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DEPARTMENT OF HEALTH & HUMAN SERVICES
Centers for Medicare & Medicaid Services
7500 Security Boulevard, Mail Stop N3-01-21
Baltimore, Maryland 21207-0512

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FROM: Stephen K. Heffler
Todd G. Caldis
Sheila D. Smith

SUBJECT: The Long-Term Projection Assumptions for Medicare and Aggregate National Health Expenditures

The Office of the Actuary (OACT) annually produces 75-year Medicare expenditure projections for the annual report of the Medicare Board of Trustees to Congress. The assumptions used in the long-term projections have evolved over several decades through internal deliberations, four independent technical advisory panel reports, ongoing discussions with the Medicare Trustees and their staffs, and the input of various external researchers. This memorandum updates the exposition of OACT's long-range health spending projection methods used in the 2013 Medicare Trustees Report.

Because of the significance of the long-range projections for public policy makers, it is important for the projection assumptions to be as transparent and understandable as possible. The purpose of this memorandum is to promote a more complete understanding of the long-range cost growth assumptions by: (i) describing the projection challenge, (ii) providing a detailed description of the current-law long-range assumptions, (iii) tracing the evolution of the long-range assumptions used in the Trustees Report, and (iv) evaluating the strengths and limitations of the current cost growth assumptions. Making such projections is not an exact science, and any long-term projection model necessarily makes assumptions about the continuation of trends into an uncertain future. The Office of the Actuary and the Board of Trustees continue to make every effort to ensure that reasonable projections of Medicare's future are included in the Trustees' annual report.

The Long-Range Projection Challenge

Federal law requires the Medicare Trustees to report annually to Congress about the financial and actuarial status of the Medicare program. OACT provides professional technical assistance to the Trustees in their preparation of this report. Financial solvency determinations, defined conceptually as measurement of the adequacy of projected program revenues to pay for projected program obligations under current law, are reported for the Medicare trust funds.

In general, long-term projections, which span 75 years beginning with the current year, are made under an assumption that existing institutional arrangements and program parameters embodied in current law will prevail for the entire projection period. The 75-year "current-law" projections are intended to reflect a policy-neutral baseline that is useful for policy makers, researchers, health-care providers, beneficiaries, and others in considering the need for changes or adjustments in national policy.

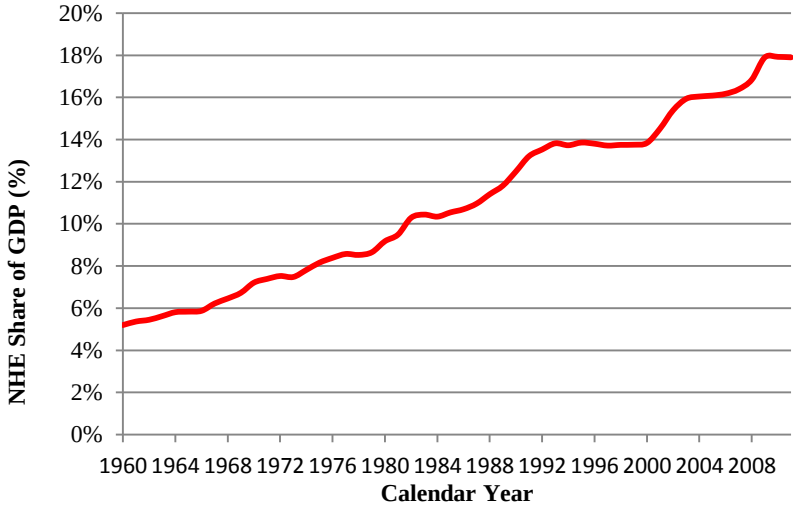
Both the time horizon and the institutional perspectives employed in long-term projections have on occasion been criticized as unrealistic. Some observers have argued that projections extending far into the future are so uncertain as to be of limited value and that the current-law perspective assumes the perpetuation of existing policy arrangements beyond any reasonable point. But such criticisms overlook a fundamental premise of long-term solvency reporting; that is, projecting the long-term consequences of the institutional status quo affords decision makers a reasonable opportunity to investigate trends, to consider alternatives, and to implement well-conceived policy adjustments before financial or programmatic challenges reach crisis proportions. Moreover, in view of the long-range financial commitments made by the Medicare program,[1] many would argue that it is critical to take every step to help ensure that these commitments can be fulfilled, starting with a long-range evaluation of the financial status of Medicare.

Long-range projections of Medicare revenues that appear in the Trustees Report are produced using various long-range economic and demographic assumptions such as the size and age distribution of the population, the size of the work force, average earnings levels, and the Gross Domestic Product (GDP). These economic and demographic assumptions are determined annually by the Social Security and Medicare Board of Trustees based on recommendations by the Office of the Chief Actuary at the Social Security Administration. Projection of long-term Medicare and aggregate national health expenditures by the Office of the Actuary at the Centers for Medicare & Medicaid Services follows a similar process, but involves additional assumptions that have been especially challenging to formulate and to validate.

The most difficult challenge in making long-range health expenditure projections is in determining if and when a sector of the economy with a long history of rapid cost growth will stabilize relative to the rest of the economy. Since the mid-20th century, the U.S. health sector has grown substantially faster than the economy as a whole and, as a consequence, is of historically unprecedented size. As Chart 1 shows, since 1960 the health sector's share of all of the nation's economic activity has increased by a factor of roughly 3.5 (from 5 percent in 1960 to almost 18 percent in 2011). Given that the U.S. economy as a whole has experienced more than fourfold real growth since 1960, the health sector has experienced more than a fourteen-fold increase (4 times 3.5) in real constant-dollar spending over the past 50 years. The share of national output that the U.S. health sector absorbs has long, and by far, exceeded the health sector share of any other developed nation, as shown in Chart 2, and there is no evidence that the status of the U.S. relative to other developed nations will end.

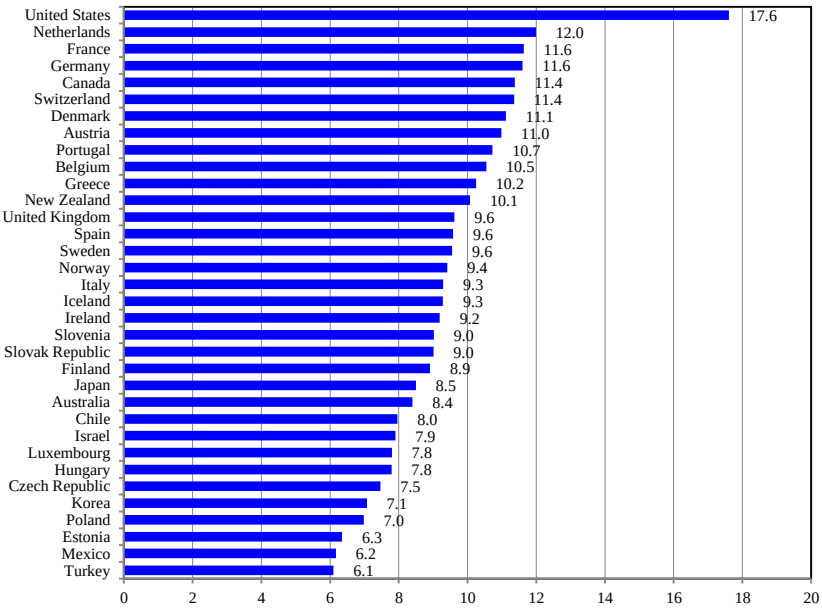
[1] As an example, consider new entrants to the workforce at age 20. If these individuals work and pay Hospital Insurance payroll taxes on their earnings for a sufficient period, then they will qualify for HI benefits at age 65 (or earlier, if they become disabled). Once enrolled at 65, these beneficiaries may live for another 30 years or more. In this way, Medicare makes financial commitments that span at least the next 75 years.

Chart 1—National Health Expenditures (NHE)
as a Percentage of Gross Domestic Product (GDP)
1960-2011



Source: Centers for Medicare & Medicaid Services, Office of the Actuary.

Chart 2—CY 2010 Health Expenditures as a Share of GDP
Selected OECD Countries



Source: OECD Health Data 2012

Note: For the United States, the 2010 data reported here do not match the 2010 data point for the United States in Chart 1 since the OECD uses a slightly different definition of "total expenditures on health" than that used in the National Health Expenditure Accounts.

One way of analyzing health spending trends is to compare the growth rate of the U.S. health sector with that of the overall economy. Using a definition of "excess cost growth" as the difference between (i) the U.S. per capita growth rate in age-gender-adjusted health-care costs and (ii) the per capita growth rate in GDP (both in constant dollars), Table 1 shows average excess cost growth rates for selected time periods since 1975. Average excess cost growth rates for national health expenditures (NHE) exhibit some volatility depending on which time periods are used for defining averages, but this differential has generally been above 2 percent per year or just slightly below this level. The only clear deviation from the 2-percent annual differential coincided with the widespread adoption of managed care approaches to delivery of health care in the 1990s, but that slowdown proved temporary as strong excess cost growth reemerged after the turn of the century. Since 2005, NHE excess cost growth rates have averaged 1.3 percent per year. However, given the depressed state of the real U.S. economy for a portion of that period, it is unclear at this time whether that represents a permanent slowdown from the 2-percent rate that has prevailed since 1975 or whether it is a temporary deviation from the long-term trend. If the historic excess growth trend were to continue unchecked, the health sector would encompass most, if not all, of the U.S. economy within the 75-year reporting horizon.

Since a nation that produces only health care is an impossibility, any method for projecting long-range U.S. national health expenditures should consider and take into account any factors that would contribute to an eventual slowdown in long-term growth rates for the health sector, to the degree deemed likely to occur under existing law. But available research provides little guidance concerning how much of a slowdown in growth rates might take place, the probable timing of a slowdown, the mechanisms that would cause a slowdown, and whether a slowdown is likely to occur under a current-law scenario. How these questions are addressed profoundly influences the outcome of the expenditure projection process.

Despite the difficulty and uncertainty involved in projecting long-range NHE and Medicare costs, projections are required for considering whether the promises made to the working population today can reasonably be expected to be fulfilled many years in the future. The balance of this memorandum describes the long-range current-law health care cost growth assumptions, explains the history behind the evolution of those assumptions, and finally considers the reasonableness of the assumptions.

Table 1 - Compound excess cost growth rates, selected time periods 1975-2011

Time period	Compound constant-dollar, per capita growth		Excess Cost (rounded)
	NHE (rounded)	GDP (rounded)	
Periods beginning with 1975:			
through 1980 (5 years)	4.7%	2.7%	2.0%
through 1985 (10 years)	4.7%	2.5%	2.3%
through 1990 (15 years)	5.0%	2.4%	2.6%
through 1995 (20 years)	4.6%	2.1%	2.4%
through 2000 (25 years)	4.2%	2.4%	1.9%
through 2005 (30 years)	4.2%	2.2%	2.0%
through 2011 (36 years)	3.7%	1.8%	1.9%
Periods beginning with 1980:			
through 1985 (5 years)	4.8%	2.3%	2.6%
through 1990 (10 years)	5.2%	2.3%	2.9%
through 1995 (15 years)	4.5%	2.0%	2.6%
through 2000 (20 years)	4.1%	2.3%	1.9%
through 2005 (25 years)	4.1%	2.1%	2.0%
through 2011 (31 years)	3.6%	1.7%	1.9%
Periods beginning with 1985:			
through 1990 (5 years)	5.6%	2.2%	3.3%
through 1995 (10 years)	4.4%	1.8%	2.6%
through 2000 (15 years)	3.9%	2.3%	1.6%
through 2005 (20 years)	4.0%	2.1%	1.9%
through 2011 (26 years)	3.3%	1.6%	1.7%
Periods beginning with 1990:			
through 1995 (5 years)	3.2%	1.4%	1.9%
through 2000 (10 years)	3.1%	2.3%	0.8%
through 2005 (15 years)	3.4%	2.0%	1.4%
through 2011 (21 years)	2.8%	1.4%	1.4%
Periods beginning with 1995:			
through 2000 (5 years)	2.9%	3.3%	-0.3%
through 2005 (10 years)	3.5%	2.4%	1.2%
through 2011 (16 years)	2.7%	1.5%	1.2%
Periods beginning with 2000:			
through 2005 (5 years)	4.2%	1.5%	2.7%
through 2011 (11 years)	2.6%	0.7%	1.9%
Periods beginning with 2005:			
through 2011 (6 years)	1.3%	0.0%	1.3%

Note: NHE rates were previously adjusted to remove age-gender effects on cost growth.

Source: Centers for Medicare and Medicaid Services, Office of the Actuary.

Long-Range Health Cost Growth Assumptions

This section summarizes the long-range excess cost growth assumptions used in the 2013 Trustees Report. Consideration of the history and reasonableness of the assumptions is deferred until later sections.

