US Fiscal Cycle and the Dollar

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The dollar is strong when the US fiscal condition is strong. The US fiscal cycle explains 50% of the low-frequency variation in the dollar's value. At the same time, a stronger US fiscal condition predicts a higher return on the dollar in the next 3 years. These patterns are unique to the US, and absorb the return predictability of the forward premium. In a model with sticky prices, I show these patterns are driven by the comovement between the US fiscal cycle and the US investors' risk premium. During expansions, higher government surpluses increase the nominal value of the dollar, while a lower risk premium reduces the expected returns the US investors require to hold foreign currencies. Consistent with this view, the US fiscal cycle also explains the term premium, the dollar carry trade, the currency return momentum, and the US investors' capital flows.

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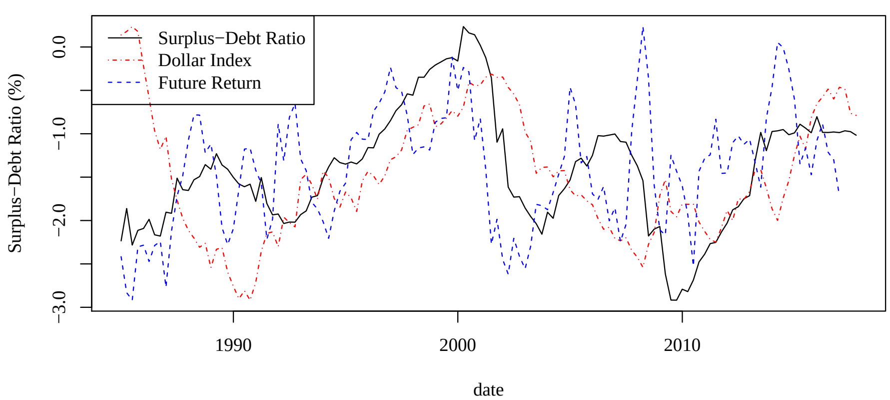
The US fiscal cycle lines up with the dollar's value and future return. Figure 1 plots the US government surplus-to-debt ratio. This ratio measures the net fraction of its outstanding debt the US government pays down in each quarter, reflecting a slow-moving fiscal cycle. Since the late 1980s, a higher US government surplus-to-debt ratio co rresponds to a *stronger* dollar today and predicts a *higher* expected return on the dollar in the next 3 years.

This finding contrasts the negative relationship between asset prices and expected returns common in asset pricing. For example, a stronger demand for US dollar safe assets corresponds to a *stronger* dollar today and predicts a *lower* expected return on the dollar (Valchev (2017); Jiang, Krishnamurthy and Lustig (2018)). These patterns also differ by their frequencies: The safe asset demand coincides with the quarter-to-quarter and the year-to-year variations in the dollar's value, whereas the US fiscal cycle comoves with the dollar's value at the frequency of multiple years.

This finding is also unique to the US: Higher government surplus-to-debt ratios do not

Figure 1. US Government Surplus-to-Debt Ratio and the Dollar.



Note: The surplus-to-debt ratio is the ratio between the US government surplus in each quarter and the quantity of US government debt at the beginning of the quarter. The dollar index is the real trade-weighted dollar index relative to its value 20 quarters ago. The future return is the average excess return of the dollar against 10 foreign currencies in the next 4 quarters. The dollar index and the future return are rescaled to fit the figure.

correlate with higher nominal exchange rates in 8 out of 10 other developed countries, and do not predict higher currency returns in 9 out of 10 other developed countries.

I conjecture that this relationship between the US fiscal cycle and the dollar is driven by two mechanisms. One the one hand, the fiscal theory of the price level shows that currency value reflects the present value of government surpluses. When the US government surpluses are higher, the dollar is stronger. On the other hand, higher US government surpluses indicate US expansions. As Lustig, Roussanov and Verdelhan (2014) show in a no-arbitrage model with complete markets, during expansions US investors require a lower compensation for holding foreign currencies. As foreign currencies have a lower risk premium with respect to the dollar, the dollar has a higher expected return with respect to foreign currencies.

