Low-Skill Domestic Outsourcing and Healthcare Costs*

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Abstract

Between 1975 and 2012, low-skill domestic outsourcing increased by approximately 10 percentage points in the United States. To account for this development, I use a general equilibrium model to link this rise to two driving forces: rising healthcare costs and the rising skill wage premium. These forces interact with two significant U.S. tax policies: anti-discrimination laws that force firms to offer the same healthcare plans to all employees, and the tax advantage of employer health plans. The main theoretical result is that more skill-intensive industries are more likely to outsource low-skill positions. I use data to find support for this prediction and calibrate the model. Using the calibrated model, I find that the rising price of medical care interacting with the two US tax policies is responsible for over 50 percent of the increase in low-skill domestic outsourcing between 1975 and 2012. Conversely, the rising skill wage premium was not a driver of the trend.

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1 Introduction

Domestic outsourcing — firms' use of domestic workers that are not employees — has increased dramatically in the US in recent decades.[1] Using data from Eckert et al. (2021), figure 1 plots the share of private employment in the "Administrative and Support Services" industry. Firms in this industry, like temporary help agencies and janitorial service firms, typically supply establishments with low-skill outsourced labor. The share of total private employment in this industry more than quadrupled between 1980 and 2020.[2]

The cause of the increase in low-skill domestic outsourcing is unknown. One hypothesis centers around employer health plan costs. The idea is that employer-provided health insurance plans drive up the cost of in-house janitors, security guards, and other low-skill workers, and firms outsource those workers to avoid offering them expensive health plans. Domestic outsourcing could increase over time if employer health plan costs increase. While this hypothesis is often discussed, this hypothesis has never been tested empirically or quantitatively.[3]

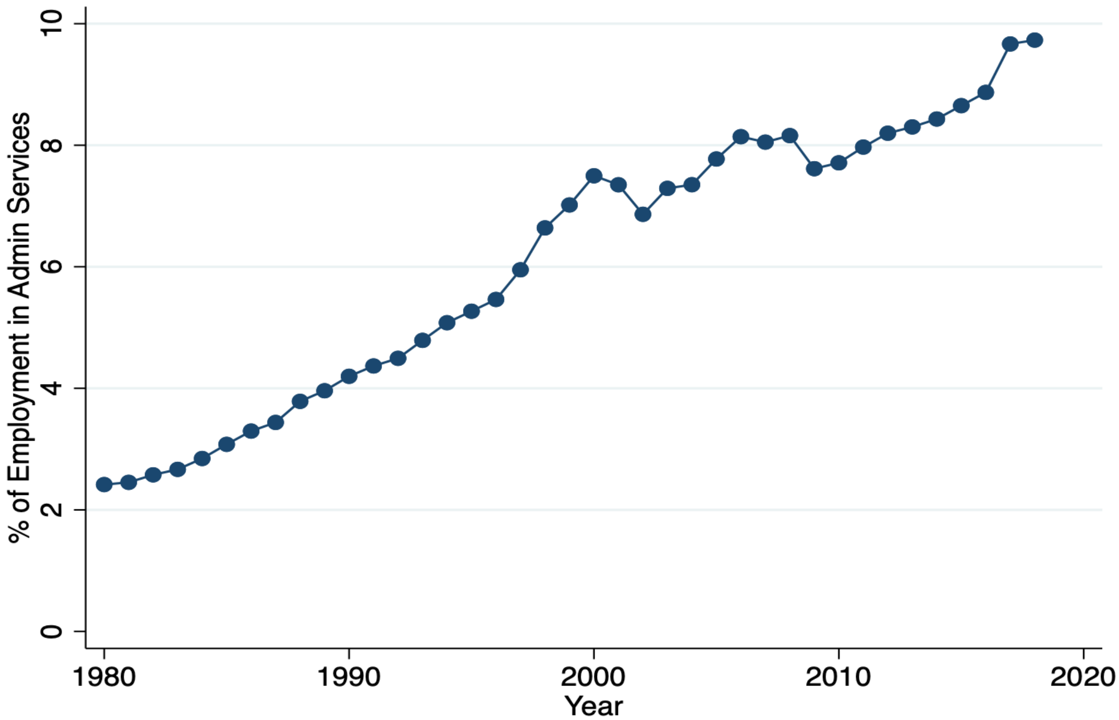
This paper fills this gap by assessing this hypothesis. I build a general equilibrium model where firms choose the health plans they offer and the workers they outsource. Qualitatively, the rising price of medical care, as seen in figure 2, can drive the increase in low-skill domestic outsourcing by interacting with two key US policies. First is the tax advantage of employer health plans — wages are taxed while employer health plans are not — which causes firms to offer high-skill workers generous health plans. Second is anti-discrimination laws, which force firms to offer their low-skill workers the same generous health plans. The rising price of medical care increases the relative cost of these generous health plans, which increases the relative cost of in-house low-skill workers through interacting with the two tax features. Similarly, an increase in the skill premium — the compensation paid to high-skill workers relative to that paid to low-skill workers — can also increase low-skill domestic outsourcing. This mechanism also implies that more skill-intensive

[1] The increase in domestic outsourcing is well documented. See Segal and Sullivan (1997) for an early discussion of the growth of temporary help services, a form of low-skill domestic outsourcing.

[2] Section A.1 has more information on the rise of domestic outsourcing.

[3] For an early discussion see Houseman (2001), which surveys employers who cite using flexible staffing arrangements (for example, temp agents, or on-call workers) to save on benefit costs.

Figure 1: The Rise in Low-Skill Domestic Outsourcing



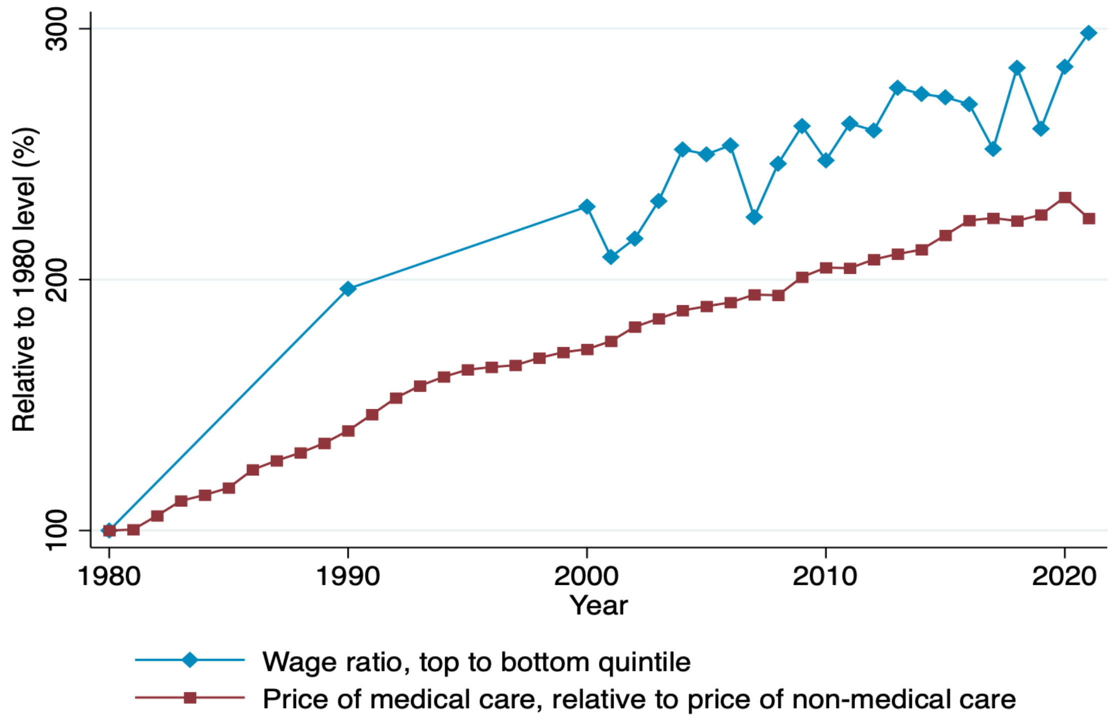
Notes: "Administration and Support Services" (NAICS 561) is composed of establishments that supply firms with low-skill outsourced labor. Underlying data is imputed County Business Patterns data from Eckert et al. (2021).

industries outsource more low-skill labor, allowing this mechanism to be tested with cross-sectional industry data. Using this data, I find support for my theory and calibrate the model. With the calibrated model, I find that the rising price of medical care interacting with the two tax features can explain over half of the increase in low-skill domestic outsourcing. On the other hand, rising income inequality does not cause low-skill outsourcing to increase significantly.

This paper makes five contributions to the literature. First, this is the first paper to study the link between rising healthcare costs and low-skill domestic outsourcing. More broadly, while many papers assess the welfare and efficiency effects of domestic outsourcing, few try to explain why it increased.[4] An alternative hypothesis for the increase in domestic outsourcing that has been tested empirically is rising firing cost

[4] A large empirical literature documents the effect of domestic outsourcing on low-skill workers: Goldschmidt and Schmieder (2017), Dube and Kaplan (2010), Drenik et al. (2023), or Felix and Wong (2021). A small structural literature analyzes the welfare and efficiency effects of the rise in domestic outsourcing: Bilal and Lhuillier (2021) or Chan and Xu (2017).

Figure 2: Two Rising Trends: Medical Care Prices and the Skill Premium



Notes: The wage ratio series is drawn from the American Community Survey and the US Decennial Census, accessed through IPUMS (Ruggles et al., 2020). Specifically, wage quintiles are calculated for privately employed full-time workers, and the ratio is total wages paid to the top quintile divided by that of the bottom quintile. Price data is drawn from the Federal Reserve Bank Economic Data (FRED). Specifically, the series is "Consumer Price Index for All Urban Consumers: Medical Care in US City Average, Index 1980=100, Annual, Seasonally Adjusted", divided by "Consumer Price Index for All Urban Consumers: All Items Less Medical Care in US City Average, Index 1980=100, Annual, Seasonally Adjusted".

(Autor, 2003).