The 75-year projections are constructed around the notion of excess cost growth, or the degree to which growth in Medicare or health expenditures generally is expected to exceed the growth rate of GDP. Excess cost growth is an intuitively understandable indicator of when a particular sector is increasing in size relative to the rest of the economy. By definition, as long as a sector's rate of cost growth exceeds that of GDP, that particular sector (such as health care) will be increasing as a share of the nation's total economic output. As noted earlier in the discussion of Table 1, one way of measuring excess health cost growth is as a difference of rates of growth: the rate of age-gender-adjusted, per capita health care cost growth minus the rate of per capita GDP growth.[2]

It is important to recognize that 75-year projections are only partially based upon long-run excess cost growth assumptions. In the case of the first 10 years of the 75-year Medicare projections, projections of costs are made separately for each category of health spending (for example, inpatient hospital, physician, home health care, etc.) and are built up from assumptions about general price inflation, excess medical inflation for each category of spending, changes in utilization of services, and changes in the "intensity" or average complexity of services. (These methods are described in detail in the Medicare Trustees Report.) An implicit year-10 excess cost growth rate can then be computed from the results of the short-range projections. Years 11 through 24 of the 75-year projection are computed on an excess cost growth basis using rates that blend the excess cost growth rate implicit in the year 10 short-range projection and the long-range excess cost growth rate expected to prevail in year 25. For the last 51 years of the long-range projection (years 25 to 75), excess cost growth assumptions are derived using the output from the factors contributing to growth model described in more detail in the next section.[3]

Each Medicare subpart has a unique implicit excess cost growth rate as of year 10 of the projection. Prior to the Affordable Care Act (ACA), the separate tenth-year growth rates were transitioned to the same long-range excess cost growth rate assumption in year 25, so that the program would then be projected as having a common set of excess cost growth rates for years 25 to 75. This long-range rate of excess cost growth for Medicare was assumed to be similar to

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[2] Excess cost growth calculations can be performed either on a nominal dollar or a real dollar basis as long as the approach chosen is consistently applied. The long-range projections have always been computed on a nominal dollar basis. In the actual development of the long-range projections, excess cost growth is computed on a multiplicative basis fully consistent with the additive framework presented here. For a detailed explanation of the implementation of excess cost growth computations see the Notational Appendix of the May 12, 2009 Projections Methodology memorandum "The Long-Term Projection Assumptions and Aggregate National Health Expenditures" at http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/ReportsTrustFunds/Downloads/ProjectionMethodology.pdf

[3] As described subsequently in this memorandum, the growth assumptions can be derived either directly in the form of excess growth rates (for example, using the traditional "GDP+X" framework) or by applying the statutory provider payment rate updates to projected rates of growth for the utilization and intensity of medical services.

the excess cost growth rate prevailing for the rest of the U.S. health sector. Current-law price provisions of the ACA, which require permanently slower annual payment updates relative to prior law for many Medicare payment systems, mean that it is no longer feasible in the current-law projection to transition to a single excess cost growth rate for the entire Medicare program. Instead, long-range assumptions of underlying medical price and quantity trajectories for each Medicare subpart are now developed from which excess cost growth rates can be computed.

In particular, for the last 51 years of the 75-year period, growth assumptions are developed for overall national health spending, and these assumptions are used in the development of separate Medicare spending assumptions for Part A, certain subsets of Part B, and Part D. A description of the overall national health spending assumption is discussed below, followed by a detailed description of the methodology used for determining the long-range Medicare spending growth assumptions for Medicare Part A, Part B, and Part D.

Overall National Health Expenditures (NHE)

The long-range projection starts with the assumption that *overall* per capita health spending will increase on a year-by-year basis at rates determined using the Office of the Actuary's "factors contributing to growth" (FCG) model. The FCG model is an assumptions-based approach in which the historical impact of key drivers of national health spending growth are used to inform expectations about the long-run future, including the long-range implications of an increasing share of our economic resources being devoted to health spending. The model is an extension of the basic factors analysis used by the 2000 Medicare Technical Review Panel. It draws on the additional data available since 2000 as well as refinements to the economic literature on the factors underlying health care cost growth—specifically, changes in national income, relative medical price inflation, health insurance coverage, and residual effects, which are primarily the impact of innovations in medical technology.[4] (Appendix A describes the FCG model in detail.) This approach produces a result that is consistent with an ultimate average rate of per capita GDP plus 1 percentage point, as has been assumed since the 2001 Trustees Report. Overall health spending is used as a starting point in developing the Medicare assumption since a significant amount of research is available decomposing the drivers of overall health spending trends (both for the U.S. and other countries), and it is assumed that over the long run that those drivers would be generally similar across the health sector.

The per capita increase in health care costs reflects the combined effects of general inflation, medical-specific "excess" price inflation (medical price inflation above general price inflation), and changes in the utilization of services per person and the "intensity" or average complexity per service. General inflation, as measured by the GDP deflator, is assumed to increase 2.4 percent per year over the long-range period. Relative medical price inflation for the overall health sector is assumed to grow at 0.8 percent annually, as determined by market forces. The medical price change that the market will bear is determined primarily by the prices paid for inputs to the production of medical care (e.g., employee compensation, medical equipment,

[4] Sheila Smith, Joseph Newhouse, and Mark Freeland, "Income, Insurance, and Technology: Why Does Health Spending Outpace Economic Growth?" *Health Affairs*, September/October 2009 28:1276-1284.

structures) and the efficiency with which those inputs are combined to produce medical care. In other words, medical price inflation can be decomposed into its two main factors[5]: (i) medical input price growth and (ii) resource-based health sector multifactor productivity growth.[6] The medical input price growth for the overall health sector is assumed to be equivalent to the rate of increase in the hospital input price index over the long run, which is estimated at about 3.6 percent per year in the 2013 Trustees Report. Resource-based health sector multifactor productivity is assumed to grow at a pace consistent with recently published historical rates for hospitals and physicians,[7] and to average roughly zero for all other provider categories, such as skilled nursing facilities, home health agencies, hospices, diagnostic laboratories, dialysis centers, ambulance companies, etc. In aggregate for the overall health sector, resource-based health sector multifactor productivity growth is estimated to be 0.4 percent per year. Combining the projected 3.6-percent medical input price growth with the assumed 0.4-percent health sector multifactor productivity growth results in medical sector output price growth of 3.2 percent per year. This rate is 0.8 percentage points faster than growth in the GDP deflator.[8]

Finally, the growth in the volume and intensity of services is determined as a function of three key elasticity coefficients that influence the demand for health care:

1) *Income-technology elasticity*, which represents the marginal increase in demand for health care and new medical technologies in response to growth in income. Over the historical period, the elasticity is estimated at 1.4. This estimate is based on cross-country comparisons of the relationship of health spending and GDP growth for member countries in the Organization for Economic Co-operation and Development (OECD). A similar elasticity was determined using only U.S.-specific time-series data.

   In the 2013 Trustees Report it is assumed that the elasticity for the 25th year of the projection period (2037) is the same as its long-term historical value (1.4). Thereafter, the income-technology elasticity is assumed to decline linearly to reach 1.0 by the end of the 75-year projection period (2087). This assumption implies that, as health care continues to consume a greater proportion of income, the marginal demand for additional spending on health care and new medical technologies will lessen. Ultimately, health

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[5]A third factor, the level of provider profit margins, is assumed to remain unchanged over the long run.

[6]*Resource-based* productivity is defined as the real value of provider goods and services divided by the real value of the resources (inputs) used to produce the goods and services, where price changes are measured across constant products—that is, defined health services with a constant mix of inputs. Resource-based productivity is used for this decomposition, rather than *outcomes-based* productivity (which incorporates the estimated value of improvements in health resulting from the services) because Medicare and most other payers reimburse providers based on their resource use.

[7]Cylus, Jonathan D., and Dickensheets, Bridget A.: "Hospital Multifactor Productivity: A Presentation and Analysis of Two Methodologies." *Health Care Financing Review* 29(2): 49-64, Winter 2007-2008; Fisher, Charles: "Multifactor Productivity in Physicians' Offices: An Exploratory Analysis." *Health Care Financing Review* 29(2): 15-32, Winter 2007-2008.

[8] The relative medical price factor of 0.8 percent per year is also consistent with historical experience, based on the CMS personal health care deflator compared to the GDP implicit price deflator.

care spending, including access to new technologies, is assumed to become a "normal good," rather than a "superior good." As a result, by the 75th year of the projection, demand for health care is projected to continue to increase with income, but only in proportion to growth in income. As medical care consumption requires a steadily increasing share of total income, demand for additional medical care at the margin is likely to taper off, and the health share of income is projected to stabilize.

2) *Relative medical price elasticity*, which reflects the sensitivity of patients and purchasers in consuming health care to rising prices for medical care in relation to all other goods. The assumption for the price elasticity is based on the Office of the Actuary's National Health Expenditure (NHE) projection model for 1970-2009 and was estimated at −0.4. As with the income-technology elasticity assumption, we use this historical assumption as an initial estimate for the long-range projection (the 25th year of the projection period, or 2037). The secular change in the price elasticity is premised on a a Slutsky-like decomposition to model how sensitive the price elasticity is in relation to the share of income accounted for by health care.[9] As the overall health sector share of GDP is projected to double during the projection period, and as the income-technology elasticity approaches 1.0, consumers will become more sensitive to further increases in relative medical prices. Based on these considerations, the price elasticity is assumed to reach −0.6 by the end of the 75-year projection period (2087). The decline in the price elasticity from −0.4 to −0.6 is assumed to occur linearly.

3) *Insurance elasticity*, which reflects the change in demand for medical care as the level of insurance coverage changes. Based on the RAND Health Insurance Experiment, this elasticity is estimated at −0.2, reflecting the change in demand for health care as the average coinsurance rate changes.[10] For the 2013 Report of the Trustees, the insurance elasticity is assumed to be unchanged over the long-range projection period at −0.2.

Additionally, insurance coverage is assumed to be unchanged over the long run in order to maintain consistency with the concept of a Medicare current-law projection in which the Medicare benefit package cannot be altered.

Based on the year-by-year growth rates determined from the FCG model, age-gender adjusted per capita national health spending is projected to grow at a rate of GDP plus 1.2 percent (or 5.3 percent) for 2037, gradually declining to GDP plus 0.3 percent by 2087 (or 4.4 percent).

Current-law Medicare Spending

The Trustees have assumed since 2001 that it is reasonable to expect over the long range that the drivers of health spending will be similar for the overall health sector and for the Medicare program. This view was affirmed by the 2010-2011 Medicare Technical Review Panel, which recommended use of the same long-range assumptions for the increase in the volume and

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[9]Silberberg, Eugene, *The Structure of Economics: A Mathematical Analysis*, McGraw-Hill, 2000.

[10]Newhouse J, Health Insurance Experiment Group. Lessons from the RAND Health Insurance Experiment. Cambridge (MA): Harvard University Press; 1993.

intensity of health care services for the total health sector and for Medicare.[11] Therefore, the overall health sector long-range cost growth assumptions for volume and intensity are used as the starting point for developing the Medicare-specific assumptions under current law.

Prior to the ACA, Medicare payment rates for most non-physician provider categories were updated annually by the increase in providers' input prices for the market basket of employee wages and benefits, facility costs, medical supplies, energy and utility costs, professional liability insurance, and other inputs needed to produce the health care goods and services. To the extent that health care providers can improve their productivity each year, their net costs of production (other things being equal) will increase more slowly than their input prices. Accordingly, since most Medicare price updates prior to the ACA were equal to the increase in providers' input prices, Medicare costs per beneficiary would increase somewhat faster than for the health sector overall. Because the market basket increase was assumed to be approximately 3.6 percent annually, Medicare payments grew about 0.4 percent greater than the net price increase of 3.2 percent per year described above for the total health sector. The ACA requires that many of these Medicare payment updates be reduced by the 10-year moving average increase in private, non-farm business multifactor productivity, which the Trustees assume will be 1.1 percent per year over the long range. The different statutory provisions for updating payment rates require the development of separate long-range Medicare cost growth assumptions for four categories of health care providers:

(i) *All HI, and some SMI Part B, services that are updated annually by provider input price increases less the increase in economy-wide productivity.*

Combining the assumed market basket increase of 3.6 percent with the estimate of economy-wide multifactor productivity, the statutory price update for these services is 2.5 percent per year over the long-range projection period. The initial projected increase in the volume and intensity of these Medicare services is assumed to be equivalent to the average projected growth in the volume and intensity of services for the overall health sector. The Trustees believe that the use of a common baseline rate of volume and intensity growth is reasonable, as there would be only a small likelihood that one part of the health sector could continue to grow indefinitely at significantly faster rates of growth than do other parts.

Additionally, the Trustees assume that the growth in Medicare payment rates under current law will reduce the volume and intensity growth of these services by 0.1 percent per year relative to the assumption from the factors model. The Trustees' assumption is also based on recommendations by the 2010-2011 Medicare Technical Review Panel, which concluded that there would likely be a small net negative impact on volume and intensity growth due to reduced incentives to develop new technologies, provider exits, and the impact of greater bundling of services for payment purposes.[12] For new technology that leads to new services,

[11] The Panel's final report is available at http://aspe.hhs.gov/health/reports/2013/MedicareTech/TechnicalPanelReport2010-2011.pdf .

[12] Other factors, such as reduced beneficiary cost-sharing requirements, would tend to increase the volume and intensity of services. The assumption of −0.1 percent reflects the Technical Panel's assessment that the overall impact would be a small net decrease in volume and intensity growth.

the ACA will result in lower fees than would otherwise be the case, and providers will be less likely to adopt new services and innovations, thereby lowering the demand for, and intensity of, the medical care provided. Regarding provider exits, as fee-for-service fees decline relative to the pre-ACA levels, facilities of marginal profitability are likely to exit the Medicare market, reducing capacity and volume. This change could also cause a more bifurcated health system to evolve in which only providers who can operate profitably under Medicare offer services to Medicare beneficiaries, with a tendency to provide only the more basic services not associated with new medical technologies. Finally, the innovations being tested under the ACA, such as bundled payments or accountable care organizations, could reduce incentives to adopt new technologies for those participating in these programs and/or could contribute to greater efforts to avoid services of limited or no value within the service bundle.

