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PROJECTIONS OF NATIONAL HEALTH EXPENDITURES AND HEALTH INSURANCE ENROLLMENT: METHODOLOGY AND MODEL SPECIFICATION

The Office of the Actuary (OACT) in the Centers for Medicare & Medicaid Services (CMS) produces short-term (10-year) projections of health care spending and enrollment for categories in the National Health Expenditure Accounts (NHEA) on an annual basis.

The National Health Expenditure (NHE) projections consist of time series for all of the major spending categories in the NHEA. These categories include trends in aggregate medical spending, medical goods and services consumed, sources of payment, and sources of financing. Detailed tables and documentation are available online.[1] In addition, an article describing these results is published annually in the journal *Health Affairs*.[2]

The NHE projections are inherently subject to uncertainty and are best viewed with this caveat. The models used to project trends in health care spending are estimated based on historical relationships within the health sector, and between the health sector and macroeconomic variables. Accordingly, the spending projections assume that these relationships will remain consistent with history, except in those cases in which adjustments are explicitly specified. The NHE Projections are constructed using a current-law framework, thus the projections do not assume any potential legislative changes over the projection period, nor do they attempt to speculate on possible deviations from current law. These projections also rely on assumptions about future trends in exogenous inputs to the model, such as macroeconomic conditions. The degree of uncertainty associated with the projections increases with the projection horizon. Given the unprecedented impact of the COVID-19 pandemic and public health emergency on health spending, enrollment, and macroeconomic conditions, these projections reflect larger adjustments for special one-time effects and are subject to a higher level of uncertainty than under more typical conditions.

The process for deriving these projections is based on accepted econometric and actuarial projection techniques. However, we frequently review the accuracy of our work and strive to make improvements in the methodology.[3] Please e-mail DNHS@cms.hhs.gov with any comments or feedback.

[1] Centers for Medicare & Medicaid Services. National Health Expenditure Data: Projected. Available at https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsProjected.

[2] Poisal, John, et al. "National Health Expenditure Projections, 2021-30." Health Affairs, 41, no.4 (2022). (Published online 28 Mar 2022.)

[3] Centers for Medicare & Medicaid Services. Accuracy Analysis of the Short-Term (10-Year) National Health Expenditure Projections. Available at https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/ProjectionAccuracy.pdf

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1) OVERVIEW OF THE NHE PROJECTIONS MODEL

The NHE Projections are based on a system of more than 100 econometric models, which reflect relationships in historical time-series data. The primary focus of the NHE Projections Model is to produce projections of future health care spending by private health insurers, consumer spending on an out-of-pocket basis, and other private revenues. Projections based on this model are conditional on exogenous projections for Medicare, Medicaid, the Children's Health Insurance Program (CHIP), Health Insurance Marketplaces, and key macroeconomic variables. As a final step in the process, legislative impacts and the effects of the COVID-19 pandemic are projected separately and added onto the NHE Projections Model estimates. Combined, these modeling approaches produce comprehensive projections for the health system as a whole.

Sections 2-3 of this methodology paper present the inputs and structure of the NHE Projections Model, with discussion of the data, assumptions, and model specifications used to produce the forecasts.

2) DATA SOURCES AND EXOGENOUS INPUTS TO THE NHE PROJECTIONS MODEL

a. Historical data sources

i. NHEA data

Historical NHEA estimates, compiled by OACT, are the source of the historical time series for health expenditures. These estimates provide a national level matrix of health spending data by type of service, source of funding, and sponsor of health care.[4]

Classification of spending by type of service, source of funding, and sponsor projected in our model is consistent with NHEA classification and is presented in Exhibits 1-3.[5] Payer categories track the source of direct payment for health care consumption, such as Medicare or private health insurance (PHI), but do not consider who is ultimately paying for (or sponsoring) each form of coverage—whether payment is made via taxes or premium payments, for example. Health spending by sponsor is defined as the underlying source of financing and can include: businesses, households, and governments.[6]

The payer versus sponsor distinction has become more important with the onset of public subsidies for the purchase of private health insurance plans under the Affordable Care Act (ACA); NHEA classification by payer defines such subsidies as private spending, while classification by sponsor of spending allocates portions of these payments to government sources.

[4] Information on the methodology used in producing the historical NHEA estimates can be found in our NHEA methodology paper, available at https://www.cms.gov/files/document/definitions-sources-and-methods.pdf.
[5] Ibid.
[6] Ibid.

EXHIBIT 1: NHE CLASSIFICATION BY TYPE OF EXPENDITURE

National Health Expenditures

- Health Consumption Expenditures
  - Personal Health Care
    - Hospital Care
    - Professional Services
      - Physician and Clinical Services
      - Other Professional Services
      - Dental Services
    - Other Health, Residential, and Personal Care
    - Nursing Care Facilities and Continuing Care Retirement Communities and Home Health Care
      - Nursing Care Facilities and Continuing Care Retirement Communities
      - Home Health Care
    - Retail Outlet Sales of Medical Products
      - Retail Prescription Drugs
      - Durable Medical Equipment
      - Other Non-Durable Medical Products
  - Government Administration
  - Net Cost of Health Insurance
  - Government Public Health Activities
- Investment
  - Structures
  - Equipment
  - Research

EXHIBIT 2: NHE CLASSIFICATION BY SOURCE OF FUNDING/PAYER

National Health Expenditures

- Out-of-Pocket
- Health Insurance
  - Private Health Insurance
  - Medicare
  - Medicaid
  - Children's Health Insurance Program (CHIP)
  - Department of Defense
  - Department of Veterans Affairs
- Other Third-Party Payers and Programs
  - Other Federal Programs
  - Other State and Local Programs
  - Other Private Revenues

EXHIBIT 3: NHE CLASSIFICATION BY SPONSORS OF PAYMENT

National Health Expenditures

- Businesses, Households, and Other Private
  - Private businesses
    - Employer contributions to private health insurance premiums
    - Other
  - Household
    - Household private health insurance premiums
    - Medicare payroll taxes and premiums
    - Out-of-pocket health spending
  - Other private revenues
- Governments
  - Federal government
    - Employer contributions to private health insurance premiums
    - Employer payroll taxes paid to Medicare hospital insurance trust fund
    - Medicare
    - Medicaid
    - Other programs
  - State and local governments
    - Employer contributions to private health insurance premiums
    - Employer payroll taxes paid to Medicare hospital insurance trust fund
    - Medicaid
    - Other programs

ii. Medical price indexes

Beginning in 2011, with the release of the 1960-2011 NHEA estimates, OACT released its first estimates of the chain-weighted NHE price deflator (available from 2004).[7] As part of the current NHE 2021-30 projections release, for the first time, projections of the NHE deflator were also produced. Though the personal health care price index has been available for many years, there had not previously been a corresponding index for NHE nor the non-personal health care categories of spending (government administration, net cost of insurance, government public health activity, research, structures, and equipment expenditures). To develop a price measure for these sectors, composite measures were developed for each non-PHC category. Because of the unique nature of the non-PHC categories, alternative data sources are used to decompose these categories into the key underlying inputs used in their production, such as compensation or capital costs, and then publicly available price series are used to deflate those input costs. Descriptions of the composite indexes used for the development of the NHE deflator and the weights for each sector set equal to the share of NHE spending accounted for by that type of service are shown in Exhibit 4 below.

For the PHC price index, the Producer Price Indexes (PPIs) and Consumer Price Indexes (CPIs) published by the Bureau of Labor Statistics (BLS) are the primary data sources for medical price indexes. Our price measure for total PHC spending is a chain-weighted deflator based on the indexes in Exhibit 4 below, with the weight set equal to the share of PHC spending accounted for by that type of service.

[7] Information on the methodology used in producing the historical NHE deflator methodology paper, available at https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/NHE-Deflator.pdf.

EXHIBIT 4: COMPONENTS OF NHE AND PHC EXPENDITURE ANNUAL-WEIGHTED PRICE INDEXES

Industry/Commodity or Service	Price proxy	2020 weight	
		NHE Weight	PHC Weight
National Health Expenditures		**100.0%**	**NA**
Non-Personal Health Care		**18.6%**	**NA**
Government Administration	Composite index of wages, benefits, professional fees, claims/FI services, office rent, and other expenses for six government programs	1.2	NA
Net Cost of Health Insurance	Composite index of compensation, capital, taxes and fees, reserves/gains/losses, and other expenses for four classes of insurance	7.3	NA
Government Public Health Activities	Composite index of federal, state, and local government consumption	5.4	NA
Research	NIH Biomedical Research and Development Price Index	1.5	NA
Structures & Equipment	Composite Index of BEA Price indexes for private fixed investment in structures by type and private fixed investment in equipment and software by type	3.2	NA
Personal Health Care		**81.4%**	**100.0%**
Hospital Care	PPI hospitals*	30.8	37.8
Physician and Clinical Services	Composite Index: PPI for Office of Physicians and PPI for medical & diagnostic laboratories	19.6	24.1
Other Professional Services	CPI services by other medical professionals	2.8	3.5
Dental Services	CPI dental services	3.5	4.2
Home Health Care	PPI home health care services	3.0	3.7
Other Health, Residential, and Personal Care:		5.1	6.2
Other (School Health, Worksite Health Care, Other Federal, Other State & Local, etc.)	CPI physicians' services		
Home and Community-Based Waivers (HCBW)	CPI care of invalids & elderly at home		
Ambulance	CPI-U All Items		
Residential Mental Health & Substance Abuse Facilities	PPI residential mental retardation facilities		
Nursing Care Facilities and Continuing Care Retirement Communities	PPI nursing care facilities	4.8	5.9
Prescription Drugs	CPI prescription drugs	8.4	10.4
Other Non-Durable Medical Products	CPI internal & respiratory over-the-counter drugs	2.1	2.6
Durable Medical Equipment	Composite Index: CPI for eyeglasses and eye care and CPI nonprescription medical equipment and supplies	1.3	1.6

*Producer Price Index for hospitals, U.S. Department of Labor, Bureau of Labor Statistics. Used beginning in 1994. Indexes for 1960-93 are based on a CMS-developed output or transaction price index.

PPIs account for the largest share of the PHC deflator. The use of PPI versus CPI indexes as price indicators is largely determined by the relative importance of third-party payment relative to direct consumer spending as a share of total expenditures.[8] Because PPIs capture variation in prices based on transactions for all payers, for most services they are preferable to CPIs, which track the price paid by consumers.

iii. Insurance coverage data

As with spending, historical enrollment estimates are drawn from historical NHEA data. The estimates cover total PHI, which is comprised of individually purchased and employer-sponsored plans, public insurance programs (including Medicare and Medicaid), and the uninsured. Estimates of total PHI enrollment are available from 1960 forward. Medicare and Medicaid enrollment estimates are available from 1966 forward; however, all other enrollment categories (including the more detailed estimates for individually purchased and employer-sponsored insurance) are only available from 1987 forward.[9]

b. Exogenous inputs to the NHE Projections Model

Exogenous inputs to the NHE projections include macroeconomic assumptions for projections of real Gross Domestic Product (GDP) growth, economy-wide inflation, labor market indicators, input price indexes for medical care, and demographic projections of the population by age and gender. Projections for macroeconomic and demographic assumptions are based on the annual projections of the Board of Trustees for Federal Old-Age, Survivors, and Disability Insurance (OASDI), which are produced annually by the Social Security Administration (SSA).[10] The projections were updated to reflect recent additional macroeconomic data and research.[11]

Projections for personal income and disposable personal income, consistent with the economic assumptions from the 2021 Medicare Trustees Report, are generated using the University of Maryland Long Term Interindustry Forecasting Tool (LIFT).[12]

The Boards of Trustees for Medicare report annually to the Congress on the actuarial status of the Hospital Insurance and Supplementary Medical Insurance trust funds.[13] Projections of Medicare spending generated for the Trustees Report, are produced by OACT, and are also consistent with macroeconomic and demographic assumptions included in the OASDI Trustees Report. The Medicare projections used in the NHE projections were sourced from the Trustees Report. Additionally, these Trustees Report projections were updated with certain provisions from two pieces of recent legislation to be consistent with current law. The legislation and provisions include (i) the Consolidated Appropriations Act (CAA) of 2021, which extended the sequestration suspension period and modified the Medicare Physician Fee Schedule and (ii) the Protecting Medicare and American Farmers from Sequester Cuts Act, which modified the sequestration periods and cuts, as well

[8] For more information, see National Health Expenditure Accounts Methodology Paper, 2020. Available at: https://www.cms.gov/files/document/definitions-sources-and-methods.pdf,.

[9] Ibid.

[10] Board of Trustees, Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds. *The 2021 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds*, 31 August 2021. Available at: http://www.socialsecurity.gov/OACT/TR/2021/.

[11] The updated macroeconomic forecast is derived from the December 2021 publication of the Blue Chip Economic Indicators, a survey of 50 of the top forecasts by different private companies and academic institutions. More information on this report can be found at https://www.wolterskluwer.com/en/solutions/blue-chip-publications.

