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# Labor Market and Fiscal Policy During and After the Coronavirus

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# Labor Market and Fiscal Policy During and After the Coronavirus

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**Abstract**

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# 1 Introduction

The U.S. fiscal response to COVID-19 has been massive: As discussed in Section 2, all told the federal response amounts to $5.4 trillion, mostly in 2020 and 2021. To put this figure into perspective, it represents nearly 25% of pre-pandemic GDP (2019). This fiscal stimulus will increase government debt levels. This paper quantitatively evaluates the effects of responding to higher levels of government debt through adjustments in government spending, labor income taxation, and capital income taxation.[1]

The model builds on neoclassical foundations with a representative household that holds government debt, elastically supplies labor, and earns capital income. Much has already been written about the macroeconomic effects of the pandemic; see, in particular, the early and influential work of Eichenbaum, Rebelo, and Trabandt (2020). To more sharply focus on fiscal policy in the post-pandemic environment, the short term effects of the pandemic are attributed to changes in total factor productivity. This approach is similar to how Gregory, Menzio, and Wiczer (2020), looking at the post-pandemic recovery in frictional labor markets, model lockdowns as temporary declines in labor productivity. Government spending is valued in that the household receives utility directly from government spending, or public goods.[2]

In most macroeconomic models, there is but one real interest rate, and the discount factor is chosen as an average of the real risk-free return, and the return on capital. In the current context, this practice implies that the return on government debt is much higher than is currently observed, driving up the government's debt servicing burden. The end result is that interest payments on government debt are large, increasing the benefits of debt reduction. By the same token, standard practice leads to a return to capital that lower than observed, distorting the sizes of both the capital stock and the capital income tax base.

With the above in mind, two features are introduced to the model, one to push the real

[1] Explicit default is not considered. Given Federal Reserve independence, inflationary financing is also ruled out. Relatively little tax revenue is raised from sales taxes, and none at the federal level.

[2] An alternative means of giving value to government spending is giving it a productive role.

bond rate below that implied by the discount factor, the other to drive the return to capital above. To start, since different government policies are evaluated based on calculations of households' lifetime utility, the discount factor continues to be calibrated to the average of the observed risk-free rate and the return to capital. The first feature introduced is a utility yield to holding government bonds. This utility yield may reflect households' desire for liquidity, although, like money-in-the-utility function, the microfoundations are left unspecified. This utility yield of bonds raises the effective return above the pecuniary return. The second feature is an investment adjustment cost. As in Kaplan, Moll, and Violante (2020), the investment adjustment cost is not measured in output or the return to capital. Consequently, the measured return to capital is below its 'true' return.

During and immediately after the pandemic, government fiscal policy is given by Congressional Budget Office (CBO) estimates, summarized in Section 2. The model predicts that government debt will rise from 105% of output in 2019 to around 140% at the end of 2024. Starting in 2025 – not too long after the pandemic – the government chooses a path for one of its policy instruments (government spending, labor income taxes, capital income taxes) to satisfy a simple feedback rule calling for larger budget surpluses when government debt is above target as in Auray, Eyquem, and Gomme (2019). This fiscal feedback rule calls for substantial fiscal austerity; for example, cuts that put goverment spending more than 14% below trend. Such fiscal austerity results in output running well below trend for many years. In fact, the *anticipation* of future austerity drives output below trend in the years leading up to the onset of debt reduction measures.

In terms of household welfare, capital income tax-based austerity is the least preferred option for two reasons. First, the capital income tax base is small not only because capital's share of income is smaller than that of labor, but also because of the tax deductibility of depreciation. Second, anticipating that the government will raise the capital income tax rate, households reduce their capital accumulation since the future return to capital will be lower. This second observation reflects the well-known finding in the public finance literature that

factors of production that are elastically supplied should not be taxed too heavily (Ramsey, 1927). The small capital income tax base necessitates a hefty increase in the tax rate while the effects on capital investment lead to substantial macroeconomic disruptions which are very costly.

The choice between cutting government spending and boosting the labor income tax rate depends on the elasticity of substitution between private and public goods in utility. When it is difficult for households to substitute between these two good – as under the baseline calibration – households prefer austerity via labor income taxation in order to avoid a drop in the provision of public goods. When private and public goods are very substitutible, the distortions of labor income taxation are more important since households can easily substitute into private consumption goods in the face of a contraction in public goods.

What if fiscal austerity is delayed until, say, 2029? Interest payments on debt lead to a higher debt-output ratio, necessitating greater austerity when the time comes. Nevertheless, delaying austerity is welfare improving under either government spending or labor income taxation: For these policy instruments, the magnitude of macroeconomic disturbances do not depend too much on when auterity starts, and discounting implies benefits to delay. On the other hand, waiting to implement capital income tax hikes gives households longer to decumulate capital, and the delayed effects of austerity lower household welfare.

Given the deletrious effects of fiscal austerity, perhaps the government should simply accommodate the higher debt. Doing so nonetheless requires fiscal austerity since the government will have higher debt servicing costs (the interest payments on the larger stock of debt). In fact, in this case the initial government spending cut is 3/4 of that called for when the government seeks to eventually return debt to its pre-pandemic level of 105% of output. This scenario requires either permanent government spending cuts, or permanent tax hikes. Despite these long run effects, a higher debt target improves household welfare.

The global pandemic has launched a tsunami of economic research, and any attempt to summarize this literature would be inadequate and incomplete. In the macroeconomics

literature, the interested reader is pointed to the papers building on Eichenbaum, Rebelo, and Trabandt (2020) who set the standard for integrating epidemiology and macroeconomics. Key to this literature is how social and economic decisions affect the progress of the disease, and how COVID influences those decisions. As mentioned earlier, the short term effects are the pandemic are subsumed by total factor productivity.

More related is the fiscal austerity literature. Much of which focuses on sovereign debt default (for example, Bi, 2012) which probably is not relevant for the United States. More pertinent are works studying the macroeconomic effects of tax adjustments to high public debt in both open economies (Mendoza, Tesar, and Zhang, 2014; Auray, Eyquem, and Gomme, 2016) and closed (Auray, Eyquem, and Gomme, 2019).

Chief differences ...

Section 2 summarizes the U.S. federal fiscal response to COVID-19. The model is developed in Section 3 and calibrated in Section 4. Fiscal austerity results are presented and discussed in Section 5. Conclusions are drawn in Section 6.

## 2 U.S. Fiscal Policy

As of May 2021, the U.S. fiscal policy response to the global pandemic has taken the form of six pieces of federal legislation:

1. March 6, 2020: H.R. 6074, Coronavirus Preparedness and Response Supplemental Appropriations Act, 2020

2. March 18, 2020: H.R. 6201, Families First Coronavirus Response Act

3. March 27, 2020: H.R. 748, Coronavirus Aid, Relief and Emergency Security (CARES) Act

4. April 24, 2020: H.R. 266, Paycheck Protection Program and Health Care Enhancement Act

5. December 27, 2020: H.R. 133, Coronavirus Response and Supplemental Appropriations Act, 2021

6. March 11, 2021: H.R. 1319, American Rescue Plan Act of 2021

The CBO provides cost estimates for each of these Acts over a ten year horizon. To more easily summarize these costs, I have categorized each item in the cost estimates as one of: government spending; unemployment compensation; transfers; labor income; and capital income. Appendix A details how each item was categorized. For the most part, this categorization is straightforward, although a careful reading of the documents accompanying the cost estimates, or even the actual legislation, were necessary. One item that deserves note is the treatment of deferring employer contributions for payroll taxes. Since these payments are deferred, I chose to treat them as akin to loans made to firms in 2020 and 2021 with repayment in 2022 and 2023. For this reason, these deferred taxes are unallocated, in the same way that the loans under the Payroll Paycheck Protection program are not classified (although associated expenses are).[3]

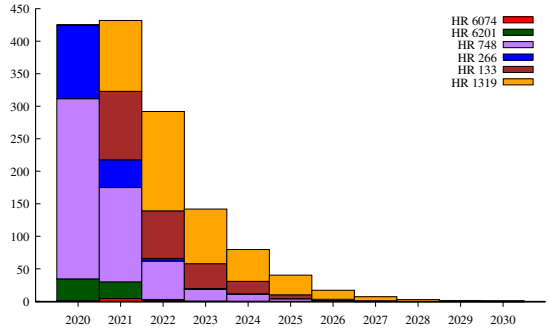
Figure 1 shows that the U.S. fiscal policy response to the pandemic was most active in 2020 and 2021. At this vantage point, this observation seems quite natural since the U.S. is on track to vaccinate all who are willing to be vaccinated by mid-2021. That said, transfers are still projected to be large in 2022, as is government spending. Overall, the fiscal response to the coronavirus are over by around 2025.

Summing over the entire 2020-2030 horizon, Figure 1(f) shows that transfers are the largest single component of the fiscal response, followed by government spending and payments to capital. The flows going to capital can be attributed to the subsidies and loans forgiven associated with the Payroll Protection Program (and its continuation in subsequent Acts). By historic standards, the flows to labor income and the unemployed may be large, but compared to the other categories of fiscal policy they appear quite modest.

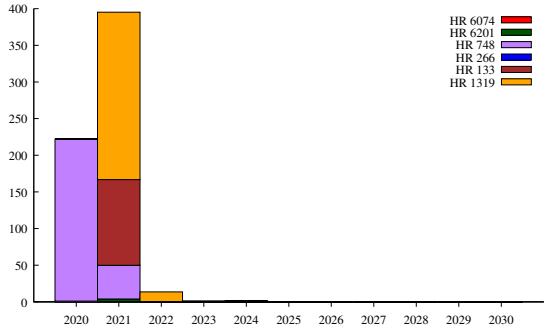
[3]The Payroll Paycheck Protection program included provisions to forgive loans provided firms met certain conditions. In this case, the loan would be treated as a transfer to firm owners. Details like this are left to the CBO to sort out.

**Figure 1:** U.S. Fiscal Policy Response to Coronavirus

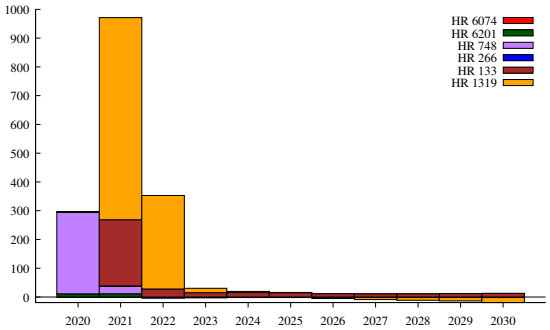
**(a)** Spending



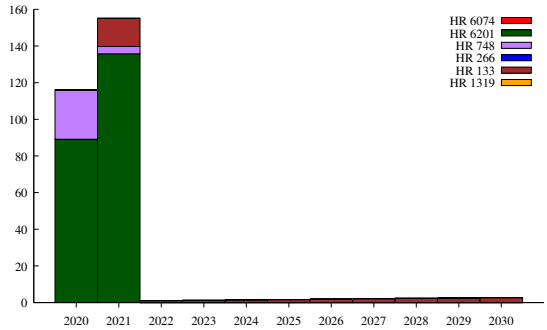

**(b)** Unemployment (UI)



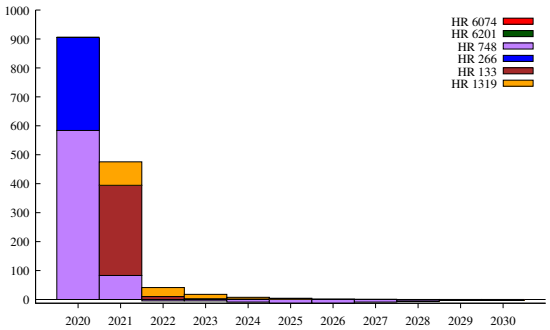

**(c)** Transfers



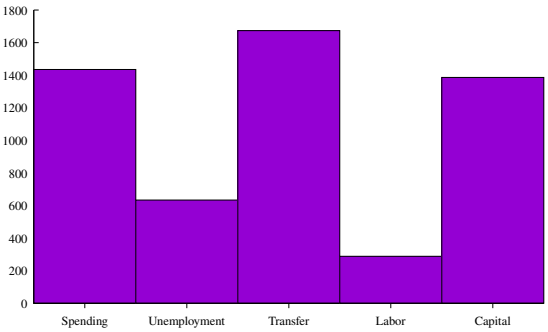

**(d)** Labor Income




**(e)** Capital Capital




**(f)** Overall



It is helpful to put some of these numbers into perspective. Payments to owners of capital in fiscal year (FY) 2020 were $905.3 billion;[4] my updating of calculations in Gomme, Ravikumar, and Rupert (2011) place total capital income taxes paid in 2019 at $700 billion. In other words, pandemic aid offered to capital was nearly 130% of taxes paid in 2019; for 2021, the figure is 70%. In contrast, in 2020, labor income received 3.5% of the taxes it paid in 2019, and 4.4% in 2021.

