The Office of the Actuary (OACT) in the Centers for Medicare & Medicaid Services (CMS) produces short-term (11-year) projections of health care spending for categories in the National Health Expenditure Accounts (NHEA) on an annual basis.

The NHE Projections consist of time series for all of the major spending categories in the NHEA. These projections reflect our analysis of probable aggregate trends in medical spending, for the mix of medical services consumed, and for trends in sources of payment and sources of financing. Detailed tables for the historical and projected NHEA are available on our website and a paper describing our results is published in Health Affairs accompanying the release of these projections.

The NHE Projections modeling methodology has evolved in response to the passage and implementation of the Affordable Care Act (ACA). Our standard NHE Econometric Model, which combines econometric models and exogenous actuarial projections of Medicare, Medicaid and the Children’s Health Insurance Program (CHIP), was modified to reflect a projection scenario on which to apply spending and enrollment impacts of the ACA, estimated using the Office of the Actuary Health Reform Model (OHRM) and detailed actuarial cost estimates prepared by OACT. Since the ACA has been in effect since 2010, it is no longer possible to explicitly determine how all the provisions of the ACA have impacted historical NHE, relative to a scenario in which the ACA hadn’t taken effect. Starting with the projections for 2013-23, therefore, our standard NHE Econometric Model incorporates the effects of most non-coverage expansion related provisions of the ACA legislation, such as payment changes to several Medicare providers. In addition, the econometric model relies on historical data that includes all the effects of the ACA. The effect of the provisions that expanded health insurance coverage starting in 2014 is estimated separately, using the OHRM. These impacts are then applied to the NHE Econometric Model projection to produce a final projection that reflects all the effects of the ACA.

The NHE Projections are inherently subject to uncertainty and are best used with this caveat. The models used to project trends in health care spending are estimated based on historical relationships within the health sector and thus assume that projected spending will be consistent with this history, except where adjustments are explicitly specified. These projections also rely on assumptions about macroeconomic conditions. The degree of uncertainty associated with the projection increases with the projection horizon. Additionally, there is limited experience under the ACA coverage expansions; the impacts of reform will continue to materialize over the coming years.

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3 ACA provisions that are excluded from the NHE Econometric Model for the 2014-2024 projections, and are modeled separately, include the major coverage expansions that began in 2014, industry fees, the excise tax on high-cost coverage, and the minimum Medical Loss Ratio provisions.
The methodology for the NHE Econometric Model is presented below. The discussion is organized in the following sections:

1. **Overview of the NHE Econometric Model**
2. **Data sources and exogenous inputs to the NHE Econometric model**
   a. Historical data sources
   b. Exogenous inputs to the NHE Econometric Model Projections
3. **NHE Econometric Model specification**
   a. Aggregate model for private personal health care spending
      • The Relationship between Macroeconomic Trends and Spending on Personal Health Care
      • Structure of the private PHC spending model
   b. Non-PHC health care spending
   c. Submodels for sector, sources of funds, and sponsors of payment
   d. Health insurance enrollment model
4. **Effects of the ACA on NHE Econometric Model Projections**
5. **Concluding note**
1. **OVERVIEW OF THE NHE ECONOMETRIC MODEL**

The NHE Econometric Model projection is based on a multi-equation structural econometric model that reflects relationships in historical time-series data and encompasses the health system as a whole. The primary focus of the NHE Econometric Model to produce projections of future health care spending by private health insurers, by consumers on an out-of-pocket basis, and by other private payers that are consistent with exogenous Medicare, Medicaid, and macroeconomic projections. The output of the NHE Econometric model excludes the effects of the major coverage expansions under the ACA.

The most recent available macroeconomic and demographic assumptions from the Social Security Administration are used as exogenous inputs into the NHE Econometric Model, as well as actuarial projections for Medicare and Medicaid spending and enrollment. The Medicare projections include all of the effects of the ACA with the exception of the various industry fees mandated by the ACA. The Medicaid projections include the effect of these industry fees, but they exclude the effects of the major expansion of coverage that began in 2014. We also project residual spending for other government programs (excluding Medicare, Medicaid and CHIP), to provide a comprehensive projection of all spending within the NHEA.

Sections 2-3 of this methodology paper present the inputs and structure of the NHE Econometric Model, with discussion of the data, assumptions, and model specification used to produce the forecast excluding the insurance expansion effects of the ACA. Section 4 briefly describes how the results of the NHE Econometric Model projections are adjusted to incorporate the estimated impacts of the ACA on health spending for all subcategories within the NHEA.

2. **DATA SOURCES AND EXOGENOUS INPUTS TO THE NHE ECONOMETRIC MODEL**

   a. *Historical data sources*

   **National Health Expenditures (NHE) data**

   The historical NHE, compiled by OACT, are used as the historical time series for health expenditures. These estimates provide a national level matrix of health spending data by type of service and source of funding.\(^5\)

   Classification of spending by types of services and sources of funding projected in our model (listed below) is consistent with National Health Expenditure Accounts (NHEA) classification. Payer categories track the source of direct payment for health care consumption (e.g. Medicare or PHI) but do not consider who is ultimately paying for each form of coverage – via taxes or premium payments, for example.

   In addition to projections of spending by type of service and payer, the NHE Econometric Model has been

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expanded in recent years to project health spending by ‘sponsor’ of spending, which, consistent with NHEA classification, is defined as the underlying source of financing for the sources of funding: businesses, households, and governments. Categories of spending projected by ‘sponsor’ are shown in a third table below.

### TYPES OF SERVICE

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

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6 For more information on NHE estimates by sponsor, see CMS.gov. National Health Expenditure Accounts: methodology paper, 2013: definitions, sources, and methods, p.29-33.
### 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 Expenditures

### SPONSORS OF PAYMENT

**National Health Expenditures**

**Business, Households and Other Private**

- Private business
  - 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

**Government**

- 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 government
  - Employer contributions to private health insurance premiums
  - Employer payroll taxes paid to Medicare hospital insurance trust fund
  - Medicaid
  - Other programs
Medical Price Indexes

Consistent with overall NHEA methodology, the Producer Price Indexes (PPI) and Consumer Price Indexes (CPI) published by the Bureau of Labor Statistics (BLS) are the primary data source for medical price indexes. Our price measure for total personal health care (PHC) spending is a chain-weighted deflator based on the indexes in the table below, with the weight for each index set equal to the share of PHC spending accounted for by that type of service.

Price indexes continue to be used as an intermediate tool within our NHE Econometric Model in the development of our NHE projection, as ACA spending impacts estimated separately in OHRM are calculated on a nominal basis – they are not explicitly broken out by quantity and price. Since our projections take into account actual 2014 price data from BLS, however, these projections now include effects on medical prices, if any, of the major Affordable Care Act coverage expansions, to the extent they are captured in the 2014 data.

