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# Industry Variations in Health Plans and Dynamic Employment Substitution

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## Abstract
Using data on the U.S., we study the effects of employer-sponsored health insurance on dynamic employment substitution between 1990 and 2007 by exploiting the interindustry variation in health care coverage. We find that industries with a high health benefit structure in 1990 have experienced faster employment growth of full-time workers relative to part-time workers, while the relative wage of full-time to part-time workers has declined more in such industries. We argue that considering the dynamic responses of both firms and workers to the benefit structure is crucial to understanding our empirical findings.

**Keywords** Employer-provided health insurance · Employment substitution · Part-time employment · Labor supply and demand

## Introduction

The surge of cost of health insurance over the past decades (Fig. 1) has aroused controversy over the effects of such changes on the labor market. It is usually argued that as employer-sponsored health insurance (ESHI) is typically tied to full-time employment, firms who face higher health care coverage are likely to replace

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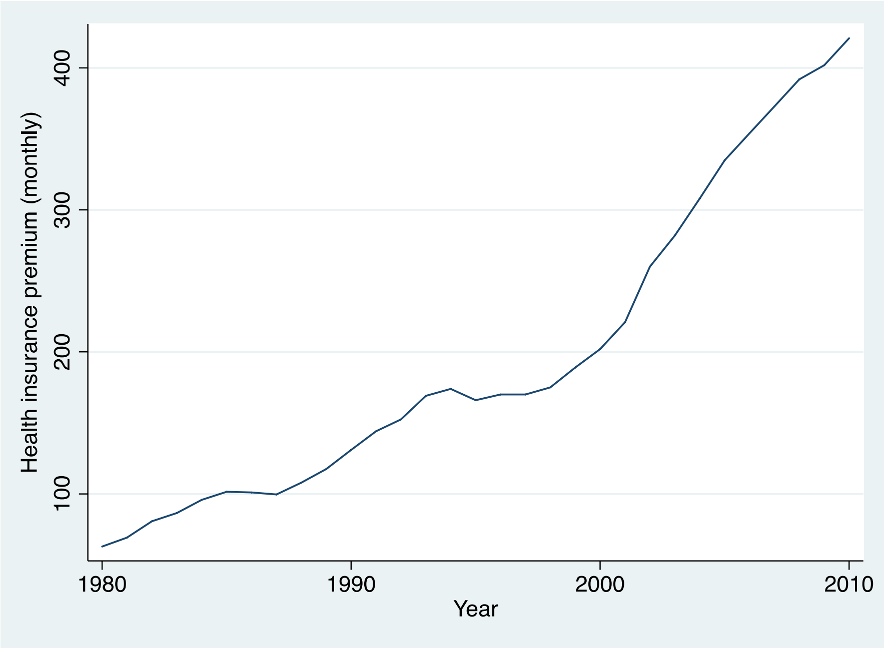


**Fig. 1** Trend of monthly health insurance premiums for singles (1980–2010). Note: The unit is measured in thousands of 1999 U.S. dollars.. Source: U.S. Department of Commerce, U.S. Bureau of Labor Statistics, U.S. General Accounting Office, Kaiser Family Foundation, U.S. Department of Health and Human Services. See Appendix A (Data Appendix) for details

full-time workers with part-time workers to minimize the cost of labor (Buchmueller et al. 2011; Baicker and Chandra 2006; Buchmueller 1999; Lettau 1997).

This paper revisits this argument by examining the extent to which the initial level of ESHI at the industry level can explain dynamic employment substitution between full-time and part-time workers. The ESHI constitutes the largest portion of fringe benefits (around 7% of total compensation),[1] and the employer contribution to insurance premiums as well as the share of beneficiaries vary across industries. Under the assumption that workers value ESHI as much as its dollar value, the standard incidence theory indicates that workers bear the full incidence of ESHI in the form of lower wages. But nominal wage rigidity can partially redistribute the incidence of rapidly rising insurance premiums (Sommers 2005). Moreover, even when nominal wages are flexible (e.g., Gruber (1994)), if the relative wage (or benefit) structure across industries is rigid, growing health care costs may force firms to bear some of the burdens of ESHI rather than lowering workers' wages (see Borjas and Ramey

[1] Total fringe benefits as a proportion of total compensation were around 30% between 1991 and 2003 (BLS). Health insurance comprises the largest portion of fringe benefits, followed by paid leave and retirement benefits.

(2000) and Shim and Yang (2018)).[2] As firms might not be able to lower wages, the usual argument against providing generous employment benefits to full-time workers is that firms bearing high benefit costs might have an incentive to change the composition of workers towards more part-time workers.[3]

The effect of health insurance benefits on employment substitution is, however, theoretically ambiguous when we further consider the dynamic labor supply channel; given the high costs of obtaining health coverage in the U.S., health insurance could be a critical factor in labor supply decisions and a firm with a higher share of full-time workers with health care coverage would attract employees to work full-time rather than part-time.[4] Thus, the labor supply curve of full-time relative to part-time workers would shift out (Buchmueller and Valletta 1999). Consistent with the theory's prediction, past findings about the effects of ESHI on employment substitution between full-time and part-time employees are mixed (see Cutler and Madrian (1998) for a review). Our study extends the insights of the existing literature by using industry-level data that span over 17 years, allowing us to examine the long-term effects of health coverage on relative employment of full-time to part-time labor.