Alternatively, the fiscal stimulus can be expressed relative to 2019 GDP. Pandemic government spending in 2020 amounted to 2.0% of 2019 GDP while payments to capital income constituted 4.2%. By way of comparison, unemployment compensation amounted to 1.0% of GDP, transfers 1.4%, and labor income received 0.5%. These percentages understate the size of the pandemic relief since these expenditures occurred in the second half of FY 2020. For 2021, the pandemic-induced increase in government spending is 5.0% of 2019 GDP; the next largest component is transfers at 4.7%. Summing the figures, pandemic relief in 2020 amounted to 9.0% of 2019 GDP, and 14.1% in 2021. By almost any measure, pandemic-related fiscal response was huge. All told, the stimulus adds up to $5.4 trillion, or 25% of 2019 GDP.

# 3 Economic Environment

The representative household receives utility from private consumption good, $c_t$, public goods, $g_t$, and holding government bonds, $d_t$, and disutility from working, $h_t$. Its lifetime utility is

$$\sum_{t=0}^{\infty} \beta^t U(c_t, g_t, d_t, h_t), \quad 0 < \beta < 1. \tag{1}$$

As discussed in the introduction, bonds-in-the-utility function is introduced to deliver a return on government debt, $R_t^d$, that reflects the low returns typically paid on government debt.

[4] Fiscal year 2020 ended September 30, 2020.

The household's date $t$ budget constraint is

$$c_t + x_t + d_{t+1} + T_t = (1-\tau_t^h)w_t h_t + (1-\tau_t^k)r_t k_t + \tau_t^k \delta k_t + R_{t-1}^d d_t + \pi_t. \tag{2}$$

The first term on the right-hand side is after-tax labor income: the tax rate is $\tau_t^h$, and $w_t$ is the real wage. After-tax capital income is the second term: $\tau_t^k$ is the capital income tax rate, and $r_t$ the real rental rate. The next term is the capital consumption allowance which reflects the tax deductibility of depreciation; $\delta$ is the depreciation rate. The final two terms on the right-hand side are principal plus interest on government debt, and profit income. On the left-hand side of (2), the household uses its resources to buy private consumption goods, invest in new capital, purchase newly issued government debt, and pay a lump-sum tax. The law of motion for capital is

$$k_{t+1} = (1-\delta)k_t + x_t - \varphi(x_t) \tag{3}$$

where $\varphi(x_t)$ is a (weakly) convex investment adjustment cost function: $\varphi' > 0$, $\phi'' \geq 0$.

The household's Euler equations are:

$$(1-\tau_t^h)w_t U_1(c_t, g_t, d_t, h_t) + U_4(c_t, g_t, d_t, h_t) = 0 \tag{4}$$

$$\frac{U_1(c_t, g_t, d_t, h_t)}{1-\varphi'(x_t)} = \beta U_1(c_{t+1}, g_{t+1}, d_{t+1}, h_{t+1}) \left[1 - \tau_{t+1}^k r_{t+1} + \tau_{t+1}^k \delta + \frac{1-\delta}{1-\varphi'(x_{t+1})}\right] \tag{5}$$

$$U_1(c_t, g_t, d_t, h_t) = \beta \left[U_1(c_{t+1}, g_{t+1}, d_{t+1}, h_{t+1}) R_t^d + U_3(c_{t+1}, g_{t+1}, d_{t+1}, h_{t+1})\right] \tag{6}$$

(4) is a typical labor supply condition while (5) and (6) govern capital and bond accumulation, respectively. From (5) and (6), the return arbitrage condition for this economy is

$$(1-\varphi'(x_t)) \left[(1-\tau_{t+1}^k)r_{t+1} + \tau_{t+1}^k \delta + \frac{1-\delta}{1-\varphi'(x_{t+1})}\right] = R_t^d + \frac{U_2(c_{t+1}, d_{t+1}, h_{t+1})}{U_1(c_{t+1}, d_{t+1}, h_{t+1})}. \tag{7}$$

On the right-hand side of (7), the marginal rate of substitution term raises the effective return on bonds above their pecuniary return, $R_t^d$; meanwhile, on the left-hand side, investment adjustment costs reduce the overall return to capital, thereby pushing up the measured

return, $R^k_{t+1} = 1 + (1 - \tau^k_{t+1})(r_{t+1} - \delta)$. This latter mechanism is similarly used by Kaplan, Moll, and Violante (2020) to drive a wedge between the return to capital and bond yields.

The representative firm solves a sequence of static profit maximization problems,

$$\pi_t = y_t - r_t k_t - w_t h_t \quad \text{where} \quad y_t = F(k_t, h_t; z_t); \tag{8}$$

$z_t$ is productivity. The first-order conditions are

$$r_t = F_1(k_t, h_t; z_t) \quad w_t = F_2(k_t, h_t; z_t). \tag{9}$$

Finally, on the government side, debt evolves according to

$$d_{t+1} = R^d_{t-1} d_t + \textsc{Def}_t \tag{10}$$

where the primary deficit is

$$\textsc{Def}_t = g_t - \tau^h_t w_t h_t - \tau^k_t (r_t - \delta) k_t - T_t. \tag{11}$$

During and for a few years after the pandemic, fiscal policy variables are taken as given. Once the coronavirus crisis has passed, government fiscal policy is determined by a feedback rule,

$$\frac{\textsc{Def}_t}{y_t} - \frac{\textsc{Def}}{y} = -\omega \left[ \frac{d_t}{y_{t-1}} - \frac{d}{y} \right] \tag{12}$$

where $d/y$ is the long run target for the government debt-output ratio, and $\textsc{Def}/y$ is the corresponding target for the deficit-output ratio. When operational, the feedback rule prescribes smaller deficits when debt is above target; the parameter $\omega$ determines how quickly the debt-output ratio returns to target.

The definition is a competitive equilibrium is standard; goods market clearing is

$$c_t + g_t + x_t = F(k_t, h_t; z_t). \tag{13}$$

# 4 Calibration

The utility function is

$$U(c,d,h) = \ln\left(\left[\vartheta c^{\frac{\zeta-1}{\zeta}} + (1-\vartheta)g^{\frac{\zeta-1}{\zeta}}\right]^{\frac{\zeta}{\zeta-1}}\right) + \xi\ln(d) - h^{1+1/\theta}. \tag{14}$$

There are several considerations going into the choices reflected in the utility function. First, so that the labor supply elasticity can be set to a value within the range estimated in the microeconomic literature, preferences exhibit a constant Frisch labor supply elasticity, given by $\theta$. Given this choice, the logarithmic forms for the other terms is the most straightforward way to write down constant-Frisch-labor-supply-elasticity preferences. Second, the elasticity of substitution between private and public goods is important when the government is considering debt reduction through government spending cuts. The baseline sets the elasticity of substitution between private and public goods to 2/3 which means that the two goods are less substitutable than Cobb-Douglas. Results are presented below for the case in which the elasticity is 2 in which case private and public goods are more easily substituted. Finally, the weight on private goods, $\vartheta$, is set such that, in steady state, the marginal utilities of private and public goods are equalized. An implication of setting the value of $\vartheta$ in this way is that the steady state allocation between private and public goods is efficient.

As is typical in the macroeconomics literature, production is Cobb-Douglas:

$$F(k,h;z) = zk^{\alpha}h^{1-\alpha}. \tag{15}$$

Investment adjustment costs are given by

$$\varphi(x_t) = \psi x_t. \tag{16}$$

While quadratic adjustment costs are more common in the macroeconomics and international finance literatures, the purpose of introducing adjustment costs is not to dampen investment fluctuations, but to increase the measured return to capital. The adjustment costs need to be nearly linear in investment, else the volatility of the bond rate is implausibly large.

**Table 1:** Calibration Targets

| Target | Value | Source |
|---|---|---|
| Capital share | 30% | Gomme and Rupert (2007), updated |
| Depreciation | 6.8% | Gomme and Rupert (2007), updated |
| Return to capital, 2010-19 | 7.55% | Gomme, Ravikumar, and Rupert (2011), updated |
| Return on government debt, 2010-19 | 0.85% | 10-Year Treasure Inflation-Indexed Security, FRED FII10 |
| Frisch labor supply elasticity | 0.5 | Typical labor supply estimates |
| Labor income tax, 2019 | 29.3% | Gomme and Rupert (2007), updated |
| Capital income tax, 2018 | 22.52% | Gomme and Rupert (2007), updated |
| Debt-output ratio, 2019 | 1.05 | FRED GFDEGDQ188S |
| Government share of output, 2019 | 17.49% | FRED A822RE1Q156NBEA |

FRED: Federal Reserve Economic Data, Federal Reserve Bank of St. Louis, with FRED identifier as indicated.

**Table 2:** Parameter Values

| Parameter | $\alpha$ | $\delta$ | $\psi$ | $\xi$ | $\vartheta$ | $\beta$ | $\zeta$ | $\omega$ |
|---|---|---|---|---|---|---|---|---|
| Value | 0.3 | 0.0175 | .2263 | 0.0408 | 0.8806 | 0.9898 | 0.6667 | 0.015 |

A model period is a quarter; the simulations below are insensitive to this choice. The model is calibrated to observations for the U.S. just prior to the pandemic on the assumption that the U.S. economy was near its steady state, with total factor productivity, $z$, normalized to one.[5] The calibration targets and sources are summarized in Table 1, and where applicable are expressed annually. The tax rates and labor supply elasticity have direct counterparts in the model. The discount factor, $\beta$, is set to the quarterly analogue of 0.96 which, in a more typical macroeconomic model, would deliver a steady state real interest rate of 4% per annum. The parameters $\alpha$, $\delta$, $\psi$ and $\xi$ are calibrated so that the steady state of the model matches the targets in Table 1; their values are given in Table 2. The steady state lump sum tax is set so that the government budget constraint is satisfied given the debt-output ratio and government share of output.

The value of $\omega$ in the fiscal policy feedback rule (12) determines the magnitude of the fiscal policy response to higher debt, and consequently the speed of debt reduction. To ensure that the value of $\omega$ is empirically relevant, I use the estimated value of 0.054 for the longest sample, 1916-1995, in Bohn (1998). Since a model period is a quarter while Bohn used annual data, his estimate is divided by four, giving the value $\omega = 0.0135$.

