Israel's Fiscal Prospects in the Post-COVID-19 Era

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Abstract

We reassess the fiscal position of the Israeli and U.S. governments, and argue that Israel faces three potential challenges. First, the deficit-to-GDP ratio was higher in 2019 than it was on average from 2010 to 2019. To keep the government debt-to-GDP ratio stable, the deficit-to-GDP ratio must be closer to its average value from 2010 to 2019. Second, the government will need to make further fiscal adjustments if interest rates on government debt rise modestly or, as forecasted by the Bank of Israel and the Ministry of Finance, the GDP growth rate falls below its pre-COVID-19 levels. The third challenge stems from tail events that impact interest rates and growth rates. Geopolitical risk will always be a fact of life for Israel. A novel first-order concern is that the U.S. may be on a fiscally unsustainable path. To buy partial insurance against these tail events, Israel needs to return to its pre- COVID-19 policy of lengthening the average maturity of government debt.

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1 Introduction

Now is a good time to reassess the fiscal position of the Israeli government. As in most other industrialized countries, government debt rose dramatically in the wake of the COVID-19 crisis. However, the real interest rate on Israeli government debt, r, remains very low by historical standards. Indeed, r is now lower than the GDP growth rate, g. If we knew that r would remain lower than g, a government could, in principle, plan on running a perpetual deficit while the debt-to-GDP ratio declined over time.

Two questions naturally arise. First, given reasonable forecasts for *r* and *g*, is Israel's fiscal situation sustainable given pre-COVID-19 government deficits? Second, how sensitiveis Israel's fiscal position to rare events that affect the interest rate on government debt andthe GDP growth rate?

We argue that if the post- COVID-19 values of r and g are similar to their pre-COVID-19 values, and the deficit-to-GDP ratio is equal to its average value over the period 2010 to 2019, then Israel's public debt-to-GDP ratio will be stable. But this conclusion is sensitive to the precise value of r, *g*, and the average value of the deficit-to-GDP ratio. For example, suppose the economy's growth rate is equal to the long-run forecast of the Bank of Israel, or the even lower forecast of the Ministry of Finance. In that case, post-COVID-19 deficits must be smaller than pre-COVID-19 deficits for the debt-to-GDP ratio to be stable. Similarly,suppose that future Israel's deficit-to-GDP ratios are equal to its 2019 value (2.93 percent) rather than its average value from 2010–19 (1.26 percent). Then, Israel can't sustain its pre-COVID-19 ratio of debt to GDP even if the post-COVID-19 values of r and g are similar to their average value in the decade before COVID-19. This sensitivity means that the government mustremain ever vigilant with respect to its fiscal situation.

Rare events are a more serious concern. Storms do happen and can wreak havoc on gardens. Israel is particularly exposed to geopolitical storms. A classic example is the second Intifada, which was associated with a prolonged increase in the spread between r and g. One cannot preclude the possibility that similar or even more dramatic geopolitical events will occur in the future. A very different tail event emanates from the fiscal behavior of the U.S. There is a serious possibility that the U.S. is on a fiscally unsustainable path. A crisis associated with such a path would lead to a worldwide increase in interest rates and a decline in output growth rates. Our calculations indicate that these rare events would dramatically affect Israel's fiscal situation, requiring substantial and painful adjustments.

Israeli policymakers must consider the tail events as they plan for the future. However, that does not mean the government should forgo socially beneficial investments with

high rates of return.[1] It does mean that policymakers shouldn't succumb to the Siren-like call of low interest rates. Instead, they should explicitly account for deficits incurred to finance growth-enhancing investments. And they should examine the point at which total debt levels unduly expose Israel to undesirable tail risks.

The Israeli fiscal authorities can't affect geopolitical risk or the behavior of the U.S. government. But they can buy some insurance against tail events by substantially increasing the average maturity of government debt. Unfortunately, the COVID-19 crisis moved the government in the opposite direction. Correcting for the impact of the Bank of Israel's quantitative easing program, we find that the average maturity of consolidated government debt (inclusive of the Bank of Israel's balance sheet) declined by roughly 0.8 of a year because of quantitative easing. The corresponding average maturity of NIS-issued debt fell by about a year. Now that the COVID-19 crisis is over, the fiscal authorities should moveback to and beyond the pre-COVID-19 average maturity level of publicly held government debt.

2 Background

Government debt has risen to historically high levels in all major industrialized countries. Figure 2.1 shows that in the U.S., the ratio of federal net government debt to GDP rose from roughly 35 percent in the early 1980s to 102 percent by the end of 2021. In Israel, that ratio fell from an extraordinary level of 250 percent to approximately 65 percent over the same time period.

Even as government debt levels rose, there was a secular decline in nominal and real interest rates. Moreover, that decline is manifest across virtually all industrialized countries and for both private and public sector debt at all points along the yield curve.

Figure 2.2 displays quarterly, annualized, 10-year Israeli and U.S. government bond yields from the mid-1990s to 2021. Despite some twists and turns, U.S. nominal interest rates steadily declined, falling from roughly 7 percent to about 1.5 percent. The Israeli case is more complicated. With the onset of the second Intifada in the early 2000s, Israeli nominal interest rates jumped dramatically, rising from roughly 6 percent to 12 percent. After peaking around2003, nominal Israeli interest rates began a long decline and have now converged to U.S.levels.

[1]The growth rate of real GDP is certainly affected by judicious investments in human and physical capital. For an analysis of this issue, see Bental, Eckstein and Sumkin (2021).

Figure 2.1 Government Debt as a Percent of GDP

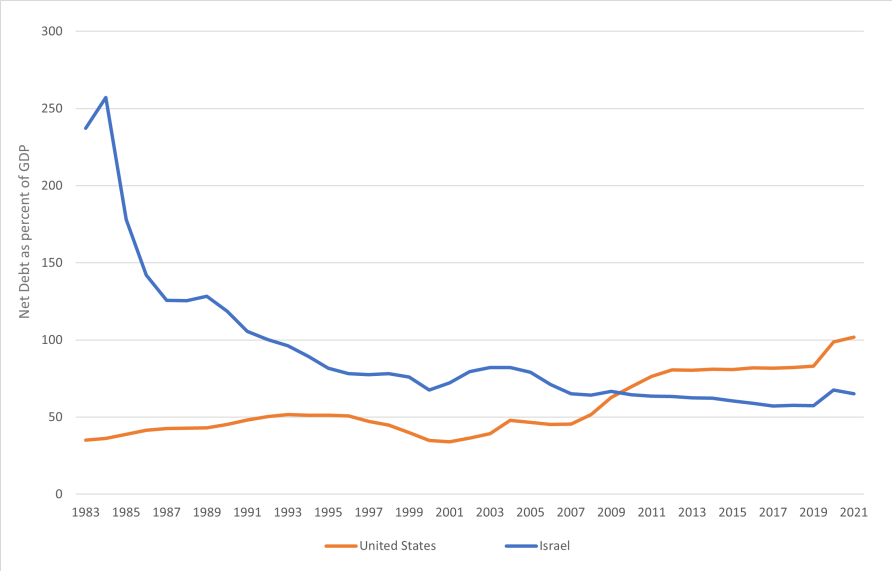


Figure 2.2 Nominal Interest Rates on Government Debt

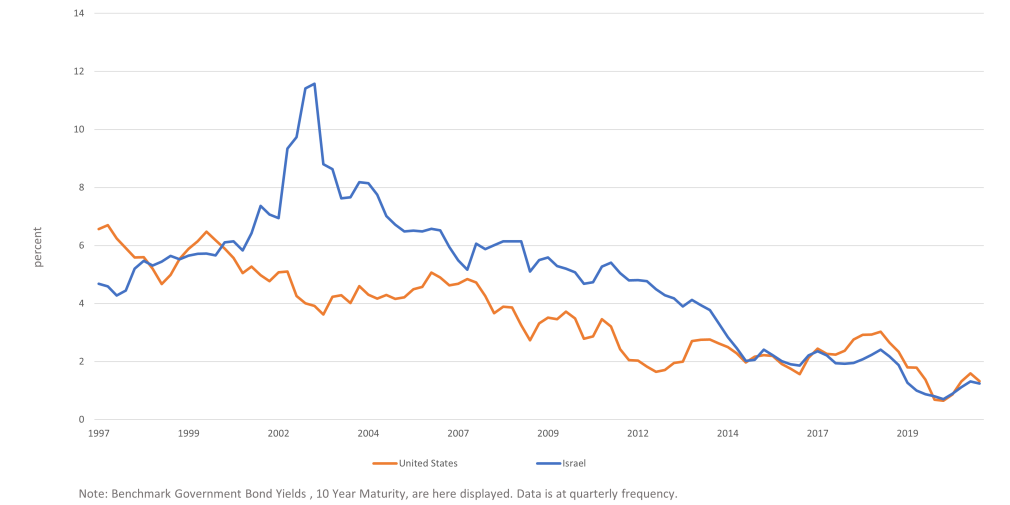
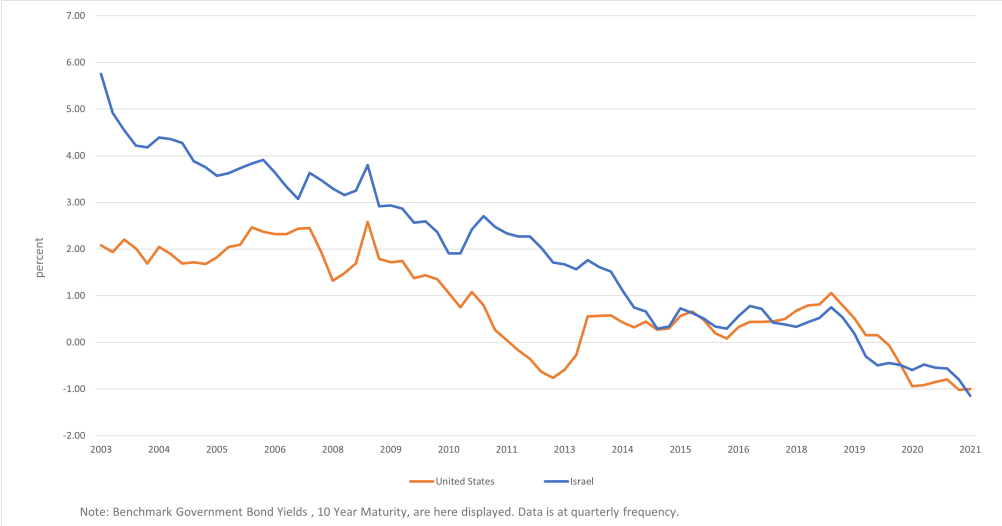


Figure 2.3 displays real quarterly, annualized 10-year inflation-indexed Israeli and U.S. government bond yields from the early 2000s onward. Real yields exhibit secular declines like nominal yields, with Israeli rates converging close to U.S. rates. Still, there are substantial periods when the differences between Israeli and U.S. interest rates became substantially larger. For example, in the early 2000s and between 2010 and 2013, the difference between Israeli and U.S. real interest rates became significantly larger. But by 2015, the two rates had essentially converged.

