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The Health Wedge and Labor Market Inequality

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The Health Wedge and Labor Market Inequality*

Amy Finkelstein, Casey McQuillan, Owen Zidar, and Eric Zwick

March 14, 2023

Abstract

Over half of the U.S. population receives health insurance through an employer, with employer premium contributions creating a flat "head tax" per worker, independent of their earnings. This paper develops and calibrates a stylized model of the labor market to explore how this uniquely American approach to financing health insurance contributes to labor market inequality. We consider a partial-equilibrium counterfactual in which employer-provided health insurance is instead financed by a statutory payroll tax on firms. We find that, under this counterfactual financing, in 2019 the college wage premium would have been 11 percent lower, non-college annual earnings would have been $1,700 (3 percent) higher, and non-college employment would have been nearly 500,000 higher. These calibrated labor market effects of switching from head-tax to payroll-tax financing are in the same ballpark as estimates of the impact of other leading drivers of labor market inequality, including changes in outsourcing, robot adoption, rising trade, unionization, and the real minimum wage. We also consider a separate partial-equilibrium counterfactual in which the current head-tax financing is maintained, but 2019 U.S. health care spending as a share of GDP is reduced to the Canadian share; here, we estimate that the 2019 college wage premium would have been 5 percent lower and non-college annual earnings would have been 5 percent higher. These findings suggest that health care costs and the financing of health insurance warrant greater attention in both public policy and research on U.S. labor market inequality.

Keywords: Health insurance, inequality, taxation, health insurance tax subsidy, labor market, college premium, non-employment.
JEL: J32, J31, I26, J22, J23, I130, H24, M52.

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1 Introduction

The gap in labor market outcomes between college- and non-college-educated workers has widened over the last four decades. In the United States, the wages of college-educated workers are now nearly twice as high as non-college educated workers, and college-educated workers also have much higher employment rates. A large and storied literature has explored the causes of this labor market inequality and its spectacular rise. This literature has uncovered a variety of contributing factors, including skill-biased technological change (e.g., Autor et al., 2020; Katz and Murphy, 1992; Bound and Johnson, 1992; Goldin and Katz, 2008; Acemoglu and Autor, 2001), institutional changes such as the erosion of unions and worker bargaining power and a declining real minimum wage (e.g., Card et al., 2004; Farber et al., 2021; DiNardo et al., 1996; Lee, 1999), globalization (e.g., Feenstra and Hanson, 2003; Goldschmidt and Schmieder, 2017), and the sorting of workers across firms (e.g., Abowd et al., 1999; Card et al., 2013; Song et al., 2018). The increase in labor market inequality has not been limited to the U.S., and many of these same forces may also drive similar trends in other OECD countries. Yet the level and growth in labor market inequality are particularly pronounced in the American case.

A uniquely American factor that may contribute to labor market inequality is the financing of health insurance through the workplace. About half of the U.S. population—and virtually all of those with private health insurance—receive their health insurance through their employer or a family member's employer (Kaiser Family Foundation, 2019). The government heavily subsidizes employer-provided health insurance by excluding any contribution employers make to their employees' health insurance premiums from employees' taxable income. This tax exclusion is the single largest federal tax expenditure. It costs the federal government about \$300 billion a year (Congressional Budget Office, 2019), or about two-fifths of the amount it spends on Medicare (Centers for Medicare and Medicaid Services, 2020).

A large literature in public finance has analyzed the impact of this tax subsidy on health insurance coverage, health care spending, and (skill-neutral) labor market distortions brought about by so-called 'job-lock' (e.g., Feldstein, 1973; Feldstein and Friedman, 1977; Gruber, 2000; Garthwaite et al., 2014; Gruber, 2002; Gruber and Madrian, 2004). However, the potential role for this form of health care financing to contribute to labor market inequality in the U.S. has received comparatively little attention in either the public finance or the inequality literature.

Crucially, from the perspective of labor market inequality, health care costs for workers do not decrease as their earnings fall. Therefore, unlike other employee benefits such as life insurance, disability insurance, or unemployment insurance that are designed to replace lost earnings, the cost of providing a worker with a given health insurance plan is a fixed dollar cost per worker, regardless of her wage or earnings. This increases the price of lower-skilled labor relative to higher-skilled labor, a phenomenon we refer to as the "health wedge."

The health wedge is substantial. Average insurance premiums for employer-provided health insurance were about \$12,000 in 2019. This amount is about 25 percent of the average annual earnings for a full-time, full-year worker without a college education (about \$50,000), and about 12 percent of the average annual earnings for a full-time, full-year college-educated worker (about \$100,000).

Several leading economists have recently and prominently conjectured that the health wedge has influenced U.S. labor market inequality. Emmanuel Saez and Gabriel Zucman advance this hypothesis in their 2019 book, *The Triumph of Injustice* (Saez and Zucman, 2019a), and summarize it in the popular press:

> Because health insurance premiums are fixed, the wage penalty is the same for a low-wage secretary as it is for a highly paid executive. This severely depresses wages for tens of millions of moderate-income workers...It's the most unfair type of tax: A huge burden for low-wage workers and almost meaningless for the rich. (Saez and Zucman, 2019b)

Anne Case and Angus Deaton make a similar argument in their 2020 book, *Deaths of Despair* (Case and Deaton, 2020b), which they summarize in an op-ed:

> Employer-based health insurance is a wrecking ball, destroying the labor market for less-educated workers. . . ...At the very least, America must stop financing health care through employer-based insurance, which encourages some people to work but it eliminates jobs for less-skilled workers. (Case and Deaton, 2020a)

This qualitative observation follows naturally from textbook models. However, to our knowledge, we have little evidence of the quantitative importance of the health wedge for labor market inequality.

In this paper, we therefore develop and calibrate a simple model of the labor market and use it to explore quantitatively how the U.S. approach to health insurance financing contributes to labor market inequality. Specifically, we ask what labor market outcomes would have been for full-time, full-year workers under two types of partial-equilibrium counterfactuals.

The first set of counterfactuals considers an alternative financing of health insurance through a national payroll tax on firms rather than through the current head-tax approach. Specifically, we calculate what labor market outcomes would have been if employees who receive health insurance through employer-provided head-tax financing, instead received it financed through a national payroll tax proportional to earnings that is levied on firms. This payroll-tax financing approach is similar in spirit to how universal health insurance is financed in many countries, such as Canada and Germany. Our purpose is not to propose such a change in financing per se, but rather to use a realistic counterfactual financing approach to quantify the impact of the current head-tax financing on labor market inequality. To focus on the impact of a change in financing of a given amount of insurance coverage, we do not give firms the option to stop or start offering health insurance. We also abstract from other potential margins of firm adjustment (such as their decisions around part time work, outsourcing, offshoring, etc).

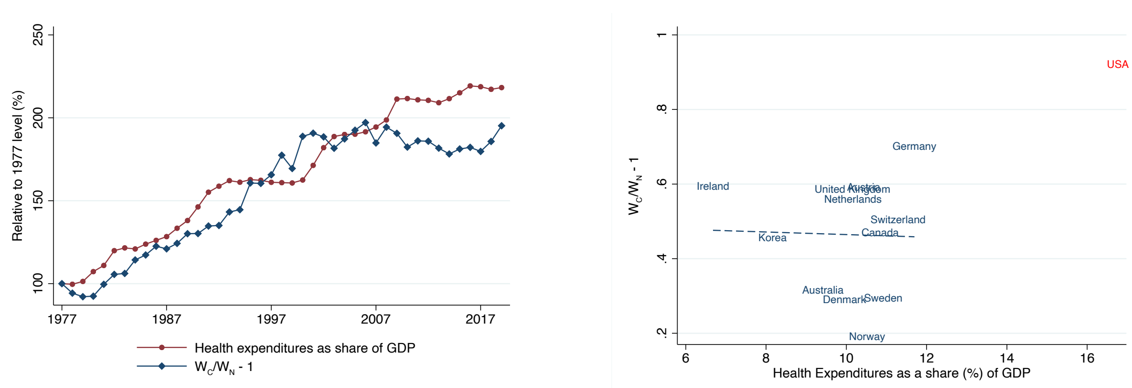
Our baseline calibration suggests that, under counterfactual payroll-tax financing, the college wage premium would have been about 11 percent lower in 2019, non-college annual earnings would have been $1,700 (about 3 percent) higher, and non-college employment would have been nearly 500,000 higher. Had this counterfactual financing been in place since 1977, the rise in the college wage premium would have been about 20 percent smaller and the rise in non-college employment about 4.6 percent larger.

The magnitude of the equilibrium labor market impact of switching from a head tax to a payroll tax depends on estimable objects such as the size of the head tax, the differences in productivity across skill groups, and labor supply functions. We explore the sensitivity of these calibrations to alternative assumptions for these parameters, such as using different labor supply elasticities by education group, and find the results reassuring. For example, a range of alternative parameters suggest that, under payroll-tax financing, the 2019 college premium would have been 10 to 13 percent lower (compared to our baseline estimate of 11 percent), and the rise in the college wage premium between 1977 and 2019 would have been 18 to 23 percent smaller (compared to our baseline estimate of 20 percent). As we discuss below, these effects are comparable in magnitude to estimates of some of the other leading drivers of labor market inequality, including outsourcing, robot adoption, rising trade, declining unionization, and the decline in the real minimum wage.

We consider a second set of counterfactuals that focus on the rise of U.S. health care spending over time. This exercise speaks to how the spectacular rise in U.S. health care spending and health insurance premiums over the last four decades has affected labor market inequality under the current, head-tax regime. Between 1977 and 2019, average health insurance premia for employer-provided health insurance rose by about $9,000 (in 2019 dollars), largely in response to the substantial rise in health care spending. Over this time period, health care spending as a share of GDP has roughly doubled in the US, as has the college wage premium (Figure 1 (a)). Today, the US is an outlier both in terms of the size of the health care sector and the college wage premium (Figure 1 (b)).

Figure 1: College Wage Premia and Health Expenditures

(a) US Over Time **(b)** Cross-Country in 2019



NOTES: Panel A shows health expenditures as a share of GDP in red and the college wage premium in blue. Both are measured as a percentage relative to their 1977 level. College wage premia data are from the Current Population Survey. Data describing health care as a share of GDP are from OECD Statistics. Panel B plots the relationship between the college wage premium and health expenditures in 2019 for countries with a GDP above 300 billion (2019 USD). The dashed line shows the line best-of-fit for non-US countries. Non-US data are from OECD Statistics.

Our baseline calibration suggests that if, counterfactually, U.S. health care spending as a share of GDP in 2019 had remained at 1977 levels of 7.7 percent of GDP rather than its 2019 level of 16.8 percent, the college wage premium would be about 11 percent lower and non-college wages would be about $6,000 (12 percent) higher. In a more realistic counterfactual, we estimate that if U.S. health care spending as a share of GDP in 2019 had been the same as in Canada—i.e., approximately 10.8 percent instead of 16.8 percent of GDP—the college wage premium would have been 5 percent lower and non-college annual earnings would have been $2,800 (5 percent) higher.

Our analyses rely on several simplifying assumptions. Perhaps most importantly, our analysis occurs in partial equilibrium and therefore does not provide a full, general equilibrium assessment of the potential impact of a change in health care financing or spending. Among other things, we hold constant the share of full-time, full-year workers covered by health insurance as well as the total cost and comprehensiveness of employer-provided health insurance coverage. These factors could be affected by our counterrfactuals; indeed, a related literature on the labor market impacts of other health insurance reforms endogenizes some of these factors, such as the decision of firms to offer health insurance and the decision of workers to sort into firms with or without health insurance (Dey and Flinn, 2005; Aizawa, 2019; Aizawa and Fang, 2020; Fang and Krueger, 2021).[1] Relatedly, we abstract from the ways in which the head-tax financing of employer-provided health insurance might contribute to the "hollowing out" of the workforce (Autor, 2018; Autor and Dorn, 2013), a shift to part-time workers (Cutler and Madrian, 1998), the rise of alternative work arrangements (Katz and Krueger, 2017), and the fissuring of the workforce (Weil, 2014; Card et al., 2013; Song et al., 2018). Nonetheless, our stylized, partial-equilibrium analysis points to the potential importance of this uniquely American form of health care financing in contributing to labor market inequality. Our findings suggest that the financing of U.S. health insurance warrants greater attention in both public policy and research on U.S. labor market inequality.

The rest of the paper proceeds as follows. Section 2 provides background on employer-provided health insurance and on patterns of labor market inequality. Section 3 describes a simple model of the effects of health insurance financing on labor market inequality. Section 4 discusses our calibration. Section 5 presents the main results on labor market outcomes under counterfactual payroll-tax financing; we compare our results to existing estimates of the impact of other leading drivers of labor market inequality from the literature. Section 6 examines labor market outcomes under counterfactual levels of health care spending and health insurance premia. Section 7 concludes.

2 Background

2.1 Trends in Labor Market Inequality and Health Care Spending

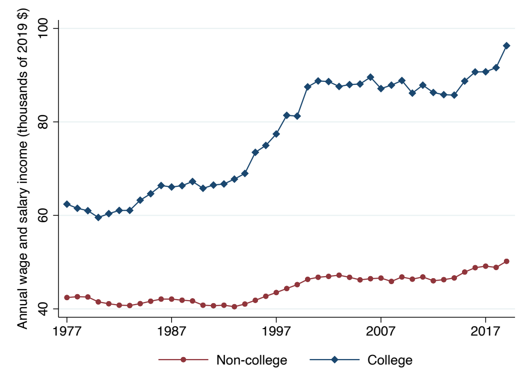
Labor market inequality has risen dramatically over the past few decades in the U.S. Figure 2 shows trends in labor market outcomes for full-time, full-year workers aged 25-64 from the Current Population Survey (CPS).[2] Full-time workers are defined as people who worked at least 40 weeks in the year and had a usual work week of at least 30 hours. We focus on full-time, full-year workers to simplify the measurement of wages, and because employer-provided health insurance is much more common among this group. We report trends separately for those with a college degree—defined as a bachelor's degree or higher—and those without a college degree.

[1] In the most closely related work that we know of, Beemon (2021) uses a labor search model to estimate the impact of switching from employer-provided health insurance to free public insurance on the equilibrium distribution of wages, finding that this would reduce wage inequality.

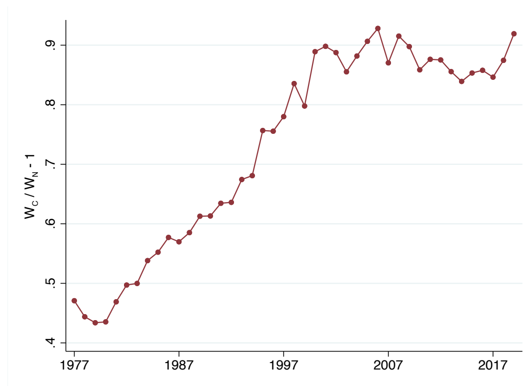
[2] For more information on the CPS, see Flood et al. (2021)

Figure 2: Labor Market Outcomes by Education

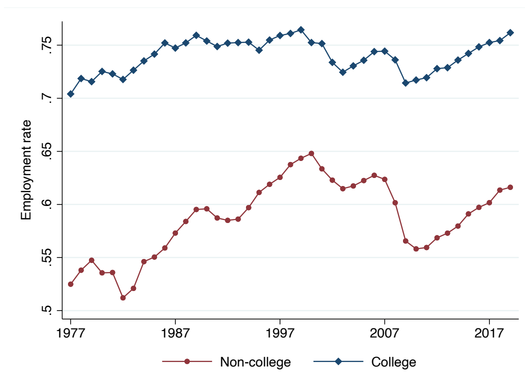
(a) Real Earnings, by Education



(b) College Wage Premium



(c) Employment Rate

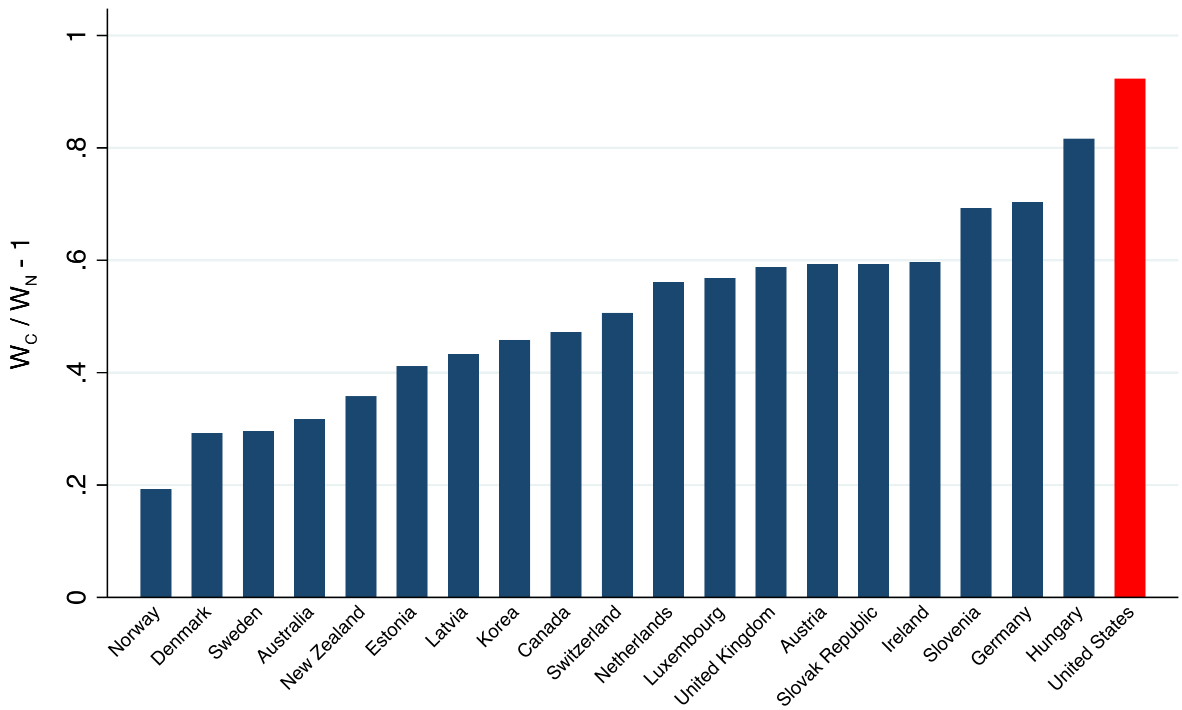


NOTES: Panel A shows the average real wages of college- and non-college-educated workers. Panel B shows the college wage premium, defined as 1 minus the ratio of college to non-college wages. Panel C shows the employment rate, defined as the ratio of workers to the population, for college- and non-college-educated individuals. Data are from the Current Population Survey. The population is restricted to individuals aged 25-64. Workers are defined as those employed full-year (at least 40 weeks per year) and full-time (at least 30 hours a week). Wages are in 2019 dollars.

