Online Appendix

Are Large Deficits and Debt Dangerous?[1]

Michael J. Boskin
Hoover Institution and Department of Economics
Stanford University

Introduction

Economists have debated the effects of deficit financed government spending on short-run aggregate demand, the price level, long-run growth and economic welfare since the classical economists. These effects will vary depending on economic conditions, assumptions on economic behavior, the details of the spending or tax changes, expectations of, and eventually realizations of, whether the policy is temporary or permanent and what future policy changes ensue. While the intellectual debate continues, a rough quasi-consensus, which I will label the Traditional View (TV), has emerged.

Recently, it has been sharply questioned on both analytical and empirical applicability grounds. After a description of the conclusions of this traditional view, I present estimates of a looming debt problem, the policies that would be necessary to contain it, and brief summaries of recent empirical research on the short- and long-run effects of deficits and debt. I then turn to the most fundamental critique, by Blanchard (2019), who suggests there may be no fiscal cost or welfare loss to sizable increases in the debt/GDP ratio, followed by analytical, empirical and political economy critiques of his analysis.

The Traditional View (TV)

The TV posits[2] that deficits and debt are acceptable, desirable even: 1) as a counter-cyclical device, the automatic stabilizers should certainly be allowed to work; additional discretionary fiscal policy may be desirable in a deep long-lived recession after the central bank moves

[1] I would like to thank Alan Auerbach, and Seth Benzell, and Olivier Blanchard for helpful comments. A condensed version of this paper will appear in the AEA Papers and Proceedings, 2020.
[2] See the early summary in Elmendorf and Mankiw (1999).

aggressively to the zero lower bound (ZLB)[3] on its nominal target interest rate if, but only if, it can be designed and implemented politically to help quickly at reasonable long-run cost[4]; 2) to finance *productive* investment (that passes *rigorous* cost-benefit tests); 3) for tax smoothing of large, temporary spending swings (e.g. WWII; 1980's defense buildup) Deficits and debt are economically harmful, in the extreme even dangerous: 1) as they crowd out private investment and reduce future income; 2) if they cause the central bank to monetize enough debt to cause serious inflation; 3) if they are, or are expected to be, so big for long enough they lead to elevated risk premia, expectations of inflation, depreciation of currency, capital flight, and/or a financial crisis (technically, an alternative equilibrium, briefly discussed below).

These are all likely to be more relevant in a low private saving context, need to be leavened for some partial Ricardian private saving offset behavior (Barro (1974), Boskin and Kotlikoff (1985)) and account for the extent and duration of foreign capital inflows and any feedback effects on spending and taxes. Finally, the TV is that the incidence of the debt falls primarily on younger generations, who will inherit a smaller capital stock, lower incomes, and pay higher taxes. The equity of the intergenerational transfer from young to old varies with the rate of productivity growth.[5]

The Projected Debt Problem

Figure 1 shows the Congressional Budget Office (2019) long-run debt outlook. From a pre-Great Recession 37% of GDP, the debt ratio has now more than doubled to 78%[6] and is projected by

[3] A warning on overinterpreting the ZLB or sticky prices: Swanson and Williams (2014) report that even one- and two-year yields were NOT constrained in the first three years of the ZLB; Bils and Klenow (2004), that prices change quite frequently.

[4] The budget should be consolidated once beyond substantial slack, better yet, a credible program to do that should be announced in advance, if possible.

[5] An exception occurs when the debt finances *productive* public investment or lower capital income taxes.

[6] For decades, various authors (Auerbach and Kotlikoff (1987) Auerbach, Gokhale and Kotlikoff (1994), Auerbach, Gale and Krupkin (2019), Boskin (1982, 1989), Eisner (1986)) have argued that the official deficit and national debt measures convey an incomplete or inaccurate picture of the government's liabilities. Even after adjusting for the business cycle and temporary factors, there is little capital budgeting, little accrual accounting and little accounting for inflation. The official measures account insufficiently for contingent liabilities of the banking system, e.g. bad loans in China and Japan, historically the S&L's; government assets, e.g. tangible capital (buildings, computers, infrastructure, planes) and land and mineral rights (the value of these assets is about equal to the official debt figures), intangible investments in R&D, education, etc. and, most importantly, the unfunded liabilities in entitlement programs. The CBO and OMB, and several international agencies, now publish several alternative deficit, debt and government capital series incorporating some of these adjustments. While, conceptually, these adjustments should be incorporated, I use the official figures in this paper for simplicity and comparability.

