

FEDERAL GOVERNMENT DEBT AND INTEREST RATES

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Why This Paper?

- Recent events.
 - Federal deficits and debt have increased (Fig. 1 + 2).
- Most surveys, including ours, conclude that there is mixed empirical evidence.
 - Comparisons of results are difficult.
 - Different measures of federal government debt and different measures of interest rates.
 - Different econometric specifications and methods.
- *Goals of this paper:*
 - Calculate a benchmark to evaluate empirical estimates.
 - Compare estimates across differences in measures of federal government debt (D) and real interest rate (r).

Figure 1
U.S. Federal Government Debt Held by the Public as a Percentage of GDP

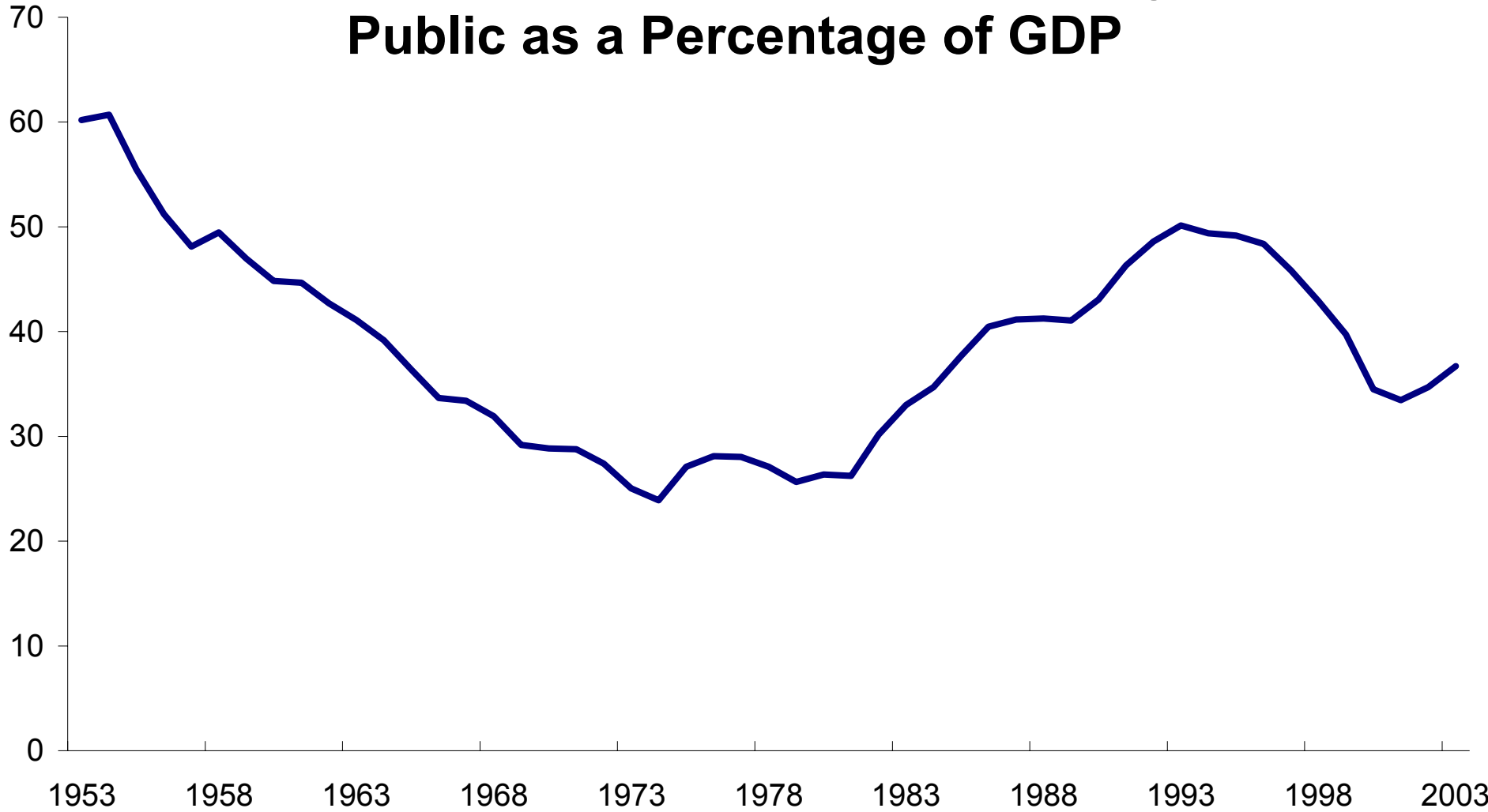
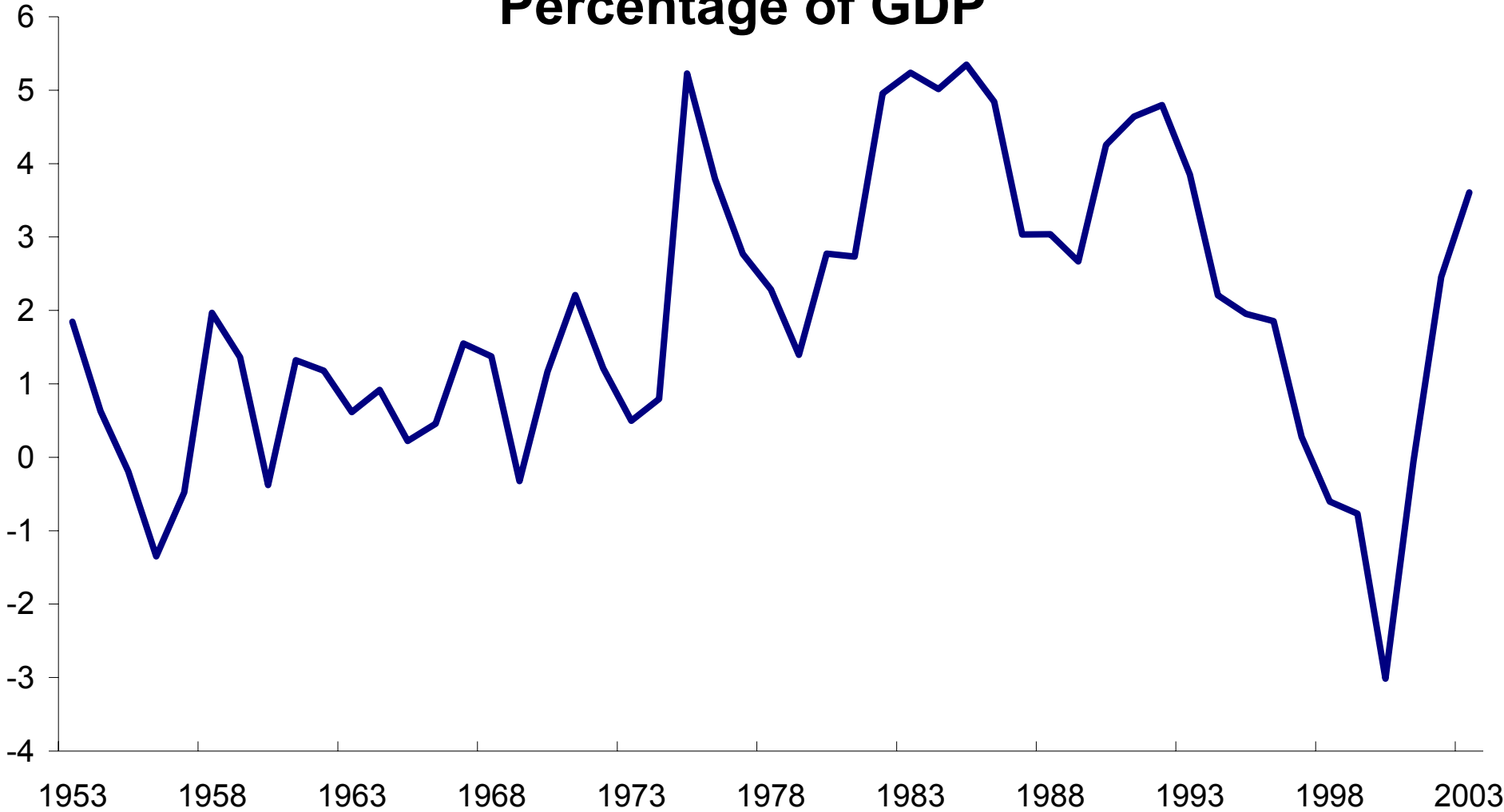


