for Medicaid eligibility in the states that expanded Medicaid under the ACA. It may be reasonable to expect this pattern of results, as those with low incomes may not respond to a subsidy, even when the subsidy is generous, because the absolute costs are still high and there may be public sources of coverage available to some members of families. Our results suggest that the price elasticity among subpopulations eligible for the Marketplace subsidies could be higher than the elasticity among other income groups, and this price elasticity could be amplified when there are fines for being uninsured, which is not the case in our time period but become applicable after 2014.

We also consider differences in responsiveness based on marital status. We find that the effect is statistically significant among married individuals at the 10-percent level, but it is not significant among non-married individuals. Part of the difference by marital status could reflect factors that move in opposite directions, such as access to alternative health insurance or alternative sources to liquidity for the purchase of health insurance, depending on the employment characteristics of the spouse. In the next rows, we attempt to disentangle these effects. We estimate a model for subgroups defined by the availability of outside options other than COBRA. For some individuals, even a 65-percent subsidy might not affect COBRA decisions because more attractive options are available, such as coverage through a spouse's employer. As shown in the third set of rows of Table 3, we find that COBRA take-up increases by 14.9 percentage points (58.0 percent) among those whose spouses are employed but who do not have ESI through those employers.[18] The estimated effect for this subgroup is statistically different from the estimated effect for everyone else at the 5-percent level. These individuals have sources of income

[18] Information on whether a spouse has an ESI offer or not at a point in time is unavailable in the SIPP.

through spouses even when they experience job loss, and they are also likely to have higher demand for ESI because of the lack of alternative sources. We find that the effects of the subsidy on other groups are small and statistically insignificant.

The fourth set of rows shows the effects of the ARRA subsidy by health status. COBRA coverage has been known to attract less healthy individuals: a survey finds that health care costs for COBRA enrollees are about 150 percent of that of active employees in 2008 (Spencer and Associates, 2009). Previous reports raise the possibility that subsidies for COBRA coverage could alleviate adverse selection because the lower price might induce those with lower marginal benefit to elect coverage (Fronstin, 1998). Since the SIPP does not contain information on chronic health conditions in any waves, we use a self-reported-health variable that takes values of "Excellent," "Very Good," "Good," "Fair," and "Poor." The subsidy significantly increases COBRA coverage by 3.4 percentage points (14.8 percent) among those whose reported health is less than "Excellent," while the effect is not significant among those whose reported health is "Excellent." We should note, however, that the difference in coefficients between these subgroups is not statistically significant and that the results are somewhat sensitive to the exact thresholds of self-reported health status we use to separate the groups.

The last set of rows estimates differences by age. Although prior work has found some differences according to age, our results do not show any statistically significant difference, perhaps because of small samples. Only a 4.5-percentage-point increase in COBRA coverage among 35-49 year olds is marginally significant at the 10-percent level. The 18-34-year-old age group is likely to be unresponsive to the subsidy because individuals in this group have lower health care demand in general. The 35-49-year-old age group is most responsive to the subsidy, and it is possible that those in this age group have relatively high demand for health care and are price sensitive to coverage due to competing demands for other family-related goods and services. Among the 50-64-year-old age group, the effect is small and statistically insignificant, but the mean of the take-up rate is 29.2 percent among this group when the subsidy is not available, and it is substantially higher than that of the other age groups. It is

possible that those who have higher health care demands in this age group elect COBRA coverage even without the subsidy, while others in this age group are not very responsive to the subsidy.

Alternative nonlinear specifications

Although we have estimated our model using a linear probability specification for ease of interpretation, we end our discussion of the single-difference estimates by estimating Equation [1] using both Probit and Logit nonlinear specifications. We obtain implied marginal effects of similar magnitude and significance as the linear estimates shown in Table 2. The marginal effect on COBRA coverage is estimated as 0.033 when using both Probit and Logit models. This estimate is almost identical to the estimate obtained in Table 2 and is significant at the 5-percent level. The marginal effect on any coverage is estimated to be 0.037 and 0.035 when we use the Probit and Logit models, respectively. These estimates are somewhat larger than the estimate obtained in Table 2, and both are significant at only the 10-percent level. The marginal effects on employer-dependent coverage are estimated to be -0.008 and -0.007 in the Probit and Logit models, respectively and both estimates are insignificant. The marginal effect on non-group insurance is estimated to be -0.009 and -0.008 in the Probit and Logit models. They are slightly smaller than the estimate obtained in Table 2, and both are significant at the ten-percent level.

Double-Difference Results

Although we have controlled for the changes in observable characteristics in our single-difference model, it is possible that unobservable characteristics of the individual changed during and outside the subsidy period, especially since our results in Table 2 indicated the importance of observable characteristics. In Table 2, we find that the significance of the effect changes for some outcome variables when we add control variables, although the magnitudes were not statistically different between the specifications with and without control variables. It is possible that our single-difference estimate of the

effect of the subsidy picks up contemporaneous trends that cannot be captured by controlling for observable characteristics. We present in Table 4 our analysis using two control groups to test whether contemporaneous insurance coverage trends might confound our estimates above. We use one control group to examine COBRA coverage and the other control group to examine the "any coverage" outcome, for reasons we discussed above. The first and second columns of Table A3 show the means of key control variables for the treatment group and for the propensity-score-matched ESI control group, respectively. These two groups are matched well on observable characteristics. This comparison should remove any common effects that occur in workplaces nationwide, for example, in reaction to national changes in the cost of health insurance. The first column of Table 4 shows that the subsidy is now associated with a 3.4-percentage-point increase in COBRA coverage, a magnitude very similar to the estimate obtained in our main specification. This bolsters our confidence that the results reported in Tables 2 and 3 are not subject to large biases that would otherwise be a concern in single-difference estimates.