2049 to reach 144% under its (already obsolete from the year-end 2019 legislation) extended baseline (EB) scenario and 219% under its increasingly likely alternative fiscal (AF) scenario. Table 1 shows the corresponding primary and total deficits are -3.0% and -8.7% for EB and 6.1% and -15.5% for AF. Compared to a gradual reduction in the debt/GDP ratio to the 50-year average of 42%, GDP is estimated to be 4.3%, and per capita GDP $3400, lower in 2049, worsening thereafter. For the AF, an additional 2.5% and 3.6% lower for GDP and GNP (the difference reflecting larger interest payments to foreigners).

To stabilize the debt ratio at the current 78% would require a consistent reduction in the primary deficit of 1.8% of GDP, e.g. achieved by a reduction of 10 percent in non-interest spending; returning to the historical average 42% debt ratio starting in a decade would require a reduction in the primary deficit of 4.4% from then on, or well over 20% of non-interest spending, even in the optimistic EB, more under AF. The largest multiyear spending reduction since 1930, except the post WWII demobilization, was 5% of GDP.

The source of these imbalances is spending outstripping revenues, and projected slow economic growth due to demography and modest productivity growth. CBO (2019) estimates the primary drivers of growing deficits and debt are Social Security and major health programs. Projected spending on these entitlements grows 6.1% of GDP from 2019 to 2049. Contrary to most commentary, just under half of this growth is due to an aging population; over half to growing real costs per beneficiary. Revenues are expected to grow by 3 percent of GDP, just over half due to real bracket creep. The larger debt and higher interest rates increase interest costs as well in the total deficit.

Evaluating Efficacy of Counter Cyclical Fiscal Policy

There are five methods used to evaluate the effects of fiscal policy 1. Stylized analytical models: 2. Macro econometric models; 3. Direct estimation of key relationships, e.g. an expenditure or tax multiplier; 4. Structural vector autoregressions (SVARs); 5. Historical case studies, which may utilize some of the others as inputs. Each of these approaches has its strengths and weaknesses: model assumptions, data limitations, difficulties of identification, etc. Often, this renders direct comparison of results tricky. Conclusions differ and are heavily dependent upon

the model assumptions on the nature, timing, assumed duration and financing of fiscal actions; the assumed path of monetary policy; the degree of wage and/or price rigidities, including the probability and duration of the ZLB; the degree of forward-looking behavior by consumers and firms, etc.

Modern research[7] decisively rejects the simplified Keynesian notions of expenditure multipliers that are large and larger than tax multipliers, with little if any long-run cost. While the results vary by research methodology, considerable evidence[8] since the financial crisis suggests:
1. present value expenditure multipliers generally below one, a dampener, lower still in models with variable labor supply and capital stock; peak multipliers somewhat, possibly well, above one at the ZLB (Hall (2009); Christiano, Eichenbaum and Rebello (2011)) initially, but rapidly declining; and potentially negative, a destroyer, if the increased spending is expected to last beyond the ZLB period (Woodford (2011) or in economies with high debt ratio (Ilzetzki et al. (2013)). 2. estimated tax multipliers are considerably larger than those for expenditure, (Mountford and Uhlig (2009); Romer and Romer (2010)), especially for permanent rate reductions, which turns the simple unitary Keynesian balanced budget multiplier negative. 3. the stimulus *may* turn negative in year two through four depending on assumptions (Mountford and Uhlig (2009) and Ramey (2019)); and 4. some early studies suggested large multipliers in recessions, smaller, even negative, in expansions (Auerbach and Gorodnichenko (2013)), but Ramey and Zubairy (2018) find no evidence of multipliers above one in slack times or even in recessions. 5. more recent studies, redone with consistent robust methods, of multipliers for the