The second contribution is qualitative. Using a novel new theory, I show how the rising price of medical care and the rising skill premium can increase low-skill domestic outsourcing. The model makes predictions about how anti-discrimination laws and the tax treatment of employer health plans interact with firm labor composition to determine what compensation packages firms offer and which workers firms outsource. The model has three types of agents. First are workers. Workers are exogenously heterogeneous in skill, and they inelastically supply labor to firms in exchange for compensation packages composed of wages and health plans. They are free to choose where they supply their labor, so they work for the firm that offers the highest utility. In equilibrium, firms offer compensation packages that vary in composition of wages and health plans but yield the same utility level, making workers indifferent to where they supply their labor. Second are traditional firms. Firms face competitive labor markets. This means that they take workers' reservation utility levels as given. If they want to hire them as in-house workers, they choose the compensation package that minimizes costs, subject to delivering this utility. Because wages are taxed while health plans are not, firms find it optimal to offer a mix of wages and health plans. Alternatively, they can outsource work by engaging the services of an outsourcing firm at the going rate. Firms are heterogeneous in production technology primitives that determine their skill intensity; all firms demand labor of every skill level, but some demand more high-skill labor than others. Third are outsourcing firms, which supply traditional firms with outsourced labor. Each skill level has a single representative outsourcing firm. Like traditional firms, they face the same competitive markets. Unlike traditional firms, each outsourcing firm demands labor of only one skill level.

The model features two aspects of US tax policy. First is the difference in tax treatment between wages and employer health plans; wages are taxed while health plans are not. This causes firms to find it optimal to offer both wages and health plans. Second are anti-discrimination laws, which force firms to offer all their workers the same health plans. An increase in the price of medical care increases the relative cost of the health plan high-skill workers want, which increases the relative cost of in-house low-skill workers due to the anti-discrimination laws. This increases low-skill domestic outsourcing. Similarly, increasing the skill premium also increases the relative cost of in-house low-skill workers.

By a similar mechanism, more skill-intensive industries are more likely to outsource low-skill positions. Hence, firm labor composition determines outsourcing behavior. This new theory for what drives variation in outsourcing across firms, along with empirical support for this prediction, is my third contribution. Alternative explanations for variance in outsourcing behavior across firms are differences in firm size (Bilal and Lhuillier, 2021) and differences in capital intensity (Holmes and Snider, 2011).[5]

[5] Bilal and Lhuillier (2021) theorizes that the propensity to outsource workers increases with firm size. Firms face upward-sloping labor supply curves while the price for outsourced labor is flat, and thus big or efficient firms outsource. Holmes and Snider (2011) proposes that firms outsource

My fourth contribution is quantitative. I calibrate the model and measure the percent of the increase in low-skill domestic outsourcing due to the rising price of medical care and the rising skill premium. The rising price of medical care is responsible for over half of the increase, while the rising skill wage premium is not a driver of the trend. I also use the quantitative model to perform several policy counterfactuals. Removing the anti-discrimination laws increases the welfare of workers of all skill levels, decreases wage inequality, and slightly decreases welfare inequality.

This paper is organized as follows. Section 2 discusses the US legislation that constrains firms ability to offer varying health plans to their workforce. Section 3 and 4 presents the theoretical model and characterize equilibrium results. Section 5 calibrates the model and finds empirical support for my theory. Section 6 discusses the quantitative exercises performed with the calibrated model, namely the accounting exercise and policy counterfactuals centered around explaining how changing the tax features affects welfare and inequality. Section 7 concludes.

2 Institutional Background: Employer Health Plans

In the US, employer-provided health plans are pervasive. In fact, in 2015 over half of all people with any health insurance were covered by an employer provided plan. Of people covered by private plans, almost 90 percent were covered by employer-provided plans (Kaiser Family Foundation, 2021). Further, employer contributions to and benefits paid out by employer-provided health plans were 7 and 10 percent of total employee compensation, according to NIPA data.[6]

One reason employers commonly provide health plans is the favorable tax treatment. Compensation in the form of health plans are generally not taxed, while on the other hand wages are. The tax rate on wages is high; Heathcote et al. (2017) estimates that the average marginal tax rate in the US was 34 percent in the early 2000s. This different in tax treatment plus the fact most people want health insurance coverage

to separate capital-intensive tasks from labor-intensive tasks. Labor leverages monopoly or worker power over both types of tasks, and firms use outsourcing to weaken labor's power over capital-intensive tasks.

[6]Specifically, NIPA Section 6 Tables 6.2 and 6.11.

incentives firms to offer health plans to their employees. Generally speaking, if firms offer a compensation package composed of wages and health plans, it will yield a higher utility level than a same-cost compensation package composed of only wages. While employer health plans are generally not taxed, they are taxed just like wages if they violate anti-discrimination laws. These laws state that firms cannot offer high-wage workers better health plans than their low-wage workers. If these laws are violated, all compensation paid in the form of health plans is taxed, nullifying the main reason why firms compensate workers with health plans. These laws were passed in 1978 and affect two of the most common types of health insurance plans. Appendix section A.2 has more information.

The anti-discrimination laws force firms to offer all employees the same menu of health plans, but health plans could, in theory, vary within a firm. Firms could attempt to skirt these laws by offering plans with varying employee contribution rates to induce low-wage workers to choose cheap health plans. This is not the case, as the majority of variation in employer premiums, which is the amount employers pay for their employee's health plans, is between firms, not within. The 1993 Robert Wood Johnson Foundation Employer Health Insurance Survey has data on 22,000 plans offered by 15,000 employers (Long and Marquis, 2006). For each plan, the data set has the employer that offers the plan, the number of employees enrolled, and employer premiums. The total dispersion of employer premiums is

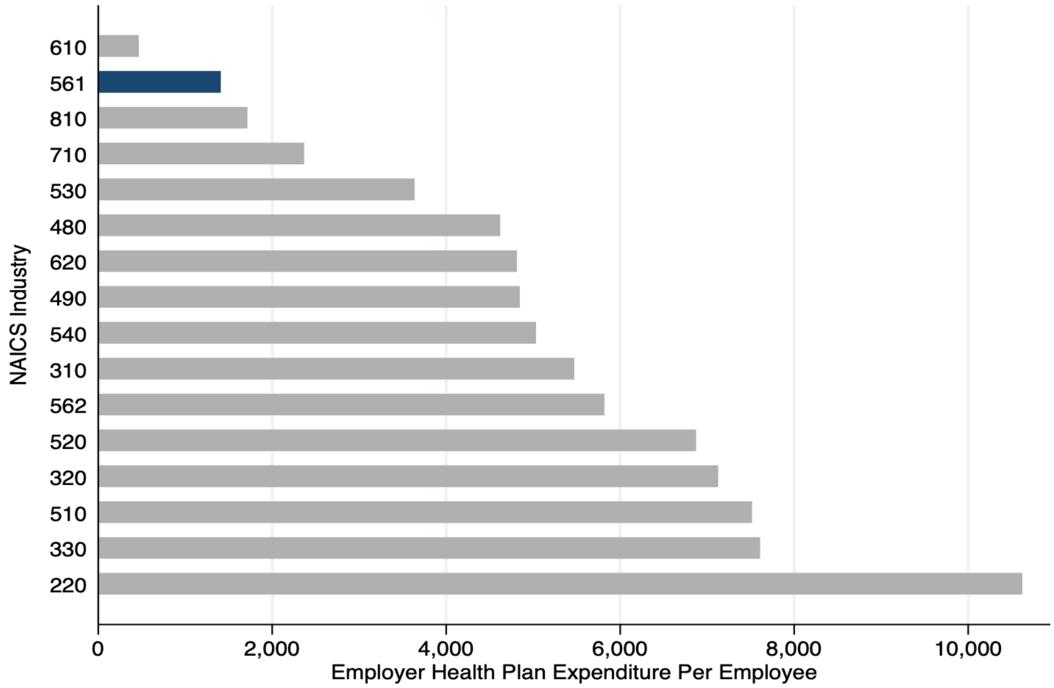
$$\underbrace{Var(x_{ij} - \bar{x})}_{\text{Total dispersion}} = \underbrace{Var(x_{ij} - \bar{x}_j)}_{\text{Within firm}} + \underbrace{Var(\bar{x}_j - \bar{x})}_{\text{Between firm}}$$

where i denotes a health plan, j is employer, x is employer premium, and the overbar denotes mean.[7] I run the above decomposition separately for single and family coverage, assuming singles and people with families operate in separate markets. I find that 83% (86%) of the total variation of single (family) plan employer premiums is between firms. The results are not sensitive to weighting by employee participation.

One potential reason we do not see much evidence of within-firm variation in health

[7] For a similar decomposition, see Haltiwanger et al. (2022).

Figure 3: Admin and Support Services (NAICS 561) has Low Health Plan Costs



Notes: “Administration and Support Services" (NAICS 561) is composed of establishments that supply firms with low-skill outsourced labor. Data is drawn from the Annual Survey of Manufacturers, the Services Annual Survey, and County Business Patterns, as discussed in section 5.

plan cost is that an alternative mechanism is available to firms that want to offer different plans to different workers: they can outsource some of their workers. Firms could domestically outsource their janitors, security guards, and other low-wage workers so that they do not have to offer them the same generous health plans that lawyers, computer scientists, and other high-wage workers want. This hypothesis is supported by figure 3, which shows health plan costs by industry using data from section 5. As pictured, the "Administrative and Support Services" industry (NAICS 561), which supplies establishments with low-skill outsourced labor, has one of the lowest health plan expenditures per employee. The only industry that ranks lower is “Education Services", which has many undergraduate and graduate student workers inflating its employee count.

If the health plans that high and low skill workers want are identical, then the anti-discrimination laws do not effect the firms. However, two trends over the past four decades could theoretically have increased the relative cost of the health plans preferred by the high skill workers, increasing the cost of in-house low-skill workers through the anti-discrimination laws. The first trend is the increase in the price of medical care, as seen in figure 2, which uses CPI data from FRED. The relative price of medical care more than doubled between 1980 and 2020. The second trend is the increase in the skill premium, or the compensation of high-skill workers relative to that of low-skill workers. Figure 2 shows wages paid to the top quintile of earners divided by wages paid to the bottom quintile, using data from the American Community Survey. This ratio has tripled between 1980 and 2021.[8] Either of these trends could theoretically increase low-skill domestic outsourcing through the difference in tax treatment and the anti-discrimination laws.