[12] Projections of personal income and gross domestic product are available from Table 1 of the CMS projected NHE data (Downloads, "NHE Projections – Tables"). Available at https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsProjected.

[13] Boards of Trustees, Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds. *The 2021 Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds*, 31 August 2021. Available at https://www.cms.gov/files/document/2021-medicare-trustees-report.pdf.

increased the Medicare Physician Fee Schedule conversion factor in 2022. The NHE projections also incorporate the latest Medicaid and CHIP projections prepared by OACT, which utilize consistent assumptions as the Medicare Trustees Report.

Projections for input price indexes in each sector are based on projections from IHS Markit, which rely on macroeconomic assumptions for aggregate wage and price growth that can differ from those incorporated in the OASDI Trustees Report. Accordingly, price and wage proxies included in these indexes are adjusted for consistency with OASDI macroeconomic assumptions on economy-wide wage and price inflation.

i. Exogenous estimates of the effects of legislation

Exogenous estimates on the future impact of legislation are primarily built into the projections through actuarial projections of spending and enrollment for Medicare and Medicaid, as well as in projections of enrollment via the ACA Marketplaces and through CHIP.

Where legislation is expected to influence the path of the NHE Projections Model's variables (such as private health insurance spending, out-of-pocket spending, as well as counts of the insured and uninsured populations), these additional impacts are built in through adjustments to the output of the econometric models. The most important effects of policy changes that are currently built into the NHE Projections Model affect trends in enrollment in private health insurance coverage, the composition of this enrollment between employer-sponsored and individual coverage, and short-term fluctuations in the net costs of private health insurance. Anticipated effects on growth in spending on personal health care are relatively smaller.

ii. Legislative and regulatory impacts on spending and enrollment projections

The Further Consolidated Appropriations Act of 2020 repealed three taxes previously mandated under the Affordable Care Act (including the medical device tax, the annual tax on health insurance providers, and the excise tax on high-cost employer sponsored health insurance).[14] The most notable effects of the repeal of these taxes are those associated with the tax on health insurance providers and the excise tax on high-cost employer sponsored insurance. The excise tax on high-cost employer sponsored health insurance was previously scheduled to take effect in 2022 and thus had not taken effect yet. However, the annual tax on health insurance providers was i) in effect in 2018, ii) suspended in 2019, iii) in effect for 2020, and iv) permanently repealed for 2021 and thereafter. Adjustments to account for the years where the health insurance tax is in effect for the projections have been made to the projections of total spending for the major payers (Medicare, Medicaid, Private Health Insurance) and were based on internal analysis of Internal Revenue Service data.[15] The impact of these changes affects the projected growth of net cost of health insurance in 2021.

A recent rule allowing employers to subsidize employee premiums in the Health Insurance Marketplace is scheduled to take effect in 2022 and is anticipated to result in modest shifts in enrollment from traditional employer sponsored insurance to individually purchased plans.[16,17] The impact of the rule change is expected to result in an incremental, small shift in coverage (roughly 2 percent of the population with employer insurance

[14] Congress.gov. H.R.1865 - Further Consolidated Appropriations Act, 2020. Available at: https://www.congress.gov/bill/116th-congress/house-bill/1865/text.

[15] Internal Revenue Service. Affordable Care Act Provision 9010—Health Insurance Providers Fee. Available at: https://www.irs.gov/businesses/corporations/affordable-care-act-provision-9010

[16] Health Reimbursement Arrangements and Other Account-Based Group Health Plans: A Rule by the Internal Revenue Service, the Employee Benefits Security Administration, and the Health and Human Services Department on 06/20/2019. Available at: https://www.federalregister.gov/documents/2019/06/20/2019-12571/health-reimbursement-arrangements-and-other-account-based-group-health-plans

[17] The implementation of the Health Reimbursement Arrangements and Other Account-Based Group Health Plans was delayed until 2022.

by 2030) from employer-sponsored-insurance to the Health Insurance Marketplace; however the net effect is a very slight increase in total private health insurance coverage and corresponding decrease in the uninsured population.

In response to the COVID-19 pandemic, the Federal government passed and enacted legislation that included substantial new funding sources for health care providers and for state and local governments: the Coronavirus Preparedness and Response Supplemental Appropriations Act of 2020; the Families First Coronavirus Response Act of 2020; the Coronavirus Aid, Relief, and Economic Security (CARES) Act of 2020; the Paycheck Protection Program and Health Care Enhancement Act of 2020; the Coronavirus Response and Relief Supplemental Appropriations Act of 2021; and the American Rescue Plan Act (ARPA) of 2021. Some of the most substantial funding was provided by the CARES Act and ARPA legislation. This legislation provided the primary funding for aid to health care providers—in particular, hospitals, physicians, and nursing homes (through the Provider Relief Fund, which provided direct financial support to providers, and through loans made under the Paycheck Protection Program to assist with qualifying expenses). In addition, this legislation provided states with additional Medicaid funding and increased funding for public health activity related to COVID-19.

Consistent with the National Health Expenditure Accounts methodology, government budget and program data were utilized to estimate spending associated with these various COVID-19 pandemic legislation.[18] Estimates of the Provider Relief Fund (PRF) were based on data from the Health Resources and Services Administration (HRSA).[19] Estimates of the amount of Paycheck Protection Program (PPP) funding given to health care providers were compiled using data from the Small Business Administration.[20] The data were tabulated according to the North American Industry Classification System categories included in the National Health Expenditure Accounts and assumed a loan forgiveness rate of 99 percent. Funding for the PRF and PPP are included in "Other Federal Programs" within the "Other Third Party Payers and Programs" payer categories. Estimates inclusive of additional Federal funding provided by the coronavirus relief legislation for government public health activity and non-commercial research (consistent with the Federal funds included in the category according to the NHEA) were based on analysis of fiscal year 2022 President's Budget outlay data and projections for applicable Federal agencies/programs.[21] Included in "other health insurance programs" NHEA spending by payer, supplemental funding from the CARES Act for the Veterans Administration were estimated using analysis from Government Accountability Office.[22]

iii. COVID19 pandemic impacts on health care spending and use

Several sources have been utilized to incorporate estimates of the impact of the COVID-19 pandemic on national health spending projections for 2021-30. In 2020, spending was directly affected by the coverage of testing and treatment of the disease. More than offsetting these additional direct patient care costs in 2020,

[18] Centers for Medicare and Medicaid Services. Accounting for Federal COVID Expenditures in the National Health Expenditure Accounts [Internet]. Baltimore (MD): CMS; [cited 2022 Jan 20]. Available from: https://www.cms.gov/files/document/accounting-federal-covid-expenditures-national-health-expenditure-accounts.pdf.

[19] Health Resources & Services Administration. PRF data: Provider Relief Fund data [Internet]. Washington (DC): HRSA; 2021 Jun [cited 2022 Feb 1]. Available from: https://www.hrsa.gov/provider-relief/data.

[20] Small Business Administration. PPP data: forgiveness data [Internet]. Washington (DC): SBA; 2021 Nov 17 [cited 2021 Nov 19]. Available from: https://www.sba.gov/funding-programs/loans/covid-19-relief-options/paycheck-protection-program/ppp-data.

[21] Fiscal Year 2022 President's Budget data, see The White House, Office of Management and Budget. Outlays XLSX [Internet]. Washington (DC): The White House [cited 2022 Jan 20]. Available for download at: https://www.whitehouse.gov/omb/supplemental-materials/.

[22] Government Accountability Office. Veterans Affairs: Use of Additional Funding for COVID-19 Relief [Internet]. Washington (DC): GAO; 2021 May [cited 2022 Feb 1]. Available from: https://www.gao.gov/assets/gao-21-379.pdf.

spending for non-COVID care declined significantly. The methods discussed below describe how these impacts were estimated and projected forward for Medicare, private health insurance, other private revenues, and for out-of-pocket spending by type of service.

To project Medicare spending and account for the spending impacts of the pandemic for the 2021 Medicare Trustees Report, adjustment factors by type of service were developed through 2023. These factors are based on (i) projections of the pandemic; (ii) direct costs associated with the testing and treatment of COVID-19; (iii) projections for non-COVID costs; and (iv) costs for the vaccines.[23] This analysis assumes an eventual return of deferred care that is more intensive, which results in a rebound in projected growth for several sectors over 2021-22 that is generally above previously released projections. Despite these projected pandemic effects, certain services were not expected to be materially impacted by the pandemic, such as prescription drugs, durable medical equipment, physician-administered drugs, and hospice care. Given all the uncertainty related to the future trajectory of the pandemic, these COVID-related impacts and that of future projections could change significantly as more information becomes available. The Medicare projections included in the NHE projections include these COVID-19 adjustments and as is typical, the Medicare projections are an exogenous input to the NHE projections model.

Building on the projections of the impact of the COVID-19 pandemic to Medicare spending and health care utilization, adjustment factors for personal health care by type of service through 2023 were also developed for projections of private health insurance and out-of-pocket spending. Medicare COVID-19 adjustments for projected impacts to health care utilization for non-COVID care were used to adjust private health insurance spending to essentially capture the effect of a rebound in use for 2021 forward, following nationwide shutdowns and avoidance of or delayed health care utilization in 2020. To crosswalk adjustment factors from Medicare to private health insurance, detailed private health insurance claims were utilized to account for differences in service use between Medicare beneficiaries and privately insured individuals. Specifically, private health insurance claims data were sourced from the IBM MarketScan Commercial Database, which consists of medical and drug data from employers and commercial health plans.[24] The MarketScan claims were grouped by Medicare service categories. Then, this distribution of spending from private health insurance claims by type of service was used to weight the Medicare adjustment factors by type of service to align more closely with the NHEA spending by type of service for private health insurance. In addition, further fine-tuning modifications were applied by sector to the private health insurance adjustment factors to incorporate preliminary data available by sector.[25] For total personal health care spending, level adjustments for COVID-19 impacts for private health insurance spending projections were largest for 2022.

To develop adjustments for out-of-pocket spending, additional analysis was conducted using the MarketScan data to account for the effects of deductibles on this type of spending. The analysis involved calculations of percent reductions in out-of-pocket spending based on varying simulated percent reductions in private health insurance spending. Generally, reductions in private health insurance spending were associated with smaller reductions in out-of-pocket spending largely due to the effects of deductibles paid. Consequently, the magnitude of the COVID-19 adjustment factors was smaller for out-of-pocket spending relative to factors for private health insurance. For total personal health care spending, level adjustments for COVID-19 impacts for

[23] Boards of Trustees, Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds. *The 2021 Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds*, 31 August 2021. Available at https://www.cms.gov/files/document/2021-medicare-trustees-report.pdf.

[24] IBM Watson Health. IBM MarketScan Research Database: Commercial Claims and Encounters Database [Internet]. Ann Arbor (MI): IBM Watson Health; 2018 Nov [cited 2022 Feb 2]. Available for purchase from: https://www.ibm.com/products/marketscan-research-databases/databases.

[25] Census Bureau. Latest quarterly services report [Internet]. Washington (DC): Census Bureau; 2021 Dec 10 [cited 2022 Feb 2]. Available from: https://www.census.gov/services/index.html.

out-of-pocket spending projections were largest for 2021.

3) NHE PROJECTIONS MODEL SPECIFICATION

The NHE Projections Model is composed of a system of econometric equations for personal health care (PHC) provided to individuals, and a supplementary set of equations for other, non-PHC spending. The specifications of these models draw on standard economic theory and the broader health economics literature. The equations in the model are re-estimated annually following the release of updated historical NHEA data, and the fit and appropriateness of model specifications are reviewed and revised at that time.

The regression models that generate the model equations are usually updated annually to incorporate an additional year of data, together with any revisions to earlier data. However, the most recent year of data (2020) is strongly influenced by large and unique effects associated with the COVID-19 pandemic. These data were therefore excluded from model re-estimation. Current models reflect data through 2019, including revisions, but are not influenced by effects specific to the pandemic, which are estimated separately outside of the context of the model, and applied to projections at a later stage.

a. Aggregate model for private personal health care (PHC) spending

Spending for medical care provided to patients (personal health care (PHC)) accounted for about 84 percent of total national health spending in 2019. The drivers of growth in spending for different types of PHC goods and services tend to be broadly similar, since these are all consumer goods that are provided to patients by medical practitioners. As a result, econometric models are generated for PHC (in aggregate and for individual goods and services). The aggregate PHC model defines the relationship of trends in spending growth for private PHC sources of funding[26] relative to the exogenous inputs to the model. Econometric models for aggregate PHC and also for individual goods and services also include equations for minor public spending programs for which exogenous projections are not available.

i. Relationship between macroeconomic trends and PHC spending

The key dynamic in econometric models for PHC spending is the relationship between private health spending growth and macroeconomic variables. Spending growth for private PHC exhibits a strong relationship to the macroeconomic business cycle. Growth cycles in health care spending can be extended in duration, lasting over a decade or more from peak to trough.

