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PROJECTIONS OF NATIONAL HEALTH EXPENDITURES: METHODOLOGY AND MODEL SPECIFICATION

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 embody our analysis of probable aggregate trends in medical spending, for the mix of medical services consumed, and for trends in sources of payment for these services. Detailed tables for the historical and projected NHEA are available on our website[1] and a paper describing our results is published in *Health Affairs* accompanying the release of these projections.[2]

The NHE Projections modeling methodology has evolved over the past four years in response to the passage 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. For the 2010-20, 2011-21, and 2012-22 projections cycles, this scenario was defined as a projection of NHE in the absence of the ACA legislation. In addition, this scenario relied on a model estimated based on data adjusted to exclude historical effects of the ACA.

As the ACA was passed and 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. For the current projections for 2013-23, therefore, our standard NHE Econometric Model now incorporates the effects of most non-coverage expansion related provisions of the ACA legislation, such as payment changes to several Medicare providers. In addition, this econometric model now relies on historical data that *includes* all the effects of the ACA.

Though many of the ACA provisions are now incorporated into the NHE Econometric Model projection, several provisions are still estimated separately. Most notably, the effect of the provisions that expanded health insurance coverage in 2014, are estimated separately, using the OHRM.[3] 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

[1] 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

[2] Sisko AM et al., "National Health Expenditure Projections, 2013–23: Faster Growth Expected With Expanded Coverage And Improving Economy" Health Affairs 33, no.10 (2014) (published online 3 September 2014)

[3] ACA provisions that are excluded from the NHE Econometric Model for the 2013-2023 projections, and are modeled separately, include the major coverage expansions that began early this year, industry fees, the excise tax on high-cost coverage, and the minimum Medical Loss Ratio provisions.

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 less than one year experience under the ACA coverage expansions; the impacts of reform will continue to materialize over the coming years.[4]

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
        - Overview and background
        - Model specification
    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*

[4] Sisko AM et al. "National Health Expenditure Projections, 2013–23: Faster Growth Expected With Expanded Coverage And Improving Economy."

1. OVERVIEW OF THE NHE ECONOMETRIC MODEL

The NHE Econometric Model projection is based on models that reflect relationships in historical time-series data and focus on the health system as a whole, taking macroeconomic conditions and projections for Medicare and Medicaid spending as exogenous inputs. The most recent available macroeconomic and demographic assumptions from the Social Security Administration are used as exogenous inputs into the model. Actuarial projections for Medicare and Medicaid are also exogenous inputs. The Medicare projections include nearly all the effects of the ACA with the exception of various industry fees as mandated by the ACA. Similarly, the Medicaid projection also excludes these various industry fees, but in addition, it excludes the effects of the major expansion of coverage beginning this year. The primary focus of the NHE Econometric Model projections is future health care spending by private payers excluding the effects of the major coverage expansion under the ACA. We also project residual public spending after Medicare, Medicaid and CHIP are excluded, to provide a comprehensive projection of all spending within the NHEA. Projections for the combined spending by private health insurers, by consumers on an out-of-pocket basis, and by other private payers, are projected within a multi-equation structural econometric model that maintains consistency with exogenous Medicare and Medicaid projections, as specified earlier in this paragraph.

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 of this paper 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

All historical data for health expenditures are comprised of the NHEA compiled by OACT. The NHEA is a national level matrix of health spending data by type of service and source of funding. Information on the methodology used in producing these historical estimates can be found at http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical.html.

Classification of spending by types of services and sources of funding projected in our model are listed below. 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 expanded in recent years to generate projections based on the additional perspective of spending by 'sponsor' of spending – defined as the underlying source of financing for the sources of funds (direct payers) including private health insurance, Medicaid, and Medicare. The Sponsor classification effectively takes a step back to look at where the funding for health consumption is actually coming from

after accounting for the flows of funding to final payers. The objective is to take a look at the financial impact of projected trends by the households and businesses who ultimately pay for medical services. Categories of spending projected by 'sponsor' are shown in a third table below.

TYPES OF SERVICE
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

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

Data sources for medical price indexes are consistent with those used in the NHEA. The primary source data for medical price indexes are the series of Producer Price Indexes (PPI) and Consumer Price Indexes (CPI) published by the Bureau of Labor Statistics (BLS) The PPI indexes for health care services are available beginning in the 1990s, with the earlier historical price indexes based on the CPI. Additional adjustments are made to the source data in certain cases to ensure conceptual consistency where two or more primary indexes are used in combination to generate a longer-term historical series.

For physician and clinical services, we use a composite index of the Producer Price Index (PPI) for offices of physicians and clinical and diagnostic laboratories. This composite index provides a comprehensive deflator for the types of provider revenue covered under this NHE category. For inpatient hospital services in the period from 1993 forward, the NHEA uses the PPI for hospital services introduced in December 1992. To obtain a measure closer to a transaction price, the PPI uses a methodology that attempts to capture discounts and redefines the "items" included in the index. For the years prior to 1993, OACT estimates a transaction price measure based on an adjusted version of the CPI for hospital and related services. For nursing care facilities and continuing care retirement communities and home health spending, we now use the respective PPIs from BLS.

Our price measure for total personal health care 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 personal health care expenditures 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; we project medical price inflation to construct our projection of nominal health care spending. However, our ACA spending impacts are estimated separately in OHRM on a nominal basis – they are not explicitly broken out by quantity and price. These impacts are added to the nominal econometric projections to yield aggregated nominal projections. Since we can't break all of the nominal ACA impacts into price and quantity components, we cannot yet generate a projection of medical price inflation that includes the full effects of the ACA.