This paper aims to measure how much of the rise in domestic outsourcing can be attributed to the rising price of medical care and the rising skill premium. Because these trends happened over several decades and plausibly have significant general equilibrium effects, a general equilibrium model is necessary to test these hypotheses. Section 3 explains a general equilibrium theory that features domestic outsourcing and compensation packages composed of wages and health plans. Section 4 explains how these two trends can increase low-skill domestic outsourcing by interacting with the anti-discrimination laws and the difference in tax treatment. Section 5 calibrates the model, which section 6 uses to measure how much of the increase in domestic outsourcing can be accounted for by these two trends.

3 A Theory of Outsourcing and Health Plans

The model features traditional firms that decide how much labor to outsource and what level of health plan to offer. Traditional firms vary exogenously in the skill intensity of their production process. They view labor markets as competitive and choose wages, health insurance plan generosity, and how much of each type of worker to outsource. Outsourcing firms hire only one type of worker and sell outsourced labor to traditional firms. Workers vary exogenously in their skill level. They value wages and health plans and choose the employer that offers the most attractive pair,

[8] For more information on the increase in income inequality or the increase in compensation paid to high-wage workers, see Krusell et al. (2000), Song et al. (2019), or Braxton et al. (2021).

given their preferences and skill level.

3.1 Environment

Time is static. The economy has three types of agents: workers, traditional firms, and outsourcing firms. Workers are heterogeneous in skill; the discrete set of skills is $\mathcal{S}$ and the mass of workers of skill $s \in \mathcal{S}$ is N_s. Workers supply labor inelastically, and their utility function u turns (non-medical care) goods c and medical care m into utility. I make the standard assumptions on the utility function so that workers want to consume both goods and medical care

Assumption 1. *Assume the utility function v is 1) strictly increasing in both arguments, 2) strictly concave in both arguments, and 3) has positive cross derivatives.*

The discrete set of traditional firms is $\mathcal{J}$. Firms' production technology inputs in-house labor and outsourced labor of each skill and outputs goods. in-house labor and outsourced labor of each skill, n_{js} and l_{js} respectively, enter into a CES function that outputs a measure of labor $\mathbf{n}_{js}$. These measures of each skill enter into a decreasing returns to scale production function yielding revenue y_j. Firm j's production technology is

$$y_j = z_j \left(\Pi_{s\in\mathcal{S}} \mathbf{n}_{js}^{\varphi_{js}}\right)^{\nu}, \quad \mathbf{n}_{js} = \left(n_{js}^{1-1/\theta_s} + \alpha_{js}^{1/\theta_s} l_{js}^{1-1/\theta_s}\right)^{\frac{\theta_s}{\theta_s-1}}$$

where $\nu < 1$ is the returns to scale parameter, $z_j > 0$ is efficiency, $\alpha_{js} > 0$ is a weight on outsourced labor, and $\varphi_{js} > 0$ is the skill weight. Each firm's skill weights sum to one, $\sum_{s\in\mathcal{S}} \varphi_{js} = 1$. θ_s is the elasticity of substitution between in-house and outsourced labor of skill s. For now, I assume that $\theta_s > 1 \; \forall s \in \mathcal{S}$, implying that in-house and outsourced workers are gross substitutes; later, I estimate this parameter from the data.

Assumption 2. *Assume that $\theta_s > 1 \; \forall s \in \mathcal{S}$.*

The microfoundation for the CES aggregator is an underlying model where the firm has to complete a continuum of tasks and can hire in-house or outsourced labor for each task. If the productivities of in-house and outsourced labor for each task is drawn from the appropriate extreme value distribution, the resulting problem is equivalent to the CES aggregator, following mathematics from Eaton and Kortum (2002). See Appendix A.3.

There is a single outsourcing firm for each skill $s \in \mathcal{S}$. The s-skill outsourcing firm's technology inputs s-skill labor n_{os} and outputs outsourced labor of the same skill, L_s. The technology is $L_s = n_{os}$.

3.2 Workers

Firms attract labor by offering compensation packages composed of wages w_{js} and health plans a_{js}. Given a compensation package $\{w_{js}, a_{js}\}$, a worker chooses consumption c, out of pocket medical care m_1, and medical care purchased with the health plan m_2 to maximize utility u. Wages and employer health plans are different in two ways. First, wages can be spent on goods or medical care, while health plans can only be spent on medical care. Second, wages are taxed at rate T while employer health plans are not. Medical care bought with wages and health plans are perfect substitutes. Given the compensation packages offered by each firm, the worker's problem is to choose which firm to work at to maximize utility,

$$\max_{j \in \mathcal{F}} v(a_{js}, w_{js}; p_m)$$

where $\mathcal{F}$ is the set of all firms (traditional and outsourcing) and v is the indirect utility function

$$\begin{aligned} v(a_{js}, w_{js}; p_m) = \max_{c, m_1, m_2} & \; u(c, m_1 + m_2) \\ s.t. \quad & c + p_m m_1 \leq w_{js}(1 - T) \\ & p_m m_2 \leq a_{js}. \end{aligned}$$

In the baseline model, wages are taxed while employer-provided health plans are not. Health plans are simply an un-taxed form of compensation that can only be spent on medical care, which is similar to how cafeteria plans work in the US.

3.3 Traditional firms

Traditional firms choose in-house labor, outsourced labor, wages, and health plans for each skill level. Their objective is to maximize profits, which is revenue minus labor costs,

$$\pi_j = y_j - \sum_{s \in \mathcal{S}} \left((w_{js} + a_{js}) n_{js} + p_{os} l_{js} \right) \tag{1}$$

The price of s-skill in-house labor is the cost of their compensation package, $w_{js} + a_j$, and the price of s-skill outsourced labor is p_{os}. The firms' choices are subject to two constraints. First, firms must offer all in-house workers the same health plan.

$$a_{js} = a_{js'} \quad \forall s, s' \in \mathcal{S}. \tag{2}$$

Second, because workers move to whichever firm offers the highest utility, firms must offer each skill level a compensation package that yields at least as much utility as each skill's best-outside option, denoted $\tilde{v}_s$,

$$v(a_{js}, w_{js}; p_m) \geq \tilde{v}_s \quad \forall s \in \mathcal{S}. \tag{3}$$

The best outside option $\tilde{v}_s$ acts as a worker's reservation utility level; workers will not work for a firm offering a utility level less than it. Note that the price of medical care and the tax on wages enters into the firm's problem through this constraint.

The traditional firm's problem follows. Given reservation utility levels $\{\tilde{v}_s\}_{s \in \mathcal{S}}$ and labor-service prices $\{p_{os}\}_{s \in \mathcal{S}}$, firms choose in-house labor n_{js}, outsourced labor l_{js}, wages w_{js}, and health plan a_{js} to maximize profits (1) subject to offering all in-house workers the same health plan (2) and offering all skills a compensation package that yields as much utility as their reservation utility level (3).

The baseline economy features two aspects of the US tax code: the tax advantage of employer health plans and the anti-discrimination laws. Later, I compare the baseline economy to ones without these tax features.

3.4 Outsourcing firms

The s-skill outsourcing firm chooses s-skill in-house labor n_{os}, a wage w_{os}, and a health plan a_{os}. They seek to maximize profits, which are revenues minus labor costs,

$$p_{os}n_{os} - n_{os}(w_{os} + a_{os}). \tag{4}$$

The s-skill outsourcing firm's profit maximization problem follows. Given the price of outsourced labor p_{os} and reservation utility level $\tilde{v}_s$, the firm picks labor n_{os}, wages w_{os} and health plan a_{os} to maximize profits (4) subject to offering in-house workers a compensation package that yields at least as much utility as their reservation utility level (3) and offering all in-house workers the same health plans (2). Looking ahead, because they each use only one type of labor, by construction the anti-discrimination law does not effect the outsourcing firms in equilibrium.

3.5 Equilibrium Definition

Given a price of medical care p_m and other exogeneous parameters, an equilibrium is allocations of labor and compensation packages for each traditional firm $\{n_{js}, l_{js}, a_{js}, w_{js}\}_{(j,s)\in\mathcal{J}\times\mathcal{S}}$, allocations and compensation packages for each outsourcing firm $\{L_{os}, n_{os}, a_{os}, w_{os}\}_{s\in\mathcal{S}}$, reservation utility levels $\{\tilde{v}_s\}_{s\in\mathcal{S}}$, and outsourced labor prices $\{p_{os}\}_{s\in\mathcal{S}}$ that satisfy the following: the compensation packages for each skill level yield their respective reservation utility levels, so workers are indifferent between firms to supply labor to; given outsourced labor prices and the reservation utility levels each firm's allocation of labor and compensation packages solve their respective profit maximization problem; labor markets for in-house and outsourced labor clear,

$$\begin{aligned} n_{os} + \sum_j n_{js} &= N_s \quad \forall s \in \mathcal{S}, \\ \sum_j l_{js} &= L_s \quad \forall s \in \mathcal{S}. \end{aligned}$$

In the background, traditional firms produce the good that worker's consume. The medical care firm purchases this good and uses a constant returns to scale technology to transform c_m units of goods into $z_m c_m$ units of medical care. Following from the medical care firm's profit maximization problem, the price of medical care is pinned by an exogenous parameter, $p_m = \frac{1}{z_m}$, essentially making it exogenous. Hence, I treat the price of medical care as exogenous. An entrepreneur uses profits from traditional firms — caused by the fact their production technology is decreasing returns to scale — to purchase this good. The resource constraint for this good clears by Walras's Law and thus is unnecessary to include in the equilibrium definition.

4 Equilibrium Results

To simplify the discussion, I assume that the economy has only two skill levels. Without loss of generality, denote the skill level that has higher utility with an h for "high-skill", and denote the one with lower utility with an l for "low-skill".