As a second and alternative control group, we use those who lost their jobs but did not have ESI in their own name prior to job loss to analyze the effects of the subsidy on any source of coverage and other types of insurance. Another concern we are able to address with this specification is that there may be an effect on all those who are unemployed from time varying unemployment benefits policies. We expect that availability of unemployment benefits, which changed during this time period, may influence take-up behavior of insurance coverage, both among those who have lost their jobs and are eligible for COBRA and among those who are not. For example, those who are eligible for longer periods of unemployment benefits may decide to seek insurance relative to those who feel their job search period will need to be shorter because of shorter unemployment benefits eligibility. We thus include in our regressions a measure of the number of weeks of unemployment benefits available at the time of job loss. These data are publicly available from the website of the Department of Labor.

The third column of Table A3 shows that, when compared to the treatment group, the individuals in the unemployed control group tend to be younger, female, Hispanic, single, and childless; to not be a member of trade union; and to have less education, a lower hourly wage, and less job tenure. The second

column of Table 4 shows that the subsidy is associated with a 4.5-percentage-point increase in any source of coverage. The magnitude of the estimate is somewhat larger but well within a 95-percent confidence interval of the estimate in our main specification. The third column shows that the association between the subsidy and employer-dependent coverage is small and statistically insignificant, and the fourth column shows that the subsidy is associated with a 2.2-percentage-point decrease in non-group insurance. These results are consistent with our main results, although the effect on non-group insurance is larger in this specification. This finding suggests that the single-difference estimates for spillover effects of the subsidy onto other types of coverage are somewhat less robust than for the COBRA coverage outcomes.

Further Robustness Checks

In addition to exploring the use of the alternative control groups through a double-difference approach, we also test the stability of our results to other robustness checks (All the results reported in this section are available upon request). For one, we currently include those who lost their jobs involuntarily and had ESI before job loss in our treatment group regardless of their income level, while those whose incomes are too high are ineligible or only eligible for reduced amounts of the subsidy. It is not clear which income measure represents the best for defining the treatment group based on income level because, for example, post-job-loss income (and labor supply decisions) could be affected by the decision to take up the subsidy. We include all income levels in our main specification as it is also not clear that our definition of income will match the definition of income used in the regulation, which is adjusted gross income (total income minus specific deductions such as half of the individual's self-employment taxes, alimony payments, school tuition and fees, and some retirement contributions) for the tax year during which the subsidy is received. As a robustness check, we use income in the month before job loss to obtain a yearly family income. We then exclude those whose income exceeds $125,000 (if they do not have spouses with jobs) or $250,000 (if they have spouses with jobs), which corresponds to the income threshold for the reduced subsidy. The subsidy is phased out at $145,000/year (corresponding to

658 percent FPL for a family of four). About 3 percent of our sample is eligible for reduced subsidies, and 6.7 percent of our sample is ineligible for subsidies. We find that the effect of the subsidy is significant at the five-percent level and that the magnitude is slightly higher than that of our main estimate: the subsidy increases by 4.04 percentage points (18.2 percent) and the implied elasticity is -0.28. We also exclude those who had worked for small employers in states that did not have "mini-COBRA" laws in effect, as these individuals were not eligible for the ARRA subsidy. Our main results do not change because there are only 14 observations of such individuals in our dataset. Further, we found that our main results are not statistically significantly different both when we remove states that passed "mini-COBRA" laws during our data period and when we remove Massachusetts from the sample due to prior comprehensive state healthcare reforms.

We noted that SIPP does not allow us to look at the full time frame of COBRA take-up in the period prior to 2008, because the panel started at that point. There is no other data set that allows us to identify the treatment group of those who have coverage through a former employer and are ARRA-subsidy eligible. However, CPS allows us to look at a similar concept. We look at coverage through 'former or current employer' for those who report themselves as unemployed for 16 weeks (close to our SIPP definition). Figure 3 shows that the pattern of coverage is very consistent with our results. The rate of those who reported having ESI is high in the year 2009, when the subsidy was available for a majority of the year.

Discussion and Conclusion

Government subsidies for health insurance among the unemployed have been a contentious policy issue. Although unemployment benefits cover some lost wages, no safety net exists to cover the loss of fringe benefits. However, even though ARRA subsides have ended, the ACA will start subsidies for COBRA-eligible workers under 400 percent FPL. The distribution of ACA subsidies to COBRA-eligible and other populations will increase the importance of providing estimates on the price elasticity

of health insurance in response to past government subsidies, especially because the prior literature is limited in the availability of policy-based natural experiments and finds a wide range of elasticity estimates between the non-group market and ESI-based studies. In this paper, we analyze the effects of the 65-percent premium subsidy for COBRA coverage introduced by the 2009 ARRA and find that the subsidy is associated with a 3.4-percentage-point increase in take-up. We find that this estimate is unaffected by whether we use a single-difference or a double-difference estimation strategy. The finding implies a price elasticity estimate of -0.24. We find evidence that uninsurance decreased and that the increase in continuation coverage was partially offset by the decrease in non-group insurance.

