



CONGRESSIONAL BUDGET OFFICE

How CBO Models Firms' Behavior in HISIM2 in Its Baseline Budget Projections as of March 6, 2020

April 2020

In *Baseline Budget Projections as of March 6, 2020* (www.cbo.gov/publication/56268), CBO's estimates are based on the economic forecast the agency developed in January 2020. They do not account for changes to the nation's economic outlook and fiscal situation arising from the recent and rapidly evolving public health emergency related to the novel coronavirus.

CBO's Health Insurance Simulation Model, HISIM2

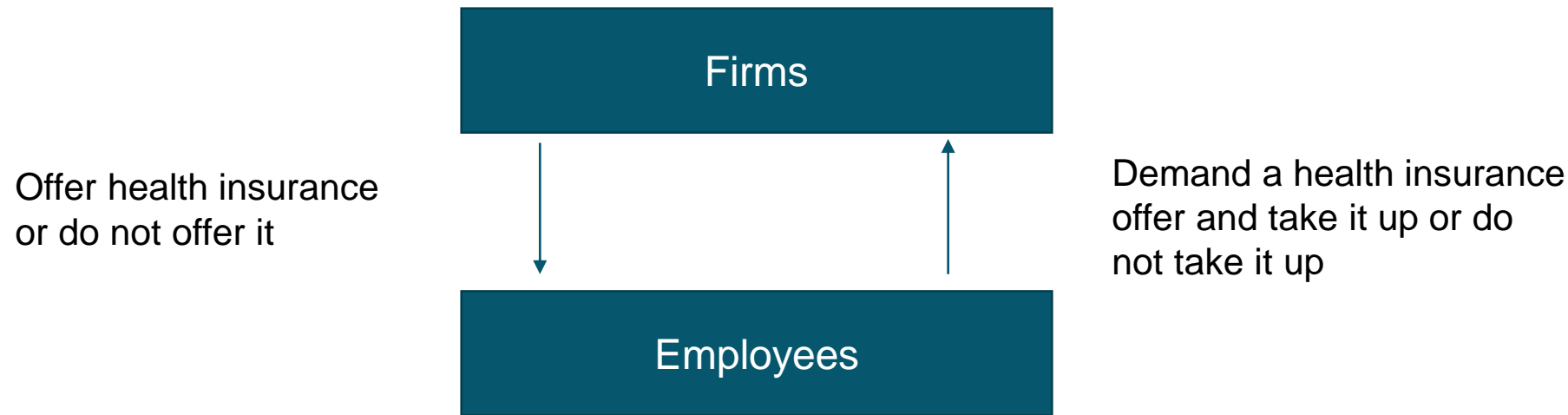
The Congressional Budget Office and the Joint Committee on Taxation use HISIM2 to estimate the major sources of health insurance coverage and associated premiums for the U.S. population under age 65.

The model is used in conjunction with other models (for example, those for related taxes, Medicaid, and Medicare) to develop baseline insurance coverage projections and their associated budgetary costs. It is also used to estimate the effects of proposed changes in policies that affect health insurance coverage.

CBO uses HISIM2 to model firms' decisions to offer health insurance as well as households' decisions to enroll in health insurance. Like all of CBO's models, HISIM2 is regularly updated. This slide deck describes the analytical methods used in HISIM2 to model firms' decisions in CBO's baseline budget projections as of March 6, 2020.

Interaction Between Firms and Employees in HISIM2

Firms decide whether to offer their employees health insurance and which plans to offer after weighing several factors: employees' demand for health insurance, the tax benefit of offering that insurance, the cost of switching plans from last year's choice, and the firms' unobserved preferences.



After considering the offers that firms have decided to make and the premium and cost-sharing characteristics of the offered plans, **employees** decide whether to take up employment-based insurance and what type of plan to enroll members of their household in.

Overview of Firms' Behavior in HISIM2

What Are Firms? Firms are synthetic decision-making units constructed to model employers' offer decisions.

What Decisions Do Firms Make? Firms determine whether to offer employment-based insurance and, if so, which type of plans to offer among the alternatives in their choice set.