Assumption 3. *Assume there are two skill levels with the same supplies of labor, but different demands due to the distribution of skill weights.*

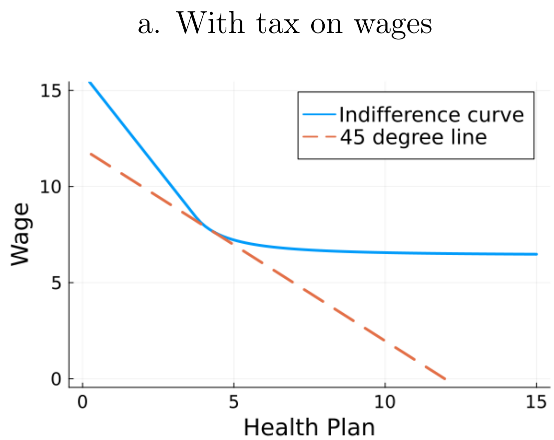
4.1 Optimal Compensation Packages and Labor Costs

Consider a firm that is minimizing the cost of a worker while offering them their reservation utility level. The cheapest compensation package $\{a_s^*, w_s^*\}$ solves

$$\{a_s^*, w_s^*\} = \underset{\{a,w\}\in R_+^2}{\operatorname{argmin}} \left\{a + w \mid v(a, w; p_m) \geq \tilde{v}_s\right\}.$$

In an economy with the tax-advantage on employer health plans, the cheapest compensation package is unique and its health plan is positive, $a_s^* > 0$. This can be see in panel a of figure 4 and follows from the fact workers want both types of goods and the tax on wages. In an economy without the tax advantage, their is not a single cheapest health plans. As seen in pabel b of figure 4, in such an economy, one of the cheapest compensation packages is the one with the health plan equal to zero.

Figure 4: Indifference Curves between Wages and Health Plans



Notes: Figures show examples of indifference curves. The blue line is an indifference curve between wages and health plan; all compensation packages on an indifference curve yield the same utility level. The dashed orange line is a 45 degree line that passes through the cheapest compensation package that is on the indifference curve. In panel a, the economy has a tax on wages. In panel b, the economy does not. In an economy with a tax on wages, the indifference curve has a unique compensation package that minimizes costs. Conversely, in an economy without a tax on wages there are multiple compensation packages that minimize costs.

The baseline economy has both the anti-discrimination laws and the tax-advantage of employer health plans. The tax-advantage causes the cost-minimizing health plans to be strictly positive $a_s^* > 0 \ \forall s$. When choosing compensation packages, traditional firms can choose from the set of compensation packages that satisfy the reservation utility constraints (3). However, the anti-discrimination constraint (2) and the fact they demand multiple skill levels of labor prevents traditional firms from offering all skills their cheapest compensation package. Following from the optimality conditions, traditional firms compromise and choose a health plan between the high- and low-skill workers' cost-minimizing health plans.

Lemma 1. *The cost-minimizing health plan of a traditional firm, $\hat{a}_j$, is approximately equal to a weighted average of each skill's cost-minimizing health plan a_s^*:*

$$\hat{a}_j \approx \sum_s \frac{\omega_{js}}{\sum_{s'} \omega_{js'}} a_s^*, \tag{5}$$

$$\omega_{js} = \underbrace{\varphi_{js}}_{\substack{\textit{skill}\\ \textit{weight}}} \times \underbrace{\frac{(w_{js} + a_j)n_{js}}{(w_{js} + a_j)n_{js} + p_{os}l_{js}}}_{\substack{\textit{share of s-expenditure}\\ \textit{on in-house labor}}} \times \underbrace{\frac{\partial^2}{\partial a^2}\Big(\log\big(a + w(a; \tilde{v}_s, p_m)\big)\Big)\Big|_{a=a_s^*}}_{\substack{\textit{curvature of the cost of the}\\ \textit{in-house compensation package}}},$$

where $w(a; \tilde{v}_s, p_m) = min_{w \in R_+}\big(w \mid v(w, a; p_m) \geq \tilde{v}_s\big)$.

Proof. See Appendix A.4 □

For any traditional firm j, the weight on a_s^* is increasing with (a) the s-skill weight, φ_{js}, (b) the share of skill s labor expenditure that is on in-house labor (as opposed to outsourced labor), and (c) the curvature of the price of in-house labor at a_s^*. The intuition for (a) and (b) is that as the quantity of in-house s-skill labor increases, the firm moves its health plan towards the health plan that minimizes the insourcing price of s-skill labor. The intuition for (c) is that as the cost of deviating from a_s^* increases, the firm moves its health plan closer to a_s^*.

On the other hand, in the baseline economy the outsourcing firms offer the cheapest compensation packages. Because they demand only a single skill type, the outsourcing firm is unaffected by the anti-discrimination laws and offers the cost-minimizing compensation package. This provides intuition for how outsourcing firms can exist in a competitive equilibrium; they purchase labor at a lower cost than the traditional firms, then sell that labor to the traditional firms. Further, because of their constant returns to scale technology, their labor costs pin the price of outsourced labor,

$$p_{os} = w_{os} + a_{os} = w_s^* + a_s^*. \tag{6}$$

4.2 Outsourcing Dynamics

The traditional firm's optimality conditions imply that the relative quantity of outsourced labor is proportional to the inverse of its relative price:

$$\underbrace{\frac{l_{js}}{n_{js}}}_{\substack{\text{outsourced over}\\ \text{in-house labor}}} = \alpha_s \underbrace{\left(\frac{w_{js} + a_{js}}{p_{os}}\right)^{\theta_s}}_{\substack{\text{compensation costs relative}\\ \text{to the price of outsourced labor}}}. \tag{7}$$

This expression is intuitive: an increase in the relative price of outsourced labor decreases the relative quantity, with the amount depending on the elasticity of substitution between in-house and outsourced labor θ_s. Plugging equation (6) into (7) yields

$$\underbrace{\frac{l_{js}}{n_{js}}}_{\substack{\text{outsourced over}\\ \text{in-house labor}}} = \alpha_s \underbrace{\left(\frac{w_{js}+a_{js}}{w_{os}+a_{os}}\right)^{\theta_s}}_{\substack{\text{compensation costs relative}\\ \text{to the outsourcing firm's}}}. \tag{8}$$

Hence, the relative quantity of outsourced labor at firm j depends on firm j's compensation costs relative to the outsourcing firm's.

When the anti-discrimination constraint is removed, both the traditional and outsourcing firms offer the cheapest compensation packages that yield the reservation utility level. Hence, the compensation cost ratio equals one, and the relative quantity of outsourced labor is pinned by an exogeneous parameter,

$$\frac{l_{js}}{n_{js}} = \alpha_{js}.$$

Thus, without the anti-discrimination laws, changes in the price of medical care or other aggregate variables like the reservation utility levels do not increase outsourcing. The intuition for this result is that in an economy without the anti-discrimination laws, changes in the price of medical care or other trends affect traditional and outsourcing firms identically.

When the tax-advantage of employer health plans is removed, one of the cheapest ways to yield the reservation utility levels is to only offer wages. In other words, from the firm's perspective their is no reason to offer health plans, and the anti-discrimination constraint does not affect the firms. In this economy, the traditional and outsourcing firms have the same compensation costs, and the relative quantity of outsourced labor is pinned by the same exogeneous parameter. Again, like the economy without the anti-discrimination laws, in an economy without the tax advantage of employer health plans, changes in the price of medical care or other aggregate variables like the reservation utility levels do not cause outsourcing to increase.

Consider the baseline economy with both the tax advantage and anti-discrimination laws. Following from equations (8) and (5), the relative quantity of low-skill outsourced labor is approximately equal to

$$\log\left(\frac{\hat{l}_{jl}}{\hat{n}_{jl}}\right) \approx \log\left(\alpha_{jl}\right) + \theta_l \log\left(1 + \underbrace{\left(\frac{\partial^2 w\left(a,\tilde{v}_l\right)}{\partial a^2}\bigg|_{a=a_l^*}\right)}_{\substack{\text{Sensitivity of wage to} \\ \text{change in health plan}}} \times \underbrace{\left(\frac{\omega_{hj}}{\omega_{lj}+\omega_{hj}}\right)^2}_{\substack{\text{Weight on} \\ \text{high skill}}} \times \underbrace{\left(a_h^* - a_l^*\right)^2}_{\substack{\text{Distance between cost-} \\ \text{minimizing plans}}} \times \underbrace{\frac{1}{w_l^* + a_l^*}}_{\substack{\text{cheapest low-skill} \\ \text{compensation cost}}}\right).$$

where $w(a,\tilde{v}_s) = min_{w\in R_+}\big(w \mid v(a,w;p_m) \geq \tilde{v}_s\big)$.

Qualitatively an increase in the price of medical care can increase low-skill domestic outsourcing by increasing the distance between the high- and low-skill cost minimizing plans. Whether this happens depends on the functional form of the utility function, namely the sign on the cross derivative $\frac{\partial^2 a_s^*}{\partial p_m \partial \tilde{v}_s}$. If $\frac{\partial^2 a_s^*}{\partial p_m \partial \tilde{v}_s} > 0$, then an increase in the price of medical care increases a_h^* more than it increases a_l^*, spreading out the health plans and increasing $a_h^* - a_l^*$.

Qualitatively an increase in the skill premium — the compensation high-skill workers make relative to low-skill workers — can also increase low-skill domestic outsourcing through two main channels. First is similar to that of the price of medical care; if the increase in utility of the high-skill worker also increases the level of medical care consumption they want, then the skill premium increase could increase low-skill domestic outsourcing. Whether this happens depends on the functional form of the utility function. The second channel is the weight on high-skill health plan in the firm's optimal health plan equation (5). Suppose that the skill premium increases due to an increase in the weight on high-skill labor φ_{jh} for some firm j. Then firm j increases its health plan as seen in equation (7) to decrease the cost of the high-skill worker, which consequently increases the relative cost of in-house low-skill labor. This increases the relative quantity of outsourced low-skill labor.