The model is solved as a two point boundary problem (Fair and Taylor, 1983); see Auray, Eyquem, and Gomme (2016) for details. One boundary is the initial pre-pandemic steady state; the other is a 'no change' condition which endogenously determines the terminal steady state. Between these two boundaries, I need to specify what happens to total factor productivity and to fiscal policy.

During 2020, model total factor productivity, $z_t$, is set so that the model's time path for

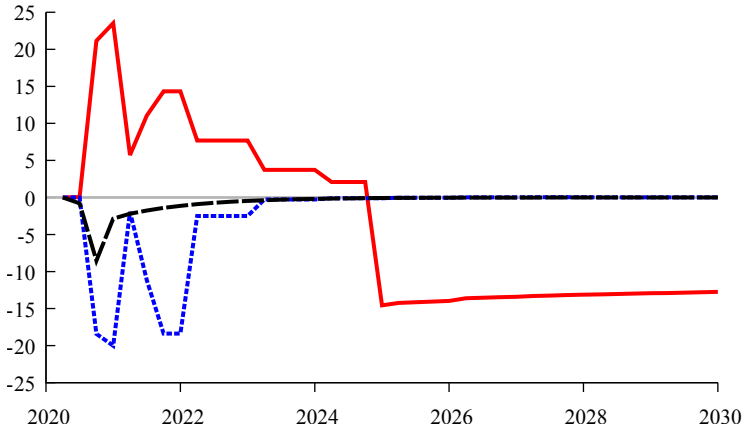
[5]For ease of presentation, the model abstracts from growth. Consequently, deviations from steady state are more properly thought of as deviations from a balanced growth path.

the logarithm of output matches the deviations from a linear trend line computed using data between 2010Q1 and 2020Q4. During 2020, total factor productivity is as much as 8.5% below trend (to match the deviation of output from trend, $-10.7\%$), although by the end of 2020, model total factor productivity is only 2.2% below trend. Starting in 2021, model total factor productivity converges to steady state according to

$$\ln z_t = \rho \ln z_{t-1}.$$

To ensure fairly rapid convergence back to steady state, the autoregressive parameter, $\rho$, is set to 0.8.[6]

**Figure 2:** Exogenous Processes




**Legend:** Solid red, government spending; dotted blue, lump-sum taxes; dashed black, total factor productivity. All processes are expressed as percentage deviations from steady state.

The evidence presented in Figure 1 on the U.S. fiscal policy response to the pandemic guides the setting of fiscal policy in the model. When legislation passed into law in the first half of a month, I assume the measures take effect in that month; otherwise, they start in the following month. The CBO's cost estimates are for government fiscal years; I apportion these equally to the remaining months of a given fiscal year. Monthly figures are, then, aggregated to obtain quarterly values. Start with government spending. Between 2020 and 2030, the

[6]The value of $\rho$ is smaller than used in business cycle analysis on the basis that the pandemic is not a 'typical' Solow residual event.

pandemic boost to government spending is expressed relative to 2019Q4 GDP which gives the increase in model government spending over the same period. Next, given the surprise nature of the changes in labor and capital income, I treat the remainder of the U.S. fiscal policy response as a lump-sum transfer to the representative household. Given the paper's focus on the eventual application of fiscal austerity, what ultimately matters is the level of government debt. Figure 2 gives a visual representation of the paths for deviations of government spending and lump-sum taxes from trend, along with total factor productivity.

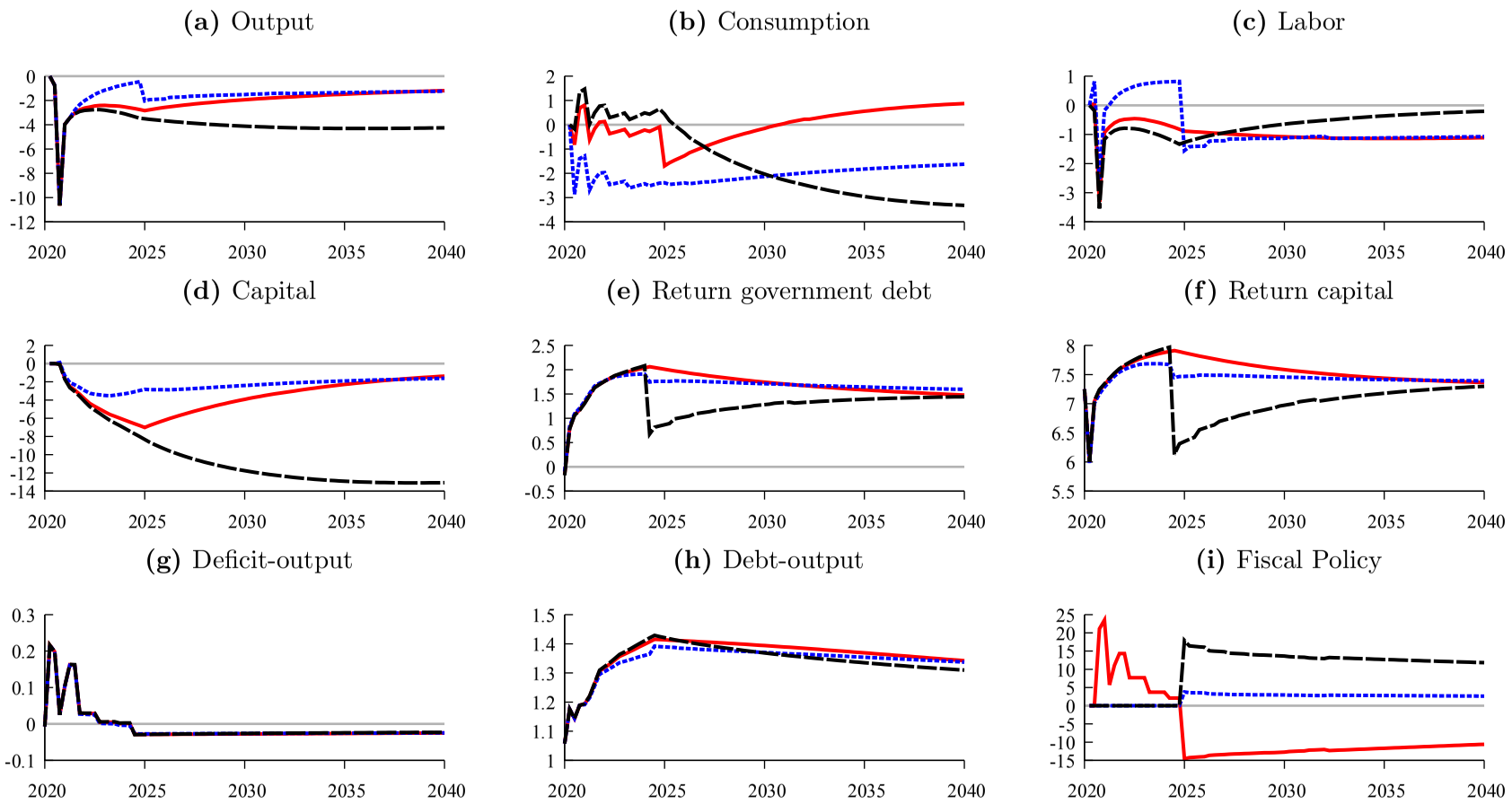
# 5 Fiscal Austerity

The choice of when to start the application of fiscal austerity is arbitrary. The various pandemic-related measures summarized in Figure 1 suggest that austerity should start no earlier than 2023. Given that the current Biden administration's mandate ends in 2024, suppose that fiscal austerity starts in 2025 at which time fiscal policy must satisfy the feedback rule, (12).

To start, suppose that the government adjusts its spending on public goods to reduce its debt. As shown by the solid red line in Figure 3(h), the model predicts an increase in debt from 105% of output to 119% at the end of 2020, a 14 percentage point (ppt) increase. Debt continues to rise, reaching 141% of output at the end of 2024. As reported in Section 2, CBO estimates of the overall pandemic stimulus totaled $5.4 trillion which, on their own, would increase the debt-output ratio by 25 ppt. The extra 11 ppt reflects a combination of lower tax receipts (due to lower capital and labor income at unchanged tax rates), and a lower level of output (which mechanically boosts the debt-output ratio). By way of comparison, the Congressional Budget Office (2021) projects a 23 ppt increase in federal government debt over 2020, after which debt is projected to rise a mere 5 ppt over the remainder of the decade.[7]

[7]Given that much of the increase in government expenditures occurs in 2021 and into 2022, it seems odd that the CBO projects no increase in government debt between 2021 and 2030. One difference is that the debt projections are not specific to the pandemic expenditures. Perhaps the CBO anticipates higher tax

**Figure 3:** Fiscal Austerity Starting 2025




**Key:** Solid red line: government spending. Dotted blue line: labor income tax rate. Dashed black line: capital income tax rate. Output, consumption, labor, capital, and government spending are expressed as percentage deviations from the pre-pandemic steady state; taxes are percentage point deviations from steady state; the rest are in levels. Returns are expressed per annum.

Given that debt stands at 141% of output at the end of 2024, the fiscal policy rule (12) calls for a swing in public spending from 2.1% above trend to 14.6% below trend starting early in 2025. Figure 3(g) shows that the government budget moves into surplus, and debt starts to decline. However, as seen in Figure 3(h), debt declines very slowly: Ten years into the fiscal austerity program, debt is still 137% of output, 32 ppt above target. Consequently, at that date, government spending remains 11.7 ppt below trend.

With government spending running above trend through to 2024, the assumed complementarity in utility between private and public goods ($\zeta = 2/3$) keeps households' consumption close to trend. As a result, government spending crowds out private investment and the capital stock falls. With less capital, the real wage declines, a repercussion of which is that the labor input remains below trend, as does output. As discussed above, the advent of fiscal austerity in 2025 brings about a sharp decline in government spending. Private consumption also falls, again due to the complementarity with public goods. Now, output is freed up for investment and the capital stock starts its return to trend.

One factor in the very slow decline in the debt-output ratio is the increase in the real return on government debt. Figure 3(e) show that this return rises to 2.1% by 2024, up from its steady state value of 0.85%. This increase in the return on debt reflects the role of bonds-in-the-utility function: The run up in government debt reduces the marginal utility of holding debt; as a result, the spread between the returns to capital and bonds narrows. To the extent that the utility yield from bonds reflects a taste for liquidity, the increase in the bond rate accompanying higher debt levels reflects the abundance of liquidity. While there is no default in the model, this rise in the bond rate provides some idea of the likely effects of a higher default premium.

revenues over these years than is implied by my model.

## 5.1 Labor Income tax

Rather than cutting government spending, suppose that the government instead uses the labor income tax to satisfy the feedback rule (12). This scenario, given by the dotted blue lines in Figure 3, leads to a slightly smaller level of debt at the end of 2024 (136% of output versus 141% for the baseline). The labor income tax rate increases by a modest 3.8 ppt.

The macroeconomic effects of labor income taxation operate chiefly through the labor supply decision as reflected by the Euler equation (4). Anticipating an increase in the tax on labor income, households choose to work more prior to the tax increase when their after-tax wage is relatively high. The higher disutility of work is, then, associated with a reduction in household consumption that pushes up the marginal utility of consumption so that (4) is satisfied. This decrease in private consumption leads to less crowding out of investment, and so a higher capital stock. Once the tax increase takes effect, households sharply reduce their hours, from 0.8% above trend to 3.0% below. Output correspondingly falls from 0.5% below trend to 2.0% below.