Reflecting all of these considerations, the year-by-year long-range current-law cost growth assumption for these HI and SMI Part B services starts at 4.5 percent in 2037, or "GDP plus 0.4 percent," and gradually declines to 3.6 percent by 2087, or "GDP minus 0.5 percent." On average over the long-range projection period, these services are assumed to increase at 4.3 percent per year under the intermediate assumptions, which is roughly equivalent to "GDP plus 0.2 percent." This average growth rate is consistent with Recommendation III-4 of the 2010-2011 Medicare Technical Review Panel's report.

(ii) *Certain SMI Part B services that are updated annually by the CPI increase less the increase in productivity.*

Such services include durable medical equipment, laboratory services, ambulatory surgical centers, ambulance services, and medical supplies, which are updated by the CPI and affected by the ACA productivity adjustment. For these services, the Trustees initially assume that the rate of per beneficiary volume and intensity growth is equivalent to that derived for the overall health sector using the factors model. This volume and intensity growth is assumed to be reduced by 0.1 percent per year to reflect the ACA impact, as described above. The post-ACA volume and intensity assumption is combined with the long-range CPI assumption (2.8 percent) minus the productivity factor (1.1 percent) to produce a long-range growth assumption for these SMI Part B services. The corresponding year-by-year growth rates are 3.6 percent in 2037, or "GDP minus 0.5 percent," gradually declining to 2.8 percent in 2087, or "GDP minus 1.3 percent." On average over the long range, the growth is about 3.5 percent per year, which equates to "GDP minus 0.6 percent."

(iii) Services payable under the physician fee schedule, as governed by the sustainable growth rate formula in current law.

The Trustees assume that per beneficiary expenditures for these services will increase at approximately the rate of per capita GDP growth in every year (or 4.1 percent), consistent with the requirements of the statutory SGR formula.

(iv) All other Medicare services, for which payments are established based on market processes, such as prescription drugs provided through Part D and the remaining Part B services.

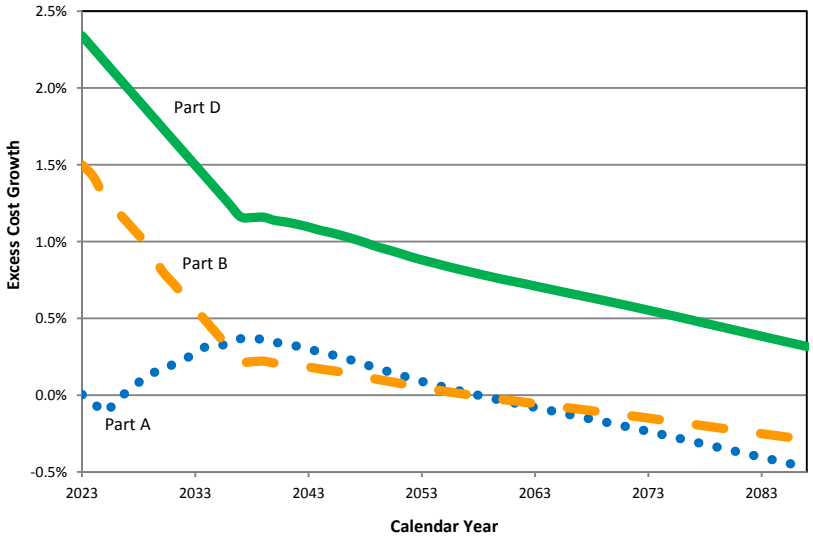
> The Trustees assume that per beneficiary outlays for these other Part B services, which constitute about 11 percent of total Part B expenditures in 2022, and for all Part D services grow at the same rate as the overall health sector as determined from the factors model. The services are assumed to grow similarly because their payment updates are determined by market forces, such as the competitive-bidding process for Medicare Part D. The year-by-year growth rates are 5.3 percent in 2037, or "GDP plus 1.2 percent," gradually declining to 4.4 percent by 2087, or "GDP plus 0.3 percent." On average over the long range, the growth rate is 5.1 percent, or "GDP plus 1 percent."

After combining the assumed rates of growth from the four categories of Medicare Part B services described above, the weighted average growth rate for Part B is 4.1 percent per year for the last 50 years of the projection period, or "GDP plus 0 percent," on average. When Parts A, B, and D are combined, the weighted average growth rate for Medicare is 4.3 percent over this same period. For each of Parts A, B, and D, the assumed growth rates for years 11 through 25 of the projection period are set by interpolating between the rate at the end of the short-range projection period (2022) and the rate at the start of the long-range period described above (2037).

Chart 3 provides a visual presentation of the year-by-year excess cost growth for current law Medicare Part A, Part B, and Part D over the last 65 years of the projection period (2023-2087). At the end of the 10-year short-range projection period, per beneficiary expenditures for Parts A, B, and D are projected to increase at 0.0, 1.5, and 2.3 percent, respectively, faster than per capita GDP growth. Chart 3 depicts the 15-year transition of excess cost growth to their starting long-range values in 2037 together with their gradually declining path thereafter. During the transition, Part A and Part B growth is not linear because the projected values of economy-wide multifactor productivity vary somewhat from year to year.

After 2037, the downward slopes of the Part A and Part D excess cost growth are similar, reflecting the changing income-technology and price elasticities. In contrast, the path for Part B does not decline at the same rate. The difference is due to the changing mix of Part B expenditures, as costs for the services affected by either the productivity adjustments or the SGR grow relatively slowly compared to the remaining services. Over time, the overall Part B growth rate is more heavily affected by this latter category.

Chart 3—Medicare Projected Excess Cost Growth
Current Law
2023-2087



Source: Centers for Medicare and Medicaid Services, Office of the Actuary.

NOTE: An excess cost growth is the rate of change in per enrollee costs relative to the growth in per capita GDP. The chart displays projected long-term excess cost growth for Medicare Subparts A, B, and D under current law. Under this scenario each of the subparts has its own unique series of excess cost growth through the end of the 75-year projection horizon due to the different applicable current law payment provisions. Excess cost growth displayed here do not include additional spending changes attributable to factors such as age and gender composition of the Medicare population, IPAB impacts, or the cessation of sequester provisions of the Budget Act of 2011 in the years 2022 and 2023.

As the Board of Trustees and others have noted, certain elements of current law raise concerns about the future adequacy of Medicare payment rates. In particular, payments to physicians would have to be reduced by almost 25 percent on January 1, 2014 under the SGR provision. Congress has acted to override the SGR requirements each year since 2003 and is widely expected to do so again for 2014. In addition, the reduction in all future annual payment updates for most other provider categories, by economy-wide productivity increases, also calls into question whether hospitals and other providers can constrain their cost growth sufficiently to stay within the statutory payment levels.[13]

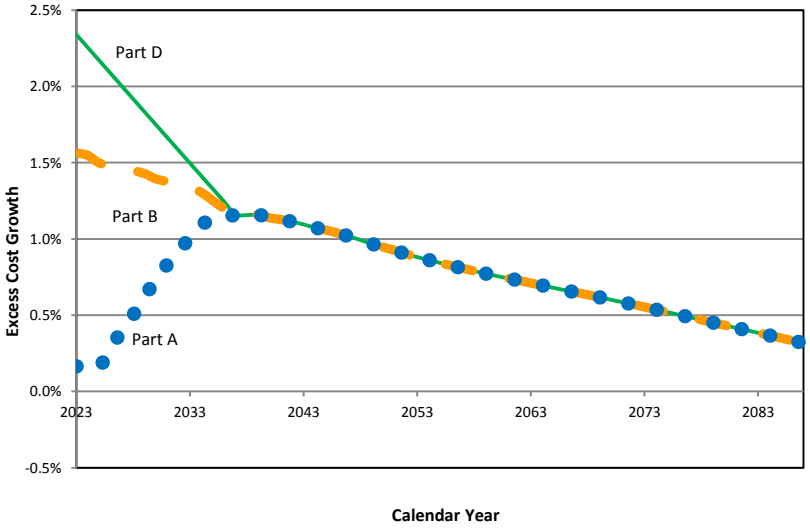
[13] More information on these concerns is available in Appendix C of the 2013 Medicare Trustees Report and in a memorandum by John Shatto and Kent Clemens of the Office of the Actuary, "Projected Medicare Expenditures under Illustrative Scenarios with Alternative Payment Updates to Medicare Providers." These documents can be found at the following links: http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/ReportsTrustFunds/Downloads/TR2013.pdf and http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/ReportsTrustFunds/Downloads/2013TRAlternativeScenario.pdf

The Trustees Report cautions that "In view of these issues with physician and other provider payment rates, the Trustees note that the actual future costs for Medicare are likely to exceed those shown by the current-law projections in this report." To help illustrate the level of Medicare costs that could result if these elements of current law are overridden, the Trustees asked the Office of the Actuary to prepare projections based on a hypothetical alternative to current law. These projections are shown in the 2013 Trustees Report and in the supplementary memorandum by the Office of the Actuary. The illustrative alternative projections are based on two key assumptions: first, that physician payment updates would be set equal to 0.7 percent for each of the next 10 years.[14] And second, that the economy-wide productivity adjustments would be gradually phased down during 2020 to 2034 and replaced with adjustments based on estimated health-specific provider productivity gains of 0.4 percent annually beginning in 2034. Readers should not infer any endorsement of this theoretical alternative to current law by the Trustees, CMS, or the Office of the Actuary.

Chart 4 shows the assumed year-by-year excess cost growth for Medicare Part A, Part B, and Part D over the last 65 years of the long-range projection period for the illustrative alternative Medicare projection. Under this illustration, per beneficiary cost growth for each part of Medicare is assumed to transition from their 2023 values to a common set of growth rates based on the FCG model for overall per capita national health expenditures (before demographic adjustments).

[14] The short-range portion of this assumption was recommended by the 2010-2011 Medicare Technical Review Panel, which recommended the updates under the illustrative alternative be based on the average of the physician payment rate updates over the past ten years.

Chart 4—Medicare Projected Excess Cost Growth
Illustrative Alternative
2023-2087



Source: Centers for Medicare and Medicaid Services, Office of the Actuary.

NOTE: An excess cost growth is the rate of change in per enrollee costs relative to the growth in per capita GDP. The chart displays projected long-term excess cost growth for Medicare Subparts A, B, and D under current law. Under this scenario each of the subparts has its own unique series of excess cost growth through the end of the 75-year projection horizon due to the different applicable current law payment provisions. Excess cost growth displayed here do not include additional spending changes attributable to factors such as age and gender composition of the Medicare population, IPAB impacts, or the cessation of sequester provisions of the Budget Act of 2011 in the years 2022 and 2023.

The excess cost growth assumptions are unchanged for Part D, since the prescription drug benefit is not affected by the SGR provision or productivity adjustments. For Parts A and B, however, the growth rates are higher than assumed under current law throughout the final 65 years of the projection.

History of the Medicare Trustees Long-Range Health Cost Growth Assumptions

Officially convened Technical Panels of distinguished economists and actuaries have reviewed the long-range Medicare projection and reporting methods on four different occasions—in 1991, 2000, 2004, and 2010-2011. Accordingly, the years 1991, 2000, 2004, and 2010-2011 serve as milestone years in the evolution of methods that are employed to project Medicare over a 75-year reporting period. In addition, the projection assumptions and methods have reflected annual reviews and reassessments by the Office of the Actuary and the staffs of the Board of Trustees. From time to time, other events have affected the projections, such as the development of *Actuarial Standard of Practice No. 32, Social Insurance*[15] and the requirements of the Medicare

[15] Available at http://www.actuarialstandardsboard.org/pdf/asops/asop032_149.pdf .

Prescription Drug, Improvement, and Modernization Act of 2003 (MMA) for the Medicare Trustees Report to compare projected growth rates for Medicare to those for aggregate national health expenditures, private health insurance expenditures, and GDP.[16] This section traces the evolution of projection methods through regular and responsible consultation with recognized subject matter experts and through thoughtful implementation of advice received in light of the reporting responsibilities that exist.

A. Stage I: Basic Structure of Long-Term Projections

The first Trustees Reports for Medicare, issued in 1966, provided 25-year projections for the Hospital Insurance (HI) trust fund and only 3-year projections for the Supplementary Medical Insurance (SMI) trust fund. No longer-range projections of any kind were made by the Medicare Trustees before 1983, although the Office of the Actuary prepared 75-year projections from time to time for special analyses. In 1983, the Board of Trustees decided to report the substantial increase in HI costs that could reasonably be expected for Medicare as a result of demographic changes alone—in particular, the retirement and subsequent aging of the post-World War II "baby boom" generation. Since existing research still had little to say concerning the likely long-term path of health care spending as it might be affected by non-demographic factors, it was determined that initial long-term projections would not explicitly take such factors into account. Accordingly, starting in 1983 long-range HI projections were made under the assumption that long-range costs per unit of service would increase at the rate of average hourly earnings. No long-range projections for SMI were reported by the Medicare Trustees until after the recommendations of the 1991 Medicare Technical Review Panel.