Real annual earnings for college educated workers (w_C) rose from about \$63,000 (in 2019 dollars) in 1977 to nearly \$100,000 in 2019.[3] At the same time, real annual earnings for non-college workers (w_N) grew more gradually, from about \$43,000 in 1977 to about \$50,000 in 2019. As a result, the college wage premium (i.e., $\frac{w_C}{w_N} - 1$) increased from 47 percent in 1977 to 90 percent in 2019. This 90 percent college wage premium exceeds that of other countries for which comparable data are available, including the U.K. where it is nearly 60 percent, and Germany where it is 70 percent (Figure 3).

[3]The rise in wages for college-educated workers was smaller in the 2000s, which could be due in part to the rise of business income of entrepreneurial owner-managers (Smith et al., 2019) who face tax incentives to re-characterize wages as profits and whose income is large enough to affect aggregate trends in the corporate sector labor share (Smith et al., 2022). Throughout, all dollar values are adjusted to 2019 U.S. dollars using the FRED series PCE price index.

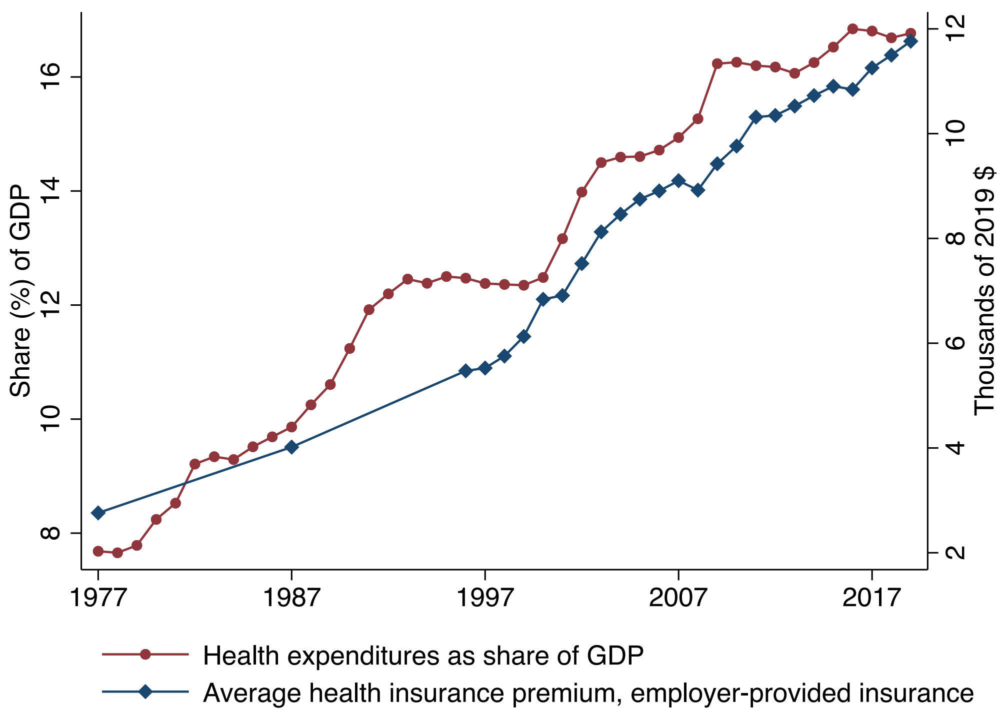
Figure 3: College Wage Premia across Countries in 2019



NOTES: This figure plots the ratio of college-educated to non-college-educated worker wages by country. The United States is highlighted in red. Data are from 2019 *OECD: Education at a Glance* statistics (`https://stats.oecd.org`). College wage premia are given for the population of 25-64 year-olds who are full-year, full-time workers in 2019. The OECD defines full-time workers as those working at least 30 hours per week, and full-year according to each country's individual definition.

Over the same time period, real premiums for employer-provided health insurance in the U.S. have also risen substantially, fueled by rising health care spending (Figure 4). Since 1977, the average health insurance premium has quadrupled in real terms, from about $2,750 (in 2019 dollars), to about $12,000 in 2019. At the same time, health care spending as a share of GDP has risen from 7.7 to 16.8 percent. As a result of these trends in health insurance premiums and in earnings, health insurance premiums as a fraction of labor market earnings increased between 1977 and 2019 from 6 percent of non-college earnings to almost 25 percent, and from 4 percent of college earnings to 12 percent.

Figure 4: U.S. Health Expenditures and Insurance Premia



NOTES: This figure depicts the growth of U.S. health expenditures and health insurance premiums over time. Total health expenditures as a share of GDP are shown in red. Average total health insurance premium cost in thousands of 2019 dollars are shown in blue. Health spending data are from OECD Health Statistics. Insurance premiums data are from NMCES (1977), NMES (1987), and MEPS (1996-2019).

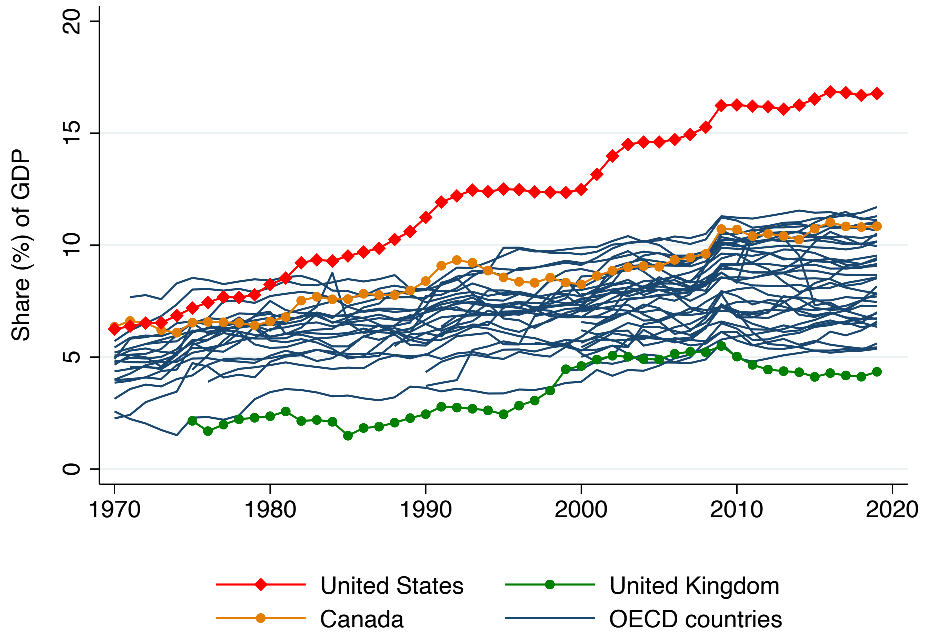
Although many OECD countries experienced both an increase in health care spending as a share of GDP and an increase in labor market inequality, the U.S. is an outlier in both trends (Figure 5). Health care spending as a share of GDP in the U.S. rose from about 8.2 percent of GDP in 1980 to 16.8 percent in 2019. At the same time, on average across the OECD countries (excluding the U.S.) it rose from 6 to 9 percent (OECD Health Statistics 2019).[4] Likewise, the college wage premium in the U.S. increased from 42 in 1980 to 91 percent in 2019. Over the same period, in the U.K., Sweden, and Canada, the college premium rose on average from 43 percent in 1980 to only 45 percent in 2019 (Brzozowski et al., 2010; Domeij and Floden, 2010; Blundell and Etheridge, 2010; Eurostat, 2022; OECD Education Statistics, 2022).[5]

[4] Across the U.K., Sweden, and Canada, where we can also calculate the change in the college wage premium, health care spending as a share of GDP rose on average from 6.5 percent in 1980 to 10.6 percent in 2019.

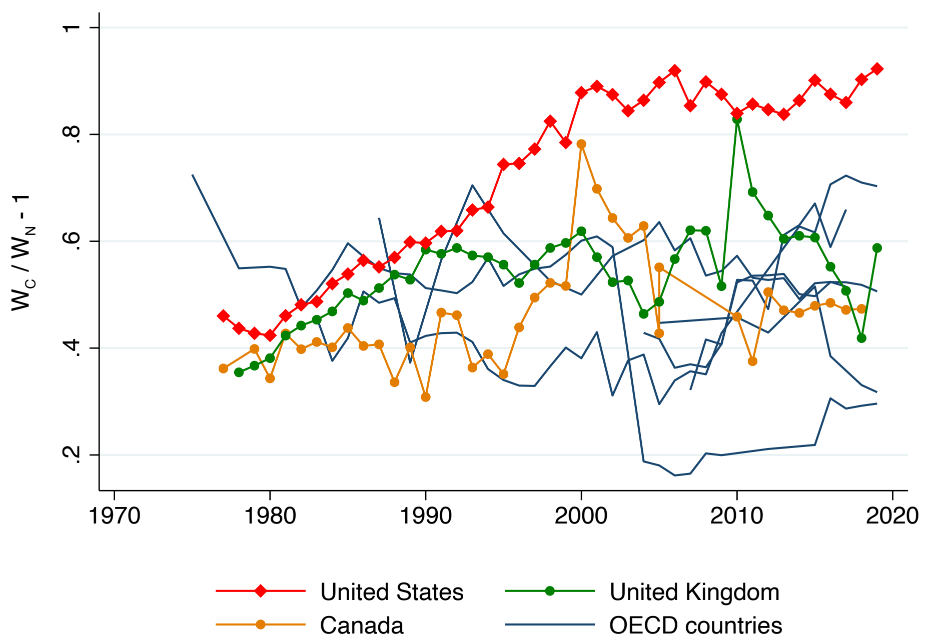
[5] Estimating the college premium for all OECD countries over this period is beyond the scope of this paper. That said, cross-country evidence (e.g., Krueger et al., 2010) suggests that most other OECD countries experienced much smaller increases in the college premium over the past few decades. Despite having college premia closer to the U.S. in 1980, most OECD countries have lower college premia than the U.S. does today (Figure 3).

Figure 5: Health Expenditures and College Wage Premia across Countries

(a) Heath Expenditures as a share of GDP



(b) College Wage Premia



NOTES: Total health expenditures as a share of GDP are shown in panel A. College wage premia are shown in panel B. In both panels, the United States is highlighted in red, the United Kingdom in green, and Canada in orange. Additional countries in panel B are Australia, France, Germany, Italy, Sweden, and Switzerland. A version of panel B with a full set of OECD countries can be found in Figure A.2. Data sources and construction are described in Appendix A.1.

These patterns over time and across countries lend some credence to the hypotheses voiced in the introduction that U.S. health care—and in particular the financing of health insurance through employers—may be contributing to rising labor market inequality in the United States.

2.2 Employer-Provided Health Insurance

Institutional Background. The workplace is the primary source of private health insurance in the United States. About half of the U.S. population—and virtually all of those with private insurance—receive that insurance through an employer (Kaiser Family Foundation, 2019). This development is generally viewed as an accident of history. During World War II, the federal government imposed wage and price controls on American firms as part of its effort to prevent a surge in inflation in the face of competition for scarce labor and goods. But employer contributions to health insurance didn't "count" as part of workers' wages, and employers soon realized that this created a loophole: faced with binding wage controls, they started offering—–and paying for—workers' health insurance as a way to attract and retain employees. What had been initially viewed as a wartime stopgap measure became codified and entrenched into the tax code after the war, with the 1954 codification of the exclusion of employer contributions to health insurance from taxable income. It remains in place to this day (Starr, 1982; Thomasson, 2002). Thomasson (2003) argues that this 1954 codification contributed to the rise of employer-provided health insurance in the United States.

While employer compensation paid in the form of wages and salary is subject to personal income taxes and to payroll taxes on both the employee and employer, compensation paid in the form of contributions to health insurance premiums is not. This treatment creates a tax subsidy to employer-financed health insurance s that is given by:

$$s = 1 - \left(\frac{1 - \tau_{inc} - \tau_{ss}}{1 + \tau_{ss}} \right),$$

where τ_{inc} is the employee's marginal tax rate on earnings and τ_{ss} is the statutory payroll tax rate paid by the employee and separately by the employer. To see where this formula comes from, first note that the employer is indifferent between contributing a dollar to the employee's health insurance premiums and contributing $1/(1+\tau_{ss})$ to her wages, since the employer must pay payroll tax on any wage contributions but not on health insurance contributions; we assume the incidence of payroll taxes is fully on the worker. If the employee is paid $1/(1+\tau_{ss})$ in wages, she must in turn pay both income tax and payroll tax on that wage. Thus, the worker faces a choice of receiving \$1 in employer contributions to her health insurance premia or $\left(\frac{1-\tau_{inc}-\tau_{ss}}{1+\tau_{ss}}\right)$ in take-home pay.

The resulting tax subsidy is substantial. For example, in 2019 the combined employer and employee payroll tax rate—including both Social Security and Medicare—was 15.3 percent, split evenly between employer and employee ($\tau_{ss} = 7.65$).[6] An employee earning \$50,000 in 2019 faced a federal income tax rate of 22 percent while one earning \$100,000 faced a 24 percent tax rate (El-Sibaie, 2018). Thus, the tax subsidy to employer-financed health insurance s was about 35 percent; if the employee faced state income

[6] The Social Security component of the tax rate was not applied to income above \$132,900 (Social Security Administration, 2022).

taxes it would be even higher. In other words, at the same cost to the employer, the employee could receive either $1 in contributions to health insurance premiums or $0.65 in take-home pay.

The tax subsidy to employer-provided health insurance is uniformly reviled by economists (Initiative on Global Markets, 2016) of both parties (Mankiw and Summers, 2015). A large empirical literature reviewed by Gruber (2002) documents that the tax-subsidy distorts compensation from wages to health insurance; this in turn distorts the demand for medical care (Feldstein, 1973; Feldstein and Friedman, 1977; Pauly, 1986). The tax subsidy is also highly regressive, since both employer provision of health insurance and tax rates rise with income (Pauly, 1986; Gruber, 2011).[7] There have been policy attempts to reduce the tax subsidy, most notably the so-called "Cadillac Tax" under the 2010 Affordable Care Act, which would have reduced the tax subsidy to employer-provided health insurance premiums above a specified dollar amount. It was passed into law but never put into effect.[8] As to the provision of health insurance through employers more broadly, the prevailing wisdom is that it is hard to rationalize on efficiency grounds. "If we had to do it over again," the health economist Uwe Reinhardt observed, "no policy analyst would recommend this model" (Blumenthal, 2006). A large empirical literature has documented that the linking of insurance to the workplace distorts labor market decisions including retirement and labor supply, and limits job-to-job mobility (Gruber, 2000; Gruber and Madrian, 2004; Garthwaite et al., 2014). More closely related to our "head tax" analysis, Cutler and Madrian (1998) observe that because health insurance contributions represent a fixed cost per employee, rising health care costs should encourage a reduction in the number of employees and an increase in hours per worker. Consistent with this prediction, they find that hours per worker increased more over time for workers with employer-provided health insurance compared to those without.

The "head tax" feature of financing employer-provided health insurance also raises the question of whether firms can voluntarily use a financing approach that charges highly compensated employees a larger amount for health insurance than lower paid employees. Our understanding is that firms can do so under current law, but rarely do so. Non-discrimination rules under IRS Code Section 105(h) prohibit discrimination in favor of highly compensated individuals, however no regulations forbid the opposite. Nevertheless, it appears that in practice market forces largely prevent firms from pursuing this approach.[9] Charging highly compensated workers more for health benefits effectively lowers their wage, making this approach less attractive for firms that compete to retain and attract college workers. Offsetting a higher charge for benefits with more pay would be tax-disadvantaged relative to the status quo arrangement.

In the context of cost-sharing, Robertson (2015) argues that agency frictions and the locus of benefit decisions within the firm can also explain why firms are reluctant to implement progressive financing

[7] Recent surveys suggest that a number of large employers vary contributions by coarse salary classes (Gregware, 2017; Sammer, 2017). Such arrangements are likely driven by the affordability limit under the Affordable Care Act, which requires the lowest-cost single coverage plan offered by large employers to be below 9.5% of household income.

[8] There have been many related policy proposals. For example, concerned about the tax subsidy's regressivity and its encouragement of low value health care innovation, Bagley et al. (2015) suggest that Congress should "replace the tax exclusion for health insurance with a tax credit for employer-sponsored insurance—a fixed amount that each taxpayer could subtract from her overall tax liability—and that phases out as income increases. Less radically, the tax exclusion could itself phase out with income."

[9] Recent surveys suggest that a number of large employers do vary contributions by coarse salary classes, but this is a far cry from the proportional financing we are analyzing (Gregware, 2017; Sammer, 2017). Such arrangements are likely driven by the affordability limit under the Affordable Care Act, which requires the lowest-cost single coverage plan offered by large employers to be below 9.5% of household income.

arrangements in their health plans. Specifically, the managers who make such decisions tend to be the higher income workers most likely to be hurt by a proportional-to-income scheme. Customizing plans to depend on worker income at the firm level also introduces administrative burden in designing health benefit menus relative to the status quo (Medland (2005)). Consistent with these barriers to private implementation, conversations with employment law experts suggest that firms typically approach health benefits from the perspective of how much it will cost to provide and then offer a simple fixed price per worker in each coverage class.

Descriptive Statistics. Table 1 provides an overview of the health insurance of the approximately 100 million full-time, full-year workers aged 25 to 64, based on the 2019 Current Population Survey. Panel A summarizes the key labor market outcomes in 2019 that will be the focus of our analysis: the employment rate and average annual earnings. The first row indicates that two-thirds of 25-64 year olds were working full time, full year in 2019, with the rest were either working less than full time, full year, or not working. The full-time, full-year employment rate for college-educated workers is 0.76, and for non-college-educated workers it is 0.62. Average annual earnings are \$96,304 for full-time, full-year college-educated workers (w_C) and \$50,179 for full-time, full-year non-college educated workers (w_N). Figure 2 Panel C shows that the full-time, full-year employment rate for college-educated workers (P_c) has been risen since 1977 from about 0.70 to 0.76, while that for non-college-educated workers (P_N) has risen from about 0.52 to 0.62. We focus on the extensive margin of labor force participation; rates of labor force non-participation are high among non-college educated prime age adults, even for men, and have generated substantial interest in their causes and consequences (Binder and Bound, 2019).