Figure 2
U.S. Federal Government Borrowing as a Percentage of GDP



A Benchmark

- Standard economic model of crowding out
 - Increase in debt (D) may increase interest rates (r).
 - *Private saving response dampens interest rate response.*
 - *Foreign saving inflows dampens interest rate response.*
 - This model implies a relationship between the *level* of debt and the *level* of the interest rate or the *change* in debt (the *deficit*) and the *change* in the interest rate.
 - Important for empirical specification.
- Alternative: Keynesian *IS-LM* model
 - An increase in interest rate from short-term aggregate demand stimulus from the deficit differs from an increase in interest rate owing to crowding out of capital formation.
 - Difficult to construct a natural Keynesian benchmark that separates these two effects.

- Federal debt currently is about 13% of the private capital stock (Fig. 3).
- Calculations from economic model (Table 1):
 - 1 to 3 basis point \uparrow in r per \uparrow in D of 1% of GDP.
 - Effects on interest rate are somewhat larger if increases in debt are persistent.
 - Effects on interest rate are somewhat smaller if increases in debt are partially offset by increased private saving and/or foreign saving inflow.
- These calculations assume that other factors are held constant.

Figure 3
U.S. Federal Government Debt Held by the Public as a Percentage of U.S. Private Capital Stock

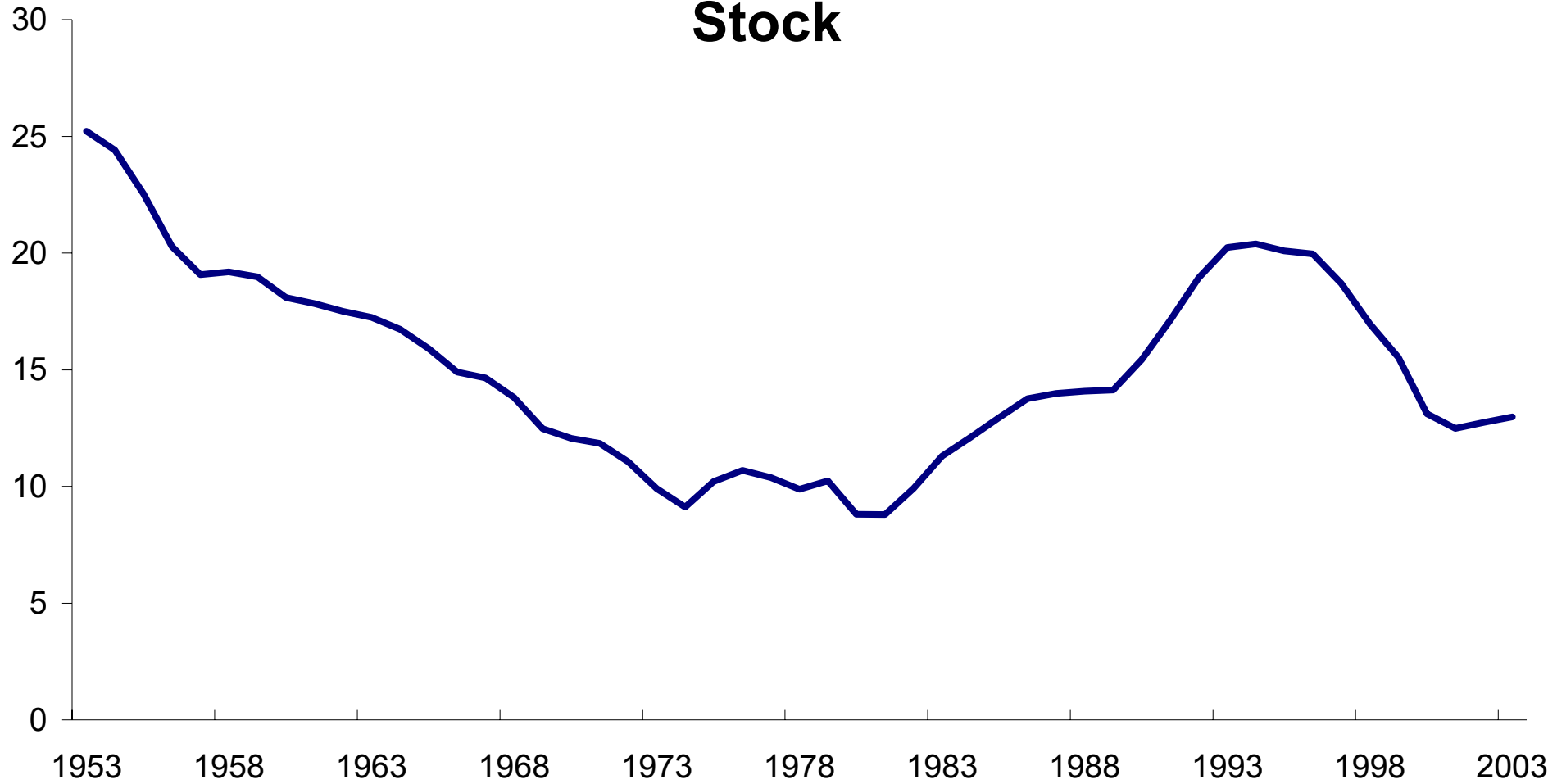


Table 1**Changes in Federal Government Debt and Interest Rates:
Calculations from a Neoclassical Growth Model**

Change in interest rates (basis points)

Increase in Federal debt (% of GDP)	No offset $\partial K/\partial D = -1$ (1)	20% offset $\partial K/\partial D = -0.8$ (2)	40% offset $\partial K/\partial D = -0.6$ (3)
1) 1 percent	2.4	1.9	1.4
2) 5 percent	11.8	9.5	7.1
3) 10 percent	23.7	18.9	14.2
Eliminate Federal Government Debt			
4) \$4 trillion	-86	-69	-52