The 1991 Medicare Technical Review Panel was the first formally convened body to consider long-range projection methods to be used in the Medicare Trustees Reports.[17, 18] A fundamental theme of the panel's report is coordination of projection methods for HI and SMI in order to facilitate a combination of the results into a comprehensive understanding of the status of the entire Medicare program. The use of a 75-year projection period was affirmed because, for the average person entering the workforce in any reporting year, this period of time will encompass his/her years as a contributor to the HI fund and as a Medicare beneficiary. The panel thus saw a 75-year reporting horizon as a reasonable period of analysis for evaluating the financial ability of the program to deliver benefits promised to beneficiaries from the inception of their working lives. The panel found the use of short-term projections based on trends that are gradually tapered to meet long-run growth assumptions to be reasonable. The panel cautiously endorsed the long-range assumption that average HI payments per unit of service would grow at the same rate as average hourly earnings and expressed similar approval for a long-range assumption that per enrollee SMI costs would grow at the same rate as per capita GDP. With regard to each

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[16] Section 801 of the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 (Pub.L. 108-173, 117 Stat. 2066), 42 U.S.C. 1395i.

[17] Before 2002 there was an annual Trustees Report for HI and another for SMI; since 2002 there has been a single annual Trustees Report that includes all parts of the Medicare program.

[18] *Report on Medicare Projections* by the Health Technical Panel to the 1991 Advisory Council on Social Security (March, 1991: Washington, D.C.).

long-run assumption, the panel recommended that regular monitoring for continuing plausibility should occur.

The approach to long-range projections described in the report of the 1991 Technical Panel was reflected in succeeding Medicare Trustees Reports up to and including the HI and SMI reports for 2000. Consistent with the recommendation to coordinate the HI and SMI projections, the annual reports starting in 1994 show 75-year projections of HI and SMI as percentages of GDP. The nature of the long-range assumptions meant that HI and SMI would grow more rapidly as a percentage of GDP in the first 25 years of the projection period than in the last 50 years. In the case of HI, the assumption that increases in per unit of service costs would equal the rate of increase of average hourly earnings in the last 50 years of the projection period meant that costs would be relatively stable in the long run. Other long-range assumptions related to demographics still allowed for substantial growth in HI's share of GDP. In the case of SMI, the long-range assumption meant that growth as a share of GDP would largely halt after the first 25 years, except to the degree that changing demographics would continue to boost SMI's share of GDP.[19]

Although the 1991 Technical Panel had not explicitly discussed implementation of an excess cost growth method to model long-range Medicare costs, the elements of the method are discernable in the panel report and in the subsequent reports of the Medicare Trustees. The long-range assumption for SMI was effectually a "GDP+0" assumption that was substantially below historic rates of SMI growth, a fact that had prompted the Technical Panel to recommend regular review of the assumption and that evoked regular cautionary commentary in Trustees Reports during the 1992-2000 period. And even though the long-range assumption for the HI growth rate was not directly related to GDP, the idea of connecting HI's growth to that of a macro-economically important aggregate was present. On these foundations, moving to an explicit excess growth method for long-range projections for all parts of the Medicare program would prove to be a natural next step.

B. Stage II: Addition of the GDP+1 Projection Method

The 2000 Medicare Technical Review Panel deliberated extensively about the long-term rate of health care cost growth and ultimately recommended an assumption of tying Medicare's long-range cost growth to the increase in per capita GDP plus 1 percentage point (GDP+1), exclusive of age-gender effects, for both HI and SMI. The panel viewed its mission as one of delivering credible and usable assumptions concerning an inherently uncertain issue. The conceptual innovation was in seeing the long-range assumption for both HI and SMI as explicitly a question of the rate of excess cost growth relative to GDP under current law. Within the conceptual framework, the practical task for the panel became a matter of arriving at a consensus for the value to assign to the key projection variable that had been defined.

[19] The resulting projection pattern of HI growth versus SMI growth as a share of GDP is illustrated in Table III.B.1 of the *2000 HI Trustees Report*.

To achieve a consensus, the experts considered many factors that are thoroughly documented in their written report.[20] Most telling for the panel were long-term time-series expenditure trends when considered in light of causal evidence. Long-term time-series evidence showed that in any multi-year time period examined by the Technical Panel, real per capita health expenditures had never grown at a rate less than 1 percent in excess of real per capita GDP growth. As for determinants of expenditure growth, the panel looked to aggregate and micro-level health economics studies, which pointed to technological change as the primary driver of real growth in health expenditures. The panel report concluded that technological change alone would account for a percentage point of real growth in excess of the rate of real GDP growth.

Also considered by the panel were factors that might in the future slow or accelerate the rate of excess medical expenditure growth through the diffusion of technological change. For example, the spread of managed care in the 1990s was seen as a short-term aberration in a long period of excess cost growth relative to GDP growth rates and, thus, as unlikely to have an enduring effect. The experts did not find evidence for a long-term differential among types of payers that would affect their conclusion about the long-term excess growth rate. The panel also noted that other forecasters showed a range of excess growth in health expenditures of between 0.8 to 1.5 percentage points, with most of the studies congregating around a value of 1 percentage point.

Finally, the panel's report discussed the sustainability of excess cost growth of 1 percent for the duration of a 75-year projection period. Concerning this issue, the report noted that excess growth of 1 percent per year over 75 years would lead to a health sector of unprecedented size as a share of the economy, but since such a growth pattern would still be consistent with increases in the absolute level of real consumption for non-health expenditure, the panel saw little grounds for expecting consumers as a group to reach some point of satiety concerning health expenditures.

Based upon their thorough review of relevant factors, the 2000 Technical Panel unanimously recommended adoption of a long-term excess cost assumption of a full percentage point of excess growth in per enrollee HI and SMI costs above the rate of growth of per capita GDP, exclusive of age-gender effects. Their recommendation was supported by the Office of the Actuary in its assumption recommendations in the Fall of 2000 to the last Medicare Board of Trustees under the Clinton Administration and was adopted formally by that Board. With the changes in Board membership under the incoming Bush Administration, the Office of the Actuary again recommended the GDP + 1 long-range growth assumption, and it was again adopted by the new Board and implemented in the 2001 Medicare Trustees Reports.[21] As was to be expected, the change to a more costly long-term assumption had a substantial effect on the

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[20] *Review of Assumptions and Methods of the Medicare Trustees' Financial Projections* by Technical Review Panel on the Medicare Trustees Reports (Baltimore: 2000) available at: http://www.cms.hhs.gov/ReportsTrustFunds/downloads/TechnicalPanelReport2000.pdf

[21] By law, the members of the Medicare (and Social Security) Board of Trustees are the Secretary of the Treasury, Secretary of Labor, Secretary of Health and Human Services, Commissioner of Social Security, and two members representing the public. Dr. John L. Palmer and Dr. Thomas R. Saving served as Public Trustees on both the 2000 and 2001 Boards of Trustees (as well as subsequent Boards through 2007).

reported financial status of the Medicare program. In 2001, the Medicare share of GDP at the end of 75 years was projected at 8.49 percent, as compared with 5.28 percent projected in the 2000 Report. The GDP+1 assumption as applied in the 2001 HI and SMI Trustees Reports was also used in the annual reports issued from 2002 through 2005.

C. Phase III: Refinement of the GDP+1 Projection Method

A new Medicare Technical Panel was convened in 2004; it reviewed and reaffirmed the long-term GDP+1 assumption as implemented by the Office of the Actuary, but also made suggestions for research into long-term projection methods.[22] In addition, the MMA required that the Medicare Trustees compare past and projected Medicare cost growth rates with annual rates of growth in GDP, private health insurance costs, national health expenditures, and other appropriate measures. Together, the changes in statutory reporting requirements and the suggestions of the 2004 Technical Panel provided impetus for refinement of how the GDP+1 assumption was implemented.

The 2004 Technical Panel considered the analysis of excess cost trends that had appeared in the report of the 2000 Technical Panel and found that analysis to be persuasive. The 2004 panel was comfortable with the existing framework and concluded that the existing GDP+1 long-range assumption was "within the range of the reasonable assumptions, given the limits of current knowledge." However, the panel also found future promise in extramural general equilibrium modeling projects already in progress under the supervision and sponsorship of the Office of the Actuary, and accordingly the experts encouraged the pursuit of additional research to build insight into the behavioral dynamics underlying health expenditure growth.[23]

The Office of the Actuary eventually determined that yearly expected excess cost rates for the overall health sector, exclusive of age-gender effects, as derived from the constrained solution of a stylized macroeconomic model—the OACT computable general equilibrium (CGE) model[24]—could be used as a tool for improving the long-range Medicare cost growth assumptions and for complying with new reporting responsibilities. A review of this approach by independent health economists convened for this purpose confirmed this finding, and the OACT CGE model was adopted as a tool in the production of long-range estimates starting with the 2006 Medicare Trustees Report.

The CGE model was used solely as a tool for developing a reasonable series of downward-trending, year-by-year health care cost growth rates that were consistent with the constant

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[22] *Review of Assumptions and Methods of the Medicare Trustees' Financial Projections* by 2004 Technical Review Panel on the Medicare Trustees Reports (Baltimore: December, 2004) available at: http://www.aspe.hhs.gov/health/medpanel/2004/2004_Technical_Review_Panel_on_the_Medicare_Trustees_Report.pdf

[23] The recommendation to explore many possible lines of insight with simple models was reiterated several years later by members of an informal advisory group of distinguished economists and actuaries convened by the Office of the Actuary in 2007.

[24] The detailed structure of the model, but not how it was used in the Trustees Reports, is described in "Projecting long-term medical spending growth," by Christine Borger, Thomas F. Rutherford, and Gregory Y. Won, *Journal of Health Economics*, Volume 27, Issue 1, pages 69-88 (2008).

GDP+1 assumption used previously. A thorough review of the CGE model determined that without exogenous identifying assumptions about the average rate of cost growth the model could not be used as an independent forecasting tool. However, it made sense to use it as a tool to translate the basic GDP+1 cost growth assumption into a financially equivalent series of smoothly decelerating cost growth rates more consistent with a notion of diminishing marginal utility of health care for a representative consumer as the budget share for health care increased.

D. Phase IV: Affordable Care Act

The enactment of the ACA in March 2010 required that several new provisions of the law be taken into account when developing long-range Medicare projections. Most notably, the ACA modifies the annual increases in Medicare payment rates for most categories of health service providers by reducing them for 2011 and later by the 10-year moving average increase in private, non-farm business multifactor productivity.[25]

For the 2010 and 2011 Medicare Trustees Reports, the Trustees first assumed a "baseline" set of pre-ACA, long-range Medicare cost growth rates, using the methods described above regarding the refinement of the GDP+1 method. This approach included continued use of the OACT CGE model to determine the year-by-year growth rates consistent with an underlying average rate of GDP plus 1 percent. These baseline long-range Medicare cost growth assumptions were then altered to incorporate the payment adjustments associated with the ACA. This adjustment affects all HI (Part A) providers; as a result, on average, the resulting long-range growth assumption for HI was the increase in per capita GDP plus 1 percent, minus the productivity factor (estimated at 1.1 percent per year). For SMI Part B, the productivity adjustment affects certain provider categories—for example, outpatient hospitals, ambulatory surgical centers, diagnostic laboratories, and most other non-physician services. These services had the same assumed long-range growth rate as did HI services. The sustainable growth rate formula in current law governs increases in average physician expenditures per beneficiary, which must increase at approximately the rate of per capita GDP growth. The remaining Part B services, and all Part D outlays, were not affected by the SGR or the ACA productivity adjustments and had an assumed average growth rate of per capita GDP plus 1 percent

In its interim report, the 2010-2011 Medicare Technical Review Panel concluded that the resulting long-range growth assumptions used in the 2010 and 2011 reports were not unreasonable in light of the provisions of the Affordable Care Act.[26]

In December 2011, the panel members unanimously recommended a new approach that builds off of the longstanding "GDP plus 1 percent" assumption while incorporating several key refinements. Specifically, the panel recommended use of two separate means of establishing long-range growth rates:

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[25] "Multifactor productivity" is a measure of real output per combined unit of labor and capital, reflecting the contributions of all factors of production.

[26] The Panel's interim report is available at http://aspe.hhs.gov/health/medpanel/2010/interim1103.shtml.

- The first approach is a refinement to the traditional "GDP plus 1 percent" growth assumption that better accounts for the level of payment rate updates for Medicare (prior to the ACA) compared to private health insurance and other payers of health care in the U.S. For applicable provider categories—those with provider payment updates based on input price increases, prior to the ACA—the refinement results in an increase in the long-range pre-ACA "baseline" cost growth assumption for Medicare to "GDP plus 1.4 percentage points." The corresponding assumed average growth rate for aggregate national health expenditures continues to be "GDP plus 1 percentage point."[27]

- The second approach recommended by the Technical Panel is the "factors contributing to growth" (FCG) model developed by the Office of the Actuary at CMS as a possible replacement for the existing process. This model also builds upon the key considerations used in establishing the earlier "GDP plus 1 percent" assumption, together with subsequent refinements in the analysis of growth factors, additional years of data on national health expenditures available since the 2000 Technical Panel's deliberations, and use of projected trends in the model's key factors. The model is based on economic research that decomposes health spending growth into its major drivers—income growth, relative medical price inflation, insurance coverage, and a residual factor that primarily reflects the impact of technological development.[28]

For the 2012 Trustees Report, the long-range Medicare spending assumption was determined as (i) a pre-ACA baseline assumption for the average ultimate Medicare growth rate using the updated "GDP plus 1.4 percent" and (ii) the FCG model to create the specific year-by-year declining growth rates during the last 50 years of the projection. These baseline assumptions were then altered by the payment adjustments in the ACA.