As with government spending, this labor income tax scenario reduces government debt only very gradually. Indeed, a decade after the start of fiscal austerity, the debt-output ratio has only fallen 1 ppt. Nonetheless, the labor income tax rate has eased back to 2.8 ppt above its pre-pandemic value.

Alternative government policies are evaluated via the usual Hicksian equivalent payment. Specifically, compute the constant fraction, $\mu$, of private consumption that can be taken away from the representative household under an alternative policy (in this case, labor income taxation) that leaves the household as well off as the baseline (government spending),

$$\sum_{t=0}^{\infty} \beta^t U\left((1-\mu)c_t^a, g_t^a, d_t^a, h_t^a\right) = \sum_{t=0}^{\infty} \beta^t U(c_t^b, g_t^b, d_t^b, h_t^b) \tag{17}$$

where $a$ superscripts denote variables under the alternative policy, and $b$ superscripts under the baseline. By computing the welfare benefit relative to the baseline, the effects of the pandemic wash out in the sense that they are present under both the baseline and alternative

policies.

As recorded on line 2 of Table 3, fiscal austerity through labor income tax increases improves welfare by 0.2% of consumption relative to austerity via government spending cuts. This measured welfare benefit aggregates the utility benefits and costs of switching to labor income taxation. The costs are fewer private goods, on average more hours worked though the 2020s, and slightly lower debt. Clearly, the benefits of enjoying more public goods more than offset the costs. By this metric, labor income taxation is preferred to government spending cuts.

## 5.2 Capital Income Tax

Now, what if fiscal austerity operates exclusively through the capital income tax rate? Under this scenario (the dashed black lines in Figure 3), at the end of 2024 debt reaches 142% of output, marginally higher than the baseline. Given the relatively small size of the capital income tax base – a combination of capital's lower share of income, and tax deductibility of depreciation – in 2025 the capital income tax rises markedly, by 17.9 ppt. Once again, the leisurely progress on debt reduction keeps taxes high: By 2034, debt is still 134% of output, and the capital income tax rate is 12.7 ppt above its pre-pandemic level.

As shown in Figure 3(f), the capital income hike starting in 2025 persistently lowers the after-tax return to capital after that date. These low returns discourage capital accumulation, and it is not until 2040 that the capital stock bottoms out. Notwithstanding this lower level of investment, with output persistently so far below trend, starting in 2025 consumption slides below trend.

The welfare *cost* of capital income tax-based fiscal austerity is 0.5%, again relative to spending cuts. Under the capital income tax, consumption of public goods is higher; in the short run, so is private consumption while hours worked are lower. However, in the medium term, private consumption is substantially lower while hours are higher. It is the medium term consequences that drive the measured welfare cost.

This capital income tax scenario points to a vicious cycle: The anticipated increase in the capital income tax rate discourages capital accumulation in the years prior to fiscal austerity which pushes up the debt-output ratio (for the reasons outlined above) which necessitates yet higher capital income tax rates when fiscal austerity is ultimately applied.

## 5.3 Austerity Delayed

The motivation for choosing 2025 as the start of fiscal austerity was that it corresponds to the end of the first mandate for the Biden administration. Suppose that austerity has to wait for the end of another presidential administration, starting instead in 2029. A summary of the key effects of delay are given in rows 4–6 of Table 3; full time paths can be found in Figure B.1. Waiting increases the debt-output ratio just prior to the application of fiscal austerity. The fall out from delay are larger spending cuts or tax increases that magnify the macroeconomic ramification.

Despite the larger macroeconomic consequences, delayed austerity can be welfare improving: For example, under government spending cuts, the welfare benefit of waiting is 0.06% of consumption relative to starting austerity in 2025. Similarly, for labor income tax hikes, delaying austerity increases welfare. For these policy instruments, the effects of delaying austerity are not much affected by the delay, and discounting implies that pushing the pain of austerity into the future is welfare enhancing. On the other hand, delaying capital income tax-based fiscal austerity reduces welfare. Recall that such austerity pushes down the after-tax return to capital. Part of the reason why delaying such austerity depresses welfare is that households have a longer period of time to decumulate capital, thereby amplifying the macroeconomic aftereffects.

## 5.4 Higher Bond Rates

The current environment with low real government bond yields implies low debt servicing costs of higher debt. Suppose that these favorable conditions cease to hold, and there

**Table 3:** Fiscal Austerity Scenarios

| | Scenario | Debt-output | Fiscal Response | Output | Consumption | Hours | Welfare Benefit |
|---|---|---|---|---|---|---|---|
| *Start 2025* | | | | | | | |
| 1. | Public goods | 1.41 | −14.56 | −2.84 | −1.70 | −0.89 | 0.00 |
| 2. | Labor | 1.36 | 3.80 | −2.04 | −2.39 | −1.55 | 0.18 |
| 3. | Capital | 1.42 | 17.90 | −3.51 | 0.44 | −1.27 | −0.48 |
| *Start 2029* | | | | | | | |
| 4. | Public goods | 1.52 | −17.84 | −3.28 | −1.44 | −1.28 | 0.06 |
| 5. | Labor | 1.44 | 3.49 | −1.40 | −1.66 | −1.53 | 0.37 |
| 6. | Capital | 1.55 | 20.09 | −4.37 | 0.85 | −1.79 | −0.51 |
| *Increase bond rate* | | | | | | | |
| 7. | Public goods | 1.46 | −24.58 | −4.41 | −1.46 | −1.98 | −0.87 |
| 8. | Labor | 1.38 | 5.91 | −2.62 | −2.76 | −2.66 | −0.11 |
| 9. | Capital | 1.48 | 29.04 | −5.61 | 2.32 | −2.66 | −1.89 |
| *Higher debt-output target* | | | | | | | |
| 10. | Public goods | 1.40 | −10.87 | −2.44 | −1.66 | −0.61 | 0.29 |
| 11. | Labor | 1.37 | 3.15 | −1.83 | −2.30 | −1.20 | 0.42 |
| 12. | Capital | 1.41 | 14.60 | −3.08 | 0.06 | −0.99 | −0.29 |
| *Stronger feedback* | | | | | | | |
| 13. | Public goods | 1.43 | −27.69 | −3.88 | −2.39 | −1.61 | −0.44 |
| 14. | Labor | 1.36 | 6.60 | −2.98 | −2.72 | −3.14 | −0.33 |
| 15. | Capital | 1.44 | 31.87 | −4.65 | 1.35 | −1.99 | −0.71 |
| *Higher private-public good elasticity* | | | | | | | |
| 16. | Public goods | 1.37 | −11.92 | −1.28 | 0.50 | −0.15 | 0.00 |
| 17. | Labor | 1.36 | 3.73 | −1.90 | −2.31 | −1.81 | −0.22 |
| 18. | Capital | 1.41 | 17.72 | −3.40 | 0.85 | −1.46 | −0.92 |

**Note:** Output, consumption and hours are expressed as percentage deviations from steady state at the start of fiscal austerity. The welfare cost is computed as the constant percentage increase in consumption for a particular policy that leaves households as well off as the baseline policy (an equal increase in both tax rates).

is a permanent increase in government bond yields. This scenario is modeled by rapidly reducing the value of $\xi$, the households' preference-for-debt parameter, so that in the long term the real bond yield rises from 0.85 to 2%. While the literal interpretation of reducing the value of this parameter is a decline in the public's attitude for holding government debt, an alternative interpretation is that this scenario captures the likely effects of a change in attitudes in other countries for holding U.S. government debt. Such a change in the bond rate necessitates altering the target deficit-output ratio in the fiscal policy feedback rule (12) since, in steady state, the government's budget surplus must cover the higher interest payments on its debt.

As shown on lines 10–12 of Table 3, such an increase the long term bond rate pushes the debt-output ratio at the end of 2024 up by 2 to 6 ppt, and so requires greater fiscal austerity. However, the relatively small increase in the debt-output ratio belies the magnitude of the fiscal response. By way of example, the labor income tax rate initially rises by 5.91 ppt, not 3.8 ppt. Behind this enhanced fiscal response is the fact that higher long run bond yields raise interest payments on the debt which compels the government to run bigger budget surpluses; that is, either raise tax rates in the long run, or cut expenditures on public goods. In turn, this increased fiscal austerity is associated with substantially larger macroeconomic disruptions: Table 3 tells the tale in terms of the impact effects on output, consumption and hours while Figure B.2 gives a more complete picture.

The change in the preference-for-bonds parameter, $\xi$, will affect lifetime utility of the representative household since the household receives less utility for a given level of government debt. In order to see through this effect so as to focus more squarely on the welfare consequences of the macroeconomic effects, the welfare costs reported in Table 3 are computed using the initial value of $\xi$. The measured welfare costs of austerity are uniformly higher across all three policy instruments, with the largest change being recorded for the capital income tax. The larger welfare costs should not be too surprising in light of the greater fiscal austerity required by higher bond rates.

## 5.5 Raising the Debt Target

Thus far, the model predicts that fiscal austerity will require sizable tax rate increases that are economically very disruptive. Perhaps the government simply accepts a larger level of debt. Specifically, suppose that the government sets its debt-output target to the actual debt-output ratio late in 2024, and makes an appropriate change to its deficit-output target as well.

Due to the effects of anticipations in determining the exact conditions in late 2024, the debt-output ratios at that time differ slightly from those obtained when the debt-output target remains 1.05. Despite accommodating the higher level of debt, substantial fiscal austerity needs to be applied. For example, government spending must initially be cut to 10.9% below trend; under the baseline, the cut was to 14.6% below trend. The smaller fiscal response associated with accommodating higher debt leads to diminished short term macroeconomic effects. However, in the longer term, either taxes must rise, or government spending fall due to the need to increase government budget surpluses owing to higher long term debt servicing costs. First, higher debt in and of itself pushes up debt servicing costs. Second, higher debt reduces households' marginal utility of debt, resulting in a long term increase in the bond rate (from 0.85% to 1.6%), and so interest payments on debt. In the very long run, either government spending is permanently 10.2% below trend, the labor income tax rate is 2.2 ppt higher, or the capital income tax rate is 11.5% higher.

The welfare implications of accommodating higher debt trade off less severe macroeconomic disruptions in the short term against fiscal policy changes that reduce household utility in the long term. Discounting gives larger weight to the short run consequences, and for a given policy instrument, accepting a higher level of debt raises welfare. For instance, the welfare cost of labor income tax-based austerity rises from 0.2% to 0.4% of consumption.

## 5.6 Stronger Feedback

An important determinant of how long it takes to reduce debt is the feedback parameter $\omega$ in the fiscal policy rule (12). Recall from Section 4 that the value for $\omega$ was taken from empirical results in Bohn (1998). Indeed, the value used is the largest among Bohn's estimates. The effects of doubling the value of $\omega$ are summarized on lines 13–15 and Figure B.4. This change nearly doubles the magnitude of the initial changes in the policy instruments, and the short term macroeconomic effects are commensurately larger. Of course, debt declines more precipitously; for example, for labor income taxes, debt falls to 119% of output by 2034 compared to 135% for the calibrated value of $\omega$. For each policy instrument, increasing the feedback parameter boosts the welfare cost of austerity.

## 5.7 The Elasticity of Substitution between Private and Public Goods

The elasticity of substitution between private and public goods, $\zeta$, crucially determines how easily households can substitute between private and public goods. For the baseline, $\zeta$ was set to 2/3; here, its value is 2.