Federal Government Debt, Credit Markets, and Interest Rates: Some Facts

- Share of federal government debt in domestic nonfinancial debt is currently 18%. (Fig. 4)
- Relevant credit market is even larger owing to international financial market integration.
 - Foreign holdings of U.S. Treasury debt have risen from 5% to over 35% during the past 35 years (Fig. 8)
 - Across countries, real interest rates are very similar (Fig. 14); fiscal positions are not.
- Strong relationship between federal debt and real interest rates is not obvious (Fig. 10 + 12).
 - Simple $\text{corr}(D, r) = 0.15$; simple $\text{corr}(\Delta D, \Delta r) = 0.06$

Figure 4
U.S. Federal Government Debt Held by the Public as a Percentage of Total U.S. Domestic Nonfinancial Debt

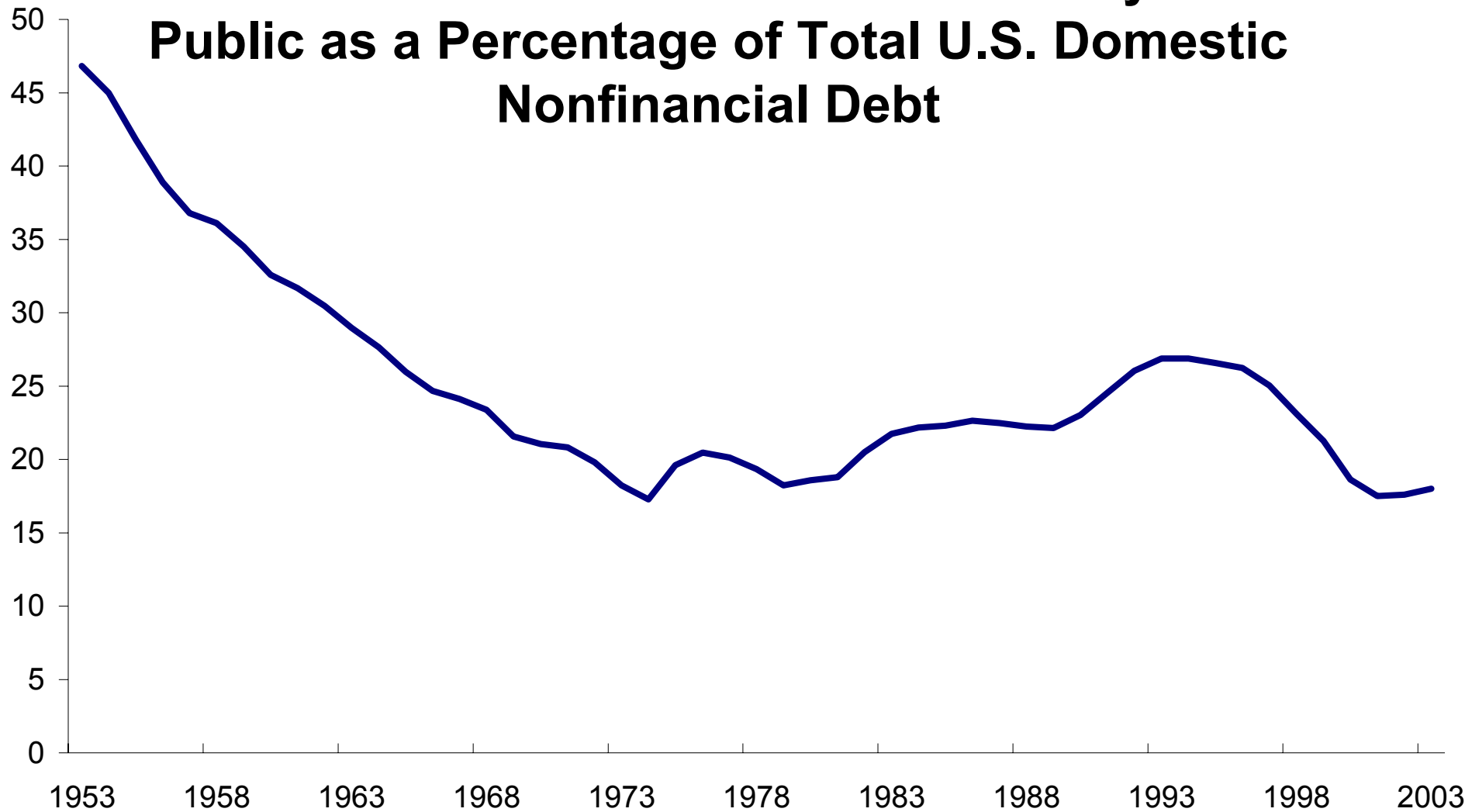


Figure 8
Foreign Holdings of U.S. Treasury Securities
as a Percentage of Total U.S. Treasury
Securities Outstanding