Panel B describes the health insurance coverage of these full-time, full-year workers. Just over 80 percent are covered by employer-provided health insurance, 11 percent have another form of health insurance (e.g., non-group private health insurance or public insurance such as Medicaid), and 8 percent are uninsured. About two-thirds of full-time workers are policyholders of employer-provided health insurance—meaning that any employer contributions to those premiums are part of the cost of hiring such workers—while another 14 percent have coverage as a dependent on a spouse's employer-provided health insurance. The share of workers who are policyholders for employer-provided health insurance is higher for college-educated workers (73 percent) than non-college-educated workers (60 percent) while rates of uninsurance are lower (3 percent versus 12.5 percent).[10]

[10] Another 14 percent of 25-64 year olds are part-time workers, defined as anyone who reports working (not counting self employment) during the year but does not meet the definition of a full-time, full-year worker. Only 53.5 percent of them are covered by employer-provided health insurance, and only 31 percent are policyholders. 15 percent have no health insurance.

Table 1: Summary Statistics for FTFY Workers Ages 25-64 (2019)

Panel A: Labor Market Outcomes	Total	College	Non-College
FTFY Employment Rate (P_g)	0.672	0.762	0.616
Avg. Annual Earnings (w_g)	\$70,333	\$96,304	\$50,179
Panel B: Health Insurance Coverage			
Employer-Sponsored	0.802	0.895	0.729
Policyholder	0.659	0.732	0.603
Dependent	0.140	0.162	0.123
Other Private	0.062	0.055	0.067
Public	0.072	0.032	0.103
None	0.084	0.031	0.125
Panel C: Offering and Take-up			
Offered Employer-Sponsored Health Insurance	0.830	0.895	0.780
Take-up | Offered	0.794	0.818	0.773

Notes: This table shows summary statistics for the populations of interest. Each column shows a different population by education level: total population, college educated (defined as having obtained a bachelor's degree or above), and non-college educated (no bachelor's degree). Panel A shows labor market outcomes for people aged 25-64. The full-time, full-year (FTFY) employment rate is the share of the population who worked at least 40 weeks in the year and had a usual work week of at least 30 hours. Annual earnings among FTFY workers are reported in the second row. Panel B shows insurance coverage for FTFY workers. Panel C shows offering and take-up conditional on offering for FTFY workers. Offering is defined as individuals who either enroll in employer-provided health insurance as a policyholder or report being offered this insurance at their workplace; take-up is defined as enrolling in employer-provided health insurance as a policyholder. The results are similar when looking at self-reported eligibility for employer-provided health insurance instead of offering. All data is from 2019 Current Population Survey. Dollar amounts are in 2019 U.S. dollars.

The one-third of workers who are not policyholders reflects a combination of working for a firm that doesn't offer health insurance and not taking up offered insurance, in roughly equal measure. About 83 percent of full-time, full-year workers are offered insurance by their employer, and, conditional on being offered this insurance, about 80 percent take up this insurance (i.e., enroll as the policyholder). Offering and conditional take-up are higher for college-educated workers (at 90 percent and 82 percent respectively) than for non-college-educated workers (78 percent and 77 percent respectively). One reason that workers may not take up employer-provided health insurance is that they typically have to pay a portion of the premiums; many who do not take up the offered insurance through their employer are insured through another source, such as another family member's employer-provided health insurance or public insurance (Gruber, 2008; Gruber and Simon, 2008).

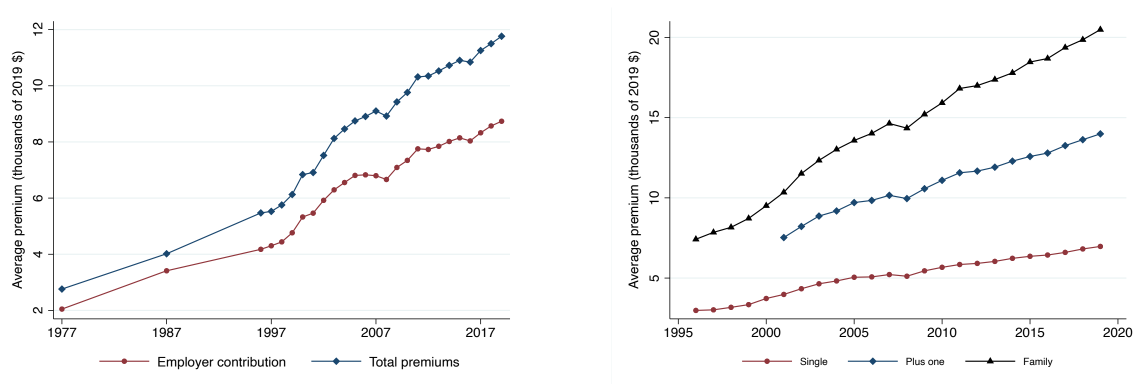
Figure 6, Panel A shows the rise in annual premiums for employer-provided health insurance over time.[11] The information is provided directly by employers and includes average employer and employee premiums for each type of coverage (single, employee-plus-one, or family coverage, see Figure 6, Panel

[11] These data come from the Insurance/Employer component of the Medical Expenditure Panel Survey (Blewett et al., 2019), or its precursor the National Medical Expenditure Survey in 1977 and 1987.

B), as well as the share of employees who are policyholders in each type of coverage. We report average premiums across employees by weighting each coverage type by its employee share. Average health insurance premiums in 2019 were about $12,000. The average premium varied from about $7,000 for a single coverage plan, to $14,000 for plus one coverage, to $20,000 for family coverage.[12]

Figure 6: Premiums for Employer-Provided Health Insurance

(a) Average Premiums **(b)** Premiums by Coverage Type



NOTES: These figures depict per employee health premiums from 1977-2019. In Panel A, the blue line depicts the average total premium (i.e., the sum of employer and employee contributions) across types of plans, while the red line depicts only the employer contributions. In Panel B, total premiums are shown separately by plan type. Data from 1996-2019 are from the Medical Expenditure Panel Survey (MEPS). Data from 1987 are from the National Medical Expenditure Survey (NMES). Data from 1977 are from the National Medical Care Expenditure Survey (NMCES).

On average, employers paid about three-quarters of these premiums (or $9,000 relative to the total average premium of $12,000). Gruber and McKnight (2003) discuss possible incentives for an employer to require some employee contributions to premiums, including encouraging those with outside insurance options to avail themselves of those instead, or allowing firms to offer a range of low-cost plan options with employees contributing on the margin if they want more comprehensive coverage.[13]

3 Conceptual Framework

To illustrate how the method of financing employer-provided health insurance can affect labor market inequality, we sketch a simple, stylized model of a competitive labor market. We use the model to analyze qualitatively the equilibrium labor market impact of counterfactually financing health insurance premiums through a proportional payroll tax rather than a fixed, per-worker head tax. In the next section, we calibrate a generalized version of this model for our quantitative analyses.

[12]The Medical Expenditure Panel Survey is not the only source of information on the cost to employers of providing health insurance. The Bureau of Labor Statistics provides an alternative estimate each quarter in the hourly Employer Cost for Employee Compensation (ECEC), which includes the cost of health benefits to the employer. In Figure A.1 we adjust both estimates to make them comparable and compare their implications for the employer cost of providing health insurance. They line up quite closely.

[13]Most employees are able to make their contributions out of pre-tax dollars. Gruber (2011) estimates that roughly 80 percent of employees with employer-provided coverage have access to a Section 125 or cateferia plan that allows them to make their health insrance contributions pre-tax.

3.1 Setup

There are two types $g \in \{N, C\}$ of workers, where N and C denote non-college and college workers, respectively. We assume that the productivity of college workers (A_C) exceeds that of non-college workers ($A_C > A_N$). For the qualitative analysis, we assume a linear production technology for output Y such that $Y = A_N L_N + A_C L_C$, where L_g is the employment of group g. The assumption that college and non-college workers are perfect substitutes with a constant relative wage determined by their relative productivity irrespective of labor supply simplifies some of our comparative statics without affecting the qualitative insights that we emphasize. We also assume that everyone in the workforce holds employer-provided health insurance. We relax both assumptions in our quantitative calibration in the next section.

Labor Demand. We consider a representative firm in a competitive labor market. The firm chooses labor inputs to solve

$$max_{L_N, L_C} Y - \omega_N L_N - \omega_C L_C, \tag{1}$$

where ω_g denotes the total cost to the employer of hiring a worker from group g. Under head-tax financing of health insurance, $\omega_g = w_g + \tau$ where w_g is the salary paid to group g and τ is the health insurance premium per worker. Under payroll-tax financing, the cost of hiring a worker from group g is given by $\omega_g = (1+t)w_g$, where t is the payroll tax on earnings. Given the assumption of a linear production technology, equilibrium costs per worker are determined by worker productivity. Thus, $\omega_g = A_g$.

Labor Supply. Each worker i in group $g \in \{N, C\}$ faces a discrete choice of whether or not to work. We model the indirect utility from employment (U^e_{gi}) as consisting of a systematic component V_g shared by all individuals in the group, and an idiosyncratic component ε_i. The systematic component V_g depends on wages and health insurance provision. The idiosyncratic component $\varepsilon_i \geq 0$ captures the individual-specific disutility from working. This construction allows us to represent the indirect utility from working by $U^e_{gi} = V_g - \varepsilon_i = w_g + \alpha_g h - \varepsilon_i$ where $\alpha_g \geq 0$ is the group-specific amenity value of health insurance expenditures h relative to wages.

A priori, α_g may be larger than or less than one. If health insurance is only available through the employer, employee risk aversion could produce a value of health insurance that is more than wages ($\alpha_g > 1$). In the presence of moral hazard, the privately and socially optimal amount of insurance would be to provide health insurance until $\alpha_g = 1$ (Baily, 1978; Chetty, 2006). However, as emphasized by Feldstein (1973), the preferential tax treatment of employer-provided health insurance can result in an equilibrium value of health insurance that is less than wages ($\alpha_g < 1$). When we keep constant the provision of employer-provided health insurance and focus solely on the impact of how it is financed, we can remain agnostic on the potentially group-specific utility to workers from health insurance relative relative to earnings, α_g.

We normalize the indirect utility from not working to 0. An individual will therefore work if and only if $U^e_{gi} > 0$. If we consider the idiosyncratic component of utility from work ε_i to be a random variable, the share of individuals in group g who will work is therefore given by

$$P_g = Pr(V_g > \varepsilon_i) = Pr(w_g + \alpha_g h > \varepsilon_i).$$

For simplicity, we assume that the idiosyncratic components ε_i are independently and identically distributed according to a uniform distribution over the interval from $\underline{\kappa}$ to $\overline{\kappa}$ (i.e., $\varepsilon_i \sim \mathrm{U}[\underline{\kappa}, \overline{\kappa}]$). The resulting aggregate labor supply function is therefore linear between $\underline{\kappa}$ and $\overline{\kappa}$:

$$P_g = \Pr[V_g > \varepsilon_i] = \begin{cases} \frac{V_g - \underline{\kappa}}{\overline{\kappa} - \underline{\kappa}} & \text{if } V_g \in [\underline{\kappa}\,, \overline{\kappa}] \\ 0 & \text{if } V_g < \underline{\kappa} \\ 1 & \text{if } V_g > \overline{\kappa}. \end{cases} \tag{2}$$

We denote by $L_g \equiv P_g N_g$ the total employees in group g, where N_g is the number of workers in group g.

3.2 Equilibrium Comparative Statistics

Under the status quo head-tax financing, the cost of hiring a worker is given by $\omega_g = w_g^H + \tau$, where we use the superscript $H$to denote the head tax scenario. Equilibrium wages are therefore $w_g^H = A_g - \tau$, and the college wage premium is

$$\frac{w_C^H}{w_N^H} - 1 = \frac{A_c - \tau}{A_N - \tau} - 1. \tag{3}$$

The greater the health insurance premiums (τ) and the greater the relative productivity of college workers ($\frac{A_C}{A_N}$), the greater the college wage premium. Substituting equilibrium wages into the labor supply function, relative equilibrium employment under the head tax (where $h = \tau$) is given by:

$$\frac{L_C^H}{L_N^H} = \frac{A_c + (\alpha_C - 1)\tau - \underline{\kappa}}{A_N + (\alpha_N - 1)\tau - \underline{\kappa}}. \tag{4}$$

We now consider the impact of financing employer-provided health insurance with a proportional, nationwide payroll tax instead of the current head tax. To compare these two alternative approaches to tax-financing employer-provided health insurance, we hold constant at τ the average employer contribution to each employee's health insurance. Thus, the per-employee cost of health insurance remains unchanged at the national level; the only thing that changes is how that contribution is financed. As noted in the Introduction, for the purpose of this conceptual exercise we hold fixed the share of full-time, full-year workers receiving health insurance in this manner. This assumption allows us to focus exclusively on the impact of changing how a fixed amount of coverage is financed. This counterfactual also allows us to abstract from difficult-to-measure parameters such as the amenity value of health insurance premiums relative to wages (α_g), which affects equilibrium employment and (once we relax the assumption of a linear production technology) equilibrium wages as well (see equation (4) and Appendix (A.2)). More generally, the amenity value of employer-provided benefits is an important parameter for a range of policy counterfactuals (see, e.g., Gruber, 1994; Summers, 1989).

Because we assume that the health insurance provided remains constant under the counterfactual payroll tax financing, the labor supply function is unaffected (equation (2)). Labor demand, however, is affected. Under payroll tax financing (which is levied statutorily on firms), the employer now contributes a fixed proportion t of each worker's earnings to their health insurance, so that the cost per worker in group g is now $\omega_g = (1+t)w_g^P$,where we use the superscript P to denote the payroll tax scenario. Equilibrium wages are now $w_g^P = \frac{A_g}{1+t}$.

Since, by constructon, the average per employee cost of health insurance is held constant, the payroll tax t is determined in equilibrium by the following equation:

$$\tau \cdot (L_N + L_C) \quad = t \cdot [w_N \cdot L_N + w_C \cdot L_C].$$

Given equilibrium wages under the payroll tax[14] we can rewrite this relationship as:

(5)
$$\tau = \left(\tfrac{t}{1+t}\right)\tilde{A} \ ,$$

where $\tilde{A} \equiv \left(A_N \cdot \frac{L_N}{L_N+L_C} + A_C \cdot \frac{L_C}{L_N+L_C}\right)$ is the average productivity of college and non-college workers, weighted by their relative shares. Since $A_N < \tilde{A} < A_C$, it follows that the equilibrium wage for college workers is lower under payroll tax financing than head tax financing:

(6)
$$w_C^P = \frac{A_C}{1+t} < A_C - \tau = w_C^H.$$

By the same token, the equilibrium wage for non-college workers is higher under payroll tax financing than under head tax financing:

(7)
$$w_N^P = \frac{A_N}{1+t} > A_N - \tau = w_N^H.$$

Because labor supply is the same under these two alternative financings, equilibrium employment under payroll tax financing is higher for non-college workers ($L_N^P > L_N^H$) and lower for college workers ($L_C^P < L_C^H$).

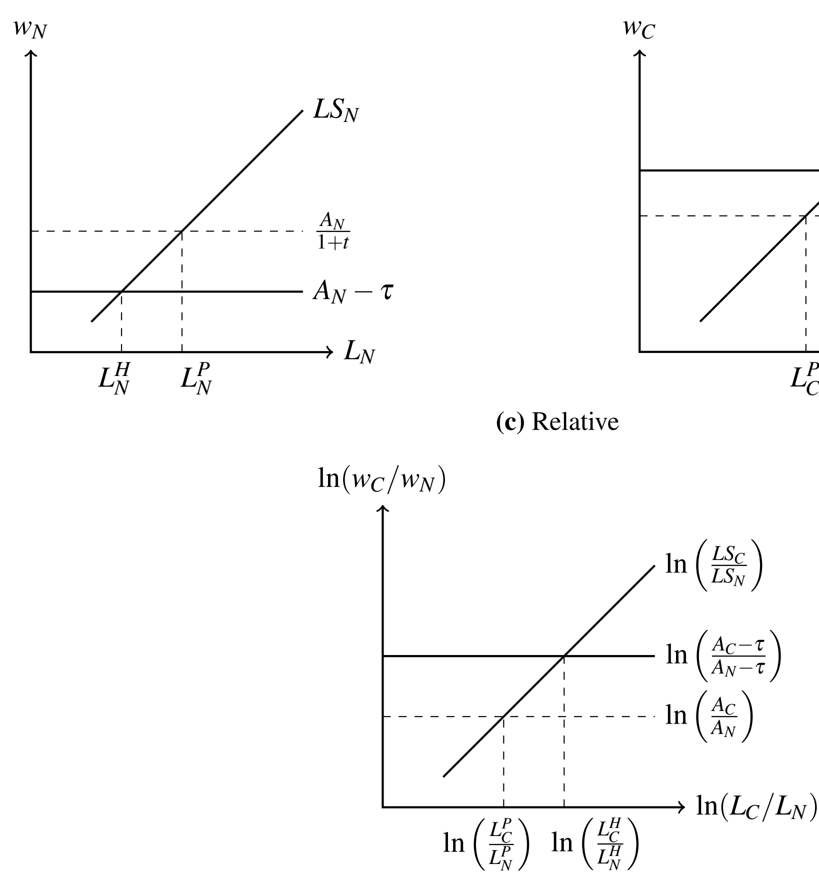
Thus, the switch from head tax financing to payroll tax financing unambiguously reduces labor market inequality. The size of the health insurance premium τ compared to the gap in productivity between groups is key for determining the quantitative impact of the change in financing on labor market inequality. Note, however, that the effect on total employment is ambiguous since employment is increasing for non-college workers and decreasing for college workers.

[14]We assume that for determining labor demand, each firm takes the payroll tax t as fixed and ignores the impact of its hiring of non-college and college workers on the equilibrium payroll tax. This seems reasonable given that any given firm's hiring has a negligible effect on the nationwide employment rates for these two types of workers.