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

Industry/Commodity or Service	Price proxy	2012 weight
Personal Health Care		100.0
Hospital Care	PPI, hospitals*	37.4
Physician and Clinical Services	Composite Index: PPI for Office of Physicians and PPI for medical & diagnostic laboratories	23.9
Other Professional Services	CPI services by other medical professionals	3.2
Dental Services	CPI, dental services	4.7
Home Health Care	PPI home health care services	3.3
Other Health, Residential, and Personal Care:		
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	6.4
Prescription Drugs	CPI, prescription drugs	11.2
Other Non-Durable Medical Products	CPI, internal & respiratory over-the-counter drugs	2.3
Durable Medical Equipment	Composite Index: CPI for eyeglasses and eye care and CPI nonprescription medical equipment and supplies	1.7

*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.

Insurance Coverage Data

The enrollment estimates in the NHEA, compiled by OACT, cover total private health insurance (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 1960-2012, Medicaid and Medicare for the length of their respective programs, and all other estimates (including the more detailed estimates individually-purchased and employer-sponsored insurance) for 1987-2012.[5] Medicaid enrollment for 2011 and 2012 were adjusted for consistency with the Medicaid Actuarial Report for 2013.[6]

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 OASDI (Federal Old-Age, Survivors, and Disability Insurance). These projections are produced annually by the Social Security Administration (SSA).[7] Adjustments are made to macroeconomic projections for the first one to three years of the projection where updated quarterly data implies substantive changes since the release of the most recent SSA assumptions.

Projections for personal income (PI) and disposable personal income (DPI) consistent with the economic assumptions from the 2014 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.[8] 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.[9] These projections, as well as the Medicaid and Children's Health Insurance Program (CHIP) projections, are produced by OACT and are also consistent with macroeconomic and demographic assumptions included in the OASDI Trustees Report.

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[5] Additional detail on historical National Health Expenditure Accounts estimation methodology are available from: Centers for Medicare & Medicaid Services. National Health Expenditure Accounts: Methodology paper, 2012. Definitions, Sources, and Methods. [Internet]. Baltimore (MD): CMS; [cited 2014 Aug 1]. Available from: http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/dsm-12.pdf

[6] Truffer CJ, Klemm JD, Wolfe CJ, Rennie KE, Shuff JF. 2013 actuarial report on the financial outlook for Medicaid [Internet]. Baltimore (MD): Centers for Medicare and Medicaid Services; 2013 Mar 1 [cited 2014 Aug 1]. Available from: http://medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Financing-and-Reimbursement/Downloads/medicaid-actuarial-report-2013.pdf

[7] Board of Trustees, Federal Old-Age and Survivors Insurance and Disability Trust Funds, *The 2014 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds*, 28 July 2014, http://www.socialsecurity.gov/OACT/TR/2014/ (accessed August 1, 2014).

[8] 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

[9] Board of Trustees, *2014 Annual Report of the Boards of Trustees of the Federal Hospital Insurance Trust and Federal Supplementary Medical Insurance Trust Funds*, 28 Jul 2014, http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/ReportsTrustFunds/Downloads/TR2014.pdf (accessed August 1, 2014).

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.

The September 2014 release of the NHE projections incorporates projections from the 2014 Trustees Reports issued in July 2014 and the 2013 Medicaid Actuarial Report, updated to reflect additional macroeconomic data and research available through July 2014.[10]

3. NHE ECONOMETRIC MODEL SPECIFICATION

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

The NHE Econometric Model is primarily focused on growth in private health care spending. It is composed of a set of econometric equations that define the relationship of private (and other public) spending trends relative to exogenous inputs to the model: assumptions for key macroeconomic variables and 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 data for the NHEA. The fit and appropriateness of model specifications for individual series are reviewed and revised at this time.

Projections are generated separately for personal health care (PHC), which includes all medical goods and services consumed by individuals, and for several non-PHC categories (administrative costs, net cost of private health insurance, non-commercial research spending, investment spending on structures and equipment, and public health expenditures).

Overview and Background

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.

The key focus of our aggregate model is growth in aggregate private PHC spending. Aggregate spending growth for private PHC spending 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

[10] The updated macroeconomic forecast comes from the July 2014 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.

relationship between private and public spending growth such that these trends can be offsetting when looking at aggregate spending. As a result, this short-term relationship contributes to volatility in growth when private spending is considered independently. Note that this is in contrast to the strong positive correlation between growth in public and private spending over the longer-term.