We begin by providing theoretical predictions about the effects of interindustry health benefit differentials on labor market dynamics using a simple labor market model. The prediction of the model with dynamic effects of labor supply can be very different from that of the model considering only labor demand, a static condition. In particular, better health benefit attracts workers to work full-time rather than part-time, hence the relative supply of full-time over part-time increases over time. Therefore, the ratio between full-time and part-time workers can increase if the dynamic labor supply channel dominates the well-known static labor demand channel, which is verified by empirical analysis.

In our empirical framework, we first document that different industries are likely to face different levels of health insurance benefits both in terms of coverage and

[2] One might argue that employers bearing high health benefits can adjust by paying lower wages, and thus, the overall rising cost of ESHI is not a burden for firms. For instance, Gruber (1994) shows that when maternity benefits are mandated towards women of childbearing age, the wage of the targeted group is reduced, indicating substantial shifting of the costs of the mandate in the form of lower wages. However, when we consider wage adjustments *inter*- or *between*- firms or industries, rather than *within*-firms or industries (as in Gruber (1994)), the studies that attempt to investigate the trade-off between wage and ESHI find a positive correlation, as high-paying jobs often provide generous health benefits (Currie and Madrian 1999). Our empirical strategy relies on interindustry variation in health benefits and thus does not necessarily contradict Gruber (1994) who considers within-firm wage adjustment upon providing mandated benefits.

[3] There might exist other channels through which employers can respond to rising health benefit costs; for instance, switching to high-deductible health plans (HDHP) might be one alternative. Koh (2018) finds that during the Great Recession, firms in industries that experienced severe recession shocks exhibit a higher growth of the enrollment rate of HDHP among workers covered by ESHI. While switching to HPDP can be an option for employers, the HDHP enrollment rate was relatively low (lower than 5% in 2006) before the Great Recession (Fig. 1 of Koh (2018)) so that the switching channel is likely to be weak in our sample period.

[4] 66% of those aged 16–64 have private health insurance that comes through employment (March Current Population Survey, 2001–2010).

costs, and this difference is persistent over time. Using U.S. data between 1990 and 2007,[5] we find that the *relative* employment of full-time to part-time workers has increased more in industries that had a high share of health coverage in 1990. These findings are consistent with the prediction of our model that reflects labor supply as well as labor demand, emphasizing the importance of considering workers' incentives when evaluating labor market effects.

Our paper contributes to the literature in two dimensions. First, to our best knowledge, this is the first paper to show that the relative supply of full-time to part-time workers in response to health benefit structure can play an important role in the subsequent changes of the aggregate labor market. In particular, our finding unveils the fact that dynamic responses of the labor market to interindustry differentials might arise from factors (health benefits) other than wages. Second, our finding provides further evidence to the literature that analyzes firms' optimal response to the (given) labor market structure (Caballero and Hammour 1998; Acemoglu and Autor 2011; and Shim and Yang 2018).

The remaining paper is organized as follows. Section 2 provides theoretical predictions that are tested by empirical strategies introduced in Section 3. Section 4 presents our main empirical findings and Section 5 concludes.

## Theoretical Considerations

This section introduces a simple labor market model to study how the interindustry differentials in health care coverage are related to subsequent changes in the composition of full-time and part-time workers, which is a dynamically extended version of the model suggested by Summers (1989). We consider interindustry differentials because we later check whether our empirical findings are consistent with the model's predictions by exploiting variations in health insurance benefits across industries. In the model economy, all markets are assumed to be perfectly competitive and there exists a representative firm in each industry that uses only labor in the production; full-time and part-time workers. Results are robust to the addition of capital in the production function. We assume that (1) all workers are identical and that (2) there exists an exogenous factor that generates initial interindustry health benefit differentials, which are fixed over time. This is to follow the non-competitive view of the labor market to explain interindustry wage differentials (see Borjas and Ramey (2000) and Shim and Yang (2018) for related discussions). One might instead consider the competitive view of the labor market by allowing unobserved worker heterogeneity to generate such interindustry wage differentials, but we choose to take the former view as it is more consistent with empirical findings that will be discussed more in Section 3.[6]

[5] We restrict the sample period up to 2007 to remove the effect of the Great Recession that occurred at the end of 2007.

[6] Importantly, this view is consistent with recent empirical evidence by Borjas and Ramey (2000) and Shim and Yang (2018): They show that a competitive view of the labor market to explain interindustry wage differentials cannot generate the pattern observed in the data. For instance, Shim and Yang (2018)

All variables are in per capita terms so that $h_{it}$ (resp.$\tilde{h}_i t$) is the employment share of full-time (resp. part-time) workers in industry $i$ at time $t$. The firm's problem is:

$$\max\ p_{it} f\left(h_{it}, \tilde{h}_i t\right) - w_{it} h_{it} - \tilde{w}_i t \tilde{h}_i t \tag{1}$$

subject to the production function

$$f\left(h_{it}, \tilde{h}_i t\right) = \left[\left(\tilde{h}_i t\right)^{\frac{\sigma-1}{\sigma}} + \left(\lambda_{it} h_{it}\right)^{\frac{\sigma-1}{\sigma}},\right] \tag{2}$$

where $p_{it}$ is the price of the good, $\lambda_{it}$ is the industry-specific shock, and $w_{it}$ is the wage rate of full-time workers including health benefits in industry $i$ at time $t$. On the contrary, $\tilde{w}_i t$, the wage rate of part-time workers, does not include health benefits. Without loss of generality, we can normalize $\tilde{w}_i t$ as 1. $\sigma > 0$ measures the elasticity of substitution between part-time and full-time workers. For example, Montgomery (1988) estimates that $\sigma$ is about 1.5.