How Do Firms Make Decisions? Firms make decisions by maximizing an objective function that depends on their employees' willingness to pay for health insurance, the tax benefit of offering employment-based insurance, the switching costs incurred by altering offer decisions from the previous year, and unobserved firm preferences. Firm decisions are deterministic.

Firms' Decisions About Compensating Employees

Firms' decisions about whether to offer health insurance are part of the choice of how to compensate employees. Although most employee compensation consists of wages, firms may offer compensation in other forms, such as health insurance or retirement benefits.

Firms may offer health insurance to compete for workers who want to be offered it. Employers that do not offer health insurance may lose workers to their competitors, especially in labor markets where workers have significant bargaining power.

Health insurance benefits are treated favorably by the tax system. Unlike wages, health insurance benefits are not usually subject to individual state and federal income taxes or employee and employer payroll taxes. In addition, employment-based insurance pools risks within groups of workers and their families and reduces the administrative costs of marketing insurance policies and collecting premiums.

Firms' Decisions About Compensating Employees (Continued)

Higher-income employees generally prefer to receive some of their compensation as health insurance to a greater extent than lower-income employees do. Employees who are subject to higher marginal tax rates benefit more from the tax system's favorable treatment of health insurance benefits. Furthermore, employees whose incomes are greater than 400 percent of the federal poverty guidelines are not eligible for subsidies for insurance obtained through the health insurance marketplaces.

Some employers can also reduce labor costs by offering insurance. Under the Affordable Care Act, employers that have at least 50 full-time-equivalent employees but do not offer health insurance coverage that meets certain standards may owe a penalty.

How Are Firms Constructed?

HISIM2 is based on the Current Population Survey (CPS), which identifies workers but does not provide information on their coworkers except for a total count. Creating synthetic firms allows CBO to use the CPS while leveraging tax data that do provide information on coworkers.

CBO constructs a synthetic firm for every wage and salary worker in the 2018 CPS (referencing earnings and age in calendar year 2017) by assigning a set of coworkers to that worker and imputing the characteristics of each type of plan the firm may offer.

HISIM2's base year for the baseline budget projections as of March 6, 2020, is calendar year 2017. Projections are made for each year through 2030, integrating data on insurance market outcomes from 2018 and 2019.

For details about how HISIM2 constructs synthetic firms, see Congressional Budget Office, *Modeling Employer Decisions With Synthetic Firms in HISIM2: New Methods and Data* (June 2019), www.cbo.gov/publication/55385.

For details about how CBO processes CPS data, see Jessica Banthin and others, *Sources and Preparation of Data Used in HISIM2—CBO's Health Insurance Simulation Model*, Working Paper 2019-04 (Congressional Budget Office, April 2019), www.cbo.gov/publication/55087.