For the 2013 Trustees Report, the long-range Medicare spending assumption was determined based on (i) the volume and intensity assumptions derived from the FCG model, (ii) the impacts on Medicare volume and intensity from the ACA, as recommended by the Technical Panel, and (iii) the Medicare payment updates specified in current law. The implementation of this approach was described in detail earlier in this memorandum, and is consistent with the methods recommended by the Technical Panel.

Evaluation of the Long-Range Cost Growth Assumptions

In this section the reasonableness of the key long-range assumptions and the projections that result are discussed.

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[27] It is important to recognize that GDP+1.4 is prior to any multifactor productivity adjustment to Medicare administrative payment systems as required by update provisions of ACA; the GDP+1 assumption for NHE is consistent with negotiated provider payment rate updates that are net of provider productivity gains deemed to be attainable across the health sector.

[28] Smith, S., Newhouse, J., and Freeland, M., "Income, Insurance, and Technology: Why Does Health Spending Outpace Economic Growth?" *Health Affairs,* September/October 2009.

A. The NHE Projection Baseline

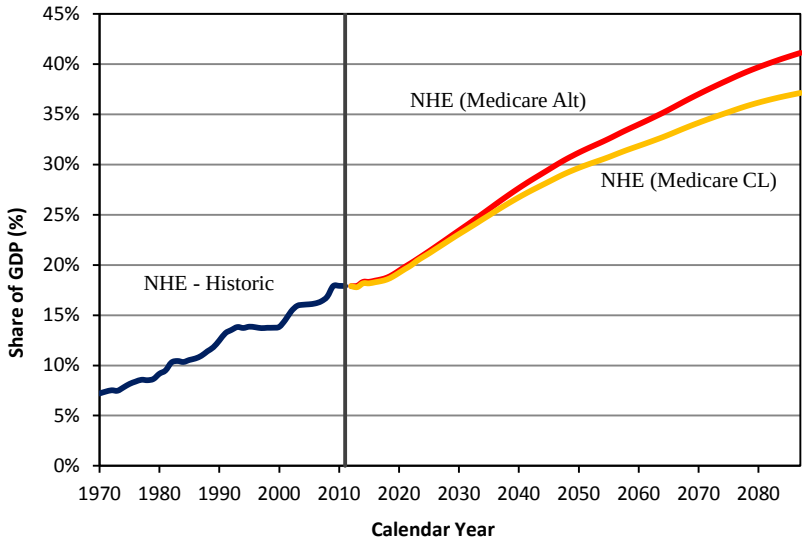
A core assumption underlying the OACT long-range health expenditure projections continues to be that net per capita health expenditure growth for the U.S. health sector as a whole, exclusive of age-gender effects, would experience a substantial slowdown from historic rates of excess cost growth. Using the FCG model, the current assumption is that excess cost growth would be GDP plus 1.2 percent for 2037, gradually declining to GDP plus 0.3 percent by 2087. This pattern of growth is consistent with an assumed average of approximately 1 percent per year more than the projected annual rate of per capita GDP growth over the last 51 years of the 75-year long-range projection horizon, or GDP plus 1.0 percent. The questions to be considered here are whether the assumed cost slowdown inherent in the NHE assumption is well-founded and whether it leads to a projection baseline that is reasonable.

In approaching these questions, it is worth remembering that the term "excess cost growth" as used by the Office of the Actuary is meant to be a descriptive rather than a normative term. In other words, the term does not mean that there is anything intrinsically bad or inherently unreasonable with faster growth for the health sector than for the rest of the U.S. economy. But, as explained earlier in this memorandum, long-run historic trends in excess cost growth rates for the health sector are ultimately unsustainable. The appropriate question regarding a long-range projection baseline is therefore what state of the world would be expected to prevail under a reasonable set of assumptions about the evolution of the health sector.

The long-range assumptions about excess cost growth, together with demographic projections of population size and age distribution, largely determine the magnitudes of resulting baseline long-range projections. Even if the long-range baseline assumptions are believed to be within the range of the reasonable, it is fair to consider the degree to which the outputs are reasonable and credible.

Under the full illustrative alternative scenario, the health sector share of GDP is expected to increase from 17.9 percent in 2011 to more than a 40 percent share of GDP in 2087 (Chart 5). Such magnitudes have no historical precedent and are even more extraordinary when it is considered that these increased economic shares would be from an economy that, in real per capita terms, is projected to be roughly three times the size that it is today.

Chart 5—National Health Expenditures as a Percent of GDP 1970-2087



Source: Centers for Medicare and Medicaid Services, Office of the Actuary.

NOTE: Historical data is used before 2012 and projections from 2012 forward.

It is fair to question, as some researchers have, whether a future health sector of this size would be macroeconomically sustainable to the end of the 75-year projection horizon.[29] When long-range scenarios have been run by the INFORUM group at the University of Maryland, with their detailed, bottom-up macroeconomic model (Long-Run Interindustry Forecasting Tool, or LIFT), maintenance of current-law benefit levels has been found sustainable in the sense that some real growth in the non-health sectors of the economy would still be feasible.[30] But that analysis purposely ignored macroeconomic "feedback effects" on investment, interest rates, and labor supply from the increases in tax rates and/or government debt levels that would be needed to finance Medicare and Medicaid.[31] The more significant that those macroeconomic effects are, the more likely a slowdown in Medicare excess cost growth even below the long-range assumption. Distributional issues are also likely to emerge as Medicare Part B premiums and

[29] Glenn Follette and Louise Sheiner, "The Sustainability of Health Spending Growth," *National Tax Journal*, Volume 58, pages 391-408 (2005).

[30] Mark Freeland, Greg Won, Stephen Heffler, and Margaret McCarthy, "Issues on the Sustainability of Long-Term Health Spending Projections," Paper delivered at 2002 SGE/ASSA/AEA Conference session on "Long-Term Projections of Health Care and Medicare Costs."

[31] When such factors were reflected in LIFT model runs, the macroeconomic impacts of tax increases and increased federal borrowing resulted in long-range economic growth that was substantially slower than assumed in the Trustees Reports.

cost sharing start to consume 50 percent or more of monthly Social Security benefits for some beneficiaries.[32]

A National Academy of Sciences committee has also issued an important report about alternative choices that the nation faces in order to make its system of entitlement programs, including Medicare, fiscally sustainable.[33] Various alternative scenarios, including scenarios involving rates of growth less than GDP+1, are considered to underscore that there are choices to be made to decide the nation's future, but no position is taken concerning which scenario would be optimal.

Abundant reasons thus exist to question whether the long-range NHE projection baseline would itself in fact be sustainable. Yet even though the sources cited here raise pertinent practical questions about the ultimate sustainability of this current law scenario, none of them provides a reliable basis for adopting a lower baseline. What is more, the persistence of high rates of excess cost growth over history, despite previous legislative initiatives aimed at reducing it, is another important inducement to caution in the adoption of a projection baseline.[34] The NHE baseline projections are undoubtedly more realistic than assuming excess cost growth continues unabated at historic trend rates, but the results are still large enough to underscore the need for effective policy intervention if the growth of the U.S. health sector relative to the rest of the U.S. economy is ever to be stabilized.[35]

B. The Relationship Between NHE and Current-law Medicare Projections

Recent Medicare Technical Review Panels have in one way or another been comfortable assuming that average growth over the long-range projection period would be consistent with slowing excess cost growth given that historic rates are simply unsustainable. However, the panels have provided little analysis of specific mechanisms that might cause a slowdown of excess cost growth. For example, the 2000 Technical Panel was impressed by evidence that an excess cost growth rate of 1 percent (GDP+1) would still be consistent with maintaining some positive real growth in an absolute sense in other sectors of the economy. Maintenance of positive real growth in per capita non-health expenditures might therefore be interpreted as defining an outer limit on social willingness to pay for additional health care.

How the U.S. economy in the absence of major policy interventions would in fact move from a historic excess cost growth rate of GDP+2 remains a largely unsettled question. The existing

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[32] See Figure II.F2, *2013 Trustees Report***,** at page 42 available at: http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/ReportsTrustFunds/Downloads/TR2013.pdf.

[33] Committee on the Fiscal Future of the United States, *Choosing the Nation's Fiscal Future*, The National Academies Press, Washington, D.C., (2010), www.nap.edu

[34] The Sustainable Growth Rate system that is supposed to control the growth of Medicare physician fees has been overridden by Congress every year since 2003.

[35] Even with zero or slightly negative excess cost growth, as in the current law Medicare projections, the Medicare program will continue to grow as a share of the U.S. economy as long as the share of the population eligible for Medicare benefits is increasing relative to the overall population.

Medicare program and private health insurance plans more generally contain numerous features by which consumer preferences for slower expansion in health care could eventually reduce the rate of excess cost growth in line with the expectations of the Technical Review Panels, including the most recent panel.

By way of illustration, consider the potential effects of cost-sharing provisions of current-law Medicare, which are more substantial and more extensive than is often recognized. [36] At present, the great majority of Medicare beneficiaries (roughly 90 percent) have supplemental health insurance coverage that helps insure against Medicare's point-of-service cost-sharing obligations. Such coverage is provided through supplemental private "Medigap" insurance programs paid for by the beneficiaries themselves, participation in private Medicare Advantage coordinated care plans, retiree health plans provided by their former employers, or the Medicaid program. As the costs of comprehensive supplemental coverage rise relative to the growth of personal income and business income, the comprehensiveness and the prevalence of such coverage are likely to diminish, and point-of-service cost sharing faced by Medicare beneficiaries is likely to become more frequent and more burdensome. Accordingly, as time passes, beneficiaries may choose more frequently not to seek health care perceived by them to be of limited marginal value or to decline health care offered by providers.

That cost sharing can have substantial effects on demand for health care is an established proposition. The results of the well-known RAND Health Insurance Experiment persuasively confirm that substantial effects on demand for health care arise from point-of-service cost obligations borne by patients.[37] Moreover, an important recent study indicates that the scope of insurance coverage is likely to have had an even greater effect on health sector size than could be identified by the study design used in the original RAND Health Insurance Experiment.[38] Further consumption-side brakes on Medicare as excess costs accumulate might include decisions not to enroll in Medicare Part B or Part D. Such individuals would face even more substantial point-of-service obligations that would have significant effects on their access to health care.

Over the past few decades the apparent role of cost sharing in the finance of health care has diminished, mostly through the spread of public health insurance coverage and private

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[36] There is no provision in current law that would permit payment of full HI benefits after trust fund exhaustion. Since the purpose of the Medicare and Social Security Trustees Reports is to evaluate the adequacy of program financing, however, the Trustees have always made projections of (i) the benefits specified under current law (and the associated costs of administering the program) and (ii) the revenues specified under current law. The annual report then compares these two projections to evaluate whether financing is sufficient. Thus, the Trustees' application of current law does not follow a strict interpretation of what would actually happen in the event of trust fund depletion; rather, it compares expenditure and income levels under the implicit assumption that full benefits would be paid. In practice, Congress has never allowed the HI trust fund to be exhausted, and it is highly likely that action would be forthcoming to prevent exhaustion at a future date.

[37] W.G. Manning, J.P. Newhouse, N. Duan et. al., "Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment," *American Economic Review***,** Volume 77(3), pages 251-277 (1987).

[38] Amy Finkelstein, "The Aggregate Effects of Health Insurance: Evidence from the Introduction of Medicare," *Quarterly Journal of Economics*, Volume 122(1), pages 1-37 (2007).

pharmaceutical coverage plans. To some degree the perceived importance of cost-sharing may continue to decline due to further expansion of the share of the population cover by public programs like Medicaid. But OACT is persuaded that the role of cost sharing at the point of service for Medicare beneficiaries as well as the financial burden of Part B and Part D premiums will continue to increase, and absent policy interventions cost sharing effects in Medicare and in the rest of the health sector would be even larger.

Cost-saving spillovers into Medicare from private sector initiatives that are focused on rationalization of treatment around best practices are another foreseeable brake on excess cost growth. The theory is that, as efficient methods of care become more widely diffused throughout the health sector, such methods would be applied by health care practitioners to patients, regardless of insurance plan. It is also possible that Medicare itself could contribute to this kind of progress, resulting in cost savings that would spill over into private health plans as well. For example, efforts are currently underway at CMS to test the effectiveness of better integration of care through Accountable Care Organizations, patient-centered "medical homes," shared savings programs and capitated plans for dual Medicare-Medicaid beneficiaries, and other approaches. Similarly, CMS is conducting demonstration programs for broader bundling of payments, reductions in unnecessary hospital readmissions and hospital-acquired conditions, etc. Innovations that are successful in reducing Medicare costs are very likely to be adopted in the private sector as well.

It is also reasonable to expect that health care providers, under financial pressure from Medicare, Medicaid, and the private sector alike, may adopt new technological innovations more prudently than they have in the past. Drug and medical device manufacturers may focus greater attention on developing cost-reducing technology in the future, more akin to what has traditionally happened in other sectors of the economy.

These examples of "natural brakes" are expected to contribute to a slowdown over the long run of excess cost growth even in the face of some foreseeable cost-increasing effects. For example, persons who do not have or who choose to forgo a private supplemental Medicare insurance policy may obtain extra coverage by enrolling in a Medicare Part C managed care type of health plan, whose government-paid premiums and "rebates" (at least currently) often exceed average per enrollee fee-for-service Medicare costs. To the degree that pharmaceutical coverage sponsored by former employers of Medicare beneficiaries becomes less available or less comprehensive, enrollment in the Medicare Part D plans may also grow, increasing total Medicare outlays. Also, if a disenrollment trend emerged for Part B or Part D, it could be mitigated for some by increased participation in Medicaid, including the "QMB," "SLMB," and "QI" options.