Figure 7 illustrates this impact of moving from head tax to payroll tax financing graphically. We plot the supply and demand for non-college and college labor services in Panels (a) and (b), respectively. In Panel (c), we plot relative supply and demand of college labor services in log terms to show directly how the college premium changes.[15] Because relative labor supply is unaffected by the form of financing, the shift from head tax to payroll tax financing lowers the college wage premium and lowers the college wage share, thereby reducing labor market inequality.

Figure 7: Moving from a Head Tax to a Payroll Tax Equilibrium

(a) Non-college **(b)** College **(c)** Relative



NOTES: This figure shows the impact on equilibrium wages and employment from swtiching from a head tax (τ) to a payroll tax (t). Panel (a) shows the results for non-college educated workers (with productivity A_N), panel (b) shows the results for college-educated workers (with productivity A_C) and panel (c) shows relative outcomes for college workers relative to non-college workers. We use superscript H to denote outcomes under the head tax and superscript P to denote outcomes under the payroll tax. As shown in the panel (c), the change from head-tax to payroll-tax financing unambiguously lowers the college wage premium and college employment relative to non-college employment.

[15] To obtain the log-linear relative labor supply expression depicted in Panel (c), we log linearize our expressions for relative labor supply ($\frac{L_C}{L_N} = \frac{w_C+\alpha_C\tau-\underline{\kappa}}{w_N+\alpha_N\tau-\underline{\kappa}} \cdot \frac{N_C}{N_N}$).

4 Calibration and Implied Parameter Values

4.1 Calibration

For our calibration exercise, we generalize the linear technology used in our qualitative analysis to a CES production function:

$$Y = \left(\lambda_N L_N^\rho + \lambda_C L_C^\rho\right)^{1/\rho}$$

where λ_g is a group-specific productivity shifter, and the parameter $\rho < 1$ dictates the relative substitutability or complementarity of non-college and college workers. When $\rho = 1$, this gives us the linear production function discussed before and implies that the two types of workers are perfect substitutes. For our baseline analysis, we assume $\rho = 0.38$ based on Autor et al. (2020), and explore sensitivity to other assumptions below.

Given per-worker costs ω_g, the firm chooses group-specific labor inputs to maximize profits:

$$max_{L_N,L_C} \left(\lambda_N L_N^\rho + \lambda_C L_C^\rho\right)^{1/\rho} - \omega_N L_N - \omega_C L_C. \tag{8}$$

We assume the observed wages and employment rates for each group (Table 1) occur under a head-tax equilibrium. The level of the head tax is based on the average observed health insurance premium (Figure 6). Together with an assumed value of ρ, this setup allows us to solve for the remaining model parameters: the productivity shifters λ_C and λ_N and the value of $(\overline{\kappa} - \underline{\kappa})$, which governs the slope of the labor supply function. Specifically, we can solve the firm's maximization problem in equation (8) for the productivity shifters λ_C and λ_N, and we use the labor supply function in equation (2) to solve for $(\overline{\kappa} - \underline{\kappa})$. Intuitively, the productivity shifters λ_C and λ_N are revealed by the firm's first order conditions for labor demand, and the labor supply slope $(\overline{\kappa} - \underline{\kappa})$ is identified from our assumption that the observed equilibrium wage and employment allocations for each group are produced by a linear labor supply function with a common slope. Appendix A.2 provides the derivation.

Having identified the baseline parameters of the CES production function and the slope of the labor supply function, we can then solve for the equilibrium under the payroll tax, where the cost per worker is now $\omega_g^P = (1+t) \cdot w_g^P$. To do so, we use the solution to the firm's maximization problem in equation (8), together with the labor supply function in equation (2),[16] and the equilibrium condition for the payroll tax. The equilibrium condition for the payroll tax that generalizes equation (5) for the CES production function is given by:

$$t = \frac{\tau}{\tilde{w} - \tau},$$

where $\tilde{w}$ is the average wage, which equals $\frac{L_N}{L_N+L_C} \cdot w_N^P + \frac{L_C}{L_N+L_C} \cdot w_C^P$. Together, this equilibrium condition gives us five equations—first order conditions for each group's employment, labor supply functions for each group, and the equilibrium payroll tax—for the five unknowns. This system of equations allows us to solve

[16] Specifically, since we know the slope of the labor supply function, we use a modified version of this equation that uses the head tax equilibrium as an intercept and calculates the labor supply given the slope of labor supply and the change in wages. Full details provided in Appendix A.2.

for wages and employment of each group, as well as the payroll tax using a nonlinear equation solver.

A key calibration choice concerns the value of the head tax τ. Average premiums for employer-provided health insurance were \$11,764 in 2019 (Figure 6). However, as seen in Table 1, not all full-time, full-year workers are enrolled in employer-provided health insurance. In Appendix A.3, we show that in a model of incomplete take-up, the effective τ is simply the average premium scaled by the share of employees who are policyholders.[17] Since only 66 percent of full-time, full-year workers are policyholders, for our baseline analysis, we therefore scale down average premiums by 0.66. This gives us a baseline value of $\tau = \$7,758$ in 2019.[18]

4.2 Implied Parameter Values

Table 2: Baseline Implied Parameter Values

College productivity shifter	λ_C	59.584
Non-college productivity shifter	λ_N	38.794
Difference in reservation wages	$(\overline{\kappa} - \underline{\kappa})$	\$316,743

Notes: This table shows implied parameter values for our baseline analysis, which assumes, following Autor, Goldin and Katz (2020), a substitution parameter (ρ) of 0.38 and that the cost of employer-provided health insurance (τ) is \$7,758. Dollar amounts are in 2019 U.S. dollars.

Table 2 provides the baseline implied values for key model parameters under the baseline assumed value of $\tau = \$7,758$, and the assumed substitution parameter $\rho = 0.38$. The college productivity shifter λ_C is roughly 50 percent higher than that of non-college workers λ_N.[19] Our estimate of $(\overline{\kappa} - \underline{\kappa}) = \$316,743$ can be translated into an implied labor supply elasticity of $\frac{1}{(\overline{\kappa}-\underline{\kappa})} \cdot \frac{w_g}{P_g} = \frac{1}{316,743} \cdot \frac{w_g}{P_g}$ for group g. Given the observed equilibrium values of w_g and P_g in Table 1, the implied elasticities are 0.40 and 0.26 for college and non-college groups, respectively. These estimates are within the range of estimates in the literature. For example, Chetty (2012) reports that estimates of extensive margin elasticities range from 0.15 to 0.45. Chetty et al. (2013) provide a meta-analysis that points to an extensive margin labor supply elasticity of

[17] In practice, Table 1 showed that the lack of coverage reflects - in roughly equal measure - the fact that some firms do not offer health insurance and that some workers who are offered do not take up the insurance. Modeling incomplete offering of health insurance is more complicated, as we must then solve for equilibrium sorting of workers across firms that do and do not offer insurance. We discuss some of the implications of this possible extension in the last section.

[18] As seen in Figure 6, employees on average pay about one-quarter of these premiums. However, as is standard in tax analysis, we focus on the statutory total tax rate and abstract from whether it is levied on the producer or the consumer. In our case, this likely reflects an equilibrium response, as discussed above.

[19] To provide some intuition for these productivity shifters, recall that when $\rho = 1$, the firm problem simplifies to equation (1) and then $\lambda_g = A_g$. Given the value of college and non-college earnings in Table 1, together with the assumed value of $\tau = 7,883$, this implies that $A_C = \$104,062$ and $A_N = \$57,937$. Thus in the case of perfect substitutes, we get that $\frac{\lambda_C}{\lambda_N} = 1.80$. Our baseline calibration of $\rho = 0.38$ has a production technology with less substitutability. The effect of this substitutability on the value of λ_C and λ_N can be seen from investigating the first order conditions for labor. The ratio of first order conditions for non-college and college workers gives the following expression: $\lambda_N = \left(\frac{w_N+\tau}{w_C+\tau}\right) \cdot \left(\frac{L_N}{L_C}\right)^{1-\rho} \cdot \lambda_C$. Re-arranging and taking logs gives an expression $\ln\left(\frac{w_C+\tau}{w_N+\tau}\right) = \ln\frac{\lambda_C}{\lambda_N} - (1-\rho)\ln\frac{L_C}{L_N}$ for the log college wage premium, which is determined by a race between education and technology (Goldin and Katz, 2008). The $\ln\frac{\lambda_C}{\lambda_N}$ term is the intercept or technology term of the relative inverse demand for college workers.

around 0.25, though estimates based on macroeconomic data tend to be larger (e.g., Keane and Rogerson, 2012; Mui and Schoefer, 2021).

5 Labor Market Outcomes Under Counterfactual Payroll Tax Financing

5.1 Effects of Payroll Tax Financing on 2019 Labor Market Outcomes

Table 3: 2019 Labor Market Effects of Counterfactual Payroll Tax Financing

	(1) Baseline	**(2)** Full Coverage
Fixed Per Worker Cost, τ:	\$7,758	\$11,764
Payroll Tax Rate, t:	11.06%	16.80%
Wages:		
Change in College Wage, $\Delta(w_C)$	-\$2,181	-\$3,158
Change in Non-college Wage, $\Delta(w_N)$	\$1,660	\$2,383
Pct. Change in College Wage Premium	-11.26%	-16.00%
Employment:		
Change in College Employment Rate, $\Delta(P_C)$	-0.69 pp	-1.00 pp
Change in Non-college Employment Rate, $\Delta(P_N)$	0.52 pp	0.75 pp
Change in Total Employment, $\Delta(L)$	86,833	119,495
Change in College Employment, $\Delta(L_C)$	-408,588	-591,747
Change in Non-college Employment, $\Delta(L_N)$	495,420	711,242
Wage Bill:		
Change in College Share of Wage Bill, $\Delta(\frac{w_C L_C}{w_N L_N + w_C L_C})$:	-1.77 pp	-2.55 pp

Notes: This table presents the change in 2019 outcomes from moving to counterfactual payroll tax financing relative to the current head tax financing. Each column shows results under a different measure of the cost of employer-sponsored health insurance (τ). The first column shows results of our baseline estimate: total premium accounting for the fact that only 0.66 percent of workers are policyholders. The second column shows results for the total premium cost with the assumption that all workers eligible for employer-provided health insurance are policyholders. The college wage premium is defined $CWP = w_C/w_N - 1$ and often referred to as a percent, i.e. a value of 0.90 implies college workers make 90% more than non-college workers. In this table, the percent change in the college wage premium is calculated as the percentage change in this value when moving from the head tax to the payroll tax, which would be equal to $(CWP^P - CWP^H)/CWP^H$. All dollars are in 2019 U.S. dollars.

Table 3 shows how labor market outcomes would differ in 2019 if, counterfactually, employer-provided health insurance were financed by a proportional payroll tax rather than a fixed, per-worker head tax. We focus on impacts on the college wage premium, the college share of the wage bill, and the non-college employment rate. The first column shows our baseline analysis, which scales down the average \$11,764 health insurance premium to account for the fact that only two-thirds of workers are policyholders. As discussed by Gruber (2002), this incomplete coverage reflects a combination of employers not offering coverage and employees not taking up coverage when offered. Taking account of this incomplete coverage lowers the per worker cost from about \$12,000 to about \$8,000. Because the cost of hiring a worker depends on the total health insurance premium, regardless of its statutory incidence, our calculation of τ does not adjust for the fact that only about three-quarters of premiums are paid by the employer (Figure 6). This calculation follows the standard approach in public finance to disregard statutory incidence in calculating the economic incidence of taxes; in our setting, as discussed above, the split into employer and employee contributions is likely an equilibrium response.

For our baseline analysis (with $\tau = \$7,758$), we calculate that the counterfactual, equilibrium payroll tax t would be 11 percent. That is, switching to payroll tax financing would add an additional 11 percent to existing payroll and income tax rates. We estimate that if employer-provided health insurance were financed by this payroll tax, the wages of college graduates would fall by \$2,181, the wages of non-college graduates would rise by \$1,660, and the college wage premium would fall by 11.1 percent. Employment would increase by 86,833 jobs, with an increase of 495,420 jobs for non-college workers that is offset by 408,588 fewer college jobs. These wage and employment changes would result in a 1.8 percentage point lower college share of the wage bill.

For comparison, the second column shows results under the assumption that the head tax τ is equal to the average \$11,764 health insurance premium for employer-provided health insurance (which naturally changes the implied parameter values in Table 2). This value for τ corresponds in a sense to the raw policy “instrument”: it is the cost of providing all full-time, full-year workers with employer-provided health insurance financed through a head tax. The counterfactual analysis thus tells us the impact of instead providing all of these workers, rather than only the 66 percent who are policyholders, with the same health insurance financed through a payroll tax.[20] In this case, we estimate that the counterfactual equilibrium payroll tax rate would be 16.8 percent, rather than 11 percent in our baseline, and the college wage premium would fall by 16 percent, rather than 11.1 percent. Likewise our baseline estimate of the approximately 500,000 increase in non-college employment would increase to 710,000 under this alternative assumption.[21]

Table 4 holds the value of τ constant at our baseline of $\$7,758$ and shows the sensitivity of our results to other assumptions. As shown in the last column, these alternative assumptions have virtually no impact on the equilibrium payroll tax rate,which ranges from 11.05 percent to 11.07 percent. They cause only slight adjustments to the other equilibrium outcomes.

Table 4 first shows results under different labor supply elasticities. Recall that for our baseline we derived group-specific elasticities based on the observed equilibrium allocations for each group and the assumption of a common labor supply slope across groups (i.e., κs are not group-specific). Here, we provide results based on directly calibrating a common labor supply elasticity. Since Chetty (2012) reports estimates of extensive margin elasticities ranging from 0.15 to 0.45, we show results for 0.15, 0.3, and 0.45. When we assume a common labor supply elasticity across groups, we now allow the κ paramters to be group-specific. In other words, to implement counterfactuals that calibrate labor supply elasticities directly, we set the slope

[20] In practice, since only about 82 percent ($= 0.659/0.802$) of those covered with employer-provided health insurance are covered as policyholders (Table 1), we might want to scale down τ by 0.82. The results would then lie between those in columns 1 and 2.

[21] In Appendix B we show results when we expand our definition of college-educated workers to include those with some college education, even if they do not have a B.A.

of the labor supply functions for both groups to be consistent with the desired labor supply elasticities.[22] When labor supply elasticities are lower, the wage premium effects are bigger in absolute value, and changes in the college wage bill share and non-college employment are smaller in absolute value. Intuitively, more of the equilibrium adjustment to the financing change happens via prices rather than quantities when labor supply is less elastic. Depending on this assumption, the decrease in the college wage premium ranges from 10.5 to 12.2 percent.

Table 4: Sensitivity Analysis: 2019 Labor Market Effects of Counterfactual Payroll Tax Financing

	Percent Change in College Wage Premium	Change in Non-college Wages $\Delta(w_N)$	Change in College Employment Rate $\Delta(P_C)$	Change in Non-College Employment Rate $\Delta(P_C)$	Change in Non-College Employment (Thous.) $\Delta(L_N)$	Payroll Tax Rate t
Baseline:	-11.26%	$1,660	-0.69 pp	0.52 pp	495.42	11.06%
Labor Supply Elasticities:						
Derived Group-Specific Elasticities:						
$\varepsilon_C = 0.42$ and $\varepsilon_N = 0.28$ (Baseline)	-11.26%	$1,660	-0.69 pp	0.52 pp	495.42	11.06%
Assumed Common Elasticities:						
$\varepsilon_C = \varepsilon_N = 0.15$	-12.28%	$1,824	-0.28 pp	0.34 pp	317.53	11.05%
$\varepsilon_C = \varepsilon_N = 0.30$	-11.35%	$1,674	-0.52 pp	0.62 pp	582.94	11.06%
$\varepsilon_C = \varepsilon_N = 0.45$	-10.55%	$1,547	-0.73 pp	0.85 pp	807.90	11.07%
Substitutability (ρ)						
Perfect Substitutes ($\rho = 1$)	-13.39%	$1,985	-0.82 pp	0.63 pp	592.36	11.07%
Gross Substitutes ($\rho = 0.38$, Baseline)	-11.26%	$1,660	-0.69 pp	0.52 pp	495.42	11.06%
Cobb-Douglas ($\rho = 0.01$)	-10.28%	$1,511	-0.63 pp	0.48 pp	450.92	11.06%

Notes: This table shows the sensitivity of our baseline analysis (Table 3, column 1; τ= $7,758) of the impact of moving to counterfactual payroll tax financing on 2019 outcomes. The college wage premium is defined $CWP = w_C/w_N - 1$. In this table, the percent change in the college wage premium is calculated as the percentage change in this value when moving from the head tax to the payroll tax, which would be equal to $(CWP^P - CWP^H)/CWP^H$.

Table 4 next shows results using higher and lower assumptions about substitutability across worker types relative to our baseline level of substitutability $\rho = 0.38$ from Autor et al. (2020). Alternative assumptions about substitutability change the slope of the relative labor demand curve for college workers compared to non-college workers. Intuitively, as that substitutability increases, the impact of a given health financing tax on employment also increases. However, in practice, because our assumed value of ρ affects the calibration of the productivity shifters, our exercise is not one of pure comparative statics. Nonetheless, we find that this qualitative intuition holds. Thus, if college and non-college workers were perfect substitutes as in Section 3 with an assumed linear production function (i.e., $\rho = 1$), the changes in outcomes would be larger in absolute value: the college premium would decline by 13 percent, and the non-college employment rate would increase by 592,000 instead of 495,000. If the production technology combining college and

[22] Specifically, given the assumed elasticity ε_g, we use the expression for the elasticity $\varepsilon_g = \frac{1}{(\overline{\kappa_g} - \underline{\kappa_g})} \cdot \frac{w_g}{P_g}$ to identify the group-specific slope of the labor supply function $(\overline{\kappa_g} - \underline{\kappa_g}) = \frac{1}{\varepsilon_g} \cdot \frac{w_g}{P_g}$. Other than this detail, calibration is the same as in the baseline analysis.

non-college workers were nearly Cobb-Douglas (i.e., $\rho = 0.01$), changes in outcomes would be smaller in absolute value, with a 10 percent increase in the college wage premium and an increase in non-college employment of 451,000.