By combining the first-order conditions for firms, we obtain the following relative demand equation of which implication is summarized in Proposition 1. Derivations and related proofs can be found in Appendix B.

$$\log\left(\frac{h_{it}}{\tilde{h}_i t}\right) = (\sigma - 1)\log\left(\lambda_{it}\right) - \sigma \log\left(w_{it}\right). \tag{3}$$

**Proposition 1** (The effect of the industry's higher health insurance benefit on relative employment: Static effects only). *Suppose that the relative health insurance benefit of industry i is different from that of industry j so that $w_{it}$ is higher than $w_{jt}$. Then the relative employment of full-time workers is lower in the industries with high health care coverage as long as $\sigma > 0$ .*

This is the usual argument based on the static model that generous benefits lead firms to substitute away from full-time employees towards part-time employees, to whom firms are not much obliged to provide health insurance.[7] This argument holds as long as the two types of workers are not perfect complements ($\sigma = 0$), which is supported by the empirical evidence.

We now turn to the (dynamic) supply side of the labor market in order to consider the equilibrium effect of interindustry differentials in health care coverage over time.

Footnote 6 (continued)
show that an initially high-wage industry has adopted new technology to replace labor more aggressively than a low-wage industry does, which cannot be explained by the standard assumption that workers are heterogenous but can be explained by the non-competitive view of the labor market. However, this does not mean that we undervalue the importance of unobserved heterogeneity across workers; rather, what we would like to emphasize is that non-competitive factors can play important roles in explaining the dynamics of the labor market.

[7] Firms' response to wage structure is similar to Shim and Yang (2018).

We assume that the dynamic relative labor supply equation of full-time workers is given as follows[8]:

$$\log\left(\frac{h_{it}}{\tilde{h}_i t}\right) = \log\left(\frac{h_{it-1}}{\tilde{h}_i t-1}\right) + \theta\left[\log w_{it-1} - \log \overline{w}_{it-1}\right] + \varepsilon_{it}, \tag{4}$$

where $\theta > 0$ and $\overline{w}_{it-1}$ is the average wage (health insurance benefit) for full-time workers in $t-1$. The first term, $\log\left(\frac{h_{it-1}}{\tilde{h}_i t-1}\right)$, captures the persistence of the relative labor supply. The second term captures the idea that the relative supply of full-time workers increases with the level of health insurance benefits relative to the average benefits in the previous period. This dynamic relative labor supply equation can be obtained under the assumptions that (1) it takes time for workers to obtain information on health benefits of other industries and (2) the benefits are highly persistent as shown in data.[9]

We can easily obtain the following two laws of motion for employment and hourly wage (including health benefits) for full-time workers: Eq. (5) is equivalent to Eqs. (4) and (6) is obtained by combining Eqs. (3) and (4). Proposition 2 summarizes the implication of Eq. (5), which is of our main interest.

$$\Delta \log\left(\frac{h_{it}}{\tilde{h}_i t}\right) = \theta\left[\log w_{it-1} - \log \overline{w}_{it-1}\right] + \varepsilon_{it}, \tag{5}$$

$$\Delta \log\ w_{it} = -\frac{\theta}{\sigma}\left[\log w_{it-1} - \log \overline{w}_{it-1}\right] + v_{it}, \tag{6}$$

*where* $v_{it} = \frac{\sigma-1}{\sigma}\Delta \log\ \lambda_{it} - \frac{1}{\sigma}\varepsilon_{it}$.

**Proposition 2** (*The effect of the industry's higher health insurance benefit on relative employment: Dynamic effects*). *If there exists a dynamic adjustment in labor supply, the relative employment of full-time workers increases over time in industries with high initial health benefits while the relative wage decreases over time.*

As a result, Proposition 1, which is obtained without consideration of the dynamic labor supply channel, that generous benefits lower the relative employment of full-time to part-time workers, may not hold in the dynamic setup. Instead, as long as labor is mobile across industries over time, workers have incentives to supply more full-time labor in industries with high health insurance benefits.

8 A similar labor supply equation can be found in Borjas and Ramey (2000).

9 The share of workers with health insurance is higher among full-time employees than part-time employees (66% vs. 7% based on the 1991 March Current Population Survey) and is persistent over time (Fig. 3).

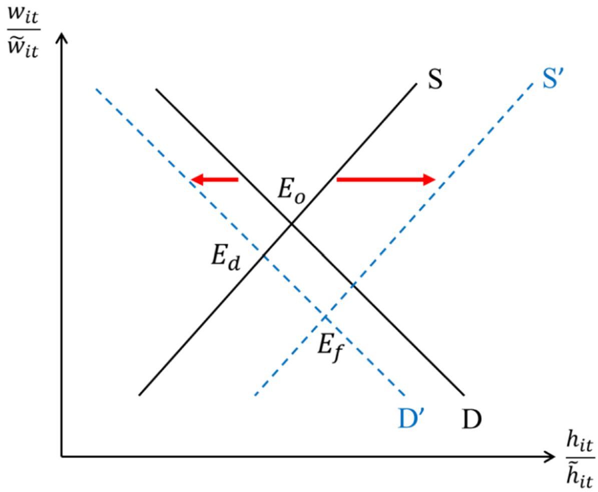


**Fig. 2** Labor market dynamics. Note: $h_{it}/\tilde{h}_it$ is the relative employment of full-time to part-time workers and $w_{it}/\tilde{w}_it$ is the relative wage of full-time to part-time employees