Figure 2.3 Real Interest Rates on Government Debt



3 Indicators of Fiscal Sustainability

In a world of low interest rates, what indicators should we look at when assessing the fiscal sustainability of government debt? The traditional canary in the coal mine is the ratio of debt to GDP. But, as the data and the Reinhart and Rogoff (2010) 90 percent debacletaught us, no magic number signals fiscal doom.

Still, we should worry about scenarios in which the ratio of government debt-to-GDP is quickly growing to unprecedented levels. After all, there must be *some* ratio of debt to GDP that is sustainable, at least for a politically feasible future budget surplus. If nothing else, high values of the debt-to-GDP ratio expose a country like Israel and maybe even the U.S. to *doom-loop* dynamics. If markets anticipate a crisis, they charge higher interest rates on government debt. Higher rates mean higher debt service, which leads the debt to explode even faster, leading to a crisis. Depending on the country in question, a doom-loop crisis could involve a loss of central bank independence, high inflation rates, a depreciated currency, and sovereign default in the most extreme of circumstances. Less dramatically, high debt levels threaten a central bank's independence. The reason is that under those circumstances, central bank efforts to reduce inflation through interest rate increases substantially raise the cost of servicing the debt and potentially crowd out items that are high on the wish lists of the fiscal authorities.

The ratio of interest payments to GDP

Furman and Summers (2020) argue that lower interest rates require new measures of a country's fiscal situation. A fundamental problem with the current debt to GDP metric is that a government can repay the debt from current and future GDPs. The mismatch of stocks and flows in the debt-to-GDP metric is particularly important in an era of low interest rates. At interest rates prevailing in 1992, a country with a 60 percent debt-to-GDP ratio paid about 5 percent of GDP in interest. Today, with a 170 percent debt-to-GDP ratio, Japan will pay about 0.2 percent of GDP in interest. The U.S., with a 102 percent debt-to-GDP ratio, will pay about 2.0 percent of GDP in interest. It cannot be that 60 percent was areasonable upper bound for the limit for the ratio of Israeli debt to GDP both now and in1992.

In designing a new metric for fiscal sustainability, one could adopt a stock-stock perspective that compares a government's debt to the present value of GDP. This metric captures the idea that a fall in interest rates raises the present value of current and future flows of GDP. That rise makes a given debt level more manageable. However, the stock-stock perspective isn't workable because it requires reliably forecasting growth and interest rates into the indefinite future, something we cannot do.

An alternative approach to measuring fiscal sustainability is a flow-flow perspective that considers the cost of servicing government debt relative to income. One flow-flow measure is the ratio of nominal interest payments to GDP. Furman and Summers (2020) argue that we should use the ratio of real interest payments to GDP as our fiscal sustainability metric. This measure corresponds to nominal interest payments as a share of GDP minus the debt that is inflated away each year.

As with the ratio of debt to GDP, there is no magic upper bound for the ratio of real interest payments to GDP. Furman and Summers argue that in practice, we should adjust fiscal policy when the ratio hits 2 percent for a prolonged period. We certainly want to avoid paths where this ratio quickly grows to unprecedented levels.

Figure 3.1 displays the ratio of net nominal interest payments on government debt to GDP in Israel and the U.S. Figure 3.2 displays the analog ratio for net real interest payments. In the U.S., the first ratio has been somewhat lower than 2 percent from 2001 to theend of 2021. The second ratio fell from roughly 1.5 percent to about 0.2 percent. The Israeli case is more complicated. The first ratio jumped from about 4 percent to over 6 percent during the second Intifada years and then fell to a bit below 2 percent by the end of 2020. In 2021, that ratio rose to about 2.4 percent. The second ratio declined from 2.3 percent in 2001 to about 1.0 percent in 2020. The ratio then increased to about 1.7 percent in 2021.

Figure 3.1 Ratio of Net Nominal Interest Payments to GDP

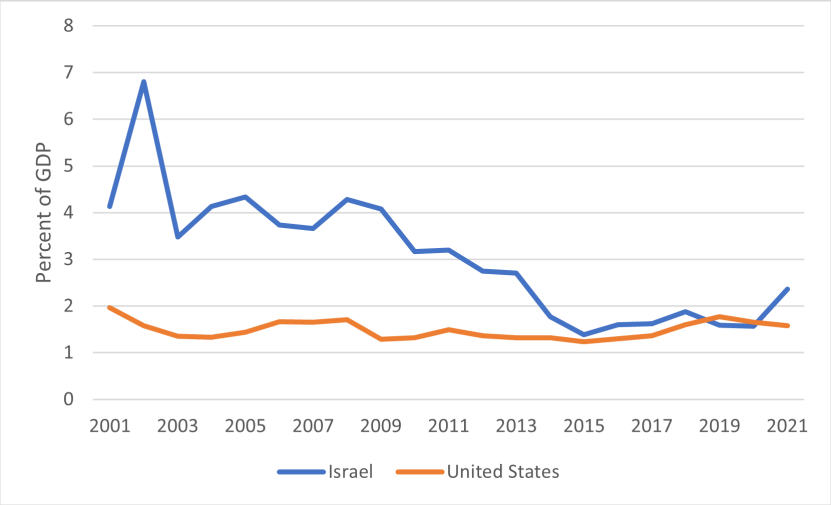
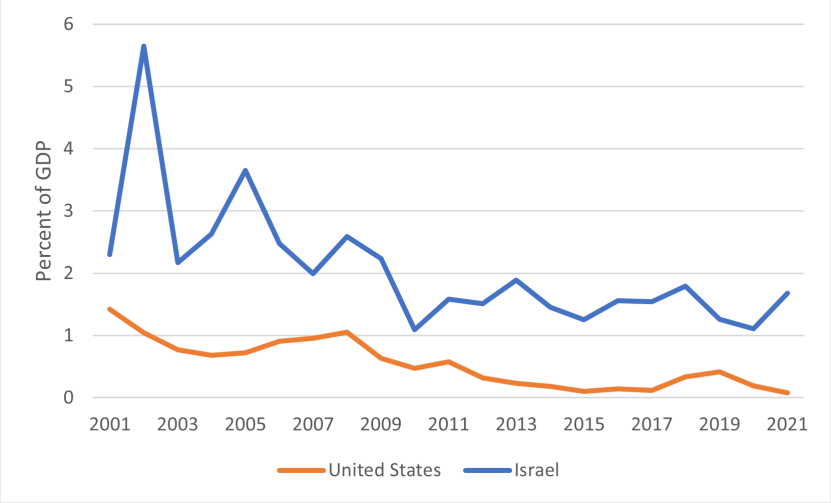


Figure 3.2 Ratio of Net Real Interest Payments to GDP



3.1 On the importance of $r - g$

A critical determinant of debt sustainability is the interest rate on government debt r, minus the GDP growth rate, g. Abstracting from seigniorage revenues, the ratio of net government debt to GDP, d_t, evolves according to the difference equation

$$d_t = \frac{1 + r_t}{1 + g_t} d_{t-1} + s_t.$$

Here g_t represents the real GDP growth rate between time t-1 and time t, r_t denotes the real interest rate on government debt, and s_t represents the ratio of the net, time-t, primary government deficit to GDP. It follows that

$$\Delta d_t = \frac{(r_t - g_t)}{(1 + g_t)} d_{t-1} + s_t.$$

According to this equation, other things equal, a higher interest rate drives up future debt-to-GDP ratios, and a higher GDP growth rate drives down future debt-to-GDP ratios.

To appreciate the role of $(r_t - g_t)$, suppose, for simplicity, that r_t and g_t are constant and that, as is currently the case, r is less than g and will remain that way indefinitely. We consider two scenarios under this assumption, both of which assume a constant interest rate.[2]

3.1.1 Scenario 1

Suppose the government borrows, on a one-time basis, a large amount of money to finance expenditures associated with the COVID-19 crisis or a social investment. The government then rolls over the debt, borrowing new money to pay principal and interest on the debt.

In this scenario, government debt grows at the rate r. If GDP grows at a rate g higher than r, then the ratio of debt-to-GDP slowly declines at the rate $r - g$. So, the government *never* has to repay what it borrowed, say by raising future taxes or lowering future government spending.

3.1.2 Scenario 2

Imagine that the government starts with some positive debt-to-GDP ratio. If r is less than g, then the government can run a primary deficit (a negative primary surplus) *forever* without affecting the size of the debt-to-GDP ratio. The size of that negative primary surplus over GDP is equal to $(r - g)/(1 + g)$ times the initial ratio of debt to GDP. For example, as measured by the IMF, the U.S. net debt-to-GDP ratio is roughly 100 percent.[3] Supposethat from now on, $r - g$ was equal to -1 percent. Then the U.S. could run a primary deficit equalto 1 percent of GDP *forever* without affecting the debt-to-GDP ratio.