The causal link between private PHC spending and macroeconomic growth (as measured by disposable personal income) is not immediately apparent when looking at growth in health care spending relative to growth in GDP. This is because the relationship is complicated by two key issues. First, and most important, a large part of the transmission of the impact of macroeconomic growth on health care spending is not immediate. Rather, this impact occurs with a lag, over a period of several years following the macroeconomic business cycle. Second, there is a negative short-term relationship between trends in private and public spending growth, which tends to obscure the link between private spending and economic growth. In order to correctly estimate the relationship between private PHC spending and economic growth, it is necessary to control for the effects of public spending.

[26] It should be noted that "private sources of funding" in this context include all private health insurance spending, which in turn, includes government subsidies for Marketplace premiums. As such, this spending is defined as private from the perspective of direct payment for care (a 'Payer' basis), rather than on the ultimate source of funding for coverage (a 'Sponsor-of-payment' basis). For purposes of econometric modeling and discussion in this paper, all private health insurance spending, out-of-pocket spending, and other private revenues are grouped together as "private spending." To obtain sponsor-based delineations of public and private spending, we incorporate models that reallocate spending from direct payer basis to sponsor-based categories (discussed later in this paper).

The negative correlation between private and public payer spending growth applies to short-term variation (less than ten years). Over the long term (time series data since 1960), spending growth for both public and private payers is dominated by the same drivers that determine the nature and cost of providing medical care at the current standards of care. These factors include changes in medical technology and professional standards for treatment together with market prices for provider inputs. Common supply-side variables that influence the cost of providing care influence spending across all payers and therefore imply a positive correlation between public and private spending trends over the long-term. However, in the short term, the relationship between public and private spending on a real per capita basis is influenced by shifts in insurance coverage between public and private programs and by the effect of short-term legislative changes that influence relative prices paid by public and private payers. The net effect of these factors is that after controlling for factors that imply a positive correlation in the long-term spending trend for all payers, the residual short-term variation in public and private spending growth tends to be negatively correlated.

The causal link between aggregate income growth and health spending is one of the most important factors that determine the long-term trend in private PHC spending. Once we account for lags in the transmission of the effect from macroeconomic growth and private PHC spending, and control for the short-term relationship between private and public spending growth, the strength of macroeconomic (disposable personal income) growth as an explanatory factor becomes clearly apparent.

The strong relationship between the macroeconomic business cycle and private PHC spending suggests that private PHC spending is highly cyclical, and that the length of the cycle roughly corresponds to the periods of macroeconomic cycles. Macroeconomic cycles tend to be long, as illustrated by the past decade (2009-19), which encompasses a single expansion from a cyclical trough. Thus, it is difficult to evaluate trends in growth over periods covering less than two decades without first understanding the cyclical and macroeconomic context. For example, our models and the most recent available historical data suggest that growth in private PHC spending reached a cyclical peak in approximately 2002-2003 and, following roughly a decade of slowing growth, reached a cyclical trough in about 2013.[27] Since the trend for private PHC spending growth over 2002-2013 is effectively a peak-to-trough movement, the pattern of growth over this interval cannot provide a characterization of the long-term trend in health care spending. Viewing the pattern without the cyclical context could greatly overstate the extent to which deceleration in growth over this period is likely to be sustained. In contrast, variation in growth for public PHC spending does not usually track the timing of the cycle for private PHC spending. While long-term spending trends track similar factors to those of private payers, short-term fluctuations are strongly influenced by the passage of legislation and policy effects.

Exhibit 5 shows the estimated effect of lagged growth in real per capita disposable personal income (DPI)[28] on real per capita private PHC spending growth. The chart illustrates the relationship between this estimated effect of income growth and the actual growth in real per capita private PHC spending. The explanatory power of lagged income growth for aggregate health spending has historically been very strong.

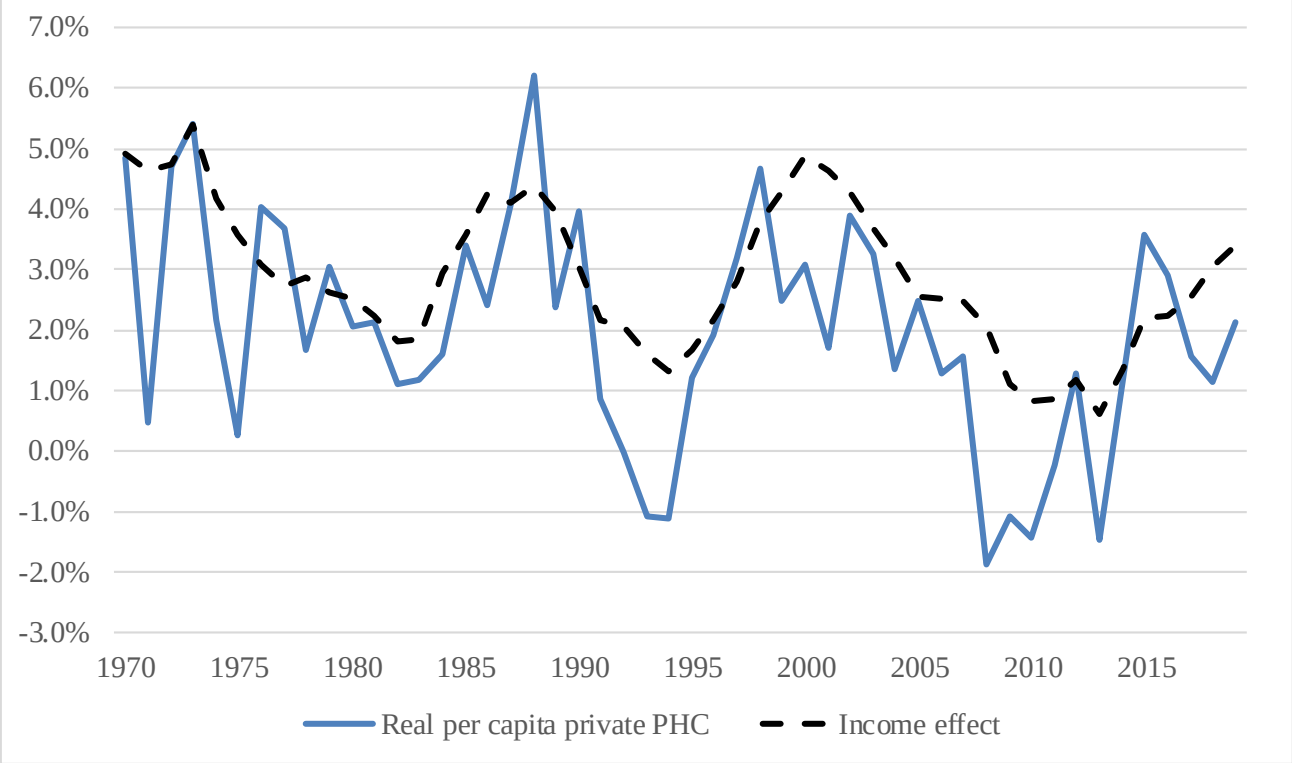
The effect of specific events that have an important impact on private PHC spending growth can often be discerned in periods where growth in private spending deviates significantly from the trend predicted by the income effect. In particular, private PHC spending growth was lower than predicted during 1991-94 due to the rapid growth in managed care enrollment during this period. Lower than predicted growth during 2008-2010 related to the economic recession was due to unusually large declines in private health insurance coverage. Faster than predicted growth in private spending for 2014-2016 can be attributed to the effects of

[27] The timing of cyclical peaks and troughs cannot be precise due to annual year-to-year volatility in the health care spending data.

[28] Values shown represent the historical values of DPI applied to the estimated model coefficients in the NHE projection model. They are estimated by fitting a coefficient to each lagged value, constrained to fit along a second degree polynomial. The peak effect of income growth on private PHC spending occurs with a lag of 2 to 3 years.

the major coverage expansions under the ACA.

Exhibit 5: Real Per Capita Growth in Private PHC Spending with Estimated Cyclical Effects, 1970-2019



A comparison of predicted versus actual growth in real per capita private PHC for the period immediately following the ACA enrollment expansions in 2014 forward shows that for the three years from 2014 through 2016, private spending growth was well above what would be predicted based on the model. Model residuals for 2014-2016 were consistently high as compared to the mean over the 1961-2016 sample period. This pattern partially reflects rapid growth in PHI enrollment associated with the onset of the major coverage provisions of the ACA in 2014. However, even after controlling for the effects of higher PHI enrollment, the growth in real private spending per enrollee is consistently higher than predicted by our model. This suggests that both increased PHI coverage and higher than predicted use of medical care per enrollee both played a role in explaining faster growth in the 2014-2016 period. Beginning with last year's model estimation, dummy variables for the years from 2014-2016 have been incorporated into the model specification to capture the effects of the ACA expansions. NHEA historical data through 2019 confirm a positive impact of the ACA on private spending growth for the period of 2014-2016, with growth returning fairly close to predicted trend over 2017 to 2019.

Notably, data for medical price inflation for the 2014-2016 period has shown no positive effects from the ACA, and has actually remained consistently below model predictions. Thus, the positive effects of the ACA on spending growth are observed entirely in higher growth in enrollment and in the volume and intensity of services per enrollee. This effect can be reasonably interpreted as reflecting pent up demand among the previously uninsured who gained coverage under the ACA expansions of coverage beginning in 2014. The return to predicted patterns of spending growth for 2017 through 2019 suggests that this effect of the ACA had tapered off by 2016.

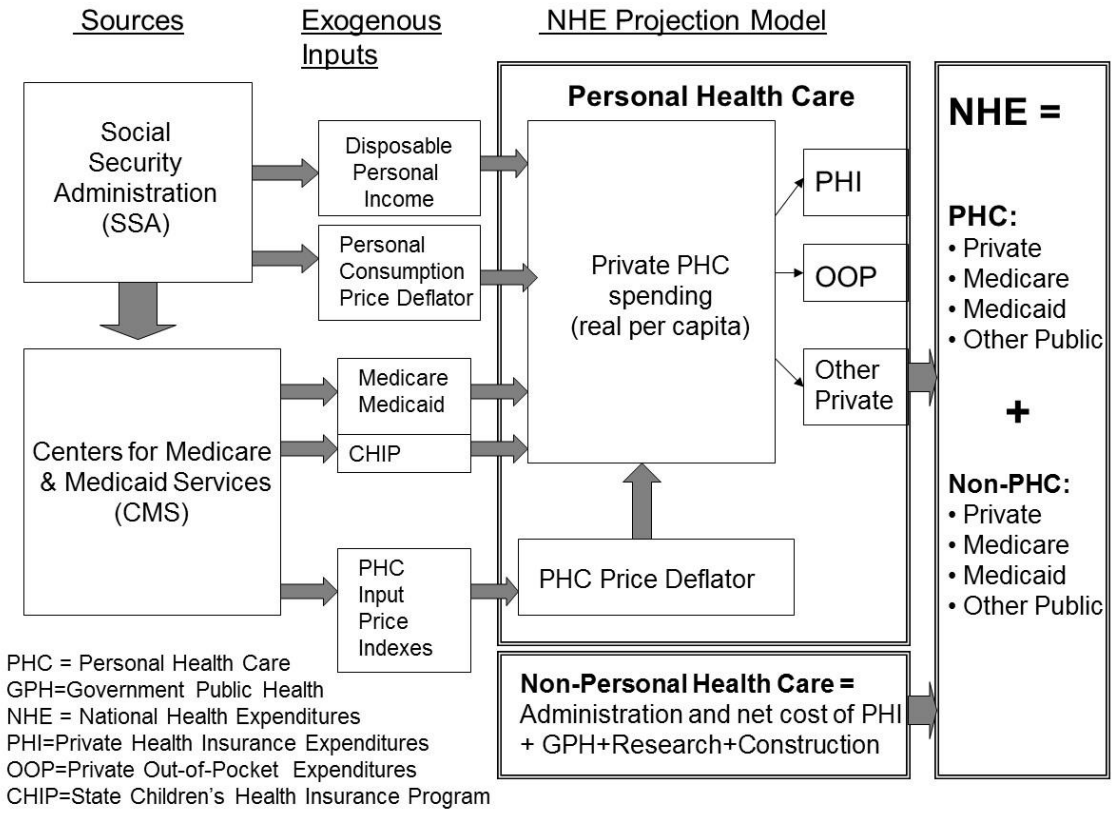
The effects of Federal stimulus in response to the COVID-19 pandemic on income growth in 2020 and 2021 have been quite substantial. The resulting pattern of income growth produces a sharp acceleration in real per capita income in 2020 – which then slows in 2021 and turns negative in 2022 as the effect of stimulus spending wanes. This pattern in income growth raises difficult questions given the strong relationship between income growth and real per capita private PHC spending growth. With the long and extended lag in the effects of income on health spending growth, these large additions to income growth in 2020-21 imply positive effects on demand for health care that taper off over time, with some effects extending out to 2027. Yet much this income has been unusual in nature – and a substantial part of it seems like to be treated as one-time additions to income. Such "windfall" additions to income tend not to influence consumer demand on a long-term basis by as great an extent as additions such as a raise in salary that are expected to persist. For purposes of model projections, we therefore developed an adjusted series for real per capita DPI that excludes a portion of stimulus spending (subtracting the total amount of Federal stimulus checks to households, together with Federal payments that augmented state unemployment benefits through September 2021). Effects of specific, pandemic-related legislative provisions on personal income are based on estimates from the Bureau of Economic Analysis (BEA).[29] The adjustment to DPI to exclude these nonrecurring payments to households dampens the effect of COVID stimulus on projected private spending growth.

ii. Structure of the private PHC spending model

Exhibit 6 below provides a schematic view of the aggregate health sector within the NHE Projections Model and shows the linkages among the data sources, exogenous data, the PHC model, the non-PHC output, and the aggregate NHE projection.