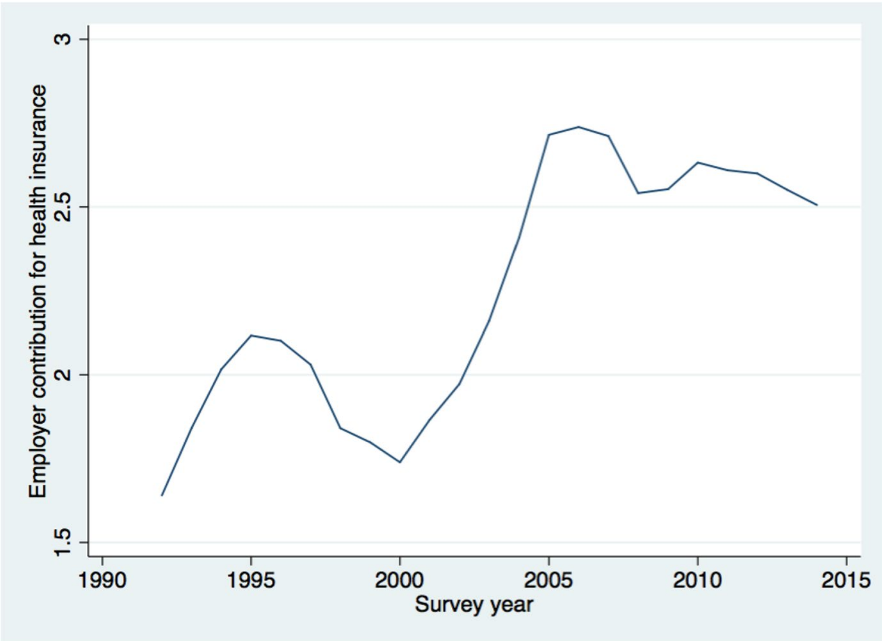


**Fig. 3** Employer contribution to health insurance over time (1992–2014). Source: March Current Population Survey 1992–2014. The unit is measured in thousands of 1999 U.S. dollars

Figure 2 summarizes our discussion graphically. Let $E_o$ be the original equilibrium. Suppose there are two industries. One industry (industry A) provides high health care coverage for full-time workers while the other industry (industry B) does not. With the rising health insurance premium, industry A facing a higher burden of providing health care benefits may decrease relative demand of full-time to part-time workers, while industry B does not. Then the relative demand for full-time workers decreases as described in Proposition 1, resulting in the equilibrium$E_d$. However, it also attracts workers to work full-time so that the relative supply shifts to the right, moving the equilibrium to $E_f$ (Proposition 2). If the supply channel dominates the demand channel, as described in Fig. 2, the ratio between full-time and part-time workers will increase. In what follows, we empirically test if this pattern is observed in the data.

## Data and Empirical Strategy

We use the Census, March Current Population Survey (CPS), and EU KLEMS data between 1990 and 2007, and thus, our data cover the period before the global financial crisis. Our main analysis focuses on this period as health insurance premiums show a notable increase since the late 1980s (Cutler and Madrian 1998; Gutowski et al. 1997). Age is restricted to 16–64 years and we only consider full-time or part-time employees in wage-and-salary sectors excluding those who are in the military. We follow the Bureau of Labor Statistics (BLS)' definition of part-time workers as those who work fewer than 35 h per week. The Census and March CPS provide information such as employment, types of health insurance, employer contribution to health insurance, occupation, and union membership, while the EU KLEMS data provide information on capital for 30 industries. Information on the proportion of ESHI to total compensation is not available in the data. Instead, we use (1) the share of full-time workers covered by ESHI and (2) the amount of employer contribution to health insurance in each industry as proxies for the benefit-cost since industries with the higher share of beneficiaries or with higher employer contribution are more likely to bear the burden of rising health insurance costs than other industries.[10] Fig. 3 depicts employer contribution to insurance premium over time. Employer contribution to health insurance shows a steep increase since the late 1990s, which may put an additional financial burden on firms.

Table 1 shows the share of full-time workers, the share of full-time workers with ESHI, and employer contribution to health insurance among full-time workers across industries. EU KLEMS data provide information of 30 industries based on the North American Industry Classification (NAICS) and thus, we follow the structure of the NAICS in this paper as well.[11] The mean share of full-time workers is 86%: the retail trade industry has the lowest share at 60%, while the transportation equipment industry has the highest share at 96%. The extent of the health care coverage among full-time workers also shows a great degree of variation across industries

[10] The information on the share of full-time workers with health benefits is available from 1980, while the information on employer contribution is available from 1991.

[11] The Census system up to the 1990 Census was based on the structure of the Standard Industrial Classification (SIC). This classification was replaced in 1997 by the NAICS and the 2000 Census industrial classification system was therefore based on the structure of the NAICS.