Our estimates of the COBRA take-up rate and the effects of the ARRA subsidy are smaller than the estimates obtained in prior studies. We find that the take-up rate of COBRA coverage among the treatment group during the subsidy period is 25.1 percent, while the U.S. Treasury (2010b) and Graetz et al. (2012) estimate the take-up rate to be 25-33 percent and 38 percent, respectively. Our estimate, obtained from a nationally-representative sample, is at the lower bound of prior estimates likely because the samples used in these two previous studies come from relatively wealthy states: New Jersey (U.S. Treasury, 2010b) and California (Graetz et al., 2012). We find that out of this 25.1-percent take-up rate, 3.4 percentage points are due to the subsidy. This is also close to a lower bound of the estimated range obtained in Bovbjerg et al. (2010), who found a range of 2-20 percentage points.

The price elasticity of the ARRA subsidy estimated through our analysis is in the middle range of existing elasticities from different contexts. It is higher than the elasticity estimates from the ESI literature but close to the lower limit of the estimates for non-group health insurance obtained in previous studies, and it is lower than the price elasticity estimate obtained in Krueger and Kuziemko (2013) for subsidies for the uninsured based on survey questions. We note that our estimate and the estimates from the ESI literature are closer than they appear, once we account for the differences in price measures used in the calculation of elasticities. In the literature on ESI, employee contributions are used as a price measure, while total premiums are used as a price measure in the literature on non-group insurance and in the current study. On one hand, employee contributions are the price visible to employees, and previous

studies such as Chernew et al. (1997) and Blumberg et al. (2001) find that individuals are responsive to employee contributions but not to total premiums. On the other hand, individuals actually pay the total premium because economic theory posits that wages are reduced by the amount of the employer contribution, provided that the workers value the health insurance being voluntarily provided. Assuming that employee contributions are roughly 20-30 percent of total premiums, the price elasticity estimates in the ESI literature will be 3.3 to five times larger if the total premium is used as the base. Once we make this adjustment, our price elasticity estimate becomes close to the upper limit of the estimates for ESI. Also, our price elasticity estimate among relatively lower-income individuals could be more comparable to the price elasticity estimate obtained in Krueger and Kuziemko (2013). Their elasticity estimate, -1.0, is obtained for the uninsured, who tend to have low income. We estimate that elasticity is -0.58 among those whose family income before job loss is between 250 and 400 percent of the FPL, although our estimate among those whose family income before job loss is less than 250 percent of the FPL was small and insignificant.

Our elasticity estimate could be a lower bound of the true effect of the subsidy for several reasons. First, some of the individuals who are identified as COBRA-subsidy eligible in our sample could be ineligible for the subsidy. For example, those whose former employers went bankrupt, closed their business, or ceased to offer ESI are likely to not be able to avail themselves of the subsidy, although the fraction of these individuals in our sample is small. Second, it is possible that some in the treatment group were unable to receive the subsidy because they did not know about it. However, we believe that this scenario is unlikely because the law mandated that employers send notices to former employees. Bovbjerg et al. (2010) conducted interviews with stakeholders such as employers and union members and concluded that the information on the ARRA subsidy was successfully communicated. Third, those who were laid off right after the end of the subsidy period might be reluctant to take up COBRA coverage knowing that the price was substantially cheaper for their colleagues who were laid off just before them. This could explain a sharp drop in COBRA take-up right after the subsidy period shown in Figure 1, and

if this is the case, the true effect of the subsidy without such psychological effect could be lower.[19] Finally, the take-up of COBRA coverage could have been measured with errors; however, we believe that such errors are small since the SIPP specifically asks about coverage through former employers.

The true effect of the ARRA subsidy on COBRA take-up could be smaller if the subsidy makes individuals more likely to stay unemployed and thus to use COBRA coverage. To mitigate this possibility, we measure COBRA take-up within the first four months after job loss, the earliest possible timing given the structure of SIPP, although it is still possible that individuals forgo job offers because of the subsidy during this short period of time. It is also possible that employers paid the costs of COBRA coverage for former employees as part of a severance package. The low take-up of COBRA coverage suggests otherwise, however, and prior research on COBRA also assumes that employers do not contribute to a premium. If employers did pay the costs of COBRA coverage when the subsidy was not available, the change in price induced by the subsidy could be greater or smaller than 65 percent, depending on whether employers reduced their contribution level following subsidy implementation. Additionally, if employers had decided to lay off their workers just before the date when the subsidy ended, knowing that the workers could benefit from the ARRA subsidy, this could bias our estimate in an unknown direction. We find that in our sample there is no evidence of a change in the number of involuntarily lost jobs around the time when the subsidy ended, which is reassuring.

The price elasticity magnitude could depend on several factors that differ between the COBRA setting and those of other studies. First, COBRA coverage is intended to bridge a gap in insurance coverage caused by job termination. Because of its temporary nature, the demand for COBRA coverage could be low compared to more permanent coverage, even when the price of COBRA is lowered substantially. Second, those eligible for the ARRA subsidy are likely to have experienced a recent loss of

[19] We can eliminate this type of psychological effect by comparing periods before and during the subsidy period, because those who lost their jobs before the subsidy period did not know that the price would decrease later. However, the number of observations from the pre-subsidy period is limited in the SIPP data. Also, another possible identification strategy that cannot be employed in this study due to small sample size is to compare the take-up before and during the subsidy period among those who became eligible retroactively. These could be areas for future studies using a larger dataset, such as records from human resources departments.

income, and this could reduce their responsiveness to the subsidy. Third, the types of individuals who are generally seeking coverage in the non-group market could differ substantially from those individuals who have had ESI while employed, as is the case for those eligible for COBRA.