[29] Bureau of Economic Analysis. Effects of Selected Federal Pandemic Response Programs on Personal Income, 2021Q4 Advance [Internet]. Suitland (MD): Bureau of Economic Analysis; 2022 Jan 7 [cited 2022 Feb 8]. Available at: https://www.bea.gov/sites/default/files/2022-01/effects-of-selected-federal-pandemic-response-programs-on-personal-income-2021q4-adv.pdf.

Exhibit 6: Illustration of the Structure of the Private PHC Model*



*Private real per capita PHC spending is adjusted to hold constant the effects of demographic shifts in the population across age and sex cohorts

The NHE Projections Model can be characterized as a top-down, reduced-form model. It is a reduced form model in that both supply and demand factors are represented as drivers of growth, but without an explicit theoretical model framework. Thus, the coefficients in the model capture the relationships between health sector variables and macroeconomic variables as they occur in equilibrium without attempting to identify the underlying parameters that characterize the dynamics of supply and demand.

It is a top-down model in that spending and pricing trends are modeled at the aggregate PHC level, with underlying trends by sector constrained to aggregate PHC for consistency with the broader picture. Thus, spending projections for all subcategories—types of medical care by sector, direct sources of funding for medical care, and all sponsors of payment—are constrained to equal aggregate projections. Though the ultimate projections for all the subcategories are constrained to add up to the aggregate projection, models for spending by sector, source of funds, and sponsor are also estimated individually—both to maintain any distinctive trends relative to the aggregate trend and also to maintain consistency with exogenous projections of macroeconomic variables, actuarial projections of spending for the Medicare and Medicaid programs, and additional assumptions specific to the health sector.

The primary reason for the choice of a top-down model is that private PHC spending at the aggregate level is much more predictable in a model context than spending for each of the individual sectors (such as hospital or physician and clinical services). This greater predictability at the aggregate level reflects the difficulty in capturing the dynamics of interrelationships in spending growth across types of care that act as substitutes. In

particular, it is critical to account for the effects of shifts in settings for health care delivery if we are to explain historical patterns of growth for the individual sectors. Such shifts often occur in response to changes in government policy or PHI coverage. For example, the shift in setting from inpatient hospital to either outpatient hospital or to physician offices was hastened by the introduction of the prospective payment system for Medicare inpatient care in 1983. The shift from the inpatient hospital setting was then further accelerated by the growth in the 1990s of managed care plans, the design of which tended to discourage the use of more intensive care relative to less intensive care. We cannot fully control for these changes in government policy and PHI coverage, because we have no direct measures of the effects of policy and institutional change that can accurately capture the year-to-year variation in the magnitude of the effects. Consequently, these event-driven shifts among the sectors are more difficult to project at the sectoral level than at the aggregate level (where much of the effect of substitution across settings of care is subsumed in the aggregate).

The core of our aggregate model of private PHC spending consists of two equations:

1) Real per capita private PHC spending (adjusted to hold demographics constant)[30]
2) PHC price inflation

Conceptually, Equation (1) represents the quantity of medical care, while Equation (2) represents the price of medical care relative to other consumption goods. All variables are expressed as log differences (growth rates). Our focus on relationships in terms of growth rates, rather than levels, reflects the relatively short forecast horizon of these projections. Models that are estimated on the basis of growth rates are concerned primarily with short-term dynamics and effectively assume that there will be no unsustainable divergences from long-term relationships in levels terms. While underlying relationships in terms of levels are not expected to change very much within the single decade that our projections cover, these relationships ultimately have an effect on the long-term trend in growth rates (particularly when growth is rapid). Thus while we project relationships in growth using our model, we also monitor them on the basis of levels as well and adjust model projections to maintain relative levels in line with historical patterns where necessary.

The aggregate model for growth in PHC spending incorporates factors that influence both the supply and demand for medical care. Real per capita private PHC is effectively a measure of the quantity of medical care purchased by private payers.[31] In this model, growth in quantity is driven primarily by factors that influence aggregate consumer demand: the effects of changes in aggregate income and the relative price of medical care. Growth in real per capita public PHC spending is also included as a variable in this model because insurance under Medicaid, Medicare, and CHIP substitutes for private coverage. In addition, the model builds in the effects on spending of shifts in the demographic composition of the population based on an index that is defined to capture the change in spending that is implied by a change in the composition of the population across age, sex, and proximity to death cohorts. In contrast, our model for relative medical price inflation is primarily a supply-side model; price is assumed to be a function of the costs of production. We assume that growth in the relative price of medical care will be driven by underlying growth in input costs for medical providers. Relative price growth also reflects trends in relative productivity growth, and these trends are implicitly captured in the historical data. In addition, we include a variable for the share of spending that is made on an out-of-pocket basis by consumers.

[30] This dependent variable is divided by a demographic index to control for the effects on spending of shifts in the composition of the population across age, sex, and proximity to death cohorts.

[31] The accuracy of real per capita spending as a measure of quantity is dependent on the accuracy of the medical price indexes that are used as deflators.

iii. Real per capita private PHC spending (adjusted to hold demographics constant)

The dependent variable in the aggregate model of real per capita private spending is growth in real per capita private PHC spending divided by a demographic index. The demographic index is defined as the share of population by each age, sex, and proximity to death (referred to as the "time-to-death" or TTD) cohort, multiplied by the base year spending for that cohort. This demographic index previously controlled only for the effect on spending of changes in the composition of the population by age and sex. With the current NHE Projections release, the demographic factor used to project expenditures was improved to reflect the increasing longevity of the population consistent with the approach used to project Medicare spending.[32] Specifically, the demographic factors now account for the changing mix of population over time on the basis of age, sex, and time-to-death (TTD). The demographically-adjusted dependent variable represents the private real per capita PHC spending growth that we would expect to see for a population with a constant distribution of population across age and sex cohorts.

The independent variables in the model are as follows:

- Current and lagged growth in disposable personal income (less Medicare and Medicaid, real per capita)
- Lagged health share of Gross Domestic Product (PHC for all sources of funds as a share of GDP)
- Relative medical price inflation (PHC)
- Public spending growth (PHC, real per capita)
- Dummy variables for 2014, 2015, 2016 (ACA coverage expansion)

[32] Centers for Medicare and Medicaid Services. Memo: Demographic Factors Used to Project Medicare Expenditures—Incorporation of Time-to-Death to Account for Increasing Longevity on the Age-Sex Distribution of Spending [Internet]. Baltimore (MD): CMS; 2020 Apr 22 [cited 2022 Feb 2]. Available from: https://www.cms.gov/files/document/incorporation-time-death-medicare-demographic-assumptions.pdf.

Exhibit 7: Functional Form of the Real Per Capita Private Personal Health Care (PHC) Spending Model

$$\Delta \ln (h_{\mathrm{pr,t}} / p_{h,t} / n_t / d_t) = \alpha + \sum_{x=0}^{-6} \beta_{y,x} \Delta \ln(y_{dpi,t-x} / p_{y,t-x} / n_{t-x}) + \beta_p \Delta \ln(p_{h,t} / p_{y,t})$$

$$+ \beta_h \, h_{t-1} / y_{gdp,t-1} + \beta_{pu} \Delta \ln (h_{pu,t} / p_{h,t} / n_t) + \beta_{2014} D_{2014} + \beta_{2015} D_{2015} + \beta_{2016} D_{2016} + \varepsilon_t$$

Model variables and parameters (t subscript represents time period):

$h_{pr,t}$	=	private PHC health spending
$h_{pu,t}$	=	public PHC health spending
h_t	=	total PHC health spending
d_t	=	index of variation in PHC spending attributable to change in the composition of population by age, sex, and time-to-death cohorts
n_t	=	population
$y_{dpi,t-x}$	=	real disposable personal income per capita, time=t-x (x=years lagged)
$y_{gdp,t}$	=	real gross domestic product
$p_{h,t}$	=	PHC price deflator
$p_{y,t}$	=	GDP price deflator
D_{yyyy}	=	dummy variable for years yyyy=2014, 2015, 2016
α	=	model constant
β_x	=	model coefficients
ε_t	=	error term

All variables are included in the model as logarithms (relationships among model variables are assumed to be multiplicative in nature). Δ indicates that variables are first differences (i.e., $\Delta h_t = h_t - h_{t-1}$). The coefficients of each lagged value of real per capita disposable personal income ($y_{dpi,t} / p_{y,t} / n_t$) were constrained to lie on a second degree polynomial. Lags for the income variable were included only for the period where the estimated coefficients on lagged values remained positive in an unconstrained estimation (six years).

We discuss each of the model variables in turn below.

iv. Disposable personal income (DPI)

For the purpose of this model, income is defined as real per capita DPI excluding Medicaid and Medicare payments.[33] The exclusion of Medicaid and Medicare spending reflects the fact that these programs are effectively "in-kind" income (income paid in the form of health care benefits) that accrues to those individuals with public coverage. Since we are attempting to approximate income growth primarily for those with private coverage, we exclude this income from our measure.

As discussed earlier in the paper, real per capita DPI is an important variable in our model of private PHC spending. While our estimates are based on time-series data for the United States alone and include spending only by private payers, the importance of this variable is consistent with a large body of literature examining the empirical relationship between national income and health spending. A number of studies based on time-

[33] The objective is to obtain a measure of income that applies to the population that accounts for private spending on medical care. Thus we exclude spending for Medicare and Medicaid, which are included in DPI but accrue to a population that is primarily publicly insured. Since private spending includes out-of-pocket and PHI spending for Medicare beneficiaries, the correspondence cannot be exact.

series cross-country data for the Organization of Economic Cooperation and Development (OECD) economies confirm the importance of the link between health spending and income.[34] It has been repeatedly shown that variations in real per capita GDP (used as a proxy for income due to data availability) explain a substantial share of variation in health spending across countries and time.

In the econometric model of real per capita private personal health care spending, income has a lagged effect on health spending. To capture the timing of these lags, the income term in our model of PHC spending is incorporated as a polynomial-distributed lag estimated over 7 years (extending from 6 previous years through the current period). The specification of the model with all variables expressed as log-differences (growth rates) implies that coefficients on model variables can be interpreted as price and income elasticities, which are assumed to be constant over time.

Though fluctuations in growth in aggregate income have some immediate effects on growth in private PHC spending, these initial impacts are usually fairly small. The current-period income elasticity in the NHE Projections Model estimate is 0.23, which means that the change in growth for health spending in response to a change in income growth in the same period will be 23 percent as large as growth in income. While on the other hand, the effective long-term income elasticity of private PHC spending is 1.6. The long-term income elasticity is based on the sum of the effects of lagged income over a period of seven years with the peak effect of lagged income estimated at two years. This long-term income elasticity implies that health care spending rises substantially faster than income growth in the longer term; a 1-percent increase in income growth will result in a cumulative increase in private PHC spending of 1.6 percentage points. The magnitude of this estimated income elasticity is at the upper end of estimates for macro-level elasticities of approximately 0.8 to 1.6 in the empirical literature.[35] This relatively higher elasticity reflects characteristics of our model specification that differ from several other published estimates including the focus on private health care spending (rather than total health care spending).

The long lags that are built into this model reflect several important characteristics of markets for health services. In particular, since private insurers or public payers account for the large majority of health expenditures, this spending is largely insulated from contemporaneous changes in household income. Furthermore, consumers generally do not pay for most medical expenses directly at the point of purchase. For the most part, the decisions of insured patients are not immediately affected by changes in their own household income except in those cases in which substantial parts of the expenditure are paid for out-of-pocket. However, some immediate effects can be expected in response to cost sharing requirements in PHI plans or the loss of employment with the associated loss of employer-sponsored health insurance. As mentioned previously, the response to the economic recession in 2007-2009 appears to have been unusually large because of the concurrent substantial decline in employment that resulted in large losses of employer-sponsored coverage.

