

A SIMULATION OF THE U.S. ECONOMY TO DETERMINE THE EFFECT OF MANDATORY EXPENSES AND INTEREST ON THE U.S. DEBT

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ABSTRACT

Cost for the three major mandatory social programs; Social Security, Medicare and Medicaid have increased at a rate much higher than the Gross Domestic Product (GDP), and thus revenue. As a result, these programs account for a larger portion of the U.S. budget. As projections continue to rise relative to available revenue, a lower level of funds will be available for other programs or the U.S. debt will continue to increase further exacerbating the problem. As the total U.S. debt approaches the yearly GDP (in 2010 the total U.S. debt is projected to be 97% of the GDP), the risk of rising interest rates becomes a larger concern. This paper shows that even a small increase in the interest rate has a big impact on the overall budget. This paper shows that the practice of continuing to increase the U.S. debt at a rate higher than the GDP/revenue increases is simply unsustainable.

JEL: H51, H55, H68

KEYWORDS: Projections, Interest on U.S. Debt, Social Security, Medicare, Medicaid

INTRODUCTION

Over the last several decades mandatory spending, primarily Social Security, Medicare and Medicaid have been consuming a larger portion of Federal spending. In 1966, Social Security, Medicare and Medicaid accounted for 16% of Federal spending. In 1986 and 2006, these same programs accounted for 30% and 40% of Federal spending, respectively. With 80 million baby boomers hitting retirement age beginning in 2008, projections indicate that these mandatory programs will see even bigger demands.

This paper looks at Social Security in detail and displays surplus/deficit projections under intermediate and high assumptions as reported in the 2009 Social Security Trustees Report. Social Security is projected to begin running a deficit in 2016, under intermediate assumptions, but with unemployment at 10% and an increased number of claims; Social Security will most likely see a deficit much sooner. In Walker's *Comeback America*, Social Security expects to have a negative cash flow in 2010/2011. This paper also looks at the effect increasing revenue and/or decreasing cost has on the long-term Social Security surplus/deficit projections.

As described in Friedman, Medicare spending has grown by 2.4% points faster than GDP over the past thirty years more than tripling as a share of GDP since 1960. If costs continue to grow at current rates relative to GDP, then Medicare alone will account for 8% of the GDP and 44% of the revenue in 2030. According to the Congressional Budget Office, rising health cost is the biggest contributor to cost growth contributing even more than that due to the ageing population. In this paper, the author calculates budget surplus/deficit projections for Medicare Health Insurance (HI). Medicare Hospital Insurance (HI) currently operates in a deficit and that deficit projects to grow with each passing year.

The deficit is the gap between expenditures and revenue in any given year (\$1.4 trillion in the U.S. in 2009), whereas debt accumulates past deficits (total, public plus private, U.S. debt at the end of 2009 is \$12.4 trillion). As described in Chernew, Baicker and Hsu, having such a large total debt relative to the

GDP is a concern for many reasons. First, interest payments consume and increasing share of income (9% of spending in 2009 was used to pay the interest on the total U.S. debt); Second, growing debt can lead to higher interest rates for all borrowers (government, businesses, and individuals) thus impeding economic growth. Finally, high debt reduces our capacity to respond to economic shocks and magnifies the detrimental effects of any deficit. The author performs an analysis to determine the effect rising interest will have on future available revenue under a various assumptions.

Finally, the author makes projections showing the percentage of U.S. revenue spent on mandatory programs and interest on the U.S. debt for the years 2018 and 2035. In 2018, projections in the 2009 U.S. Budget indicate that spending on mandatory expenses and interest will account for 85% of the U.S. revenue. Results presented at the end of this report show the need for reform of mandatory programs, debt control, and increase in revenue.

LITERATURE REVIEW

All historical data, prior to 2008, was taken directly from the 2010 U.S. Budget Historical Tables. Unless otherwise noted, projection data for years 2009 through 2018 was taken directly from the 2010 U.S. Budget Updates Summary Tables (May 2009). The 2010 U.S. Budget assumes an average annual GDP increase of 4.92% from 2010 through 2019 with the increase tapering down to 4.45 % from 2014- 2019. For the last 30 years, the annual U.S. revenue has averaged 18.0 % of the Gross Domestic Product (GDP). For the last 40-years, the U.S. debt has increased an average of 9 % per year. In the 2009 U.S. Budget, the U.S. debt projects to increase an average of 8.7% per year for years 2009-2018. During that same 10-year period, revenue projects to increase an average of 5.3% per year. Mandatory programs as a percentage of Federal spending, provided in the Introduction, was calculated from the 2010 U.S. Budget historical tables and is consistent with the data provide in the 2008 U.S. Financial Condition and Fiscal Future Briefing.