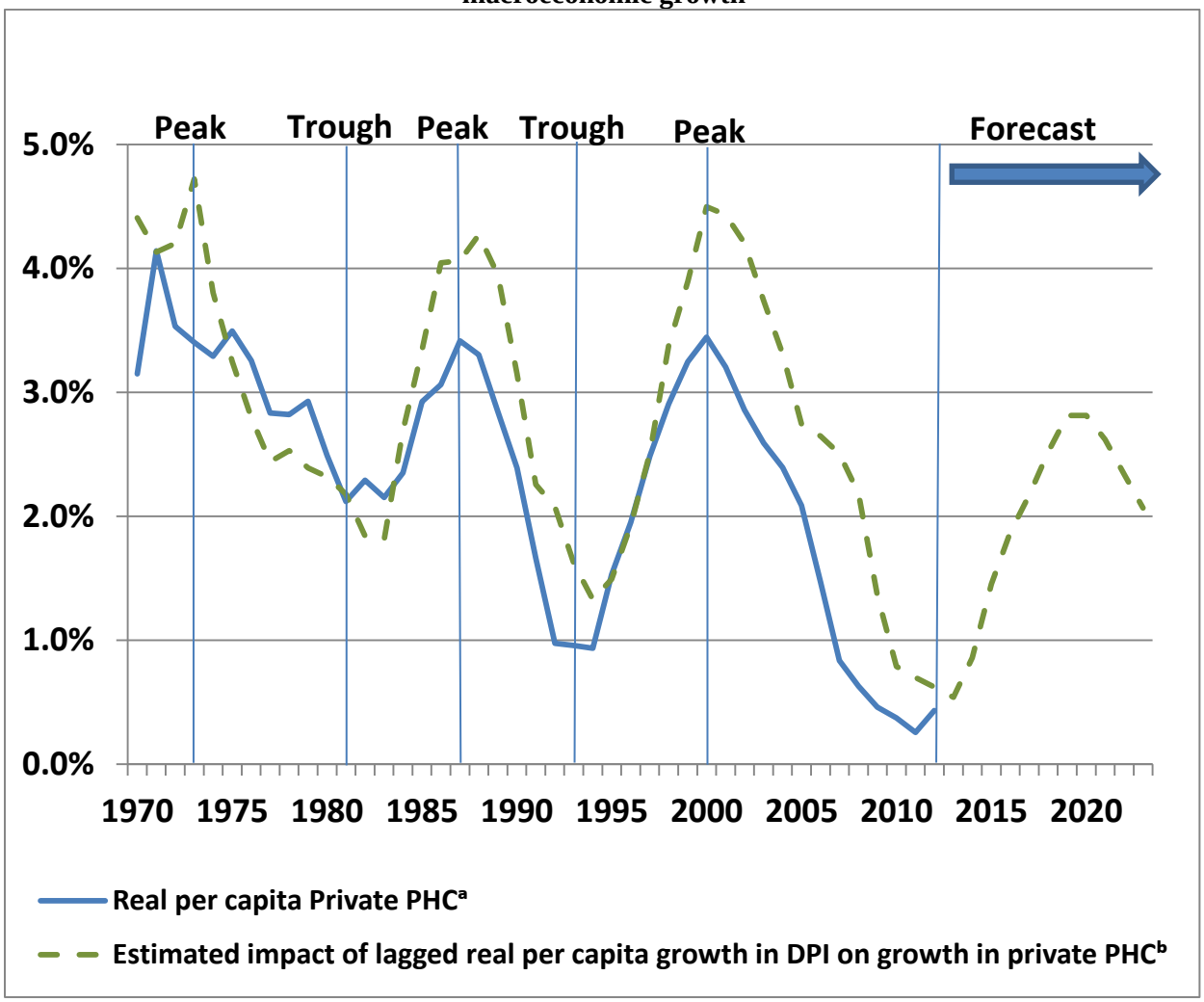
The causal link between aggregate income growth and health spending is largely reflected in private PHC spending rather than spending on public programs; however, this relationship can be observed in the aggregated data as well.

The magnitude and length of the growth cycles that characterize private health care spending means that it is difficult to look at trends less than a decade without understanding the cyclical and macroeconomic context. For example, our models suggest that the trough of the recent cycle in real per capita private PHC spending growth occurs near 2013, following a downturn since a peak in about 2000-2002.[11] The cycle for public health spending does not always closely track the timing of the cycle for private spending; however, in this case OACT analysis suggests public spending is also nearing a cyclical trough.

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

Chart 1 shows the estimated effect of lagged growth in real per capita income (DPI) on real per capita private PHC spending growth. 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.

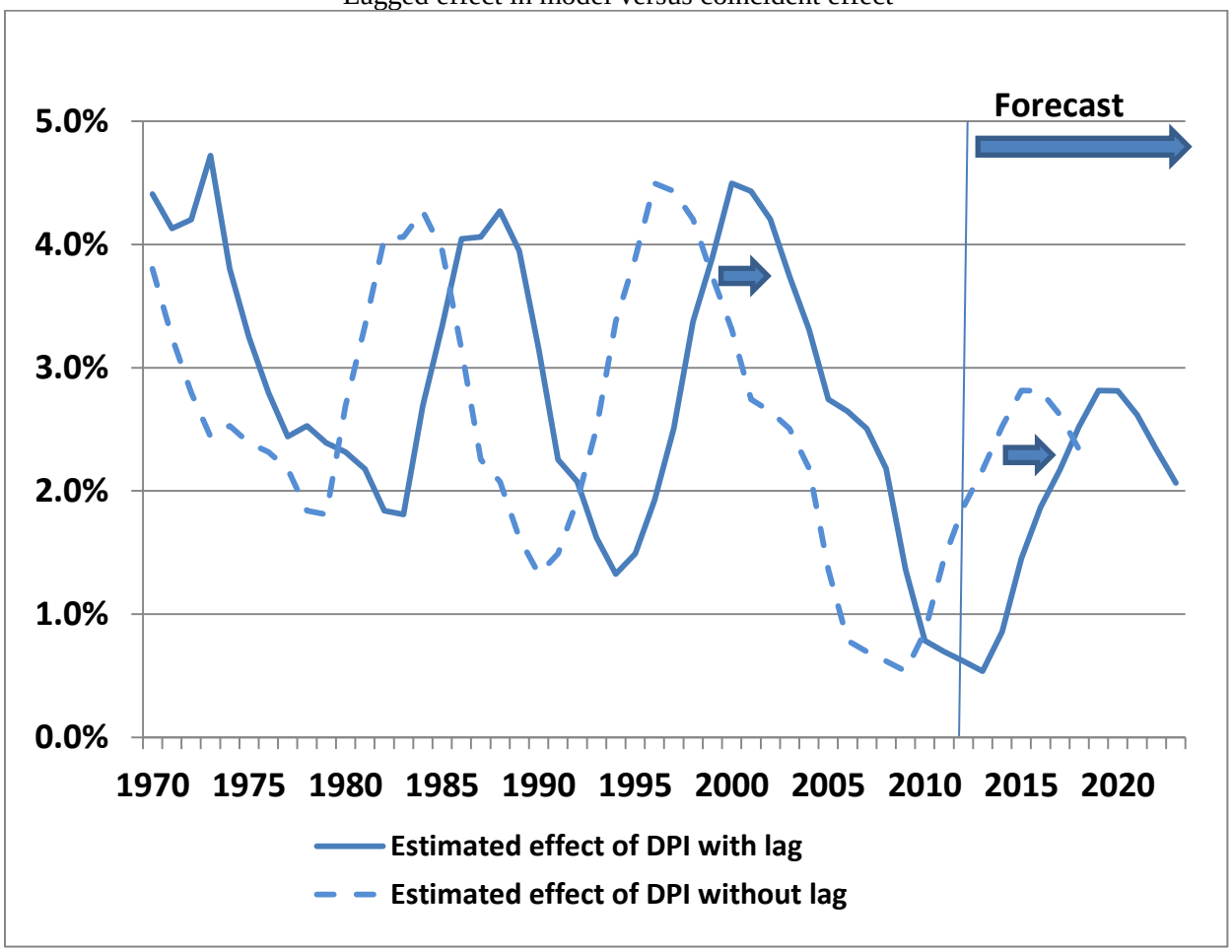
Chart 1. Real per capita growth in private health care spending with estimated cyclical effects of macroeconomic growth