The fiscal theory mechanism affects the dollar's nominal value, whereas the risk premium mechanism affects the dollar's real return. Price stickiness is required to connect the nominal and the real exchange rates. In a reduced-form new-Keynesian model, I derive the dollar's real exchange rate as future cash flows minus future expected returns. Higher government surpluses increase the dollar's cash flows, whereas a lower risk premium of the US investors increases the dollar's expected returns against foreign currencies. In this way, the dollar is a special asset whose cash flows are positively correlated with its expected returns, and this correlation gives rise to my main results.

The comovement between the US fiscal cycle and the US investors' risk premium has broader implications, as the risk premium also affects other asset returns and capital flows. Indeed, it allows the US fiscal cycle to provide an organizing principle for the following asset pricing phenomena.

First, the *forward premium puzzle* finds that a higher forward premium of the dollar predicts a *higher* excess return on the dollar in the short run. I show that 43% of the variation in the dollar's forward premium is explained by the US government surplus-to-debt ratio, and the dollar's forward premium no longer predicts its excess return in the short run once I control for the surplus-to-debt ratio. Just as my finding is unique to the US, the forward premium puzzle also disappears in 7 out of 10 foreign currencies.

Moreover, Engel (2016) finds that a higher forward premium of the dollar predicts a *lower* excess return on the dollar in the long run. My model implies that a higher US government surplus-to-debt ratio also predicts a lower excess return on the dollar in the long run, and I confirm this implication in the data. On the other hand, once I control for the US government surplus-to-debt ratio, the prediction of the dollar's long-run excess return by the dollar's forward premium turns positive. In this way, my model provides a reconciliation between the long-run and the short-run return predictability of the forward premium.

Second, a higher US government surplus-to-debt ratio is associated with a lower term premium and a lower Cochrane and Piazzesi (2005) bond factor, both of which measure the risk premium of long-term US government bonds (Fama and Bliss (1987)). The US government surplus-to-debt ratio explains 35% to 37% of the variations in the two measures. This result is consistent with my model: When the US fiscal condition improves, the US investors lower their risk premia. Not only do they require lower returns on foreign currencies, they also require lower returns on long-term US government bonds.

Now that a higher US government surplus-to-debt ratio predicts a higher currency risk premium but a lower term premium, the US fiscal cycle covaries with short-term bonds' expected returns but not with long-term bonds' expected returns. This result is consistent with Lustig, Stathopoulos and Verdelhan (2017)'s finding that the forward premium predicts the excess returns of short-term bonds but not long-term bonds.

Third, Lustig, Roussanov and Verdelhan (2014) construct a *dollar carry trade* that buys foreign currencies against the dollar whenever the dollar's forward premium is below 0, and shorts foreign currencies against the dollar otherwise. This simple strategy produces a Sharpe ratio in excess of 0.50. Since the US government surplus-to-debt ratio comoves with the dollar's forward premium, I construct currency portfolios that exploit the time-series variation in the surplus-to-debt ratio. These portfolios have similar Sharpe ratios and explain the abnormal return of the dollar carry trade, providing evidence for the out-of-sample return predictability of the surplus-to-debt ratio.

Fourth, Burnside, Eichenbaum and Rebelo (2011); Moskowitz, Ooi and Pedersen (2012); Asness, Moskowitz and Pedersen (2013) find momentum effects in currency returns. My model shows that when the US government fiscal condition improves, the dollar appreciates and is expected to have a higher expected return in the future. The US fiscal cycle drives the common variation in past and future currency returns. Consistent with this result, past currency returns no longer predict future currency returns once I control for the US government surplus-to-debt ratio.