5.2 Effects of Payroll Tax Financing on Changes in Labor Market Outcomes, 1977-2019

Table 5 considers the counterfactual changes in labor market inequality that would have occurred from 1977 to 2019 if payroll tax financing had been in place throughout. We use the observed values of τ (Figure 6) in 1977 and 2019 in the baseline calculations, and assume throughout that 67 percent of full-time, full-year workers are policyholders of employer-provided health insurance.[23]

Table 5: Changes over Time: Labor Market Effects of Counterfactual Payroll Tax Financing, 1977-2019

	Head Tax Equilibrium	Payroll Tax Equilibrium: Baseline	Payroll Tax Equilibrium: Full Coverage
Employer-Sponsored Health Insurance:			
Change in Cost $(\tau_{2019} - \tau_{1977})$	-	\$5,937	\$9,003
Payroll Tax $(t_{2019} - t_{1977})$	-	7.16 pp	10.88 pp
Wages:			
Change in College Wages $w_{C,2019} - w_{C,1977}$	\$33,903	\$32,121	\$31,339
Change in Non-college Wages $w_{N,2019} - w_{N,1977}$	\$7,754	\$9,305	\$9,976
PP Change in College Wage Premium	44.83 pp	35.80 pp	32.08 pp
Employment Rate:			
Change in College Employment Rate $P_{C,2019} - P_{C,1977}$	5.77 pp	5.44 pp	5.31 pp
Change in Non-college Employment Rate $P_{N,2019} - P_{N,1977}$	9.13 pp	9.55 pp	9.73 pp
Wage Bill:			
College Share of the Wage Bill $\left(\frac{w_C L_C}{w_N L_N + w_C L_C}\right)_{2019} - \left(\frac{w_C L_C}{w_N L_N + w_C L_C}\right)_{1977}$	31.06 pp	29.62 pp	29.00 pp

Notes: This table presents the change of each outcome between 1977 and 2019 for the head tax equilibrium and for the payroll tax counterfactual. Columns 2-3 show results for different measures of the cost of employer-sponsored health insurance (τ). The college wage premium is defined $CWP = w_C/w_N - 1$ and often referred to as a percent, i.e. a value of 0.90 implies college workers make 90% more than non-college workers. In this table, the percentage point change in the college wage premium is calculated as the percentage change in this value from 1977 to 2019, which would be equal to $CWP_{2019} - CWP_{1977}$.

The first column shows changes over time that have occurred under the head tax regime. Column 2 shows counterfactual changes under our baseline assumption of τ, which scales average premiums by 0.66 to reflect the share of workers that are policyholders. Column 3 shows results without that scaling. We focus our discussion on the baseline results.

[23] In practice, this number ranges from 0.73 to 0.66 from 1996 to 2019, but since it is not available for every year, we use the statistic for 2019 throughout.

Under the head tax regime, real college wages (in 2019 dollars) increased by $33,903, while real non-college wages grew by $7,754. As a result, the college premium increased by 44.8 percentage points over this period. Employment rates also increased for both groups; the employment rate increased by 5.8 percentage points for college workers and by 9.1 percentage points for non-college workers.

If we had instead used payroll-tax financing, these labor market outcomes would have evolved quite differently. The revenue-equivalent payroll tax rate—the payroll tax rate required to finance the same amount of health coverage as through the head tax—increased steadily from around 4 percent in 1977 to 11 percent in 2019. Under this alternative financing, the increase in the college wage premium would have been about 20 percent smaller: a 35.8 percentage point increase instead of the observed 44.8 percentage point increase. The employment rate of non-college workers would have increased by about 4.5 percent more; specifically, the non-college employment rate would have increased by 9.6 percentage points under the payroll tax, instead of the observed 9.1 percentage points.

Table 6 shows the sensitivity of the results to alternative assumptions about the substitutability of workers and labor supply elasticities. Our baseline estimate (Table 5, column 2) that the college wage premium would have risen about 20 percent less varies modestly from 18 to 23 percent less. Appendix B shows results when workers with some college education are included in the definition of college-educated workers.

Table 6: Sensitivity Analysis: Changes over Time: Labor Market Effects of Counterfactual Payroll Tax Financing, 1977-2019

	Change in College Wage Premium	Change in Non-College Wages $w_{N,2019} - w_{N,1977}$	Change in College Employment Rate $P_{C,2019} - P_{C,1977}$	Change in Non-College Employment Rate $P_{N,2019} - P_{N,1977}$	Change in Payroll Tax Rate $t_{2019} - t_{1977}$
Head Tax Equilibrium	44.83 pp	$7,754	5.77 pp	9.13 pp	-
Payroll Tax Equilibrium					
Labor Supply Elasticities:					
Derived Group-Specific Elasticities:					
$\varepsilon_C = 0.42$ and $\varepsilon_N = 0.28$ (Baseline)	35.80 pp	$9,305	5.44 pp	9.55 pp	7.16 pp
Assumed Common Elasticities:					
$\varepsilon_C = \varepsilon_N = 0.15$	35.32 pp	$9,430	5.58 pp	9.43 pp	7.15 pp
$\varepsilon_C = \varepsilon_N = 0.30$	36.04 pp	$9,292	5.42 pp	9.69 pp	7.16 pp
$\varepsilon_C = \varepsilon_N = 0.45$	36.66 pp	$9,175	5.28 pp	9.91 pp	7.17 pp
Substitutability (ρ)					
Perfect Substitutes ($\rho = 1$)	34.46 pp	$9,578	5.47 pp	9.61 pp	7.17 pp
Gross Substitutes ($\rho = 0.38$, Baseline)	35.80 pp	$9,305	5.44 pp	9.55 pp	7.16 pp
Cobb-Douglas ($\rho = 0.01$)	36.49 pp	$9,174	5.44 pp	9.52 pp	7.16 pp

Notes: This table shows the sensitivity of our baseline analysis (Table 5, column 2) of the impact of moving to counterfactual payroll tax financing on the change in outcomes between 1977 and 2019. The college wage premium is defined $CWP = w_C/w_N - 1$ and often referred to as a percent; therefore, in this table, the percentage point change in the college wage premium is calculated as the percentage change in this value from 1977 to 2019, which would be equal to $CWP_{2019} - CWP_{1977}$.

Disaggregating Effects by Sex. The employment rate for non-college males declined by 4.3 percentage points from 1977 to 2019. To consider how this group would have fared under a payroll tax, we extend the baseline model to account for different trends in employment and wages by sex. To do so, we assume that male and female workers of the same group are perfect substitutes. Total labor input from group $g \in \{N, C\}$ is therefore equal to $L_g = X_{g,M} L_{g,M} + X_{g,F} L_{g,F}$, where we normalize the male-specific productivity shifter $X_{g,M}$ to one. We also assume that the parameters determining labor supply $\overline{\kappa_s}$ and $\underline{\kappa_s}$ are sex-specific. By disaggregating wage and employment rate data by sex, the rest of the calibration follows the same logic as our main analysis.

Appendix Table A.4 shows the effects of moving from a head tax to a payroll tax in 2019 in aggregate and for each sex. In aggregate, the results largely match those from our main analysis, yet differences emerge when disaggregated by sex. The payroll tax has a redistributive effect such that the wage loss is biggest for the subgroup with the highest wages, college males, and the wage gain is biggest for the subgroup with the lowest wages,non-college females. Meanwhile, the effects for college females and non-college males are relatively smaller. Changes in employment rates and employment follow a similar pattern.

Appendix Tables A.5 and A.6 show the changes over time under a head tax versus a payroll tax for males and females, respectively. As before, the payroll tax is redistributive such that the wage loss is biggest for college males and the wage gain is biggest for non-college females, while college females and non-college males experience more modest effects. Since the effect is more modest for non-college males, their wage increase would only be $1,300 greater and their employment rate decline would only be 0.4 percentage points smaller from 1977 to 2019 under the payroll tax than the head tax. Therefore, the results suggest the health wedge is unlikely to account for much of the excess decline in employment rates for non-college males.

5.3 Benchmarking the Estimates

To benchmark these calibration results, we compare the impacts of counterfactual payroll tax financing to existing estimates from the literature of the impact of other factors on U.S. labor market inequality. Although there is a vast literature to draw on, direct comparisons are often hampered by differences across papers in the outcomes analyzed, the measures of inequality used, and the time periods studied. Still, we are able to provide some benchmarks for our estimated impacts on the college wage premium, non-college employment, and non-college wages. Where we are able to make reasonable comparisons, they suggest that the magnitude of the health wedge effect rivals other leading causes of labor market inequality, including outsourcing, union density, trade, the relative supply of college graduates, and automation.

College Wage Premium. Our baseline estimate is that switching from head-tax to payroll-tax financing of employer-provided health insurance would decrease the 2019 college wage premium by 11 percent. Our sensitivity analyses suggest a range for this estimate of 10 to 13 percent. This decline in the college wage premium is comparable to the effect of outsourcing that Goldschmidt and Schmieder (2017) estimate. Specifically, they find that domestic outsourcing in Germany causes wages at the outsourcing establishment to fall about 10 percent for non-outsourced non-college educated workers, while there is no effect on wages of non-outsourced college-educated workers; this suggests that outsourcing raises the college premium at the parent establishment by about 10 percent.

Another way to benchmark our estimate is to consider the equivalent shock to the relative supply of college workers needed to cause the college premium to decline by the same magnitude as the impact of switching to payroll tax financing. Autor et al. (2020), who update Katz and Murphy (1992), estimate that a 10 percent increase in the relative supply of college equivalents reduces the college premium by about 6 percent.[24] From 1979 to 2017, the log relative supply of college equivalents fell 0.213 per decade or 2.13 log points per year. A decade of decline in the relative supply of college equivalents would therefore increase the log college wage premium by 0.131 ($= \frac{0.213}{1.62}$). Thus, our estimate that the college wage premium would be around 11 percent lower under payroll tax financing is roughly the same magnitude (albeit opposite in sign) as the estimated impact of a decade of decline in the relative supply of college workers.

We can also compare our estimate of the decline in the college wage premium from payroll-tax financing to estimates of the impact of the minimum wage on the college wage premium. In particular, Vogel (2022) generalizes the canonical model in which the college wage premium is determined by the relative supply and demand of labor to incorporate labor market institutions—such as monopsony power, minimum wages, and unemployment—and uses this framework to estimate the elasticity of the college wage premium with respect to the real minimum wage. These results suggest that the real minimum wage would need to increase by around 30 percent to achieve an equivalent of the 11 percent decrease in the college wage premium that we estimate would occur from switching from head-tax to payroll-tax financing.[25]

Much of the literature has focused on the role of various factors in contributing to changes in labor market inequality over time. We estimate that under counterfactual payroll tax financing, the college wage premium would have increased by 20 percent less from 1977 through 2019. In our sensitivity analyses, alternative calibrations suggest a range of 18 to 23 percent for how much less the college wage premium would have increased. This estimate is roughly comparable to the estimated impact of rising trade, and declining unionization (albeit over slightly different time periods). Binder and Bound (2019) provide a useful summary of the literature on the contribution of rising trade and declining unionization to the change in the college premium between 1980 and 2006. They cite Katz's comment on Krugman (2008); Katz (2008) suggesting that "rising trade accounted for less than 20 percent of the increase in the college wage premium" over this period (Katz, 2008). This assessment preceded the findings of Autor et al. (2013), which have shed further light on the effect of trade on inequality. Binder and Bound (2019) also note that DiNardo et al. (1996) find the decline in unionization led to around 20 percent of the rise in the college wage premium over the 1980s. Using a related measure of inequality, Farber et al. (2021) find declines in union density explain about 12 to 21 percent of the increase in the Gini coefficent from 1968 to 2014.[26]

[24] Note that college equivalents are college plus half those with some college, and non-college workers are those with 12 years or fewer of schooling and half of those with some college.

[25] Vogel (2022) measures the college wage premium as the ratio of wages instead of the percent difference, but this benchmark calculation accounts for this difference. Additionally, note that the results in Vogel (2022) are based on the average minimum wage across states instead of the federal minimum wage.

[26] Farber et al. (2021) find that a ten percentage point decline in union density—which is roughly the observed decline since 1980—reduced the college premium by about 12-15 percent when using time series variation, but found somewhat smaller effects when using micro-level and state-year panel designs. Their state-year panel estimates, for example, were about half the magnitude of the time series estimates and the micro estimates were in between those of the two designs.

Non-College Wages. Our baseline estimate is that switching from head-tax to payroll-tax financing would increase the annual earnings of non-college full-time, full-year workers by about $1,700 (about 3 percent). Two useful benchmarks are the estimate of an average 10 percent union wage premium over the last two decades (Farber et al., 2021), and the estimate that domestic outsourcing of workers in Germany causes wages to fall about 10 percent for non-college-educated non-outsourced workers (Goldschmidt and Schmieder, 2017).

Other useful comparisons are to the impact of increased exposure to imports or to robots. Chetverikov et al. (2016) estimate that for every $1,000 increase in import exposure per worker (roughly the inter-quartile range in CZ-level import exposure growth from 2000 through 2007 in Autor et al. (2013)), weekly wages decrease by about 0.7 percent on average, with workers in the bottom quartile of the wage distribution experiencing declines about twice as large in percentage terms and those at the top experiencing smaller declines. Acemoglu and Restrepo (2020) estimate that one more robot per thousand workers (the observed increase from 1993 to 2007) decreased wages by 0.4 percent, with effects against concentrated on those towards the lower end of the wage distribution. Our estimate of the impact on non-college wages of switching to payroll-tax financing are thus larger than the estimated impact of a $1,000 increase in import exposure per worker or of the increase in robots per thousand workers from 1992 to 2007.

Non-College Employment. Our baseline estimate is that switching from head-tax to payroll-tax financing of employer-provided health insurance would increase the 2019 employment rate for non-college workers by 0.52 percentage points. In our sensitivity analyses, alternative calibrations suggest a range for the increase in the non-college employment rate from 0.3 to 0.8. This effect is roughly comparable in magnitude to what others have estimated would be the decline in non-college employment from a $500 increase in import exposure per worker, or a doubling of the growth in the number of robots per one thousand workers between 1993 and 2007.

To gauge the impact of the spread of robots, we look to Acemoglu and Restrepo (2020). They estimate that an additional robot per thousand workers between 1993 and 2007 reduced the employment-to-population ratio in a local area by 0.4 percentage points, with negative employment effects for all but the most highly educated workers.[27] They also document that the number of robots in the United States increased by about one per thousand workers from 1993 to 2007. Thus, our baseline estimate of the impact of switching to payroll tax financing on increasing the employment rate of non-college workers is similar in magnitude to the estimated effect of the increase in robots from 1993 to 2007 on decreasing that employment rate.

To gauge the impact of import exposure, we draw on Autor et al. (2013). They estimate that a $1,000 greater import exposure shock (roughly the inter-quartile range in CZ-level import exposure growth from 2000 through 2007) decreased the the non-college employment rate by 1.11 percentage points. Thus our baseline estimate of the impact of switching to payroll-tax financing on increasing the employment rate of non-college workers is around half the size of the decrease in this employment rate caused by a $1,000

[27] Using a model of how local economies interact, Acemoglu and Restrepo (2020) then use their regional estimate to calculate that the overall effect on employment-to-population is about 0.2 percentage points or about 400,000 jobs, which are the estimates that they discuss in their conclusion.

import exposure shock.

6 Labor Market Effects of Rising Health Care Spending

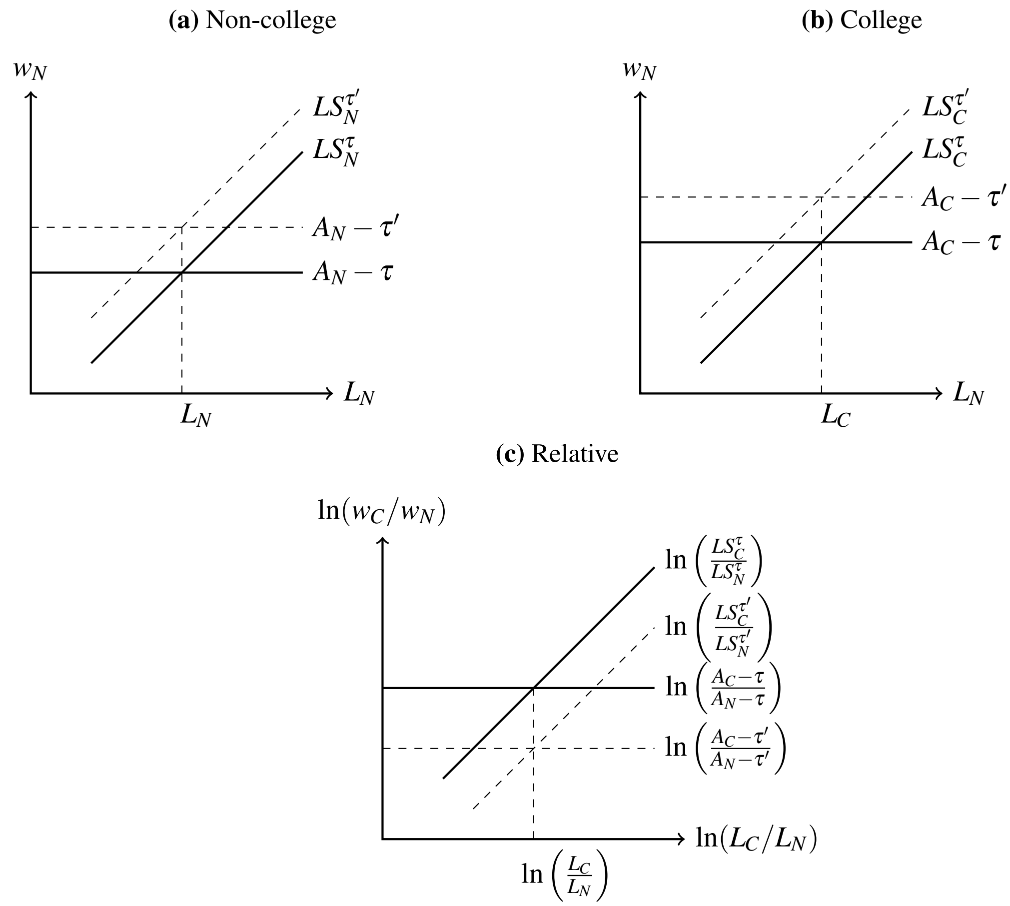
We can also use our framework to consider how the rapidly increasing cost of health insurance in the U.S. affected labor market outcomes under the current head tax regime. Health expenditures increased in the U.S. from 6.25 to 16.77 percent of GDP between 1977 and 2019. During this time, the U.S. "advanced" from being on the higher end of health care spending across countries to being an extreme outlier (Panel (a) of Figure 5).