[7] Important issues lie beneath the headline deficit and debt numbers. Estimating effects on historical data, unless controlled for, implicitly assumes the typical conditional mix of these details. Leaving assumptions about the reaction of monetary policy aside, the degree of tightening of credit conditions, changes or prospective changes in regulation of major sectors of the economy, the structure of tax and transfer rules, and policy uncertainty all can have important effects. For example, the credit tightening surrounding the 1990-91 and 2008-9 recessions was even more extreme than economic conditions suggested; Mulligan (2012) demonstrates substantial disincentive effects from the transfer policies accompanying the 2009 fiscal stimulus; and the policies and uncertainty concerning the new regulation of financial services, healthcare and energy likely created a drag on the economy—something I argued in 2008 was likely. Similarly, the extremely strong rebound from the 1981-2 recession may well have been aided by the structure of the tax reductions, e.g. lower marginal rates and increased investment incentives. Then CEA Chair Art Okun later said the corporate investment tax changes were the most effective part of the Kennedy-Johnson program. Separating these types of effects from more traditional "Keynesian stimulus" effects operating through increasing cash flows of liquidity constrained consumers or firms, especially when accompanied by unusually tight credit conditions, is difficult and, despite some important work in this area (Barro and Redlick; Mulligan), remains a high research priority.
[8] See Ramey (2019) and the earlier discussion in Auerbach and Gale (2010).

2009 ARRA are consistent with the real time Cogan, Cwik, Taylor and Wieland (2010) estimates of about 0.6. In her excellent survey, Ramey (2019) concludes knowing what we know now, the 2009 stimulus package should have relied "more on tax rate cuts and less on expenditure." 6. fiscal consolidations relying primarily on spending reductions are more successful in improving the fiscal position and avoiding recession than those focused on tax increases (Alessina et al. 2019).

Deficits, Debt and Longer-run Growth

The long-term costs of deficit spending are not emphasized often enough in academic studies and even less in policy debates. They can be substantial. For example, Uhlig (2013) merges New Keynesian DSGE and neoclassical growth models and estimates each dollar of debt financed spending ultimately costs the economy $3.40 in present value, a sobering figure. Reinhart and Rogoff (2009) demonstrate damaging effects from high debt ratios in numerous historical episodes.

To the extent deficits decrease national saving and crowd out investment, incomes, especially wages, will be lower than they would have been in the future. While, as noted above, the effects likely vary based on a number of factors, a rough sense of the order of magnitude of this loss from the CBO scenarios can be calculated from a simple production function and an assumption on how much the debt substitutes for tangible capital, as opposed to increasing private saving or crowding in foreign capital. In the full crowding out case, for example, with a standard production function, the result is roughly a 15% decrease over a generation for AF. With a productivity growth rate of 1 ¼ % per year, that's roughly a third smaller improvement in living standards. There is a range of empirical estimates of these effects. One influential IMF study (Kumar and Woo (2010)), which adjusted for factors such as reverse causality. estimated that each 10% increase in the debt/GDP ratio lowered the growth rate 0.2 percent, which would lead to larger income losses. Finally, modern research on the nature and biases of technical change concludes that production in the G-7 economies in the post-WWII period has been capital and human capital augmenting, which Boskin and Lau (2000) show implies that even if the potential rate of technical progress is exogenous, the rate realized is an increasing function of the levels of capital. Thus, debt substituting for tangible capital may be even more harmful. The same would

follow *if* technical change is embodied in new capital or there is substantial learning by doing (Arrow (1962); De Long and Summers (1992), Auerbach, Hassett and Oliner (1994)). So numerous cautionary signs against "debt is free" abound.

A main mechanism through which deficits and debt affect the economy, both in the analysis of fiscal effects on growth and in the Fiscal Theory of the Price Level analyses of the ultimate causes of inflation (Sargent and Wallace (1981); Leeper (1991); Woodford (1994); Cochrane (1998)) is by raising interest rates. Laubach (2009) estimates each 1% of GDP debt ratio increase raises long-term interest rate by 3-4 basis points. Greenlaw, Hamilton, Hooper and Mishkin (2013) estimate by 4.5 basis points, accelerating rapidly at debt ratios above 80%, just above the current U.S. level, more with large current account deficits. They conclude there is an important feedback effect not fully included in official projections.

The U.S. likely would have been affected even more, except the global reserve currency status of the dollar, the depth, liquidity and relative safety of U.S. financial markets, the substantial growth outperformance relative to Europe and Japan and the capital inflows from rapidly growing Asia and international portfolio diversification from other countries have thus far muted these effects. Simply put, the supply of foreign capital to the U.S. has been far more elastic over much larger levels for longer than many early analyses predicted (Feldstein and Horioka (1980)). For example, foreigners now hold almost two-thirds of federal debt held outside the government. There ultimately must be an upper bound on the share of wealth investors are willing to hold in U.S. government bonds (Sargent and Wallace (1981)). So the supply of foreign capital to the United States must turn increasingly inelastic as the upper bound is approached. But exactly when, how and why that will occur is difficult to say. Mathematically, our present value intertemporal government budget constraint and dynamic model transversality conditions tell us only what ultimately must happen, not when.