The other critical element captured by the lag in the impact of income growth on private PHC spending is the role of multiple intermediaries between consumers and medical providers. These intermediaries consist of employers or unions, who negotiate on behalf of pools of employees, and governments at the Federal and state level, which determine the nature of coverage and methods of payment for Medicare and Medicaid, as well as the regulations that constrain private employers and insurers. The intermediaries' determinations may result in changes in coverage and methods of payment, which can then affect providers' decisions on behalf of individual patients. Many such decisions are determined contractually or by regulations. Consequently, substantial delays may be required to implement any response to changes in underlying consumer preferences, both to negotiate any changes to contracts and regulations, and to implement such changes in a way that would influence choices of medical treatment in practice. In addition, in response to any modifications in the design

[34] Chernew, Michael E., and Newhouse, Joseph P. "Health Care Spending Growth." In *Handbook of Health Economics*, vol. 2 (2012). Eds. Pauly, Mark V., McGuire, Thomas G., and Barros, Pedro P. Amsterdam (NLD). Elsevier, Pages 1-43.
[35] Ibid.

of their health plans, employees may take time to respond to changes in incentives under the conditions of insurance coverage by gradually changing their patterns of health care consumption over time. Further, doctors and other medical providers may also respond gradually to changes put in place by payers. In the long run, responses could include altering treatment protocols in response to the incentives inherent in methods of payment for care and in response to constraints on coverage imposed by insurers. Because of these interactions among intermediaries, consumers, and providers, it is reasonable to expect that the response of the system to changes in income growth will extend over a period of years.

v. Lagged health share of Gross Domestic Product (GDP)

Though our models are expressed in terms of relative growth rates, short-term growth in private PHC spending is not independent of underlying relationships in spending levels. In particular, the relationship between current growth in private PHC spending and aggregate growth in DPI can be expected to change as health spending accounts for a rising share of consumption. As the aggregate health share of consumption increases, demand will tend to become more responsive to rising relative medical prices. The income elasticity of demand for health care must ultimately decline towards a value of one over the long run, where health spending grows at the same pace as income. As this adjustment in consumer preferences occurs, the rate of increase in the share of income allocated to health care can be expected to slow down compared to other goods and services. Given the dominant role of insurance as a direct payer for health care, we can expect this effect to influence growth at the aggregate level for the pool of health consumers covered by insurance.

The model specification includes a variable intended to explicitly capture the impact of the rising health share of consumption on the relationship between health care spending growth and its determinants. This variable is defined as the ratio of total PHC spending to GDP, lagged by one year. Its estimated impact is negative and significant, but fairly small in magnitude compared with the year-to-year variation in real per capita private PHC spending. Despite the small magnitude of the effect on annual predicted for spending, the ratio is important to include in the model specification. In concept, this variable controls for the effects of structural changes in the long-term relationship between health spending growth and the other variables included in the model specification.

In defining this variable, we use aggregate spending on medical care by all payers (not solely private payers), and we use GDP rather than income or consumption for this measure. This definition reflects the theoretical basis for the effect.[36] Like any other form of consumption, health spending is fundamentally subject to a budget constraint, but in cases in which insurance coverage severs the connection between individual decision-making and individual income, the budget constraint for health spending is binding at the level of the insurance pool.

The binding budget constraint that is applicable is defined at the level of a population pool that is relevant for those decision-making processes influencing the delivery of health care within our current system.[37] Decisions with systemic implications for the delivery of medical care are made by both private and public insurers. Medicare and Medicaid policies influence private insurers, particularly through the structure of payment rates for medical providers. Thus the appropriate definition of the pool that is relevant to the definition of a binding budget constraint is national in scope. We use GDP (rather than DPI) because, for the domestic economy as a whole, GDP is a measure of the total value of output of the economy. It therefore dictates the budget for aggregate national health spending, which is the ultimate long-term constraint on health spending growth.[38] While we can expect consumers to form short-term preferences on health versus non-health consumption based on short-term fluctuations in their own income, the long-term budget constraint on payment for health care (for

[36] Getzen, Thomas E. "Health Care Is an Individual Necessity and a National Luxury: Applying Multilevel Decision Models to the Analysis of Health Care Expenditures." *Journal of Health Economics*, 19, no. 2 (2000): 259-270.
[37] Ibid.
[38] Ibid.

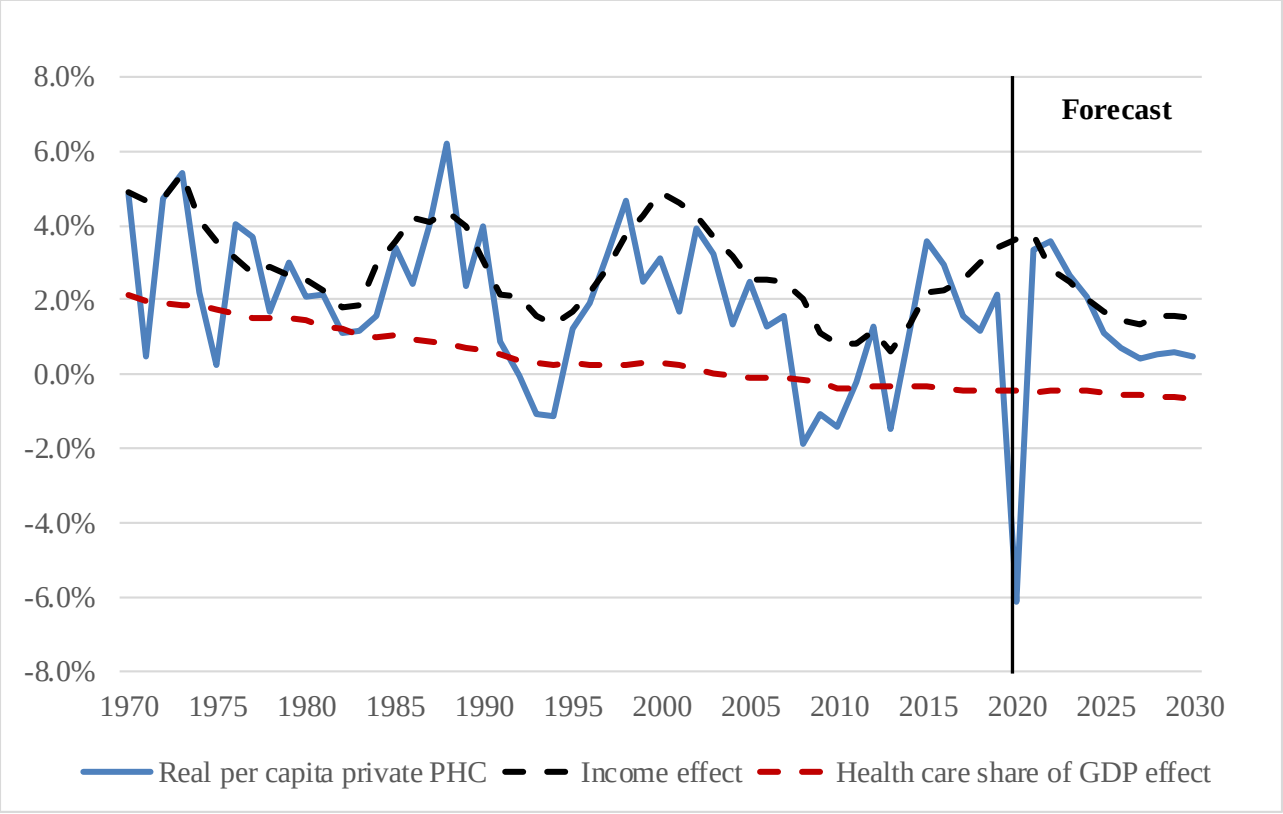
both public and private payers) cannot exceed growth in GDP.

Exhibit 8 illustrates growth in real per capita private PHC, the estimated effect of growth in real per capita DPI, and the estimated negative impact on real per capita private PHC growth of the lagged, rising health share of GDP. Note that the negative effect of the rising health share varies in response to recent experience; a period of slower health spending growth tends to relieve some pressure from the system. As the trend in the health share of GDP flattens, this reduces the negative effect on current-period private spending growth attributable to the national budget constraint.

The pattern of real per capita private PHC spending shown in Exhibit 8 for this year's projections also reflects the unusual effects of the COVID-19 pandemic, which impacted both actual pattern of medical care delivered to patients as well as substantial additional spending associated with Federal assistance to health care providers due to the pandemic. The substantial one-time effects strongly influence private health spending as well as the magnitude and projected effects of income, and the health share of GDP.

Exhibit 8: Growth in Real Per Capita Private PHC Spending

with Estimated Effects of Income Growth and Health Share of GDP, 1970-2030



*Values shown were re-scaled by the model's constant term for illustration purposes. The rescaling was calculated by subtracting the value of the estimated constant in the model from the annual value of the estimated impact of the lagged health share of GDP.

vi. Relative medical price inflation

Economic theory predicts that consumers adjust their spending on different goods and services in response to variations in the relative price of these alternatives. However, the existence of third-party payers for medical care complicates the response of demand to relative price variation. Consumers bear only a fraction of the

actual price of medical services at the time of purchase. Thus, in short-term consumption decisions, they respond to the marginal out-of-pocket price rather than to the actual price, which is generally determined by a combination of deductibles, cost-sharing requirements, and out-of-pocket maximums.[39]

However, the effects of out-of-pocket prices on consumer choices are only one potential avenue for price effects in health care markets. Medical prices also influence demand for care in two other ways. First, the price of health insurance is effectively the price of the bundle of medical goods and services an enrollee is expected to consume (plus administrative costs and profits). Consumers' decisions to purchase private health insurance and the generosity of the coverage selected, are therefore influenced by the relative price of medical care through this channel. Second, the relative price of care affects demand for services through the price sensitivity to health insurers' coverage, through provider selection decisions (as with narrow networks), and in some cases through the design of cost-sharing requirements (as with tiered copays).

Exhibit 9: Functional Form of the Relative PHC Price Model

$$\Delta \ln\left(p_{h,t}/p_{c,t}\right) \;=\; \alpha + \beta_{ipi}\,\Delta \ln\left(\frac{\sum_{x=0}^{-1}\left(ipi_{t-x} \,/\, p_{y,t-x}\right)}{2}\right) + \beta_{oop}\,\Delta \ln\left(h_{proop,t} \,/\, h_t\right) \;+ \varepsilon_t$$

$p_{h,t}$	=	PHC price deflator
$p_{c,t}$	=	Personal consumption price deflator
$p_{y,t}$	=	Gross domestic product price deflator
$ipi_{h,t}$	=	Input price index for medical providers
$h_{proop,t}$	=	private out-of-pocket PHC health spending
h_t	=	total PHC health spending
α	=	model constant
β_x	=	model coefficients
ε_t	=	error term

All variables are included in the model as logarithms (relationships among model variables are assumed to be multiplicative in nature). Δ indicates that variables are first differences (i.e., $\Delta h_t = h_t - h_{t-1}$). Growth in input prices for medical providers is estimated based on an index based on the composition of input costs, with each major input to production of medical care represented by a price index (or proxy). Input price index is deflated by the GDP deflator. Relative input price inflation is represented in the model specification by a two-year moving average of input price inflation. The out-of-pocket share of PHC spending is defined as the ratio of out-of-pocket spending to private PHC spending.

[39] The price to consumers can be roughly approximated by the fraction of total costs paid out-of-pocket multiplied by the actual price. This approximation is flawed; for decision-making purposes, the important question is the marginal price, which is the amount that the consumer pays for an additional dollar of medical care. Because of the broad use of copayments, deductibles, and out-of-pocket maximums, combined with the fact that a large share of health care consumption is accounted for by high-cost cases, the marginal price paid by consumers is often zero.

Within our model, relative medical price inflation has a significant negative coefficient, as we would expect. The price elasticity of demand for private PHC in our model is −0.3, which is above micro-level estimates of price elasticity of demand for medical care (−0.1 to −0.2 based on the RAND Health Insurance Experiment).[40] This difference reflects the use of individual-level data in micro-based studies to analyze the relationship between an individual's out-of-pocket spending and effective prices paid for services (accounting for coinsurance rates), compared to our use of macro-level national health spending data and price indexes from the Bureau of Labor Statistics. The difference also reflects the relatively short time frame used in micro-level studies compared to our analysis, which spans more than five decades.

Medical price inflation is an endogenous variable in our model (i.e. it is projected based on an equation within the NHE Projections Model rather than taken as an outside input to the projection). The dependent variable in the model equation is growth in relative medical prices, defined as the ratio of OACT's price deflator for PHC spending to the economy-wide consumer price deflator. The model for relative medical price inflation includes two independent variables: 1) relative input price inflation for medical goods and services (a measure of the wages and prices paid by providers of medical care for costs) and 2) the out-of-pocket share of private health spending.[41]

The measure of input price inflation included in the model for relative medical price inflation is based on individual input price indexes that are defined for each type of medical provider. Input price indexes are defined as indexes, where each component of provider costs is represented by a proxy series that is selected to track economy-wide price growth of that individual service or commodity, and the index weights represent the share of provider costs for that input Due to data limitations, input price indexes have historically omitted compensation for self-employed workers in some sectors. A substantial fraction of these self-employed workers are physicians or other medical professionals. Accordingly, input price inflation measurement may be influenced by this omission as a function of the differential in growth between compensation for employed workers and that for self-employed workers. The effects of causal factors other than input price inflation (economy-wide price inflation, productivity growth, and industry profitability) are either captured indirectly through their influence on input price inflation, or captured within the model constant.