Components of personal health care expenditure chain-type annual-weighted price index

<table>
<thead>
<tr>
<th>Industry/Commodity or Service</th>
<th>Price proxy</th>
<th>2013 weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Health Care</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Hospital Care</td>
<td>PPI hospitals*</td>
<td>38.0</td>
</tr>
<tr>
<td>Physician and Clinical Services</td>
<td>Composite Index: PPI for Office of Physicians and PPI for medical &amp; diagnostic laboratories</td>
<td>23.8</td>
</tr>
<tr>
<td>Other Professional Services</td>
<td>CPI services by other medical professionals</td>
<td>3.3</td>
</tr>
<tr>
<td>Dental Services</td>
<td>CPI dental services</td>
<td>4.5</td>
</tr>
<tr>
<td>Home Health Care</td>
<td>PPI home health care services</td>
<td>3.2</td>
</tr>
<tr>
<td>Other Health, Residential, and Personal Care:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (School Health, Worksite Health Care, Other Federal, Other State &amp; Local, etc.)</td>
<td>CPI physicians’ services</td>
<td></td>
</tr>
<tr>
<td>Home and community-based waivers (HCBW)</td>
<td>CPI care of invalids &amp; elderly at home</td>
<td></td>
</tr>
<tr>
<td>Ambulance</td>
<td>CPI-U All Items</td>
<td></td>
</tr>
<tr>
<td>Residential Mental Health &amp; Substance Abuse Facilities</td>
<td>PPI residential mental retardation facilities</td>
<td></td>
</tr>
<tr>
<td>Nursing Care Facilities and Continuing Care Retirement Communities</td>
<td>PPI nursing care facilities</td>
<td>6.3</td>
</tr>
<tr>
<td>Prescription Drugs</td>
<td>CPI prescription drugs</td>
<td>11.0</td>
</tr>
<tr>
<td>Other Non-Durable Medical Products</td>
<td>CPI internal &amp; respiratory over-the-counter drugs</td>
<td>2.3</td>
</tr>
<tr>
<td>Durable Medical Equipment</td>
<td>Composite Index: CPI for eyeglasses and eye care and CPI nonprescription medical equipment and supplies</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Insurance Coverage Data

As with spending, historical enrollment estimates are drawn from the historical NHE. The estimates cover total private health insurance (PHI) (including individually-purchased and employer-sponsored plans), public insurance programs (including Medicare and Medicaid), as well as an estimate of the uninsured. Estimates of total PHI enrollment are available for 1960-2013. Medicare and Medicaid enrollment is available for 1966-2013, and all other enrollment categories (including the more detailed estimates individually-purchased and employer-sponsored insurance) are available for 1987-2013.\footnote{Additional detail on historical NHE enrollment estimates are available from CMS.gov. National Health Expenditure Accounts: methodology paper, 2013: definitions, sources, and methods.} Medicaid enrollment for 2011-2013 was adjusted for consistency with the Medicaid Actuarial Report for 2014, which employed state-level enrollment data available through the end of 2013.\footnote{Truffer CJ, Wolfe CJ, Rennie KE. 2014 actuarial report on the financial outlook for Medicaid [Internet]. Baltimore (MD): Centers for Medicare and Medicaid Services; 2015 July 10 [cited 2014 July 10]. Available from: http://medicaid.gov/medicaid-chip-program-information/by-topics/financing-and-reimbursement/downloads/medicaid-actuarial-report-2014.pdf}

\subsection*{b. Exogenous inputs to the NHE Econometric Model}

Exogenous inputs to the NHE Projections include assumptions for projections of real GDP growth, economy-wide inflation, labor market indicators, 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). These projections are produced annually by the Social Security Administration (SSA).\footnote{Board of Trustees, Federal Old-Age and Survivors Insurance and Disability Trust Funds, The 2015 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds, 22 Jul 2015, http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthAccountsProjected.html} The projections were updated to reflect additional macroeconomic data and research available through June 2015.\footnote{The updated macroeconomic forecast comes from the June 2015 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 is found at: http://www.aspenpublishers.com/blue-chip-publications.htm.}

Projections for personal income (PI) and disposable personal income (DPI) consistent with the economic assumptions from the 2015 Medicare Trustees Report are generated using the University of Maryland Long Term Interindustry Forecasting Tool (LIFT). The relationship between PI, DPI, and GDP is influenced by fluctuations in taxes and government transfer payments, depreciation of capital stock, and retained earnings and transfer payments of private business.\footnote{Projections of PI and GDP are available from Table 1 at: Centers for Medicare & Medicaid Services. National Health Expenditure Data: Projected. http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsProjected.html} The Board of Trustees for Medicare reports annually to the Congress on the actuarial status of the Hospital Insurance and Supplementary Medical Insurance Trust Funds.\footnote{Board of Trustees, 2015 Annual Report of the Boards of Trustees of the Federal Hospital Insurance Trust and Federal Supplementary Medical Insurance Trust Funds, 22 Jul 2015, http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/ReportsTrustFunds/Downloads/TR2015.pdf} Projections of Medicare spending generated for this report, as well as projections of Medicaid and Children’s Health Insurance Program (CHIP) spending, are produced by OACT and are also consistent with macroeconomic and

Projections for input price indexes in each sector are based on projections from IHS Global Insight, Inc. Since these projections are generated conditional on macroeconomic assumptions for aggregate wage and price growth that differ from those incorporated in the OASDI Trustees report, price and wage proxies included in these indexes are adjusted for consistency with OASDI macroeconomic assumptions.

3. **NHE Econometric Model Specification**

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

   Spending for medical care provided to patients, or personal health care (PHC), accounts for about 85 percent of total NHE. The remaining 15 percent of NHE includes additional costs such as the net cost of insurance, administration, non-commercial research spending, public health spending, and investment. The drivers of growth in spending for different types of personal health care services tend to be similar, while the drivers of growth for the non-PHC categories are quite different, do not tend to be closely interrelated, and are generally more volatile. As a result, projections are generated separately for PHC (in total and for individual goods and services) and non-PHC categories.

   The NHE Econometric Model is primarily focused on growth in personal health care spending for private health insurance, consumer out-of-pocket, and other private revenues. It is composed of a set of econometric equations that define the relationship of trends in spending growth for these sources of funding (and for other government programs) relative to the exogenous inputs to the model: assumptions for key macroeconomic variables and the actuarial projections for Medicaid, Medicare, and the Children’s Health Insurance Program (CHIP) spending.

   The specification of the NHE Econometric Model draws on standard economic theory and on the broader health economics literature. The equations in the model are re-estimated annually following the release of updated historical NHE. The fit and appropriateness of model specifications for individual series are reviewed and revised at this time.

   **The Relationship between Macroeconomic Trends and Spending on Personal Health Care**

   Spending growth for private PHC is quite cyclical, and growth cycles can be extended in duration, lasting over a decade or more from peak to trough. Cycles in private PHC spending are closely linked to macroeconomic growth. However, this causal link is not immediately obvious when looking at the health share of GDP because of two key factors. First, the transmission of the effect occurs over a period of several years following the macroeconomic business cycle. Second, there is a negative short-term and often offsetting relationship between trends in private and public spending growth. As a result, this short-term relationship contributes to volatility in growth when private spending is considered independently. Note that this relationship in the short term stands in contrast to the strong positive correlation between growth in public and private spending over the longer term.