3.1.3 On the empirical relevance of scenarios 1 and 2

Should the previous scenarios make us complacent about the fiscal outlook for Israel and the U.S.? The first scenario is relevant for thinking about a one-time increase in the

[2]The scenarios considered here are the same as those analyzed by Cochrane (2021) for the U.S.
[3]The IMF measure nets out financial assets from the debt.

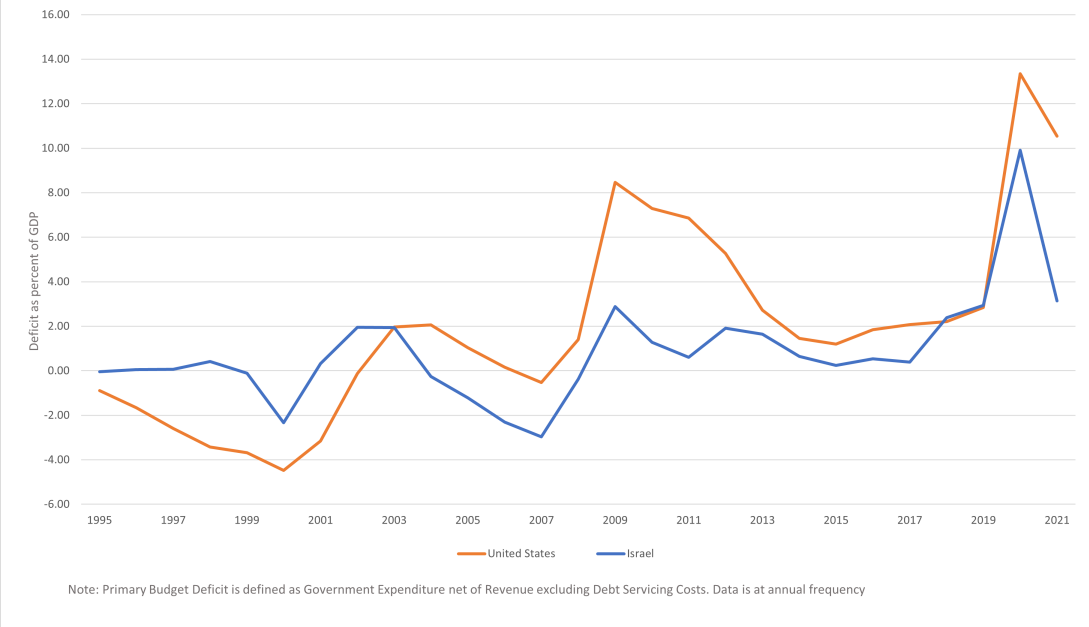
debt, not ongoing deficits. A one-time expansion of Covid-related debt in Israel might be considered in these terms. In contrast, the U.S. was running large primary deficits before COVID-19 and, by all accounts, will continue to do so after COVID-19. For a given value of $r - g$, the second scenario contemplates a small, perpetual deficit that doesn't raise the ratio of debt-to-GDP.

A critical question is: how small is small?

4 The data on budget deficits and $r - g$

Figure 4.1 displays the quarterly primary government budget deficit as a percent of GDP for Israel and the U.S. over the period 1995 to 2021. Table 4.1 reports sample averages of this ratio for different subsamples.

Figure 4.1 Primary Government Budget Deficit as a Percent of GDP



The behavior of the ratio of the budget deficit to GDP is quite different in the two countries. Over the period 1995–2002, the U.S. had a budget surplus equal to 2.5 percent ofGDP, on average. After that, the U.S. ran large budget deficits. Over the periods 2003–09 and 2010–19, those deficits were on average equal to 2.08 percent and 3.38 percent of GDP, respectively. In contrast, over those three periods, the deficit-to-GDP ratio in Israel was 0.2 percent, -0.33 percent, and 1.26 percent of GDP. So, over the past twenty years, Israel has been a model of fiscal rectitude relative to the U.S.

Table 4.1 Average ratio of budget Deficit to GDP

	Israel	United States
1995–2002	0.2	-2.5
2003–2009	-0.33	2.08
2010–2019	1.26	3.38

Table 4.2 Average value of (r-g)

	Israel	United States
1987–1999		1.44
2000–2009	1.69	-0.38
2010–2019	-2.33	-1.49

Figure 4.2 The Evolution of r-g

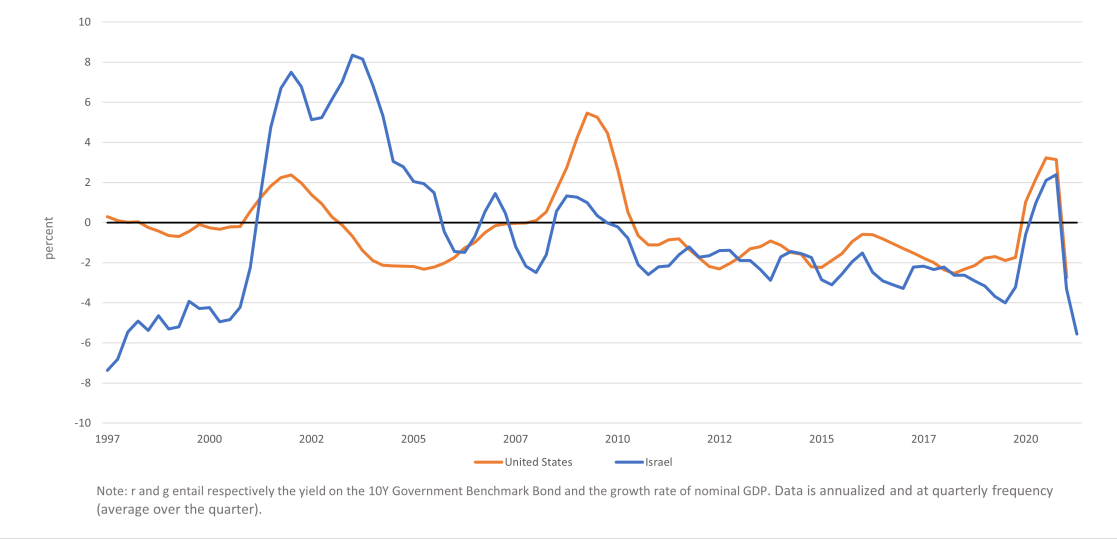


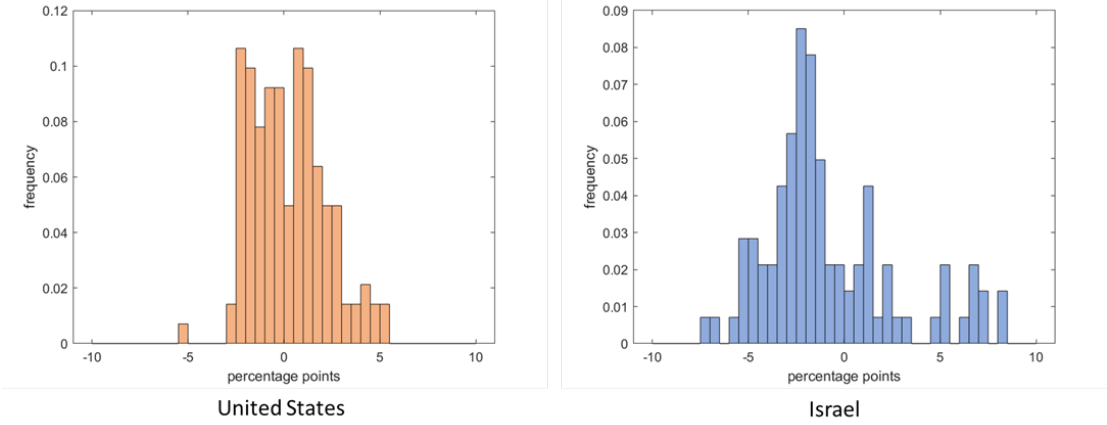
Figure 4.2 displays the time series on $r - g$. Here r is measured as the quarterly, annualized nominal interest rate on Israeli non-indexed government debt and U.S. government debt. The variable g is the quarterly annualized growth rate of nominal GDP.[4] For both Israel and the U.S., $r - g$ was negative after 2010, with an average value of -2.33 percent and -1.49 percent, respectively.

However, negative values of $(r - g)$ are no sure thing. Figure 4.3 displays histograms of the quarterly values of $r - g$ for Israel and the United States for the periods 1997–2021 and

[4] Since we are interested in the difference between r and g it doesn't matter whether we work with the real or nominal version of these variables if the GDP deflator and the CPI rise in a parallel way. In reality, there can be substantial differences in the behavior of these deflators. Also, a substantial portion of Israeli government debt is indexed to the CPI. We deal with indexed debt below and show that our results are robust to this complication.

1987–2021. Two features are worth noting. First, negative values of $r - g$ occur regularly in both countries. The percent of periods in which $(r - g) > 0$ in Israel and the U.S. are 34.4 and 28.1, respectively. The percent of periods in which $(r - g) > 1.5$ percent in Israeland the U.S. is 21.9 and 14.6, respectively. Second, the distribution of $r - g$ for Israel is significantly more right-skewed than the U.S. distribution. This fact reflects that Israel is more exposed to geopolitical events like the second Intifada. Tail-risk is a genuine, *in-sample* phenomenon for Israel.

Figure 4.3 The Distribution of r-g for Israel and the U.S.



Note: r and g entail respectively the yield on the benchmark 10Y Federal Government Benchmark Bond and the growth rate of nominal GDP. Data is at quarterly frequency.