We consider two alternative counterfactual paths for the growth in health care spending: a "No Growth" counterfactual in which the cost of employer-provided health insurance remains fixed at the 1977 level in real terms and a "Canada" counterfactual in which health care spending in the U.S. is the same share of GDP in 2019 as it is in Canada (i.e., 10.84 percent of GDP instead of 16.77 percent). In 1977, average employer-provided premiums were \$2,760 in 2019 dollars. Under our baseline assumption that only 67 percent of full-time full-year workers are policyholders, the implied head tax $\tau_{1977} = \$1,820 = 0.66 \cdot \$2,760$. Thus, compared to our baseline 2019 head tax $\tau_{2019} = \$7,758$, under the no-growth counterfactual the head tax would be $\$5,937$ lower than under the observed baseline. Under the Canada counterfactual, we scale our baseline 2019 head tax by the ratio of the Canadian share to the U.S. share of the economy in terms of health care spending. As a result, the counterfactual 2019 head tax is 64 percent ($= 10.84/16.77$) of our baseline value, or \$5,017. Thus, under the Canada counterfactual, the head tax would be $\$2,740$ lower than under the observed baseline.

Interpreted through the lens of our model, a decline in τ shifts out labor demand curve (since the total cost for hiring an employee is smaller) and also shifts in labor supply (since less health coverage is provided at a given wage). As can be seen from equation 3 and Section 3, this would reduce the college wage premium.[28]

[28] This counterfactual lowering of τ can also be loosely viewed as a way of analyzing the impact of the Cadillac tax that was enacted but never implemented, as discussed in the Introduction. In particular, one way of interpreting a goal of the Cadillac tax is that it was designed to reduce the generosity of health insurance provision. However, the effects on disposable income and labor supply of different groups, whose marginal tax rates vary, would need to be incorporated into our model to characterize the effects of a Cadillac tax more realistically. In addition, there are several other important aspects of this policy that are beyond the scope of our paper, such as the prevalence of Cadillac health plans across different groups.

Figure 8: Reducing the Cost of ESHI



NOTES: This figure shows the impact on equilibrium wages and employment from reducing τ to τ' under the assumption of $\alpha_g = 1$. Panel (a) shows the results for non-college educated workers (with productivity A_N), panel (b) shows the results for college-educated workers (with productivity A_C) and panel (c) shows relative outcomes for college workers relative to non-college workers. As shown in the panel (c), the reduction in τ unambiguously lowers the college wage premium.

To determine what labor outcomes would have been under counterfactual levels of U.S. health care spending and health insurance premiums, we must make additional assumptions regarding the workers' amenity value α_g of employer-provided health insurance relative to cash. These assumptions were not required for our analysis of counterfactual financing of employer provided health insurance, but are important for determining the magnitude of supply shifts for both groups in this counterfactual.[29] If the amenity value of rising health care spending were 0, rising health care spending would function in the same way as a standard tax increase, with impacts on wages and employment that depend on relative supply and demand elasticities. If the amenity value were 1 for both groups, labor supply would shift out by the same amount as the cost increase and effects would be entirely on wages, with no impact on employment (Summers (1989);

[29]Specifically, as discussed in Appendix A.2, the amenity value α_g is relevant only for pinning down the intercept of the labor supply function. In our payroll tax analysis, we assume this amenity value is the same across groups ($\alpha_C = \alpha_N$); in our sensitivity analysis where we make a direct assumption about the shape of the labor supply function, we also do not have to make any additional assumptions about α_g.

Gruber (1994)). Figure 8 illustrates the impact of a reduction in the cost of ESHI from τ to τ' when assuming the amenity-value of ESHI is equal to one for both groups (i.e., assuming $\alpha_N = \alpha_C = 1$).[30]

Conceptually, as discussed in Section 3, α may range from 0 to a value above 1. In practice, there is considerable disagreement about the amenity value of health care spending, and further ambiguity about the amenity value of the portion of health care spending that rose over the last four decades. Some researchers emphasize the valuable and health-increasing technological improvements in medicine behind the rise in health spending (e.g., Cutler, 2022), and others emphasize the large amounts of waste in U.S. health spending (e.g., Garber and Skinner, 2008). Naturally, these views are not mutually exclusive. Absent much guidance from the empirical literature, we present results for four different amenity values: 0, 0.75, 1, or 1.25. In each case, we assume that the amenity value is the same for both groups of workers so that the marginal rate of substitution between health insurance and wages is equal across groups at the margin.

Table 7: 2019 Labor Market Effects of Health Care Spending Counterfactuals

	No Growth Counterfactual				Canada Counterfactual			
	$\alpha = 0$	$\alpha = 0.75$	$\alpha = 1$	$\alpha = 1.25$	$\alpha = 0$	$\alpha = 0.75$	$\alpha = 1$	$\alpha = 1.25$
Change in Cost, τ:	-$5,937	-$5,937	-$5,937	-$5,937	-$2,740	-$2,740	-$2,740	-$2,740
Wages:								
Change in College Wage, $\Delta(w_C)$	$6,062	$5,969	$5,937	$5,905	$2,799	$2,755	$2,740	$2,726
Change in Non-college Wage, $\Delta(w_N)$	$5,840	$5,912	$5,937	$5,962	$2,695	$2,729	$2,740	$2,752
Pct. Change in College Wage Premium	-9.99%	-10.43%	-10.58%	-10.73%	-4.88%	-5.10%	-5.18%	-5.25%
Employment Rate:								
Change in College Employment Rate, $\Delta(P_C)$	1.91 pp	0.48 pp	0.00 pp	-0.48 pp	0.88 pp	0.22 pp	0.00 pp	-0.22 pp
Change in Non-college Employment Rate, $\Delta(P_N)$	1.84 pp	0.46 pp	-0.00 pp	-0.46 pp	0.85 pp	0.21 pp	-0.00 pp	-0.21 pp
Wage Bill:								
Change in College Share of Wage Bill, $\Delta(\frac{w_C L_C}{w_N L_N + w_C L_C})$	-1.30 pp	-1.27 pp	-1.26 pp	-1.25 pp	-0.62 pp	-0.61 pp	-0.61 pp	-0.60 pp

Notes: The college wage premium is defined $CWP = w_C/w_N - 1$. In this table, the percent change in the college wage premium is calculated as the percentage change in this value when moving from the head tax to the payroll tax, which would be equal to $(CWP^P - CWP^H)/CWP^H$.

Table 7 presents the results. We estimate that college and non-college wages would both be about $6,000 higher under the no-growth counterfactual and about $2,750 higher under the Canada counterfactual. These effects are largely insensitive to our assumption about the amenity value. Both groups experience a similar absolute increase in wages when health care spending grows less rapidly.[31] However, this increase is larger

[30] Panels (a) and (b) plot the demand for and supply of labor for non-college and college workers respectively while Panel (c) shows the relative supply and demand of labor services in log terms. For both groups of workers, the reduction in the cost of ESHI leads to an increase in labor demand at any given wage and so wages unambiguously increase for both groups. Since wages increase by a similar amount for both groups, wage inequality decreases as shown in Panel (c). However, the effect on labor supply depends on the amenity-value of ESHI. Since we assumed $\alpha = 1$ for both groups, the shift in labor demand is matched exactly by a shift in labor supply so that the quantity of labor supplied is unaffected. For $\alpha < 1$, then the shift in labor supply is less than the shift in labor demand and labor supply increases for both groups; conversely for $\alpha > 1$, then the shift in labor supply is greater than the shift in labor demand and labor supply decreases for both groups.

[31] In all cases, we can see that the cost reduction leads to a nearly equal increase in wages for both groups of workers. With linear production (as in our stylized model in Section 3 and α= 1) it is straightforward to see that the increase in wages would be the same for both groups (and equal to the decrease in health care costs τ). This is also the case with CES production (see columns 3 and 7), but with CES production and other values of α equilibrium changes in employment which affect marginal productivity of labor have a second-order effect on equilibrium wages that can differ across groups.

proportionally for non-college workers (12 and 5.4 percent, respectively) than for college workers (6 and 3 percent, respectively). As a result, the college wage premium is about 10.5 percent lower in the no-growth counterfactual and about 5 percent lower in the Canada counterfactual.

By contrast, the impacts of alternative levels of health care costs on employment vary greatly depending on the assumed amenity value. If workers are indifferent between wages and spending on employer-provided health insurance, as represented by a value of α equal to 1, then lower spending increases have no employment effects (Summers, 1989; Gruber, 1994). For α less than 1, workers value an increase in wages more than an increase in spending on employer-provided health insurance. As a result, an increase in health care spending is partially a tax on workers, and the incidence of this tax is split between wages and employment. Thus, under counterfactuals of lower spending increases, employment increases. Conversely, for α greater than 1, workers value increased spending on employer-provided health insurance more than the increase in wages and so employment increases as health care spending rises. Thus, under counterfactuals of lower spending increases, employment falls.

7 Discussion

This paper calibrates the effect of the U.S. healthcare head tax on labor market inequality. We find that if employer-provided health insurance were instead financed by a proportional payroll tax, the college premium would be 11 percent lower, and non-college employment would be nearly 500,000 higher. Over the last four decades, the rise in the college premium would have been about 20 percent lower and the rise in the employment rate of non-college adults would have been 4.6 percent higher. These effects are comparable in magnitude to previous estimates of the impact of other leading sources of labor market inequality, including outsourcing, robot adoption, rising trade, and declining unionization. Some of these forces might be driven in part by firms' responses to rising health costs for domestic workers, so they are not mutually exclusive from our mechanism.

Our analyses rely on several important simplifying assumptions. We briefly discuss them here, in the hopes that they may offer fruitful directions for future research.

Perhaps most importantly, our analysis occurs in partial equilibrium. In particular, we have not considered potential effects on employer behavior. In practice, health insurance financing reforms may change whether employers offer health insurance or the generosity of plan offerings. For example, one noticeable trend has been the move in employer-provided health insurance toward high-deductible health insurance plans, which reduce the amount of insurance coverage provided (Claxton et al., 2020). There may also be important labor market margins of response, such as the share of workers in part-time versus full-time employment, the propensity of employers to use contract workers, domestic outsourcing, and offshoring. These potential responses are ignored in our counterfactual analysis of the impact of rising U.S. health care spending under current head tax financing, and they are explicitly assumed away in our analysis of a counterfactual, nationwide payroll tax to finance the health insurance of workers. Naturally, a policy that applies based on workers' current form of health insurance is not practically feasible. As noted in the Introduction, in practice a nationwide payroll tax would need to also finance health insurance for currently uninsured individuals.

Within this partial equilibrium framework, there are other, potentially important simplifying assumptions. First, like much of the existing literature on labor market inequality, we focus on outcomes such as the college wage premium and non-college employment and wages. In practice other measures of inequality such as welfare inequality and compensation inequality also warrant greater attention from economists and policy makers. Pierce (2001), Pierce (2010), Gittleman and Pierce (2015), and Piketty et al. (2018) provide valuable estimates of the growing role of health benefits in a broader measure of compensation inequality.

Second, our model of the labor market involves a number of simplifying assumptions. We consider a textbook, competitive model of the labor market. Imperfect competition and other labor market frictions are attracting increasing attention among labor economists (Card, 2022), and their quantitative impact on our calibrations is an important and open question. We also abstract from the fact that some full-time, full-year workers are not offered employer-provided health insurance; we instead model the incomplete coverage as happening only through the take-up margin. In practice, firms choose whether or not to offer health insurance in equilibrium (Dey and Flinn, 2005), and non-college workers are disproportionately located in firms that do not offer health insurance (Table 1). This sorting—which is itself an equilibrium outcome (Aizawa, 2019)—may be partly a reaction to the head-tax financing of insurance and likely cushions its impact on labor market inequality. How quantitatively important such worker sorting across firms is for our analysis, however, remains unclear, especially because high-wage workers tend to disproportionately sort into high-wage firms (Song et al., 2018).

Expanding our model to allow workers to choose between firms that do and do not offer health insurance would also allow analysis of additional impacts of the financing of employer-provided health insurance on the distribution of employment and earnings. In particular, our analysis follows Case and Deaton (2020b) in focusing on college workers compared to non-college workers. Others have focused on the decline in the share of workers in the middle of the wage distribution (Autor, 2018; Autor and Dorn, 2013). It is conceivable that this "hollowing out" phenomenon may also be affected by the head-tax financing of employer-provided health insurance. The lowest wage group may be predominantly covered by Medicaid and in jobs that do not offer health insurance. Accordingly, the middle group would be the one squeezed out by head-tax financing, which makes them less attractive relative to both higher-wage workers for whom the head tax is a smaller share of labor costs, and lower-wage workers who do not require the head tax to be paid by their employers. Relatedly, it is also conceivable that financing health insurance through the firm contributes to the rise of alternative work arrangements that don't provide insurance and to the fissuring of the workforce (Weil, 2014; Katz and Krueger, 2017; Card et al., 2013; Song et al., 2018).

One important way to make progress on these issues would be through empirical work that identifies exogenous variation in the costs of employer-provided health insurance that can be used to study its impact on labor market outcomes. Importantly, the ideal variation would occur at the labor market rather than firm level, so that it might be possible to estimate impacts on the labor market equilibrium.

Despite all these important directions for further work, our calibrated analysis suggests that the uniquely American approach to financing health insurance could have a quantitatively important impact on labor market inequality. Our analysis suggests that if the cost of health care in the United States continues its rapid rise over the coming years, labor market inequality will also continue to grow in the absence of substantial reforms to how we finance health insurance in America.

References

Abowd, J., F. Kramarz, and D. Margolis (1999). High wage workers and high wage firms. *Econometrica 67*(2), 251–333.

Acemoglu, D. and D. Autor (2001). Skills, tasks and technologies: Implications for employment and earnings. *Handbook of Labor Economics*.

Acemoglu, D. and P. Restrepo (2020). Robots and jobs: Evidence from U.S. labor markets. *Journal of Political Economy 128*(6).

Aizawa, N. (2019). Labor market sorting and health insurance reform. *Quantitative Economics 10*(4), 1401–1451.

Aizawa, N. and H. Fang (2020). Equilibrium labor market search and health insurance reform. *Journal of Political Economy 128*(11), 4258–4336.

Autor, D. (2018, February). Trade and labor markets: Lessons from China's rise. *IZA World of Labor 431*.

Autor, D. and D. Dorn (2013). The growth of low-skill service jobs and the polarization of the US labor market. *American Economic Review 103*(5), 1553–97.

Autor, D., D. Dorn, and G. Hanson (2013). The China Syndrome: Local Labor Market Effects of Import Competition in the United States. *American Economic Review 103*(6), 2121–68.

Autor, D., C. Goldin, and L. Katz (2020). Extending the race between education and technology. *AEA Papers and Proceedings 110*, 347–51.

Bagley, N., A. Chandra, and A. Frakt (2015, October). Correcting Signals for Innovation in Health Care. Technical report, The Hamilton Project.

Baily, M. (1978). Some aspects of optimal unemployment insurance. *Journal of Public Economics 130*(3), 379–402.

Beemon, D. (2021, October). Job search, wage dispersion, and universal healthcare. Working Paper.

Binder, A. and J. Bound (2019). The declining labor market prospects of less-educated men. *Journal of Economic Perspectives 33*(2), 163–90.

Blewett, L., J. R. Drew, R. Griffin, and K. Williams. (2019). IPUMS Health Surverys: Medical Expenditure Panel Survey, Version 1.1 [dataset]. Technical report, IPUMS.

Blumenthal, D. (2006). Employer-sponsored health insurance in the United States—origins and implications. *New England Medical Journal*.

Blundell, R. and B. Etheridge (2010). Consumption, income and earnings in Britain. *Review of Economic Dynamics 13*(1), 76–102.

Bound, J. and G. Johnson (1992). Changes in the structure of wages in the 1980's: An evaluation of alternative explanations. *The American Economic Review 82*(3), 371–392.

Brzozowski, M., M. Gervais, P. Klein, and M. Suzuki (2010). Consumption, income, and wealth inequality in Canada [datatset]. *Review of Economic Dynamics 13*(1), 52–75.

Card, D. (2022). Who set your wage? *American Economic Review 112*(4), 1075–90.

Card, D., J. Heining, and P. Kline (2013). Workplace Heterogeneity and the Rise of West German Wage Inequality. *Quarterly Journal of Economics 128*(3), 967–1015.

Card, D., T. Lemieux, and W. C. Riddell (2004). Unions and wage inequality. *Journal of Labor Research 25*, 519–559.

Case, A. and A. Deaton (2020a, April). America Can Afford a World-Class Health System. Why Don't We Have One? *New York Times*.

Case, A. and A. Deaton (2020b, March). *Deaths of Despair and the Future of Capitalism*. Princeton University Press.

Centers for Medicare and Medicaid Services (2020). National Health Expenditure Data: Historical. `https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical`.

Chetty, R. (2006). A new method of estimating risk aversion. *American Economic Review 96*(5), 1821–1834.

Chetty, R. (2012). Bounds on elasticities with optimization frictions: A synthesis of micro and macro evidence on labor supply. *Econometrica 80*(3), 969–1018.

Chetty, R., A. Guren, D. Manoli, and A. Weber (2013). Does Indivisible Labor Explain the Difference between Micro and Macro Elasticities? A Meta-Analysis of Extensive Margin Elasticities. *NBER Macroeconomics Annual 27*(1), 1–56.

Chetverikov, D., B. Larsen, and C. Palmer (2016). IV Quantile Regression for Group-Level Treatments, With an Application to the Distributional Effects of Trade. *Econometrica 84*(2), 809–833.

Claxton, G., M. Rae, G. Young, D. McDermott, H. Whitmore, J. Kerns, J. Cifuentes, A. Damico, and L. Strange (2020). 2020 employer health benefits survey. Technical report, Kaiser Family Foundation.

Congressional Budget Office (2019). Federal Subsidies for Health Insurance Coverage for People Under Age 65: Tables From CBO's May 2019 Projections. Technical report, Congressional Budget Office.