All Social Security data comes from the 2009 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds hereafter referred to as the 2009 Social Security Annual Report. Total Social Security benefits paid in 2008 were \$615 billion. Total income was \$805 billion, and assets held in special issue U.S. Treasury securities grew to \$2.4 trillion. Social Security currently operates on a yearly surplus and that yearly surplus pays the current U.S. obligations in exchange for special issue Treasury Securities. Since the Social Security Administration has loaned the surplus funds to the Treasury Department, only IOU's are in the \$2.4 trillion Social Security trust fund.

All Medicare data comes from the 2009 Annual Report of the Board of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds. In 2008, total Medicare expenditures were \$468 billion and future expenditures will increase at a faster pace than the overall U.S. economy. Medicare Hospital Insurance (HI), Part A, is currently operating in a deficit and that deficit will grow with each passing year with the Medicare trust fund exhausted in 2017 under intermediate assumptions. The Medicare HI trust fund is similar to the Social Security trust fund because Medicare loans surplus funds to the Treasury Department in exchange for special issue securities (IOU's). For the last 10-years, income has increase an average of 4.2% while expenses have increased an average 6.4% per year. Under intermediate assumptions, this deficit trend expects to continue and increase in the out years. The Supplementary Medical Insurance (SMI), Part B, trust fund is adequately financed over the next 10-years because general revenues are reset every year to match cost. Under current law, Medicare requires an average annual growth rate of 5.5% for the next 5-years. As described in the Annual Report, this is unrealistically constrained and requires physician fee reductions (21.5% for 2010) to be continually overridden by Congress (2003-2009). If Congress continues to override these physician fee reductions,

the part B average annual growth rate will be 8.5% to 9.0%. The average annual Part D growth rate is 11.1% through 2018. The U.S. Economy, as described in the Medicare Trustees Report, projects to grow 4.5% during the same period.

All Medicaid data comes from the 2008 Actuarial Report on the Financial Outlook for Medicaid. Medicaid spending in 2007 was 333.2 billion; \$190.6 billion represents Federal spending and \$142.6 billion represents State spending. Medicaid expects to grow about 7.9% per year on average and reach \$673.7 billion by 2017. The U.S. budget projects revenue to grow an average of 4.9% per year during the same timeframe.

Projected cost for “Other Mandatory Programs” comes directly from the 2010 U.S. Budget for years 2009 through 2019. Other Mandatory Programs projects to increase 4.26% per year after 2019, which is the average projected increase from 2008 through 2019.

In 2008, the U.S. debt was \$9.986 trillion and interest paid on the U.S. debt was \$253 billion accounting for 10% of the 2008 revenue. The interest rate paid on the total U.S. debt in 2008, as reported in the Updated 2010 U.S. Budget Summary Tables, was 2.53%. The current U.S. debt is \$12.04 trillion (Nov. 2009). The debt in the 2010 U.S. Budget projects to be \$23.29 trillion in 2019. The average interest rate paid on the U.S. debt for years 2009-2019 in the U.S. Budget is 2.5%.

DATA AND METHODOLOGY

In the short term, Social Security is projected to begin running a yearly growing deficit. In the long term, under intermediate assumptions, Social Security projects to continue to account for a larger portion of the yearly U.S. revenue thereby increasing the total U.S. debt. The Social Security Surplus/Deficit Projections (Figures 1 and 2) were determined from data provided in the 2009 Social Security Annual Report and calculated by subtracting income from cost that were determined by multiplying the OASDI Income and Cost Rates (Table IV.B1) by the Taxable Payroll (Table VI.F6) for years 2010 – 2035 under Intermediate and High assumptions. Results under intermediate assumptions are consistent with that reported by Allan Sloan (2010) in “*The next great bailout: Social Security*” which utilized the same methodology (high projections were not provided by Mr. Sloan). Potential solutions discussed in the Social Security Trustees Report include increasing the payroll tax from its current level of 12.4 percent (for employees and employers combined) to 14.41 percent. This tax increase, excluding reaction effects, results in a theoretical 16.2% increase in income [$16.2\% = (14.1/12.4) - 1$]. Alternatively, Social Security can reduce current and future costs by 13.3 percent. Alternatively, there could be a combination of the two. A first order analysis of these options looks at the effect on Social Security itself and not the impact to the growth of the U.S. economy or impact on beneficiaries. Results shown in the next section (Figures 3-6) were determined as described in this paragraph and by increasing the income or decreasing the cost by the percentages suggested in the Social Security Annual Report under intermediate assumptions.