While there are natural brakes in the current health care system that are likely to slow excess NHE and Medicare cost growth, the "out-of-sample" nature of the health expenditure projection problem makes it especially difficult to project the magnitude and speed of a slowdown in the rate of excess cost growth. Given the current state of knowledge and the recommendations of distinguished panels of technical experts, OACT is satisfied that the current long-range assumption, which incorporates a gradual slowing of cost growth from historical trends, is a plausible and reasonable expression of trends likely to prevail under current law. A last attribute of the current methodology is the assumption of the same cost slowdown to all parts of the U.S.

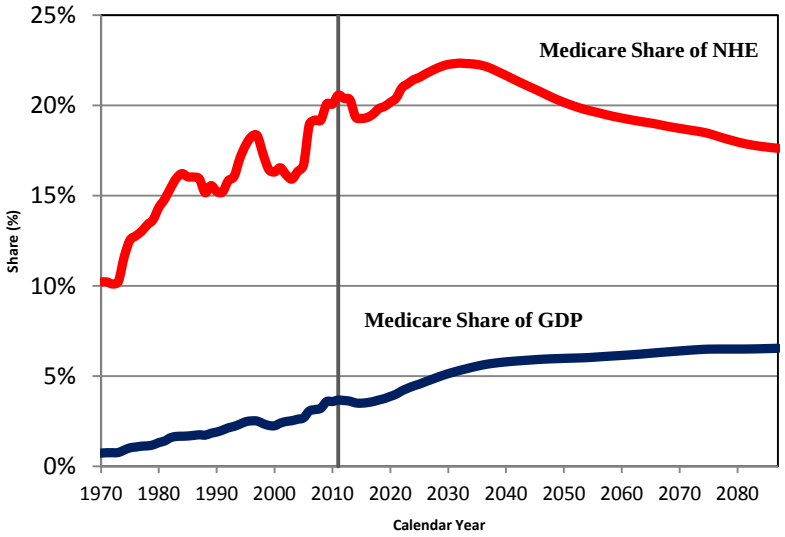
health sector.[39] OACT is skeptical that a sustained divergence in cost growth rates between Medicare and the rest of the U.S. health sector could prevail for long without the appearance of access to care issues.

C. The Current-law and Illustrative Alternative Medicare Projections

The Trustees Reports since the enactment of the ACA have presented current-law scenarios in which the financial and actuarial status of the Medicare program is materially improved. The projected insolvency date of the HI Trust Fund in the 2009 Trustees Report, the last report appearing under pre-ACA current law, was 2017. In the 2013 Trustees report the insolvency date is 2026. Projected growth in the size of the Medicare program as a share of total Gross Domestic Product (GDP) is substantially smaller under current law than under prior law. The 2009 Trustees Report projected Medicare's GDP share in year 75 as 11.4 percent whereas the 2013 Trustees Report projects Medicare's GDP share in year 75 at 6.5 percent, with most of this difference attributable to the productivity adjustments introduced by the ACA. Chart 6 displays the projected long-run expenditures of the Medicare program as a share of GDP and as a share of aggregate national health expenditures, based on the current-law projections in the 2013 Medicare Trustees Report. As a share of GDP, Medicare spending under current law is projected to continue increasing until the late 2030s due to the combined effects of excess cost growth and enrollment increases, though mainly due to the impacts of increased enrollment. For the last 50 years of the projection the Medicare share of GDP is relatively stable, reflecting slower enrollment growth and assumed per enrollee cost growth rate that is near or below the per capita GDP growth rate. The convergence of per enrollee cost growth to something near or below the rate of per capita GDP growth mainly occurs because the growth in Medicare payment updates over this period are near the increases in the GDP deflator, as required by the ACA. As a share of NHE, however, Medicare spending under current law is projected to fall over the long-range as the assumed rate of per enrollee Medicare cost growth is less than assumed for per capita NHE. Again the main reason for this pattern is the Medicare payment updates, which are projected to increase at a slower rate than non-Medicare health price updates (volume and intensity is assumed to grow similarly for Medicare and non-Medicare).

[39] How excess cost growth for Medicare under the illustrative alternative scenario and other parts of the health sector would slow is envisioned differently. For the privately insured, prices would be determined through the market process whereas for the Medicare alternative scenario prices would be set through the update process for the administrative payment systems.

Chart 6—Medicare as a Percentage Share of GDP and as a Percentage Share of NHE Under Current Law Long-Range Projection 1970-2087

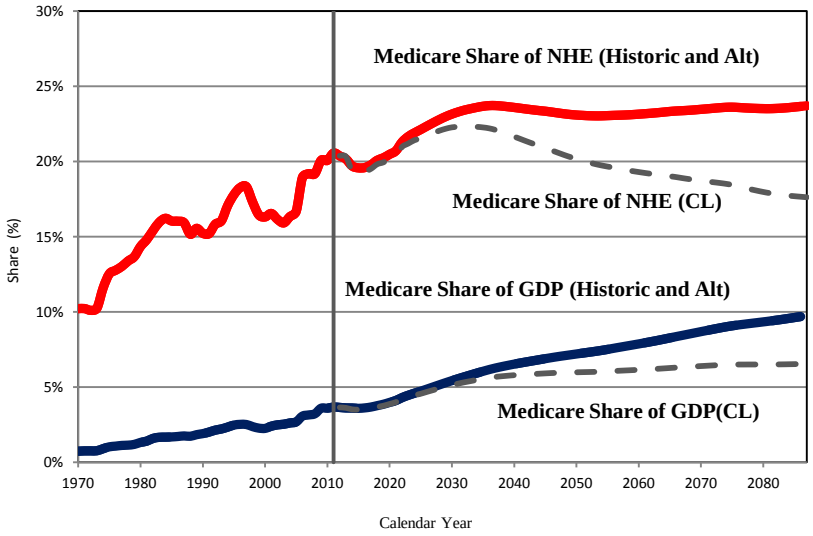


Source: Centers for Medicare and Medicaid Services, Office of the Actuary.

NOTE: For Medicare Share of GDP historical data is used before 2012 and projections from 2012 forward. For Medicare Share of NHE historical data is used before 2012 and projections from 2012 forward.

As noted previously, there is substantial uncertainty concerning whether automatic payment update reductions required by the SGR and the ACA productivity adjustments could be sustained into the long-run without affecting access to care by Medicare beneficiaries. Therefore, the Trustees also report a long-range projection based upon an illustrative alternative scenario in which adherence to the ACA cost-saving measures erodes, and the SGR restraints and cost-saving actions of the IPAB are assumed to be overridden. Chart 7 displays projected long-run Medicare expenditures as a share of GDP and NHE under the illustrative alternative scenario.

Chart 7—Medicare as a Percentage Share of GDP and as a Percentage Share of NHE Under Alternative Illustrative Long-Range Projection 1970-2087



Source: Centers for Medicare and Medicaid Services, Office of the Actuary.

NOTE: For Medicare Share of GDP historical data is used before 2012 and projections from 2012 forward. For Medicare Share of NHE historical data is used before 2012 and projections from 2012 forward.

As indicated in Chart 7, if the productivity adjustments were gradually phased down after 2019, and if the SGR system for physician payments were permanently overridden, then Medicare costs would continue to increase as a share of GDP throughout the long-range projection, reaching 9.8 percent by the end of the 75-year period, compared to 6.5 percent under current law. Similarly, as a share of NHE, Medicare costs would level off after 2035, rather than declining substantially.

D. Other Pertinent Considerations

The model used to develop the long-range projections does not explicitly include many of variables that might affect the trajectory of expenditure growth in the health sector and in Medicare. To the degree that such variables affect expenditure levels (for example, institutional factors like managed care or population factors like the prevalence of obesity), they do so through the judgments of the experts who helped to formulate and validate the current assumption, which is best seen as an informed summary of expectations concerning the net effects of all relevant variables. As with any uncertain measure of central tendency, movement around an average long-term trend of GDP plus 1 percent must be assumed to be present.

Another important source of uncertainty regarding the current long-range assumption is how quickly consumers would respond to the increased costs that they would eventually confront for insurance coverage and for copayments at points of service. If such responses emerged in the near term, then the current baseline assumption might in retrospect be found to have been too high; if they unfolded in the more distant future, then the current baseline assumption might be

found to have been too low. The same kind of uncertainty exists regarding the effects of other conceivable natural brakes on health expenditure growth under current law.

Actual long-range Medicare costs are virtually certain to differ from whatever is projected and, as this consideration of sources of variability would suggest, perhaps to a very significant degree. Such variation, however, is unlikely to be sufficient to alter the conclusion that the Medicare program faces serious and enduring financial challenges that will become worse the longer that they continue. OACT continues to engage in internal and external research projects aimed at improving the foundations of the long-range health expenditure cost growth assumptions.

Conclusion

The Medicare Trustees have statutory responsibility to report on the long-term financial and actuarial status of the Medicare program in the context of broader growth trends in the U.S. health sector. To discharge this responsibility, long-range spending projections must be made for both the overall health sector and Medicare, and those sets of projections must be appropriately interrelated. For the 2013 Trustees Report, based on the recommendations of the 2010-2011 Medicare Technical Review Panel, the FCG model was used to determine the long-term growth trajectory of the U.S. health sector; the results from the model are consistent with the average rate of growth of the GDP plus 1 percent assumption. The long-range Medicare cost growth assumptions are computed as the increases in the volume and intensity of health care services per person from the FCG model of total national health expenditures, adjusted by the expected impact on volume and intensity from the ACA, together with the Medicare-specific provider payment rate updates specified in current law, with further adjustments to incorporate demographic effects. Continuing uncertainty concerning the feasibility of certain elements of current law—the SGR provision for physician payments and the permanent reductions in most other Medicare payment updates by the increase in economy-wide productivity—has prompted the Trustees to again provide an illustrative alternative projection whose growth trajectory is the same as for the health sector as a whole.

The long-range cost growth assumptions have evolved through regular processes of expert review, and improvements, refinements, and alternative approaches to the projection method continue to be considered. In their present form, the long-range assumptions lead to current-law and illustrative alternative Medicare projections of health expenditures that provide a sound basis for evaluating long-range fiscal challenges for the Medicare program.

Stephen K. Heffler, M.B.A.
Director, National Health Statistics Group

Todd G. Caldis, Ph.D, J.D.
Senior Economist

Sheila D. Smith, M.A.
Senior Economist

Appendix A
Factors Contributing to Growth (FCG) Model

The Office of the Actuary's Factors Contributing to Growth (FCG) model is an accounting framework that is used to track the historical contribution of factors that drive national health expenditure growth and to develop projections of health care spending that are consistent with the evolution of these factors. The model relies on a wide range of empirical research as the basis for historical parameter estimates that reflect the sensitivity of health care spending to changes in each of the factors. For instance, how does health spending growth relate to changes in income or medical prices? When these parameter estimates are combined with a range of projected assumptions for macroeconomic and health-care-specific variables, the results can be used to develop projections for health care spending that are consistent with historical relationships. Where the projected path for these parameters is expected to differ from historical patterns, the assumptions can be adjusted to reflect the expected shift.[40]

This appendix discusses the underlying structure of the FCG model, including a nuanced discussion of the impacts associated with the interaction between income and medical technology growth. Next, it provides a detailed discussion of the historical derivation of the key parameters in the model, and presents the historical fit of the model from 1960-2010. Finally, this appendix discusses how the FCG model is used as the framework for developing long-range projections of national health spending growth that were used in the 2013 Medicare Trustees Report.

1. Factors Contributing to Growth (FCG) Model Structure

FCG model equation

There are five key factors that have been identified to influence growth in aggregate per capita growth in national health care expenditures:[41]

- demographics (the impact of distributional shifts across age and gender cohorts),
- changes in insurance coverage,
- relative medical price inflation,
- changes in aggregate real per capita income,
- a residual factor attributed primarily to the development and diffusion of new medical technologies.[42]

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[40] For example, insurance now covers a far higher share of health care spending than was the case in 1960. Simply because we start from a much higher base, we can expect the average contribution to growth from broader coverage to be below the mean for the historical period. Likewise, the expected relationship of health care spending and income would change over time as the health share of consumption rises substantially.

[41] Sheila Smith, Joseph Newhouse, and Mark Freeland, "Income, Insurance, and Technology: Why Does Health Spending Outpace Economic Growth?" *Health Affairs*, September/October 2009 28:1276-1284.

[42] While there are a large number of potential factors that can be expected to influence health spending levels, most cannot reasonably be assumed to influence growth rates over extended periods of time. A broad consensus holds that technological change is at the root of explaining growth in health care spending at rates consistently above what would be predicted based on other key factors contributing to growth.