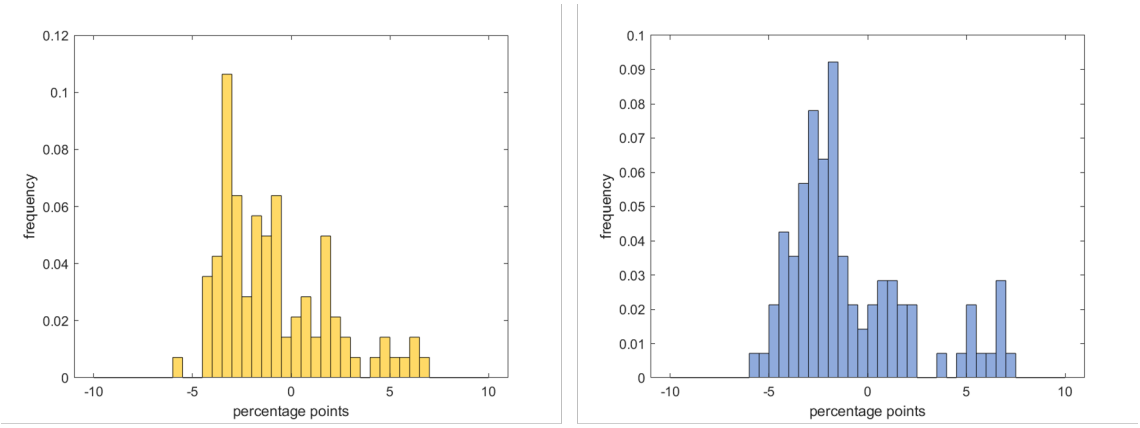
Table 4.2 and Figure 4.3 abstract from the fact that roughly 45 percent of Israel's domesticdebt is indexed. Tables 4.3 and Figure 4.4 report results for the case in which we incorporate indexed debt into the analysis for Israel. Here $(r - g)$ is computed as $(r - g)^{wvg} = \omega_t(r^{Indexed} - g^{real}) + (1 - \omega_t)(r^{unindexed} - g^{nominal})$ where ω_t is the share of indexed government debt, and $(1 - \omega_t)$ is the time t share of unindexed government debt. In addition, $r^{Indexed}$ is the real yield on ten-year indexed government bonds. The variable $r^{unindexed}$ is the nominal yield on ten-year unindexed government bonds. We obtained these measures from the BoI's estimates of the real and nominal yield curves. Finally, $g^{nominal}$ and g^{real} are the nominal and real year-on-year growth rate of Israeli GDP.[5] Note that the key qualitative features of $(r - g)$ for Israel, taking indexed debt into account, are very similar to the case in which we abstract from indexed debt.

[5] We derive the shares of indexed and non-indexed government debt from Table 6.8.19, Composition of Government Borrowing by type of indexation, provided by the Bank of Israel. The share of indexed debt is equal to the share of debt labeled "CPI-indexed, including nonnegotiable". The share of Non-Indexed debt consists of all the components labeled as "unindexed": unindexed fixed rate, zero coupon and variable rate debt. We abstract from dollar indexed and foreign-currency denominated debt in our analysis.

Table 4.3 Robustness of Israel (r-g) taking indexed debt into account

	Indexed Debt r-g	Weighted Average r-g	Share of Indexed Debt
2000–2009	0.75	1.28	39.8%
2010–2019	-2.96	-2.63	46.3%

Figure 4.4 The Distribution of r-g , taking indexed debt into account, for Israel



Indexed Debt Weighted Average Debt

5 How much fiscal space do low values of $r - g$ give Israel and the U.S.?

Figure 5.1 displays the implications of different values of $r - g$ for the ratio of total debt to GDP. Consider first the case of Israel. The orange bar depicts the 2021 Israeli debt-to-GDP ratio, roughly 65 percent. In constructing the other bars, we suppose that, for ten years, starting from current debt levels, the primary budget deficit in Israel is equal to 1.26 percent of GDP, its average value in 2010–19. Suppose that for the next ten years, $r - g$ is equal to -2.33 percent, the historical average for 2010–19. Then, as the green bar shows, the debt-to-GDP ratio would *fall* from 65 percent to roughly 63.5 percent after ten years. So *if* the post-Covid years look like the ten years before COVID-19 for deficits and $r - g$, Israel could run moderate deficits without weakening its fiscal position.

Suppose instead that we base $r - g$ on the Bank of Israel (BoI) forecasts for r and g. As of January 2022, the BoI forecast for the long-run growth rate of real GDP and the real interest rate is 4.1 percent and 2.9 percent, respectively. This forecast implies that $r - g$ is equal to -1.2 percent.

The blue bar shows that the implied value of the debt-to-GDP ratio would *rise* to 70 percent. So whether one expects the debt-to-GDP ratio to rise or fall depends sensitively on one'sviews about the future value of $r - g$.

To further explore this sensitivity further, Figure 5.2 displays the implications for the Israeli debt-to-GDP ratio of alternative values of $r - g$. If $(r - g)$ was zero over the next ten years, the debt-to-GDP ratio would rise from 65 percent to 78 percent. More dramatically, suppose that $(r - g)$ was equal to 1.5 percent, the historical average for Israel over the period 2000–19.Then the debt-to-GDP ratio would rise to 88.4 percent after ten years.

Based on these simulations, we infer that Israel has some space to run *moderate* deficits. What does moderate mean in practice? Figures 5.3 and 5.4 are the analogs to Figures 5.1 and 5.2, assuming that, for ten years, starting from current debt levels, the primary budget deficit in Israel and the U.S. is equal to 2.93 percent and 2.86 percent of GDP, their values in 2019. Note that the prognosis for Israel deteriorates with the ratio of debt-to-GDP rising in all of the experiments. These results reflect the fact that the 2019 deficit-to-GDP in Israel was substantially higher than its average value over the period 2010–19.

Even if we abstract from tail risk, one can't take the stability of the Israeli debt-to-GDP ratio for granted. The fiscal authorities must be ever vigilant to changes in r and g that adversely affect the debt-to-GDP ratio and deficits-to-GDP ratios that are high relative to their average values for 2010–19.

Now consider the analog scenarios for the U.S. The average value of the primary budget deficit in the U.S. between 2010 and 2019 is 3.38 percent. Suppose that for the next ten years,

$r - g$ is equal to -1.49, the U.S. historical average for 2010–19. Then the debt-to-GDP ratio would rise from 102 percent to 120 percent. Suppose instead that we base $r - g$ on the Congressional Budget Office's (CBO) forecast for r and g. As of May 2022, the CBO forecasts that the long-run (10 years) growth rate of nominal GDP and the nominal interest rate will be 3.9 percent and 3.8 percent, respectively. This forecast implies that $r - g$ is equal to -0.1 percent. The blue bar shows that under this scenario, after ten years, the debt-to-GDP ratio would rise to 135 percent.

Figure 5.2 displays the sensitivity analysis for the U.S. If $(r - g)$ was zero over the next ten years, the debt-to-GDP ratio would rise to almost 136 percent. Finally, if $(r - g)$ was equal to 1.5 percent, the ratio would increase to almost 155 percent within ten years. None of our inferences about the U.S. are qualitatively sensitive to whether we assume the deficit-to-GDP for the next ten years is equal to its value in 2019 (see Figure 5.3 and 5.4).

In *all* of the previous scenarios, the U.S. debt-to-GDP ratio will rise to unprecedented peacetime levels. Yes, $r - g$ may be negative. But it is simply not negative enough to compensate for the large deficits that the U.S. has been running.

Figure 5.1 Net Debt-to-GDP, Different (r-g) Scenarios, Primary Deficit Equal to 2010–19 Average

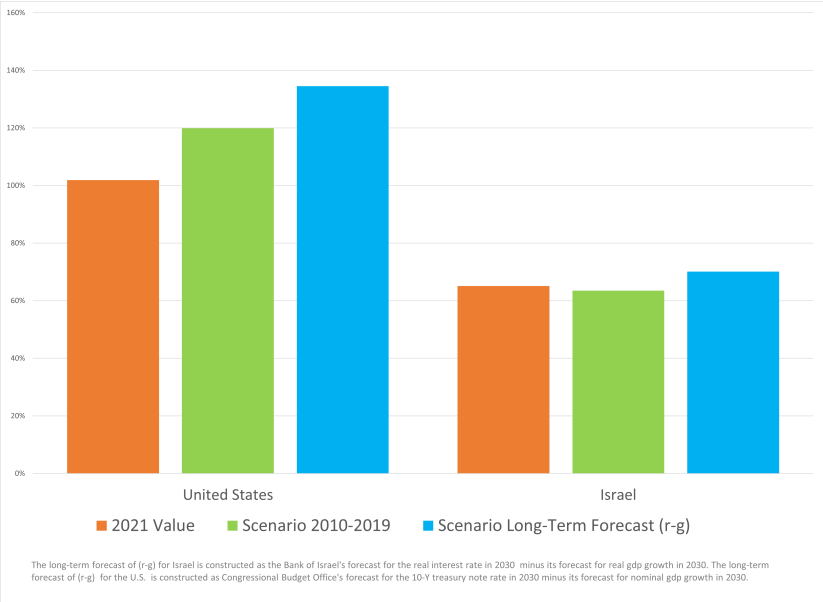


Figure 5.2 Net Debt-to-GDP, Additional (r-g) Scenarios, Primary Deficit Equal to 2010–19 Average

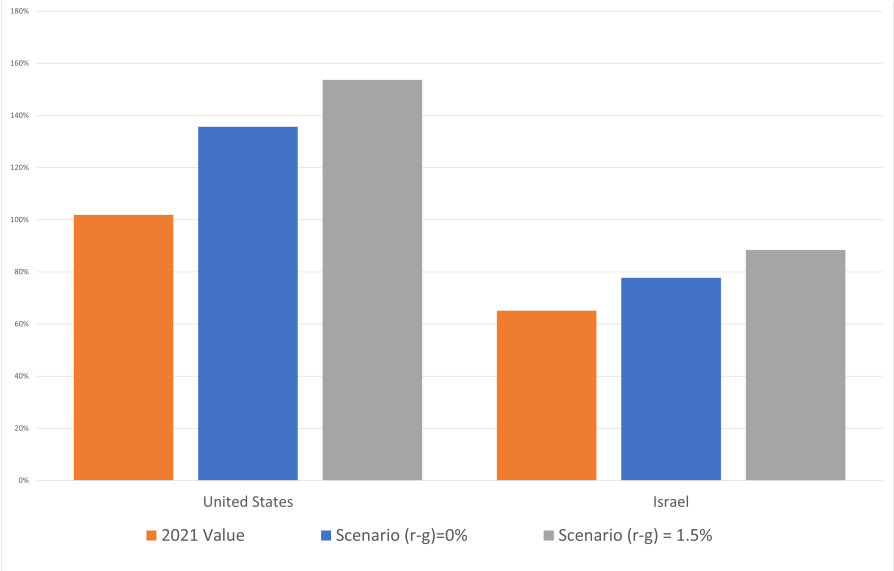


Figure 5.3 Net Debt-to-GDP, Different (r-g) Scenarios, Primary Deficit Equal to 2019 value