The Medicare Hospital Insurance surplus/deficit deficit (Figure 7) was determined from data provided in the 2009 Federal Hospital Insurance and Federal Supplementary Medical Insurance Annual Report and calculated by subtracting income from cost that was determined by multiplying the HI Income and Cost Rates (Table III.B7) by the Taxable Payroll for years 2010 – 2035 under intermediate assumptions. This data is similar but worse than that presented in David M. Walkers GAO U.S. Financial Condition and Fiscal Future Briefing however his data was based on the 2007 Medicare Annual Report.

A Monte Carlo simulation, utilizing Oracle Crystal Ball[®], was performed to look at the effect GDP growth, yearly U.S. debt increases, and varying interest rates have on the available revenue and future U.S. debt. Oracle Crystal Ball[®] is the leading spreadsheet based application suite for predictive modeling,

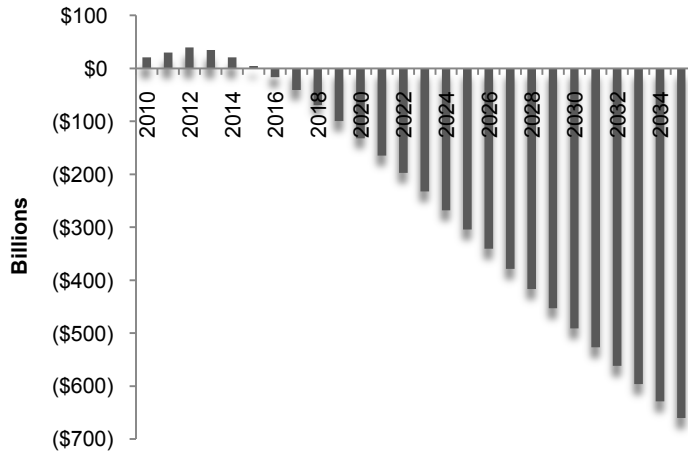
forecasting, simulation, and optimization. Simulation A, B, and C, assume the following; (1) The U.S. debt continues increasing at an average rate of 7% per year. Debt increases with a normal distribution with 7.06% as the mean. Since this is an average increase over a number of years, the standard deviation was set at .005%. (2) The average annual GDP growth rate modeled with a normal distribution with the mean set at 4.6%. Since this is an average increase over a number of years, the standard deviation was set at .002%. For simulation A (low assumption), the interest rate paid on the Total U.S. debt for a given year was modeled with a normal distribution with the mean set at 2.5%. The standard deviation was set at .005 with the interest rate truncated at 1.2%. The interest rate paid on the U.S. debt listed in the 2010 U.S. Budget for 2011 is 1.2% and represents the minimum. For simulation B (moderate assumption), the interest rate paid on the Total U.S. debt for a given year was modeled with a normal distribution with the mean set at 2.5%. The standard deviation was set at .02 with the interest rate truncated at 1.2%. For simulation C (high assumption), the interest rate paid on the Total U.S. debt for a given year was modeled with a triangular distribution with the likeliest set at 2.5%, the minimum set at 1.2%, and the maximum set at 9.4%. Table 1 displays the results from this analysis.

Finally, we look at the effect that mandatory programs and interest on the U.S. debt have on available revenue for 2008, 2018 and 2035. GDP, total U.S. debt and revenue for 2008 and projections for 2018 come directly from the 2010 U.S. Budget. GDP was projected to increase 4.6 % per year from 2019-2035, consistent with GDP increase contained in the Social Security Annual Report. The U.S. debt projects to increase 7% per year from 2019- 2035. All Social Security expense data comes from the 2009 Social Security Annual Report. Medicare expenses for 2008 and 2018 come directly from the 2009 Medicare Annual Report (Table V.E4). Medicare expenses were estimated to continue increasing 6.9% per year for 2019-2035 which is the average annual increase from 2008 – 2018 reported in the 2009 Medicare Annual Report. Medicaid expenses for 2008 and 2018 come from the 2010 U.S. Budget. Medicaid expenses were estimated to increase 7.9% per year from 2019-2035 consistent with the projected yearly increases described in the 2009 Medicaid Annual Report. Other Mandatory Expenses for 2008 and projections for 2018 come directly from the 2010 U.S. Budget. Projections for 2035 assume an average 4.26% per year increase, consistent with the increases from 2008 – 2018. Interest on U.S. debt comes directly from the 2010 U.S. Budget for 2008 and 2018. For this analysis, interest on the total U.S. debt in 2035 is 2.5%. Table 2 and Figure 8 display the results.