[a]Values shown are calculated as 7-year moving average centered on the current period.
[b]Values shown represent the historical and projected values of DPI applied to the estimated model coefficients in the NHE projection model. These coefficients reflect the lagged structure of the model.

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 to four years).

Chart 2. Estimated impact of aggregate income growth on private health care spending,
Lagged effect in model versus coincident effect



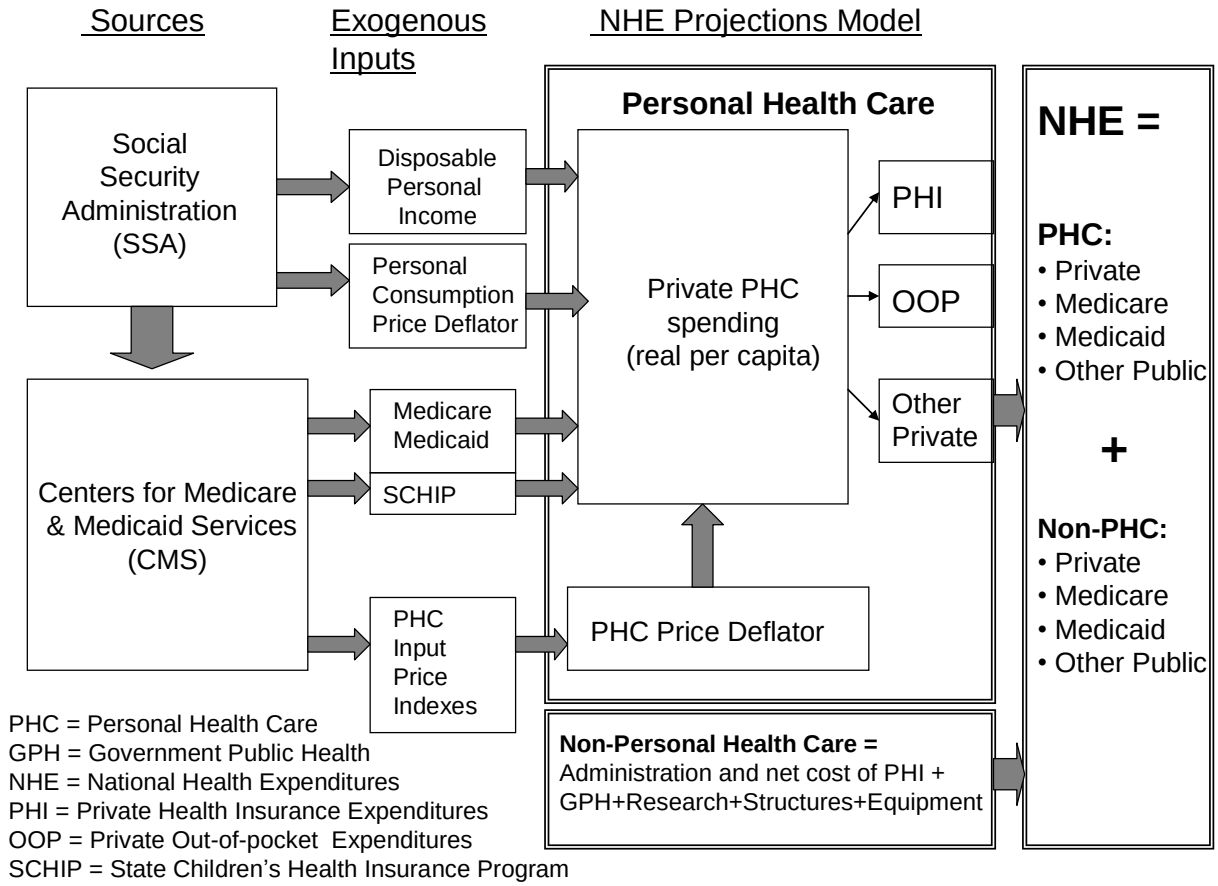
Based on Chart 2, we make two observations. The first observation is that the depth and length of the current slowdown in private PHC spending growth is largely cyclical, and reflects the severity of the 2007-2009 recession and its associated modest recovery. In fact, this severity and the extended period of sluggish growth following the recession has been anomalous relative to the rest of the historical period. Given that the coefficients in the model reflect an average over the entire historical period, we expect that the predicted depth of the cyclical trough in response to this unusually severe recession will overstate the weakness of health spending growth in the first two years of the projection. Therefore, we adjust our current projection for private PHC spending growth upwards for the initial years of the projection. This positive adjustment is consistent with initial data currently available for 2013 that suggests that spending growth may be coming in somewhat higher than our model predicts.

The second observation based on Chart 2 is that the historical macroeconomic data available as of mid-2014 suggests a cyclical resurgence in health care spending growth between now and 2017. This is an indication of the modest recovery in aggregate income growth that we have already experienced since the low point of the business cycle in 2009. As a result, we expect projected health spending growth to remain low in 2013 and 2014 (in the absence of the full effects from the major coverage expansions under reform), and then to accelerate significantly in response to the improvement in macroeconomic conditions to date and to the continued recovery anticipated over the projection.