The Deficit and the Evolution of the Debt

Most analyses of the deficits and debt play off the same two equations we teach our students: the government's intertemporal budget constraint that the NPV of future *primary* surpluses must cover the current debt net of assets:

$$B_0 \leq \sum_{t=0}^{\infty} \frac{T_t - G_t}{(1+r)^t}$$

where B_0 = government debt net of assets; G = outlays other than interest; T = revenue. And the debt dynamics difference equation:

$$d_t = \frac{1+r_t}{1+g_t} \; d_{t-1} + x_t$$

where d = ratio of debt to GDP; x_t = ratio of primary surplus to GDP; r = interest rate paid by government; and g = growth rate.

Before proceeding to discuss Blanchard (2019), it is important to remember from traditional optimal growth theory that when i, the marginal product of capital, exceeds g, the economy is said to be dynamically efficient (Diamond 1965). If the growth rate exceeds the marginal product of capital, the economy is dynamically inefficient with too much capital, beyond the Golden Rule level (Phelps 1961), and current consumption can use up some of the capital while holding constant the consumption of future generations. Empirical estimates suggest i substantially exceeds g. But adjustments must be made for risk. In an uncertain world, Abel, Mankiw, Summers and Zeckhauser (1989) show that the productive economy generating more capital cash flow than investment is the analogous criterion, which NIPA data shows has been easily met. Subtracting labor compensation and two-thirds of proprietors' income from, and adding capital consumption to, national income yielded $8.6 trillion, compared to gross investment of $4.3 trillion, in 2017. That implies that debt policy decreasing capital accumulation is harmful.

The TV conclusion has been challenged recently by a number of authors arguing secular stagnation – investment is insufficient to equilibrate with saving permanently at a positive interest rate, among other things therefore increasing the likelihood of ZLB periods. And so-called modern monetary theory -- there is no cost to a central bank buying up all the bonds denominated in its own currency. The proponents of each view argue that it alters the need to be concerned, for some long period of time, about large deficits and the debt growing rapidly. That

analysis coincides with political pressure to increase federal spending, paid for with more debt if necessary, even in a fully employed economy.

The most fundamental critique is Blanchard's (2019) elegant extension of the Diamond (1965) OLG model to account for risk by focusing on expected utility. In his model, both the safe (maturity adjusted, net of tax) Treasury rate, r, and the risky marginal product of capital, i, are relevant to the evaluation of debt policy on generational welfare. Recently, r has been below g, the bond market expects that to continue, and i is well above g. He concludes that a sizable increase in debt may well have no fiscal cost and improve welfare. He thus echoes the traditional optimal growth theory dynamic inefficiency result mentioned above.

Blanchard's theoretical analysis is accompanied by simulations, spanning four 25-year generations, that in many instances support his conclusions. Before turning to concerns about the analysis, which still lead me to conclude that a large debt increase is likely to be economically damaging, it is worth emphasizing that Blanchard's analysis makes a case for increased current consumption. Many of the other arguments for more debt make a case for more public investment, not more consumption. Reconciling the two requires a neo-Galbraithian (1958), "relative poverty of the public sector" argument focused on investment. It would likely depend on whether public capital was more complementary to consumption or private capital, among other factors. The U.S. certainly has public investment needs, most clearly for recapitalizing the military and for infrastructure. Some of the latter is appropriately a government function, some of that appropriately federal. Lower government borrowing costs would, cet. par., imply more long-lived, capital intensive projects would pass benefit cost tests. But if the lower r was accompanied (even caused) by lower g, slower growth of the project benefits would be an offset.

Figures 2 and 3 clearly show there have been long periods Treasury yields were continuously lower, or higher, than nominal growth. Economists and financial markets have badly missed the shifts between them. For example, when the FED hit the ZLB in late 2008, it was expected to stay there for nine months, not seven years. Even if, on average, Treasury costs are below the growth rate, debt rollovers might fail if the rate paid by the government exceeds the growth rate for long enough for the debt to explode.