RESULTS

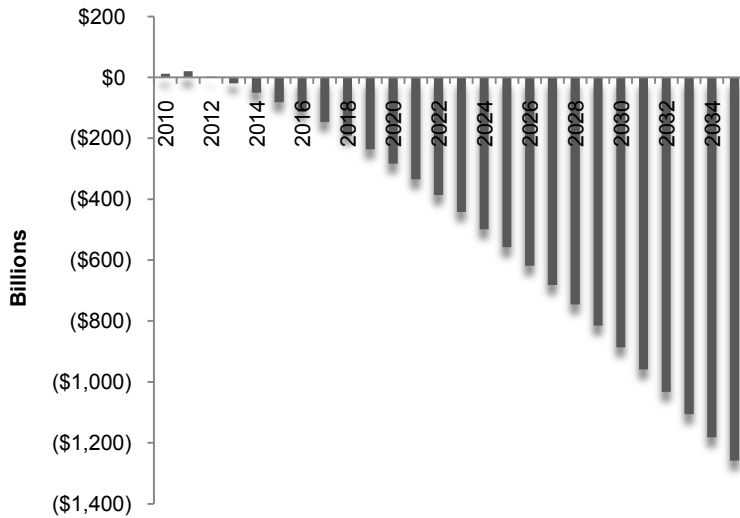
Under intermediate assumptions (Unemployment rate of 8.2%, 8.8%, and 7.9% in calendar years 2009, 2010, and 2011 respectively and tapering down to 5.5% in 2016), Social Security will continue to operate with a yearly surplus until 2016 at which time it will begin operating on a yearly deficit that is projected to grow with each passing year (see Figure 1). Under high-cost assumptions (Unemployment rate of 8.5%, 9.3%, and 8.3% in calendar years 2009, 2010, and 2011 respectively and tapering down to 6.5% in 2018), Social Security will begin operating on a yearly deficit in 2013 (see Figure 2). Since the U.S. unemployment rate is currently at 10.2% (Nov. 2009), Social Security is expected to run a deficit before 2013 and possibly as early as 2010. When Social Security runs a yearly deficit, Social Security will sell the Treasury Securities that the U.S. government owes itself to investors. The bond market will react to this debt shift especially as it grows. Under the intermediate assumptions, the Social Security Trust fund will remain solvent until 2036 at which time the annual Social Security deficit will be \$690 Billion per year and growing (See Figure 1). Social Security reform is required and expects to be a hot topic in Washington, DC after the Health Care debate.

Figure 1: Social Security Yearly Surplus/Deficit (Intermediate Projections)



This figure shows the yearly Social Security surplus/deficit projections under intermediate assumptions for years 2010 – 2035. Data comes from the 2009 Social Security Annual Report by subtracting expenses from income.

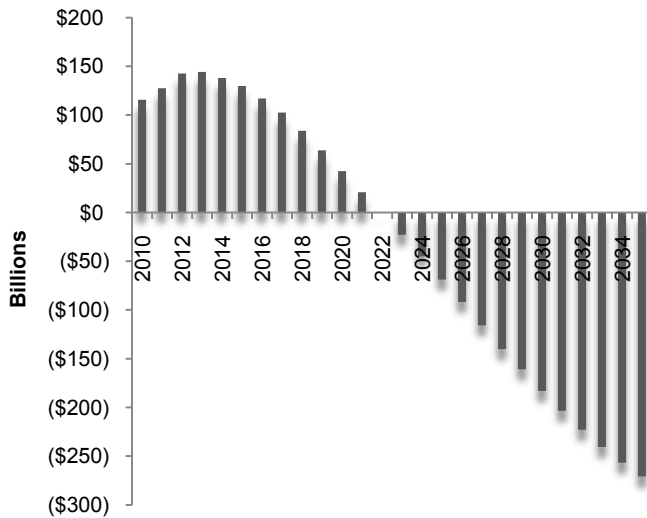
Figure 2: Social Security Yearly Surplus/Deficit (High Projections)



This figure shows the Social Security yearly surplus/deficit projections under high assumptions for years 2010 – 2035. Data comes from the 2009 Social Security Annual Report by subtracting expenses from income.