Fifth, Alvarez, Atkeson and Kehoe (2002, 2009); Pavlova and Rigobon (2012); Bruno and Shin (2014); Chien, Lustig and Naknoi (2015); Dou and Verdelhan (2015); Maggiori (2017) show that investors should hold more foreign risky assets when their risk appetite improves. If the US fiscal cycle coincides with the US investors' risk premium, the US fiscal condition should also explain cross-border capital flows. Consistent with this claim, when the US government surplus-to-debt ratio is higher by 1%, the US investors hold 6.6% more foreign stocks and 1.0% less foreign bonds as fractions of the US quarterly GDP. In the following 4 quarters, they continue to buy foreign stocks and sell foreign bonds.

A. *Related Literature*

My paper shows how the comovement between US investors' countercyclical risk premium and the US fiscal cycle affects the dollar's value and expected return. It highlights the US fiscal cycle as a relevant variable for understanding currency returns, which have been studied in models that feature countercyclical risk premia[1]. Lustig, Roussanov and Verdelhan (2014) state that the countercyclical risk premia are the key to understand why the dollar's forward

[1] Colacito and Croce (2011, 2013); Bansal and Shaliastovich (2013); Colacito et al. (Forthcoming) show how long-run risks affect exchange rates. Verdelhan (2010); Heyerdahl-Larsen (2014); Stathopoulos (2016) show how external habits affect exchange rates. Gourio, Siemer and Verdelhan (2013); Farhi and Gabaix (2016) consider rare-disaster risks. Hassan (2013); Martin (2013); Richmond (2016) use country size and trade network centrality to explain currency risk premia. Lustig and Verdelhan (2015); Chien, Lustig and Naknoi (2015); Dou and Verdelhan (2015) consider market incompleteness and segmented financial markets.

premium predicts the dollar's excess return against foreign currencies. Engel (2016) further finds that a higher forward premium of the dollar predicts a lower expected return on the dollar in the long run. I show these results are consistent with my key mechanism, and I present empirical support.

On the other hand, fiscal conditions have been shown to affect currency value during currency crises and under the fiscal theory of the price level[2]. I find the US fiscal cycle comoves with the dollar's exchange rate and expected return in a unique way. In comparison, it is still difficult to explain and predict foreign currencies' exchange rate movements using foreign countries' fundamentals, which is documented as the exchange rate disconnect puzzle (Meese and Rogoff (1983); Backus and Smith (1993); Obstfeld and Rogoff (2000)).

Lastly, the US dollar has been studied from other perspectives. Valchev (2017); Jiang, Krishnamurthy and Lustig (2018) show that the demand for US dollar safe assets drive the dollar's value and expected return. Valchev (2017) also provides a solution for Engel (2016)'s puzzle. Gourinchas and Rey (2007, 2014) show the dollar is also related to the US trade balance. Table B11 in the Appendix shows my results are robust to controlling for the US current account-to-GDP ratio. Evans and Lyons (2002); Hau and Rey (2004, 2005); Froot and Ramadorai (2005); Fourel et al. (2015) show order flows, investor flows and portfolio rebalancing motives also drive exchange rates. Relative to these factors, the US fiscal cycle drive the dollar at lower frequencies.

[2]Burnside, Eichenbaum and Rebelo (2001, 2003); Corsetti and Mackowiak (2001); Daniel (2001*a*) show how fiscal shocks affected nominal exchange rates during currency crises. The fiscal theory of the price level shows fiscal conditions are reflected by domestic price levels (Sargent and Wallace (1984); Leeper (1991); Woodford (1994); Sims (1994); Cochrane (2001, 2005, 2018*b*, 2017); Dupor (2000); Daniel (2001*b*)). Bolton and Huang (2017) introduce sovereign default and study the optimal financing decision of a government. Bénétrix and Lane (2010, 2011) show fiscal variables covary with output cycles and financial cycles. In a contemporary work, Nguyen (2018) shows that high government debt forecasts low consumption growth and deflation.