Beginning in 2014, the ACA has provided more insurance choices to low-income households in the U.S. In states that will expand Medicaid coverage, those with income of up to 138 percent of the FPL will be eligible for Medicaid. In our sample, 30 percent of COBRA-eligible individuals have family income of 138 percent of the FPL or less after job loss; thus, these individuals will have both Medicaid and COBRA coverage as possible insurance options if they reside in states that expand Medicaid coverage. The ACA also provides premium subsidies for purchasing health insurance coverage through the Marketplace to eligible individuals and families with incomes between 100 and 400 percent of the FPL. Although draft ACA implementation rules had proposed that COBRA-eligible individuals would be ineligible for the subsidy through the Marketplace, final regulations extended ACA subsidies to COBRA-eligible individuals (Code of Federal Regulations, 2013). Thus our findings that 19.4 percent of eligible workers take up COBRA coverage and that a 65-percent subsidy can increase coverage by 3.4 percentage points remain relevant even after the ACA is implemented, since a portion of future COBRA-eligible individuals will also be eligible for ACA subsidies; these estimates in our paper help us predict their responses.

Prior estimates of the price elasticity of demand for health insurance have focused on smaller subsidy amounts than those that would be available through the Marketplace, which range from 20 to 90 percent of the premium amounts, depending on household income. On the other hand, the ARRA subsidy is a 65-percent premium subsidy, which is close to the amount a family of four with income at 250 percent of the FPL will receive through the Marketplace. Our elasticity estimate of -0.37 among those whose family incomes before job loss are between 138 percent and 400 percent of FPL suggests that subsidy alone might not be enough to induce targeted individuals to purchase health insurance through the Marketplace. On the other hand, if one of the factors that make our current elasticity estimate low is the short-term nature of COBRA, the fact that ACA subsidies are not time-limited may result in higher take-

up than is implied through this exercise. Also, individuals entering the Marketplace will have more choices of health insurance plans compared to COBRA-eligible individuals, who are typically allowed to switch plans only during periods of open enrollment, and even then their choices are limited to what their former employers offer. The availability of various insurance plan choices through the Marketplace could make individuals more responsive to subsidies because they are more likely to find plans that suit their needs. Another difference is that there is a penalty for not purchasing insurance coverage under the ACA, and this penalty will likely make individuals more responsive to the subsidies. Since administrative costs are higher for non-group coverage compared to ESI, however, premiums for the plans available through the Marketplace will be relatively high, and this could make responsiveness to the subsidies through the Marketplace lower.

Aside from studying the elasticity of demand for health insurance, the ARRA premium subsidy presents an opportunity to explore several other economic concepts related to health and labor economics. It is well established that generous unemployment benefits can reduce job search efforts and prolong the period of unemployment (Mortensen, 1977; Krueger and Mueller, 2010). Subsidies to search could also lead to better eventual job matches because workers would be less likely to settle for the first jobs they are offered (Gruber and Madrian, 1997). Given the close relationship between labor market participation and health insurance, the effect of the ARRA subsidy on labor market outcomes remains an important topic for future study.

Acknowledgements

The authors are grateful for helpful comments from Yaa Akosa Antwi, Seth Freedman, Carole Roan Gresenz, Bradley Heim, Anthony Lo Sasso, Darren Lubotsky, Kerry Anne McGeary, David Molitor, Ryoko Morozumi, Anne Beeson Royalty, Ariel Dora Stern, Mark Wilhelm, and the seminar audiences at IUPUI's Health Economics Seminar Series, Iowa State University's Health Policy Seminar Series, the 2013 Midwest Economics Association Annual Meeting, the fourth annual Midwest Health

Economics Conference, and the 2013 AcademyHealth Health Economics Interest Group Meeting, the 10th Annual Meeting of Japan Health Economics Association, and IUPUI-IUB Mini-Conference.