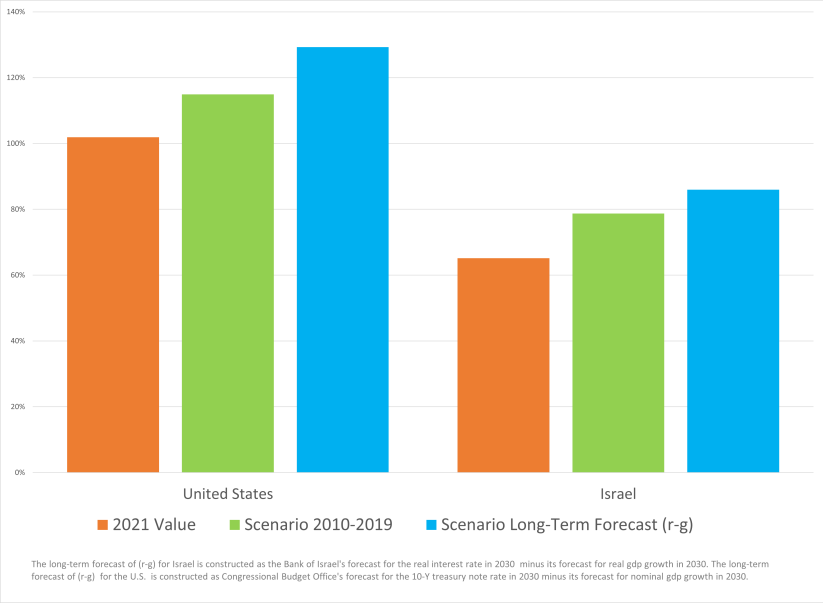
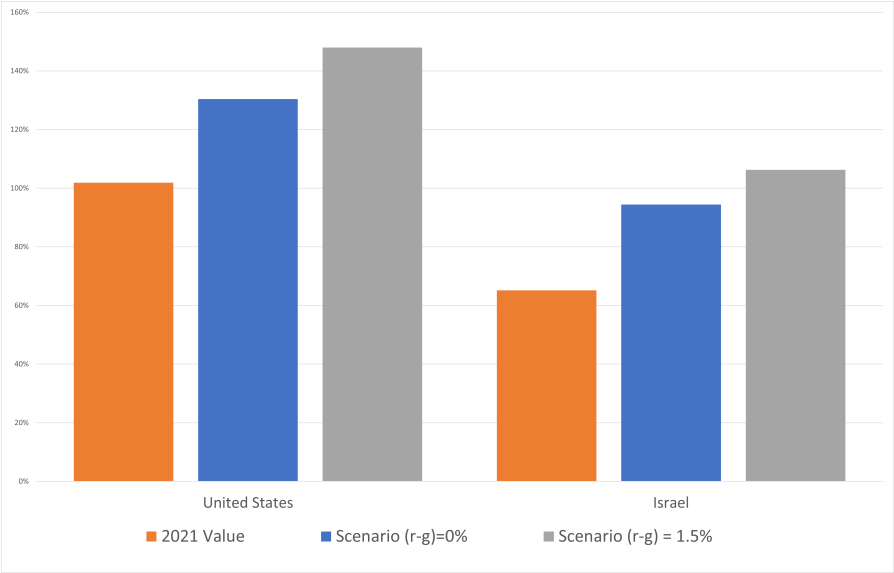


Figure 5.4 Net Debt-to-GDP, Additional (r-g) Scenarios, Primary Deficit Equal to 2019

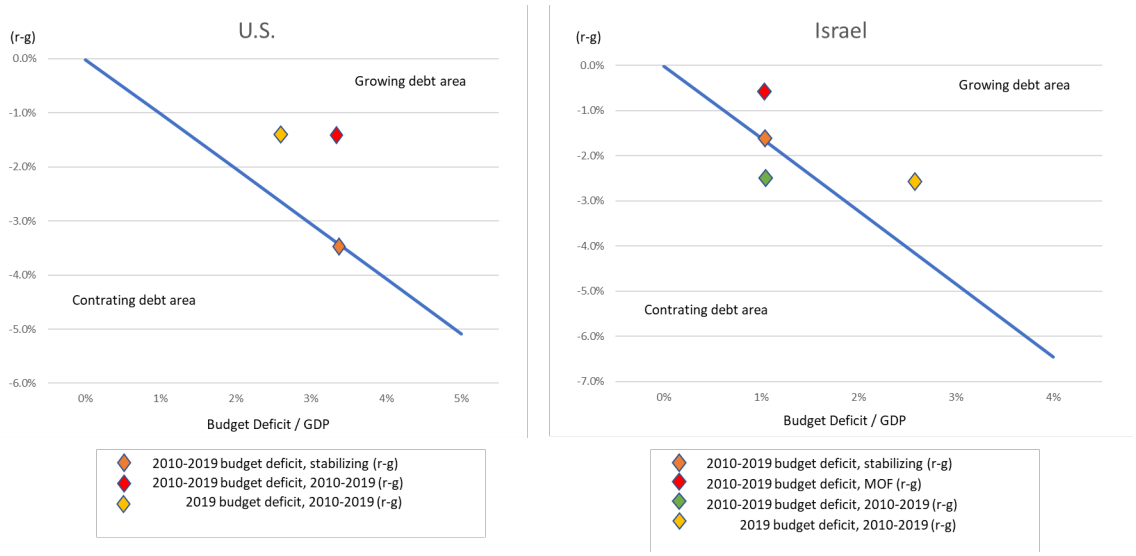


6 The fiscal-alarm frontier

Each of us has views about how large government deficits will be in the post-pandemic era and what values of $(r - g)$ are plausible over the next decade. So it's useful to know the answer to the following question. Given an assumed value for future deficits in the next decade, what is the maximum value of $(r - g)$ such that the debt-to-GDP ratio

doesn't grow? The *fiscal-alarm frontier* displays the answers to this question for different values of the future deficit.

Figure 6.1 Fiscal-Alarm Frontiers, Israel and the U.S.



Consider the U.S. case. The X-axis of the orange diamond is located at the average value of the U.S. deficit-to-GDP ratio over the period 2010 to 2019. The corresponding value of the Y-axis shows what $r - g$ would have to be for the debt-to-GDP ratio to be constant. The Y-axis value of the red and yellow diamonds are drawn at the average value of $r - g$ over the period 2010 to 2019. Since the red diamond lies above the blue line, the U.S. debt-to-GDP ratio would grow even if the post-Covid values of $r - g$ were equal to their very low pre-Covid values. The yellow diamond shows that the U.S. debt-to-GDP would also grow if the U.S. deficit-to-GDP ratio were equal to its 2019 value for the next ten years.

Now consider the case of Israel. The X-axis of the orange diamond is located at the average value of the Israeli government deficit-to-GDP ratio over the period 2010–19.The corresponding value of the Y-axis shows what $r - g$ would have to be for the Israeli debt-to-GDP ratio to be constant. The Y-axis value of the green diamond is drawn at the average value of $r - g$ in Israel over the period 2010 to 2019. Since the green diamond lies below the orange diamond, the Israeli debt–to-GDP ratio would contract if the Israeli government continued to run pre-Covid like moderate deficits.

One should not be overly sanguine about the Israeli case. To make this point sharply,we draw the Y-axis value of the red diamond at the value of $r - g$ implied by the Ministry of Finance's (MoF) estimate of the long-run value of g (3.2 percent) and the BoI long-run estimate of r (2.9 percent). Note that the MoF estimate of g is lower than the BoI's and

reflects the MoF's view that the future growth of GDP will be substantially lower than it was during the ten yearsthat preceded COVID-19. The X-axis is located at the average value of the Israeli government deficit-to-GDP ratio from 2010 to 2019. Notice that the red diamond lies substantially above the fiscal-alarm frontier. Thus, both the MoF estimate of future growth implies that the Israeli debt-to-GDP ratio isn't stable if the government incurs deficit-to-GDP ratios equal to their average value from 2010 to 2019. Of course, the MoF may be incorrect in its estimate of g. Nevertheless, this calculation illustrates the sensitivity of inference about the sustainability of the debt-to-GDP ratio to alternative but plausible assumptions about $r - g$.

As we noted above, the deficit-to-GDP ratio in Israel was higher in 2019, at 2.93 percent, than its average value from 2010 to 2019, of 1.26 percent.[6] The X-axis of the yellow diamond is located at the value of the 2019 deficit-to-GDP ratio in Israel. Note that the yellow diamond lies above the fiscal-alarm frontier. So, consistent with the discussion above, Israel cannot
sustain a debt-to-GDP ratio equal to its 2021 value if it runs a persistent deficit-to-GDP ratio equal to its 2019 value, certainly not for historically plausible values of $(r - g)$. Some fiscal adjustments will be required to bring the deficit-to-GDP-ratio back to its average value over the period from 2010 to 2019.