Start by considering government spending as the policy instrument. With households finding private and public consumption goods better substitutes, the period of big government spending, 2020-24, is now associated with less private consumption. As a result, there is less crowding out of private investment, and so a higher capital stock. Debt at the end of 2024 now stands at 137% of output; previously, it was 141%. The large public spending cuts starting in 2025 are met with increases in private consumption, not reductions. With a higher capital stock, the real wage is close to trend and so hours worked are much closer to trend.

Next, fiscal austerity through the labor income tax rate. There is little change in the debt-output ratio relative to the baseline calibration. The initial increase in the labor income

tax rate is, nonetheless, a bit smaller (3.7 ppt, down form 3.8 ppt), and the macroeconomic effects are similarly smaller. Yet, switching from government spending-based austerity to labor income tax-based generates a welfare loss of 0.2%; previously, such a switch yielded a welfare *benefit* of 0.2%. To understand the difference in these welfare results, notice that spending-based austerity requires accepting a sizable drop in the provision of public goods while austerity through labor income tax hikes is accompanied by larger labor supply distortions. The desirability of one policy instrument over another amounts to the sizes of these costs. When private and public goods are easily substituted ($\zeta = 2$), the cost to households of reduced public spending is low which favors spending-based austerity.

The story is much the same for capital income tax-based austerity: The 2024 debt-output ratio is marginally smaller, and the capital income tax increase slightly smaller. The welfare cost of switching from government spending to capital income tax-based austerity rises from 0.5% ($\zeta = 2/3$) to 0.9% of consumption ($\zeta = 2$). Once again, the welfare cost calculus evaluates the loss in public goods against larger tax distortions. Given the similarity in the initial capital income tax hike, the tax distortions are quite similar across the two values of $\zeta$; when public and private goods better substitutes in utility, the cost of foregone public goods is lower and the household finds the distortions associated with capital income taxation more onerous.

## 5.8 Discussion

Certainly since the Lucas critique it has been well known that expectations over future government policy matter. The results show that fiscal austerity along with an expectation of higher labor income taxes alone leads to better outcomes: macroeconomic disruptions are smaller and welfare is higher. An unexpected switch from labor income to capital income taxation is arguably best, although it is not clear how the government can credibly or consistently implement such a policy.

Permanently accommodating the higher level of debt accumulated through to the end of

2024 is, according to the model, welfare improving relative to fiscal austerity (debt reduction). Some portion of the welfare gains can be attributed to utility gains associated with bonds-in-the-utility function, a feature introduced so that bond returns in the model are as low as seen in the U.S. data. To the extent that this feature reflects a legitimate economic force like a "preference of liquidity," including this utility yield is appropriate. Certainly, it would be difficult for central banks to conduct monetary policy (open market operations) absent government debt.

Ramsey literature

1. Sharp increase in capital income tax rate; short lived; surprise (like lump-sum tax)
2. Here, capital income tax rate is high for a considerable period of time
3. Long time to return to **trend**

# 6 Conclusion

One of the consequences of COVID-19 has been an expansion in fiscal outlays that is unprecedented outside war time. As documented in Section 2, the overall fiscal expansion adds up to $5.4 trillion (equivalent to 25% of U.S. GDP for 2019) over a period of two or three years, a quarter of which is government spending. According to my model, this fiscal expansion will increase government debt from 105% of output to around 140%. Fiscal austerity starting in the mid-2020s, with the goal of restoring the debt-output ratio to its pre-pandemic level, will require a combination of large government spending cuts and/or sizable tax increases. Model results indicate that fiscal austerity is generally best applied through the labor income tax; there are severe deleterious effects of capital income taxation both at the time of the tax increases take place, and in anticipation of these tax increases. The effect of expected reductions in the after-tax return to capital manifest themselves in lower capital accumulation in the years leading up to austerity applied through capital income taxes.

It is important to understand the model findings against the use of capital income taxes for what they are: cautioning against taxation of accumulated assets that are elastically supplied in all but the very short term. The case against raising capital income tax rates is *not* a case against progressive income taxation. Indeed, since the model features a representative agent, it is entirely silent on distributional aspects of taxation.

Restricting attention to either spending cuts or labor income tax hikes, model results indicate that delaying fiscal austerity enhances welfare. While delay leads to higher debt levels, and so greater austerity when the time comes, the difference in macroeconomic outcomes are relatively insensitive to the deal. The upshot is that the additional discounting associated with delay sways the case in favor of waiting, at least a few years. Arguably, even better is to accept permanently higher debt. On the one hand, higher debt results in permanent austerity in the long run, brought about higher debt servicing costs (the larger debt itself, and higher real bond yields), so that the government runs permanently larger budget surpluses. On the other hand, accommodating higher debt dampens the short term fiscal response thereby diminishing the near term macroeconomic disruptions. Again, due to discounting, the deleterious long term effects of higher debt end up being less important than the short run effects.

Of course, there are good reasons to reduce debt. One is the higher long run real interest rate scenarios studied above. As with the higher debt cases, ones featuring a long term rise in real bond rates require permanent fiscal austerity, again to deliver larger government budget surpluses. Faced with this risk, it may be better to reduce debt levels before real government yields rise.

Romer and Romer (2019) present a case against higher debt that goes beyond my analysis. Their case is built around maintaining "fiscal space." The idea is that high debt levels leave governments with less leeway to respond to crises. Romer and Romer present evidence that, in the face of a financial crisis, countries with lower debt-output ratios respond with much more expansionary fiscal policy, and suffer much less severe effects. Their explanation: when

government debt is high, sovereign debt yields rise to prohibitively high values, constraining countries' access to debt markets.

While the benefits of accommodating the higher level of government arising from increases in pandemic-related government outlays are modest, for the reasons stated above, there are good reasons to think that these benefits are overstated. Given a desire to reduce government debt, at the U.S. federal level the choices come down to: government spending cuts, raising labor income taxes, or booting capital income taxes. Higher capital income tax levies are not a particularly good idea: the associated tax base is relatively small, the required tax increases large, as are the associated tax distortions. The choice between reducing expenditures on public goods and labor income tax hikes comes down to the elasticity of substitution between private and public goods in utility: The model comes down on the side of government spending cuts when the two goods are easily substituted.

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# A Details of U.S. Fiscal Response

In the tables that follow, the following abbreviations indicate the classification of various government outlays:

**G:** Government spending

- Supplemental appropriations
- Medical or health care, including medicare and medicaid
- Spending

**U:** Unemployment compensation

- Anything that mentions unemployment compensation or insurance

**T:** Transfers

- Typically mentions good

**L:** Labor income

- Various credits
- Rebates
- Other tax provisions mentioning things like charitable contributions and retirement funds

**K:** Capital income

- The Paycheck Protection Program
- Items mentioning business

Primary sources for CBO estimates can be found at the following web sites.

- H.R. 6074: https://www.cbo.gov/publication/56227
- H.R. 6201: https://www.cbo.gov/publication/56316
- H.R. 748: https://www.cbo.gov/publication/56334
- H.R. 266: https://www.cbo.gov/publication/56338
- H.R. 133:
  - Divisions A through L: https://www.cbo.gov/publication/56913
  - Division M: https://www.cbo.gov/publication/56916
  - Division N: https://www.cbo.gov/publication/56961
  - Divisions O through FF: https://www.cbo.gov/publication/56962

- H.R. 1319: https://www.cbo.gov/publication/57056

The terms "Table," "Division," and "Title" refer to corresponding entries in the CBO cost estimates. For brevity, items in the CBO cost estimates with no outlay implications are omitted. Blank entries are zeros.

**Table A.1:** H.R. 6074: Coronavirus Preparedness and Response Supplemental Appropriations act, 2020 (millions of dollars)

| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
| **Table 1** | | | | | | | | | | | | |
| • Agriculture: Food and Drug Administration | G | 10 | 27 | 15 | 4 | | | | | | | |
| • Financial Services and General Government: Small Business Administration | G | 25 | 13 | −9 | −10 | | | | | | | |
| • Labor, Health and Human Services, Education: Centers for Disease Control and Prevention, Public Health And Social Services Emergency Fund, National Institutes of Health | G | 882 | 3701 | 1346 | 182 | 122 | 25 | 8 | | | | |
| • State, Foreign Operations: Department of State, U.S. Agency for International Development, Bilateral Economic Assistance | G | 124 | 419 | 348 | 204 | 70 | 36 | 15 | 6 | 2 | | |
| **Table 2** | | | | | | | | | | | | |
| • Direct Spending, Division B: Secretarial Authority to Temporarily Waive or Modify Application of Certain Medicare Requirements With Respect to Telehealth Services Furnished During Certain Emergency Periods | G | 110 | 160 | 220 | | | | | | | | |

**Table A.2:** H.R. 6201

| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Table 2:** Discretionary Spending | | | | | | | | | | | | |
| • Agriculture: Food and Nutrition Service | T | 540 | 402 | 19 | 10 | | | | | | | |
| • Defense: Military Programs | G | 33 | 39 | 6 | 1 | | | | | | | |
| • Financial Services and General Government: Internal Revenue Service | G | 8 | 7 | | | | | | | | | |
| • Interior: Indian Health Service | G | 47 | 12 | 3 | 1 | 1 | | | | | | |
| • Labor, Health and Human Services, Education: Employment and Training Administration, Public Health and Social Services Emergency Fund, Administration for Community Living | | 175 | 728 | 235 | 60 | 20 | | | | | | |
| • Of which: "Aging and Disabilities Services Programs" (e.g., home-delivered nutritional services). $250 million available until end of FY2021. | T | 46 | 189 | | | | | | | | | |
| • Remainder: Medicare and Medicaid ($1 billion) | G | 130 | 539 | 235 | 60 | 20 | | | | | | |
| • Military Construction/Veterans Affairs: Veterans health Administration | G | 40 | 20 | | | | | | | | | |
| **Table 3:** Changes in Direct Spending | | | | | | | | | | | | |
| **Division B** | | | | | | | | | | | | |
| • Title III – SNAP waivers for Work Requirements | T | 630 | 2110 | | | | | | | | | |
| • Title III – Supplemental SNAP Benefits | T | 9800 | 8700 | | | | | | | | | |
| • Division C – Paid sick leave | | | | | | | | | | | | |
| • Division D – Emergency Unemployment Insurance Stabilization and Access Act of 2020 | U | 1045 | 3905 | | | | | | | | | |
| • Division E – Emergency Paid Sick Leave Act | L | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

**Table A.2:** HR 6201 (continued)

| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| • Division F – Health provisions | | | | | | | | | | | | |
| • Health Insurance Coverage | T | 0 | 5 | 2 | | | | | | | | |
| • Medicare | G | 2750 | 3300 | 675 | | | | | | | | |
| • Medicaid and CHIP | G | 1097 | 778 | | | | | | | | | |
| • Departments of Defense and Veterans Affairs | | | | | | | | | | | | |
| • Federal Matching Assistance Percentage | G | 29182 | 20830 | | | | | | | | | |
| • Medicaid Allotment to U.S. Territories | G | 105 | 99 | | | | | | | | | |
| • Refundable Credits | L | 8667 | 1529 | | | | | | | | | |
| **Table 4:** Changes in Revenues | | | | | | | | | | | | |
| • Division D – Emergency Unemployment Insurance Stabilization and Access Act of 2020 | T | 0 | 10 | 39 | 57 | 50 | 32 | 19 | 9 | 1 | | |
| • Division F – Health provisions | | | | | | | | | | | | |
| • Health Insurance Coverage | U | | 3 | 1 | | | | | | | | |
| • Revenue Effect of Tax Credits | L | 80460 | 134199 | | | | | | | | | |