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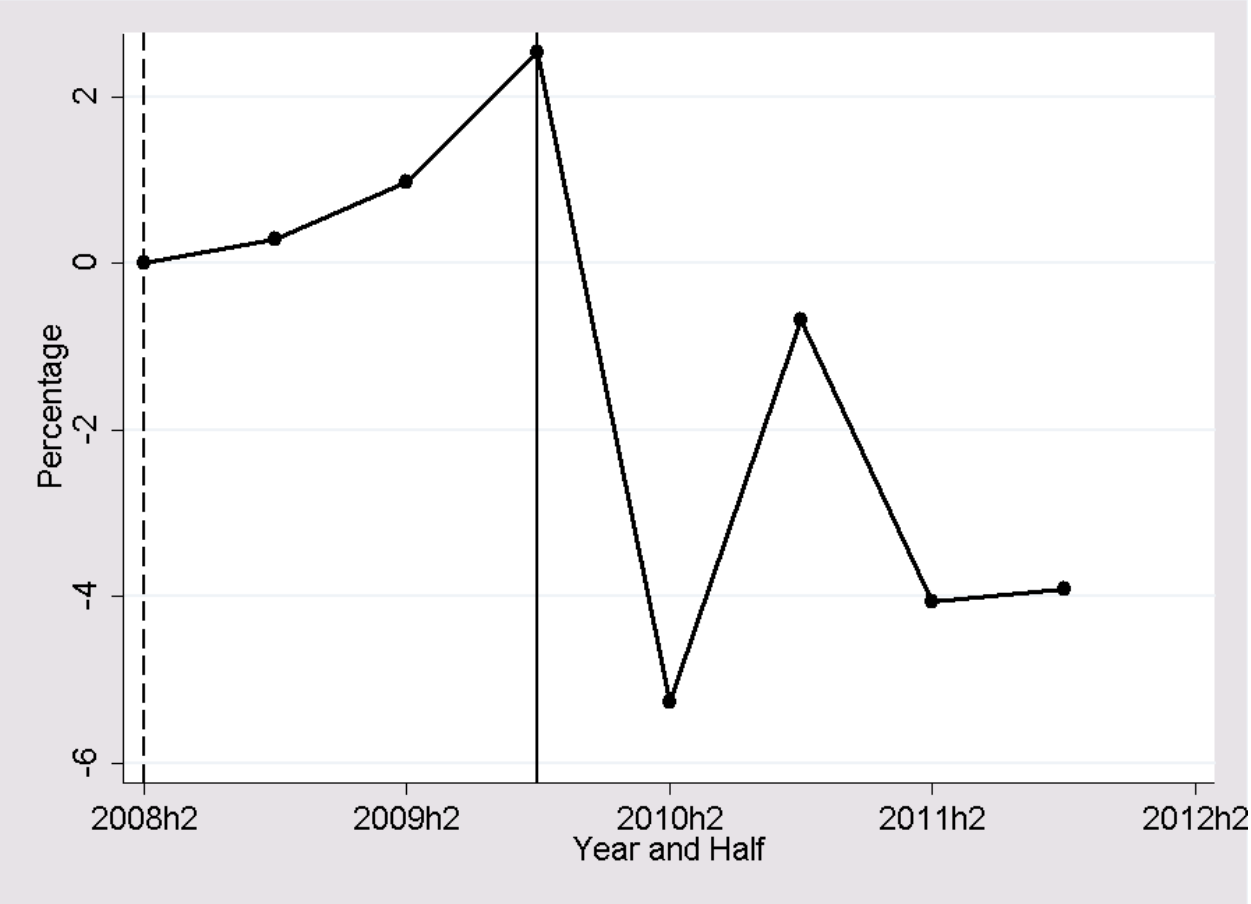
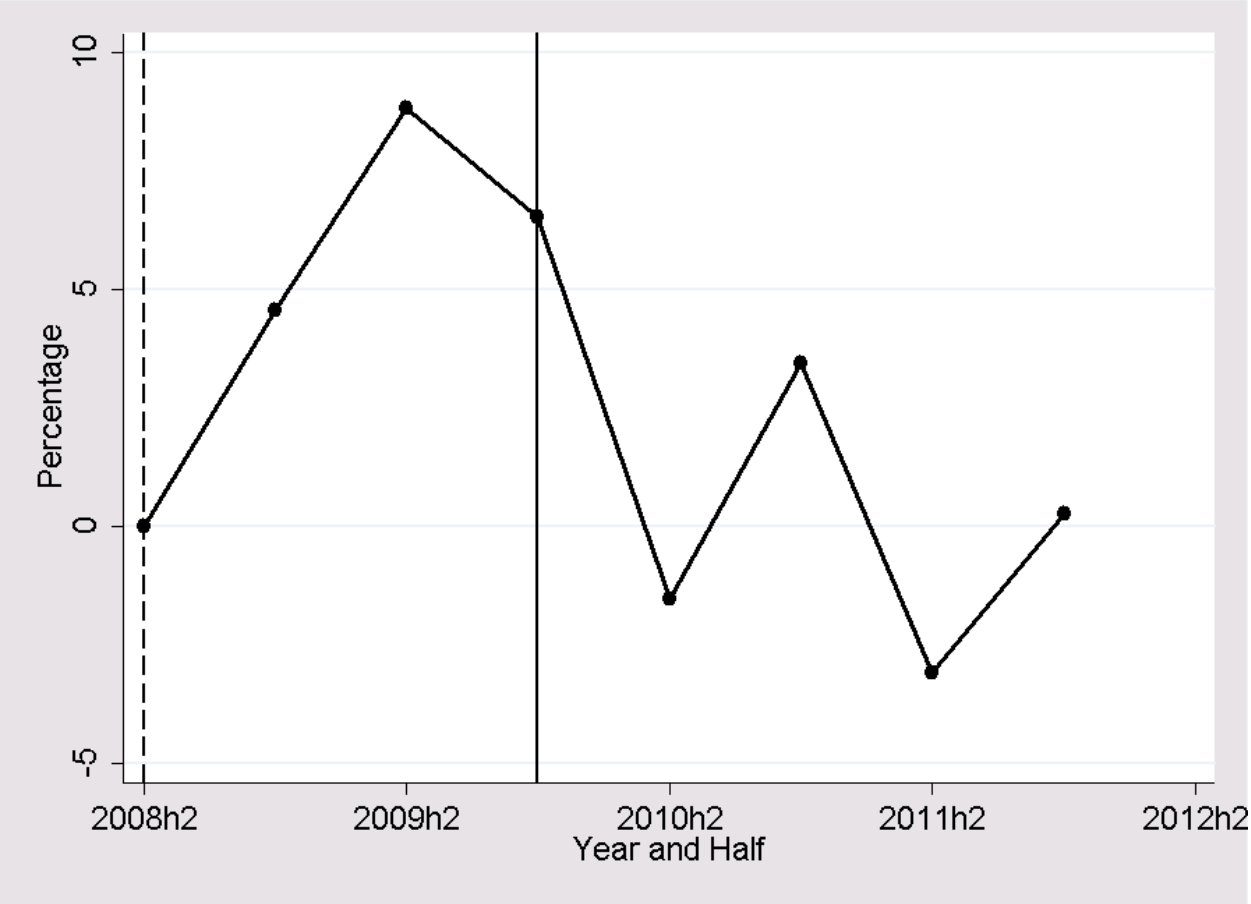
Figure 1. Conditional COBRA Take-up Rate, Treatment Group, During vs. Outside the Subsidy Period