   The causal link between aggregate income growth and health spending is largely reflected in private PHC spending rather than spending on public programs; however, this relationship can be observed in the aggregated data for spending across all sources of funds as well.
The magnitude and length of the growth cycles that characterize private health care spending means that it is difficult to look at trends over periods covering less than two decades without understanding the cyclical and macroeconomic context. For example, our models and the most recent available historical data suggest that growth in private health care spending reached a cyclical peak in approximately 2002, and, following more than a decade of slowing growth, reaches a cyclical trough in 2013.\textsuperscript{13} The trend for private health care spending growth over 2002-2013 is effectively a peak to trough movement. It does not, however, provide a characterization of the long-term trend in health care spending, and greatly overstates the deceleration in growth that is likely to be sustained when the role of the growth cycle is fully accounted for. The cycle for public health spending, on the other hand, does not always closely track the timing of the cycle for private spending; however, in this case OACT analysis suggests public spending growth is also likely to be close to a cyclical trough in the most recent data.

Chart 1 shows the estimated effect of lagged growth in real per capita income (DPI)\textsuperscript{14} on real per capita private PHC spending growth.\textsuperscript{15} The chart illustrates the close relationship in the trends of the estimated effect of income and the growth in real per capita private PHC spending. The explanatory power of lagged income growth for aggregate health spending is very strong. In particular, the aggregate model for private PHC spending growth has relatively high predictive power for the first few years of the projection because it relies on information (namely, the lagged growth in DPI) that is largely determined over the past five years.

\textsuperscript{13} The timing of cyclical peaks and troughs cannot be precise due to annual year-to-year volatility in the health care spending data.

\textsuperscript{14} Values shown represent the historical values of DPI applied to the estimated model coefficients in the NHE projection model. These coefficients reflect the lagged structure of the model.

\textsuperscript{15} Real per capita private PHC spending growth values are calculated as a 7-year moving average centered on the current period.
Chart 1. Real per capita growth in private health care spending with estimated cyclical effects of macroeconomic growth, 1970-2013
Chart 2 further illustrates the relationship between real per capita private PHC spending and lagged income (DPI). The dotted line shows the estimated effect centered on the current period, while the solid line shows the actual lagged effect that is incorporated in our model for private health spending (the mean lag in the effect is about three years).

**Chart 2. Estimated impact of aggregate income growth on private health care spending, 1970-2013**

Lagged effect in model versus coincident effect

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**Structure of the private PHC spending model**

The diagram below provides a schematic view of the aggregate health sector within the NHE Econometric Model and shows the linkages among the data sources, exogenous data, the personal health care (PHC) model, the non-PHC output, and the aggregate NHE projection.
The NHE Econometric 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. It is a top-down model in that spending and pricing trends are modeled at an aggregate level. Spending projections for all subcategories: types of medical care (sector), direct sources of funding for medical care (e.g. public and private insurance, out-of-pocket, and other), and for all sponsors of payment (ultimate sources of funding for insurance coverage) are constrained by aggregate trend projections. Models for spending by sector, source of funds, and sponsor are estimated historically both to maintain trends relative to the aggregate consistent with historical patterns, and 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.

Aggregate private spending for PHC as a whole is far more predictable than is the case at the sectoral level (e.g., hospital, physician, etc.). This reflects interrelationships in relative spending growth across types of care that may act as substitutes in some circumstances. Accounting for the effects of shifts of care provided in different settings is critical in explaining historical patterns of growth for the individual sectors. Shifts across settings for the delivery of care (e.g., from hospital inpatient to outpatient and to physician offices) often occur in response to shifts in either government policy (e.g., the initial imposition
of prospective payment for Medicare inpatient care in 1983) or to changes in incentives within private health insurance coverage (e.g., managed-care-related incentives in the 1990s). The effects of these event-driven shifts cannot be fully controlled for, since we have no proxies that can accurately capture the time path of the impact for major policy changes such as the introduction of prospective payment under Medicare, or the expansion of managed care in the 1990s. One result of these event-driven shifts is that trends at the sectoral level are more difficult to predict than those at the aggregate level (which subsumes the effect of such shifts). While similar factors drive demand and supply for medical services in different settings, the nature and timing of these effects differ. Models for prescription drugs differ from the general pattern of models for health services in that supply-side factors for these purchases differ markedly.

The core of our aggregate model of private personal health care (PHC) spending consists of two equations:

- Real per capita PHC spending
- Personal health care price inflation

Conceptually, these two equations represent the quantity of medical care and the relative 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; underlying relationships in terms of levels are not expected to change very much within a period of the single decade that our projections cover. However, underlying relationships in terms of levels do matter for the long-term trend in growth rates (particularly where growth is rapid) and we monitor this perspective as well in the process of evaluating and adjusting the projected growth.

The aggregate model for growth in personal health care 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. In this model growth in quantity is driven primarily by factors that influence aggregate consumer demand: the effects of changes in aggregate income and in the relative price of medical care. Growth in real per capita public spending is included as a variable in this model as well because insurance under Medicaid and Medicare substitutes for private coverage.

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 current and lagged growth in input costs for medical providers. Relative price growth also reflects trends in relative productivity growth, and these trends will be implicitly captured in the historical data.

The independent variables in our aggregate model of real per capita private personal health care (PHC) spending are:

- Disposable personal income growth (less Medicare and Medicaid, real per capita)
- Lagged health share of GDP (PHC for all sources of funds as a share of GDP)

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16 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.
Relatives medical price inflation (PHC)
• Public spending growth (PHC, real per capita)

We discuss each of these model variables in turn below:

Disposable Personal Income

For the purpose of this model, income is defined as real per capita disposable personal income (DPI) excluding Medicaid and Medicare payments. 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 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 at length earlier in the paper, real per capita DPI is a highly influential variable in our model of private health spending. 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-series cross-country data for Organization of Economic Cooperation and Development (OECD) economies confirm the importance of the link between health spending and income. It has been repeatedly shown that variations in real per capita GDP (used as a proxy for income due to data availability) account for a substantial share of variation in health spending across countries and time.

In the NHE Econometric Model, income has a lagged effect on health spending. Fluctuations in growth in aggregate income do have an immediate effect on growth in private health spending; however, these initial effects are fairly small. The current period income elasticity is only about 0.2, which means that the change in growth for health spending in response to a change in income growth will be about 20 percent as large. The estimated lagged effect of income for private spending growth peaks at a lag of three years. The effective long-term income elasticity of private health care spending (the sum of estimated coefficients over six years’ lags) is 1.4. This means that health care spending rises substantially faster than income growth in the longer term; a one percent increase in income growth will result in a cumulative increase in private health care spending of 1.4 percentage points.

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 spending, 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. Thus, their decisions are not immediately affected in the short term by variations in income except where substantial parts of the expenditure are paid for out-of-pocket.

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17 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.