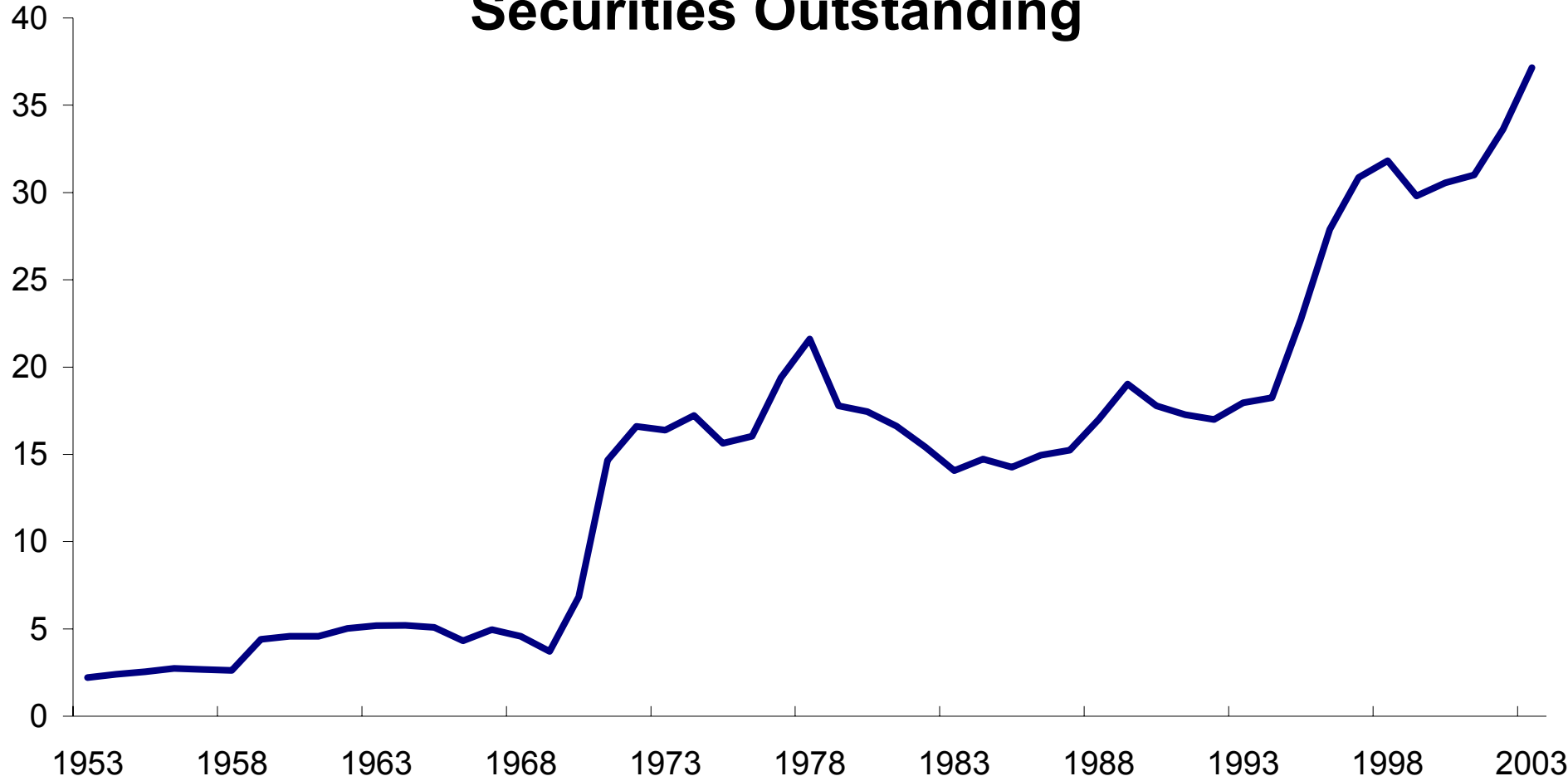


Figure 14

Real Interest Rates on 10-Year Government Bonds for Major Advanced Economies