This mechanism can be directly tested with data on the cross section of firms. Optimality conditions imply that skill weights equal skill shares of labor expenditure,

$$\varphi_{js} = \frac{\text{Expenditure on } s\text{-skill labor}}{\text{Total expenditure on labor}}. \tag{9}$$

Hence, this mechanism implies that firms with relatively high share of their expenditure on high-skill labor also outsource a relatively high share of their low-skill labor. I formalize this mechanism in the following proposition.

Proposition 1. *Across firms there is a positive relationship between high-skill labor expenditure share* $\frac{X_{jh}}{X_j}$ *and the share of low-skill labor expenditure on outsourced workers* $\frac{p_{ol} l_{jl}}{(w_{jl}+a_j)n_{jl}+p_{ol} l_{jl}}$.

Proof. See appendix A.5 □

To sum up, over time an increase in the price of medical care or the skill premium can interact with the two tax features to increase low-skill outsourcing. This hypothesis is difficult to test over time due to data constraints. However, this mechanism also holds in the cross-section of industries, and thus the theory can be tested using cross-sectional industry data. The following section 5 does just that and finds empirical support for this mechanism.

5 Data and Calibration

The previous section showed that the across time predictions of the model can also be tested with cross-sectional data on employment, compensation packages, and expenditure on outsourced labor by industry by skill. To this end, I draw on publicly available, industry-level survey data from several sources. To map the firm-level theory to this data, I assume that firms within an industry all have identical skill weights, allowing them to be represented by a single firm. I then calibrate each representative firm with the most disaggregated industry data available. I focus on the year 2012 due to constraints in the underlying data.[9] The rest of this section details the underlying data used for each variable, then uses this data to validate proposition 1 from section 4, then extends and calibrates the model.

5.1 Data Sources

Data on employment and wages by skill by industry is drawn from the 2012 Occupation and Employment Wage Statistics (OEWS) data. This data has employment and wages by NAICS industry and granular 5-digit SOC occupation code.[10] I map occupation codes into

[9]Health plan expenditure is only available for a wide range of industries between 2012-2017, while measures of outsourcing expenditure are most detailed in 2012.

[10]Some examples of 5-digit level occupation codes are "Podiatrists," "Traffic Technicians," and "Line Installers and Repairers."

three skill groups (low, medium, and high) equally sized in employment based on their average economy-wide earnings. For each industry, in-house s-skill labor n_{js} is the sum of employment in occupations of skill level s and wages w_{js} is the employee-weighted average wage for occupations of skill level s.

Data on health plans by industry is drawn from the Annual Survey of Manufacturers (ASM) and the Services Annual Survey (SAS). The ASM and SAS are surveys of manufacturing and service industries with data on health plan expenditures by industry. Because of the anti-discrimination laws and how the majority of employer premium variance is between firm as discussed in section 2, I assume that all workers within an industry receive the same health plan. Health plan expenditure per worker a_j is taken directly from the ASM and SAS. (SAS does not have employee counts, so I use employment from County Business Patterns for the service industries, while appropriately rescaling variables across data sets.)

Measures of outsourced labor expenditure by skill by industry are drawn from the 2012 BEA's Input-Output (IO) data.[11][12] The IO table has each industry's expenditure on outputs from all other industries. I assume that expenditures on the industries "Professional Services" (NAICS 541) and "Administrative Services" (NAICS 561) are expenditures on outsourced labor. Establishments in NAICS 561 supply firms with low-skill outsourced labor, like janitorial, security guard, and temporary help services, while establishments in NAICS 541 supply firms with high-skill outsourced labor, like legal, accounting, and management consulting services. Further, a large share of these industries' outputs are used by firms; in 2020, 95% and 59% of NAICS 561 and 541's output were used as intermediate inputs. To calculate outsourcing expenditure by skill by industry, $p_{os}l_{js}$, I map each 4-digit sub-industry of 541 and 561 to skill levels using their skill-level employment shares (from the OEWS). Specifically, I map expenditure on each 4-digit industry to the single level that has the highest employment share in that industry. For example, the most employed skill level in the janitorial service industry is low-skill, so I consider all expenditure on janitorial services to be expenditure on low-skill outsourced labor. For robustness, I also map each 4-digit sub-industry to multiple skill levels by multiplying expenditure by employment skill shares, and the results are similar.

Altogether, the cross-section has data on in-house employment n_{js}, wages w_{js}, and

[11] The BEA has several different Input-Output tables, varying by expenditure definition; I use the "Use Tables/Before Redefinitions/Producer Value". I use Before Redefinitions for consistent classification with the BEA's historical tables.

[12] The year 2012, at its most disaggregate level, has 405 industries, as opposed to 71 in most other years.

outsourcing expenditure $p_{os}l_{js}$ by skill by industry, and health plan a_j by industry for 128 industries. Industries are defined at the most detailed level possible given the availability in the underlying survey data. Every manufacturing industry is defined at the 4-digit level. Service industries are defined at the 2-, 3-, or 4-digit level.

5.2 Validating the Model's Cross-Sectional Predictions

As stated by proposition 1, across firms there are positive relationship between high-skill labor expenditure share, health plan expenditure per worker a_j, and the outsourcing share of low-skill labor expenditure. To test this predictions I regress these variables on each other, as seen in table 1, and I find strong empirical support for this proposition. As seen in column 1, a 1 pp increase in the high-skill share increases health plan expenditure per employee by 0.849 percent. Column 2 shows that a 1 percent increase in a_j is associated with a 0.197 pp increase in the low-skill outsourcing share. Column 3 shows that a 1 pp increase in the high skill share is associated with a 0.973 pp increase in the low-skill outsourcing share. All coefficients are large, positive, and statistically significant.

In the model, the reason low-skill outsourcing increases with skill-intensity is entirely due to health plans; an increase in φ_{jh} causes the firm to demand more high-skill labor, so they increase a_j to decrease their costs, which consequently increases the relative price of in-house low-skill labor $w_{jl} + a_j$. However, as seen in column 4 of table 1, skill-intensity still has a statistically significant effect on the low-skill outsourcing share even with a_j included in the regression. Hence in the data, skill-intensive industries outsource more low-skill workers for other reasons besides the effect of health plans.

One explanation for this is that benefits other than health plans must also be shared across all in-house workers. The cost of these benefits could be positively associated with the high-skill share in the regression and the low-skill outsourcing share, biasing the estimate on the high-skill share upwards. Another possible explanation is that skill-intensive firms invest in technology over time that decreases the cost of low-skill labor. Through the lens of the model, this is interpreted as a positive correlation between the high-skill weight φ_{jh} and the low-skill outsourcing weight α_{jl}.

Table 1: Cross-Sectional Regressions

	(1) log a_j	(2) $\frac{\text{low-skill outsourcing exp}}{\text{low-skill labor exp}}$	(3) $\frac{\text{low-skill outsourcing exp}}{\text{low-skill labor exp}}$	(4) $\frac{\text{low-skill outsourcing exp}}{\text{low-skill labor exp}}$
$\frac{\text{high-skill exp}}{\text{total labor exp}}$	0.849***		0.973***	0.867***
	(0.262)		(0.118)	(0.122)
log a_j		0.197***		0.124***
		(0.0339)		(0.0276)
Observations	128	128	128	128
R^2	0.071	0.153	0.371	0.427

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.3 Extending the model

Before calibrating the model I make several assumptions. I assume that the worker's utility function is CES,

$$u(c, m) = (\psi c^{1-1/\eta} + (1-\psi)(m)^{1-1/\eta})^{\eta/(\eta-1)},$$

where η is the elasticity of substitution between wages and health plans, and ψ is a weight. A CES utility function captures a key features of the data; in the time series, rising medical prices are accompanied by a rising medical expenditure share. The CES utility function with complementary between medical care and goods is consistent with this empirical fact. I also add a parameter to the worker's budget constraint to increase the cost of medical care that the worker pays for out of pocket, γ:

$$c + p_m m(1+\gamma) \leq w(1-T).$$

Hence, firms find it optimal to offer health plans because of γ and the difference in tax treatment.

I assume their is only one traditional firm, which simplifies calibration. As this paper is focused on low-skill domestic outsourcing, I shut off high and medium skill outsourcing by replacing the CES formulation with a CRS one. As before, their are only three skill levels: low, medium, and high.

5.4 Calibration

My calibration strategy has three steps. First, I normalize a subset of parameters. Second, I exogenously assign all but one of the remaining parameters. Finally, I calibrate the remaining parameter using a minimum distance estimator.

First, I normalize three parameters. I normalize the price of medical care to 1 in the baseline model. In a counterfactual, I change this price to measure its effect on outsourcing. I normalize the efficiency of the traditional firm z and the mass of workers N to arbitrary amounts.

Second, I exogenously assign several parameters. I set the share of each type of worker to be equal, $N_s = \frac{1}{3}N \; \forall s \in \{l, m, h\}$, as I set each skill level to have equal levels of employment when mapping the data to the model. I set the returns to scale of the traditional firm, ν, to 0.95. I set the parameter γ so that workers pay 10 percent more for medical care out-of-pocket. To calibrate the traditional firm's skill weights, I use its optimally condition (9) to set skill weights equal to skill expenditure shares.

To calibrate the utility function parameters (the weight and elasticity of substitution) I use a time series on the price of medical care and health plan expenditure shares. I set up a simple representative household problem with a CES utility function. Optimality conditions yield a regression equation that relates relative expenditure to relative prices. Taking this equation to data on expenditures and prices yields an estimate of $\eta = 0.11$ and $\psi = 0.81$. Appendix section A.6 has more detail.

The last parameter I estimate externally is the within-skill elasticity of substitution between in-house and outsourced labor, θ_s. Manipulating equation (7) yields

$$\underbrace{\log \frac{p_{ol} l_{jl}}{n_{jl}}}_{\substack{\text{outsourcing expenditure} \\ \div \text{ in-house employees}}} = \theta_l \log(\underbrace{w_{jl} + a_j}_{\substack{\text{compensation} \\ \text{costs}}}) + \underbrace{(1-\theta_l)\log p_{ol}}_{\text{constant}} + \underbrace{\log \alpha_{jl}}_{\text{shifter}} + \underbrace{\epsilon_{js}}_{\substack{\text{error} \\ \text{term}}}$$

Hence, the parameter θ_l can be estimated with the cross-sectional data. The only complication is the parameter α_{jl}, which acts as an exogenous shifter; in words, some industries are inherently better at outsourcing low-skill workers. Omitting this parameter biases my estimate of θ_l upwards. If an industry has a high α_{jl}, holding all else equal, they outsource a relatively high share of low-skill labor, which increases the dependent variable. This also allows them to increase a_j to decrease their cost of in-house high skill labor, which increases the cost of low-skill labor, $w_{jl} + a_j$. Hence, the parameter α_{jl} is positively correlated with both the dependent variable and the key independent variable. Hence, omitting it will bias my estimate of θ_l upwards.