Figures 3 through 6 show the results of reducing cost, increasing income or a combination thereof as described in the 2009 Social Security Annual Report. Figure 3 displays the Social Security surplus/deficit projection assuming a 13.3% reduction in costs as reported in the 2009 Social Security Annual Report under nominal assumptions.

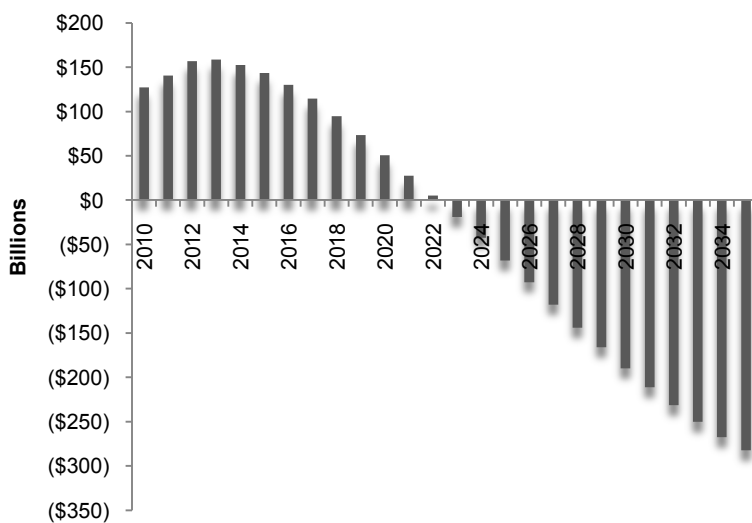
Figure 3: Social Security Yearly Surplus/Deficit Projections (Intermediate) with 13.3% Reduction in Cost



This figure shows the Social Security yearly surplus/deficit projections under intermediate assumptions with a 13.3% reduction in cost for years 2010 – 2035. Results come from the 2009 Social Security Annual Report by subtracting expenses x 86.7% from income.

With a 13.3% reduction in cost, Social Security will begin operating in a yearly growing deficit in 2023. The Social Security Trust Fund will have more years to grow and therefore will take longer to deplete. Keep in mind that the intermediate projections are optimistic since Social Security under-predicted unemployment rates. Figure 4 displays the Social Security surplus/deficit projection assuming a 16.2% increase in revenue, as reported in the 2009 Social Security Trustees Report under nominal assumptions. With a 16.2% increase in revenue, Social Security will begin operating in a yearly growing deficit in 2023. The Social Security Trust Fund will have more years to grow and therefore will take longer to deplete.

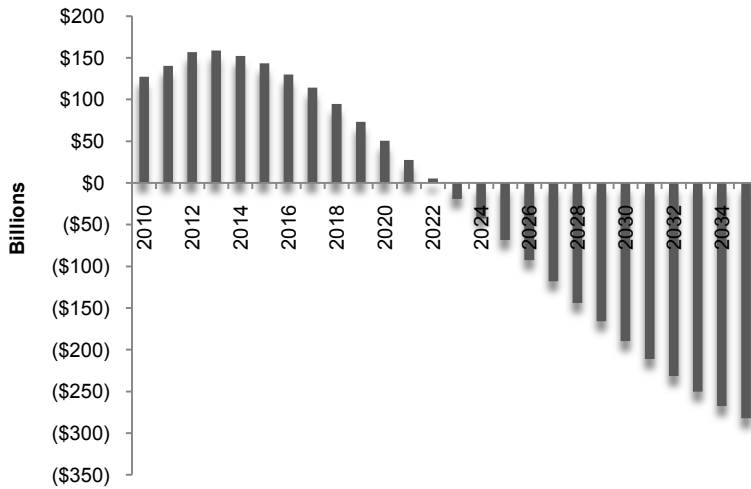
Figure 4: Social Security Yearly Surplus/Deficit Projections (Intermediate) with 16.2% Increase in Revenue



This figure shows the Social Security yearly surplus/deficit projections under intermediate assumptions with a 16.2% increase in revenue for years 2010 – 2035. Results come from the 2009 Social Security Annual Report by subtracting expenses from income x 16.2%.