In addition to variables that capture the growth in input prices, the model for relative medical price inflation includes a demand-side variable: the growth in the share of out-of-pocket spending as a share of total private spending. The basis for the inclusion of this variable is that the out-of-pocket share influences the price elasticity at the point of purchase. While we would expect to see a portion of this effect reflected in the price coefficient in the model for real per capita medical spending, recent analysis of NHEA data suggests that providers are reacting to the increasing cost sharing requirements of PHI plans in their price-setting decisions. Growth in the out-of-pocket share of spending thus acts as a constraint on the ability of providers to charge higher prices to consumers for services.

[40] Manning, Willard G., *et al*. "Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment." *American Economic Review*, 77, no. 3 (1987): 251-277.

[41] The input price index used for personal health care is a weighted average of OACT's input price indexes for hospital services, physician services, home health services, nursing home services, and pharmaceuticals.

vii. Real per capita public PHC spending

The use of the total population (rather than private health insurance enrollment) as the denominator for real per capita private PHC spending implies that that the relationship of the dependent variable to real per capita public PHC spending growth will be negative. This negative coefficient primarily captures the effects on private spending of shifts in the insured population between public and private forms of coverage. However, in addition to the effects of shifts in enrollment, the negative coefficient on public spending can be expected to capture the impacts on private PHC spending growth of any cost-shifting (private to public, or public to private) that may occur.[42]

viii. ACA coverage expansion

Dummy variables are included in the model to capture the effects of the ACA for the years 2014, 2015, 2016. The substantial expansion of private health insurance coverage under the ACA corresponds to an increase in private PHC spending growth. However, even after controlling for the effects of the ACA on coverage, growth in private PHC spending also seems to have increased over this period on a per enrollee basis, implying a temporary increase in utilization of services for PHI enrollees above that predicted by the model.[43] Dummy variables for years beyond 2016 were not found to be significant as growth in real per capita private PHC returned to a pace that is closer to model predictions after 2016.

b. Non-PHC health care spending

For non-PHC health care spending (accounting for the remaining 16 percent of national health spending after PHC in 2019), models are estimated for each of the four categories: (1) government administration and the net cost of private health insurance (PHI), (2) non-commercial research, (3) government public health, and (4) structures and equipment. These categories are heterogeneous in nature and are somewhat more volatile and unpredictable than that for personal health care. In addition, the drivers of growth for the non-PHC categories are quite different from those for PHC. As a result, projections for the non-PHC categories are based on separate models with varying specifications.

As stated earlier, projections of the NHE deflator and the non-PHC sectors were produced for the first time with the NHE 2021-30 projections release. Thus, econometric models for price indexes were developed for non-personal health care categories of spending (government administration, net cost of insurance, government public health activity, research, structures, and equipment expenditures). The PHC and non-PHC price projections and the projected spending by sector for NHE are utilized to generate the chain-weighted NHE deflator.

Several of the non-PHC sector projections were impacted by additional Federal funding in response to the

[42] The choice of denominator reflects consistency issues in the underlying enrollment data for PHI, as well as cyclical fluctuations in the demographic mix of those individuals with public versus private coverage. While it would be conceptually preferable to estimate a model based on growth in spending per enrollee, there are serious flaws in the available data for this purpose. Data for private enrollment are defined to comprise all persons with private coverage, including Medicare beneficiaries with private supplementary coverage, so that there is substantial portion of PHI enrollees that also have Medicare coverage. Since private spending reflects only the supplementary share of spending for these Medicare beneficiaries, PHI per enrollee trends tend to become distorted. In addition, the history for PHI enrollment stems from multiple sources. Data prior to 1987 are subject to inconsistencies over time due to variations in survey questions. Another issue concerns the effect of linked fluctuations in Medicaid and PHI enrollment over the business cycle. Slower economic growth can lead to an influx of a population (for example, children and non-disabled adults) that is relatively low-cost compared to the existing Medicaid population (which is weighted relatively heavily towards the institutionalized). This shift distorts per enrollee growth for both private spending and Medicaid.

[43] This conclusion is based on the estimation of an alternative specification of the model with real private spending on a per enrollee basis – rather than on a per capita basis – as the dependent variable.

COVID-19 pandemic. Estimates of the impact of this additional funding was primarily estimated separately (also discussed earlier in this document) and added on to the projections described below.

i. Government administration and the net cost of health insurance

Administrative costs include government administrative costs and the net cost of health insurance. These two categories are projected separately. Government administration spending (i.e., salaries and expenses related to the management of health insurance) is projected based on available budgetary information, with trend-based econometric models for the remaining categories.

The net cost of health insurance is a category of spending that is composed of the costs associated with administering health insurance and the profit margins that accrue to health insurers. Net costs for all health insurance plans are included in the category. The net cost of insurance for Medicare Advantage plans, as well as Medicaid and CHIP managed care plans is estimated primarily using actuarial methods and is exogenous, as with spending and enrollment projections for these payers.

Private health insurers' spending on net costs is projected based on econometric models that extrapolate historical trends and cyclical patterns. However, expectations for growth in the net cost of private health insurance for the near term of the projection period are primarily based on exogenous data and estimates of the impact of recent legislation rather than econometric models. Such estimates include the projected net costs of individual policies purchased through the ACA Marketplace, the mix of employer-sponsored and individual policies, and the anticipated effects of recent legislated changes on insurer premiums. In addition, the COVID-19 pandemic is estimated to have had a substantial effect on the variation in the net cost of private health insurance over the near term of the projection period, and in particular for 2020 and 2021. Actual medical claims spending in 2020 was substantially below expectations, as patients reduced utilization of discretionary medical care, which in turn, drove net costs substantially higher for the year. The higher than anticipated net cost spending in 2020 is expected to influence the pattern of growth projected in the near-term as private insurers adjust premiums in 2021.

Recent legislation has also exerted a particularly important effect on the net cost of private health insurance over 2019-2021 as we expect substantial variation prompted by the applicability of the health insurance fee (also referred to as the health insurance tax). The ACA imposed a non-deductible fee on private insurers providing fully-funded health insurance coverage. This fee was suspended in 2017 and reinstated in 2018. Projections for private health insurance spending reflect the removal of the health insurer fee in 2019, its temporary resumption in 2020, and its permanent removal from 2021 forward. The impact of these changes generates substantial year-to-year variability in net costs of private health insurance and in implied private health insurance premiums over the period from 2019 through 2021.

The projection for net costs of private health insurance in the second half of the projection period reflect general assumptions for the long-term trend, as well as exogenous assumptions for the effects of legislative or policy changes on this measure. Since the administrative costs portion of the category is generally fairly stable, most of the historical time-series variation in this category is attributable to profit margins, which have tended to move in cyclical patterns. (This phenomenon is known as the underwriting cycle.) The importance of this cyclical pattern has diminished in recent years as information technology has improved the ability of insurers to track medical claims in real time and as the consolidation of the industry has reduced variation in premiums due to insurers' entry into and exit from markets. In addition, as a result of the passage of the ACA and the establishment of the minimum medical loss ratio requirements[44], the importance of this cycle is ultimately

[44] The minimum medical loss ratio requirement under the ACA states that health insurers must spend a minimum share of premium revenues on health care benefits and quality improvements (80 percent in the individual and small group coverage and 85 percent in the large group coverage).

anticipated to diminish further over the projection period. In the long run, profit margins are expected to stabilize, with the ratio of net costs to underlying trend in medical benefits per enrollee converging towards the recent historical average.

Finally, some variation is expected to be generated by shifts in enrollment to the relatively smaller market for individually-purchased private coverage, which is subject to higher net costs than is the case in the large group market. Changes in the individual insurance market reflect the combined impacts of the continued effects of the implementation of the Marketplaces under the ACA, as well as other regulatory changes that have since occurred.[45]

ii. Non-commercial research

Non-commercial research spending growth is projected based on relationships to economic growth as represented by a 4-year lagged moving average of growth in real per capita GDP. Specific adjustments are made in cases in which Federal budgetary information is available (see also section 2b (ii) of this paper for a discussion specific to COVID-19 related funding).

iii. Government public health

Government public health spending growth is extrapolated based on historical trends, with specific adjustments made in cases in which budgetary information is available (see also section 2b (ii) of this paper for a discussion specific to COVID-19 related funding).

iv. Structures and equipment

Spending on health system structures is dominated by hospital construction and is therefore projected as a function of growth in hospital spending. Any additional information that becomes available (such as surveys of hospital construction)[46] is incorporated via adjustments into the projection. Equipment purchases are projected as a function of spending on health system structures to capture concurrent equipment spending that occurs with medical real estate investments and as a function of relative prices of new equipment purchases compared with other health care prices.

c. Submodels for sectors, sources of funds, and sponsors of payment

Spending projections are estimated for three underlying subcategories of health care spending:

- Type of service (sector)
- Source of funds (direct payer)
- Sponsor of payment (ultimate payer)

i. Models for health care spending by type of service

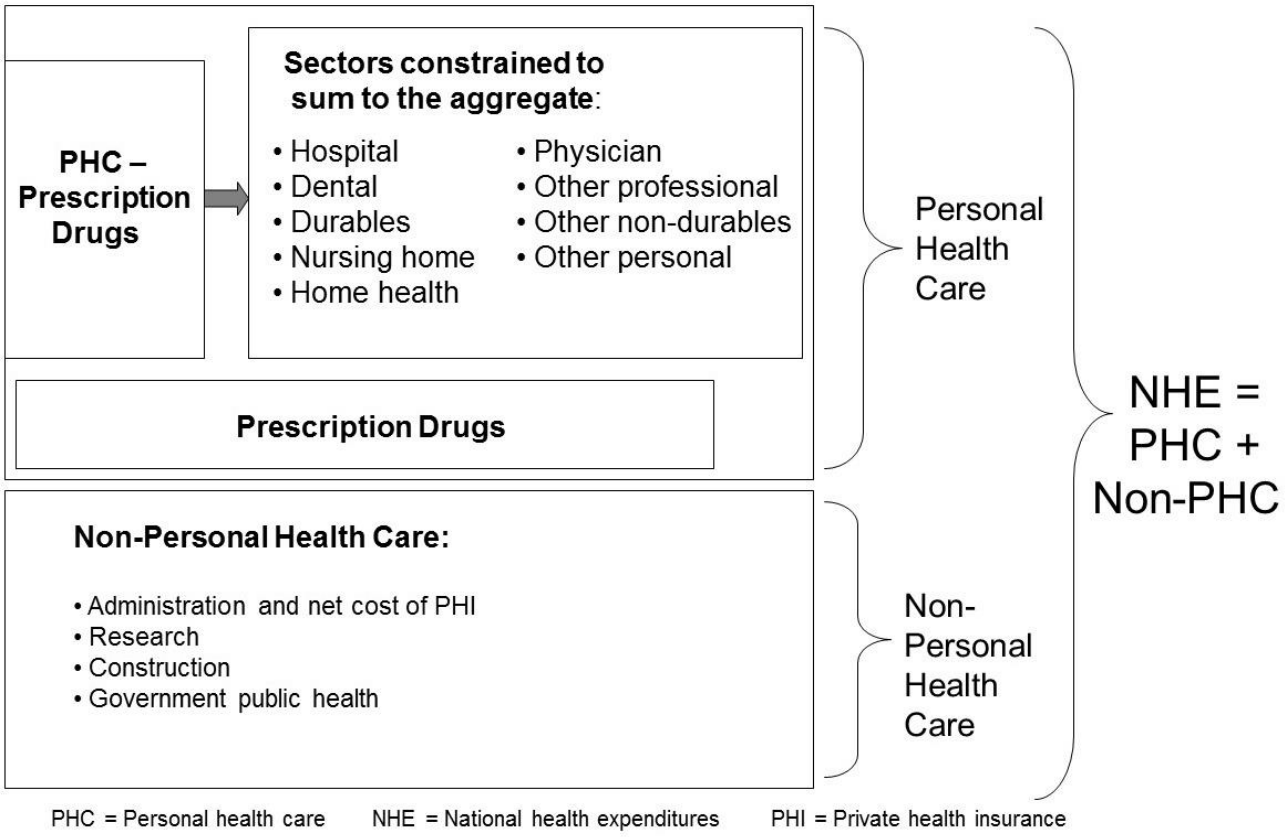
Models for real per capita private spending growth and price inflation for individual types of medical services are similar in specification to the aggregate model. Because the aggregate PHC-level model projections are

[45] In addition to those changes described in the legislative and regulatory impact section of this paper, prior regulatory changes included: the health tax provisions of the continuing resolution legislation passed January 22, 2018 (the insurer fees associated with the ACA were deferred in 2019) and the cancellation of the cost-sharing reduction payments (previously mandated under the ACA to insurers from the federal government) from 2018 forward, in accordance with the October 12, 2017, executive order.