But is the government's net cost, r, likely to remain below the growth rate, g? Blanchard reports a calculation that current budget projections might lead to an increase in r of 1.2-1.8 percentage points. The CBO AF has g at 3.9%, r at 4.6%. With only one-third of debt held by taxable investors, the net of tax Treasury cost still exceeds the growth rate. The Laubach (2009) estimates imply a 240 bp increase for EB, 500 bp for AF (Greenlaw et al. (2013) even more) which easily reverses the recent inequality between the Treasury rate and growth rate.

The welfare implications in Blanchard's model are determined by two effects: a partial equilibrium direct effect of the transfer that depends on the safe rate r which, if below the growth rate, is positive. And a general equilibrium effect on wages and returns to capital that depends on the risky marginal product of capital i, which, if greater than the growth rate, decreases welfare. The *more* the marginal product of capital *exceeds* the growth rate, the *further below* the growth rate the safe rate must be for the transfer to be welfare improving. Estimates of the marginal product of capital from national income data are far above the growth rate. After adjusting for the ratio of capital goods to output prices and eliminating land and mineral rights from the value of the capital stock, Caselli and Fehrer (2007) estimate a marginal product of capital of 9% for the U.S. (8.4% for all rich economies). Applying the same adjustment factors to 2017 U.S. NIPA net capital income and BEA net reproducible capital stock data would also yield high estimates. Monopoly profits and intangibles account for some of the return, but they would have to be immense, over one third of capital returns for the entire economy, not just Big Tech, to reduce i to less than 4% above the growth rate; and by over half to reduce i to less than 2% over g. The maturity adjusted, net of tax, interest cost to the government r, is about 1.5% below the growth rate. Hence, the debt operations Blanchard envisions are quite likely welfare decreasing.

In Blanchard's most realistic example, the simulated welfare effects of a debt and rollover finance of about 12% of GDP intergenerational transfer turn negative, and in some cases, substantially so, for future generations. In this case, one would need a very large discount rate to make the gains (in many, not all, cases) to the first generation worth the harm to future generations. Decadal productivity growth slowed, and estimates of future growth remain low,

thus slower improvement of living standards suggests a low social discount rate. That makes the likelihood of (possibly sizable) social welfare losses much larger. Surely d, g and r are not independent. Productivity pessimists (Gordon (2016) argue new technology does and will not raise productivity nearly as much as did electricity, the automobile, etc.; optimists (Brynjolfsson et al. 2019) counter that the "killer app" has or will show up for social media, nanotechnology, AI, precision biomedicine, etc. Time will tell.

Like all modelers, Blanchard makes assumptions, some for tractability, and inputs parameter values, but several affect the no cost, increased welfare results, most weakening (w), others strengthening (s) his argument. To his credit, he analyzes some, but dismisses most, while acknowledging that these and other reasons may cause the growth rate to fall, and/or the safe rate to increase, even by enough to reverse the recent relationship.

Among these, with likely effect on conclusions in parentheses, are 1) most fundamentally, the effects of d on r and g is minimized, as is the fact $x > 0$ (w); 2) debt is nearly fully net wealth even when the government must levy future taxes to pay interest costs (s); 3) there is no pre-existing government, so no spending, tax and debt paths already in the government's intertemporal budget constraint and no greater harm from any future tax rate increases on top of existing taxes (the deadweight loss rises with the square of tax rates (w)); 4) the young generation, with a lognormal wage distribution, also has a nonstochastic endowment, E, equal to the *average* wage. But E is not derived or justified and is wildly exaggerated for most workers, especially so for the young, less skilled and renters; U.S. total labor compensation, including benefits, divided by fulltime work equivalents is about $90,000, far above the median. Adding a large E may insure the transfers are feasible, but likely limits cases of large risk premia in Treasury yields (w); 5) capital and labor are equally risky, ignoring capital price risk (perhaps w); 6) there is no longer an artificially low safe rate in the observed data caused by financial repression leading to a liquidity discount (w); 7) the economy is closed to trade and capital flows; opening the model, Blanchard notes, to external debt to comport with the considerable observed external debt means some of the substitution of debt for capital is in foreigners' portfolios, which decreases crowding out of domestic investment (but the foreigners get the returns to the capital, even as domestic wages fall less than otherwise) (s); further, if the debt

increases become large and crowd out enough other countries' domestic investment, foreign governments might react to keep capital at home, which could raise U.S. interest rates (w), rendering the net welfare implications ambiguous. 7) downplaying the possibility that dual equilibria may exist, one with a low rate and one with a higher rate when investors believe the debt is risky; as Blanchard notes, the expectations can be self-fulfilling, and the equilibrium may be unstable, with interest rates and risk premia continuing to rise (w). Sargent (1982, 1999), in the context of causes of, and remedies for, high inflation argues a major fiscal regime change was involved.