Structure of private spending model

Aggregate private spending for PHC as a whole is far more predictable than is the case at the sectoral level. This reflects interrelationships in relative spending growth across types of care that may acts as substitutes in some circumstances (e.g. hospital, physician, etc.) and are critical in explaining historical patterns of growth. 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, with the result 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 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. 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 the next decade. However, underlying relationships in terms of levels do matter for 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.[12] 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; however, as mentioned earlier, this model does not incorporate the full effects the ACA, such as the effects of the major coverage expansions of Medicaid and the Marketplaces on provider fees.[13] 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)
- Relative 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.[14] The exclusion of Medicaid and Medicare spending reflects the fact that these are income in kind that accrues to those with public coverage. Since we are

[12] 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.

[13] Foster, R.S. Estimated financial effects of the "Patient Protection and Affordable Care Act," as amended [Internet]. Baltimore (MD): Centers for Medicare and Medicaid Services; 2010 Apr 22, http://www.cms.gov/Research-Statistics-Data-and-Systems/Research/ActuarialStudies/downloads/PPACA_2010-04-22.pdf (Accessed August 1, 2014).

[14] 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.

attempting to approximate income growth primarily for those with private coverage, we exclude this income from our measure.

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.[15] 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 effect on current period 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 lagged effect peaks at a lag of two-three years. The long-term income elasticity of private health care spending over six years is 1.4, which means that health care spending rises substantially faster than income growth in the longer term.

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.[16] The importance and structure of out-of-pocket cost-sharing varies quite a bit across sectors and over time, and where the share paid out of pocket is higher, this can be expected to shorten the lag structure of the income effect. The growing importance of out-of-pocket health spending 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 household income since a trough in 1996 (in contrast to a declining trend seen over the long-term since 1960). However, it continues to grow at a pace slightly below that observed for private health insurance spending. 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 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. Because so many decisions are contractual (or built into law) and are intended to

[15] For a review of this literature, see Chernew, Michael E., and Joseph P. Newhouse (2011) "Health Care Spending Growth" in *Handbook of Health Economics,* Vol.2., Mark V. Pauly, Thomas G. McGuire, Pedro P. Barros (eds.):1-43.

[16] 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.

apply to an underlying pool with varying preferences, it takes time for the system to respond–time to determine what decisions best fit the preferences of all members of the pool, to change the structure of coverage, and for these changes to influence standards of medical practice at the point of service.

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 over seven years (from six years previous through the current period), and our estimates imply that this effect rises to a peak at about two years lag.[17] The relationship between real per capita spending and real per capita DPI is assumed to be log-linear. The assumption of log-linearity implies that prices and income elasticities are constant over time. The income elasticity in our current model is 1.43, towards the upper end of estimates for macro-level elasticities of approximately 0.8 to 1.6 in the empirical literature.[18] However, we believe it is reasonable that our estimated income elasticity is above 1.0 because:

1) Elasticity estimates based on spending by all sources of funding, rather than on private spending alone like in our model, tend to be higher.
2) Elasticity estimates based on variation at a state or regional level, rather than at the national level like in our model, tend to be smaller.
3) Elasticity estimates that control for institutional characteristics of health systems that are correlated with variation in aggregate income tend to be lower. These factors, such as changes in medical technology, can be seen as endogenous functions of aggregate income but are not reflected in our model.

Lagged health share of GDP

Our models are expressed in terms of relative growth rates. However, as mentioned, 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 ultimately 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) 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. Functionally, this restraint on growth reflects an underlying multistep process whereby budget constraints are set for insurers by the employers, insurers, and governments that are the ultimate source of funding (sponsors)

The negative impact of rising health share of consumption on growth in private PHC spending has long been represented mechanistically by the inclusion of a negative time trend in our model for real PHC spending growth. The current version of the model contains a variable intended to capture the substantive impact of rising health share of consumption on health care spending growth. This additional variable is defined as the lagged ratio of total PHC spending to GDP. It captures the long-term effect on

[17] 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.
[18] Chernew, Michael E., and Joseph P. Newhouse (2011) "Health Care Spending Growth'in *Handbook of Health Economics,* Vol.2., Mark V. Pauly, Thomas G. McGuire, Pedro P. Barros (eds.):19-20.

health spending growth of underlying changes in the model variables when evaluated in terms of relative levels. The negative coefficient on the health share of GDP implies that the income elasticity tends to decline over time.[19]

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.[20] 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.[21] 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 binding 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 constraint on health spending growth.[22] 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.

[19] The inclusion of the lagged health share of GDP as an independent variable in our model of current period private health care spending growth adds an element of circularity to this model: health share of GDP is also a function of growth in private health spending. This element requires that the model be solved iteratively to maintain internal consistency.