19 Some current period effect can be expected in response to consumer cost-sharing and loss of employment, with the associated loss of employer-provided health insurance.
The importance and structure of out-of-pocket cost-sharing varies quite a bit across sectors and over time. A higher share of services paid for out-of-pocket can be expected to shorten the lag structure of the income effect. This implies, for example, that rising deductibles and other forms of cost-sharing relative to household incomes might be expected to gradually increase the sensitivity of consumer demand to current fluctuations in income and relative medical prices. Out-of-pocket spending has grown modestly relative to disposable personal income, from a trough of 2.6 percent of income in 1996 to 2.7 percent in 2013. However, this small increase is an average across all households; the experience for subpopulations within this average will be quite different, especially given the proliferation of high deductible health plans and increases in cost sharing implemented over the last several years.\footnote{20} Out-of-pocket spending continues to grow at a pace slightly below that observed for private health insurance spending. As a result, most of the aggregate impact on health spending occurs through the changes in the structure of health insurance coverage and the public regulatory environment that constrains this coverage.

The critical element that introduces the delay captured by the lag in the impact of growth in income on private health care spending is the role of multiple intermediaries between consumers and medical providers. These intermediaries include employers or unions who negotiate on behalf of pools of employees, and governments at the Federal and state level who determine the nature of coverage and methods of payment for Medicare and Medicaid – as well as the structure of regulations that constrains private employers and insurers. Beyond the determination of coverage, providers will respond to changes in coverage and methods of payment in making choices on behalf of individual patients. Many decisions are either contractual in nature or built into law and are intended to apply to an underlying pool with varying preferences. This implies that it takes time for the system to respond to any changes. For example, employers will need to decide upon changes to contracts for insurance coverage for their employees will best fit the preferences of all members of the pool. Employees may change their patterns of consumption of health care in response to any changes in the structure of their coverage. Doctors and other medical providers may gradually change treatment protocols in response to the incentives inherent in methods of payment for care and to constraints on coverage imposed by insurers.

To capture the timing of these lags, the income term in our model of personal health care spending is incorporated as a polynomial-distributed lag estimated over seven years (from six years previous through the current period), and our estimates imply that this effect rises to a peak at about three years lag.\footnote{21} 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 constant over time. The income elasticity in our current model is 1.43, toward the upper end of estimates for macro-level elasticities of approximately 0.8 to 1.6 in the empirical literature.\footnote{22} This reflects several characteristics of our model specification in comparison with many published estimates.

Most critically, our estimates are based on time-series data for the United States alone, rather than pools


\footnote{21} Estimates that allow coefficients to vary across this period based on a polynomial distributed lag (PDL) show no statistically significant improvement in explanatory power compared with a moving average over the same period.

of time series data across multiple countries. This means that we cannot control for interaction effects between growth in health care spending over time (largely due to technological change) as is commonly done in estimates that have both a cross-sectional and a time-series dimension. This implies that our estimated income elasticity is likely to capture some effects of changing medical technology over time, in addition to a pure income effect.

**Lagged health share of GDP**

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

The model specification includes a variable intended to explicitly capture the impact of rising health share of consumption on health care spending growth. This variable is defined as the lagged ratio of total PHC spending to GDP. The estimated impact attributed to this variable is negative and significant, but fairly small in magnitude in comparison with the year-to-year variation in real per capita private health care spending. It is intended to capture the effect of long-term structural change on health spending growth of underlying changes in the model variables.

In defining the variable that we use to capture the effect of the long-term rise in the health share of total spending, 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. Health spending is fundamentally subject to a budget constraint just as any other form of consumption, but where insurance coverage severs the connection between individual decision-making and individual income, this budget constraint is binding at the level of the insurance pool.

The binding budget constraint that is applicable will be defined at the level of a population pool that is relevant for decision-making processes that influence the delivery of health care within our current system. Decisions with systemic implications for the delivery of medical care are made both by private and public insurers. Medicare and Medicaid policy 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 budget constraint that is binding in its effect is national in scope. We use GDP (rather than DPI) as a measure of this budget constraint because it abstracts away from short-term fluctuations due to fiscal policy and to public and private borrowing. More fundamentally, GDP is a measure of the total resources available for production for the domestic economy as a whole. It therefore dictates the budget for aggregate national health spending that is the ultimate long-term

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24 Ibid.
constraint on health spending growth. 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 (public and private) cannot exceed growth in GDP.

Chart 3 below expands on the discussion of cycles presented in Chart 1, showing growth in real per capita private PHC along with the estimated effect of lagged growth in real per capita DPI (a six-year polynomial distributed lag with a peak effect at two to three years) 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 will tend to vary in response to recent experience; a period of slower health spending growth will tend to relieve some pressure from the system and will result in a pause in the dampening effects of national budget constraints.

*Values shown were re-scaled by the model’s constant term for illustration purposes.

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25 Ibid.
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 to 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, generally determined by a combination of deductibles, cost-sharing requirements, and out-of-pocket maximums.

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, the amount that the consumer pays for an additional dollar of medical care. The broad use of copayments, deductibles, and out-of-pocket maximums, combined with the fact that the majority of health care consumption is accounted for by high-cost cases, means that the marginal price paid by consumers is most often zero.

However, the effects of out-of-pocket prices on consumer choices are only one potential avenue for price effects in markets for health care. Medical prices also influence demand for care in two additional 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 health insurance (primarily through their employers as agents), and the generosity of the coverage selected are therefore influenced by the relative price of medical care as well. Second, the relative price of medical care affects demand for services across types of medical care through the price sensitivity of health insurers’ coverage and provider selection decisions, and in some cases through the structure of cost-sharing (as with tiered copays).

Within our model, relative medical price inflation has a significant negative coefficient, as we would expect. The price elasticity of demand for private health care in our model is −0.4. This price elasticity 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). This difference reflects the fact that micro-based studies use household-level data on the relationship between consumer out-of-pocket spending below out-of-pocket maximums and effective price given coinsurance rates, and the scope of these studies tends to cover relatively short periods of time.

Medical price inflation is an endogenous variable in our model (i.e., it is determined within the NHE Econometric Model). The dependent variable in our model is OACT’s price deflator for personal health care spending. This is estimated as a function of input price inflation (IPI) for medical goods and services, and the out-of-pocket share of private health spending. The effects of other factors (economy-wide price inflation, productivity growth, industry profitability) are captured indirectly through their influence on IPI, and through a first-order autocorrelation adjustment.

Our measure of input price inflation is based on the cost structure of health providers as estimated in input price indexes by type of medical providers. The effect of each component of provider costs is represented

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27 The input price index used is a weighted average of OACT’s input price indexes for hospital services, physician services, home health services, nursing home services, and pharmaceuticals.
by a proxy series that is selected to track the input prices of each individual service and commodity. The effects of other factors (economy-wide price inflation, productivity growth, industry profitability) are captured indirectly through their influence on IPI, and through a first-order autocorrelation adjustment.