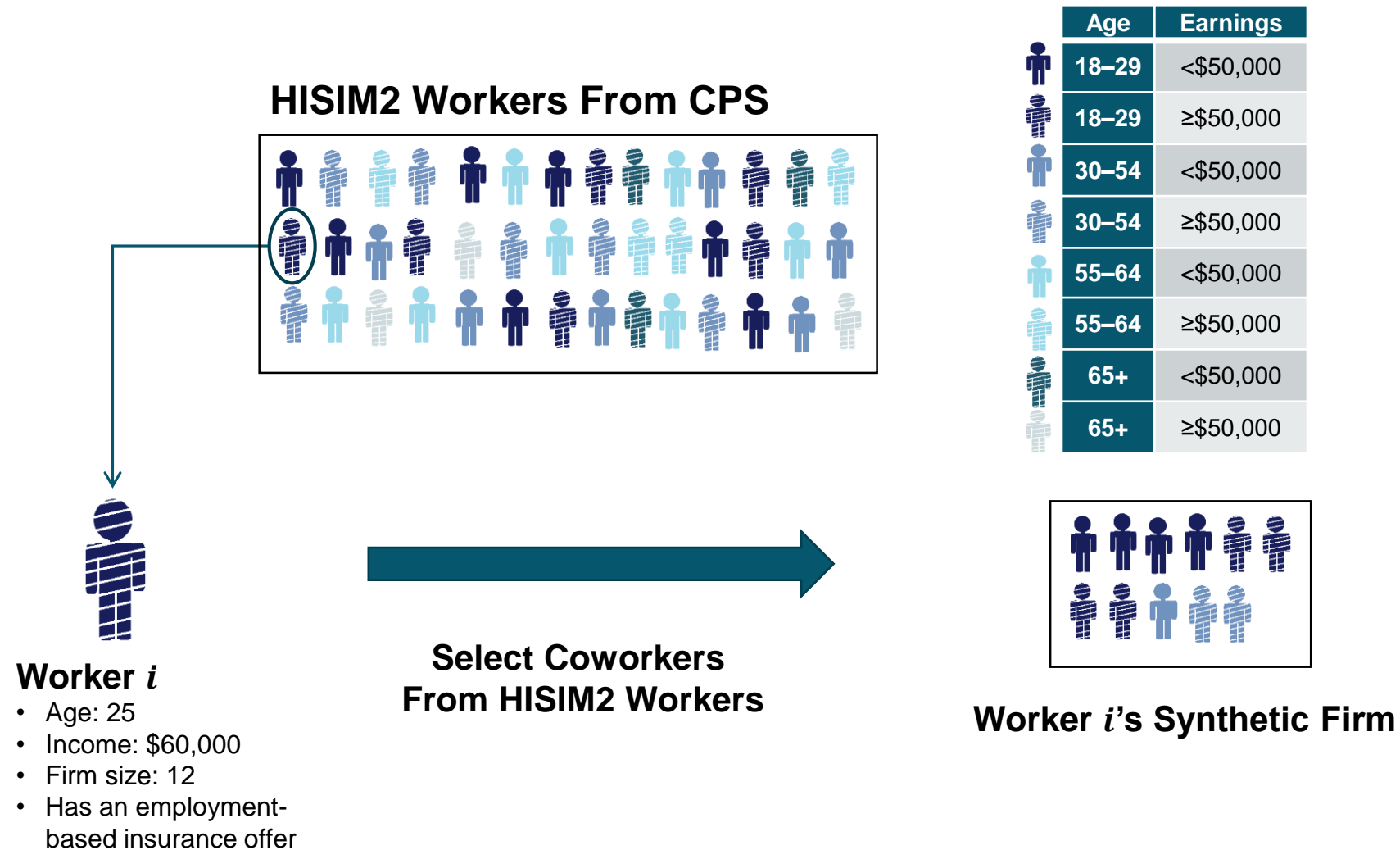
How Are Firms Constructed? (Continued)

The probability that a coworker is sampled depends on the worker's age, earnings, state of residency, and firm size and on whether the worker's employer offers insurance. The probabilities are estimated from tax data for 2017.

Form 941s, 1095-Bs, 1095-Cs, and W-2s, which provide information on employers and workers, are linked by employer identification number. Those data are supplemented with data from other sources, such as the Social Security Administration's DM1 data that provide information on workers' ages.

For each firm and type of plan, CBO imputes the employer and employee shares of the premiums and the plan's cost-sharing characteristics. The characteristics of a firm's employees and their hypothetical employment-based insurance offers determine the firm's tax benefit from offering each type of insurance plan.

A Simplified Example of How Firms Are Constructed



Firms are created for each worker in the CPS. The same CPS respondent can be assigned to multiple firms or multiple times to the same firm. CBO simplified the exhibit by collapsing the annual earnings intervals for workers into two groups (<\$50,000 and ≥\$50,000). The annual earnings intervals actually used in the HISIM2 assignment are <\$10,000, \$10,000–\$15,000, \$15,000–\$20,000, \$20,000–\$25,000, \$25,000–\$30,000, \$30,000–\$35,000, \$35,000–\$40,000, \$40,000–\$50,000, \$50,000–\$70,000, \$70,000–\$90,000, and ≥\$90,000.

Firms' Choice Sets

Firms determine whether to offer employment-based insurance and, if so, the type of plans they offer. Firms may only offer one plan of each type.

CBO specified firms' choice sets on the basis of the literature on employer decisions and advice from experts in the field. Choice sets are limited to a small set of alternatives so that the model is tractable. Small firms are limited to offering their employees one type of plan, reflecting observed patterns in the data.

- Any firm may choose not to offer employment-based insurance.
- Firms with 50 or more employees are allowed to offer any combination of three types of plans: high-deductible health plans (HDHPs), health maintenance organizations (HMOs), and preferred provider organizations (PPOs).
- Firms with fewer than 50 employees may offer only one of those three types of plans.