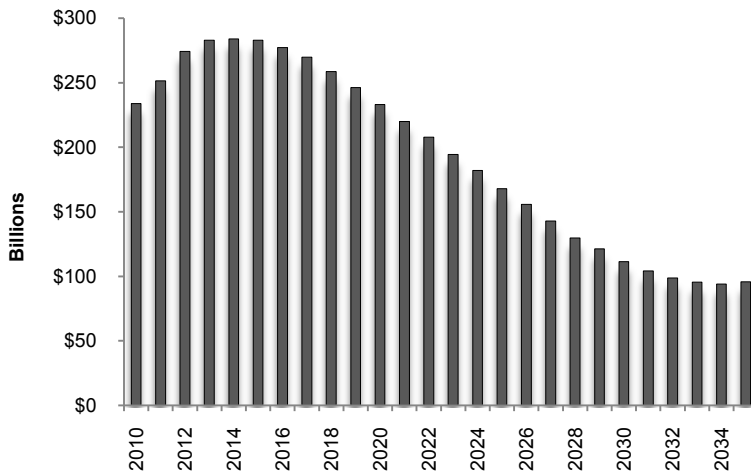
Figure 5 displays the Social Security surplus/deficit projection assuming a combination of 6.65% reduction in costs and an 8.1% increase in revenue. Also for this case, Social Security will begin operating in a yearly growing deficit in 2023. The Social Security Trust Fund will have more years to grow and therefore will take longer to deplete.

Figure 5: Social Security Yearly Surplus/Deficit (Intermediate Projections) with 6.65% Reduction in Cost and 8.1% Increase in Revenue



This figure shows the Social Security yearly surplus/deficit projections under intermediate assumptions with a combined 6.65% reduction in cost and 8.1% increase in revenue for years 2010 – 2035. Results come from the 2009 Social Security Annual Report by subtracting expenses x 93.35% from income x 8.1%.

Figure 6: Social Security Yearly Surplus/Deficit Projections (Intermediate) with Full 13.3% Reduction in Cost and 16.2% Increase in Revenue



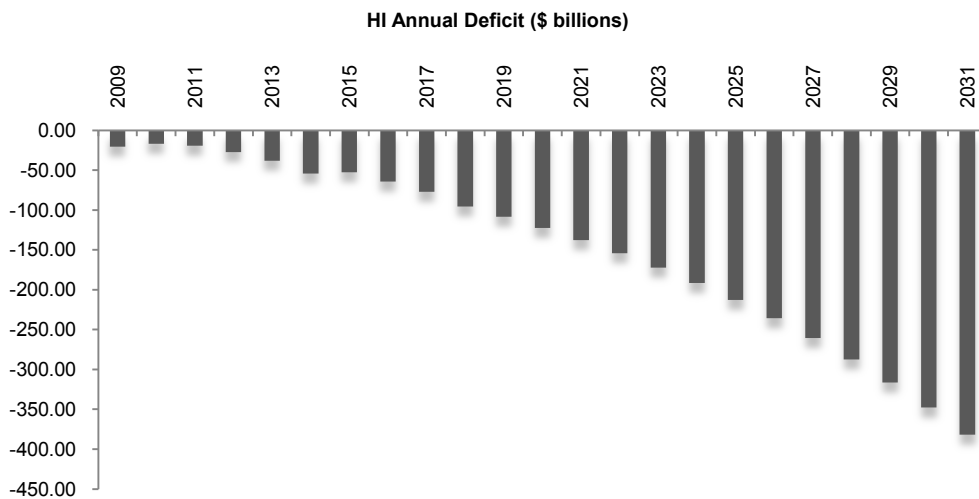
This figure shows the Social Security yearly surplus/deficit projections under intermediate assumptions with a combined 13.3% reduction in cost and 16.2% increase in revenue for years 2010 – 2035. Results come from the 2009 Social Security Annual Report by subtracting expenses x 86.7% from income x 16.2%.

A final projection of the Social Security surplus/deficit assumes a full combination of 13.3% reduction in costs and 16.2% increase in revenue. Clearly, a full 13.3% reduction in benefits and 16.2% increase in

Social Security payroll taxes would have a larger impact on beneficiaries and economic growth. As shown in Figure 6, for a combined effort less than a 13.3% reduction in benefits and less than 16.2% increase in payroll taxes could keep Social Security operating in the black.

Figure 7 displays the Medicare Hospital Insurance (HI) surplus/deficit curve for 2010 – 2035. Medicare HI is currently operating with a yearly deficit and that yearly deficit projects to grow with each passing year. In addition, the Medicare HI surplus/deficit deficit keeps getting worse with each Annual Report. Clearly, Medicare HI costs need to be controlled.