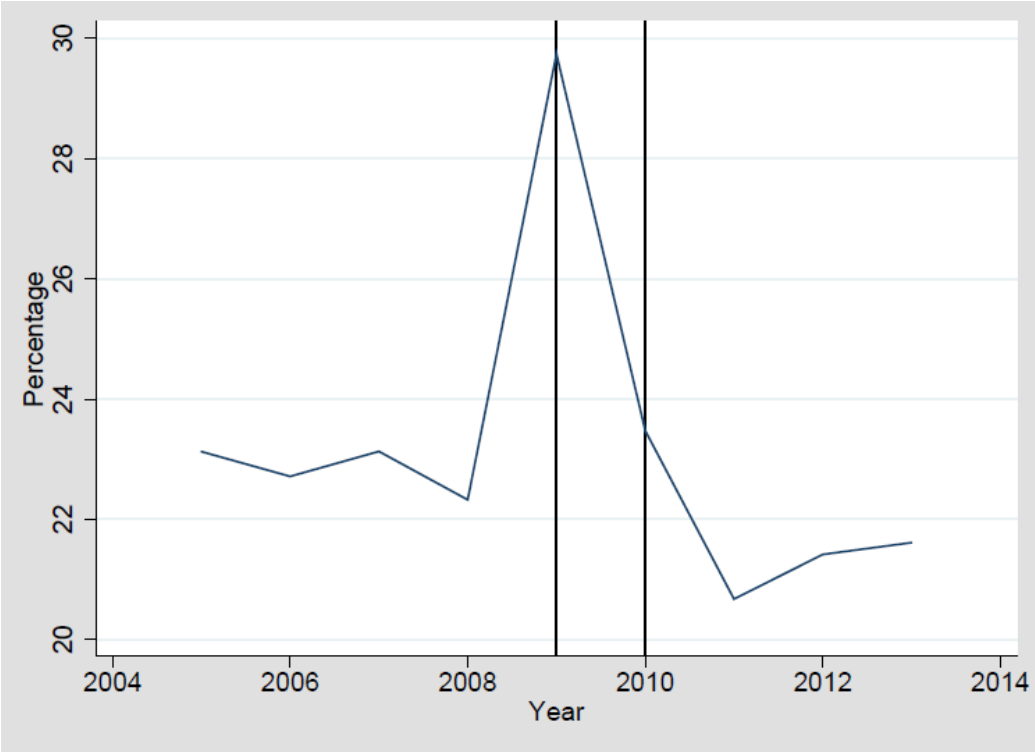
Notes: (1) Sample estimates from the 2008 SIPP panel, using data from September 2008 to March 2012 on those involuntarily lost jobs through which workers had held ESI. (2) We use information on COBRA coverage collected in the most recent reference month of the wave to reduce recall bias and to measure COBRA coverage within four months after job termination. To produce the conditional take-up values for this graph, we run a regression for COBRA take-up that includes indicator variables for each half-year in which individuals lost their jobs (the omitted category is the second half of 2008, the starting point), as well as the following control variables: gender, age, race/ethnicity variables, marital status variables, an indicator for having children, education variables, job characteristics (occupation dummies, industry dummies, job tenure, log of hourly wages, and union status) of the previous wave, state unemployment rate, and state fixed effects. We plot the coefficient estimates of the indicator variables for each half-year. (3) The first (dotted) vertical line represents the second quarter of 2008, in which about 20 percent of individuals were eligible for the ARRA subsidy when their take-up was measured. Those who lost their jobs in November or December of 2008 were eligible for the subsidy if their take-up was measured after February 17th, 2009. The subsidy became available to the majority of these individuals in the first half of 2009 (except for about 15 percent of individuals whose take-up was measured before February 17th, 2009). The second (solid) line represents the second half of 2010, in which the ARRA subsidy became unavailable. See text for further details regarding the sample.

Figure 2. Conditional Rate of Any Insurance Coverage, Treatment Group, During vs. Outside the Subsidy Period



Notes: (1) See Notes (1) and (3) under Figure 1. (2) We use information on any insurance coverage collected in the most recent reference month of the wave to reduce recall bias and measure any insurance coverage within four months after termination. We run a regression for any insurance coverage that includes the same variables listed in Note (2) under Figure 1.

Figure 3. ESI Take-up Rate Among the Unemployed, Unemployment Duration is 16 Weeks or Less



Notes: (1) Sample estimates from the 2004-2013 Annual Social and Economic Supplement of the CPS, using annual information on health insurance coverage in the previous year among those whose unemployment duration is 16 weeks or less in March of the current year. (2) The first vertical line represents the year 2009, when the ARR subsidy became available to the majority of those eligible. The second vertical line represents the year 2010, when the subsidy became unavailable.