**Table 1** Summary statistics by industry

| Industry | Share of full-time workers in 1990 | Share of full-time workers w/ ESHI in 1990 | Employer contribution to ESHI in 1991 |
|---|---|---|---|
| Agriculture | 0.796 | 0.240 | 0.497 |
| Mining and quarrying | 0.944 | 0.791 | 2.717 |
| Food, beverages and tobacco | 0.904 | 0.755 | 1.923 |
| Textiles, textile, leather and footwear | 0.883 | 0.649 | 1.278 |
| Wood and of wood and cork | 0.904 | 0.640 | 1.567 |
| Pulp, paper, printing and publishing | 0.867 | 0.765 | 2.193 |
| Coke, refined petroleum and nuclear fuel | 0.958 | 0.863 | 2.528 |
| Chemicals and chemical products | 0.945 | 0.860 | 2.572 |
| Rubber and plastics | 0.938 | 0.793 | 2.344 |
| Other non-metallic mineral | 0.931 | 0.788 | 2.038 |
| Basic metals and fabricated metal | 0.948 | 0.792 | 2.452 |
| Machinery, nec | 0.945 | 0.824 | 2.595 |
| Electrical and optical equipment | 0.949 | 0.806 | 2.408 |
| Transport equipment | 0.959 | 0.852 | 2.953 |
| Manufacturing, nec; recycling | 0.896 | 0.719 | 1.970 |
| Electricity, gas and water supply | 0.954 | 0.872 | 2.641 |
| Construction | 0.877 | 0.472 | 1.260 |
| Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel | 0.858 | 0.489 | 1.097 |
| Wholesale trade and commission trade, except of motor vehicles and motorcycles | 0.891 | 0.694 | 1.746 |
| Retail trade, except of motor vehicles and motorcycles; repair of household goods | 0.605 | 0.469 | 0.933 |
| Hotels and restaurants | 0.737 | 0.479 | 0.908 |
| Transport and storage | 0.863 | 0.704 | 2.355 |
| Post and telecommunications | 0.915 | 0.871 | 2.599 |
| Financial intermediation | 0.875 | 0.765 | 1.746 |

**Table 1** (continued)

| Industry | Share of full-time workers in 1990 | Share of full-time workers w/ ESHI in 1990 | Employer contribution to ESHI in 1991 |
|---|---|---|---|
| Real estate, renting and business activities | 0.782 | 0.518 | 1.095 |
| Community social and personal services | 0.616 | 0.363 | 0.730 |
| Public admin and defence; compulsory social security | 0.910 | 0.817 | 2.318 |
| Education | 0.726 | 0.777 | 1.708 |
| Health and social work | 0.763 | 0.700 | 1.633 |
| Other community, social and personal services | 0.749 | 0.611 | 1.433 |

Employer contribution to ESHI is in thousands of dollars

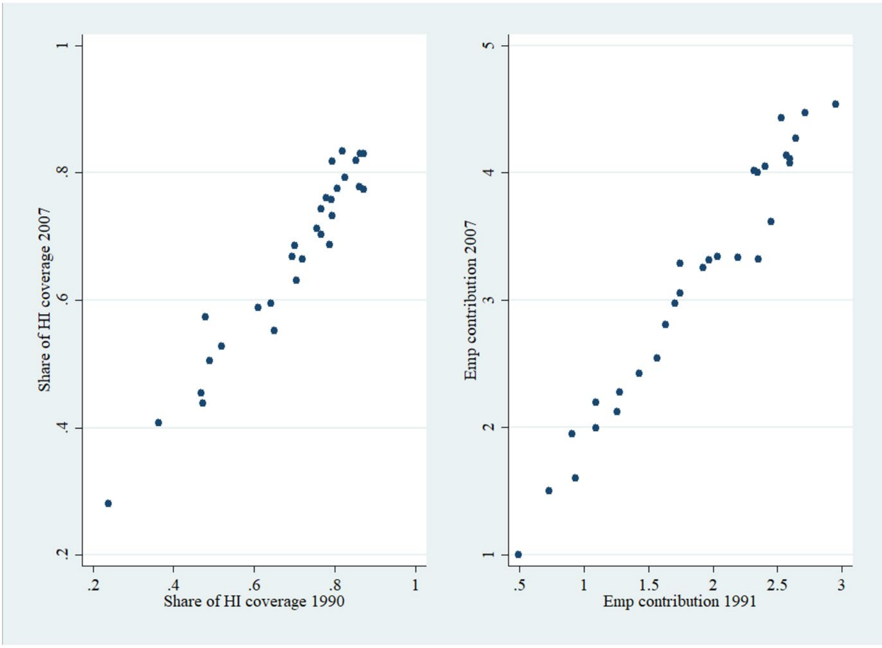


**Fig. 4** Health coverage benefits by industry between 1990 (1991) and 2007

although the mean is 69%: the lowest share is observed in the agricultural industry (24%) whereas the highest share of workers with benefits is 87% in the industry of post and telecommunications industry. Employer contribution has a similar distribution: it varies from \$497 (agriculture) to \$2953 (transport equipment), and the mean is \$1874. One reason why health insurance coverage varies across industries is the differential costs of offering health insurance. This can be due to differences in marginal tax benefits they face; for instance, some industries will find greater cost saving in providing health insurance than the others.

Since our measures for the burden of health benefits are calculated among full-time workers, the variation in initial ESHI is not driven by industry differences in the share of full-time workers. However, if a share of full-time workers in the industry is associated with the economies of scale, the measure of the burden of health benefits can still be driven by the share of full-time workers. While this is a possibility, we note that cross-industry variation in the share of health coverage is much greater than the variation in the full-time employment rate. The standard deviation across industries is 0.165 for health care coverage while that for the share of full-time workers is 0.098, indicating that there appears to be idiosyncratic variation in initial coverage generosity in ESHI that is distinguished from the share of full-time workers in each industry.