Figure 7: Medicare HI Yearly Surplus/Deficit Projections (Intermediate)



This figure shows the annual Medicare Health Insurance (HI) deficit in billions of dollars. Results come from the 2009 Medicare Annual Report by subtracting expenses from income.

Next, the Monte Carlo simulation results are presented that predict the probability of what percentage of yearly revenue will be required to pay the interest on the U.S. debt for 2018 and 2035. Results from simulation A (low assumption), show a 50% probability that in 2018, the interest on U.S. debt will account for between 12% - 16% of the revenue for that year with the full range of probabilities between 6% - 22%. In 2035, for simulation A there is a 50% probability that the interest on the U.S. debt will account for 17% - 23% of the revenue for that year with the full range of probabilities between 8% - 33%. Presented in Table 1 are the results for Simulations B and C in addition to Simulation A.

Table 1: Probability of Percent of U.S. Revenue Paid Towards Interest on U.S. Debt (2018 and 2035)

	Year	50% Probability Range	Complete Probability Range
Simulation A (low)	2018	12% - 16%	6% - 22%
	2035	17% - 23%	8% - 33%
Simulation B (moderate)	2018	8% - 19%	6% - 42%
	2035	13% - 28%	8% - 61%
Simulation C (high)	2018	13% - 27%	7% - 53%
	2035	17% - 37%	9% - 76%

This table shows the probability distribution of the percentage of revenue required to pay the interest on the U.S. debt for 2018 and 2035 under Low (Simulation A), Moderate (Simulation B), and High (Simulation C) interest rate assumptions. For all simulations the U.S. Debt was modeled to increase 7.06% per year with a normal distribution with a standard deviation of .005, GDP was modeled to increase 4.6% per year with a normal distribution with a standard deviation of .002. For Simulation A, the interest rate was model with a normal distribution with the mean set at 2.5% and a standard deviation of .005. For Simulation B, the interest rate was model with a normal distribution with the mean set at 2.5% and a standard deviation of .02 and the minimum truncated at 1.2%. For Simulation C, the interest rate was model with a triangular distribution with the most likely value of 2.5%, a minimum of 1.2% and a maximum of 9.4%.

Based on the results above, it is clear that rising interest rates are a threat to available resources in the coming years. It is clear that the U.S. cannot continue to increase the U.S. Debt at an average of 9% per year while GDP, and thus revenue, increase at an average rate of 4.6%. The Federal Reserve must make efforts to keep interest rates relatively low while at the same time controlling inflation. At the same time, after the U.S. economy improves, the Government must then focus its efforts to reduce the yearly deficit and thus debt. To keep this problem from getting worse, at a minimum, the average annual debt increase should be lower than the average annual revenue increase. Below are projections of mandatory expenses and interest on the U.S. debt for 2008, 2018, and 2035.

Table 2: Mandatory Outlays and Interest on U.S. Debt for Years 2008, 2018 and 2035

U.S. Dollars in Billions	2008 (% of revenue)	2018 (% of revenue)	2035 (% of revenue)
GDP	\$ 14,222	\$ 21,884	\$ 46,940
U.S. Debt (EOY)	\$ 9,986	\$ 22,248	\$ 68,756
Revenue	\$ 2,524	\$ 4,218	\$ 8,778
Social Security Outlay	\$ 625 (24.8%)	\$ 1,148 (27.2%)	\$ 2,923 (33.3%)
Medicare Outlay (Fed.)	\$ 386 (15.3%)	\$ 780 (18.5%)	\$ 2,775 (31.6%)
Medicaid Outlay	\$ 201 (8.0%)	\$ 438 (10.4%)	\$ 1,590 (18.1%)
Other Mandatory Expenses	\$ 411 (16.3%)	\$ 506 (12.0%)	\$ 1,064 (12.1%)
Interest on U.S. Debt	\$ 253 (10.0%)	\$ 708 (16.8%)	\$ 1,719 (19.6%)