Table 1. Means of Demographic, Socioeconomic, and Job Characteristics: Treatment Group, During vs. Outside the Subsidy Period

	Treatment group, outside the subsidy period	Treatment group, during the subsidy period	Test of Difference
Demographic characteristics			
Age	42.2	42.0	
Indicator: female	0.378	0.361	
Indicator: White	0.700	0.730	*
Indicator: African American	0.115	0.109	
Indicator: Hispanic	0.121	0.099	*
Indicator: Asian	0.028	0.031	
Indicator: married	0.527	0.485	**
Indicator: separated or divorced	0.196	0.210	
Indicator: does not have kids under age 18	0.666	0.668	
Education			
Indicator: less than high school	0.082	0.075	
Indicator: high-school graduate	0.281	0.267	
Indicator: some college	0.386	0.427	**
Indicator: college graduate	0.181	0.163	
Labor status (previous job)			
Union membership	0.147	0.156	
Log of hourly wage	3.81	3.88	
Job tenure in months	71.8	76.2	
State-level variable			
Monthly unemployment rate	8.68	9.45	***
Insurance outcomes			
COBRA coverage	0.221	0.251	*
ESI dependent coverage	0.097	0.077	
Non-group coverage	0.043	0.031	*
Any source of insurance coverage	0.623	0.645	
Number of observations	1,115	1,389	

Notes: (1) Sample estimates from the 2008 SIPP panel, using data from September 2008 to March 2012.
(2) ***, **, and * suggest that means differ in a two-tailed t-test between the two columns, with statistical significance of 1 percent, 5 percent, and 10 percent, respectively.

Table 2. Main Results, Effects of the ARRA subsidy on COBRA Coverage and Other Health Insurance Outcomes

	COBRA coverage	Any coverage	Employer-dependent coverage	Non-group insurance
Subsidy effect, no control variables included	0.0299 *	0.0218	-0.0198 *	-0.0121
	(0.0171)	(0.0194)	(0.0113)	(0.0075)
Subsidy effect, control variables added	0.0337 **	0.0290 *	-0.0053	-0.0109 *
	(0.0153)	(0.0171)	(0.0098)	(0.0065)
Dependent Variable Means				
Outside subsidy period	0.221	0.623	0.097	0.043
During subsidy period	0.251	0.645	0.077	0.031
N	2,504	2,504	2,504	2,504

Notes: (1) Sample estimates from the 2008 SIPP panel, using data from September 2008 to March 2012.
(2) The first two sets of rows contain the coefficient from the dummy variable for the subsidy time period, with standard errors in parentheses.
(3) Superscripted notation next to the coefficient indicates the level of statistical significance from a two-tailed t-test. *** denotes the 1-percent level, ** denotes the 5-percent level, and * denotes the 10-percent level.
(4) Standard errors are clustered at the state level.
(5) Dependent variables—column 1: indicator variable that equals 1 if the individual is covered by COBRA continuation coverage in own name and 0 otherwise; column 2: indicator variable that equals 1 if the individual is covered by health insurance from any source and 0 otherwise; column 3: indicator variable that equals 1 if the individual is covered by employer-sponsored health insurance as a dependent and 0 otherwise; column 4: indicator variable that equals 1 if the individual is covered by non-group private insurance.
(6) Other regressors are gender, age, age squared, race/ethnicity variables, marital status variables, an indicator for having children, education variables, job characteristics (occupation dummies, industry dummies, job tenure, log of hourly wages, and union status) of the previous wave, state unemployment rate, state fixed effects, year fixed effects, and month fixed effects

Table 3. Main Results by Subgroup: Effects of the ARRA subsidy on COBRA Take-up

Family Income before Job Loss	Less than 250% FPL	250% FPL or more, less than 400% FPL	400% FPL or more
Subsidy effect	0.0234	0.0726 **	0.0220
	(0.0375)	(0.0346)	(0.0426)
Mean, COBRA eligible, no subsidy period	0.155	0.194	0.288
N	776	709	1,019
Marital Status	Married	Non-married	
Subsidy effect	0.0434 *	0.0195	
	(0.0233)	(0.0248)	
Mean, COBRA eligible, no subsidy period	0.235	0.205	
N	1,262	1,242	
Have spouses who are employed but do not have ESI	Yes	Everyone else	
Subsidy effect	0.149 **	0.0141	
	(0.0565)	(0.0154)	
Mean, COBRA eligible, no subsidy period	0.257	0.212	
N	463	2,041	
Health Status	"Excellent"	Less than "Excellent"	
Subsidy effect	0.0449	0.0340 **	
	(0.0500)	(0.0151)	
Mean, COBRA eligible, no subsidy period	0.1980	0.230	
N	514	1,734	
Age Group	18-34 year olds	35-49 year olds	50-64 year olds
Subsidy effect	0.0324	0.0451	0.0091
	(0.0298)	(0.0274)	(0.0338)
Mean, COBRA eligible, no subsidy period	0.174	0.200	0.292
N	767	961	776

Notes: (1) Dependent variable is an indicator that equals 1 if an individual is covered by COBRA continuation coverage in own name and 0 otherwise.
(2) In our definition, people are of less-than-excellent health if their self-reported health status is very good, good, fair, or poor. Information on self-reported health is obtained from Wave 4 Topical Module.
(3) See Notes (1)-(4) and (6) under Table 2.