[46] Surveys include 1) US Census Bureau Value of Construction Put in Place Survey (VIP). Available at: https://www.census.gov/construction/c30/c30index.html and 2) ASHE Health Facilities Management Magazine. 2021 Hospital Construction Survey. Available at: https://www.hfmmagazine.com/articles/4148-2021-hospital-construction-survey.

considered to carry a higher level of accuracy than the individual models by type of service, projected spending levels for all types of care within PHC (excluding prescription drugs) are normalized (adjusted for consistency with) aggregate projections. In practice this means that spending by type of service is multiplied by an adjustment factor that constrains aggregate spending levels across the sectors to sum to the aggregate projection for total PHC spending (excluding prescription drugs). Prescription drug spending is excluded from the normalization process because of its historic volatility and its lack of correlation with spending in other sectors.

Exhibit 10: Illustration of NHE Projections Models by Type of Expenditure



For the most part, key variables in the sector models follow a template specification similar to that used for the aggregate model for PHC spending growth. Major variables in the sector models include the following:

- Disposable personal income (excluding Medicare and Medicaid, real per capita)
- Relative medical price inflation
- Public spending growth (real per capita)
- Dummy variables for legislation, policy, and event driven effects

The parallel structure of the sectors within PHC allows income and price elasticities, and sensitivity to variation in public spending growth, to vary relative to the aggregate, with the constraint that the sum across all sectors must be equal to the projection generated by the aggregate model. Dissimilarities across the models for different types of services include varying lag structures for the income effect, the relative importance of the three variables, and the inclusion of dummy variables to capture phenomena specific to the sector. In a few cases in which relevant data are available, additional independent variables are included that are specific to the individual sector.

For each type of service, the lag on the income term in the models generally tends to vary with the share of spending that is accounted for by consumers' out-of-pocket expenses; that is, the greater the out-of-pocket share, the shorter the lag, as consumer demand responds more quickly to changes in their income.

Exhibit 11 summarizes the independent variables used to model real per capita private spending growth for each of the PHC sectors. We have provided additional descriptive information about the models for those sectors that represent the greatest shares of health spending.

EXHIBIT 11: MODELS BY TYPE OF SERVICE OR GOOD

SECTOR	DEPENDENT VARIABLE	INDEPENDENT VARIABLES*
Hospital services	Real private hospital services per capita, age-sex-TTD adjusted	Real disposable personal income (PDL, 7 years) (+) Relative price (−) Real per capita public spending growth (−) Dummy, 1984- (−) Dummy, 1984- * time trend (+) Time trend (−) Dummy, 2015 (+) Dummy, 2016 (+)
Physician and Clinical services	Real private physician services per capita, age-sex-TTD adjusted	Real disposable personal income (moving average of lags, 4 years) (+) Real per capita public spending growth (−) Relative price (−) Dummy, 1983-85 (+) Dummy, 1960-92*time trend (+) Dummy, 2015 (+) Dummy, 2016 (+)
Prescription Drugs**	Real aggregate drug spending per capita, age-sex-TTD adjusted*	Real disposable personal income (3-year moving average) (+) Relative drug price*Share paid out-of-pocket (3-year moving average) (−) New drug introductions (+) Generic dispensing rate (−)
Dental services	Real private dental services per capita, age-sex-TTD adjusted	Real disposable personal income (PDL, 3 years) (+) Relative price (−) Real per capita Medicaid and CHIP spending growth (3-year moving average of lags) (+) Dummy, 1981 (+) Dummy, 1960-1992 (+)
Nursing Care Facilities and Continuing Care Retirement Communities	Real private nursing home services per capita, age-sex-TTD adjusted	Real disposable personal income (moving average, 6 years) (+) Real per capita public spending (−) Relative price (−) Dummy, 1990 (+) Dummy, pre-Balanced Budget Act of 1997 (+) Share of population aged 85+ years (+)
Other Professional services	Real private other professional services per capita, age-sex-TTD adjusted	Real disposable personal income (+) Real per capita public spending growth (−) Relative price (+) Dummy, 1977 (+) Dummy, 1989 (−) Dummy, 1992- (−) Dummy, 1992- *Real disposable personal income (−) Dummy, 1992- *Real per capita public spending growth (+) Dummy, 1992- *Relative Price (-)
Over-the-Counter Drugs and Other Nondurables	Real private other nondurables spending per capita, age-sex-TTD adjusted	Real disposable personal income (2-year moving average) (+) Relative price (−) Lagged dependent variable (+)
Durables	Real private durables spending per capita, age-sex-TTD adjusted	Real disposable personal income (PDL, 2 years) (+) Relative price (−) Public spending growth (−)
Home Health services	Real private home health services per capita, age-sex-TTD adjusted	Relative price (−) Real per capita Medicaid spending growth (−)

*Independent variables in the form of a "dummy" followed by a dash denote that the variable effect starts at the specified year and continues through the projection period. **The prescription drug model is based on aggregate expenditures rather than private expenditures, due to complications in projecting shifts in payments associated with the introduction of Medicare Part D prescription drug coverage. See the Prescription Drug section below.

ii. Sector model: hospital services

Real per capita growth in private hospital spending is well explained by the variables in our template model specification. Because hospital services represent the largest share of personal health care spending among the services, we would expect to find a similar relationship between household income and hospital services spending as we observed between household income and overall personal health care spending. In addition, given the low out-of-pocket share, on average, for hospital services (our model captures both inpatient and outpatient settings), we anticipate a longer lag between a change in household income and the time of impact on hospital spending. Our results are consistent with these expectations; we estimate coefficients on lagged income growth with a polynomial distributed lag estimated for the current period and 7 previous years, one year longer than the lag structure for disposable personal income in the aggregate model for private personal health care spending. Additionally, the peak effect of income fluctuations occurs with a lag of 3 to 4 years, slightly longer than the aggregate model. As expected, public real per capita spending has a negative coefficient, capturing shifts in enrollment between private and public coverage as well as any possible short-term cost-shifting effects between private and public payers.

For this sector, the combined effects of managed care expansion and the introduction of the Medicare prospective payment system (PPS) are represented in the current model as a structural change in the relationship of growth to price and income that is largely one-time in nature, beginning in 1984 after the PPS was introduced. The alterations in provider incentives associated with the PPS, coupled with similar pressures from the expansion of managed care in the late 1980s through the 1990s, produced an initial reduction in growth that gradually tapers off. This tapering of the impact of PPS and managed care reflects the diminishing potential for reduced inpatient utilization over time as it becomes more difficult to find additional efficiencies at the margin. Similarly, the one-time effect of the ACA's coverage expansion implementation on real per capita hospital spending in 2015 and 2016 is captured through dummy variables, an approach consistent with that previously discussed for the aggregate model.[47] Likewise, consistent with the method discussed for the aggregate model, the estimated impacts of the COVID-19 pandemic on hospital spending are added on to a projection generated using the above model that uses historical data through 2019.

iii. Sector model: physician and clinical services

In the physician model, the estimated effect of the lag of disposable personal income (DPI) extends 4 years. The coefficient of relative price inflation is negative, as expected. Growth in real per capita public spending on physician services has a smaller estimated negative effect than the magnitude estimated in the aggregate model.

In general, our template specification fits real per capita growth in physician spending somewhat less well than it accommodates hospital spending. This reduction in model fit primarily reflects two distinctive periods of growth—1983-1985 and 1960-1992—that are not well predicted by the model. To capture the period of rapid growth from 1983 through 1985, we have included a dummy variable for these years. Our interpretation of this variable is that it captures a non-recurring substitution effect of professional services for inpatient care. The 1983-1985 period saw a major shift in provider incentives associated with the introduction of the Medicare PPS and the initial surge in managed care enrollments (as described earlier).

Despite substantial volatility, real per capita growth rates exhibit a slight upward trend during the second period, from 1960 through 1992. We have included a trend variable for these years to capture this effect. We interpret this variable as capturing the period of faster growth prior to the dampening effects of constraints from managed care organizations on use and intensity of care for privately insured individuals enrolled in these

[47] A dummy variable for 2014 was also tested as part of the model specification but was found to be not statistically significant.

organizations. Even as the effects of these more stringent utilization constraints diminished in the late 1990s, real per capita growth over 1992-2014 rarely peaked above 3 percent (compared to the period from the 1970s through 1992, when growth was above 4 percent for roughly half the years). The result of the inclusion of this variable is that the effects of the rapid growth prior to 1992 are removed from the other estimated coefficients, thereby moderating projected growth after 1992 in a manner that is more consistent with the recent history.

Mainly due to the major coverage expansions implemented in 2014 under the ACA, there was a notable acceleration in real per capita private spending growth that occurred in 2015 and 2016 for physician and clinical services. Given that these growth rates are largely influenced by exogenous legislative effects, we have included dummy variables for 2015 and 2016 to capture the effects of these major coverage expansions (similar to the handling previously discussed for the aggregate model for PHC). For the physician and clinical services model, only dummy variables for the years 2015 and 2016 were statistically significant, while the dummy variable for 2014 was not and was thus excluded from the final model.

The model for this service was estimated through 2019, which excluded the extraordinary impacts from the COVID-19 pandemic on the use of health care services in 2020. Because the effects of the pandemic were so unique relative to the historical period, these effects were estimated separately (as discussed previously) and added onto the econometric projections for 2021 forward.

iv. Sector model: prescription drugs

Prescription drugs differ in important ways from other types of medical care. First, since prescription drugs are a product, not a service, the cost structure of the industry differs substantially from that of other sectors (such as hospital, physician, or nursing home), for which labor costs play a critical role in driving price. In contrast, the cost structure of production for prescription drugs is highly capital-intensive, with relatively low marginal costs and a relatively larger role for the introduction of new products. Second, prescription drug spending has had a much larger consumer out-of-pocket share than other types of medical care, so that demand tends to be more sensitive to price. Third, we have access to additional information on supply and demand factors for this sector, in the form of data on new drug introductions, generic dispensing rates, research spending, patent expirations, and direct-to-consumer (DTC) advertising. As a result, our model for prescription drugs is somewhat different from the models developed for other sectors.

As opposed to the other health sectors, the dependent variable in the prescription drug model is real aggregate per capita drug spending (not private only). This decision was made because the start of Medicare drug coverage in 2006 produced a massive shift in the source of payments for drugs, which resulted in a sharp decrease in private drug spending growth in 2006, though it had little estimated effect on overall growth in drug spending. Accordingly, our model projects total prescription drug spending without simulating an explicit effect for Part D. The income variable within the prescription drug model fits with a shorter lag than in our aggregate model; this is the expected result based on the larger share paid on an out-of-pocket basis historically. Relative price inflation has a strong fit. The price variable is defined as the product of the out-of-pocket prescription drug share and the prescription drug price index—a definition that accounts for the trend in consumers' steadily declining out-of-pocket share over the last 20 years. However, available data do not distinguish out-of-pocket spending by the uninsured and by Medicare beneficiaries from the fixed co-payments that are often required within managed care, and thus our ability to capture this declining share is limited. The prescription drug price index is estimated historically and projected net of rebates received. Public spending growth is not included as a variable in this model due to its relatively minor role in the historical period (prior to 2006) and because the dependent variable is overall drug spending and not private drug spending.

Patterns of growth over the most recent 15 to 20 years of data are difficult to explain, as the effects of several different factors must be disentangled. The out-of-pocket share of spending by consumers dropped sharply as privately insured patients moved into managed care plans that generally have lower co-payments. (For the

most part, this phenomenon did not apply to Medicare beneficiaries, who continued to pay a relatively large share of drug costs out-of-pocket.) Also, changes to regulations in 1997 eliminated some of the earlier restrictions on television advertising for prescription drugs. In addition to income and relative price terms, our model for real per capita drug spending includes a 4-year moving average of the number of new prescription drugs introduced, as well as the rising generic dispensing rate, which has played an increasing role in depressing growth in prescription drug spending in recent years. In 2014, drug spending growth spiked up partly as a result of the use of new, expensive specialty drugs that were curative treatments for Hepatitis C (growth also increased because of the first year of the ACA major coverage expansion). However, in 2016 and 2017, the growth rate of prescription drug spending decelerated significantly and one major factor driving the slower growth was the decline in the use of these expensive Hepatitis C drugs. Another factor keeping drug spending growth relatively low from 2016-2020 was an increase in drug rebates, which resulted in the net growth of drug prices to be negative from 2018 to 2020.

v. Models for health care spending by source of funds (direct payer)

Our core econometric models project direct payments (spending) by all private sector payers. This total spending by private payer can be disaggregated to sources of payment at a more detailed level. The major types of private payers are private health insurers, direct payment by consumers on an out-of-pocket basis (OOP), and other private revenues.[48]

In contrast to our method for modeling total private spending for each of the sectors within PHC relative to aggregate PHC, our model for health care spending by private payer is "bottom-up" in nature; in other words, the private payer trends are projected at the level of individual sectors (hospital, physician, drugs, etc.). This approach reflects the fact that the nature of patient cost sharing differs greatly depending on the setting in which services are provided and the type of service. It also allows us to take into account the implications of sector-specific research and sector-level trends. For example, prescription drugs, physician services, nursing home care, and dental services account for roughly three-fifths of OOP spending; each of these sectors is influenced by a different mix of factors. As has been discussed throughout the paper, shifts in the composition of PHC spending across sectors have important effects on aggregate trends.