To control for this parameter, I include controls for high- and medium-skill outsourcing expenditure per employee and IT expenditure per employee. The regression I take to the data is

$$\log \frac{p_{ol} l_{jl}}{n_{jl}} = \theta_l \log(w_{jl} + a_j) + \beta_0 + \beta_1 X_j + \epsilon_j. \tag{10}$$

where X_j includes logged per worker values of IT expenditure and non-low-skill outsourcing.[13] I run the regression on cross-sectional industry data. The variable of interest, θ_l, is identified by how much variance in the price of in-house labor can explain variance in the expenditure on outsourced labor relative to the quantity of in-house labor.

The results of this regression are in table 2. I find that the elasticity of substitution θ_l is large, positive, and statistically significant. The first column of table 2 corresponds to the regression with no controls. I find that a 1 percent increase in the price of in-house low-skill labor increases the low-skill outsourcing expenditure per low-skill employee by 5.509 percent. With all controls in the third column, this estimate decreases to 3.258. All estimates of θ_l are statistically significant. I use the estimate with controls, $\theta_l = 3.258$, in my calibration.

Table 2: Elasticity of Substitution, In-house vs Outsourced Low-Skill Labor

	(1)	(2)	(3)
	Low-skill out expnd per low-skill employee		
Low-skill compensation $w_{jl} + a_j$	5.509***	4.546***	3.258***
	(0.746)	(0.578)	(0.500)
IT expnd per employee		1.036***	0.400***
		(0.108)	(0.120)
Non-low-skill out expnd per employee			0.828***
			(0.105)
Observations	127	125	125
R^2	0.304	0.600	0.735

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: The table shows the regression results from equation (10). All variables are in logs.

[13] IT Expenditure is technically “communication services expenditure".

Table 3: Summary of Parameters and Moments

Parameter	Description	Value	Moment	Model	Data
Normalized					
p_m	Price of medical care				
z	Efficiency				
N	Mass of workers				
External					
N_s	Mass of workers of skill s	$\frac{1}{3}N$			
η	Elast. of subs., goods vs medical care	0.11			
ψ	Weight on goods in utility	0.81			
γ	% more workers pay for medical care out of pocket	0.1			
ν	Returns to scale, traditional firms	0.95			
θ_l	Elast. of subs., low-skill, in vs outsourced	3.26			
φ_{js}	Skill weights		Expenditure shares		
MDE					
α_l	Weight on low-skill outsourced labor in production	0.08	% of low-skill outsourced	0.14	0.14

Notes: The table shows the parameter values and matched moments from the main model specification. The model is calibrated to the year 2012.

Last, I calibrate the last remaining parameter, α_s, using a minimum distance estimator (MDE). I set the skill-s weight on outsourced labor in the firm's production function, α_s, to match the percent of s-skill workers that are outsourced. The pairing between this moment and this parameter is direct; an increase in α_s directly increases the percentage of outsourced s-skill workers. I estimate the quantity of s-skill outsourced workers in year t as the number of s-skill workers in “Administration and Support Services" (NAICS 561) adjusting by the share of the industry's output that is used as intermediate inputs:

$$\text{Outsourced workers}_{st} = n_{561,t} \times \frac{n_{561,s,2012}}{n_{561,2012}} \times \frac{\text{Output used an intermediate inputs}}{\text{Total output}}_{561,t}$$

where the skill shares from 2012 are used across all years because the underlying data used to calculate these shares, the OEWS data, is not consistently offered before 1997. Table 3 summarizes the targeted moments and parameter estimates. The model successfully matches the share of low-skill outsourced workers.

6 Quantitative Exercises

With the calibrated model in hand I perform multiple quantitative exercise. First is an accounting exercise that contributes the change in outsourcing to the rise in the price of medical care and the rising skill premium. Second I perform policy counterfactuals and measure the welfare and distributional effects of changing the tax laws.

Table 4: Accounting for the Increase in Low-Skill Domestic Outsourcing

	Δ p.p.	% explained
Data:	10.7	
Model:		
Skill premium ↑ alone	0	0
Price of medical care ↑ alone	0	0
Laws alone	2.6	24.1
Laws + skill premium ↑	2.6	24.2
Laws + price of medical care ↑	6.0	56.1
Laws + skill premium ↑ + price of medical care ↑	6.0	56.3

Notes: The table shows the share of the percentage point change in low-skill outsourcing between 1975-2012, the amount of this change explained by the model counterfactual, and outsourcing rates in several counterfactual economies.

6.1 Accounting for the Rise of Low-Skill Domestic Outsourcing

To account for the ris of low-skill domestic outsourcing, I model the year 1975 by 1) decreasing the price of medical care to its 1975 level, 2) decreasing the high-skill weight φ_{j5} so that the change in high- to low- wage ratio $\frac{E[w_h]}{E[w_l]}$ matches that in the data between 1975 and 2012, which is calculated using ACS data, and 3) removing the anti-discrimination laws. Then one-by-one and in combination I add back each feature, comparing outsourcing rates in the different equilibriums.

Table 5 shows the results. As expected from the discussion from section 4, the two trends have no effect on outsourcing in an economy without both laws. Adding the laws alone explains 24 percent of the increase in low-skill domestic outsourcing seen in the data. The laws plus the increase in the price of medical care explains 56 percent of the increase seen in the data. I conclude that the rising price of medical care interacting with the laws was a major driver of the increase in low-skill domestic outsourcing.

Table 5 also shows the effect of the rising skill premium on the increase in low-skill domestic outsourcing. I find that it has no economic effect on outsourcing. Intuitively, given an increase in utility for high skill workers, the traditional firm finds it optimal to increase wages as opposed to increasing health plans. Because the firm does not increase its health plan, the price of low skill in house workers does not increase so low skill domestic outsourcing does not increase.

Table 5: Policy Counterfactuals: Changes in Welfare Relative to Baseline Economy

	Skill		
	Low	Medium	High
i. Remove Anti-Discrimination Laws			
%Δ Utility v_s	19.2	0.4	9.8
%Δ Wage $E[w_{js}]$	25.6	-0.8	-23.9
%Δ Health Plan $E[a_{js}]$	-20.0	2.1	104.6
ii. Remove Tax Advantage of Employer Health Plan			
%Δ Utility v_s	15.8	-3.9	3.7
%Δ Wage $E[w_{js}]$	8.9	8.3	3.2
%Δ Health Plan $E[a_{js}]$	-8.5	-13.5	-13.5

Notes: The table shows the change in utility, mean wage, and mean health plan by skill level for two counterfactual economies relative to the baseline economy. Panel i has the changes relative to the baseline for an economy without the anti-discrimination laws. Panel ii has that for an economy without the tax advantage on employer health plans. Specifically, this economy has a tax on health plans which is equal to that on wages, and the tax rate is set so that tax revenue is equal to that in the baseline economy.

6.2 Policy Counterfactuals: Changing the Tax Code

Panel i of Table 5 displays changes in utility, mean wages, and mean health plans for each skill level upon removing the anti-discrimination laws from the baseline 2012 model. The table shows that removing the anti-discrimination laws increases welfare for all workers. The low- and high-skill worker's utility increases by 19.3% and 9.9%. Upon removing the anti-discrimination laws, the traditional firm is able to offer each skill level their cost-minimizing compensation package. This decreases the price of all types of workers, which increases the traditional firm's demand for each type of worker. This increases their utility levels; the utility of the low-skill workers increases by almost 20 percent, while that for the high-skill workers increases by almost 10 percent. The low-skill worker gets a large decrease in their health plan and a large increase in their wages. Symmetrically, the high-skill workers get a large decrease in their wage and a large increase in their health plan. Panel ii of Table 5 displays changes in utility, mean wages, and mean health plans for each skill level upon removing the tax advantage of employer health plans from the baseline model. Specifically, I add a tax rate to health plans that is equal to that on wages, and I decrease the level of these taxes to keep tax revenue the same as it was in the baseline economy. The table shows that removing the tax advantage increases the utility of low-skill

Table 6: Inequality in the Baseline and Counterfactual Economies

	Ratio, high- to low-skill	
Economy	Utility $\frac{v_h}{v_l}$	Wage $E[\frac{w_{jh}}{w_{jl}}]$
Baseline	3.1	4.8
Remove anti-discrimination laws	2.9	2.9
Remove health plan tax advantage	2.8	4.5

The table shows the change in the wages and utility of the high-skill workers relative to that of the low-skill, for the baseline economy and economies without the tax features.

workers by almost 16 percent. The logic is that without the tax advantage, the cost minimizing health plans for each skill level all decrease and move closer together. This makes the anti-discrimination law less costly, and the price of the low-skill worker decreases, which in turn increases their demand and utility. High-skill workers experience a 3.7 percent increase in their utility. Meanwhile, medium skill workers see a 3.8 percent decrease in their utility.

Table 6 displays measures of inequality for the baseline economy and the resulting economy after removing either law. In the baseline economy, the high-skill workers make 4.8 time the wage rate of the low-skill workers. Removing the anti-discrimination laws decreases the wage ratio to 2.9. Hence, without the anti-discrimination laws, the traditional firm increases the health plan and decreases the wage paid to high-skill workers, and this decreases the wage gap between high and low-skill workers. However, the utility ratio does not change much between the baseline economy, where it is 3.1, and that without the anti-discrimination laws, where it is 2.9. Hence, while wages change a lot, health plans also change in a way that does not change the utility ratio much. Removing the tax advantage of employer health plans decreases the utility ratio and the mean wage ratio.