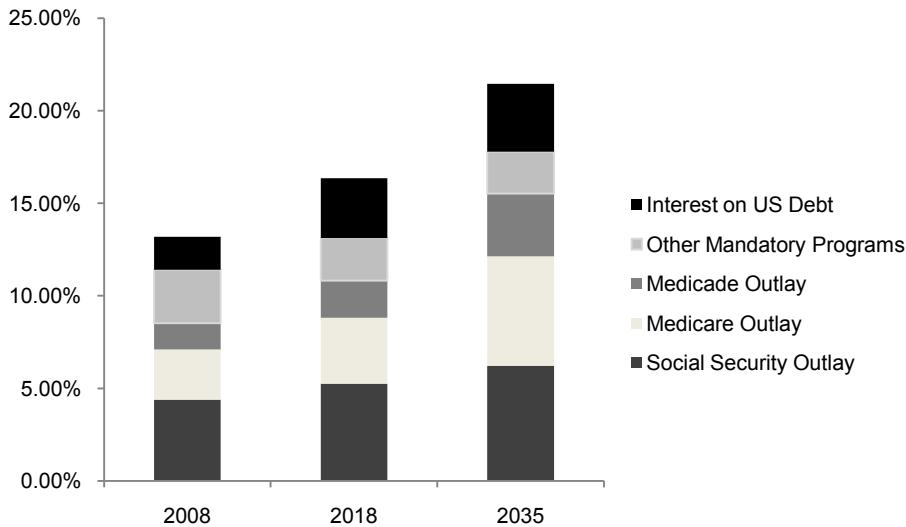
This table shows GDP, U.S. Debt, revenue, mandatory expenses, and interest on U.S. debt for 2008, 2018, and 2035. Also shown in parentheses is the percentage of yearly revenue for each of the mandatory programs under intermediate assumptions.

In 2018, using projections in the 2010 U.S. Budget, the interest paid on the U.S. debt will account for 16.8 % of the revenue for that year. Based on the assumptions mentioned above, in 2035 the interest paid on the U.S. debt will account for 19.6 % of the revenue for that year. An interesting side note, for every 1% increase in the interest rate on the U.S. debt, in 2018 and 2035, an additional 4.9% and 7.8 %, respectively, of the revenue for that year is required.

As shown in Table 2 and Figure 8, mandatory programs and interest on U.S. debt accounted for 74% of the available revenue in 2008. Under intermediate assumptions, Mandatory Programs and interest payment on the U.S. debt projects to account for 85% of the revenue in 2018 and 115% of the revenue in 2035. This analysis does not account for any military, State Department, FBI, IRS, EPA, unemployment compensation, veteran’s benefits, food assistance programs or any other discretionary spending. From this first order analysis, with most of the data taken directly from Government reports, it is clear that a major shift in U.S. policy is required with a focus on fiscal responsibility.

According to the analysis performed by Kogan, Cox, and Horney, the “fiscal gap” or the average amount of program reductions or revenue increases required over the next forty years to stabilize the debt to its 2009 levels, as a share of the U.S. economy- equals 4.2% of the GDP. Eliminating the gap would require the equivalent, immediate and permanent 24 percent increase in tax revenues or 20 percent reduction in expenditures for all federal programs. Given the size of the gap, some combination of revenue increases and program cuts is required.

Figure 8: Mandatory Outlays and Interest on U.S. Debt as a Percentage of GDP



This figure shows the percentage of U.S. revenue spent on mandatory programs and the interest on total U.S. debt relative to GDP for years 2008, 2018 and 2035. It is a graphical presentation of the results presented in Table 2. Revenue is a constant 18.7% of GDP.

CONCLUDING COMMENTS

There are serious concerns for Social Security, Medicare and Medicaid. Projected growth, as reported in their respective annual reports, for all three programs outpaces projected revenue growth. With unemployment currently higher than the estimated high projections, one can expect less near-term revenue for all three programs further taxing these strained programs. Major reform is required for all three programs and the sooner we enact solutions, the more flexible and gradual they can be.

With the total U.S. debt approaching the annual GDP, yearly debt payments project to further strain the economy. As shown through the Monte Carlo simulation and through basic math equations, with even a small increase in the interest rate, the interest payments go up a lot due to the large size of the current and increasing U.S. debt. With interest rates currently at historic lows and debt currently at historic highs, the combination makes us especially vulnerable to rising interest rates. After the U.S. economy improves, we must make a focused effort to control the growing U.S. debt while the problem is still manageable.

The combination of mandatory programs and interest on U.S. debt, as reported in their respective annual reports, account for 85% of the U.S. revenue in 2018. If current trends continue, in 2035 115% of revenue will be required for mandatory programs and interest on the U.S. debt. Clearly, major reform is required. It will likely require both an increase in revenue and a reduction in cost requiring Congress and the President to overcome a political quagmire.

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