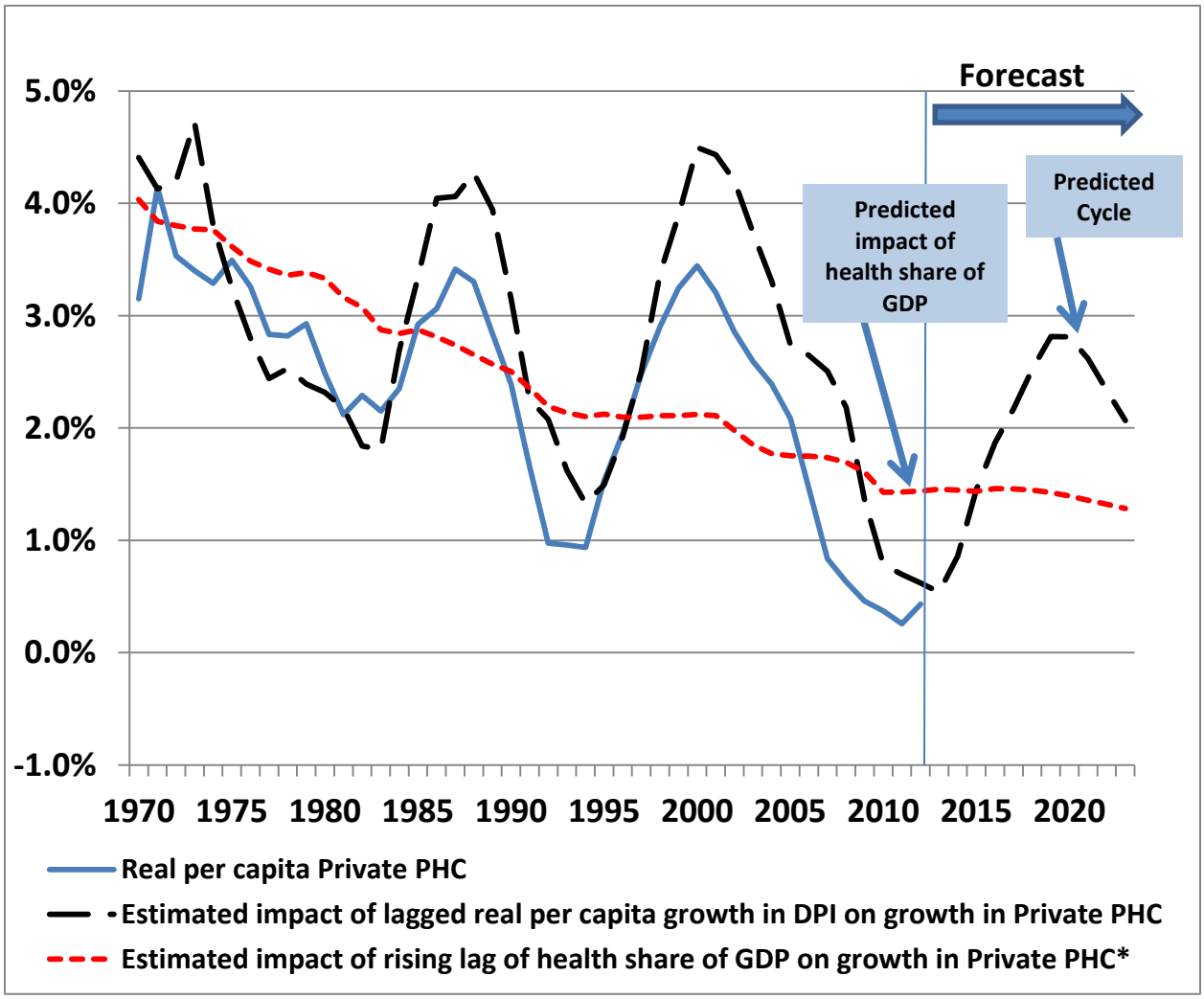
[20] Getzen, T.E., "Health Care is an Individual Necessity and a National Luxury: Applying Multilevel Decision Models to the Analysis of Health Care Expenditures," *Journal of Health Economics*, 2, (2000): 259-270.

[21] Ibid.

[22] Ibid.

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.

Chart 3: Real per capita growth in private health care spending with estimated effects of the health share of GDP



*Values shown were re-centered at the average growth of Real per capita Private PHC over the period shown on the chart.

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. However, the approximation is very poor; 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. The analysis of micro data confirms that variations in the out-of-pocket price paid by patients has sizable effects on health care spending; however, at an aggregate level the indicator is too flawed to use as a single measure of the generosity of insurance coverage within an aggregate time-series model. We do adjust projections for spending growth where indicated based on the analysis of the effects of specific types of cost-sharing (e.g. tiered copays, deductibles) for individual types of service.

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 well above micro-level estimates of price elasticity of demand for medical care (−0.1 to −0.2 based on the Rand Health Insurance Experiment).[23] 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.[24] The effects of other factors (economy-wide price inflation, productivity growth, industry

[23] Manning, W.G., et al., "Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment," *American Economic Review*, Vol. 77, No. 3, June 1987.

[24] 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.

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 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.[25] This substantially improves the fit of the model. Our data indicate that physician incomes have been generally growing at a slower pace in comparison with other inputs to medical care since the early 1990s, a finding that is consistent with a concurrent slowdown in output price inflation relative to our index of input price inflation. Notably, this pattern has reversed in data for 2009-2012, with physician incomes growing faster than our aggregate input price index for PHC. 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.

Real per capita public PHC spending

In our model of real per capita private spending growth, the use of the total population (rather than the pool of privately insured) as the denominator means that that the effect of 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

[25] We estimated an historical physician income series through 2012. 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.[26]

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

[26] 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 sector, 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)