Cutler, D. (2022). *Your Money or Your Life: Strong Medecine for America's Health Care System*. Oxford University Press.

Cutler, D. and B. Madrian (1998). Labor market responses to rising health insurance costs: Evidence on hours worked. *The RAND Journal of Economics 29*(3), 509–530.

Dey, M. and C. Flinn (2005). An equilibrium model of health insurance provision and wage determination. *Econometrica 73*(2), 571–627.

DiNardo, J., N. Fortin, and T. Lemieux (1996). Labor market institutions and the distribution of wages, 1973-1992: A semiparametric approach. *Econometrica 664*(5), 1001–1044.

Domeij, D. and M. Floden (2010). Inequality trends in Sweden 1978-2004. *Review of Economic Dynamics 13*(1), 179–208.

El-Sibaie, A. (2018). 2019 Tax Brackets. `https://taxfoundation.org/2019-tax-brackets/`.

Eurostat (2022). EU Statistics on Income and Living Conditions [dataset]. `https://ec.europa.eu/eurostat/web/microdata/european-union-statistics-on-income-and-living-conditions`.

Fang, H. and D. Krueger (2021, September). "the affordable care act after a decade: Its impact on the labor market and the macro economy". Working paper 29240, National Bureau of Economic Research.

Farber, H., D. Herbst, I. Kuziemko, and S. Naidu (2021, August). Unions and inequality over the twentieth century: New evidence from survey data. *Quarterly Journal of Economics*, 1325–1385.

Feenstra, R. and G. Hanson (2003). Global production sharing and rising inequality: A survey of trade and wages. *Handbook of International Trade*.

Feldstein, M. (1973). The welfare loss of excess health insurance. *Journal of Political Economy 81*(2).

Feldstein, M. and B. Friedman (1977). Tax subsidies, the rational demand for insurance and the health care crisis. *Journal of Public Economics 7*(2), 155–178.

Flood, S., M. King, R. Rodgers, S. Ruggles, J. R. Warren, and M. Westberry (2021). Integrated Public Use Microdata Series, Current Population Survey: Version 9.0 [dataset]. Technical report, IPUMS.

Fuchs-Schuendeln, N., D. Krueger, and M. Sommer (2010). Inequality trends for Germany in the last two decades: A tale of two countries [dataset]. *Review of Economic Dynamics 13*(1), 103–132.

Garber, A. and J. Skinner (2008). Is American Health Care Uniquely Inefficient? *Journal of Economic Perspectives 22*(4), 27–50.

Garthwaite, C., T. Gross, and M. Notowidigdo (2014, May). Public health insurance, labor supply, and employment lock. *Quarterly Journal of Economics 129*(2), 653–696.

Gittleman, M. and B. Pierce (2015). Pay for performance and compensation inequality: Evidence from the ecec. *ILR Review 68*(1), 28–52.

Goldin, C. and L. Katz (2008). *The Race Between Education and Technology*. Belknap Press for Harvard University Press.

Goldschmidt, D. and J. Schmieder (2017). The rise of domestic outsourcing and the evolution of the German wage structure. *Quarterly Journal of Economics 132*(3), 1165–1217.

Gregware, J. (2017). Mercer's national survey of employer-sponsored health plans 2016. Technical report, Mercer.

Gruber, J. (1994, June). The incidence of mandated maternity benefits. *American Economic Review 84*(3), 622–641.

Gruber, J. (2000). Health insurance and the labor market. *Handbook of Health Economics 1*.

Gruber, J. (2002). Taxes and health insurance. *Tax Policy and the Economy 16*, 37–66.

Gruber, J. (2008, September). Covering the Uninsured in the United States. *Journal of Economic Literature 46*(3), 571–606.

Gruber, J. (2011). The tax exclusion for employer-sponsored health insurance. *National Tax Journal 64*(2.2).

Gruber, J. and B. Madrian (2004). *Health Insurance, Labor Supply, and Job Mobility: A Critical Review of the Literature*, Chapter 12, pp. 97–178. Urban Institute Press.

Gruber, J. and R. McKnight (2003). Why did employee health insurance contributions rise? *Journal of Health Economics 22*(6), 1085–1104.

Gruber, J. and K. Simon (2008). Crowd-out 10 years later: have recent public insurance expansions crowded out private health insurance? *Journal of Health Economics 27*(2), 201–212.

Initiative on Global Markets (2016). U.S. Poll: Cadillac Tax. `https://www.igmchicago.org/surveys/cadillac-tax/`.

Jappelli, T. and L. Pistaferri (2010). Code and data files for "Does Consumption Inequality Track Income Inequality in Italy?". *Review of Economic Dynamics*.

Kaiser Family Foundation (2019, December). Health Insurance Coverage of the Total Population [dataset]. `www.kff.org/other/state-indicator/total-population/`.

Katz, L. (2008). Comment on "Trade and Wages, Reconsidered" by Paul Krugman. *Brookings Papers on Economic Activity*, 143–149.

Katz, L. and K. Murphy (1992). Changes in relative wages, 1963-1987: Supply and demand factors. *Quarterly Journal of Economics 107*(1), 35–78.

Katz, L. F. and A. B. Krueger (2017). The role of unemployment in the rise in alternative work arrangements. *American Economic Review 107*(5), 388–92.

Keane, M. and R. Rogerson (2012). Micro and macro labor supply elasticities: A reassessment of conventional wisdom. *Journal of Economic Literature 50*(2), 464–76.

Krueger, D., F. Perri, L. Pistaferri, and G. Violante (2010). Cross sectional facts for macroeconomists. *Review of Economic Dynamics 13*, 1–26.

Krugman, P. (2008). Trade and wages, reconsidered. *Brookings Papers on Economic Activity*, 103–137.

Lee, D. (1999). Wage inequality in the United States during the 1980s: Rising dispersion or falling minimum wage? *Quarterly Journal of Economics 114*(3), 977–1023.

Mankiw, G. and L. Summers (2015, October). Uniting behind the divisive 'cadillac' tax on health plans. *New York Times*.

Medland, M. E. (2005). Employers try to eke out savings through spousal surcharges, increased prescription drug co-payments and tiered health plan premiums. Technical report, HR Magazine.

Mui, P. and B. Schoefer (2021, May). The aggregate labor supply curve at the extensive margin. Working paper 28770, National Bureau of Economic Research.

OECD Education Statistics (2022). Educational attainment and labour-force status [database]. `https://www.oecd-ilibrary.org/content/data/889e8641-en`.

OECD Global Health Expenditure (2022). Health expenditure and financing [database]. `https://stats.oecd.org/Index.aspx?DataSetCode=SHA`.

Pauly, M. (1986). Taxation, health insurance, and market failure in the medical economy. *Journal of Economic Literature 24*(2), 629–675.

Pierce, B. (2001). Compensation inequality. *The Quarterly Journal of Economics 116*(4), 1493–1525.

Pierce, B. (2010). Recent trends in compensation inequality. In *Labor in the new economy*, pp. 63–98. University of Chicago Press.

Piketty, T., E. Saez, and G. Zucman (2018). Distributional national accounts: methods and estimates for the united states. *The Quarterly Journal of Economics 133*(2), 553–609.

Robertson, C. (2015). Scaling cost-sharing to wages: How employers can reduce health spending and provide greater economic security. *Yale Journal of Health Policy, Law, and Ethics*.

Saez, E. and G. Zucman (2019a). *The Triumph of Injustice: How the Rich Dodge Taxes and How to Make Them Pay*. W. W. Norton.

Saez, E. and G. Zucman (2019b, November). We can afford Medicare for All...and it could even deliver a huge pay raise to the middle class. *Politico*.

Saez, E. and G. Zucman (2020). The rise of income and wealth inequality in america: Evidence from distributional and macroeconomic accounts. *Journal of Economic Perspectives 34*(4), 3–26.

Sammer, J. (2017). Tying health plan premiums to salary can aid lower-paid earners. Technical report, Society for Human Resource Management.

Smith, M., D. Yagan, O. Zidar, and E. Zwick (2019). Capitalists in the twenty-first century. *Quarterly Journal of Economics 134*(4), 1675–1745.

Smith, M., D. Yagan, O. Zidar, and E. Zwick (2022). The rise of pass-throughs and the decline of the labor share. *American Economic Review: Insights 4*(3), 323–340.

Social Security Administration (2022). Contribution and benefit base. `https://www.ssa.gov/oact/cola/cbb.html`.

Song, J., D. Price, F. Guvenen, N. Bloom, and T. von Wachter (2018). Firming up inequality. *Quarterly Journal of Economics 134*(1), 1–50.

Starr, P. (1982). *The Social Transformation of American Medicine: The Rise Of A Sovereign Profession And The Making Of A Vast Industry*. Basic Books.

Summers, L. (1989). Some simple economics of mandated benefits. *AEA Papers and Proceedings 79*(2), 177–183.

Thomasson, M. (2002). From sickness to health: The twentieth-century develpment of U.S. health insurance. *Explorations in Economic History*, 233–253.

Thomasson, M. (2003). The importance of group coverage: How tax policy shaped U.S. health insurance. *American Economic Review 93*(4), 1373–1384.

Vogel, J. (2022, July). The Race Between Education, Technology, and Institutions. Working paper 30311, National Bureau of Economic Research.

Weil, D. (2014). The fissured workplace. In *The Fissured Workplace*. Harvard University Press.

Zoutman, F., E. Gavrilova, and A. Hopland (2018). Estimating both supply and demand elasticities using variation in a single tax rate. *Econometrica 86*(2), 763–771.

Online Appendix to

"The Health Wedge and Labor Market Inequality"

A Data and Calibration

A.1 Data on international health spending and educational outcomes

Data for Figure 5 is constructed as follows: Panel A data from OECD Global Health Expenditure "Health expenditures and statistics." Panel B data 2010-2019 for all countries from OECD Education Statistics "Education at a Glance 2019" for the population of full-year, full-time workers aged 25-64 . Panel B data for EU member countries 2003-2009 from EU-SILC . Panel B data for United States 1977-2010 from the Current Population Survey (Flood et al. (2021)). Panel B data for Canada 1977-2005 from Brzozowski et al. (2010). Panel B data for Italy 1987-2002 from Jappelli and Pistaferri (2010). Panel B data for Sweden 1975-2002 from Domeij and Floden (2010). Panel B data for Germany 1983-2004 from Fuchs-Schuendeln et al. (2010). Panel B data for the United Kingdom 1978-2004 from Blundell and Etheridge (2010). United Kingdom college wage premium data pre-2005 are for men only. For all countries and years, we use wages of "some college" workers in the college wage premium when the wages of "B.A. or more" workers are unavailable.

A.2 Calibrating Key Parameters

We can use the observed health insurance premium and wages and participation rates for each group in what we assume to be the head tax equilibrium to solve for the key model parameters: the productivity shifters λ_C and λ_N and the parameters $\overline{\kappa}$ and $\underline{\kappa}$, which govern the distribution of reservation wages and thus the shape of the labor supply function.

Specifically, given per-worker costs ω_g, the firm chooses group-specific labor inputs to maximize:

$$max_{L_N,L_C} \left(\lambda_N L_N^{\rho} + \lambda_C L_C^{\rho}\right)^{1/\rho} - \omega_N L_N - \omega_C L_C. \tag{A.1}$$

Under the head tax, the cost per worker is $\omega_g = w_g + \tau$. Plugging this into the first order conditions for the firm's maximization problem yields:

$$\omega_g^H = w_g^H + \tau = \lambda_g L_g^{\rho-1} \left(\lambda_N L_N^{\rho} + \lambda_C L_C^{\rho}\right)^{\frac{1-\rho}{\rho}}$$

Given we observe employment and wages for both groups in (what we assume to be) the head tax equilibrium as well as τ, we can solve the firm's maximization problem for the the productivity shifters λ_C and λ_N. Specifically, by combining the equations for ω_C^H and ω_N^H, we can express λ_N as a function of λ_C. Plugging this back in and and re-arranging yields a solution for λ_C:

$$\lambda_N = \left(\frac{w_N+\tau}{w_C+\tau}\right) \cdot \left(\frac{L_N}{L_C}\right)^{1-\rho} \cdot \lambda_C$$

$$\lambda_C = \left[(w_c + \tau) \cdot (L_C)^{1-\rho} \cdot \left(\left(\frac{w_N + \tau}{w_C + \tau} \right) \cdot \left(\frac{L_N}{L_C} \right)^{1-\rho} \cdot (L_N)^{\rho} + (L_C)^{\rho} \right)^{1/\rho} \right]^{\rho}.$$

Next, we can solve for the slope of the labor supply function in equation (2), which gives the share of agents that choose to work as:

$$P_g^H = \frac{(w_g^H + \alpha_g \tau) - \underline{\kappa}}{\overline{\kappa} - \underline{\kappa}}$$

We identify the the slope of the labor supply $\frac{1}{(\overline{\kappa} - \underline{\kappa})}$ by using labor force participation rates for both groups P_g and the assumption that both groups have the same distribution of reservation wages. Specifically, the difference in participation rates between college and non-college groups is proportional to the difference in wages plus the difference in amenity value of health insurance in our model. We can solve for $(\overline{\kappa} - \underline{\kappa})$:

$$(P_C^H - P_N^H) \cdot (\overline{\kappa} - \underline{\kappa}) = (w_C^H - w_N^H) + (\alpha_C - \alpha_N) \cdot \tau$$

$$(\overline{\kappa} - \underline{\kappa}) = \frac{(w_C^H - w_N^H) + (\alpha_C - \alpha_N)\tau}{P_C^H - P_N^H}.$$

Intuitively, for a given college wage premium, a bigger gap in labor force participation rates between college and non-college individuals reveals that the inverse extensive margin labor supply curve is flatter, i.e., that $(\overline{\kappa} - \underline{\kappa})$ is smaller, and therefore, that the labor supply slope $\frac{1}{(\overline{\kappa} - \underline{\kappa})}$ is bigger.[1] Note that the slope of the labor supply function can be identified by making an assumption about the difference in the amenity-value of health insurance relative to cash $(\alpha_C - \alpha_N)$ without making assumptions about the exact values of α_C or α_N. The group-specific amenity value α_g matters only for pinning down the intercept in the labor supply function. In the payroll counterfactual, we assume that this amenity value is the same for college and non-college workers $(\alpha_C = \alpha_N)$ and this is suffiicient to solve for the equilibrium.. In the cost counterfactuals, it is necessary to make an assumption about the group-specific amenity values since the value of τvaries. This allows us to identify $\overline{\kappa}$ by subtracting the lower bound $\underline{\kappa}$ of reservation wages from the dispersion in reservation wage parameters $(\overline{\kappa} - \underline{\kappa})$. Next, plugging the expression for $(\overline{\kappa} - \underline{\kappa})$ back in to the expression for P_g^H allows us to separately identify $\underline{\kappa}$ and then $\overline{\kappa}$:

$$\underline{\kappa} = (w_g^H + \alpha_g \tau) - P_g^H \cdot (\overline{\kappa} - \underline{\kappa})$$

$$\overline{\kappa} = (\overline{\kappa} - \underline{\kappa}) + \underline{\kappa}.$$

Lastly, to estimate equilibrium values under a payroll tax in the cases where we make an assumption about the difference in the amenity value for college and non-college workers $(\alpha_C - \alpha_N)$ but do not make assumptions about the exact values of α_C or α_N, we use a modified version of the labor supply function that uses

[1] Note that identifying the slope of the labor supply curve from quantity differences relies on our simple model of inverse labor demand. If labor demand were downward sloping and not just pinned down by technology A_g less the cost of providing employee-provided-health insurance, then identifying these parameters would require different steps that relate equilibrium prices and quantities to policy shocks (Zoutman et al. (2018)).

the equilibrium values P_g^H and w_g^H under the head tax, the change in wages $(w_g^H - w_g^H)$, and the slope of the supply curve $(\overline{\kappa} - \underline{\kappa})$:

$$P_g^P = \frac{(w_g^P + \alpha_g \tau) - \underline{\kappa}}{\overline{\kappa} - \underline{\kappa}} = P_g^H + \frac{(w_g^P - w_g^H)}{\overline{\kappa} - \underline{\kappa}}$$

A.3 Estimating tax rate under each tax regime

A.3.1 Head Tax τ

Our benchmark model in Section 3 assumes that all full-time, full-year workers have covered by employer-provided health insurance. When we calibrate the model in Section 4, we use as the effective head tax rate (τ) the observed average health insurance premium (τ^{obs}), scaled down by the share θ of full-time, full-year workers who are policyholders. We show here that this scaling can be derived from a simple model in which all firms offer employer-provided health insurance but only a fraction θ of them take it up.[2] To see this, let

$$\tau = \tau^{obs} \cdot \theta.$$

To simplify the exposition, we continue with the assumption of a linear production technology (see equation (1)). Therefore, once again we have equilibrium wages in the head tax regime $w_g^H = A_g - \tau$ and in the payroll tax regime $w_g^P = \frac{A_g}{1+t}$. Recall that on average workers pay about one-quarter of their health insurance premiums, and that—presumably as a result—take-up is incomplete. To account for this incomplete take-up, we allow for heterogeneity in the amenity value of health insurance. Specifically, for a worker in group a worker in group $g \in \{N, C\}$, we assume their amenity-value α_{gi} is $\overline{\alpha}_g$ with probability p_g and $\underline{\alpha}_g$ with probability $(1 - p_g)$. We assume that $\overline{\alpha}_g$ and $\underline{\alpha}_g$ are such that $\alpha_{gi} = \overline{\alpha}_g$ implies the worker will take up the insurance, and $\alpha_{gi} = \underline{\alpha}_g$ implies they will not. In practice, the lower amenity value could reflect that workers have access to another source of health insurance, or have lower expected medical costs or are less risk averse.