These factors are used to develop the structure of the FCG model as shown in equation (1) below:

$$(1) \qquad h_t = a + \varepsilon_y y_t + \varepsilon_i i_t + (1+\varepsilon_p) p_t + d_t$$

where each factor is expressed as a log difference (approximate growth rates), all spending series are in constant dollar terms based on the GDP deflator, and the variables are defined as:

- t = time period
- h_t = constant dollar health spending per capita at time t
- a = residual factor (primarily attributed to spending on new medical technology)
- y_t = income at time t (approximated by GDP per capita)
- i_t = average coinsurance rates at time t (approximated by the out-of-pocket share of total health spending)
- p_t = relative medical price at time t (relative to GDP deflator)
- d_t = index of demographic contribution at time t
- ε_y = income elasticity
- ε_i = coinsurance elasticity
- ε_p = health care price elasticity

Note that growth in relative medical prices affects health spending in two ways in this model. First, there is the direct impact of higher prices causing higher spending, other things being equal. In addition, however, there is a partial offset to this effect as higher prices for medical services tend to reduce demand somewhat, and this effect is reflected in the $\varepsilon_p \cdot p$ term above (where ε_p is negative).

The contribution of medical technology to health care spending, primarily reflected as *a* in equation (1), is defined as the incremental spending on treatment methods within the period associated with greater use of new technology. This occurs from the initial introduction of the technology through its diffusion to equilibrium (in the absence of changes in other variables). Medical technology will influence health care spending growth through:

1. the focus of medical research, particularly regarding the expected profitability of technologies in development,
2. the variation in the rate at which new technologies are introduced,
3. the variation in the rate of diffusion of new technologies,
4. the responsiveness to the relative price of new technology (both with respect to existing methods of treatment and with respect to non-health consumption goods), and
5. the responsiveness to changes in the state of medical knowledge (the "march of science").

Note that only the last of these channels is likely exogenous to macroeconomic conditions. While there have been attempts to develop proxies that are correlated with the state of medical knowledge (e.g. R&D spending, patents, etc.), the underlying concept remains fundamentally immeasurable. The other technology influences—focus of research efforts, the speed with which patients are given access to new technology (particularly in cases where it is costly), the speed of its diffusion, and the responsiveness to relative price—will be influenced by the resources available to pay for medical care, which will be a function of real per capita GDP.

Because of these relationships, the FCG model as presented in equation (1) is a simple reduced-form picture that assumes that the contribution of each of the factors to health spending growth is

independent of all of the others, though we know that may not necessarily be the case. For example, income may influence the nature of insurance coverage, which in turn will influence the research agenda that ultimately determines the development of new products and procedures.

In many cases, we cannot control for these behavioral interaction effects in estimating the parameters of the model, largely due to data issues. Equation (1) does not attempt to measure or reflect these interactions explicitly. Rather, the parameters are intended to measure the sensitivity of health spending to each factor (the elasticity) given that all other factors are held constant. However, if all elasticities are selected to exclude any endogenous feedback effects among the individual factors, then variation in health expenditure growth that is attributable to these interaction effects will be included in the contribution to growth from the residual term (*a*).

In previous considerations of the factors driving health spending growth, it was typically assumed as a simplification or approximation that the contribution to growth from technology (attributed to the residual) was constant over the historical period, and thus assumed to be constant over the long-run projection period.[43] In deriving the FCG model used in the 2012 Trustees Report, we modified Equation (1) in one critical way to address this issue. Rather than treating the contribution of technology to medical spending growth as an exogenous constant, we estimate the relationship between the historical technology residual and real per capita GDP (as a proxy for average income). This allows us to develop a projection of the technology residual that maintains consistency with the historical relationship to the macroeconomic environment.[44]

We can re-specify the FCG model from Equation (1) to relate the impact of the technology residual to GDP growth, as show in Equation (2) below:

$$(2) \qquad h_t = a'_t + \varepsilon'_y y_t + \varepsilon_i i_t + (1+\varepsilon_p)\, p_t + d_t$$

where ε'_y is defined as the combined "income-technology elasticity" and the residual (a'_t) reflects the remaining residual variation that is not correlated with income. As we discuss in more detail later, this remaining residual (a'_t) had a small negative contribution (less than 3 percent) over the 1960-2010 period, compared to the 26 to 45 percent that was accounted for by the original residual (*a*).[45] The major reason for the difference is the exclusion of the income and technology relationship in the current residual (a'_t), which represents a methodological change from prior estimates. Equation (2) is used as the FCG model in developing the year-by-year growth rates for the long-range projection for the 2013 Medicare Trustees Report.

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[43] Technical Review Panel on the Medicare Trustees Reports, *Review of Assumptions and Methods of the Medicare Trustees' Financial Projections*, Centers for Medicare and Medicaid Services (formerly Health Care Financing Administration), December 2000.

[44] There are other potentially important behavioral interaction effects that are not explicitly accounted for in the FCG model. For example, a second important relationship is the effect of the extent and nature of insurance coverage on the direction of medical research and the diffusion of new medical technology. Though this effect is widely acknowledged, the current state of empirical research does not allow for this effect to be included in a way that is defensibly grounded in historical data. See Edgar A. Peden and Mark S. Freeland, "Insurance Effects on U.S. Medical Spending (1960-1993)," *Health Economics*, Volume 7, 1998: 671-687.

[45] Smith, et. al. Estimates have been updated to include recent data and historical revisions to data through 2010.

2. Estimation of FCG model parameters

Income-Technology Elasticity

The combined contribution of income and new medical technology accounts for an estimated 63-77 percent of health spending growth over the period from 1960-2007.[46] Thus, the elasticity of real per capita health care spending with respect to income and technological change is a critical parameter in the FCG Model.

A substantial empirical literature addresses the relationship between health care spending and real per capita GDP.[47] This relationship has long been recognized as a strong and consistent empirical regularity in cross-country time-series data. Variations in real per capita GDP across countries and time can predict a large part of the variation in real per capita health spending. Higher income countries tend to introduce new technologies earlier and to encourage broad diffusion into standards of medical practice.[48] The empirical literature on international variations is the foundation for the estimation of the aggregate-level income elasticity.[49]

Equation (3) below is a basic form of the equation used to estimate the income elasticity based on international variations in health spending and GDP:[50]

(3) $H_{ct} = \beta^0 + \sum_c \beta^c X_c + \sum_t \beta^t Z_t + \beta^y Y_{ct} + e_{ct}$

H_{ct} = real per capita health care spending for country c in year t,

Y_{ct} = real per capita GDP for country c in year t,

X_c = fixed effects for each country c in the sample,[51]

Z_t = fixed effects for each year t in the sample,

e_{ct} = error term.

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[46] Smith, et. al.

[47] Gerdtham U, Jönsson B. "International comparisons of health expenditures." in: Culyer AJ, Newhouse JP, editors. *Handbook of Health Economics*. Amsterdam (Netherlands): North-Holland; 2000: 11–53.

[48] Moïse, Pierre, "The Heart of the Health Care System: Summary of the Ischaemic Heart Disease Part of the OECD Ageing-Related Diseases Study," in *A Disease-based Comparison of Health Systems: What is Best and at What Cost?*, Organisation for Economic Co-operation and Development, 2003: 27-52.

[49] The international variations literature has focused on the estimation of an "income elasticity" of demand for health care. However, note that the elasticity estimated in these studies represents the sensitivity of health spending (rather than quantity of care) to growth in income under the assumption of constant technology. Thus it is a different concept from the usual microeconomic definition of an income elasticity.

[50] There are many variants on this model in the empirical literature, but most of these are similar in basic structure with some additional variables or focusing on a specific econometric issue.

[51] Countries in the sample include the United States, Luxembourg, Switzerland, Canada, Germany, France, Sweden, Australia, Iceland, Denmark, Netherlands, Austria, Belgium, Japan, Norway, UK, New Zealand, Italy, Finland, Spain, Ireland, Portugal, and Greece. For some of these countries, data are not available for certain subperiods within the estimation period.

All variables are defined in logs (with the approximate growth rate $h_{ct} = H_{ct} - H_{ct-1}$). Spending and income are defined in constant dollar per capita terms and deflated based on the GDP deflator. Currency conversion to U.S. dollars is based on purchasing power parities.[52] The term $\sum_c \beta^c X_c$ is the sum of the country-level fixed effects across all countries c in the sample, while $\sum_t \beta^t Z_t$ is the sum of time-period fixed effects across all periods t. Estimating equation (3) produces an estimate of the income elasticity, represented by β^y as well as fixed effects β^0, β^c, and β^t.

The sum of the constant and fixed effects ($\beta^0 + \sum_c \beta^c X_c + \sum_t \beta^t Z_t$) is roughly comparable to the residual *a* in the Equation (1), though it is a broader concept as it is inclusive of the effects of additional omitted variables such as relative price where we do not have consistent data across countries and time.[53]

There is a strong positive correlation between the fixed effects by country and time and the variation in real per capita GDP. This is consistent with the assumption that spending on medical technology will be a function of income. If we modify equation (3) to exclude the fixed effects that are correlated with real per capita GDP, we can capture this correlation in the income coefficient, as shown in equation (4):[54]

$$(4) \qquad H_{ct} = \beta'_0 + \beta'_y Y_{ct} + \varepsilon'_{ct}$$

We would expect the coefficient on income to be higher in equation (4) than equation (3); that is, $\beta'_y > \beta^y$. In this case, β^y can be interpreted as an estimate of the historical income elasticity under constant medical technology, which is equivalent to ε_y in equation (1). Historically, this elasticity has been estimated in the range of 0.6 to 0.9.[55] The elasticity β'_y will capture both (i) the effect of income on demand for health care spending under constant technology, and (ii) the effect of income on the uptake, price, and diffusion of new technology. Historically, this elasticity has been estimated at 1.4, and is equivalent in concept to ε'_y in equation (2).

As described earlier, the FCG model was based on the specification in equation (2) where the behavioral relationships between technology and income were modeled directly. As a result, β'_y is the better estimate for our projection purpose. The measure of 1.4 is used as the beginning income-technology elasticity in the FCG model.

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[52] Source: Organisation for Economic Co-operation and Development (2010), "*OECD Health Data*", OECD Health Statistics (database).

[53] Sogaard J., "Decomposition of the aggregate income elasticity in health care using panel data" [Internet]. Copenhagen (Denmark): Danish Institute for Health Services Research; 2000 [cited 2009 Jun 24]. Available from: http://www.nek.lu.se/ryde/luche99/Papers/econpapers/sogaard.pdf.

[54] Income elasticity, as defined based on international variations, is not equivalent to the standard neoclassical income elasticity of demand for health care. Most estimates do not attempt to control for variation in relative medical price inflation, so that the dependent variable includes variation in relative price. The elasticity is estimated within a reduced form model that does not distinguish between supply and demand side effects.

[55] Smith, et. al.

Relative medical price inflation

Data sources for medical prices are consistent with those used in the Office of the Actuary's National Health Expenditure (NHE) accounts.[56] The price measure for total personal health care spending is a chain-weighted deflator based on relevant Producer Price Indexes (PPI) and Consumer Price Indexes (CPI), with the weight for each index set equal to the share of personal health care expenditures accounted for by that type of service.

The aggregate price elasticity (–0.4) is based on the estimate in the Office of the Actuary's NHE Projections Model.[57] This elasticity exceeds the out-of-pocket price elasticity of –0.2 estimated based on the Rand Health Insurance Experiment (HIE). This higher price elasticity at the aggregate level reflects the broader definition of the elasticity, which includes price sensitivity at the market level in addition to the price effects for households in response to variations in the effective out-of-pocket price that are the basis for the HIE elasticity. Additional price sensitivity occurs at the point of purchase of private health insurance and in the process of selective contracting by insurers acting as agents for consumers.

Insurance

The effects of insurance are defined based on the aggregate average out-of-pocket share of health expenditures. This definition is conceptually consistent with the elasticity based on the Rand HIE (–0.2).[58] The estimation of this insurance elasticity was primarily cross-sectional based on variation in health care spending as a function of the generosity of insurance coverage across households at a point in time, so this elasticity effectively holds technology constant. This variable captures static effects of insurance coverage only; that is, interaction effects between insurance and technology are included in the remaining residual (a').

Demographic change

The effects of shifts in the population across age and gender cohorts are estimated based on the historical and projected population cohorts over time prepared by the SSA Office of the Chief Actuary on behalf of the Board of Trustees, combined with a base-year distribution of expenditures across age-gender groups. The application of base-year weights to projections of population by age-gender cohorts produces an index of growth in health spending that will result from shifts across these cohorts.[59] This methodology assumes that the distribution of expenditures does not change over time in response to changes in the distribution of population across age-gender cohorts. Such a change could occur, for example, if the development of new

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[56] See documentation of historical National Health Expenditures data, downloadable at http://www.cms.hhs.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/dsm-10.pdf.

[57] Centers for Medicare and Medicaid Services. "Projections of national health expenditures: methodology and model specification." Available from: http://www.cms.hhs.gov/NationalHealthExpendData/downloads/projections-methodology.pdf.

[58] Newhouse J, Health Insurance Experiment Group. *Free for All? Lessons from the RAND Health Insurance Experiment*. Cambridge (MA): Harvard University Press; 1993.

[59] *2013 Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds*, http://www.cms.hhs.gov/ReportsTrustFunds.

technology tended to be biased towards cohorts that tended to be more generously insured. If such an effect occurs, it would be captured in the constant term (a').