I. Main Results

A. Data

My sample contains 11 developed economies: Australia, Canada, Denmark, Germany, Japan, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States. Data are quarterly. The main panel covers the period from 1988Q1 to 2017Q4.

Exchange rates and forwards rates are nominal, unless otherwise indicated. Government surpluses, government debt and GDP are obtained from Oxford Economics. US GDP is seasonally adjusted, but US government surplus and US government debt quantity are not. For robustness tests, I also obtain government surplus data from Federal Reserve Economic Data (FRED) and Thomson Reuters International Comparable Economics (TRICE). Treasury basis is obtained from Jiang, Krishnamurthy and Lustig (2018).

The government surplus-to-debt ratio is defined as the ratio between the nominal government surplus in each quarter and the nominal quantity of government debt at the beginning of the quarter. This ratio measures the net fraction of its outstanding debt the US government pays down during each quarter. If this ratio is negative, the government has to issue additional debt to finance its budget deficit.

B. Time-Series Regressions

I aggregate the data into a single time-series by fixing the dollar as the base currency and taking the equal-weighted average of exchange rates and currency returns across foreign countries. Let e_t denote the average log nominal exchange rate of the dollar against foreign currencies. It is the equal-weighted dollar index:

$$e_t \overset{\text{def}}{=} \frac{1}{N}\sum_i e_t^{US,i}.$$

Let fp_t denote the average log forward premium of the dollar against foreign currencies.

The forward premium is the defined as the difference between the spot exchange rate and the 3-month forward. If the covered interest rate parity holds, a higher forward premium corresponds to a higher US nominal interest rate relative to the average foreign interest rate:

$$fp_t \stackrel{\text{def}}{=} \frac{1}{N}\sum_i (e_t^{US,i} - f_t^{US,i}).$$

Let $r_{t,k}$ denote the average log excess return of the dollar against foreign currencies in the next k quarters. It is the sum of log quarterly exchange rate movements and log quarterly forward premia:

$$r_{t,k} \stackrel{\text{def}}{=} e_{t+k} - e_t + \sum_{\tau=0}^{k-1} fp_{t+\tau}.$$

I regress the dollar's nominal exchange rate e_t and future excess return $r_{t,k}$ on the US government surplus-to-debt ratio in quarter t. I include the US Treasury basis, the US government debt-to-GDP ratio, and the dollar's forward premium as controls because the literature finds that they predict currency returns.

Table 1 reports the result. A higher US government surplus-to-debt ratio is associated with a stronger dollar today and predicts a higher expected return on dollar in the next 2 quarters to 3 years. A 1% higher US government surplus-to-debt ratio is associated with a 10% stronger dollar and a further 5% excess return in the next year. In comparison, a more negative US Treasury basis and a lower US government debt-to-GDP ratio are associated with a stronger dollar today and predicts a lower expected return on dollar in the next 3 years.

This result is specific to the US. Table B1 and Table B2 in the Appendix repeat the time-series regressions for foreign countries in my sample. Higher government surplus-to-debt ratios do not correlate with higher nominal exchange rates in 8 out of 10 other developed countries, and do not predict higher currency excess returns in the next 4 quarters in 9 out

Table 1—What Explains The Dollar's Value and Future Return.

	Dependent variable:					
	e	r_1	r_2	r_4	r_8	r_{12}
	(1)	(2)	(3)	(4)	(5)	(6)
US Government Surplus-Debt Ratio (%)	9.66***	1.31	2.58***	5.43***	7.64***	7.21*
	(1.92)	(0.88)	(0.86)	(0.90)	(2.47)	(4.36)
US Treasury Basis (bps)	−0.05	−0.04**	−0.04*	−0.03	0.01	0.05**
	(0.06)	(0.02)	(0.02)	(0.04)	(0.05)	(0.02)
US Government Debt-GDP Ratio (%)	−0.06***	0.01*	0.01	0.03**	0.08***	0.13***
	(0.02)	(0.005)	(0.01)	(0.01)	(0.02)	(0.03)
Forward Premium (%)	−6.25*	−0.61	−0.35	−0.46	3.61	7.86
	(3.35)	(1.32)	(1.71)	(3.29)	(5.63)	(7.02)
Observations	118	118	118	116	112	108
R^2	0.51	0.11	0.12	0.21	0.32	0.43
R^2 without Surplus-Debt Ratio	0.34	0.09	0.07	0.12	0.23	0.38