Once again, we normalize the utility from not working to zero; utility from working in the Head Tax regime is now $U_{gi}^e = w_g + \alpha_{gi}\tau - \varepsilon_i$. An individual will work if and only if her utility from working exceeds her utility from not working. The probability that an individual in group $g \in \{N, C\}$ chooses to work in the Head Tax Equilibrium can then be expressed as:

$$P_g^H = p_g \cdot \frac{A_g + (\overline{\alpha}_g - 1)\tau - \underline{\kappa}}{\overline{\kappa} - \underline{\kappa}} + (1 - p_g) \cdot \frac{A_g + (\underline{\alpha}_g - 1)\tau - \underline{\kappa}}{\overline{\kappa} - \underline{\kappa}},$$

where the first term represents the employment rate of the share of workers with $\alpha_{gi} = \overline{\alpha}_g$ and the second term represents the employment rate of the share of workers with $\alpha_{gi} = \underline{\alpha}_g$. Note that the participation rates of the two groups differ by $\frac{(\overline{\alpha}_g - \underline{\alpha}_g)\cdot\tau}{\overline{\kappa} - \underline{\kappa}}$. Intuitively, workers who place less value on the health insurance that is part of their compensation are less likely to work. We define $\alpha_g = \left[p_g \cdot \overline{\alpha}_g + (1 - p_g) \cdot \underline{\alpha}_g\right]$ to represent the average amenity value of health insurance in the entire population for type $g \in \{N, C\}$, which allows us

[2] We abstract from the fact that, in practice, θ is higher for college educated workers than non-college educated workers (Table 1). This would introduce a potential further source of inequality (redistribution from non-college educated workers to college educated workers) from financing health insurance through the employer.

to rewrite group-specific labor supply in the head tax equilibrium as a function that does not depend on the parameter p_g,

$$P_g^H = \frac{A_g + (\alpha_g - 1)\tau - \underline{\kappa}}{\overline{\kappa} - \underline{\kappa}},$$

and is the same expression as in our benchmark model with full take-up. It immediately follows that the comparison to outcomes in the payroll tax equilibrium therefore also remains the same

A.3.2 Payroll Tax t

Given the the parameters of the CES production function and labor supply equation, as well as an estimate of the head tax τ, we can now solve for the equilibrium tax rate t under the payroll tax. Under the payroll tax, a portion of a worker's wage goes to the payroll tax so that the cost per worker is $\omega_g = (1+t) \cdot w_g$. Plugging this into the first order conditions for the firm's maximization problem in (A.1) yields:

$$\omega_g^P = (1+t) \cdot w_g^P = \lambda_g L_g^\rho \left(\lambda_N L_N^\rho + \lambda_C L_C^\rho\right)^{\frac{1-\rho}{\rho}}$$

We can also use the labor supply function in equation (2) to write equilibrium employment as a function of wages:

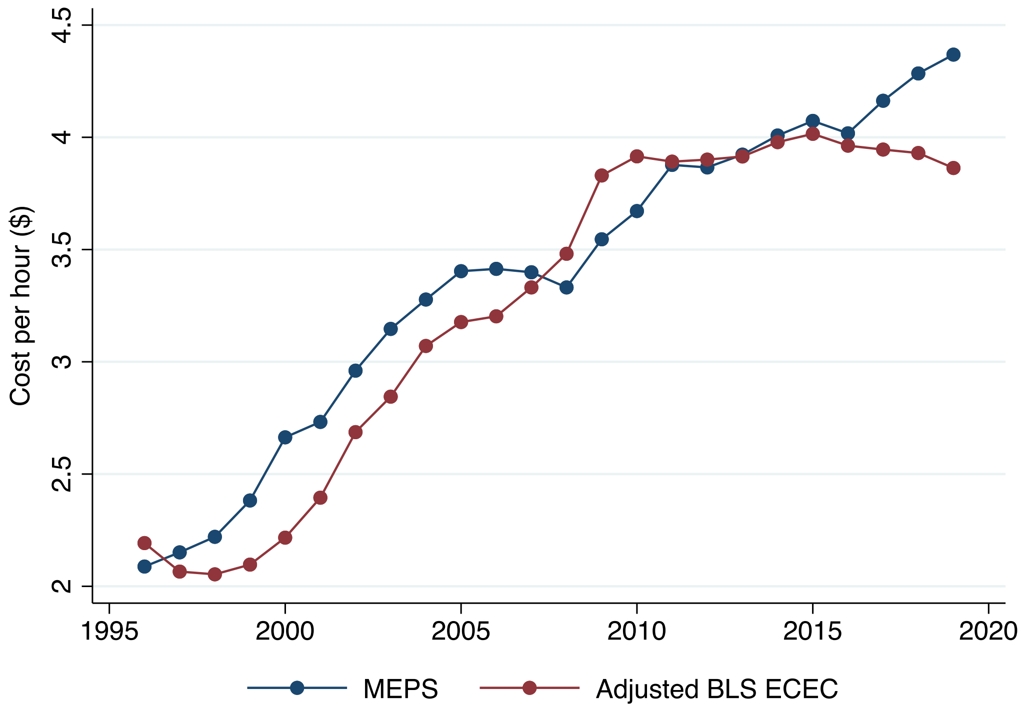
$$P_g^P = P_g^H + \frac{w_g^P - \underline{w_g^H}}{\overline{\kappa} - \underline{\kappa}}$$

Lastly, equilibrium also requires solving for the payroll tax t, which can be expressed (see equation (5)):

$$t = \frac{\tau}{\tilde{w} - \tau}$$

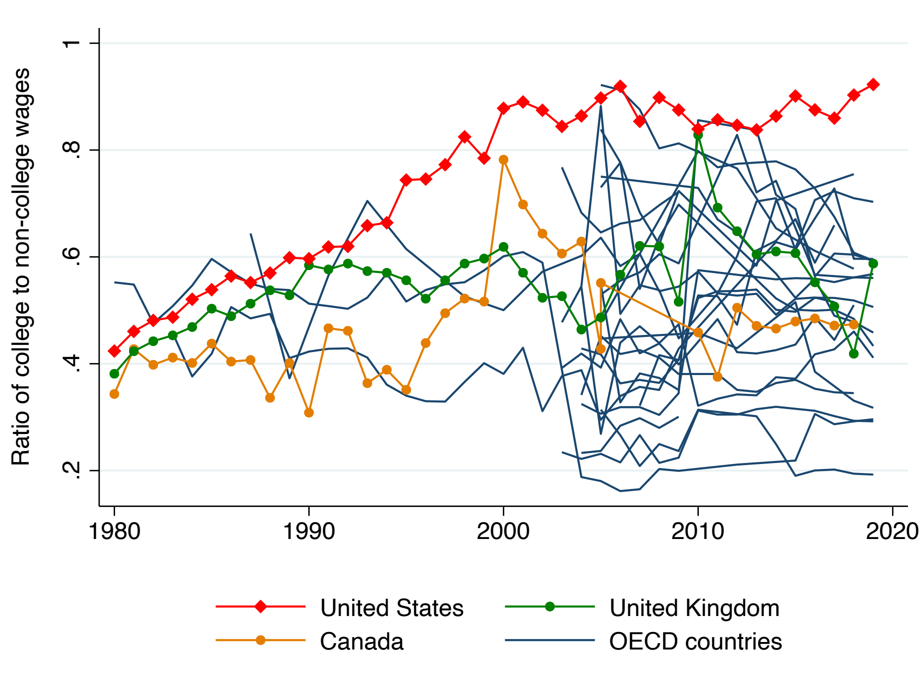
where $\tilde{w}$ is the average wage under the payroll tax, and thus equal to $\tilde{w} = \frac{L_N}{L_N + L_C} \cdot w_N + \frac{L_C}{L_N + L_C} \cdot w_C$, where employment and wages are determined in the payroll tax equilibrium. Together, this gives us five equations for the five unknowns, allowing us to solve for wages and labor supply of each group as well as the payroll tax using a nonlinear equation solver.

Figure A.1: Alternative Measures of Employer Costs (per hour) of Health Insurance



Notes: This figure compares two estimates of the hourly employer cost of health insurance per full-time, full-year employee. Red series shows an adjusted estimate from the BLS' hourly Employer Cost for Employee Compensation (ECEC) series. The ECEC reports the estimated hourly employer cost ofr employee compensation each quarter, including the cost of health benefits to the employer. Private industry ECEC estimates are a weighted average of the cost of health insurance for all workers, including part-time workers and those who do not take up insurance despite eligibility. These estimates are weighted by current employment, so year-to-year changes reflect differences in employment and industry composition as well as changes in the cost of health insurance itself. To more directly compare the ECEC estimates to the MEPS estimates, we divide the ECEC estimates each year by the share of the population who are full-time, full-year workers in that year. Blue series shows an adjusted estimate from the MEPS series used in the main text. Specifically, to more easily compare the MEPS data to the BLS's ECEC estimates, we use the annual MEPS employer contribution series divided by 2,000 (assuming a full-time, full-year employee works 40 hours per week for 50 weeks a year). This provides an estimate of the hourly cost of the MEPS employer contribution. Like the ECEC series, the MEPS series is based on private sector employee compensation.

Figure A.2: College Wage Premia



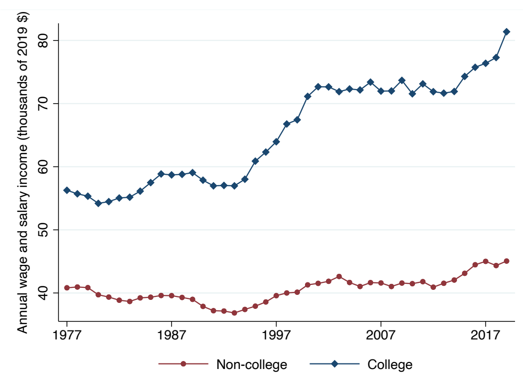
NOTES: This figure shows college wage premia for the full set of of OECD countries. A version with fewer countries is found in Figure 5.

B Broaden Definition of College-educated Workers To Include Those With Some College

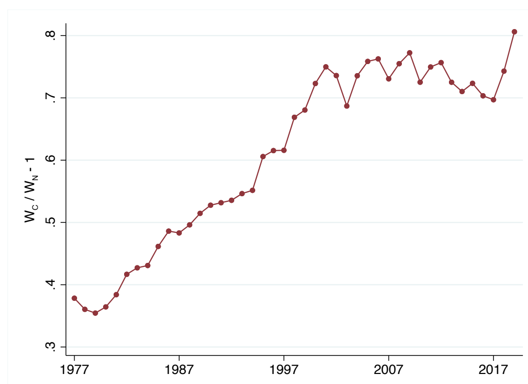
We reproduce our main analyses using an alternative definition of college-educated worked which includes workers with some college in the definition of college-educated; by contrast, in our baseline definition these workers are included in the group without a college degree, while the college-educated category requires a bachelor's degree or higher. Figure A.3 shows trends in labor market outcomes (the analog of Figure 2) for this alternative definition, and Table A.1 shows summary statistics (the analog of Table 1) for this alternative definition. Tables A.2 and A.3 show, under this alternative definition of college educated workers, counterfactual labor market outcomes in 2019 and counterfactual changes over time in labor market outcomes under a payroll tax.

Figure A.3: Labor Market Outcomes, By Education

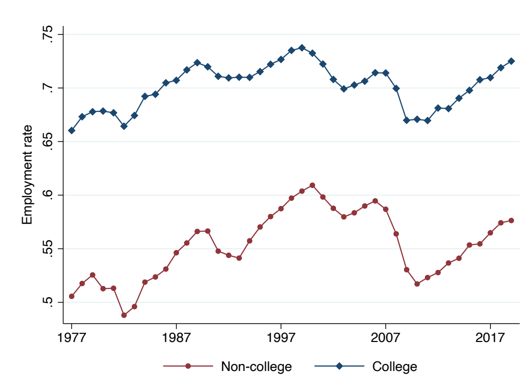
(a) Real Earnings, by Education



(b) College Wage Premium



(c) Employment Rate



NOTES: This figure replicates Figure 2, but defines college-educated such that the individual has attended at least some college.

Table A.1: Summary Statistics for FTFY Workers Ages 25-64 with Some College or More (2019)

Panel A: Labor Market Outcomes			
	Total	College	Non-College
Employment Rate (P_g)	0.672	0.725	0.576
Avg. Annual Earnings (w_g)	\$70,333	\$81,381	\$45,057
Panel B: Health Insurance Coverage			
Employer-Sponsored	0.802	0.859	0.670
Policyholder	0.659	0.706	0.554
Dependent	0.140	0.153	0.112
Other Private	0.062	0.059	0.067
Public	0.072	0.051	0.122
None	0.084	0.048	0.166
Panel C: Offering and Take-up			
Offered Employer-Sponsored Health Insurance	0.830	0.872	0.733
Take-up | Offered	0.794	0.809	0.755

Notes: This table replicates the results in Table 1, but defines college such that the individual attended at least some college.

Table A.2: 2019 Labor Market Effects of Counterfactual Payroll Tax Financing (Some College or More)

	(1) Baseline	**(2)** Full Coverage
Fixed Per Worker Cost, τ:	\$7,758	\$11,764
Payroll Tax Rate, t:	11.05%	16.78%
Wages:		
Change in College Wage, $\Delta(w_C)$	-\$914	-\$1,325
Change in Non-college Wage, $\Delta(w_N)$	\$2,046	\$2,937
Pct. Change in College Wage Premium	-12.14%	-17.14%
Employment:		
Change in College Employment Rate, $\Delta(P_C)$	-0.37 pp	-0.54 pp
Change in Non-college Employment Rate, $\Delta(P_N)$	0.84 pp	1.20 pp
Change in Total Employment, $\Delta(L)$	85,696	117,755
Change in College Employment, $\Delta(L_C)$	-371,593	-538,730
Change in Non-college Employment, $\Delta(L_N)$	457,288	656,486
Wage Bill:		
Change in College Share of Wage Bill, $\Delta(\frac{w_C L_C}{w_N L_N + w_C L_C})$:	-1.21 pp	-1.75 pp

Notes: This table replicates the results in Table 3, but defines college such that the individual attended at least some college.

Table A.3: Changes over Time: Labor Market Effects of Counterfactual Payroll Tax Financing, 1977-2019 (Some College or More)

	Head Tax Equilibrium	Payroll Tax Equilibrium: Baseline	Payroll Tax Equilibrium: Full Coverage
Employer-Sponsored Health Insurance:			
Change in Cost $(\tau_{2019} - \tau_{1977})$	-	\$5,937	\$9,003
Payroll Tax $(t_{2019} - t_{1977})$	-	7.16 pp	10.87 pp
Wages:			
Change in College Wages $w_{C,2019} - w_{C,1977}$	\$25,111	\$24,434	\$24,139
Change in Non-college Wages $w_{N,2019} - w_{N,1977}$	\$4,233	\$6,134	\$6,955
PP Change in College Wage Premium	42.78 pp	34.06 pp	30.55 pp
Employment Rate:			
Change in College Employment Rate $P_{C,2019} - P_{C,1977}$	6.47 pp	6.34 pp	6.28 pp
Change in Non-college Employment Rate $P_{N,2019} - P_{N,1977}$	7.08 pp	7.77 pp	8.06 pp
Wage Bill:			
College Share of the Wage Bill $\left(\frac{w_C L_C}{w_N L_N + w_C L_C}\right)_{2019} - \left(\frac{w_C L_C}{w_N L_N + w_C L_C}\right)_{1977}$	34.49 pp	33.63 pp	33.27 pp

Notes: This table replicates the results in Table 5, but defines college such that the individual attended at least some college.

Table A.4: 2019 Labor Market Effects of Counterfactual Payroll Tax Financing, by Sex

	Baseline	Aggregate	Male	Female
Fixed Per Worker Cost, τ:	\$7,758	\$7,758	-	-
Payroll Tax Rate, t:	11.06%	11.07%	-	-
Wages:				
Change in College Wage, $\Delta(w_C)$	-\$2,181	-\$2,227	-\$3,731	-\$632
Change in Non-college Wage, $\Delta(w_N)$	\$1,660	\$1,601	\$1,085	\$2,412
Pct. Change in College Wage Premium, $\%\Delta(w_C/w_N - 1)$	-11.26%	-11.14%	-	-
Employment Rate:				
Change in College Employment Rate, $\Delta(P_C)$	-0.69 pp	-0.56 pp	-0.90 pp	-0.29 pp
Change in Non-college Employment Rate, $\Delta(P_N)$	0.52 pp	0.68 pp	0.26 pp	1.10 pp
Change in Total Employment, $\Delta(L)$	86,833	305,099	-116,362	421,461
Change in College Employment, $\Delta(L_C)$	-408,588	-334,349	-240,678	-93,671
Change in Non-college Employment, $\Delta(L_N)$	495,420	639,448	124,316	515,132
Wage Bill:				
Change in College Share of Wage Bill, $\Delta(\frac{w_C L_C}{w_N L_N + w_C L_C})$:	-1.77 pp	-1.77 pp	-	-

Table A.5: Changes over Time: Labor Market Effects of Counterfactual Payroll Tax Financing, 1977-2019, for Males

	Head Tax Equilibrium	Payroll Tax Equilibrium	
		Baseline	Full Coverage
Employer-Sponsored Health Insurance:			
Change in Cost $(\tau_{2019}-\tau_{1977})$	-	\$5,937	\$9,003
Payroll Tax $(t_{2019}-t_{1977})$	-	7.16 pp	10.88 pp
Wages:			
Change in College Wages $w_{C,2019}-w_{C,1977}$	\$41,406	\$38,398	\$37,083
Change in Non-college Wages $w_{N,2019}-w_{N,1977}$	\$5,184	\$6,466	\$7,032
Employment Rate:			
Change in College Employment Rate $P_{C,2019}-P_{C,1977}$	-1.14 pp	-1.67 pp	-1.89 pp
Change in Non-college Employment Rate $P_{N,2019}-P_{N,1977}$	-4.28 pp	-3.92 pp	-3.76 pp

Table A.6: Changes over Time: Labor Market Effects of Counterfactual Payroll Tax Financing, 1977-2019, for Females

	Head Tax Equilibrium	Payroll Tax Equilibrium	
		Baseline	Full Coverage
Employer-Sponsored Health Insurance:			
Change in Cost $(\tau_{2019}-\tau_{1977})$	-	\$5,937	\$9,003
Payroll Tax $(t_{2019}-t_{1977})$	-	7.16 pp	10.88 pp
Wages:			
Change in College Wages $w_{C,2019}-w_{C,1977}$	\$37,551	\$36,645	\$36,223
Change in Non-college Wages $w_{N,2019}-w_{N,1977}$	\$13,911	\$15,695	\$16,442
Employment Rate:			
Change in College Employment Rate $P_{C,2019}-P_{C,1977}$	19.16 pp	18.56 pp	18.27 pp
Change in Non-college Employment Rate $P_{N,2019}-P_{N,1977}$	17.80 pp	18.18 pp	18.31 pp