However, due to the limited coverage of the available time-series data available for medical providers, this input price index has historically excluded compensation for self-employed workers, including a substantial fraction of physicians and other medical professionals. Thus, true input price inflation will be under or overstated depending on the growth differential between compensation for employed versus self-employed workers. For this reason, we include growth in physician income in our model as a proxy for supervisory and self-employed provider compensation not covered by our input price indexes. This substantially improves the fit of the model. Growth in physician incomes based on this measure is included in our model for medical price inflation as a proxy for the variation in input costs paid to the medical professionals (mainly self-employed) whose compensation is not reflected in our input price indexes.

Physician income is projected based on the assumption that rates of increase in physician income will tend to track rates of compensation for alternative occupations over long periods of time (we use the BLS employment cost index (ECI) as a proxy for income of all professional and technical workers). We also include real private physician spending as a proxy for approximate change in the volume of services that are reflected in our measure of physician income, in order to approximate a wage measure. In addition to variables that capture the growth in input prices, the model for relative medical price inflation also includes a demand-side variable; the growth in the share of out-of-pocket spending as a share of total private spending. Growth in the out-of-pocket share of spending acts as a constraint on the ability of providers to charge higher prices to consumers for services where cost-sharing is an important factor. The estimated contribution from this variable implies that the relatively faster growth in out-of-pocket costs over the period from 2008 through 2013 has played a role in restraining growth in medical price inflation.

Real per capita public PHC spending

The use of the total population (rather than the pool of privately insured) as the denominator for real per capita private spending means that the relationship with real per capita public spending will be negative, capturing the effects of shifts in the insured population across public and private forms of coverage. In addition to the effects of shifts in enrollment between private and public coverage, the

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28 We estimated an historical physician income series through 2013. Source data include the IRS Statistics of Income (SOI), Bureau of Labor Statistics (BLS), and the Medical Group Management Association (MGMA) data. This series reasonably tracks growth in physician income historical series from other sources.
negative coefficient on public health care spending can be expected to capture any effects on private spending growth of any cost-shifting (private to public, or public to private) that may occur.\(^{29}\)

\[\text{b. Non-PHC health care spending}\]

For Non-PHC health care spending, models are estimated for each of the following categories:

- Government Administration and the Net Cost of PHI
- Non-Commercial Research
- Government Public Health
- Structures and Equipment

Projections for administrative costs are split between government administrative costs and the net cost of private health insurance. Government administration is projected based on available budgetary information, with trend-based econometric models for residual categories.

The net cost of private health insurance can be divided into two parts: the costs associated with administering private health insurance, and the profit margins that accrue to private health insurers. Most of the time-series variation in this series is attributable to profit margins, which tends to move in cyclical patterns (this is called the underwriting cycle). Projections for net costs of PHI have two major inputs. First, we have an autoregressive model that effectively extrapolates forward the pattern of historical cycles in growth. Secondly, we use several sources of survey data on current and expected price health insurance premiums to evaluate and adjust the timing of the underwriting cycle.

NHE non-commercial research spending growth is projected based on relationships to economic growth as represented by a four-year lagged moving average of growth in real per capita GDP. Specific adjustments are made where federal budgetary information is available.

Government public health spending growth is extrapolated based on historical trends, with specific adjustments where budgetary information is available.

Spending on health system structures is dominated by hospital construction, and thus is projected as a function of growth in hospital spending. Where we have additional information (e.g. surveys of hospital construction), this is incorporated via adjustments to 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.

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\(^{29}\) The choice of denominator reflects consistency issues in the underlying enrollment series for private health insurance, and cyclical fluctuations in the demographic mix of those 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 is defined to include all persons with private coverage. This includes Medicare beneficiaries with private supplementary coverage, so that there is a substantial overlap between the series. Since private spending reflects only the supplementary spending for these enrollees, this tends to distort per enrollee trends. In addition, the history for private health insurance enrollment stems from multiple sources. Prior to 1987, the time series is 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 (e.g. children and non-disabled adults) that is relatively low-cost relative to the existing Medicaid population (which is relatively heavily weighted towards the institutionalized). This shift distorts per enrollee growth both for private spending and for Medicaid.
purchases compared with other health care prices.

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

Spending projections are estimated for several underlying subcategories of health care spending, which include the following components:

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

**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. Spending projections generated for each of the types of services are then constrained for consistency with the aggregate spending projection. Our choice of this model structure reflects our finding that the model is substantially more robust at the aggregate level due to the impact of event-driven shifts in the provision of medical care whose effects on growth cannot be accurately captured at the level of individual types of service, as discussed earlier in the paper. For the most part, key variables in the sector models follow the specification of the aggregate model for personal health care spending growth.

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**Sectoral Composition of NHE Projections Model**

- **PHC – Prescription Drugs**
  - **Sectors constrained to sum to the aggregate:**
    - Hospital
    - Dental
    - Durables
    - Nursing home
    - Home health
  - Physician
  - Other professional
  - Other non-durables
  - Other personal

- **Prescription Drugs**

- **Non-Personal Health Care:**
  - Administration and net cost of PHI
  - Research
  - Structures
  - Equipment
  - Government public health

- **NHE = PHC + Non-PHC**

- **PHC = Personal health care**

- **NHE = National health expenditures**

- **PHI = Private health insurance**
Major variables in the sector models include:

- Disposable personal income growth (excluding Medicare and Medicaid, real per capita)
- Relative medical price inflation (PHC)
- Public spending growth (PHC, real per capita)

Differences 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, the additional independent variables are included that are specific to the individual sector where relevant data is available.

The lag on the income term in the models for each type of service generally tend to vary with the share of spending that is accounted for by consumers’ out-of-pocket expenses: the greater the out-of-pocket share, the shorter the lag, as consumers respond more quickly to changes in their income.

The table below summarizes the independent variables used to model real per capita spending growth for each of the personal health care sectors. For the sectors with the greatest share of NHE, we have provided some additional descriptive information about their sector models.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Dependent Variable</th>
<th>Independent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital services</td>
<td>Real private hospital services per capita</td>
<td>Real disposable personal income (PDL, 7 years) (+)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relative price (−)</td>
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<tr>
<td></td>
<td></td>
<td>Real per capita public spending growth (−)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dummy, 1984-2013 (−)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dummy, 1984-2013 * time trend (+)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time trend (−)</td>
</tr>
<tr>
<td>Physician and Clinical services</td>
<td>Real private physician services per capita</td>
<td>Real disposable personal income (PDL, 4 years) (+)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relative price (−)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Real per capita public spending growth (−)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dummy, 1983-85 (+)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dummy, 2007-2010 (−)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time trend, 1960-92 (+)</td>
</tr>
<tr>
<td>Other Professional services</td>
<td>Real private other professional services per capita</td>
<td>Real disposable personal income (+)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Real per capita public spending growth (−)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dummy, 1992-2013 (−)</td>
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<tr>
<td></td>
<td></td>
<td>Dummy, 1992-2013*Real disposable personal income (−)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dummy, 1992-2013*Real per capita public spending growth (+)</td>
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<tr>
<td></td>
<td></td>
<td>Autoregressive term (−)</td>
</tr>
</tbody>
</table>
### Sector Model: Hospital Services

Real per capita growth in private hospital spending is well explained by the variables in our template model specification. Given the low out-of-pocket share on average for hospital services (our model captures both inpatient and outpatient), we anticipate a long lag between a change in household income and the time of impact on hospital spending. Our results are consistent with this expectation; we estimate coefficients on lagged income growth with a polynomial distributed lag, which indicates the peak effect of income fluctuations occurs with a lag of 3 to 4 years. Public real per capita spending has a negative coefficient as expected, capturing shifts in enrollment between private and public coverage, as well as any possible short-term cost-shifting effects between private and public payers.