Note: Dependent variables: e is the level of dollar index in percentage points; r_k is the excess return of the dollar against a basket of foreign currencies in the next k quarters, not annualized and in percentage points. Explanatory variables: forward premium and past innovation to Treasury basis are included as controls. The constant is not reported. Standard errors are HAC-consistent. *p<0.1; **p<0.05; ***p<0.01.

of 10 other developed countries.

I report the following robustness tests in the Appendix. (1) I reconstruct the dollar's index and returns using total trade weights across a broader set of foreign countries. (2) Following Stambaugh (1999), I adjust point estimates to account for small-sample bias. (3) Following Lazarus et al. (2018), I use a larger truncation parameter in Newey-West tests to capture long-run covariance. (4) I disaggregate the time series into a panel of 10 foreign countries and run a panel regression. (5) I use government surplus data from Federal Reserve Economic Data (starting at 1973) and Thomson Reuters International Comparable Economics (starting at 1988). The government surplus-to-debt ratio robustly predicts the dollar's future returns, but it only comoves with the dollar's value in the post-1988 sample.

C. Impulse Response Functions

Next, I evaluate the joint dynamics of the US government surplus-to-debt ratio and the dollar in a first-order vector autoregression (VAR) system:

$$x_{t+1} = A + Bx_t + \varepsilon_{t+1},$$

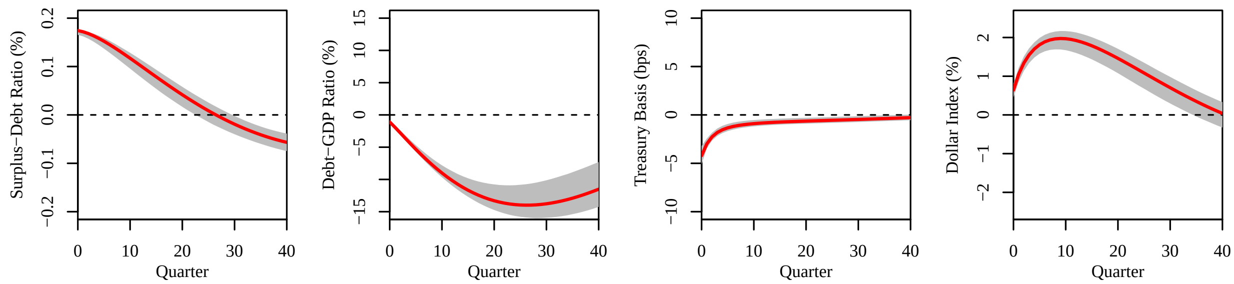
where the vector x_t contains four variables: the US government surplus-to-debt ratio, the US government debt-to-GDP ratio, the US Treasury basis, and the dollar index e_t.

Figure 2 reports the impulse responses. Panel (a) shows the responses to a one-standard deviation increase in the US government surplus-to-debt ratio. When this shock arrives, the US dollar immediately appreciates by 0.6%, and continues to appreciate against other currencies in the next 10 quarters, culminating in an appreciation of 2.0%. Afterwards, the US dollar depreciates back to its original level after 40 quarters. This VAR system provides another way to confirm the return predictability of the US government surplus-to-debt ratio without relying on the predictive regressions of overlapping returns.