The projections for relative growth in PHI, OOP, and all other private spending for each individual sector are then added up and used to generate the projections for the shares of total private spending for the detailed private payer categories at the aggregate level. This process requires an adjustment procedure (iterative proportional fitting[49]) to ensure 1) the sum of spending for all private sources of funds by sector equals total private spending for all sources of funding and 2) the sum of spending for private health insurance, out-of-pocket, and other private spending across all types of services must equal the aggregate spending for total private spending.

[48] The other private revenues source of funds category is comprised of the medical portion of property and casualty insurance and philanthropy. Philanthropic support may be obtained directly from individuals, through philanthropic fund-raising organizations, or from foundations or corporations. For institutions such as hospitals and nursing homes, other private funds also include income from the operation of gift shops, cafeterias, parking lots, and educational programs, as well as investment income.

[49] According to Terry P. Speed, "Iterative proportional fitting, also known as iterative proportional scaling, is an algorithm for constructing tables of numbers satisfying certain constraints." "Iterative Proportional Fitting." In *Encyclopedia of Biostatistics* (2005). Available at https://doi.org/10.1002/0470011815.b2a10027.

In addition to private sources of funds, we also project public sources of funds other than Medicare and Medicaid. [50] These other sources account for approximately 25 percent of total public spending. The largest of these payers are the Department of Veterans Affairs (VA) and the Department of Defense (DoD), and the methodology we use for these programs is discussed below. Residual Federal and other state and local spending for smaller government programs is projected based on econometric models similar to those used to project real per capita private spending.

vi. Spending projections for Department of Defense (DOD) and Department of Veterans Affairs (VA) health insurance programs

The NHE projection model includes the separate econometric type of service equations for both the Department of Defense and Department of Veterans Affairs health care systems. Projections based on these models are then adjusted using data from published Federal budget requests for the upcoming fiscal year and data projections of the veteran population from the current VA Office of the Actuary's Veteran Population Projection Model (or "VetPop" Model). [51]

Expenditures for both the DOD and VA are driven mainly by fiscal policy, demographics, and economic conditions and, to a lesser extent, by overseas military operations. VA spending is expected to exhibit countercyclical elements, as eligibility is determined in part by income and the presence of other insurance coverage along with a myriad of other factors. Consistent with actuarial projections from the VA, it is expected that the number of veterans and active duty military personal will decrease over the forecast period.

vii. Models for spending by sponsor of payment

Sponsor of payment categories define which groups hold the ultimate responsibility for financing or supplying the funds needed to support health care spending by direct payers. Thus, our focus is on the relative spending for governments, households, and businesses that support payment for insurance coverage. For example, NHE spending by payer for PHI contains premiums paid to insurance companies financed through multiple sources, including contributions from employers (both public and private) and households and from governments through premium subsidies. Similarly, financing for Medicare consists of dedicated tax revenue from employers and employees, premium and interest income, and intergovernmental transfers. [52]

We project premiums for PHI plans, including their underlying components, employer-sponsored insurance (ESI) and other private health insurance for households and employers by types of insurance (group and individual) and sector of employment (public or private). Though PHI consists of ESI, Medicare supplemental insurance, and individually purchased plans, ESI premiums comprise the majority of PHI premiums

[50] Specifically, we model the Department of Defense and Department of Veterans' Affairs portion of spending within spending classified as "Other Health Insurance Programs." We also model spending trends for worksite health care, Indian Health Service, workers' compensation, general assistance, maternal and child health, vocational rehabilitation, other federal programs, Substance Abuse and Mental Health Services Administration, other state and local programs, and school health, all of which are included within "Other Third Party Payers." For further details on specific programs included in "Other Health Insurance Programs" or "Other Third Party Payers," please see the accounting identities for these categories in our NHEA methodology paper, available at https://www.cms.gov/files/document/definitions-sources-and-methods.pdf.

[51] US Department of Veterans Affairs. National Center for Veterans Analysis and Statistics, The Veteran Population Projection Model 2018 [Internet]. Washington (DC): VA; 2021 Apr 14 [cited 2022 Feb 2]. Available from: https://www.va.gov/vetdata/veteran_population.asp.

[52] Classification of spending by sponsor in the NHE projections is consistent with overall NHEA classification. A detailed description of how spending by source of funding maps to sponsor categories and associated sponsor accounting identities can be found in our NHEA methodology paper, 2020. Available at https://www.cms.gov/files/document/definitions-sources-and-methods.pdf.

(approximately 89% in 2019); consequently, the factors described previously that influence the PHI share of our aggregate projection of private PHC spending, combined with growth in the net cost of PHI, explain nearly all the variation in ESI premium growth.

Because premiums for Medicare supplemental insurance and other individually purchased plans grow differently than ESI premiums, we remove each type of spending from total PHI and project them separately. Our projections of per enrollee Medicare supplemental premium growth incorporate assumptions from the most recent Medicare Trustees Report regarding beneficiary trends in benefits and cost-sharing. For other individually purchased plans, we use their historical relationship with overall PHI to develop a projection of spending per enrollee. We then multiply projected enrollment in both Medicare supplemental plans and other individually purchased plans by their respective per enrollee premium projection to obtain an overall premium projection. (See further details on enrollment below.)

To maintain consistency within total expenditures across sponsor and payer estimates, we utilize iterative proportional fitting to adjust the matrix of spending for each cell relative to totals. For example, projections of components of PHI premiums, described above, for households and employers by types of insurance (group and individual) and sector of employment (public or private) must be adjusted to sum to total PHI spending. Additionally, we project payments by employers to state and local governments for workers' compensation and temporary disability insurance econometrically using macroeconomic trends. Conversely, a number of categories of spending are exogenous projections, based on the financing assumptions for both Medicare and Medicaid contained in the most recent Medicare Trustees Report. These categories include the following:

- Worker contributions to Hospital Insurance trust fund and taxation of benefits
- Employer contributions to Hospital Insurance trust fund
- Supplemental Medical Insurance Part B and Part D premium revenues
- Medicaid buy-ins for Medicare premiums
- State Medicaid phase-down payments

d. Private health insurance enrollment and uninsured population models

Projections for insurance enrollment by source of coverage are generated separately from projections for spending by payer. However, both enrollment and spending are modelled as a function of similar macroeconomic and public sector trends, and the implications of the two models for trends in spending per enrollee are a key part of the adjustment process involved in generating the final projections.

As with spending models, enrollment models primarily focus on projecting private sector insurance enrollment, taking projections for enrollment in public sector programs as exogenous inputs to the model. Projections for private health insurance are projected as a function of macroeconomic trends (including growth in employment and real GDP), demographic trends, as well as exogenous projections of enrollment in Medicare, Medicaid and other public sources of coverage.

In projections of private health insurance enrollment, we take trends in Medicaid, Medicare, and CHIP enrollment as exogenous inputs. Current projections of enrollment for these programs are based on the most recent Medicare Trustees Report and the latest available Medicaid projections from the Office of the Actuary. PHI enrollment consists of three components, which are (1) Employer-sponsored insurance, (2) Individually purchased insurance (non-Medigap), and (3) Individually purchased supplemental coverage for Medicare enrollees (Medigap).

The uninsured population is effectively projected as a residual implied by projections of population, together with enrollment from all sources of coverage and assumptions on overlap across those sources.

i. Employer-sponsored insurance

Employer-sponsored insurance (ESI) enrollment is obtained through the employment relationship and is therefore modeled as a ratio of ESI coverage to total employment. Growth in ESI enrollment may differ from growth in employment for several reasons. One reason is that not all employees have access to coverage through their employers. The offer rate for coverage and the terms under which it is offered (share of premium paid by employee) change over time. Another reason is that not all employees accept coverage when offered, which can also vary year-to-year. Finally, a number of those enrolled in ESI are not current employees; retirees and dependents of employees may also have coverage. For these groups, rates of coverage are determined by access to family or retiree coverage and the terms on which it is available.

The model of ESI enrollment includes the following independent variables:

- *Growth in enrollment in Individual PHI and Medicaid coverage.* This captures the substitution effect between ESI coverage and Individual coverage (purchased either through Marketplace Exchanges or off-Exchange) and Medicaid coverage. By controlling for substitution effects, this negative effect maintains aggregate level consistency between ESI and other enrollment categories.
- *Growth in total employment.* This variable has a negative coefficient, but it is effectively a partial offset to the coefficient of 1.0 on employment growth that is implied by the fact that the dependent variable is expressed as a ratio to employment (which assumes ESI enrollment will grow proportionately to employment). The negative coefficient on employment growth means that ESI enrollment responds less than proportionately to employment growth. Another way of looking at this is that ESI enrollment is less responsive to business cycle fluctuations than employment.

A portion of the trend in the ratio of ESI enrollment to employment is captured in the negative constant term, which reflects the declining trend in coverage caused by decreasing offer and take-up rates for individual and family coverage. We dampen this decline in coverage over the projection to reflect the estimated effects of the employer coverage mandate in the ACA.

ESI enrollment generally grows slightly less than proportionately to overall growth in employment producing a fairly consistent and predictable declining trend in the ratio of ESI enrollment to total employment. However, this relationship was significantly altered due to the unusual effects of the COVID-19 pandemic, with a substantially smaller decline in ESI enrollment than in employment in 2020. This unusual pattern of growth also influenced the near-term projection for growth in ESI enrollment relative to expected growth in employment.

ii. Individually purchased insurance (excluding Medicare supplement insurance)

Individually purchased insurance for non-Medicare enrollees includes coverage purchased both on and off of the ACA Health Insurance Marketplaces. Projections for Marketplace enrollment account for the largest share of this enrollment. Marketplace enrollment is projected exogenously and includes the effects of legislation providing additional resources to individuals to enroll in this coverage in response to the economic effects of the COVID-19 pandemic. Off-Marketplace coverage (sold outside of the ACA Marketplace) is not eligible for subsidies, and has been declining rapidly. Current projections for the total individual market assume that total enrollment on and off of the Marketplace will grow in proportion to the under-65 population. Off-Marketplace enrollment is then defined as a residual, equal to the difference between total individual enrollment and (exogenous) Marketplace enrollment.

iii. Medicare supplemental insurance

We model Medicare supplemental insurance—that is, private secondary Medigap coverage for Medicare enrollees—as a share of overall Medicare enrollment. Variables in this model consist of an exogenous

projection of Medicare Advantage enrollment (consistent with the most recent Medicare Trustees Report and a form of coverage that acts as a substitute for privately purchased Medigap plans), a dummy variable for 1994 to account for an outlier, and a variable representing the moving average growth of real per capita GDP.

iv. Uninsured population

We expect growth in the uninsured population to be consistent with growth in the "population residual" (which represents the total population minus the sum of enrollment in insurance across all sources of coverage). In practice, growth in the uninsured population and the population residual have historically been somewhat consistent, but do at times however, exhibit some noticeable differences. Historical differences between the uninsured and the population residual are largely due to measurement issues for coverage that affect all sources, as well as to variations in overlap across sources of coverage over time (those who have coverage from two or more sources). According to recent data, increases in the sum of enrollment across all sources of coverage correspond to a smaller decrease in the uninsured population. This relationship reflects a trend toward a rising share of insured persons with overlapping coverage from more than one source.

We project the uninsured population using the projected growth in the sum of enrollment across all public and private insurance categories together with a projection of the overall population of the U.S. The overlap across enrollment categories is assumed to continue rising gradually at a rate consistent with recent historical data; an increase in enrollment from any insurance source translates to a slightly smaller reduction in the uninsured population.

4) APPENDIX: LIST OF ACRONYMS

ACA	Affordable Care Act
BLS	Bureau of Labor Statistics
CHIP	Children's Health Insurance Program
CMS	Centers for Medicare & Medicaid Services
CPI	Consumer Price Index
DoD	Department of Defense
DPI	Disposable Personal Income
DTC	Direct-to-Consumer
ESI	Employer Sponsored Insurance
GDP	Gross Domestic Product
HCBW	Home and Community-Based Waivers
LIFT	Maryland Long Term Interindustry Forecasting
NAIC	National Association of Insurance Commissioners
NHE	National Health Expenditure
OACT	Office of the Actuary
OASDI	Old-Age, Survivors, and Disability Insurance
PHC	Personal Health Care
PHI	Private Health Insurance
PI	Personal Income
PPI	Producer Price Index
VA	Department of Veterans Affairs