The combined effect of historical fluctuation in the effects of managed care and the Medicare prospective payment system (PPS) for this sector are represented in the current model as a structural change in the relationship of growth to price and income variables that is largely one-time in nature, beginning after the introduction of PPS (from 1984). The alterations in provider incentives associated with 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 tapers off gradually over time. This reflects diminishing potential for additional reductions in inpatient utilization over time due to these factors.

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<table>
<thead>
<tr>
<th>Sector Model: Hospital Services</th>
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<tbody>
<tr>
<td>Prescription Drugs</td>
</tr>
<tr>
<td>Real aggregate drug spending per capita*</td>
</tr>
<tr>
<td>Independent variables:</td>
</tr>
<tr>
<td>Real disposable personal income (3 year moving average) (+)</td>
</tr>
<tr>
<td>Relative drug price * Share paid out-of-pocket (−)</td>
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<tr>
<td>New drug introductions (+)</td>
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<tr>
<td>Generic dispensing rate (−)</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Over the Counter Drugs and Other Nondurables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real private other nondurables spending per capita</td>
</tr>
<tr>
<td>Independent variables:</td>
</tr>
<tr>
<td>Real disposable personal income (2 year moving average) (+)</td>
</tr>
<tr>
<td>Relative price (−)</td>
</tr>
<tr>
<td>Real per capita other non-durables spending paid out-of-pocket, lagged one year (+)</td>
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<table>
<thead>
<tr>
<th>Durables</th>
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<tbody>
<tr>
<td>Real private durables spending per capita</td>
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<tr>
<td>Independent variables:</td>
</tr>
<tr>
<td>Real disposable personal income (PDL, 2 years) (+)</td>
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<tr>
<td>Relative price (−)</td>
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<tr>
<td>Public spending growth (−)</td>
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</tbody>
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<thead>
<tr>
<th>Dental services</th>
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<tbody>
<tr>
<td>Real private dental services per capita</td>
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<tr>
<td>Independent variables:</td>
</tr>
<tr>
<td>Real disposable personal income (PDL, 3 years) (+)</td>
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<tr>
<td>Relative price (−)</td>
</tr>
<tr>
<td>Medicaid and CHIP spending growth (+)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nursing Care Facilities and Continuing Care Retirement Communities</th>
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</thead>
<tbody>
<tr>
<td>Real private nursing home services per capita</td>
</tr>
<tr>
<td>Independent variables:</td>
</tr>
<tr>
<td>Real disposable personal income (PDL, 3 years) (+)</td>
</tr>
<tr>
<td>Real per capita public spending (−)</td>
</tr>
<tr>
<td>Relative price (−)</td>
</tr>
<tr>
<td>Dummy, 1990 (+)</td>
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<tr>
<td>Dummy, 1995 (+)</td>
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<tr>
<td>Moving-average term (+)</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Home health services</th>
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<tbody>
<tr>
<td>Real private home health services per capita</td>
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<tr>
<td>Independent variables:</td>
</tr>
<tr>
<td>Real disposable personal income (PDL, 2 years) (+)</td>
</tr>
<tr>
<td>Dummy, 1999-2013* Real per capita Medicaid spending growth (−)</td>
</tr>
<tr>
<td>Real per capita Medicare spending growth (+)</td>
</tr>
</tbody>
</table>

*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’s Part D prescription drug coverage. See the Prescription Drug section below.
Sector Model: Physician Services

The estimated lag structure for the income term in the physician model indicates an effect that extends over five years, with a peak effect at the first lag. This is effectively a shorter average lag as compared with the hospital model, where the peak income effect occurs at a lag of 3-5 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 hospital spending. This reduction in model fit primarily reflects two outlying patterns of growth 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. This period saw a major shift in provider incentives associated with the introduction of inpatient PPS under Medicare (spillover effects for private spending) and the initial surge in managed care enrollments. In this sense this pattern of growth is a counterpart of the changes in inpatient utilization generated by these developments. The effect of the inclusion of this dummy is that the resulting model will tend to project a pattern of growth for physician services that is more consistent with the near-stable share of PHC in the pre-1984 data rather than the more rapid growth of the mid-1980s.

Despite substantial volatility, real per capita growth rates exhibit a slight upward trend over 1960 through 1992, which does not persist after 1992. We have included a trend variable for the period 1960-1992 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 organizations. Even as the effects of more stringent utilization constraints of managed care organizations diminished in the late 1990s, real per capita growth after 1992 rarely peaked above 4 percent (compared to 1970s through 1992, when growth was above 4 percent for nearly half the years). The result of the inclusion of this variable is that the effects of this period of rapid growth prior to 1992 is removed from the other estimated coefficients, which moderates projected growth after 1992 in a manner more consistent with the history.

We have also included a dummy variable for the period of 2007-10, over which predicted growth is otherwise overstated. Our interpretation of this variable is that it captures effects from two key factors. The first factor is the rapid growth of high-deductible plans,30 which disproportionately depresses physician office and clinic visits related to primary care and preventative services compared to acute care services.31 The second factor is the response of health care consumers to the recession, many of whom decided to delay or forgo preventive care and visits to physicians more so than other types of care.32 In addition, related to the recession, the high rates of uninsured individuals over 2008-10 had a disproportionate effect on the use of preventative care and recommended screenings, as the uninsured

were less likely to receive preventative care compared to other types of health care services. The result of the inclusion of this dummy variable, for 2007-10, allows for a pattern of projected growth for physician services that returns to the trend of maintaining a somewhat stable physician and clinical services share of PHC expenditures.

*Sector Model: Prescription Drug Services*

Prescription drugs differ in important ways from other types of medical care. First, it is a product, not a service, so the cost structure of the industry differs substantially from sectors such as hospital, physician, or nursing home, where labor costs play a critical role in driving price. Second, historically, 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, the public sector has historically played a relatively small role in funding prescription drug spending. We also 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 those developed for other sectors.

As opposed to the other sectors, the dependent variable in the prescription drug model is real aggregate per capita drug spending (not private only). This change was made because the start of Medicare drug coverage in 2006 produced a massive shift in the source of payments for drugs, resulting in a sharp drop in private drug spending growth in 2006, but otherwise had little estimated effect of overall growth in drug spending. Therefore, 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. This definition accounts for the trend in consumers’ steadily declining out-of-pocket share over the last twenty years. However, the fact that available data does not distinguish out-of-pocket spending by the uninsured and by Medicare beneficiaries from the fixed co-payments often required within managed care limits our ability to capture this effect. 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 ten to fifteen 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 (this phenomenon largely 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 dropped 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 four-year moving average of the number of new prescription drugs introduced. In addition, the rising generic dispensing rate, which has played an increasing role in depressing growth in prescription drug spending in recent years, is now included in our model.