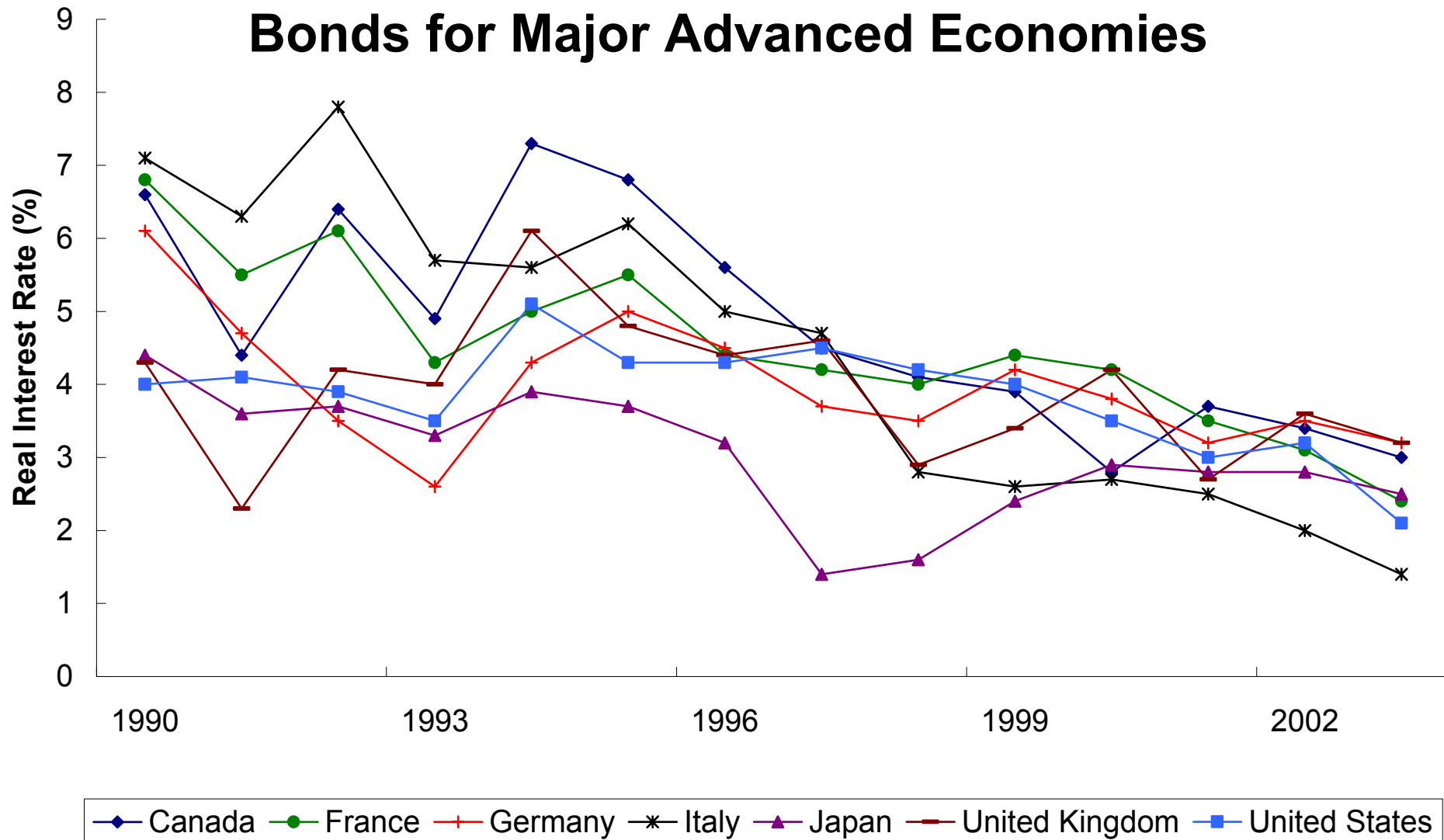


Figure 10

U.S. Federal Government Debt Held by the Public as a Percentage of GDP and Real 10-Year Treasury Interest Rate