7 Conclusion

I create a new theory that features firms that choose which workers to outsource and what compensation packages to offer. Qualitatively, I find that a rising price of medical care or rising skill premium can increase low-skill domestic outsourcing by interacting with two features of US policy. First is the tax advantage of employer health plans. Second are anti-discrimination laws. By a similar mechanism, more skill-intensive firms are more likely to outsource low-skill positions. I find empirical support for this predictions. Using the calibrated model I find that the price of medical care interacting with the health plan laws was responsible for over 50 percent of the increase in low-skill outsourcing seen in the data. Conversely, the rising skill premium was not a driver of the trend.

This is the first paper to quantitatively measure the effect of the rising price of medical care, skill biased technical change on domestic outsourcing. Further, compared to the literature, the model can explain a relatively high amount of the increase in low-skill domestic outsourcing.[14] While my theory explains the phenomena of low-skill outsourcing, it does not explain that of high-skill outsourcing. The driver of high-skill domestic outsourcing is an open question that I leave to future researchers.

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[14] Autor (2003) finds that the erosion of the employment-at-will doctrine explains 20% of the growth of employment in the temporary help services industry between 1973 and 1995. To the best of my knowledge, this is the only paper that quantifies an explanation of the trend.

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A Appendix

A.1 Domestic outsourcing in the US since 1975

This section documents the increase in domestic outsourcing since 1980 using industry-level data. For my analysis, I focus on the 1975–2020 period because the relevant health plan legislation came into effect in 1980. I also focus on the private sector. I use two data sources: input-output data from the BEA and harmonized County Business Patterns employment data from Eckert et al. (2021), who use crosswalks to provide a consistent employment series at the country-industry level.

As is common in the literature, I use industry classification to identify outsourced labor.[15] I designate all sub-industries with 3-digit NAICS codes 561, "Administrative and Support Services," and 541, "Professional, Scientific, and Technical Services," as *outsourcing industries*. Firms in NAICS 561 supply firms with low-skill outsourced labor, are commonly discussed in the domestic outsourcing literature, and include janitorial service firms, security guard service firms, temporary help services, and other business support services.[16] In 2020, 94% of this industry's output was used as intermediate inputs by firms, as opposed to final consumption. On the other hand, firms in NAICS 541 supply firms with high-skill outsourced labor, like legal services, accounting services, and management consulting services. In 2020 58% of this industry's output was used as intermediate inputs.[17] Table 7 lists each 3-digit industry's sub-industries and with their growth over the past 40 years. Employment in all outsourcing industries grew by 9.3 percentage points, from 6.4% in 1980 to 15.7% in 2015.

Which industries, if any, increased their use of outsourced labor? If services, on average, use more outsourced labor than manufacturing, then the shift of economic activity towards services would mechanically increase domestic outsourcing. I find that this is not the case. I define the *outsourced labor share* as the share of total output paid to intermediate inputs from labor-service industries. The change in outsourced labor share between time t and τ is

$$\Delta s_{t,\tau} = \sum_{j \in J} \underbrace{\bar{\omega}_{j,t,\tau} \Delta l_{j,t,\tau}}_{\text{Within-industry}} + \underbrace{\Delta \omega_{j,t,\tau} \bar{s}_{j,t,\tau}}_{\text{between-industry}}$$

[15]See Dube and Kaplan (2010) or Dorn et al. (2018).

[16]Drenik et al. (2023) analyzes the effect of employment in a temporary help agency on wages. Dube and Kaplan (2010) does the same for the employment of janitors and security guards in business service firms.

[17]The data used in this and the preceeding calculation is the BEA's Use Tables.

Table 7: Employment By Outsourcing Industry, 1980-2015

NAICS Code	Industry Title	Share of Total Private Employment 1980	2015	Change, pp
541, 561	Total	6.4	15.8	9.3
541	Professional, Scientific, and Technical Services	4.0	7.1	3.1
5411	Legal Services	0.7	0.9	0.2
5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	0.5	1.2	0.6
5413	Architectural, Engineering, and Related Services	0.8	1.2	0.3
5414	Specialized Design Services	0.1	0.1	0.0
5415	Computer Systems Design and Related Services	0.2	1.4	1.2
5416	Management, Scientific, and Technical Consulting Services	0.2	1.0	0.7
54161	Management Consulting Services	0.2	0.8	0.6
5417	Scientific Research and Development Services	0.8	0.6	-0.2
5418	Advertising, Public Relations, and Related Services	0.4	0.4	0.0
5419	Other Professional, Scientific, and Technical Services	0.3	0.5	0.2
561	Administrative and Support Services	2.4	8.7	6.2
5611	Office Administrative Services	0.1	0.4	0.3
5612	Facilities Support Services	0.0	0.2	0.2
5613	Employment Services	0.7	4.9	4.1
56131	Employment Placement Agencies and Executive Search Services	0.1	0.2	0.1
56132	Temporary Help Services	0.4	2.7	2.2
56133	Professional Employer Organizations	0.1	2.0	1.8
5614	Business Support Services	0.3	0.6	0.4
5615	Travel Arrangement and Reservation Services	0.2	0.2	0.0
5616	Investigation and Security Services	0.5	0.7	0.3
56161	Investigation, Guard, and Armored Car Services	0.2	0.6	0.4
56162	Security Systems Services	0.2	0.1	-0.1
5617	Services to Buildings and Dwellings	0.5	1.5	1.0
56172	Janitorial Services	0.3	0.8	0.5
5619	Other Support Services	0.2	0.2	0.1

The table shows the share of economy-wide private employment that is employed in the 3-digit NAICS codes 541 and 561 and their sub-industries. These industries typically supply firms with outsourced labor. Data is from Eckert et al. (2021).

where J is the set of all industries, $\omega_{j,t}$ and $s_{j,t}$ are industry j's share of total output and outsourced labor share at time t respectively, the over bar denotes the mean of the value at time t and τ, and Δ denotes the percentage point change between two time periods. Using BEA Use Table data where a majority of industries are defined at the 3-digit level, I find that between 1980 and 2021, the within component was responsible for 71.7% of the total increase in the outsourced labor share. Further, a similar pattern holds if expenditure on 541 or 561 is looked at individual, or if the decomposition is performed over smaller time-periods within the 1965 to 2020 period.

If manufacturing was responsible for a majority of the increase, then an explanation for the increase in outsourcing centered upon unions or worker power shows promise. However, the manufacturing sector saw a relatively small increase in its outsourced labor share. Table 8 shows the change in outsourced labor share by private sector between 1980 and 2020. Manufacturing's outsourced labor share increased by only 1 percentage point between 1980 and 2020, which was less than that of 14 sectors and more than only 4 sectors. Because manufacturing historically had the strongest and highest concentration of unions, this is evidence against the hypothesis that domestic outsourcing is driven by firms using it to prevent workers from unionizing or diminish workers' bargaining power.

A.2 Employer health plans

In the US, two of the most common types of health insurance plans are self-funded plans and cafeteria plans. Self-funded plans are plans in which the employer assumes direct financial responsibility for the costs of enrollees' medical claims.[18] In 2021, 64% percent of employees with employer-provided health plans were covered by self-funded plans.[19]

Cafeteria plans are plans in which employees can choose between receiving their compensation from the plans in cash or as a benefit; if taken as a benefit, the compensation is not taxed.[20] Cafeteria plans are also common; in 2006, 49% percent of all workers had access to some type of cafeteria health plan (Stolzfus (2007)).

Anti-discrimination tax laws constrain self-funded and cafeteria plans. These tax laws penalize employers that offer high-wage and low-wage employees different quality health

[18] Source: Kaiser Family Foundation Survey 2020. URL: https://www.kff.org/report-section/ehbs-2020-section-10-plan-funding/

[19] Source: Kaiser Family Foundation Survey 2021. URL: https://www.kff.org/report-section/ehbs-2021-section-10-plan-funding/

[20] Source: Society of HR Management. URL: https://www.shrm.org/resourcesandtools/tools-and-samples/toolkits/pages/understanding-section-125-cafeteria-plans.aspx

Table 8: Outsourced Labor Share by Sector, 1980-2020

NAICS	Sector	1980	2020	Change, pp
51	Information	2.5	13.6	11.1
56	Admin., Support, and Waste Management	4.4	14.7	10.3
22	Utilities	0.9	7.6	6.7
55	Management of Companies and Enterprises	8.8	15.3	6.4
53	Real Estate and Rental and Leasing	1.8	8.0	6.2
54	Professional, Scientific, and Technical Services	8.2	14.3	6.1
62	Health Care and Social Assistance	3.8	9.0	5.2
48-49	Transportation and Warehousing	1.9	6.7	4.8
21	Mining, Quarrying, Oil and Gas Extraction	1.1	5.7	4.6
42	Wholesale Trade	5.8	9.6	3.9
52	Finance and Insurance	4.4	7.8	3.3
72	Accommodation and Food Services	3.7	6.3	2.5
81	Other Services (except Public Administration)	4.0	6.1	2.1
44-45	Retail Trade	7.8	9.6	1.8
31-33	Manufacturing	1.8	3.1	1.3
11	Agriculture, Forestry, Fishing and Hunting	0.4	0.8	0.3
23	Construction	6.6	6.5	-0.1
71	Arts, Entertainment, and Recreation	6.1	5.9	-0.1
61	Educational Services	4.7	3.3	-1.4

The table shows the change in the share of total output paid to intermediates inputs from the 3-digit NAICS industries 541 and 561 by sector. Underlying data is from the BEA's Use tables.

plans. Health plans are compensation that are generally not taxed. However, if anti-discrimination laws are violated, all compensation paid in the form of health plans is taxed. Under IRS Code section 105(h), self-funded benefit plans cannot discriminate in favor of the highest-paid 25 percent of all employees.[21] Under IRS Code section 125, cafeteria plans cannot discriminate in favor of highly compensated individuals.[22] Section 105(h) and 125 were both enacted in 1978.[23][24]

A.3 Microfoundation for the CES Aggregator

This section follows Eaton and Kortum (2002). For each skill level $s \in \mathcal{S}$ there is a unit measure of tasks $j \in [0, 1]$. These unit measures do not overlap; each task can be completed

[21] Source: Cornell Law School. URL: https://www.law.cornell.edu/uscode/text/26/105
[22] Source: Cornell Law School. URL: https://www.law.cornell.edu/uscode/text/26/125
[23] Source: Internal Revenue Service. URL: https://www.irs.gov/pub/irs-tege/lesson4.pdf
[24] Source: Internal Revenue Code. URL: www.govinfo.gov/content/pkg/USCODE-2010-title26

by only one skill level. I drop firm and skill subscripts from here on out for convenience. Workers are either in-house or outsourced. I call a worker's employment status its type.