Blanchard argues the bad equilibrium can be offset by an aggressive contingent fiscal rule. Unfortunately, the history of fiscal rules does not lead to optimism on this score. As a participant in designing fiscal rules, budgeting to implement them and academic observer my conclusion is they are potentially useful only when they have strong automatic enforcement mechanisms and only so long as a political consensus is maintainable in the face of short run economic and political cost. Witness the EU Growth and Stability Pact failures and several rounds of U.S. fiscal rules that did not endure. Recall also the difficult political economy of even getting back to primary budget balance and the historically enormous spending and/or tax changes that would be required, raising questions about the relevance of Blanchard's debt rollover with primary balance cases (w).

An additional political economy point extends Buchanan and Wagner's (1977) argument that by reducing the perceived tax price that ultimately must be paid for more spending, a fiscal illusion leads to excessive spending. Surely imbuing elected officials with the notion that price is zero would substantially worsen the tendency, drive up the debt, crowd out still more investment and weaken whatever cost benefit discipline exists in spending decisions.

Conclusion

Blanchard said "My purpose…is not to argue for more public debt… It is to have a richer discussion of the costs of debt…than is currently the case." By that standard, it is already well on its way to being one of the most influential AEA Presidential addresses since Milton Friedman's in December 1967 (Hall and Sargent (2017)). It is widely cited in the polity and media as a

justification for substantial debt increases to finance more spending. But for serious economists, he has done us the favor of raising vital analytical and empirical issues. For that he should be lauded.

But there are serious substantive issues with Blanchard's argument that limit its applicability, including failing to account for the effect of increasing debt on interest rates and growth and the pre-existing spending, taxes, primary deficit, debt and their projected evolution; disputable readings of the data; strong assumptions and parameter values driving the results; and a political economy of deficits and debt likely to lead to far worse outcomes than the impression he imparts that large increases in debt are likely much less costly and harmful than commonly supposed. Acknowledging many uncertainties about the necessary size and timing, the evidence still suggests that large increases in the debt ratio pose many major risks: much higher taxes and lower future incomes; in the extreme, eventually inflation or other financial problems; and serious intergenerational inequity, among them.