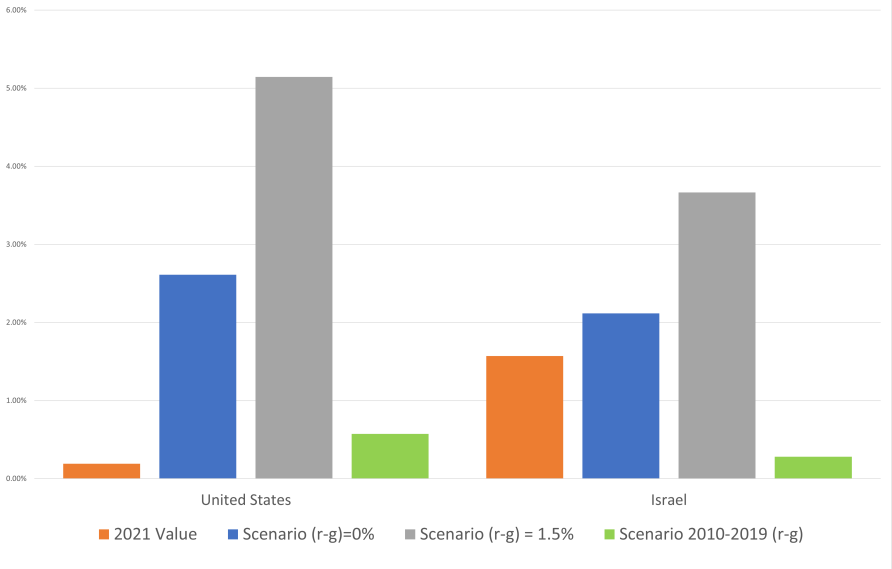
A similar story about the fiscal situation of the two countries emerges if we use Furman and Summers's (2020) preferred metric, the ratio of net real interest payments to GDP. In what follows, we assume that the deficit-to-GDP ratio equals its 2010–19 average value.

For Israel, if $r - g$ were equal to its average 2010–19 value, the ratio of net real interest payments to GDP would fall slightly from our estimate of its 2021 value. However, if $r - g$ were zero, the ratio would increase to 2.12 percent after ten years. Finally, if $(r - g)$ increases to 1.5 percent, the ratio would rise to 3.67 percent, requiring substantial fiscal policy adjustments. In sharp contrast, the U.S. would significantly exceed the 2 percent Furman-Summers threshold even if $(r - g)$ was zero for the decade. And if $(r - g)$ was equal to 1.5 percent, the ratio of real net interest payments to GDP would exceed 4 percent within ten years. That is a recipe for a crisis.

Finally, Figure 6.3 reports results for the scenarios of Figure 6.2, assuming the budget will be constant at its 2019 level.

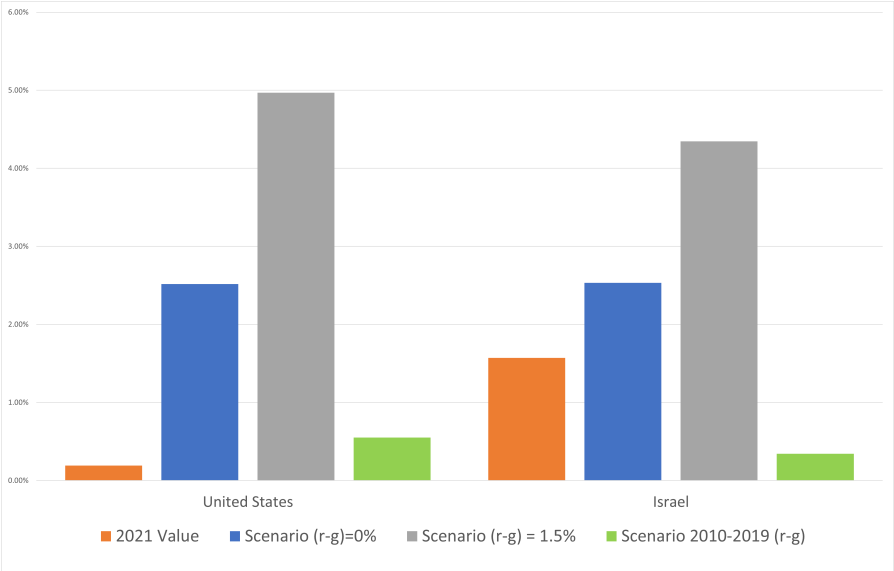
[6] See also Chapter 6 of Bank of Israel Annual Report for 2019.

Figure 6.2 Ratio of Net Real Interest Payments to GDP, Different (r-g) Scenarios, Primary Deficit Equal to 2010–19 Average



The previous calculations provide some reason for Israelis to be optimistic about their fiscal future. If Israel's post- COVID-19 fiscal policy looks like it did in the decade before COVID-19, Israel won't hit the fiscal-alarm frontier as long as $(r - g)$ is less than roughly -0.7 percent and the deficit-to-GDP ratio is equal to its average value over the period 2010–19.Modest adjustments would be necessary if future growth turns out to be somewhat lower along the lines forecast by the BoI. However, these comforting conclusions miss two important points. First, the deficit-to-GDP ratio was substantially higher in 2019 than its average value from 2010–19, so some fiscal adjustments are required. Second, Israel is subject to critical tail events stemming from geopolitical risk and the risk that the U.S. is on an unsustainable fiscal path.

Figure 6.3 Ratio of Net Real Interest Payments to GDP, Different (r-g) Scenarios, Primary Deficit Equal to 2019



7 Tail events

Israel is a small, open economy whose average, long-term real interest rates are primarily determined outside its borders and whose growth rate is heavily affected by external events. Moreover, because of its location and history, Israel is subject to substantial geopolitical risks that affect the interest rate on government debt and GDP growth rate.

The geopolitical risks are obvious. We know that the second Intifada led to a sustained rise in $r - g$. It is unreasonable to attach zero probability to a similar event in the future or a shock stemming from hostile regimes. A different kind of tail event arises from the troubling fiscal position of the United States. In principle, the U.S. could fix its fiscal problems. After all, the U.S. collects only 31 percent of GDP in general revenue, well below the OECD average of 37 percent. So the fiscal capacity is there. The question is, does the U.S. have the political ability to fix its fiscal problems? We see no indication whatsoever that it does. If anything, the signs point in the other direction.

We cannot dismiss the possibility that markets might, at some point, conclude that the U.S. is on an unsustainable fiscal path. In that event, the interest rate on U.S. debt will jump up. In the ensuing chaos, the U.S. growth rate g will fall. Almost certainly, such a crisis would lead to a rise in benchmark Israeli interest rates and a fall in the growth rate of Israeli GDP. The net effect would be a persistent rise in the Israeli-relevant value of $r - g$.

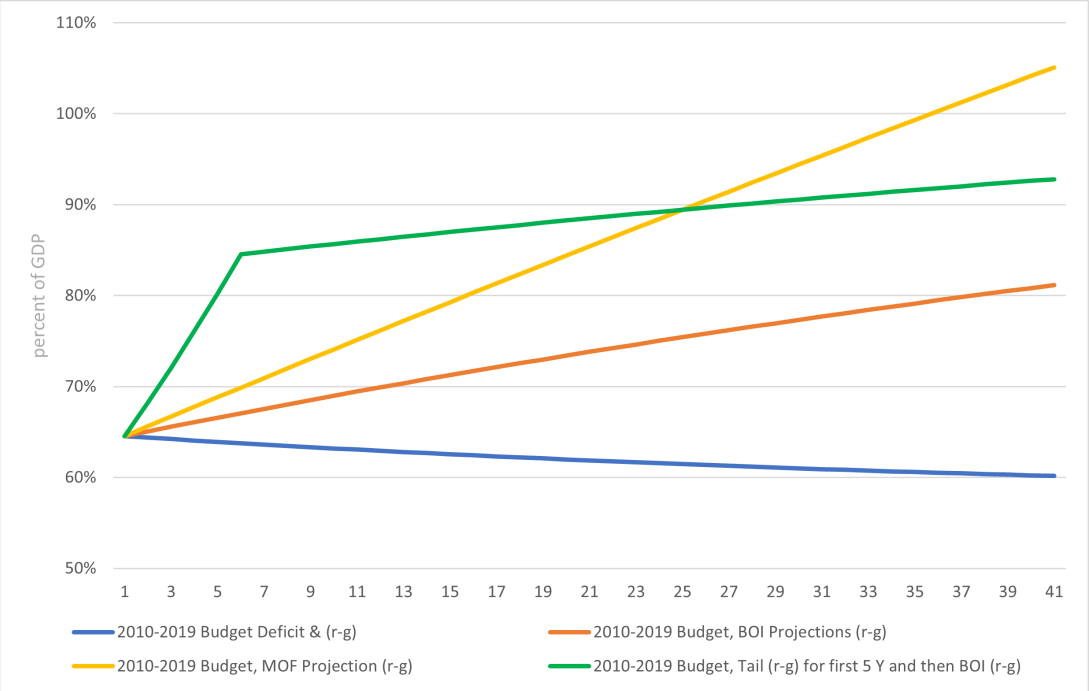
To assess the potential importance of these tail events, we consider the evolution of Israel's debt-to-GDP ratio under different assumptions about $r - g$. Figure 7.1 presents the results of various experiments. In all cases, we assume that the deficit-to-GDP ratio in Israel is equal to its average value over the period 2010–19, an assumption that is optimistic if tail events manifest themselves in large military expenditures. For reference, the blue line shows the evolution of the debt-to-GDP ratio assuming $r - g$ is equal to its average value in the period 2010–19. Consistent with the discussion above, the debt-to-GDP ratio exhibits a moderate long-term decline in this scenario.

The orange line depicts the evolution of the debt-to-GDP ratio based on the BoI long-term forecasts of $r - g = -1.2$ percent. Again, consistent with the analysis above, the debt-to- GDP ratio rises over time, approaching 70 percent in 10 years and 80 percent in the long run. The yellow line corresponds to the pessimistic scenario where we assume $r - g = -0.3$ percent. Recall that this value emerges from the MoF long-term forecast of g (3.2 percent) and the BoI long-term forecast of r (2.9 percent). Note that the debt-to-GDP ratio grows very quickly, eventually exceeding 100 percent.

One plausible tail event is a geopolitical crisis that raises $r - g$ for five years to 4.0 percent. This value coincides with the rough average of $r - g$ over the second Intifada period, 2001–05. We assume that after five years, $r - g$ reverts to -1.2 percent, the value implied by the BoI long-run forecast of r and g. Note that the debt-to-GDP ratio rises to about 85 percent within five years and then climbs more slowly, eventually exceeding 90 percent. So even assuming that the deficit was unaffected by the crisis, there would be an alarming deterioration in Israel's fiscal situation.