Firms' Choice Sets (Continued)

Firms' choice sets consist of alternatives categorized into “no offer” and “offer” nests. Alternatives within the same nest are considered closer substitutes than alternatives in different nests. That structure ensures that a firm offering a PPO, for example, is relatively more likely to offer an HMO or HDHP than it is to stop offering employment-based insurance altogether.

Nests	Alternatives	Firms With 50 or More Employees	Firms With Fewer Than 50 Employees
No Offer	No Offer	✓	✓
Offer	HDHP	✓	✓
	HMO	✓	✓
	PPO	✓	✓
	HDHP and HMO	✓	
	HDHP and PPO	✓	
	HMO and PPO	✓	
	HDHP, HMO, and PPO	✓	

Overview of Firms' Objective Function

The value of firm k 's objective function for alternative l , U_{kl} , consists of the predicted value that the firm places on the alternative, V_{kl} , and an idiosyncratic unobservable component, ε_{kl} . The value of the objective function is measured on a per-employee basis.

$$U_{kl} = \overbrace{\beta_1 WTP_{kl} + \beta_2 TB_{kl} - C_{kl} + \mu_l(Size_k, Industry_k)}^{V_{kl}} + \varepsilon_{kl}$$

WTP_{kl} is firm k 's employees' income-weighted average willingness to pay for the alternative l . β_1 captures the responsiveness of the firm's objective function with respect to changes in the willingness to pay.

TB_{kl} is firm k 's average tax benefit from offering the alternative l . β_2 captures the responsiveness of the firm's objective function with respect to changes in the tax benefit.

C_{kl} is firm k 's switching cost incurred by altering its offer decisions from the previous year.

μ_l are firm type- and alternative-specific intercepts capturing average unobserved preferences.

ε_{kl} implies a nested logit model.

Firms' Objective Function

Willingness to Pay (WTP_{kl}). Employees' willingness to pay (WTP) for an alternative is estimated as the difference between their expected maximum household utilities under choice sets with and without their firm's insurance offer divided by their marginal utility of income.

For example, all else being equal, workers with higher marginal tax rates benefit more from the tax exclusion for employer-sponsored insurance and thus have a higher WTP than workers with lower marginal tax rates. Moreover, low-income workers who qualify for Medicaid, the Children's Health Insurance Program, or marketplace subsidies are not willing to pay as much for an offer of employment-based insurance as high-income workers are.

To replicate the observed patterns of health insurance offers, the firms in CBO's model place a slightly higher weight on the willingness to pay of higher-income employees. WTP is measured in dollars per employee.

Firms' Objective Function (Continued)

Tax Benefit (TB_{kl}). The tax benefit, which is measured in dollars per employee, includes the employer mandate penalty and a small portion of the tax benefit that is created by the offer of insurance to employees.

CBO's model incorporates an assumption that, in the long run, firms pass back to their employees the tax benefit of offering insurance. In the short run, firms are able to retain a small portion of those tax benefits, which encourages them to offer insurance and helps the model predict short-term static offer responses to proposed policies.

Firms' Objective Function (Continued)

Coefficients β_1 and β_2 . The values of those coefficients are set separately to be consistent with the literature on the price elasticity of offering employment-based insurance and firms' responses to the employer mandate penalty.

The coefficients are allowed to differ for firms with fewer than 100, 100 to 999, and 1,000 or more employees. Existing literature finds that the elasticity of employers' offer rates with respect to the price of health insurance is larger for smaller firms than it is for medium or large firms.

The employer mandate penalty is modeled to affect firms' offer decisions by reducing tax benefits for firms that are subject to it and that are not offering health insurance or are offering unaffordable health insurance.

Firms' Objective Function (Continued)

Switching Costs (C_{kl}). To capture inertia in employers' decisions, some firms incur a positive switching cost for offering an alternative other than the one they offered in the previous year.

Firms incur a large switching cost for not offering insurance if they previously offered it, a medium switching cost for offering it if they previously did not offer it, and a small switching cost for offering one set of plans if they previously offered another.

The switching cost is set to zero for all alternatives in the base year.