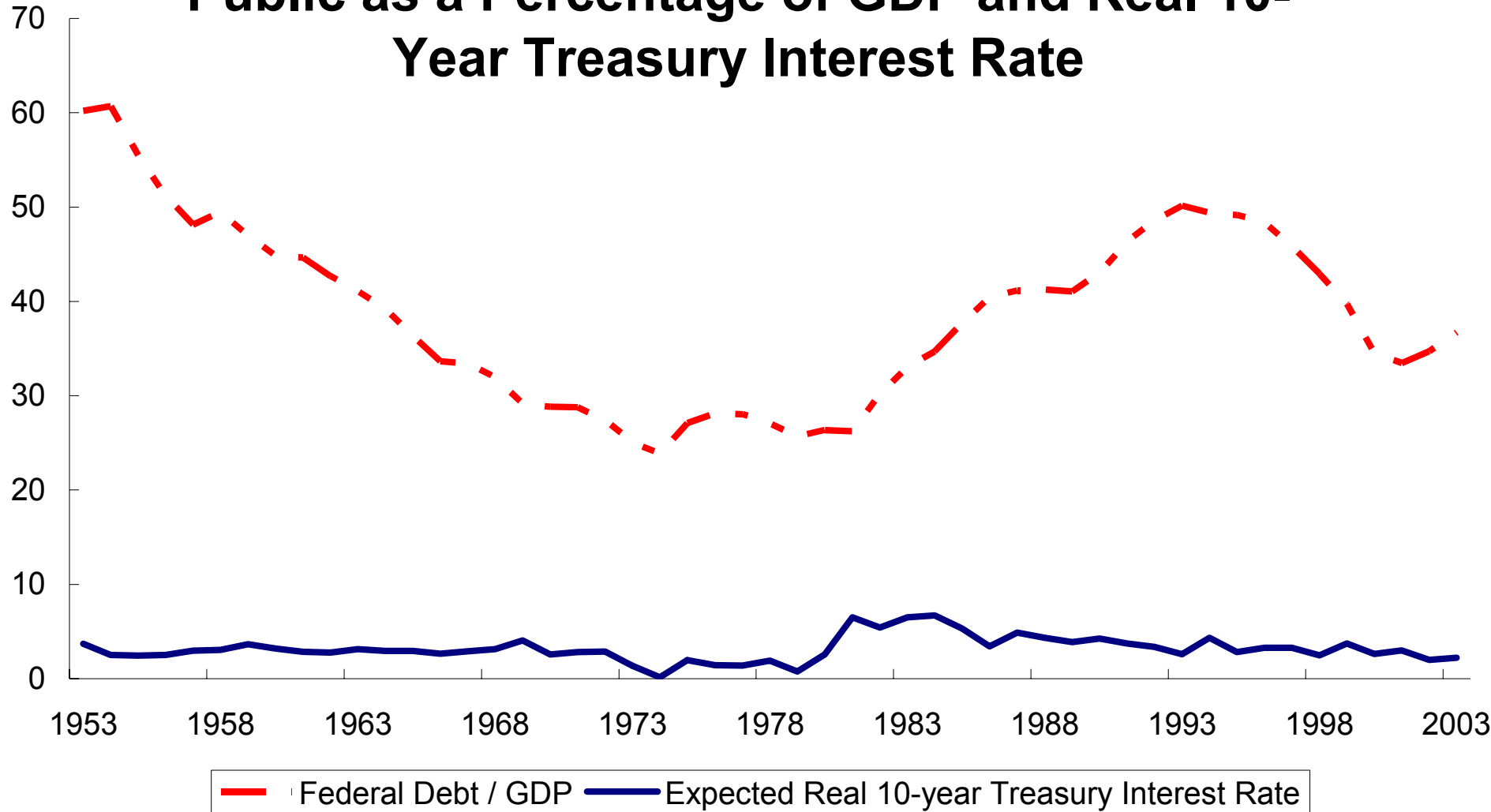
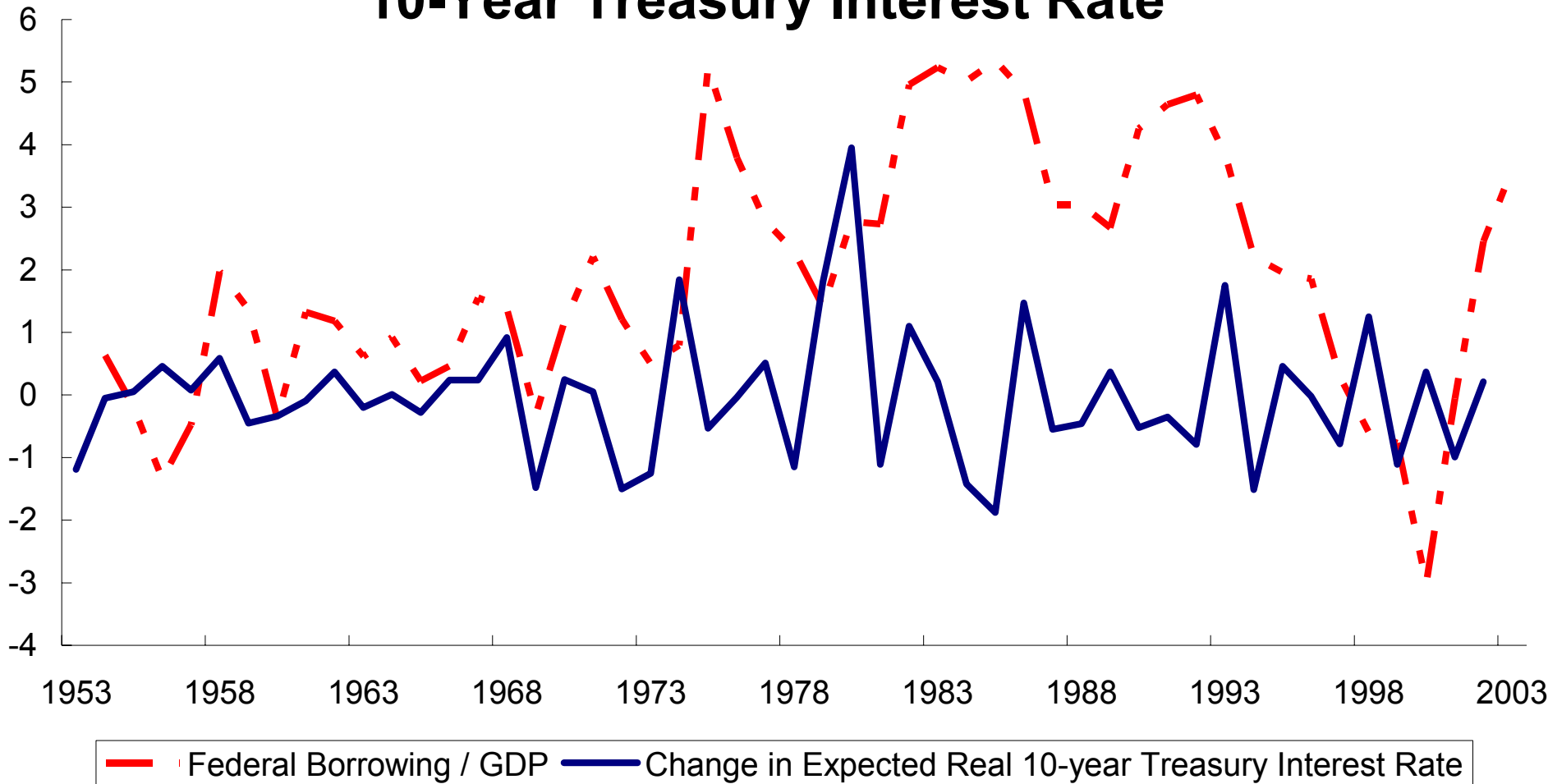