Table 4. Effects of the ARRA subsidy on Insurance Coverage, Using ESI Control Group and Unemployed Control Group

Outcome Variable	COBRA coverage	Any coverage	Employer-dependent coverage	Non-group insurance
Control Group	ESI	Unemployed	Unemployed	Unemployed
Subsidy effect	0.0342 **	0.0452 *	-0.0022	-0.0222 **
	(0.0151)	(0.0230)	(0.0147)	(0.0086)
Dependent Variable Means				
COBRA eligible, unavailable	0.221	0.623	0.097	0.043
ESI control, unavailable	0.917	0.491	0.240	0.034
COBRA eligible, subsidy available	0.251	0.645	0.077	0.031
ESI control, subsidy available	0.906	0.475	0.238	0.043
N	7,512	6,814	6,814	6,814

Notes: (1) The first two rows contain the coefficient from the dummy variable for the subsidy time period interacted with the treatment group dummy, with standard errors in parentheses.
(2) Dependent variables- column 2: indicator that equals 1 if the individual is covered by COBRA continuation coverage in own name and 0 otherwise; column 2: indicator that equals 1 if the individual is covered by health insurance from any source and 0 otherwise; column 3: indicator that equals 1 if the individual is covered by employer health insurance as a dependent and 0 otherwise; column 4: indicator that equals 1 if the individual is covered by non-group private insurance.
(3) Other regressors are an indicator for treatment group, an indicator for the period when the subsidy is available, and all the control variables mentioned in Note (6) under Table 2. In addition, we include the number of weeks of unemployment benefits available at the time of job loss in that particular state when we use the unemployed control group (columns 2-4).)
(4) See Notes (1), (3), and (4) under Table 2.

Appendix

Table A1. Industry Categories

Sector	Description
11, 21	Agriculture, Forestry, Fishing, and Hunting; Mining, Quarrying, and Oil and Gas Extraction
23	Construction
31-33	Manufacturing
42	Wholesale Trade
44-45	Retail Trade
48-49	Transportation and Warehousing
51	Information
52, 55	Finance and Insurance; Management of Companies and Enterprises
53	Real Estate and Rental and Leasing
54	Professional, Scientific, and Technical Services
56	Administrative and Support and Waste Management and Remediation Services
61	Educational Services
62	Health Care and Social Assistance
71	Arts, Entertainment, and Recreation
72	Accommodation and Food Services
81	Other Services (except Public Administration)
92, 22	Public Administration; Utilities

Note: Categories are based on the 2007 North American Industry Classification System (NAICS) 2-digit codes. The numbers of individuals who were in the following three categories are small in our sample: "Mining, Quarrying, and Oil and Gas Extraction;" "Utilities;" and "Management of Companies and Enterprises". We merge each of them respectively with "Agriculture, Forestry, Fishing, and Hunting," "Public Administration," and "Finance and Insurance," respectively, based on similarity in characteristics and mean hourly wage.

Table A2. Occupation Categories

SOC High-level aggregation	Title
1	Management, Business, Science, and Arts Occupations
2	Service Occupations
3	Sales and Office Occupations
4	Natural Resources, Construction, and Maintenance Occupations
5	Production, Transportation, and Material Moving Occupations

Note: Categories are based on the "high-level aggregation to 6 groups" in the 2010 Standard Occupational Classification (SOC) developed by the Department of Labor. One of the six groups, "Military Specific Occupations," is not included because the SIPP data does not include those who live in military barracks.

Table A3. Means of Demographic, Socioeconomic, and Job Characteristics: Treatment Group and Control Groups

	Treatment group	ESI control group		Unemployed control group	
Demographic characteristics					
Age	42.1	42.1		36.2	***
Indicator: female	0.369	0.363		0.447	***
Indicator: White	0.716	0.727		0.597	***
Indicator: African American	0.111	0.112		0.129	**
Indicator: Hispanic	0.109	0.102		0.208	***
Indicator: Asian	0.030	0.026		0.029	
Indicator: married	0.504	0.503		0.443	***
Indicator: separated or divorced	0.204	0.198		0.131	***
Indicator: does not have kids under age 18	0.667	0.672		0.576	***
Education					
Indicator: less than high school	0.078	0.076		0.172	***
Indicator: high-school graduate	0.273	0.266		0.347	***
Indicator: some college	0.409	0.416		0.350	***
Indicator: college graduate	0.171	0.180		0.104	***
Labor status (previous job)					
Union membership	0.152	0.157		0.040	***
Log of hourly wage	3.85	3.80		2.87	***
Job tenure in months	74.2	72.4		31.4	***
State-level variable					
Monthly unemployment rate	9.11	9.08		9.15	
Insurance outcomes					
COBRA coverage (ESI in own name for ESI control group)	0.237	0.911	***		
ESI dependent coverage	0.086	0.027	***	0.239	***
Non-group coverage	0.036	0.010	***	0.039	
Any source of insurance coverage	0.635	0.958	***	0.483	***
Number of observations	2,504	5,008		4,310	

Notes: (1) Sample estimates from the 2008 SIPP panel, using data from September 2008 to March 2012.
(2) ***, **, and * suggest that means differ in a two-tailed t-test between the treatment group and each of the control groups with statistical significance of 1 percent, 5 percent, and 10 percent, respectively.