The first graph in Fig. 4 presents a scatter plot of the fraction of full-time workers with health benefits between two periods of time; 1990 and 2007. The ESHI coverage rate across industries is remarkably persistent over time. The second graph also depicts the relationship of employer contribution in 1991 and 2007. They show that industries that provided relatively high health insurance benefits in 1990 (or 1991) still provided high benefits in 2007, which indicates persistence in health care coverage across industries.

To identify the effect of health coverage on employment substitution over 17 years, we estimate the following equation, which is usually used in the growth literature that analyzes convergence in economic growth (Barro and Sala-i-Martin 1992; Mankiw et al. 1992) but is also widely used in the labor literature that studies the extent to which an initial condition of the labor market shapes the subsequent changes (Autor and Dorn (2013), Shim and Yang (2018), and Acemoglu and Restrepo (2021)). In addition, one can easily check that Eqs. (5) and (6), which are the key conditions in the model, already take the form of the growth equation, which further justifies the following equation[12]:

$$\Delta y_{it,t+k} = \alpha + \theta b_{it} + \beta x_{it} + \varepsilon_{it}, \quad (7)$$

where $y_{it}$ is the variable of interest in industry $i$ at time $t$ such as employment and wage, and $\Delta y_{it,\ t+k}$ is the average annual growth rate of the variable $y_{it}$ between $t$ and $t+k$ (i.e., between 1990 and 2007).[13] $b_{it}$, the proxy for health care burden, is the share of full-time workers with ESHI or an employer contribution to health insurance in industry $i$ at time $t$, which is calculated using March CPS data.[14] $x_{it}$ includes industry-specific variables that can affect the subsequent labor market outcomes. We use robust standard errors. In each regression, we weight the regression by the initial (i.e., 1990) employment of each industry. We finally note that this equation is the version of Eq. (5), which is derived from our model.

For instance, we regress the relative annual employment growth rate of full-time workers to part-time workers[15] on our key regressor, the share of full-time workers with ESHI in 1990 in each industry, so the coefficient $\theta$ is interpreted as the average long-term effects of ESHI coverage in 1990 on the average annual growth rate of full-time workers to part-time workers. We also progressively control for other variables, which include the labor unionization rate in 1990 and capital per worker in 1990.[16] For instance, a labor union can affect both the number of health insurance beneficiaries in the initial period and the dynamic changes in the labor market (Alder et al. 2014). In addition, if workers' abilities are different from each other and they are positively associated with the capital-labor ratio, the high ratio of beneficiaries

[12] This specification does not allow our estimate to be interpreted as a causal effect; rather, the estimate is a partial correlation.

[13] We do not use industry fixed effects in our specification as there is not much variation in the ESHI coverage within-industry over time.

[14] To calculate the share of full-time workers with ESHI, using the sample of full-time workers, we create a dummy variable indicating whether an individual was a policyholder in a group health insurance plan to a job that the person had during 1990. We then take the average of this variable at the industry level.

[15] That is, $\Delta y_{i1990,2007} = \left[\frac{Full-time\ workers_{i,2007}}{Part-time\ workers_{i,2007}} - \frac{Full-time\ workers_{i,1990}}{Part-time\ workers_{i,1990}}\right]/17$, where $Full-time\ workers_{it}$ is the number of full-time workers in industry $i$ at time $t$.

[16] For the union membership database, see Hirsch and Macpherson (2003) for details.

**Table 2** Estimates of relative full-time to part-time employment growth

| | (1) | (2) | (3) |
|---|---|---|---|
| | Full/part-time employment growth between 1990 and 2007 | | |
| Share of full-time workers w/ ESHI | 0.645*** | 0.684*** | 0.681*** |
| | (0.166) | (0.192) | (0.192) |
| Union membership | | −0.075 | −0.079 |
| | | (0.292) | (0.292) |
| Capital/worker ratio | | | 0.011 |
| | | | (0.012) |
| $R^2$ | 0.334 | 0.336 | 0.352 |
| Mean dep. Var | 0.28 | 0.28 | 0.28 |

There are 30 industries. Average share of full-time workers with ESHI is 0.63. Regressions are weighted by number of employees by industry. Explanatory variables are measured in 1990. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table 3** Estimates of relative full-time to part-time wage growth

| | (1) | (2) | (3) |
|---|---|---|---|
| | Full/part-time wage growth between 1990 and 2007 | | |
| Share of full-time workers w/ ESHI | −0.075* | −0.090* | −0.089* |
| | (0.044) | (0.050) | (0.051) |
| Union membership | | 0.029 | 0.030 |
| | | (0.065) | (0.066) |
| Capital/worker ratio | | | −0.002 |
| | | | (0.001) |
| $R^2$ | 0.334 | 0.336 | 0.352 |
| Mean dep. Var. | −0.04 | −0.04 | −0.04 |

There are 30 industries. Regressions are weighted by number of employees by industry. Explanatory variables are measured in 1990. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

can be the compensation for their abilities and the subsequent labor market changes can be also related.