Quantifying the risk from a U.S. fiscal crisis is truly a trip into the unknown. We suspect the consequences would be much more severe than the tail event just discussed.

Figure 7.1 Evolution of Israeli Debt to GDP: Tail Risks



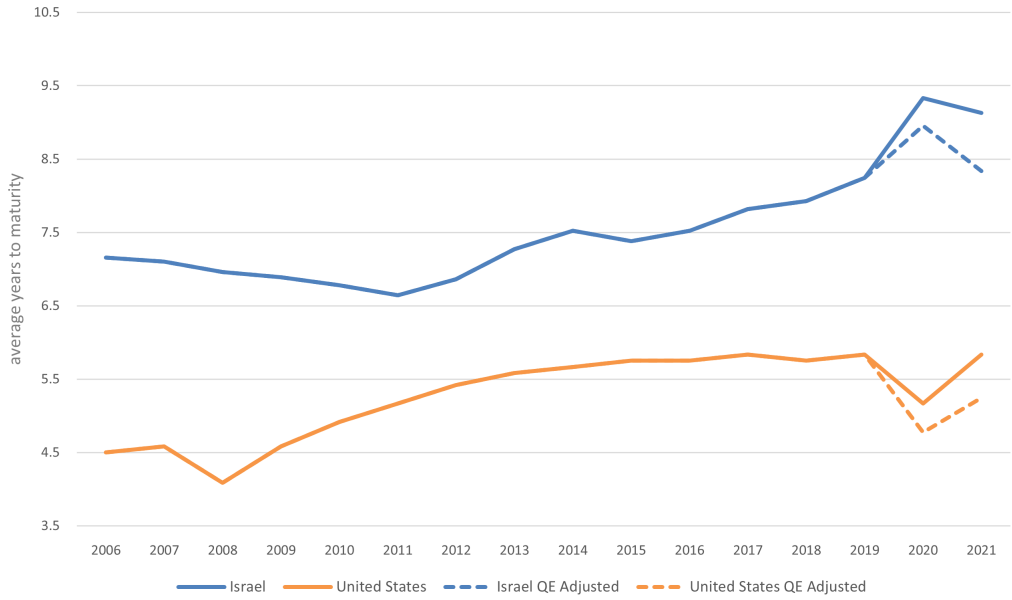
8 Insurance

What can Israel do to minimize the fiscal damage from tail risks? At a minimum, it can buy some insurance by lengthening the average maturity of government debt. By analogy, suppose you were taking out a mortgage and saw that long-term rates were incredibly low. Would you take out a variable rate mortgage, especially if you were worried about a possible rise in rates? Of course not: you would lock in low, long-term rates. In this spirit, Israel should lengthen the maturity of its debt structure, locking in historically low rates on government debt.

The solid orange and blue lines in Figure 8.1 display the average maturity of bonds issued by the U.S. Treasury and the Israeli government. The data underlying these lines do not net out purchases by the Federal Reserve Board or the BoI. So they don't represent the average maturity of *consolidated* government debt. See Greenwood, Hanson, Rudolph, and Summers (2015) for an analysis of how to calculate the duration of consolidated government debt.

Before consolidation, the average maturity of U.S. debt declined from almost 5.8 years at the onset of the COVID-19 crisis to 5.2 years. In contrast, the average maturity of Israeli government debt increased from about 8.2 years percent to over 9.3 years.

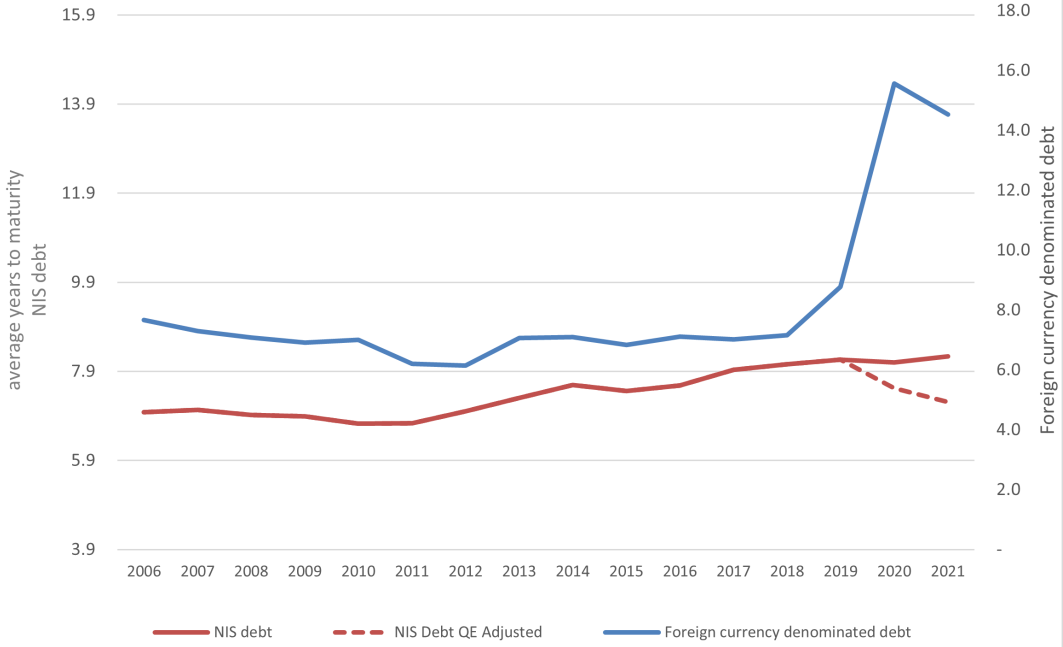
Figure 8.1 Average Maturity of Government Debt



Orange Line: average years to maturity of total U.S. government debt. Blue line: average years to maturity of total Israeli government debt.

The solid blue and red lines in Figure 8.2 display the average maturity of foreign currency and NIS-denominated Israeli government debt. Note that the average duration of foreign currency-denominated debt rose sharply from 8.8 to 14.5 years. However, the average maturity of NIS-denominated debt basically stayed at 8.2 to 8.1 years. So the overall rise in the average maturity of Israeli government debt entirely reflects the behavior of foreign currency-denominated debt.

Figure 8.2 Average Maturity of Government Debt

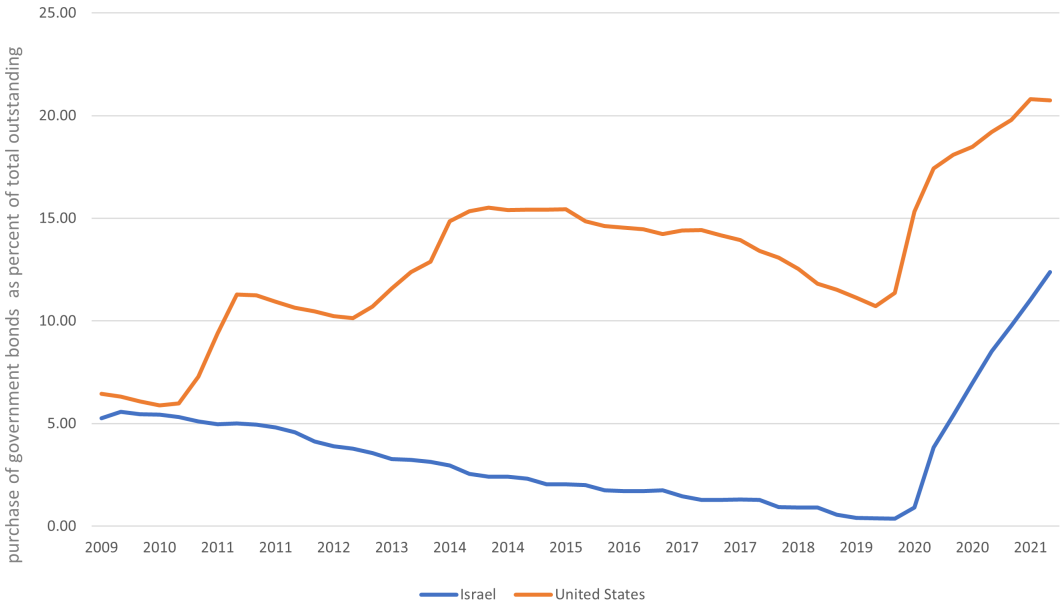


Red line: average years to maturity of NIS issued government debt. Blue line: average years to maturity of foreign currency issued Israeli government debt.

The Federal Reserve Board and the BoI responded to the COVID-19 crisis via vigorous quantitative easing programs. In such a program, a central bank buys government bonds and other government-guaranteed securities at the long end of the yield curve. The goal is to lower longer-term interest rates. The central bank pays for the longer-term assets with overnight reserves. The latter can be thought of as zero-maturity liabilities. So, the net effect of these operations is to lower the average maturity and effective duration of the *consolidated* government debt held by the public.

In both countries, the size of the operation was very large. For example, the Federal Reserve's balance sheet expanded by roughly $4.5 trillion between March 2020 and March 2022. Over the same period, the BoI purchased approximately NIS 80 billion worth of bonds. Figure 8.2 displays the percentage of outstanding Israeli and U.S. government debt held by the BoI and the Federal Reserve System. In both cases, quantitative easingand other measures led to a sharp rise in the percentage, peaking at roughly 12.4 percent and21 percent, respectively.

Figure 8.3 Quantitative Easing: Central Banks Hold More Government Debt



Orange line: the share of total U.S. treasury securities held by the Federal Reserve System. Blue line: the share of negotiable debt issued by the Central Israeli government held by the Bank of Israel.