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

In contrast to our model for private PHC spending as a whole, our model for health care spending by payer or source of funds (e.g. private health insurance (PHI), out-of-pocket spending (OOP), and other private spending) is “bottom-up” in nature: the projection is adjusted and finalized at the most detailed sectoral level, and the aggregate composition of spending for personal health care by source of funds is determined by the sum of trends for each type of service. This sectoral focus reflects the fact that the nature of patient cost-sharing differs greatly depending on the setting where services are provided and the type of service. In some important areas, we have additional information (anecdotal or otherwise) that is useful in projecting probable trends. On the issue of out-of-pocket/PHI/other private shares of payment, in particular, aggregation can be expected to obscure trends that apply to specific types of services. Prescription drugs, physician services, nursing home care, and dental services account for about three-fifths of out-of-pocket 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.

For each type of service (hospital, physician, etc.) the projection of the growth in spending for PHI and out-of-pocket in comparison relative to total private spending is based on econometric models for growth in real per capita spending. For example, PHI spending on prescription drugs is projected as a share of total spending on prescription drugs as a function of growth in total private spending by type of service, and trends in insurance coverage (growth in enrollment in PHI, Medicaid and Medicare). Trends in insurance coverage (private, Medicaid, and Medicare enrollment, and the uninsured population) also influence the composition of private spending by payer, since the fraction paid out of pocket differs substantially across these groups. In addition, growth in disposable personal income may have an impact on the relative pace of growth in out-of-pocket spending through its influence on discretionary medical spending.

Sector-level spending for PHI, out-of-pocket, and other private funds are adjusted for consistency with aggregates across two dimensions. First, the sum of spending for all private sources of funds by sector must equal total private spending for all sources of funding. Second, spending for PHI across all types of services must equal the aggregate spending for PHI. Spending at the level of type of service by source of funds is adjusted for consistency with aggregates based on iterative proportional fitting. In addition to our model of private sources of funds, we also project sources of public funds other than Medicare and Medicaid. These sources account for approximately 25 percent of total public spending. The largest of these other sources of funding are the Veterans’ Administration (VA) and the Department of Defense (DoD). The methodology for these payers is discussed below. Residual Federal and other

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34 The most widely recognized source of other private funds is philanthropy. Philanthropic support may be direct from individuals or may be obtained through philanthropic fund-raising organizations such as the United Way. Support may also be obtained from foundations or corporations. Philanthropic revenues may be spent directly for patient care or may be held in an endowment fund to produce income to cover current expenses. 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.

state and local spending for smaller government programs are projected based on econometric models similar to those used to project real per capita private spending models.

**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 VA and DOD healthcare systems. Projections based on these models are then adjusted using data from published federal budget requests for the upcoming fiscal year. Within these aggregate projections, iterative proportional fitting is utilized to control spending within benefit categories to the aggregate spending totals for each program to produce more reasonable type of service totals.

Expenditures for both the VA and DOD are mainly driven by fiscal policy, demographics, economic conditions, and to a lesser extent overseas military operations. VA spending is expected to exhibit countercyclical elements as eligibility is in part determined by income as well as the presence of other insurance coverage along with a myriad of other factors. Consistent with VA actuarial projections, it is expected that the number of veterans and active duty military personnel will decrease over the forecast period.\(^{36}\)

**Models for Spending by Sponsor of Payment**

Sponsor of payment categories define what group holds the ultimate responsibility for financing or supplying the funds needed to support healthcare spending by direct payers. A major focus here is 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, as well as governments through premium subsidies. Similarly, financing for Medicare is comprised of dedicated tax revenue from employers and employees, premium and interest income, and intergovernmental transfers.\(^{37}\)

Premiums for private health insurance plans,\(^{38}\) including employee sponsored health insurance (ESI) and other private health insurance (OPHI), are projected for households and employer for types of insurance (group and individual) and sector of employment (public or private). ESI premiums comprise the majority of private health insurance premiums (roughly 95 percent in 2013). As such, 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.

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\(^{36}\) National Center for Veteran Statistics: The Veteran Population Model 2011  

\(^{37}\) Classification of spending by sponsor in the NHE projections is consistent with overall NHEA classification. For a detailed description of how spending by source of funding maps to sponsor categories, see Centers for Medicare & Medicaid Services. National Health Expenditure Accounts: Methodology paper, 2013: Definitions, Sources, and Methods, p. 29-34.

\(^{38}\) Total private health insurance includes employee sponsored health insurance and other private health insurance (which includes both individually purchased insurance plans as well as Medicare supplemental insurance).
The remaining PHI subcomponents that grow differently than ESI premiums are removed from total PHI and forecasted separately, namely Medicare supplemental insurance and other individually purchased insurance plans. Projections of per enrollee Medicare supplemental premium growth incorporate assumptions of growth in per beneficiary Medicare spending cost sharing on benefits from the 2015 Medicare Trustees Report supplemented by premium trends for this type of insurance from the National Association of Insurance Commissioners (NAIC).\textsuperscript{39} Projections of per enrollee premium growth for other individually purchased insurance plans are developed based on their historical relationship with overall private health insurance. Projected enrollment in Medicare supplemental plans and other individually purchased insurance are then multiplied by their estimated per enrollee premium to obtain an overall premium estimate (see further details on enrollment below).

To maintain consistency within total expenditures across sponsor and payer estimates, iterative proportional fitting is used 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 employer for types of insurance (group and individual) and sector of employment (public or private) must be adjusted to sum to total PHI spending.

Additionally, payments by employers for workers compensation and temporary disability insurance to state and local governments are forecast econometrically using macroeconomic trends and were applied through the model’s accounting identities.

Moreover, a number of categories of spending are projected exogenously based on the current Trustees’ Report financing assumptions for both Medicare and Medicaid.

These categories include:

- Worker contributions to HI trust fund and Taxation of Benefits
- Employer contributions to HI trust fund
- SMI Part B and D Premium revenues
- Medicaid Buy-Ins for Medicare premiums
- State Medicaid Phase Down payments

For additional information on the accounting identities used to produce these estimates please see the historical NHE methodology paper.\textsuperscript{40}

\textit{d. Private Health Insurance Enrollment Model}

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 2015 Trustees Report and the 2014 Medicaid Actuarial Report.

Growth in enrollment in private health insurance per capita (PHI) is projected as a function of macroeconomic indicators, which capture fluctuations in private coverage due to unemployment and real income growth, and in response to changes in enrollment in Medicaid, Medicare, and other forms of

\textsuperscript{39} National Association of Insurance Commissioners (NAIC) Medicare Supplemental Insurance Experience Exhibit. 2001-2013.