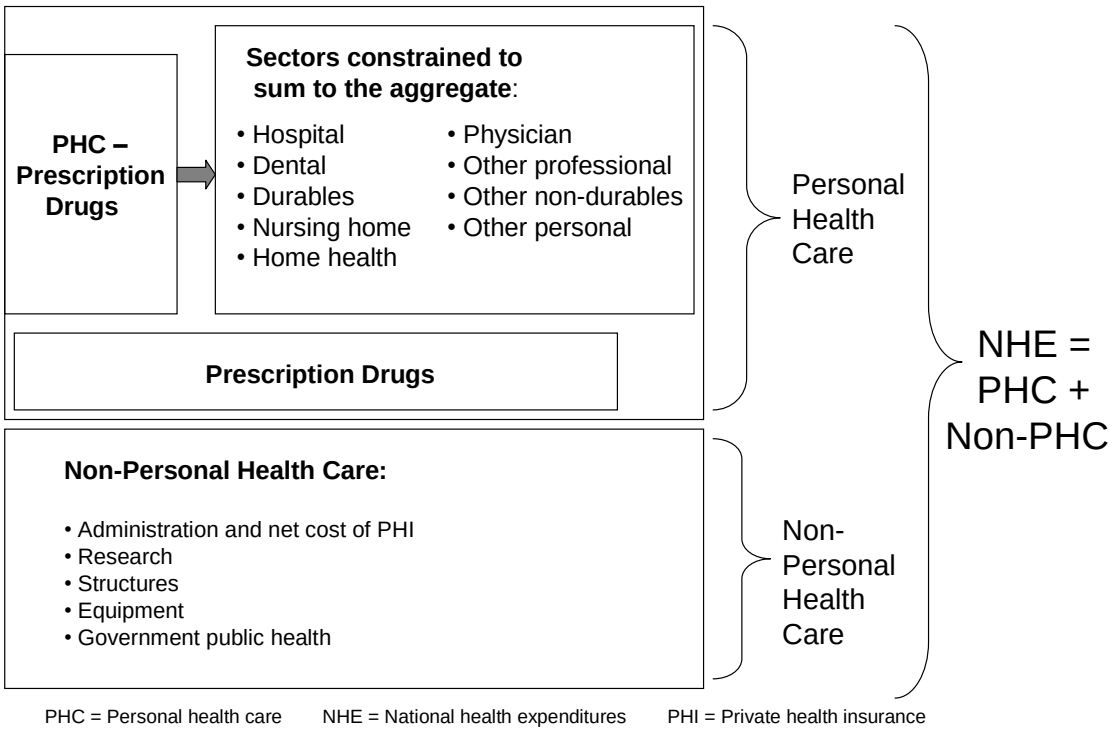
Models for health care spending by type of service

Models for 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.[27] Our choice of this type of model reflects our finding that the model is substantially more robust at the aggregate level.[28] For the most part, key variables in the sector models follow the specification of the aggregate model for personal health care spending growth.

[27] See discussion of sectoral constraints under 'Type of Service.'

[28] There are several possible reasons for this finding. First, spending for the different types of services is interdependent. Conceptual and measurement issues with the data make it difficult to convincingly capture complementary and substitutive relationships across types of services. When shifts across services are believed to have occurred on a large scale, it is difficult to accurately capture the effect on patterns of growth. For example, such a shift occurred following the introduction of Medicare's prospective payment (PPS) system for most inpatient hospital services. The magnitude and timing of the impact of PPS on hospital and physician spending is not straightforward, and the selection of proxies to capture this effect is difficult. However, the manner in which such events are specified matters, since it affects the coefficients obtained on the model variables. Working with aggregate growth rates captures the net effect on health spending of factors that cause sectoral shifts. Second, data on relative prices across types of medical services are somewhat flawed for our purposes and are not always consistent across services; thus, obtaining reasonable cross-price elasticities is difficult. Third, health services tend to be purchased as bundles that incorporate types of services extending across several different sectors, while the data are not measured in such a way that we can track the behavior of the market for these linked bundles. Aggregation across all types of medical care ameliorates these problems.

Sectoral Composition of NHE Projections Model



Major variables in sector models:

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

Models for individual sectors of the NHE Projections Model are discussed below. Sectors are broken into personal health care (PHC) and non-personal health care (Non-PHC) categories.

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.

SECTOR	DEPENDENT VARIABLE	INDEPENDENT VARIABLES
Hospital services	Real private hospital services per capita	Real disposable personal income (PDL, 7 years) (+) Relative price(−) Real per capita public spending growth (−) Dummy, 1984-2012 (−) Dummy, 1984-2012 * time trend (+) Time trend (−)
Physician and Clinical services	Real private physician services per capita	Real disposable personal income (PDL, 5 years) (+) Real per capita public spending growth (−) Relative price (−) Dummy, 1983-85 (+) Dummy, 2007-2010 (−)
Other Professional services	Real private other professional services per capita	Real disposable personal income (+) Real per capita public spending growth (−) Dummy, 1992-2012 (−) Dummy, 1992-2012*Real disposable personal income (−) Dummy, 1992-2012*Real per capita public spending growth (+) Autoregressive term (−)
Prescription Drugs	Real aggregate drug spending per capita*	Real disposable personal income (3 year moving average) (+) Relative drug price * Share paid out-of-pocket (−) New drug introductions (−) Generic dispensing rate (−)
Over the Counter Drugs and Other Nondurables	Real private other nondurables spending per capita	Real disposable personal income (2 year moving average) (+) Relative price (−) Real per capita other non-durables spending paid out-of-pocket, lagged one year (+)
Durables	Real private durables spending per capita	Real disposable personal income (PDL, 2 years) (+) Relative price (−) Public spending growth (−)
Dental services	Real private dental services per capita	Real disposable personal income (PDL, 3 years) (+) Relative price (−) Medicaid and CHIP spending growth (+) Dummy, 1981 (+)
Nursing Care Facilities and Continuing Care Retirement Communities	Real private nursing home services per capita	Real disposable personal income (PDL, 3 years) (+) Real per capita public spending (−) Relative price (−) Dummy, 1990 (+) Dummy, 1995 (+) Moving-average term (+)
Home health services	Real private home health services per capita	Real disposable personal income (PDL, 2 years) (+) Dummy, 1999-2012* Real per capita Medicaid spending growth (−) Real per capita Medicare spending growth (+)

*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: 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 (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.

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 primarily reflects two outlying periods: much higher than predicted growth in 1983-85 and much lower than predicted growth for 2007-10. Absent these periods, the pattern of growth implied by the income and relative price term produces a fairly good fit. We have included a dummy variable to capture the period of rapid growth from 1983 through 1985, while the faster growth later in the decade is consistent with the lagged effects of the income term. 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. 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,[29] which disproportionately depresses physician office and clinic visits

[29] Kaiser Family Foundation and Health Research Educational Trust. Employer Health Benefits, 2013 Annual Survey. 2013August 20,http://kff.org/privateinsurance/report/2013-employer-health-benefits (Accessed August 1, 2014).

related to primary care and preventative services compared to acute care services.[30] 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.[31] 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.[32] 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. Our income variable 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

[30] Fronstin, P. et al., "Consumer-Directed Health Plans Reduce The Long-Term Use Of Outpatient Physician Visits And Prescription Drugs," *Health Affairs*, Vol. 32, No.6, June 2013.