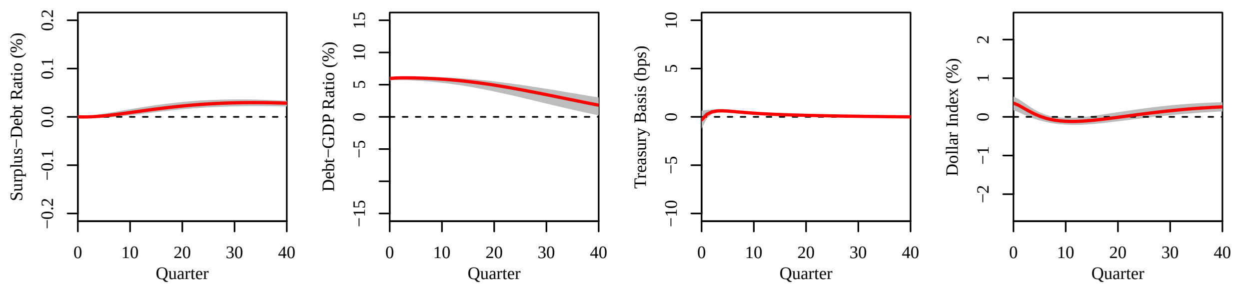
Moreover, as the US fiscal cycle is persistent, the 0.2% increase in the government surplus-to-debt ratio leads to a 2.0% increase in the sum of expected future government surplus-to-debt ratios. The persistent increase in future government surpluses sets off a sustained reduction in the supply of US government debt. As investors have a downward-sloping demand for the US government debt, the sustained reduction in the supply of US government debt raises the safe asset premium, leading to a more negative Treasury basis. Because a more negative Treasury basis predicts a lower return on the dollar (Jiang, Krishnamurthy and Lustig (2018)), this effect makes the dollar's higher expected return even more puzzling.

Panel (c) shows the responses to a one-standard deviation shock to the US Treasury basis. A higher Treasury basis means a lower convenience yield on the US Treasury, which leads to an immediate depreciation of the dollar but predicts dollar appreciation in the next 15 quarters. This effect is in line with the asset pricing intuition that a lower discount rate

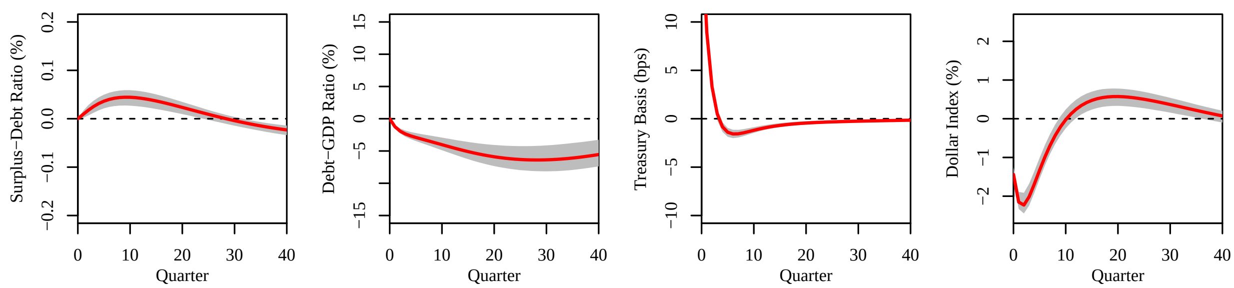
Figure 2. Impulse Responses.



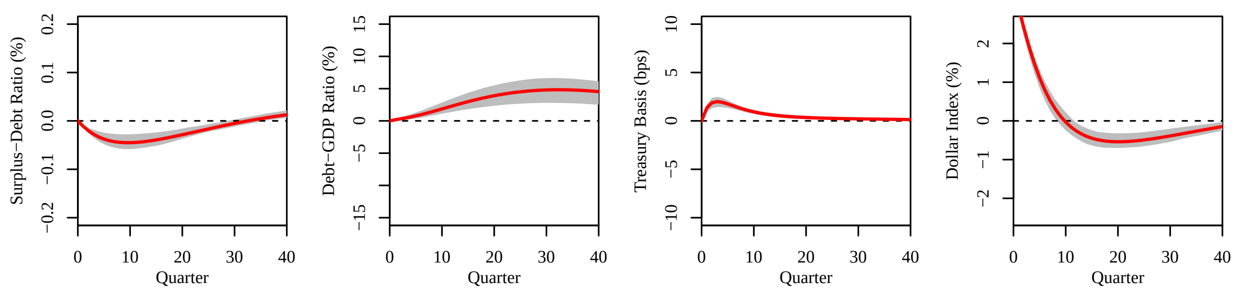
(a) Impulse Responses to a Government Surplus-to-Debt Shock.