\textsuperscript{40} CMS.gov. National Health Expenditure Accounts: methodology paper, 2013: definitions, sources, and methods.
The variables in our current model of PHI per capita are lagged values of two macroeconomic indicators:

- **Civilian unemployment rate.** Increased unemployment reduces PHI enrollment with a lag of zero to one year. Since variation in Medicaid enrollment growth tends to be positively correlated with the unemployment rate, this variable also tends to act as a proxy for the effect of shifts from PHI to Medicaid enrollment that occur in periods of rising unemployment.
- **Real disposable personal income (DPI).** The model includes a polynomial distributed lag on growth in DPI. A three-year lag is included, with the current and previous year’s income growth account for almost all of the impact on PHI enrollment.

In addition to projecting enrollment in overall PHI, the subcomponents of PHI enrollment are projected, which include models for employee sponsored health insurance (ESI) and individually purchased insurance.

The variables in our current model of ESI per capita enrollment are the following:

- **Enrollment Growth in PHI per capita.** As ESI represents the vast majority of spending, it correspondingly comprises the majority of PHI enrollment (about 90 percent of PHI enrollment in 2012); thus, factors that impact overall PHI enrollment growth largely explain the variation ESI enrollment.
- **Real Gross Domestic Product per capita, lagged 1 year (rGDP).** When economic growth as measured by rGDP is stronger, relative growth in employment tends to increase with concurrent increases in ESI enrollment growth.
- **Total public enrollment growth.** Public health insurance programs (Medicare, Medicaid, CHIP, and other Federal, and State and Local programs) act as a substitute for other forms of private insurance. Thus, factors that increase public enrollment growth, such as when the public ages into Medicare or becomes eligible for Medicaid or other programs during recessionary periods, tend to coincide with relatively slower growth in ESI enrollment.
- **Dummy for 2001-13.** This variable captures the shift from more rapid growth in ESI enrollment prior to 2001, to more modest growth that has persisted thereafter.\(^{41}\)

The remaining, smaller subcomponents of PHI enrollment (i.e., individually purchased Medicare supplemental insurance plan and other individually purchased plans) are modeled separately. Medicare supplement insurance is modeled as a share of overall Medicare enrollment utilizing a lagged value of supplemental insurance enrollment, as well as an exogenous projection of Medicare Advantage enrollment that is consistent with the 2015 Trustees Report. Other individually purchased plan enrollment per capita is modeled with the trend in overall PHI enrollment per capita, the ESI share of overall PHI enrollment, Medicaid enrollment per capita, and the unemployment rate.

Historical data for the uninsured population is based on survey data; however, we can expect growth in the uninsured population to track with a residual defined as the difference between total population and a sum of enrollment in insurance coverage across all sources of coverage. In practice, a combination of

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varying overlap across the enrollment categories and data issues mean that the change in the uninsured population does not always correspond closely to the change in the residual. Nonetheless, it is necessary to maintain internal consistency between these two concepts. For this reason, growth in enrollment for private and public programs is the most important determinant of the projection in the uninsured population. Given the strong link between the uninsured population and labor market conditions due to employer-provided coverage, the model also includes the civilian unemployment rate.

While our econometric models for private spending growth and private health insurance enrollment are separately estimated and solved, they are linked in that both are primarily driven primarily by common macroeconomic trends and by shifts between the private and public roles in funding health care spending. The model for PHI enrollment places greater emphasis on labor market conditions than the model for spending growth, and changes in enrollment tend to respond to macroeconomic fluctuations with a much shorter lag than does aggregate PHI spending. Taken together, models for private health insurance spending and enrollment imply PHI spending per enrollee. Both spending and enrollment projections are then adjusted as necessary to produce a reasonable trajectory for growth on a per enrollee basis.

4. **Effects of the ACA on NHE Econometric Model Projections**


   The Office of the Actuary Health Reform Model (OHRM) and related actuarial cost estimates are used to estimate the impact of the ACA coverage expansions, minimum Medical Loss Ratio (MLR), the Excise Tax on High-Cost Insurance Plans, and Industry Fees that are not already included in the NHE Econometric Model projections.42 The OHRM simulates the impact of health reform legislative provisions on both household and employer decision-making in regard to health insurance coverage and health spending. These impacts are then applied to the econometric nominal NHE projections calculated as described in prior sections.

   b. *ACA Impacts on the Net Cost of Private Health Insurance and Government Administration*

   Our estimates of the impact of the ACA on the net cost of insurance take into account two important factors. First, we constrain our estimates to reflect MLR provisions of the ACA. Projected PHI premiums are reduced by a projected MLR rebate impact based upon historical rebate experience and behavioral simulation modeling.43 Secondly, we apply different net cost assumptions for each type of available coverage through the projection period. This method allows us to capture the effect on net cost of the expansion of health insurance coverage and shifts in coverage that will take place under ACA. Our estimates of government administration also reflect the ACA impact on Medicaid administrative costs.

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42 Though the OHRM has evolved since the passage and enactment of the ACA, further details on the history and development of this model may be found in the appendix of this document: Foster, R.S. Estimated Financial Effects of the “America’s Affordable Health Choices Act of 2009” (H.R. 3200), as Reported by the Ways and Means Committee [Internet]. Baltimore (MD): Centers for Medicare and Medicaid Services; 2009 Oct 21, http://www.cms.gov/Research-Statistics-Data-and-Systems/Research/ActuarialStudies/Downloads/HR3200_2009-10-21.pdf (Accessed August 1, 2014).

based on actuarial budget projections.

c. ACA Impact on Sponsor Analysis

In order to overlay the effects of the Affordable Care Act, projected healthcare reform payer impacts from the OHRM were estimated on a sponsor basis. Final payer and sector estimates for Medicare, Medicaid (Federal/State), Other Public (Federal/State), and Other Private Revenues are utilized without the need to split impacts over multiple sponsors. ACA impacts to Medicare financing sources were captured through the premium and tax income quantities in the sponsor accounting. For PHI, sponsor-based spending impacts associated with ACA provisions to ESI were estimated to account for expected differential impacts by sector of employment. Lastly, the net household financed premium impact to the individual market from ACA coverage expansions and other provisions is added to total household spending along with other private health insurance in order to get the final and household sponsored NHE.

Underlying the described calculations above, premium subsidies for employees, as well as premium tax credits for small employers, were subtracted from the total Marketplace premium cost and private business health insurance spending, respectively. These were then added into other federal spending to reflect the source of the subsidy’s funding. In addition, PHI spending impacts from high risk pools and early retiree reinsurance program are allocated between the sponsors in a comparable manner. Finally, the impact of industry fee provisions and excise tax to PHI were distributed in a dollar weighted fashion among the sponsors after the rest of the NHE impacts of the ACA had been taken into account.

5. CONCLUDING NOTE

Our projection process is based on accepted econometric and actuarial projection techniques. However, as with any projection, we are constantly reviewing the accuracy of our projections and working to make improvements in the methodology. Please e-mail DNHS@cms.hhs.gov with any comments, feedback, or suggestions on our NHE Projection Model.