Quantifying the exact impact of quantitative easing on the average maturity of outstanding government debt is a non-trivial task. Here we use the following back-of-the-envelope calculation. Suppose that the Central Bank buys X percent of government bonds by issuing zero maturity reserves. For simplicity, we assume that the Central Bank buys government bonds of different maturities in the same proportion as they appear in thegovernment balance sheet.[7] Then the overall adjusted maturity of government debt held by the non-central bank public is

$$(1 - X_t) * (\text{Unadjusted Average Maturity}_t)$$

We compute X_t as the ratio of negotiable government bonds purchased by the Central Bank during Covid as a percent of total outstanding negotiable government bonds in year $t = 2020, 2021$.

The dotted lines in Figures 8.1 and 8.2 show the QE-adjusted maturity of U.S. and Israeli *consolidated* government debt. Suppose that the average maturity of the government debt purchased by the monetary authority is the same as the overall maturity of all outstanding government debt. Then these lines also provide a lower bound for the average

[7] Since quantitative easing was aimed at bonds with longer maturities, this assumption is conservative in terms of assessing the impact of that policy on average maturity.

maturity of the government's consolidated debt. Based on our rough calculations, quantitative easing lowered the overall average maturity of U.S. and Israeli government debt by 0.6 and 0.8 years, respectively. The average maturity of NIS-issued debt fell by about a year.

These stark changes move in the opposite direction of buying insurance against fiscal tail events. There were certainly good reasons for the Federal Reserve Board and the BoI to engage in large quantitative easing programs during the COVID-19 crisis. But the program led Israel to depart from a prior policy in which the government was increasing the average maturity of its debt. Now that the COVID-19 crisis is over, it would be wise for Israel to move back to and beyond pre- COVID-19 average debt maturity levels.

9 Conclusion

Israel was a model of fiscal responsibility relative to the U.S. in the decade before COVID-19. In recognition of this fact, the interest rate on Israeli government debt relative to U.S government debt fell to record low levels. Looking forward, Israel faces three potential challenges. First, the deficit-to-GDP ratio was higher in 2019 than it was on average from 2010 to 2019. To keep the debt-to-GDP ratio stable, the government deficit-to-GDP ratio must be closer to its average value from 2010 to 2019. Second, the government will need to make further fiscal adjustments if interest rates on government debt rise modestly or, as forecasted by the Bank of Israel and the Ministry of Finance, the GDP growth rate falls below its pre-Covid levels. The third challenge stems from tail events that impact interest rates and growth rates. Geopolitical risk will always be a fact of life for Israel. A novel first-order concern is thatthe U.S. is on a fiscally unsustainable path. The U.S. might put its fiscal house in order. But it might not. Responsible leadership must take the latter possibility into account.

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[6] Reinhart, Carmen and Kenneth S. Rogoff, (2010). "Growth in a Time of Debt". American Economic Review. 100 (2): 573–78.

Appendix :Data Sources and Transformations

Table 1: Israeli Data

Variable	Short Description	Applied Transformation	Frequency	Source	URL
Nominal GDP	Gross Domestic Product - Current Prices	Year on Year growth rate at quarterly frequency	Quarterly	Bank of Israel	https://www.boi.org.il/; Series ID: CHAINED.GDP.Q_N
Real GDP	Gross Domestic Product - Fixed 2015 Prices	Year on Year growth rate at quarterly frequency	Quarterly	Bank of Israel	https://www.boi.org.il/; Series ID: CHAINED.GDP.Q_FP
Net Debt	Total Net Public Debt	-	Yearly	Bank of Israel	https://www.boi.org.il;
Inflation	CPI - Total excl. energy and food	Year on Year growth rate at yearly frequency	Yearly	Bank of Israel	https://www.boi.org.il; Series ID: PT_NO_EN_1
Nominal Net Interest/GDP	Nominal Interest Payments - Interest, Dividend and Property Income	Total Government Surplus - Total Government Surplus excluding Interest and Income from Property	Yearly	Bank of Israel; Israel Ministry of Finance Budget Projections for 2021	https://www.boi.org.il; https://www.gov.il
Real Net Interest/GDP	Nominal Net Interest Payments net of debt inflation. See Furman and Summers (2020) for details.	Nominal Net Interest/GDP - Inflation*Debt/GDP. Inflation is smoothed through a 5-period centered moving average.	Yearly	Authors' computations; Bank of Israel Inflation Forecast	-
Government Primary Budget Balance/GDP	Total Government Budget Balance excluding	-	Yearly	Bank of Israel	https://www.boi.org.il;
Net Debt/GDP	Ratio of Net Debt to Nominal GDP	Net Debt/Nominal GDP	Yearly	Authors' computations	-
10Y Nominal Government Bond Yield	Nominal rate of return derived from the zero coupon yield curve estimation - 10 years	Quarterly average	Quarterly	Bank of Israel	https://www.boi.org.il; Series ID: TSB_ZND_10Y.M
10Y Real Government Bond Yield	Real rate of return derived from the zero coupon yield curve estimation - 10 years	Quarterly average	Quarterly	Bank of Israel	https://www.boi.org.il; Series ID: TSB_ZRD_10Y.M
Real Net Interest/GDP	Ratio of Real Net Interest Payments to Real GDP	Real Net Interest Payments/Real GDP	Yearly	Authors' computations	-
(r-g)	Spread between interest rate on federal debt and nominal GDP growth. See Cochrane (2021) for details.	10Y Nominal Government Bond Yield minus Year on Year nominal GDP growth rate. Smoothed through MA(4).	Quarterly	Authors' computations	-
Debt held by Central Bank	Total Negotiable Debt held by Bank of Israel	Negotiable Debt held by Bank of Israel/Total Negotiable Debt	Yearly	Bank of Israel	https://www.boi.org.il; News; News
Average Time to Maturity of Debt	Average Maturity of Total Outstanding Treasury Marketable Securities	Average months to Maturity/12. Quarterly average of monthly series	Quarterly	Bank of Israel	https://www.boi.org.il
X%	Share of total Negotiable Government Bonds purchased by the BoI	Outstanding Bonds, BoI Assets / Outstanding Bonds, Israel Gov. Liabilities	Yearly	Bank of Israel	tnc13_e.xls; f_19_e.xlsx

Table 2: United States Data

Variable	Short Description	Applied Transformation	Frequency	Source	URL
Nominal GDP	Nominal Gross Domestic Product	Year on Year growth rate at quarterly frequency	Quarterly	FRED	https://fred.stlouisfed.org/series/GDP
Real GDP	Real Gross Domestic Product	Year on Year growth rate at quarterly frequency	Quarterly	FRED	https://fred.stlouisfed.org/series/GDPC1
Net Debt	Gross Debt net of Financial Assets	Backcast for the years before 2001 with profile of Net Debt from Government Balance Sheet Statistics.	Yearly	Global IMF Fiscal Monitor; Government Balance Sheet Data (Total Debt - Financial Assets)	https://data.imf.org/?sk=4be0c9cb-272a-4667-8892-34b582b21ba6&sId=1390030341854; https://fred.stlouisfed.org/series/FYGFGDQ188S; https://fred.stlouisfed.org/series/FGTLBLQ027S; https://fred.stlouisfed.org/series/FGTFASA027N
Inflation	Personal Consumption Expenditure excl. Food and Energy, Price Index	Year on Year growth rate at yearly frequency	Yearly	U.S. CBO, Historical Data and Economic Projections, May 2022	https://www.cbo.gov/system/ les/2022-05/55022-2022-05-Historical-Economic-Data.zip
Nominal Net Interest/GDP	Nominal Interest Payments - Interest, Dividend and Property Income over GDP	-	Yearly	U.S. CBO, Historical Budget Data, May 2022	https://www.cbo.gov/system/ les/2022-05/51134-2022-05-Historical-Budget-Data.xlsx
Real Net Interest/GDP	Nominal Net Interest Payments net of debt inflation. See Furman and Summers (2020) for details.	Nominal Net Interest/GDP - Inflation*Debt/GDP. Inflation is smoothed through a 5-period centered moving average.	Yearly	Authors' computations;	-
Federal Primary Budget Balance/GDP	Federal Budget Surplus/Deficit before Interest Expense	Federal Surplus or Deficit [-] as Percent of Gross Domestic Product + Federal Outlays: Interest as Percent of Gross Domestic Product	Yearly	FRED	https://fred.stlouisfed.org/series/FYFSGDA188S; https://fred.stlouisfed.org/series/FYOIGDA188S
Net Debt/GDP	Ratio of Net Debt to Nominal GDP	Net Debt/Nominal GDP	Yearly	Authors' computations	-
10Y Nominal Government Bond Yield	Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity	Quarterly average	Quarterly	FRED	https://fred.stlouisfed.org/series/DGS10
10Y Real Government Bond Yield	Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity, Inflation-Indexed	Quarterly average	Quarterly	FRED	https://fred.stlouisfed.org/series/FII10
Real Net Interest/GDP	Ratio of Real Net Interest Payments to Real GDP	Real Net Interest Payments/Real GDP	Yearly	Authors' computations	-
(r-g)	Spread between interest rate on federal debt and nominal GDP growth. See Cochrane (2021) for details.	10Y Nominal Government Bond Yield minus Year on Year nominal GDP growth rate. Smoothed through MA(4).	Quarterly	Authors' computations	-
Debt held by Federal Reserve System	Federal Debt Held by Federal Reserve System as Percentage of Federal Debt Held by the public	Federal Debt Held by the public as percent of federal debt held by the public	Quarterly	FRED	https://fred.stlouisfed.org/series/FDHBFRBN; https://fred.stlouisfed.org/series/FYGFDPUN
Average Time to Maturity of Debt	Average Maturity of Total Outstanding Treasury Marketable Securities	Average months to Maturity/12	Quarterly Average of Monthly series	Treasury	nasdaq.com/data/USTREASURY/; treasury.gov
X%	Share of total Treasury Marketable securities purchased by the FED	Outstanding Bonds, FED Assets/ Outstanding Bonds, Fed Gov. Liabilities	Yearly: end of year of quarterly series	FRED	https://fred.stlouisfed.org/series/FGDSLAQ027S; https://fred.stlouisfed.org/series/TREAST