[31] Pickens, G. and G. Popa. "The Current Recession and Healthcare Consumers," Research Paper, Center for Healthcare Improvement, Thomson Reuters, April 2009. http://www.collaborationhealthcare.com/6-6-11ThompsonReutersTheCurrentRecessionHCConsumers_FINAL_041509.pdf (Accessed August 1, 2014)

[32] Kaiser Family Foundation and Kaiser Commission on Medicaid and the Uninsured. Key Facts about the Uninsured Population, 2013 Fact Sheet. 2013September 13, http://kff.org/uninsured/fact-sheet/key-facts-about-the-uninsured-population/ (Accessed August 1, 2014).

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.

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[33]) 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. 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

[33] 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.

funds is adjusted for consistency with aggregates based on iterative proportional fitting.[34]

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). Methodology for these payers is discussed below. Residual Federal and other state and local spending for smaller 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. Beneficiary populations within both the VA and DOD tend to be less healthy and more costly to care for than the general population on a per-beneficiary level. In addition, these enrollees are faced with significantly less cost sharing and enrollment fees than in other sources of healthcare leading to an expected faster growth in per beneficiary spending.

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 households and business that support payment for insurance coverage – trends at the level of payment for premiums that may be masked by focusing on the direct source of payment for care. For example, NHE spending by payer for PHI contains premiums paid to insurance companies financed through multiple sources, including employers and employees (households contributions to premiums), and households as the source of dedicated tax revenues including the payroll tax that is the major source of funding for Medicare Part A.

Premiums for private health insurance plans,[35] 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

[34] "Iterative proportional fitting, also known as iterative proportional scaling, is an algorithm for constructing tables of numbers satisfying certain constraints." From Speed, T.P., "Abstract: Iterative Proportional Fitting," *Encyclopedia of Biostatistics*, 15 July 2005, http://mrw.interscience.wiley.com/emrw/9780470011812/eob/article/b2a10027/current/abstract (accessed 22 February 2008).

[35] 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).

majority of private health insurance premiums (roughly 95 percent in 2012). As such, the factors described previously that influence the PHI share of our aggregate projection of private PHC spending growth (for growth in both PHC real per capita spending and price inflation) combined with growth in the net cost of PHI explain nearly all the variation in ESI premium growth. However, to isolate ESI premiums, the subcomponents of PHI that grow differently than ESI premiums are removed from total PHI, namely Medicare supplemental insurance and other individually purchased insurance plans (combined they accounted for roughly 5 percent of PHI premiums in 2012). Projections of Medicare Supplemental premium growth per enrollee incorporate assumptions of growth in per beneficiary spending on Medicare benefits from the 2014 Medicare Trustees Report supplemented by premium trends for this type of insurance from the National Association of Insurance Commissioners (NAIC).[36] Projections of per enrollee premium growth for other individually purchased insurance plans are developed based on their historical relationships to trends in per enrollee premium growth in overall private health insurance and Medicare supplemental insurance. Enrollment trends for Medicare supplemental plans and other individually purchased insurance are then incorporated into per enrollee premium trends to obtain overall premiums (see further details on enrollment below).

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.

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.

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.[37]

[36] National Association of Insurance Commissioners (NAIC) Medicare Supplemental Insurance Experience Exhibit. 2001-2013.

[37] "National Health Expenditures Accounts: Methodology Paper, 2012." http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/dsm-12.pdf, pp.28-33 (Accessed August 1, 2014).

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 2014 Trustees Report and the 2013 Medicaid Actuarial Report with updates for recent data.

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 public coverage.

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 years. 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 2001-12.* This variable captures the shift from more rapid growth in ESI enrollment prior to 2001, to more modest growth that has persisted thereafter.[38]

The remaining, smaller subcomponents of PHI enrollment (i.e., individually purchased Medicare supplemental insurance plan and other individually purchased plans) are modeled separately. Medicare

[38] Gould, E. A Decade of Declines in Employer-Sponsored Health Insurance Coverage [Internet].District of Columbia: Economic Policy Institute; 2012 Feb 23 [cited 2014 Aug 1]. Available from: http://s3.epi.org/files/2012/bp337.pdf

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 2014 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.

Econometric models for private spending growth and private health insurance enrollment are separately estimated and solved. However, projections of spending and enrollment 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. The implications of our enrollment projection is that they are used when estimating private health insurance spending per enrollee; therefore, these trends are continually monitored and adjusted during the projections process.

4. EFFECTS OF THE ACA ON NHE ECONOMETRIC MODEL PROJECTIONS

a. Estimates for ACA Insurance Coverage Expansions, Minimum Medical Loss Ratio, Excise Tax on High-Cost Insurance Plans, and Industry Fees

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.[39] 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 the minimum medical loss ratio provisions of the ACA. 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, 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

[39] 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).

the OHRM were estimated on a sponsor basis for each provision. 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. However, impacts to PHI are an exception, as private businesses, households, governments all participate in this portion of the health economy. Sponsor-based spending impacts associated with ESI enrollment changes (gains or losses of coverage) were adjusted to account for the impact of the introduction of Marketplaces on ESI. Lastly, the impact of increased insurance spending by Marketplace enrollees was added to total household spending along with other private health insurance (with the effects of the ACA) in order to get the final PHI spending effect due to the introduction of the Marketplaces and Medicaid expansion.

Moreover, 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 dependent coverage provisions, high risk pools, early retiree reinsurance program, and excise tax were allocated between the sponsors in a comparable manner. Finally, the impact of industry fee provisions 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.