Figure 12

U.S. Federal Government Borrowing as a Percentage of GDP and the Change in the Real 10-Year Treasury Interest Rate



Empirical Analysis

- Estimate a reduced form equation
 - $r = \beta_0 + \beta_1 D + \Gamma Z + u$
- To facilitate comparisons across studies, we estimate the effect of:
 - an *expected* measure of D on a *forward-looking* measure of r .
 - an *expected* measure of D on a *current* measure of r .
 - a *current* measure of D on a *current* measure of r .
 - Z : real GDP growth rate, real oil prices, equity premium, military spending dummy variable, Fed Reserve Treasury purchases.
- Also estimate relationship in a Vector Autoregression (VAR) framework.

Empirical Results

- Forward-looking real interest rates and projections of government debt (Table 2).
 - $\uparrow D$ by 1% of GDP $\rightarrow \uparrow r$ by 3 bp (significant).
 - With $(\Delta r, \Delta D) \rightarrow \uparrow r$ by 3 bp (insignificant).
 - With $(r, \Delta D) \rightarrow \uparrow r$ by 18 bp (significant).
- Current real interest rates and expected federal debt (Table 3).
 - With $(r, D) \rightarrow \uparrow r$ by 3 bp (significant)
 - With $(\Delta r, \Delta D) \rightarrow \uparrow r$ by 3 bp (insignificant)
 - With $(r, \Delta D) \rightarrow \uparrow r$ by 24 bp (significant)

- Current real interest rates and current federal debt (Table 4).
 - With $(r, D) \rightarrow \hat{r}$ by 5 bp (insignificant).
 - With $(\Delta r, \Delta D) \rightarrow \hat{r}$ by 7 bp (insignificant).
 - With $(r, \Delta D) \rightarrow \hat{r}$ by 9 bp (insignificant).
- **Vector Autoregressions** (Figures 15-20)
 - Response of r to *projected* D is positive ($1\frac{1}{2}$ - $2\frac{1}{2}$ bp) but *current* D is not statistically significant.
 - Response of *forward-looking* r to projected ΔD is positive (12 bp) but r and ΔD have statistically insignificant relationship in other specifications.

Conclusions

- Evidence is still mixed...
- ...though most of the statistically significant effects we estimated, using a specification implied by a standard economic model, are consistent with benchmark calculations.
 - an $\uparrow D$ by 1% of GDP \rightarrow $\uparrow r$ by 2 to 3 basis points.
- *What we don't explore*: mix of offset to an increase in federal government debt from private saving and inflow of foreign savings.
- *What we don't claim*: Deficits don't matter.
 - How deficits are reduced does matter.