**Table A.3:** H.R. 748: CARES Act (millions of dollars)

| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Table 2:** Changes in Direct Spending | | | | | | | | | | | | |
| • Title I – Keeping American Workers Paid and Employed Act | K | 377 | 1 | | | | | | | | | |
| • Title II – Assistance for American Workers, Families, and Businesses | | | | | | | | | | | | |
| • Pandemic Unemployment Assistance | U | 30 | 5 | | | | | | | | | |
| • Emergency Increase in Unemployment Compensation Benefits | U | 175 | 1 | | | | | | | | | |
| • Pandemic Emergency Unemployment Compensation | U | 12 | 39 | | | | | | | | | |
| • Other Unemployment Compensation Provisions | U | 1 | | | | | | | | | | |
| • Recovery Rebates for Individuals | T | 139 | 12 | | | | | | | | | |
| • Employee Retention Credit | L | 2 | | | | | | | | | | |
| • Title III – Supporting America's Health Care System in the Fight Against the Coronavirus | | | | | | | | | | | | |
| • Education Provisions | G | 9 | | | | | | | | | | |
| • Increasing Medicare Telehealth Flexibilities | G | | 1 | | | | | | | | | |
| • Adjustment of Sequestration | G | 4 | 4 | | | | | | | | | |
| • Medicare Inpatient Prospective Payment System | G | 2 | | | | | | | | | | |
| • Increased Access to Postacute Care | G | 1 | 2 | 1 | | | | | | | | |
| • Department of Health and Human Services Programs | G | 2 | 4 | 1 | 1 | | | | | | | |
| • All other | G | | 1 | | | | | | | | | |
| • Title IV – Economic Stabilization and Assistance to Severely Distressed Sectors of the U.S. Economy | | | | | | | | | | | | |

**Table A.3:** HR 748 (continued)

| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| • Credit Assistance for Air Carriers and Businesses Critical to National Security | K | 2 | | | | | | | | | | |
| • Pandemic Relief for Aviation Workers | L | 22 | 2 | | | | | | | | | |
| • Title V – Coronavirus Relieve Funds | G | 150 | | | | | | | | | | |
| • Title VI – Miscellaneous Provisions (USPS) | G | 10 | | | | | | | | | | |
| **Table 3:** Changes in Revenues | | | | | | | | | | | | |
| • Title II – Assistance for American Workers, Families, and Businesses | | | | | | | | | | | | |
| • Unemployment Insurance Revenue Provisions | U | 3 | 1 | | | | | | | | | |
| • Recovery Rebates for Individuals | T | 131 | 11 | | | | | | | | | |
| • Special Rules for Use of Retirement Funds | T | | 2 | | | | | | | | | |
| • Temporary Waiver of Required Minimum Distribution | T | 11 | 1 | −1 | −1 | −1 | −1 | −1 | −1 | −1 | −1 | −1 |
| • Allowance of Partial Above-the-Line Deduction for Charitable Contributions | T | | −1 | 1 | | | | | | | | |
| • Modification of Limitations on Charitable Contributions During 2020 | T | 1 | 4 | −2 | −1 | | | | | | | |
| • Employee Retention Credit for Employers | K | 47 | 5 | | | | | | | | | |
| • Modifications for Net Operating Losses | K | 80 | 9 | −3 | −4 | −9 | −13 | −13 | −9 | −6 | −3 | −3 |
| • Modification of Limitation on Losses for Taxpayers Other Than Corporations | K | 74 | 64 | −2 | −1 | | | | | | | |
| • Modifications of Limitation on Business Interest | K | 7 | 5 | | | | | | | | | |
| • Other Tax Provisions | T | 3 | −3 | | | | | | | | | |
| • Title III – Supporting America's Health Care System in the Fight Against the Coronavirus | | | | | | | | | | | | |
| • Single-Employer-Plan Funding Rules | L | −3 | −2 | | | | | | | | | |

**Table A.3:** HR 748 (continued)

| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| • Expansion of Qualified Medical expenses | T | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| • Title IV – Economic Stabilization and Assistance to Severely Distressed Sectors of the U.S. Economy | | | | | | | | | | | | |
| • Suspension of Certain Aviation Excise Taxes | K | 3 | 1 | | | | | | | | | |
| **Table 4:** Discretionary Spending | | | | | | | | | | | | |
| • HHS Public Health and Social Services Emergency Fund | G | 24 | 60 | 30 | 6 | 4 | 2 | | | | | |
| • FEMA Disaster Relief Fund | G | 18 | 13 | 3 | 3 | 2 | 1 | 1 | 1 | | | |
| • Department of Transportation | G | 11 | 12 | 5 | 4 | 3 | | | | | | |
| • Education Stabilization Fund | G | 4 | 14 | 10 | 2 | 1 | 1 | 1 | | | | |
| • Department of Veterans Affairs | G | 6 | 7 | 5 | | | | | | | | |
| • Other | G | 36 | 27 | 4 | 2 | 1 | | | | | | |

**Table A.4:** H.R. 266: Paycheck Protection Program and Health Care Enhancement Act (billions of dollars)

| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
| **Table 1:** Changes in Direct Spending Under Division A, Small Business Programs | | | | | | | | | | | | |
| • Paycheck protection program | K | 321 | | | | | | | | | | |
| **Table 2:** Discretionary Spending Under Division B, Additional Emergency Appropriations for Coronavirus Response | | | | | | | | | | | | |
| • Labor, Health and Human Services, Education: Department of Health and Human Services (Title I) | G | 52 | 42 | 4 | 1 | 0 | | | | | | |
| • Financial Services and General Government: Small Business Administration (Title II) | G | 62 | 1 | | | | | | | | | |

**Table A.5:** H.R. 133: Coronavirus Response and Relief Supplementary Appropriations Act 2021 (millions of dollars)

| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| • Division M: Coronavirus Response and Relief Supplemental Appropriations | G | | 77786 | 58385 | 28024 | 13896 | 4540 | 1907 | 818 | | | |
| • Division N: Additional Coronavirus Response and Relief (DOUBLE COUNTED?) | | | 652956 | 16066 | 3903 | 2852 | 1131 | 102 | 108 | −39 | −60 | −45 |
| • Title I: Healthcare | G | | 4870 | 1052 | | | | | | | | |
| • Title II: Assistance to Individuals, Families and Businesses (UI, direct payments) | | | | | | | | | | | | |
| • Subtitle A: Unemployment Assistance | U | | 116961 | 314 | 683 | 975 | 249 | 1 | 3 | 5 | 6 | 6 |
| • Subtitle B: Direct Payments to Individuals | T | | 163251 | 277 | | | | | | | | |
| • Title III: Continuing the Paycheck Protection Program and Other Small Business Support | K | | 296528 | 5308 | 13 | 1 | | | | | | |
| • Title IV: Transportation (see Title IV of CARES Act) | G | | 17590 | 360 | −40 | −30 | −30 | −280 | −130 | −140 | −140 | −140 |
| • Title V: Banking ($25 billion rental assistance for very-low-income households; $12 billion support community development financial institutions; $9 billion purchases of financial instruments; $3 billion grants to financial institutions) | | | 28757 | 6800 | 898 | 288 | 123 | −15 | −6 | 0 | 1 | 1 |
| • Title V: rental assistance | T | | 14379 | 3400 | 449 | 144 | 62 | −8 | −3 | 0 | 1 | 1 |
| • Title V: financial institutions | K | | 14379 | 3400 | 449 | 144 | 62 | −8 | −3 | 0 | 1 | 1 |
| • Title VII: Nutrition and Agriculture Relief (payments to farmers; SNAP; funds to territories) | T | | 24526 | 553 | 139 | 98 | 66 | 57 | 64 | 65 | 50 | 74 |
| • Title IX: Broadband Internet Access Service (reimburse communications providers for costs) | K | | 453 | 1402 | 2210 | 1520 | 723 | 339 | 177 | 31 | 23 | 14 |

**Table A.5:** HR 133 (continued)

| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| • Division O: Extensions and Technical Corrections (Direct Spending) | G | | 165 | 137 | 61 | 34 | 16 | 7 | 7 | 7 | 7 | 70 |
| • Division Q: Financial Services Provisions | G | | | | | | | | | | | |
| • Division X: Supporting Foster Youth and Families Through the Pandemic (Direct Spending) | T | | 707 | 107 | 9 | 1 | 1 | | | | | |
| • Division Y: American Miner Benefits Improvement (Direct Spending) | G | | 11 | 26 | 43 | 56 | 69 | 83 | 91 | 94 | 97 | 100 |
| • Division Z: Energy Act of 2020 (Direct Spending) | G | | 8 | 28 | 68 | 126 | 126 | 119 | 74 | 67 | 56 | 56 |
| • Division AA: Water Resources Development Act of 2020 (Direct Spending) | G | | −220 | −125 | −108 | 7 | 76 | 75 | 75 | 75 | 75 | 75 |
| • Division BB: Private Health Insurance and Public Health Provisions (Direct Spending) | G | | 1456 | 3713 | 4547 | 2816 | 774 | −68 | −85 | −89 | −93 | −96 |
| • Division CC: Health Extenders (Direct Spending) | G | | 2002 | 3983 | 4883 | 1536 | −280 | −1512 | −2228 | −1445 | −1642 | −1306 |
| • Division EE: Taxpayer Certainty and Disaster Tax Relief Act of 2020 (total) | L | | 9480 | 632 | | | | | | | | |
| • Division FF: Other Matter | | | | | | | | | | | | |
| • Title VII: FAFSA Simplification | G | | 1531 | 5566 | 849 | 681 | 720 | 747 | 783 | 786 | 797 | 811 |
| • Title XII – Horseracing Integrity and Safety | G | | | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| • Division N: Additional Corona Virus Response and Relief | L | | 5913 | −192 | −108 | −110 | −83 | −49 | −34 | −3 | 4 | 4 |
| • Division O: Extensions and Technical Corrections | T | | 31 | 86 | 119 | 155 | 193 | 232 | 274 | 320 | 369 | 383 |
| • Division BB: Private Health Insurance and Public Health Provisions: No Surprises Act | L | | | 636 | 1322 | 1581 | 1702 | 1969 | 2164 | 2315 | 2479 | 2655 |
| • Division CC: Health Extenders: Health Offsets | L | | | | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 |