The efficiency of type i workers in producing a unit of task j is $z_i(j)$. Hence

$$Q_i(j) = n_i(j) * z_i(j).$$

With CRS, the price of a unit of task j from workers of type i is $p_i(j) = \left(\frac{c_i}{z_i(j)}\right)$, where c_i is the input cost for workers of type i. For in-house workers, $c_{in} = (w + a)$, and for outsourced workers $c_{out} = p_o$. Firm chooses to outsource task j if the price is lower.

Assume that task-level labor $Q(j)$ is aggregated in a CES fashion to yield total labor,

$$\mathbf{n} = \left(\int_0^1 Q(j)^{\frac{\sigma-1}{\sigma}} dj\right)^{\frac{\sigma}{\sigma-1}}.$$

where $Q(j) = \sum_i n_i(j) * z_i(j)$.

Assume efficiency of type i workers for task j $z_i(j)$ is the realization of a random variable z_i drawn independently for each j from a type specific discribution $F_i(z)$. Assume that this distribution is a Frechet distribution,

$$F_i(z) = e^{-T_i z^{-\psi}}$$

where $T_i > 0$ and $\psi > 1$. Following Eaton and Kortum (2002), assuming that the efficiencies are pulled from a Frechet distribution yields that the price index for labor $\mathbf{n}$ is

$$q_n = \gamma[\sum_i T_i c_i^{-\psi}]^{-1/\psi},$$

where $\gamma = \left[\Gamma\left(\frac{\psi+1-\sigma}{\psi}\right)\right]^{1/(1-\sigma)}$ is a constant (Γ is the Gamma function). The share of expenditure on type i workers is

$$\frac{X_i}{X} = \frac{T_i c_i^{-\psi}}{\sum_{i'} T_{i'} c_{i'}^{-\psi}}.$$

Thus, the expenditure shares and price index from the task-based set up match the model's main CES specification. To clearly see this, set parameters $\psi = \theta - 1$, $T_{in} = \gamma^{\psi}$, and $T_{out} = \alpha\gamma^{\psi}$.

A.4 Proof of Lemma 1

The traditional firm first order conditions (dropping the j subscript for convenience) are

$$\nu\varphi_s y = q_s \mathbf{n}_s \quad \forall s \tag{11}$$

$$\tilde{v}_s = u(w_s, a) \quad \forall s \tag{12}$$

$$\frac{\partial q_s}{\partial w_s}\mathbf{n}_s = \lambda_s \frac{\partial u_s}{\partial w_s} \quad \forall s \tag{13}$$

$$\sum_s \frac{\partial q_s}{\partial a}\mathbf{n}_s = \sum_s \lambda_s \frac{\partial u_s}{\partial a} \tag{14}$$

where $q_s = [(w_{js} + a_j)^{1-\theta_s} + \alpha p_{os}^{1-\theta_s}]^{\frac{1}{1-\theta_s}}$ is the price index of $\mathbf{n}_s$, and $u_s \equiv u(w_s, a)$.

Combine (14) and (13) to get

$$\sum_s (\frac{\partial q_s}{\partial a} - \frac{\partial u_s}{\partial a}\frac{\partial w_s}{\partial u_s}\frac{\partial q_s}{\partial w_s})\mathbf{n}_s = 0$$

$$\sum_s (\frac{\partial q_s}{\partial a}\frac{\partial w_s}{\partial q_s} - \frac{\partial u_s}{\partial a}\frac{\partial w_s}{\partial u_s})\mathbf{n}_s \frac{\partial q_s}{\partial w_s} = 0$$

$$\sum_s (\frac{\partial q_s}{\partial a}\frac{\partial w_s}{\partial q_s} - \frac{\partial u_s}{\partial a}\frac{\partial w_s}{\partial u_s})\mathbf{n}_s \frac{\partial q_s}{\partial w_s} = 0$$

$$\sum_s (1 - \frac{\partial u_s}{\partial a}\frac{\partial w_s}{\partial u_s})\mathbf{n}_s \frac{\partial q_s}{\partial w_s} = 0$$

By the chain rule

$$\frac{du_s}{da} = \frac{\partial u_s}{\partial a} + \frac{\partial u_s}{\partial w}\frac{\partial w}{\partial a} \tag{15}$$

By (12), $\frac{du_s}{da} = \frac{d\tilde{v}_s}{da} = 0$ since $\tilde{v}_s$ is a constant (an change in a (w) causes w (a) to change so that the utility level remains the same). Use this fact in (15) and rearrange to get

$$-\frac{\partial w_s}{\partial a} = \frac{\partial w}{\partial u_s}\frac{\partial u_s}{\partial a} \tag{16}$$

Now continue with the algebra

$$\sum_s (1 + \frac{\partial w_s}{\partial a})\mathbf{n}_s \frac{\partial q_s}{\partial w_s} = 0$$

$$\sum_s \frac{\partial a + w_s}{\partial a}\mathbf{n}_s \frac{\partial q_s}{\partial w_s} = 0$$

Use (11) to get

$$\sum_s \frac{\partial a + w_s}{\partial a} \varphi_s q_s^{-1} \frac{\partial q_s}{\partial w_s} = 0$$

$$\sum_s \frac{\partial a + w_s}{\partial a} \varphi_s \frac{(w_s + a)^{-\theta}}{(w_s + a)^{1-\theta} + \alpha p_s^{1-\theta}} = 0$$

$$\sum_s \frac{\partial \log(a + w_s)}{\partial a} \varphi_s \frac{(w_s + a)^{1-\theta}}{(w_s + a)^{1-\theta} + \alpha p_s^{1-\theta}} = 0$$

Following from (**??**), I get

$$\sum_s \frac{\partial \log(a + w_s)}{\partial a} \varphi_s \frac{(w_s + a) n_s}{(w_s + a) n_s + p_{os} l_s} = 0$$

Take a second order Taylor approximation of $\frac{\partial \log(a+w_s)}{\partial a}$ around a_s^* to get

$$\frac{\partial \log(a + w_s)}{\partial a} \approx \frac{\partial \log(a + w_s)}{\partial a}|_{a=a_s^*} + \frac{\partial^2 \log(a + w_s^*)}{\partial a^2}\Big|_{a=a_s^*}(a - a_s^*).$$

(I take the second order approximation as opposed to the first because $\frac{\partial \log(a+w_s)}{\partial a}|_{a=a_s^*} = 0$ by the fact a_s^* minimizes labor costs)

Plug in the taylor approximations and rearrange to get

$$a \approx \sum_s \frac{\varphi_s \times \frac{\partial^2 \log(a+w(a,\tilde{v}_s))}{\partial a^2}\Big|_{a=a_s^*} \times \frac{(w_s+a)n_s}{(w_s+a)n_s+p_{os}l_s}}{\sum_{s'} \varphi_{s'} \times \frac{\partial^2 \log(a+w(a,\tilde{v}_{s'}))}{\partial a^2}\Big|_{a=a_{s'}^*} \times \frac{(w_{s'}+a)n_{s'}}{(w_{s'}+a)n_{s'}+p_{ls'}l_{s'}}} a_s^*. \tag{17}$$

□

A.5 Proof of Proposition 1

By optimality condition (9), the share of expenditure on high-skill labor is equal to the high skill weight. Recall $\varphi_{jh} + \varphi_{jl} = 1$. Hence an increase in φ_{jh} decreases φ_{jl}.

Holding all else equal, by equation (5), an increase in φ_{jh} and a decrease in φ_{jl} increases a_j (assuming the effect of changes in φ_{js} on the in-house expenditure shares is second order to the effect on φ_{js} itself).

An increase in a_j increases the cost of the low-skill in-house worker $w_{jl} + a_j$ because it moves the firm farther away from the low-skill cost-minimizing package $\{w_l^*, a_l^*\}$. By 7, the share of low-skill labor expenditure on outsourced labor $\frac{p_{ol} l_{jl}}{(w_{jl}+a_j)n_{jl}+p_{ol}l_{jl}}$ increases.

Hence, as the share of labor expenditure on high-skill labor increases, so does φ_{jh}, which increases a_j, which increases $w_{jl} + a_j$, which increases the share of low-skill expenditure on outsourced labor, $\frac{p_{ol} l_{jl}}{(w_{jl}+a_j)n_{jl}+p_{ol}l_{jl}}$. □

A.6 Estimating the Utility Parameters

Set up a simple representative household problem.

$$\max_{c,m} \left(\psi c^{1-1/\eta} + (1-\psi)\, m^{1-1/\eta}\right)^{\frac{\eta}{\eta-1}} \;\; s.t. \; p_c c + p_m m \leq y$$

where c is non-medical care consumption, m is medical care consumption, p_x is the price of x, y is income, ψ is a weight and η is the elasticity of substitution. Optimality implies

$$\log\left(\frac{p_m m}{p_c c}\right) = (1-\eta)\log\left(\frac{p_m}{p_c}\right) + \eta \log\left(\frac{1-\psi}{\psi}\right)$$

The parameters η and ψ can be backed out from the coefficient and constant from the above regression. As data on changes in prices is readily available from CPIs, data on relative prices is not. Hence, I take a first difference of the previous equation to get

$$\Delta\log\left(\frac{p_m m}{p_c c}\right) = (1-\eta)\,\Delta\log\left(\frac{p_m}{p_c}\right) + \eta \log\left(\frac{1-\psi}{\psi}\right)$$

Data on relative prices and expenditure shares are from FRED. The above regression yields an estimate of η. The estimate of η and optimality conditions are used to back out ψ.