## Results

In Table 2, we report the results for how the initial level of ESHI is related to the growth rate of relative employment of full-time to part-time. For all our results, we focus our interpretation on the main coefficient of interest, the initial share of full-time workers with ESHI. Columns 1 to 3 show the OLS results, progressively controlling for union rate and capital per worker at the industry level. The results

**Table 4** Estimates of relative full-time to part-time employment growth, using employer contribution to ESHI as benefit measure (in 1000 USD; the base year 2000).

| | (1) | (2) | (3) |
|---|---|---|---|
| | Full/part-time employment growth between 1990 and 2007 | | |
| Employer contribution to ESHI | 0.210*** | 0.266*** | 0.264*** |
| | (0.038) | (0.042) | (0.043) |
| Union membership | | −0.379* | −0.375* |
| | | (0.199) | (0.202) |
| Capital/worker ratio | | | 0.005 |
| | | | (0.009) |
| $R^2$ | 0.511 | 0.557 | 0.560 |
| Model | OLS | OLS | OLS |

There are 30 industries. Regressions are weighted by the number of employees by industry. The average employer contribution to ESHI is 1874 USD. Explanatory variables are measured in 1990, except for employer contribution to ESHI, which is measured in 1992. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

indicate that the initial share of full-time workers with health benefits has a positive and statistically significant relationship with the subsequent growth in full-time to part-time employment between 1990 and 2007. In particular, the coefficient estimate of 0.68 in column (3) suggests that when the share of ESHI increases by 0.1, say from its average of 0.63 to 0.73, the annual growth of full-time to part-time employment will increase by 0.068 (0.68×0.1). Given that the average annual growth during this period is 0.28, the size is roughly 25% of the average. This relationship is robust when additional controls are included.

Table 3 shows the results for the growth rate of relative wage of full-time to part-time workers. The results suggest that high-beneficiary industries have experienced lower subsequent real wage growth for full-time than for part-time workers. To be specific, the coefficient estimate of −0.089 in column 3 suggests that when the share of full-time workers with ESHI increases by 0.1, from its average of 0.63 to 0.73, the annual growth of full-time to part-time wage ratio will decrease by 0.01 (−0.089×0.1). Given that the average annual growth of the wage ratio during this period is −0.04, the size is roughly 25% of the average.

As Fig. 2 suggests, an increase in the labor supply of full-time workers could lower the wage of full-time workers relative to part-time workers. These findings on employment and wage support our hypothesis that dynamic labor supply adjustment is an important factor; consistent with the prediction of our model, a high share of beneficiaries is associated with more labor supply towards full-time employment, resulting in the higher relative employment of full-time to part-time as well as the lower relative wage of full-time to part-time.

Tables 4 and 5 present estimates of the relative employment and wage growth using employer contribution (in 1000 USD in 2000) to ESHI. When we use this alternative measure of health benefits, the pattern of the results is similar to those in Tables 2 and 3 that use the share of full-time workers with health benefits. Table 4 shows that relative full-time to part-time annualized employment growth decreases

**Table 5** Estimates of relative full-time to part-time wage growth, using employer contribution to ESHI as benefit measure (in 1000 USD; the base year 2000).

| | (1) | (2) | (3) |
|---|---|---|---|
| | Full/part-time wage growth between 1990 and 2007 | | |
| Employer contribution to ESHI | −0.029*** | −0.043*** | −0.042*** |
| | (0.008) | (0.012) | (0.012) |
| Union membership | | 0.092* | 0.091* |
| | | (0.053) | (0.053) |
| Capital/worker ratio | | | −0.001 |
| | | | (0.001) |
| $R^2$ | 0.365 | 0.467 | 0.469 |
| Model | OLS | OLS | OLS |

There are 30 industries. Regressions are weighted by the number of employees by industry. Explanatory variables are measured in 1990, except for employer contribution to ESHI, which is measured in 1992. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table 6** Four scenarios of labor supply and demand

| | Labor demand | |
|---|---|---|
| Labor supply | No respond | Decrease |
| No respond | No change in E, W | E decreases, W decreases |
| Increase | E increases, W decreases | E ambiguous, W decreases |

by 26 percentage points when employer contribution increases by $1000. In particular, the average growth rate of part-time employment declines by 2.2% when employer contribution rises by $1000. Table 5 also shows that the relative wage growth of full-time to part-time workers is lower in industries with a high burden of providing health insurance.

To summarize, we find that there is an increase in relative full-time to part-time employment as industries have high ESHI share, while there is a decrease in relative wage. Our conceptual framework suggests that firms lower relative labor demand or do not respond, and workers increase relative labor supply or do not respond. To identify which channels work, consider four possible scenarios and their predictions for firms and workers in industries facing high health insurance burden summarized in Table 6. First, the relative labor demand decreases, while the relative labor supply does not change. Second, labor demand does not change, while supply increases. Third, labor demand decreases while supply increases. Fourth, both labor demand and labor supply do not change. For the first case, the prediction would be that there is a decrease in relative full-time to part-time employment and relative wage, while for the second, relative employment increases and relative wage decreases. For the third case, the relative wage decreases while the employment effect is ambiguous. Fourth, the prediction would be no relationship between high ESHI industries and wage or employment. While we cannot pinpoint whether the labor demand responds or not, our results are consistent with the importance of the labor supply channel, which should be taken into account when considering the effect of the policy regarding ESHI.