**Table A.5:** HR 133 (continued)

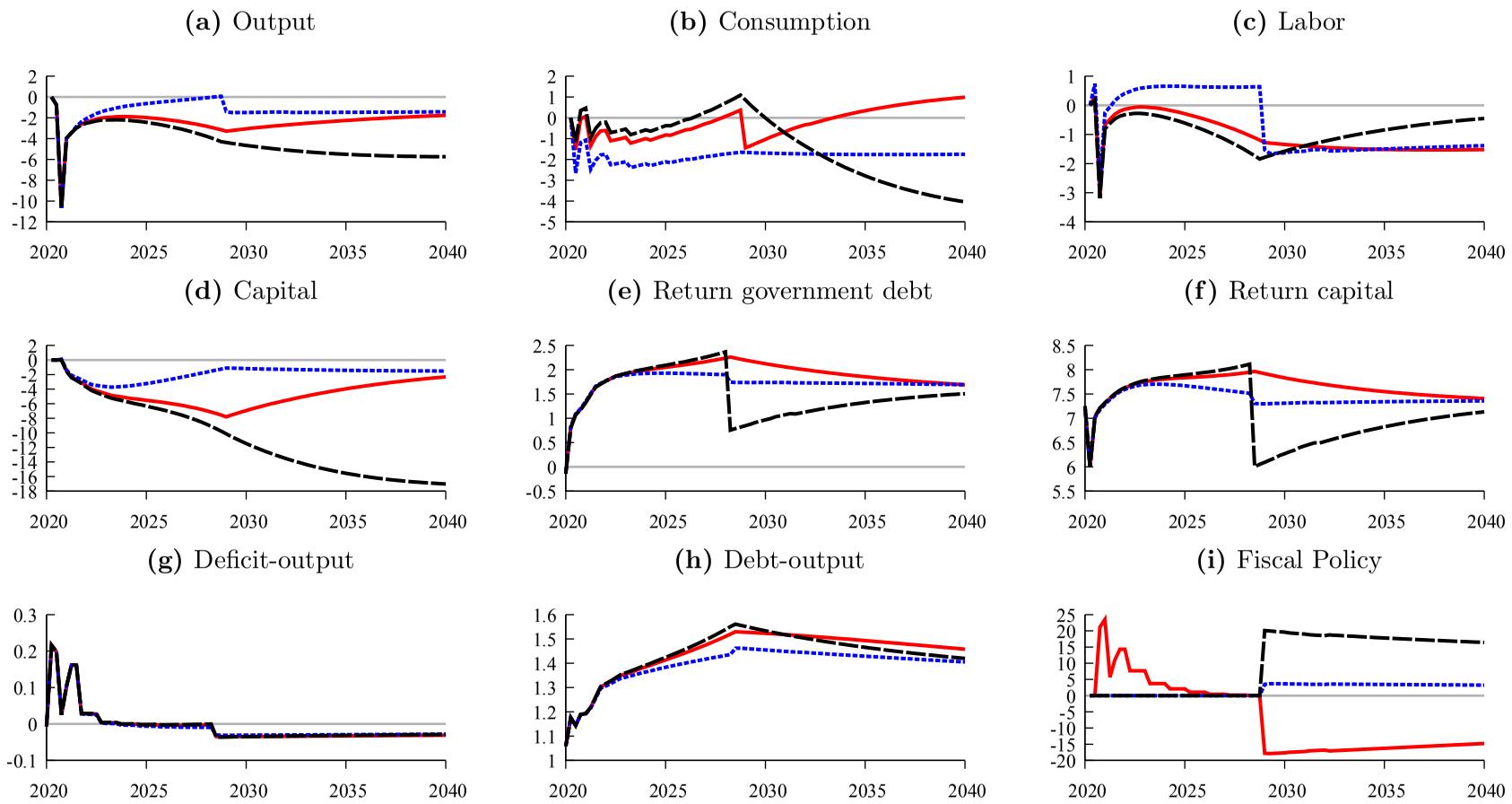
| | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| • Division EE: Taxpayer Certainty and T Disaster Tax Relief Act of 2020 | | 27463 | 23468 | 14248 | 14876 | 14867 | 10886 | 10048 | 10646 | 11619 | 12516 |

**Table A.6:** H.R. 1319: American Rescue Plan Act 2021 (billions of dollars)

| | | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Direct Spending** | | | | | | | | | | | | |
| • Title 1-Agriculture, Nutrition and Forestry | 1 | 18823 | 2595 | 937 | 160 | 33 | 32 | 32 | 33 | 33 | 33 | |
| • Title 2-Health, Education, Labor and Pensions | 1 | 40725 | 114831 | 65657 | 40564 | 25447 | 11010 | 4109 | 1635 | −17 | −19 | −19 |
| • Title 3-Banking, Housing and Urban Affairs | 5 | 32544 | 29877 | 15018 | 6105 | 3626 | 1225 | 325 | 100 | | | |
| • Title 4-Homeland Security and Governmental Affairs | 1 | 12558 | 11914 | 8693 | 5357 | 3726 | 2556 | 1705 | 1004 | 804 | | |
| • Title 5-Small Business and Entrepreneurship | 5 | 48550 | 1130 | 250 | 5 | 5 | | | | | | |
| • Title 6-Environment and Public Works | 1 | 812 | 1102 | 528 | 412 | 151 | 100 | 100 | | | | |
| • Title 7-Commerce, Science, and Transportation | 1 | 22427 | 9539 | 2780 | 886 | 64 | −172 | −73 | −89 | −100 | −110 | −229 |
| • Title 8-Veterans' Affairs | 1 | 10510 | 4288 | 1438 | 275 | 131 | 26 | | | | | |
| • Title 9-Finance | | 898024 | 292261 | 16337 | 8119 | 3143 | 2792 | 1127 | −88 | −1253 | −6933 | −2394 |
| • Unemployment | 2 | 228 | 13 | 318 | 344 | 157 | | | | | | |
| • Transfers | 3 | 669652 | 279051 | 16019 | 7775 | 2986 | 2792 | 1127 | −88 | −1253 | −6933 | −2394 |
| • Title 10-Foreign Relations | 1 | 1159 | 4196 | 2695 | 871 | 327 | 170 | 62 | 28 | 9 | 9 | |
| • Title 11-Indian Affairs | 1 | 1976 | 4348 | 1166 | 412 | 284 | 199 | 101 | 68 | 19 | 6 | |
| **Revenues** | | | | | | | | | | | | |
| • Title 2-Education and Labor | -3 | 14 | −43 | 222 | 250 | 2 | −1 | −3 | −4 | −5 | −5 | −5 |
| • Title 3-Energy and Commerce | -5 | 0 | 0 | −241 | −279 | −285 | −303 | −316 | −260 | −190 | −24 | −14 |
| • Title 9-Finance | -3 | 33 | 46 | −989 | −4 | −5 | −5 | −5 | −6 | −6 | −5 | −5 |