Firms' Objective Function (Continued)

Intercepts ($\mu_l(Size_k, Industry_k)$). The alternative-specific intercepts capture firms' average unobserved preferences for different alternatives. Each firm has three offer intercepts that affect the value of all alternatives in the offer nest: one that is common to all firms, a second that depends on the firm's size, and a third that depends on the industry the firm services. Each firm also has an alternative-specific intercept that affects the value of offering that alternative and that also depends on the firm's size and industry.

The intercepts capture concepts such as the human resources costs in offering health insurance and the extent to which offering the alternative helps the firm retain workers.

The intercepts are calibrated so that employers' offer rates in the base year of the model align with the offer rates from the 2018 CPS and the Medical Expenditure Panel Survey—Insurance Component (MEPS-IC).

Firms' Objective Function (Continued)

Idiosyncratic Unobservable Component (ε_{kl}). The unobservable random component in the firm's objective function is drawn from a simulated distribution that implies a nested logit model for each alternative l for each firm k in the base year. It is drawn so that the value of a given firm's objective function is the greatest for the offer decision imputed for that firm on the basis of the CPS and MEPS-IC data.

The firm- and alternative-specific unobservable components are set to be constant over time. Thus, in the years following the base year, a firm changes its offer decision only in response to changes in the other components of its objective function.

The value of a firm's objective function is completely specified in each year of the model, and a firm chooses a single alternative in its choice set that maximizes its objective function. Thus, firms' decisions in HISIM2 are deterministic.

Changes to Firms' Behavior in CBO's Baseline Budget Projections as of March 6, 2020

In preparing its spring 2020 baseline budget projections, CBO made several major updates to firms' behavior in HISIM2.

Those updates are intended to improve the accuracy of predictions about the type of plans employees enroll in and make firms' offer behavior in the model more closely resemble firms' offer behavior observed in historical data.

Changes to Firms' Behavior in CBO's Baseline Budget Projections as of March 6, 2020 (Continued)

2020 Baseline	2019 Baseline
Modeled firms' behavior using a nested logit model	Modeled firms' behavior using an atypical disturbance distribution
Allowed firms with 50 or more employees to offer more than one type of plan	Allowed firms to offer only one type of plan
Specified separate coefficients for tax benefit and willingness to pay that vary for firms of different sizes	Used the same coefficient on all terms in the objective function
Increased the weight firms place on higher-income employees relative to lower-income employees in terms of employees' willingness to pay for an offer of insurance	Used the same weights for the willingness to pay for an offer of insurance, regardless of the employees' income
Estimated alternative-specific intercepts that varied by the firms' size and industry	Estimated alternative-specific intercepts that varied by the firms' size and region
Imputed the firms' age and removed switching costs for firms less than two years old	Did not consider the firms' age

Further Information About HISIM2

The development of CBO's health insurance simulation model is an ongoing process that involves sharing information about the model and improving it in response to new data and feedback that CBO receives. Over the past year, CBO has made [several presentations](#) on the development of the new model. CBO has also solicited input from many experts—such as those on its [Technical Review Panel](#) for the model—with knowledge on a variety of topics, including microsimulation modeling, health insurance markets, federal health programs, and data sources.

In addition, CBO has received helpful input from seminar participants at the Agency for Healthcare Research and Quality, the Heritage Foundation, the Office of the Actuary at the Centers for Medicare and Medicaid Services, the RAND Corporation, and the Urban Institute. CBO has used those experts' feedback to further develop the model. As with all of CBO's models, HISIM2 will be regularly updated to incorporate new data and changes in law.

About This Document

This document was prepared to enhance the transparency of CBO's work and to encourage external review of that work. In keeping with CBO's mandate to provide objective, impartial analysis, the document makes no recommendations.

Zhuang Hao, Ben Hopkins, Geena Kim, and Alexandra Minicozzi prepared the document with guidance from John McClelland, Julie Topoleski, and Chapin White. The staff of the Joint Committee on Taxation and members of the [Technical Review Panel](#) for CBO's health insurance simulation model provided helpful comments.

Jeffrey Kling reviewed the document, and Rebecca Lanning edited it. It is available on CBO's website (www.cbo.gov/publication/56303).