Historical parameter assumptions

Table A.1.—Historical elasticities based on the FCG model

	Equation (2) variable	Historical estimate
Income-technology elasticity	ε'_y	1.4
Insurance elasticity*	ε_i	–0.2
Relative medical price elasticity	ε_p	–0.4
Residual†	a'	—

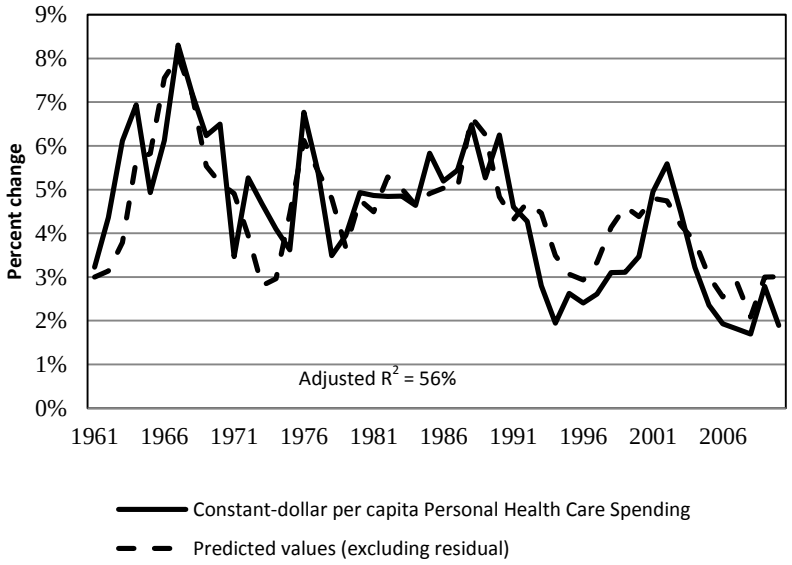
* Reflects the static impact of insurance coverage

† Residual as defined in Equation (2) excludes the effects of technology attributable to variation in income. This residual is not an elasticity; therefore, we excluded it from this table. However, over the entire 1960-2010 period the residual has averaged roughly −0.1 percent growth per year, which reflects the mean contribution to real per capita health spending growth.

Table A.1. provides a summary of the key elasticities estimated from the historical data from the FCG model specified as in equation (2). Based on these historical parameters, the FCG model explains a large part of historical growth in health spending over the period from 1960 through 2010, including the short-term variation in growth within that period, as shown in Figure A.1 below.[60]

[60] The predicted increases in real per capita health expenditures in Figure A.1. include the estimated contribution from a combined income-technology effect, relative medical price inflation, insurance coverage, and demographic change. By definition, the inclusion of annual residuals would match the actual data precisely. Thus, this comparison includes only the sum of the non-residual factor contributions.

Figure A.1.—Growth in constant-dollar per capita personal health care spending: Actual versus Predicted using FCG Model



3. FCG long-range projections model

Ideally, projections of health spending growth using the FCG model should be consistent with historical relationships between growth in health spending and the individual factors contributing to growth. However, a simple extrapolation of the historical relationships over 1960-2010 implies an increase in the health share of spending that would ultimately absorb all available economic resources. In order to develop a reasonable long-run projection that would reflect economic realities, there must be some combination of changes in the growth of factors driving health spending as well as changes in the sensitivity of health spending to growth in these factors.

We attempt to maintain consistency with the historical parameter assumptions in the FCG model while also including changes to model parameters that are consistent with a future where health care spending absorbs an ever-greater share of available resources. This suggests, for example, that households are likely to respond more strongly to medical price increases in the long run, as these increases will impact a greater share of their total budget. In addition, we can expect households to become less willing to sacrifice consumption of other goods and services for additional increases in health care as health care spending increasingly dominates private and public budgets, and the opportunity cost of additional growth in health care rises.

In the discussion below we present the FCG parameter assumptions over the projection period, the exogenous parameter assumptions used to develop the FCG projections, and the results from the FCG model that were used in the 2013 Trustees Report.

FCG Parameter Assumptions

The elasticity assumptions in the FCG model determine the sensitivity of national health care expenditures to changes in each factor. For the initial 10 years of the projection period, we assume that these elasticities remain constant at their historical values. This assumption is reasonable because the magnitude of change within the historical sample frame is generally relatively small. It is accepted practice to maintain consistency with historical parameters when

making near-term projections, as we are not far out of the historical sample range. However, the variation in the health share of consumption over a 75-year projections horizon is large, and it extends well outside of the historical sample range. This implies that consumer preferences for health care are unlikely to be static.

Economic theory suggests that as the health share of consumption rises substantially over the next 75 years, the elasticities that represent consumer preferences can be expected to change. Table A.2. below provides the key elasticity assumptions used for the FCG model in developing the year-by-year growth rates for the 2013 Medicare Trustees Report.

Table A.2.—Elasticity assumptions for FCG model: 2037-2087

Income-technology elasticity (ε'_y)	Insurance Elasticity (ε_i)	Price elasticity (ε_p)
1.4 → 1.0	−0.2	−0.4 → −0.6

Theory also provides some guide for how we can expect income and price elasticities to change as health care accounts for a rising share of national and consumer budgets. Increasing price sensitivity and a declining income elasticity of demand for new medical technology both contribute to a balanced long-range equilibrium where consumption is not increasingly dominated by health care indefinitely.

Research implies that the income-technology elasticity of demand for all new medical technologies is well above 1.0 in historical data. Our interpretation is that rapid and broad access to new medical technologies is a luxury that increases more than proportionately to aggregate income, while consumption of basic health care is best seen as a necessity. However, we would expect to see a convergence of this income-technology elasticity towards 1.0 as the health care share of consumption rises, assuming that the marginal utility of additional health care will eventually decline relative to other consumption as a rising share of consumption is spent on health care. In these projections, we assume that the income-technology elasticity will decline linearly to 1.0 in year 75. By reaching 1.0, this means that, all else equal, health care spending will represent a constant share of economic income, and thus would be considered in equilibrium at that point.

The price elasticity of demand for health care (ε_p) is inelastic historically, but can be expected to increase (in absolute value) as the share of consumption allocated to health care rises over time.[61] Ultimately, in the long-range, the price elasticity should converge to –1.0. At that point, an increase in relative price for health care spending will be exactly offset by a reduction in quantity of health care consumed. The path for nominal spending growth would then be independent of the projection for relative medical price inflation.

In our projection, we assume that as the overall health sector share of GDP is projected to double during the projection period and as the income-technology elasticity approaches 1.0, the price

[61] Silberberg, Eugene, *The Structure of Economics: A Mathematical Analysis*, McGraw-Hill, 2000.

elasticity will grow to −0.6 by the end of the 75-year projection period. The demand price elasticity is premised on the relationships represented in the Slutsky equation in elasticity form. The price elasticity for all health care is assumed to be the sum of (i) an income effect associated with a change in the average price of consumption, and (ii) a substitution effect in response to a change in the relative price of health care. As the health care share of consumption increases, the weight on the income component of the price effect rises, and the price elasticity increases in absolute terms (see Box 1 below).

Box 1: Projecting the price elasticity of demand for health care as the health share of consumption rises

The Slutsky equation (in elasticity form) is an identity that decomposes the price elasticity into two components: a pure substitution effect and an income effect. The pure substitution effect is not observed—it is the change in demand in response to a change in the relative price of health care holding utility constant. The income effect occurs because a rise in price implies a lower income. That is, the greater the share of health care out of total consumption, and the higher the income elasticity, the larger will be the income component of the price effect:

$$\varepsilon_p = \varepsilon_p^c - s_h \varepsilon_y'$$

where ε_p is the observed price elasticity, ε_p^c is the compensated price elasticty (or pure substitution effect), s_h is the health spending share of total consumption, and ε_y' is the income-technology elasticity.

Given assumptions of price and income elasticities and historical data on the health share of consumption, we can back out the unobserved pure substitution effect (compensated price elasticity). If in 2008 the observed price elasticity is –0.4, the income-technology elasticity (including interaction effects) is 1.4, and the health share of GDP is 17 percent, then the compensated price elasticity is estimated at –0.2 (calculated as –0.4 + 0.17*1.4).

We assume that the compensated elasticity remains constant at –0.2 over time as the pure substitution effect is not affected as the health share of consumption changes. We can combine this constant with preliminary projections for the health share of consumption and the assumed income-technology elasticity over time to impute the rise in the total price elasticity that is consistent with the rising share of health care spending.

Note that the health share of GDP will be influenced by the projected price elasticity. This means that the system will be simultaneous by nature. However, we can approach an answer that is fairly stable by iterating between the projections based on the FCG model and the relationship between elasticities in the Slutsky equation. The resulting estimate for the price elasticity (ε_p) in year 75 is –0.6 (which is determined by –0.6 = –0.2 – 0.40*1.0), as shown in table A.2.

As mentioned previously, the residual a_t' in equation (2) (which excludes the technology-income interaction) has had a small negative contribution to expenditure growth over the 1960-2010 period. With the mean contribution of this residual on average over this period being roughly –0.1 percent per year, we assume that this residual is zero over the projection period. Future research efforts will be focused on analyzing the trend in this residual, which has fallen over time

and been slightly negative in the recent period, to determine if the specification of the model can be improved to produce a smaller residual.

Exogenous Assumptions

The key economic assumptions for per capita GDP and the GDP deflator are from the intermediate set of assumptions underlying the 2013 Social Security and Medicare Trustees Reports. The relative medical price inflation is determined based on long-range assumptions regarding growth in medical input prices and available evidence on achievable resource-based health sector productivity growth. As described in the main text of this memorandum, medical input prices are assumed to grow at roughly 3.6 percent per year. This is based on using year-10 (2022) labor and non-labor shares from the hospital "market basket" input price index applied to the growth rates for economy-wide average hourly compensation and the Consumer Price Index (CPI), respectively, from the 2013 Medicare Trustees Report.[62]

Overall resource-based health sector productivity is assumed to grow at 0.4 percent per year by assuming hospital and physician productivity will grow at recently published historical rates (0.4 percent and 1.1 percent, respectively),[63] while all other provider categories, such as skilled nursing facilities, home health agencies, hospices, diagnostic laboratories, dialysis centers, ambulance companies, etc., will grow at zero, on average. Combining these assumptions produces a medical output price increase of 3.2 percent per year, which is 0.8 percentage point faster than the GDP deflator. Thus, the FCG model uses a relative medical price inflation assumption of 0.8 percent per year, equivalent to the historical average growth in the deflator for personal health care spending, relative to the GDP deflator, over the period from 1992-2010.[64]

Finally, it is assumed in the FCG model that the out-of-pocket share of national health expenditures remains unchanged over the projection period. This assumption reflects, in part, that the average cost sharing associated with the Medicare benefit is likely to remain stable over the long-range projection period under current law, including consideration of the effects of supplemental coverage through private Medigap policies, Medicare Advantage plans, employer-sponsored retiree health plans, and Medicaid.

Results

The FCG model output was used to determine the year-by-year growth rates for overall national health spending and volume and intensity in the 2013 Trustees Report. Figure A.2. below shows the excess cost growth rates from the FCG model based on the methods and assumptions described above. As noted in the main body of this memorandum, the volume and intensity growth rates from the FCG model were used with the Medicare-specific payment rate updates

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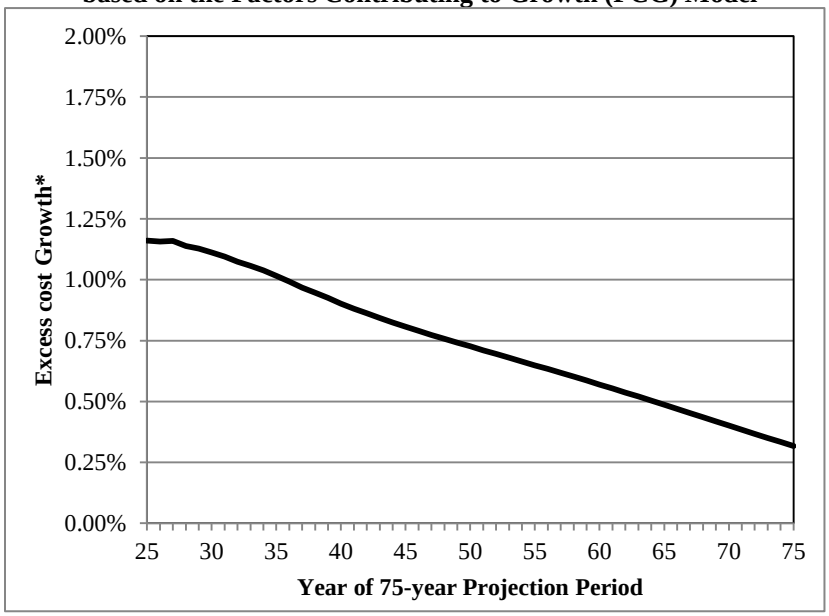
[62] See table IV.A1 and its associated description in the 2013 Medicare Trustees Report, pp. 121-123.

[63] Charles Fisher, "Multifactor productivity in physicians' offices: An exploratory analysis," *Health Care Financing Review*, Volume: 29, Issue: 2, 2008. p. 15-32. Jonathan D. Cylus and Bridget A. Dickensheets, "Hospital multifactor productivity: A presentation and analysis of two methodologies." Health Care Financing Review, Volume: 29, Issue: 2, 2008. p. 49-64.

[64] CMS, Office of the Actuary, *National Health Expenditure Accounts: Methodology Paper, 2010*, http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/dsm-10.pdf .

under current law and anticipated impacts on volume and intensity from the ACA to obtain the projected increases in Medicare expenditures per beneficiary by type of service.

Figure A.2.—Long-Range Excess Cost Growth*
based on the Factors Contributing to Growth (FCG) Model



Source: Centers for Medicare & Medicaid Services, Office of the Actuary.

*Excess Cost Growth is defined as growth in per capita, age-gender adjusted health spending less growth per capita GDP.