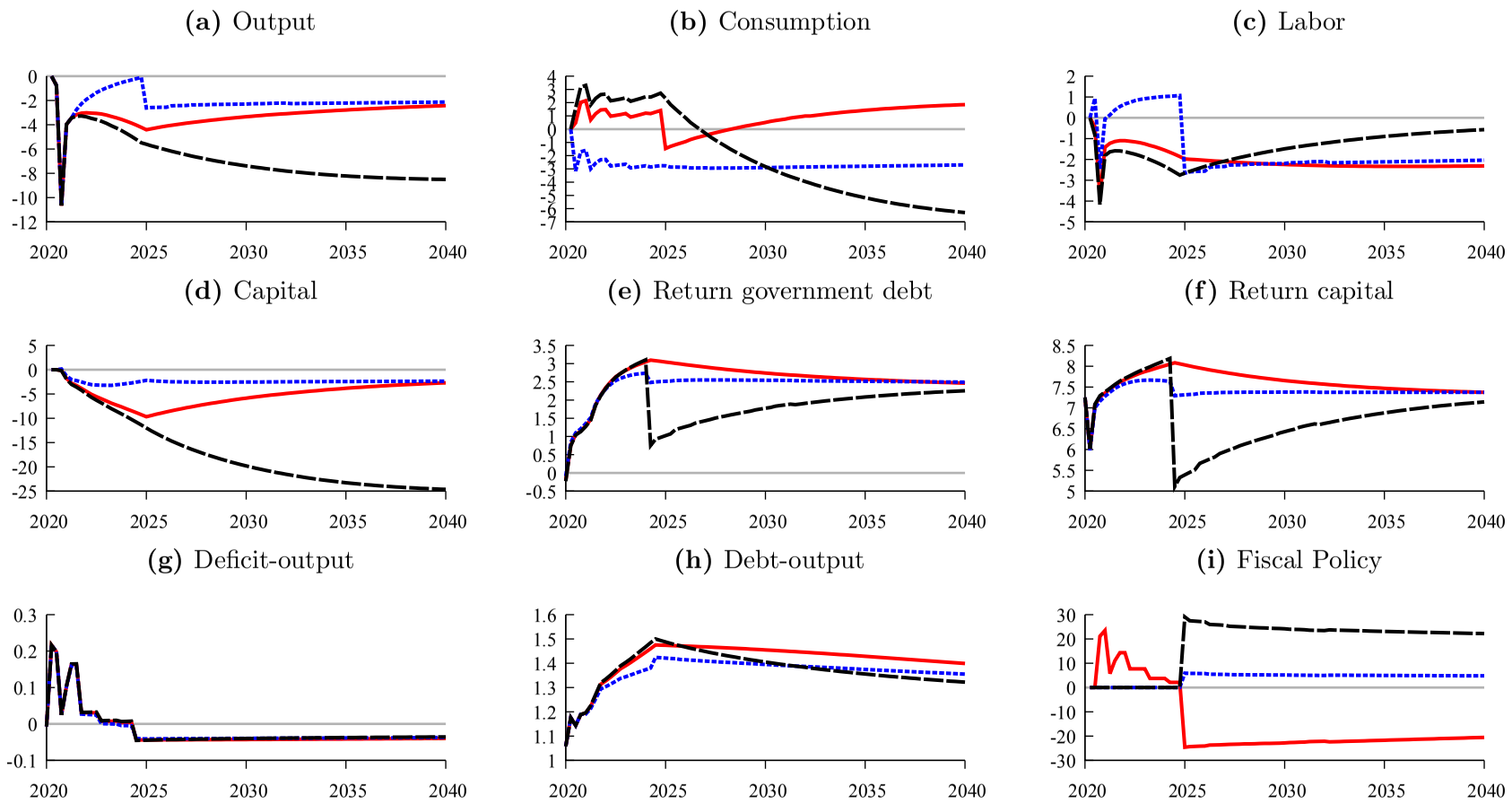
# B Figures For Online Publication

**Figure B.1:** Fiscal Austerity Starting 2029



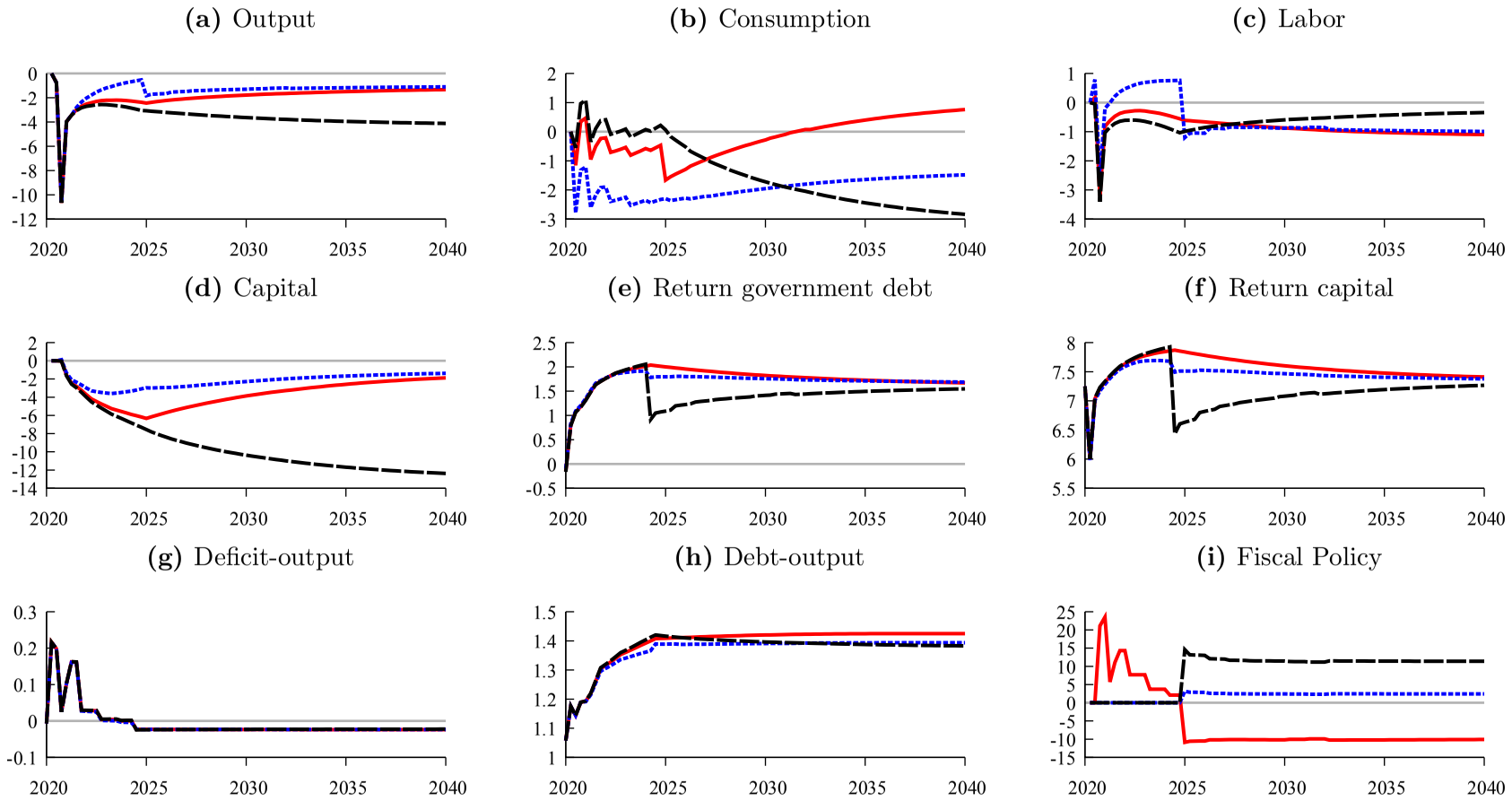

**Key:** Solid red line: government spending. Dotted blue line: labor income tax rate. Dashed black line: capital income tax rate. Output, consumption, labor, capital, and government spending are expressed as percentage deviations from the pre-pandemic steady state; taxes are percentage point deviations from steady state; the rest are in levels. Returns are expressed per annum.

**Figure B.2:** Higher bond rate



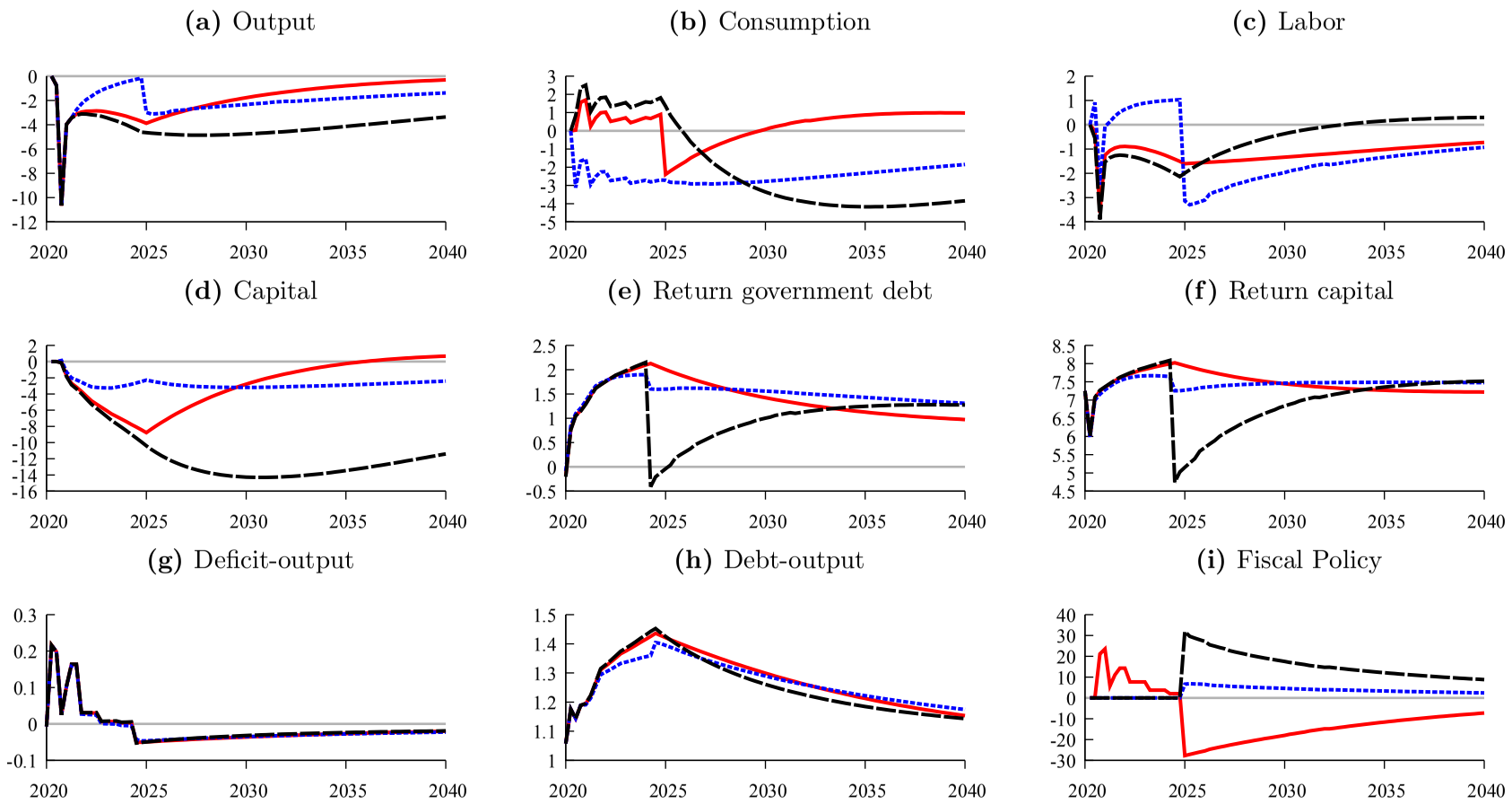

**Key:** Solid red line: government spending. Dotted blue line: labor income tax rate. Dashed black line: capital income tax rate. Output, consumption, labor, capital, and government spending are expressed as percentage deviations from the pre-pandemic steady state; taxes are percentage point deviations from steady state; the rest are in levels. Returns are expressed per annum.

**Figure B.3:** Higher debt-output target starting 2025



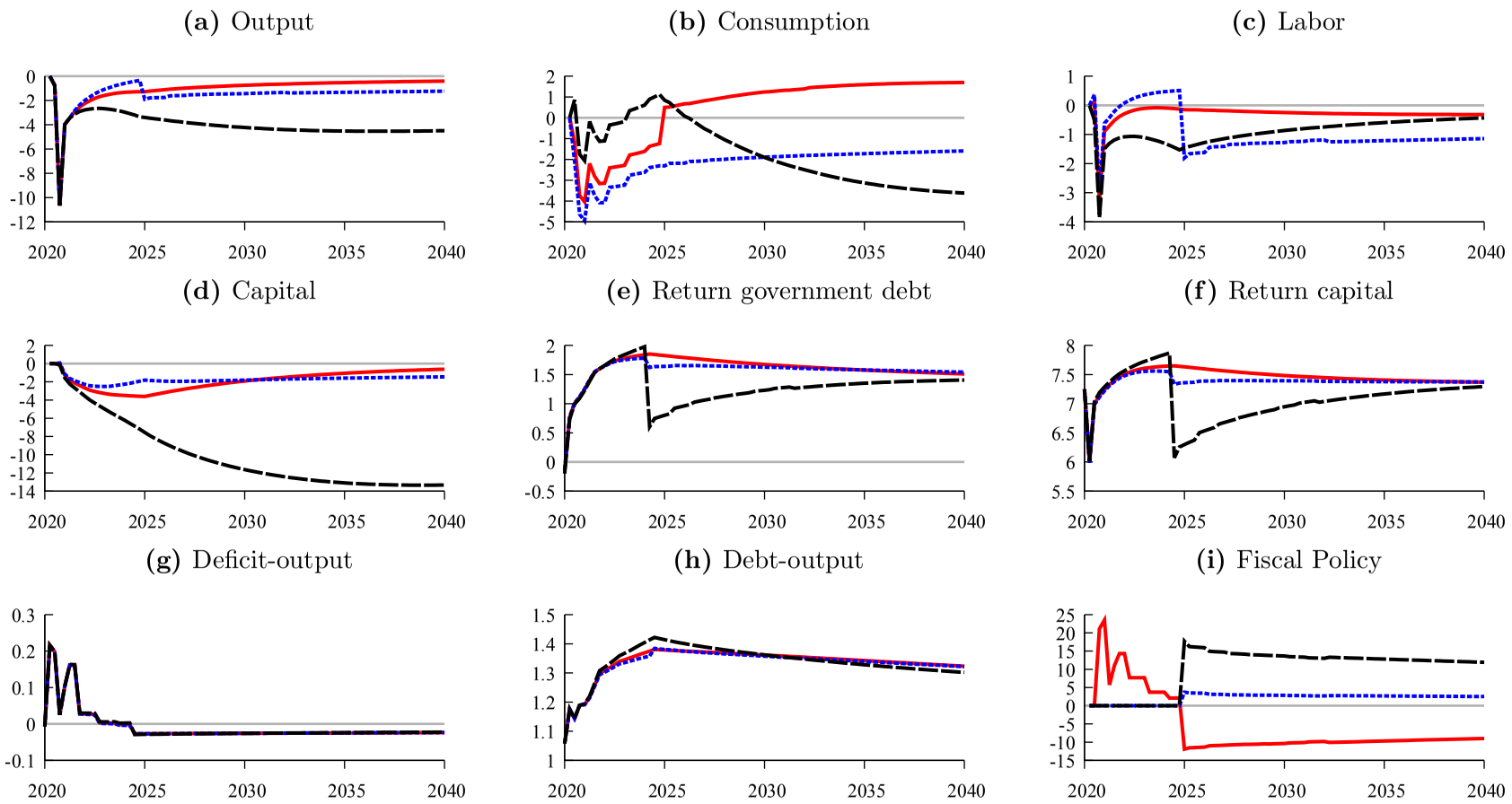

**Key:** Solid red line: government spending. Dotted blue line: labor income tax rate. Dashed black line: capital income tax rate. Output, consumption, labor, capital, and government spending are expressed as percentage deviations from the pre-pandemic steady state; taxes are percentage point deviations from steady state; the rest are in levels. Returns are expressed per annum.

**Figure B.4:** Larger response to government debt




**Key:** Solid red line: government spending. Dotted blue line: labor income tax rate. Dashed black line: capital income tax rate. Output, consumption, labor, capital, and government spending are expressed as percentage deviations from the pre-pandemic steady state; taxes are percentage point deviations from steady state; the rest are in levels. Returns are expressed per annum.

**Figure B.5:** Higher elasticity of substitution between private and public goods




**Key:** Solid red line: government spending. Dotted blue line: labor income tax rate. Dashed black line: capital income tax rate. Output, consumption, labor, capital, and government spending are expressed as percentage deviations from the pre-pandemic steady state; taxes are percentage point deviations from steady state; the rest are in levels. Returns are expressed per annum.