FIGURE 1

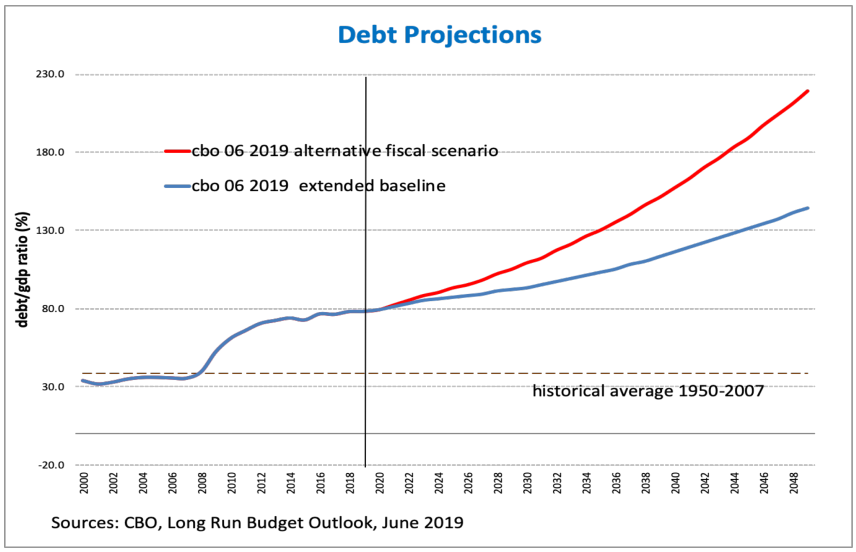

FIGURE 2

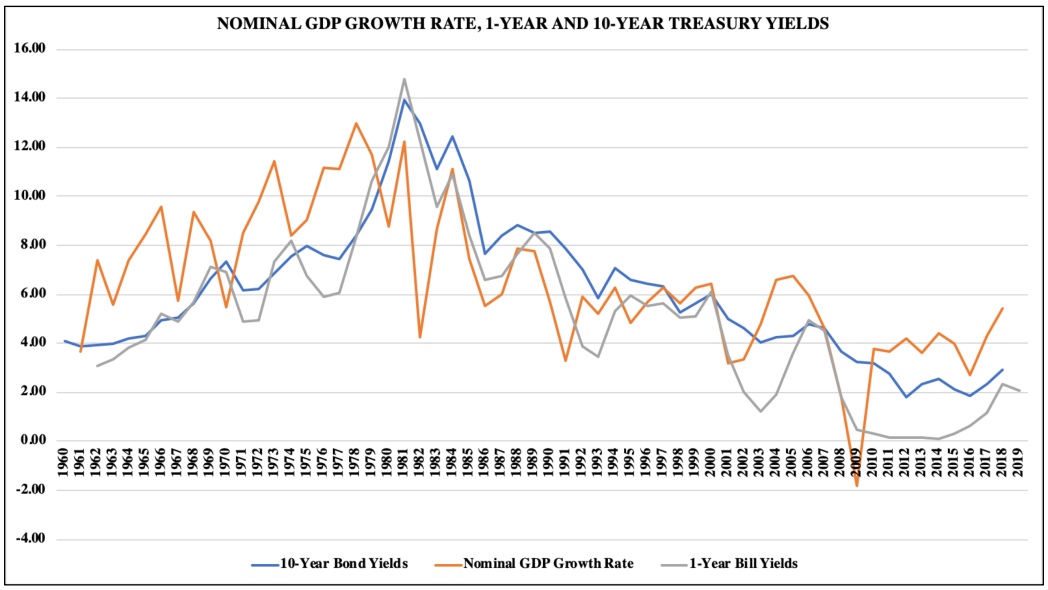

FIGURE 3

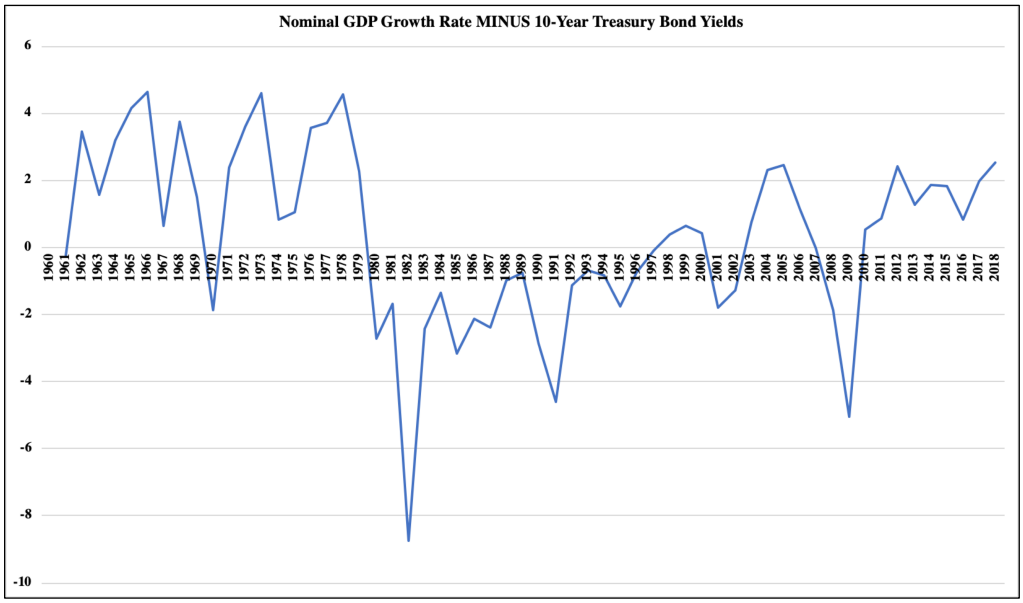

Table 1
Fiscal Variables Projected 2049 (%)

	EB	AF
d	144	219
x	-3.0	-6.1
total surplus	-8.7	-15.5
change in:		
x from 2020 to reach 2019 d	1.8	NA
x from 2030 to reach ave. d	4.4	NA
entitlements/GDP	6.1	NA

Source: Congressional Budget Office 2019 and author's calculations

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