## Conclusion

This paper examines the effects of ESHI on employment substitution between 1990 and 2007 by exploiting large variations in health care coverage across industries. Past studies have examined the link between health insurance and labor market outcomes. This paper contributes to this broader literature on the relationship between health insurance and its implication on the labor market.

The analysis of labor market responses to the benefit structure may inform about the effects of federal health care reforms in the United States. Since the Affordable Care Act (ACA) of 2010 requires employers with at least 50 full-time workers to provide those working at least 30 h per week with health insurance, it could be argued that employers that operate on the margin have an incentive to hire more part-time workers to minimize the cost of expanded coverage. But this study shows that this argument is not necessarily the case. The study finds that high-benefit industries have experienced faster employment growth of full-time workers relative to part-time workers, while the relative wage of full-time to part-time workers has decreased. With a simple labor market model, we show that this phenomenon can be explained as firms' and workers' optimal responses to the benefit structure. Our results are consistent with recent studies (Garrett and Kaestner 2015; Mathur et al. 2015) which find little evidence that the ACA has caused a shift towards part-time employment.

We lastly comment on the possible welfare implication of our findings. Similar to Summers (1989), our finding indicates that the increase in ESHI coverage does not necessarily reduce social welfare; while the relative wage of full-time over part-time workers might decrease, the relative employment increases, and hence, as an aggregate, the overall income level does not necessarily decline. In addition, as more workers receive health insurance, it might improve social welfare as health insurance lowers the mortality rate, which is an important factor in determining aggregate welfare (Jones and Klenow 2016).

## Appendix

Appendix A (Data Appendix for Fig. 1) The data are spliced from a variety of sources to form one continuous time series. Real health premiums are constructed by dividing nominal health insurance premiums by the Consumer Price Index (CPI).

**1980–1985:** U.S. Department of Commerce, Statistical Abstract of the United States, 1994 and 1999 editions, Washington D.C., available from.

https://www.census.gov/prod/www/statistical_abstract.html.

Average health insurance premium per capita is calculated by dividing health insurance income by population (also from the Statistical Abstract). Missing years

(1981 and 1985) are interpolated by first deflating the data by the Bureau of Labor Statistics' CPI to account for inflation. The CPI data are from the U.S. Bureau of Labor Statistics (2015) Washington D.C., CPI Detailed Report, Table 24, accessed in August 2015, http://www.bls.gov/cpi/#tables.

**1986–1988:** U.S. Bureau of Labor Statistics, Office of Compensation and Working Conditions (2002), Employer Costs for Employee Compensation Historical Listing (Annual), 1986–2001, Table 3, p. 12, Washington D.C., available from: http://www.bls.gov/ncs/ect/sp/ecechist.pdf.

**1989–1995:** U.S. General Accounting Office (February 1997), Employment-Based Health Insurance, Costs Increase and Family Coverage Decreases, Report to the Ranking Minority Member, Subcommittee on Children and Families, Committee on Labor and Human Resources, GAO/HES-97-35, U.S. Senate*,* Washington D.C., Appendix II, p. 33, available from: http://www.gao.gov/assets/230/223812.pdf.

**1996:** The Henry J. Kaiser Family Foundation (2012) California, U.S., Employer Health Benefits Annual Survey Archives, various issues, accessed in January 2015, http://kff.org/health-costs/report/employer-health-benefits-annual-survey-archives.

**1997:** U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality (2013) Rockville, Maryland, Medical Expenditure Panel Survey, accessed in January 2015, http://meps.ahrq.gov/mepsweb/survey_comp/Insurance.jsp.

**1998–2010:** Kaiser (2012). Kaiser (2015) California, U.S., Premiums and Worker Contributions Among Workers Covered by Employer-Sponsored Coverage, 1999–2014, accessed in January 2015, http://kff.org/interactive/premiums-and-worker-contributions.

## Appendix B (Collection of Proofs)

Given the firm's problem introduced in Eqs. (1) and (2), one can derive the following first-order conditions:

$$\frac{w_{it}}{p_{it}} = \frac{h_{it}^{-1/\sigma} \lambda_{it}^{(\sigma-1)/\sigma}}{\left(\tilde{h}_i t\right)^{(\sigma-1)/\sigma} + \left(\lambda_{it} h_{it}\right)^{(\sigma-1)/\sigma}} \tag{A.1}$$

$$\frac{w_{it}}{p_{it}} = \frac{h_{it}^{-1/\sigma} \lambda_{it}^{(\sigma-1)/\sigma}}{\left(\tilde{h}_i t\right)^{(\sigma-1)/\sigma} + \left(\lambda_{it} h_{it}\right)^{(\sigma-1)/\sigma}} \tag{A.2}$$

By dividing Eq. (A.1) by (A.2) and rearranging the terms, one would get the Eq. (3) in the main text. Differentiating Eq. (3) with respect to wage would yield the following equation, which proves Proposition 1.

$$\frac{\partial \log(\frac{h_{it}}{\tilde{h}_i t})}{\partial \log w_{it}} = -\sigma < 0 \tag{A.3}$$

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**Availability of Data and Code** Data and codes are available on request.

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## Declarations

**Ethics Approval and Informed Consent** We do not need ethics approval from the IRB as we use publicly available data sets only, such as (1) the U.S. Census, (2) March Current Population Survey and (3) EU KLEMS data, and thus the research does not involve identifiable private information.

**Conflict of Interest** None of us has significant competing financial, professional, or personal interests that might have influenced the work described in this manuscript.

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