(b) Impulse Responses to a Government Debt-to-GDP Shock.



(c) Impulse Responses to a Treasury Basis Shock.



(d) Impulse Responses to a Cumulative Dollar Return Shock.

Note: This panel plots the impulse responses to one-standard-deviation shocks. The VAR system contains the US government surplus-to-debt ratio, the US government debt-to-GDP ratio, the US Treasury basis, and the dollar index. The grey area is the 95% confidence interval, obtained from 10,000 rounds of simulation.

raises the asset price but lowers future returns. In contrast, the pattern in Panel (a) requires a different explanation.

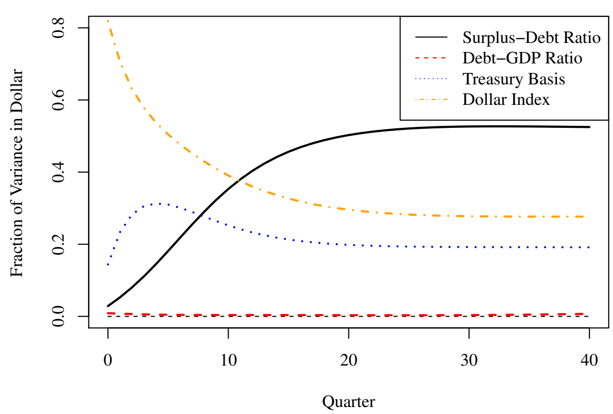
The response in the US government surplus-to-debt ratio in Panel (a) is more persistent than the response in the US Treasury basis in Panel (c). The former shock sets off an expected response in the dollar index that lasts longer. That is, the fiscal cycle and the safe asset demand affect the dollar's expected returns at different frequencies.

D. Variance Decomposition of the Dollar Index

The VAR system also allows me to decompose the forecast error variance of the dollar index. Figure 3 shows the fractions of the *unexpected* exchange rate movements of the dollar explained by the four variables. In the short run, 82% of the dollar index's variation is not explained by the shocks to the US government surplus-to-debt ratio, the US government debt-to-GDP ratio, and the US Treasury basis. Of the remaining 18% of the variation, the US Treasury basis explains 14%.

In the long run, the fraction of variation explained by the US government surplus-to-debt ratio increases to about 50%, while the fraction explained by US Treasury basis falls back

FIGURE 3. VARIANCE DECOMPOSITION.



Note: This panel plots the variance of forecast error due to each orthogonalized shock, as implied from the VAR system.

to 20%. This result suggests that the US fiscal cycle and the safe asset premium also affect the dollar's spot exchange rate at different frequencies: The safe asset demand, proxied by the Treasury basis, is quickly mean-reverting. Consistent with the estimation results in Jiang, Krishnamurthy and Lustig (2018), it affects the quarter-to-quarter and the year-to-year variation in the dollar index. The US fiscal cycle, proxied by the US government surplus-to-debt ratio, is slow-moving with an autocorrelation of more than 0.95. It affects the value of the US dollar at the frequency of multiple years.

The impulse responses and the variance decomposition are not sensitive to switching the order of the variables in the VAR system. The Appendix reports the results using different orders. The only exception is that any shocks ordered after the dollar index shock no longer affects the spot exchange rate by definition. Even in this case, a shock to the US government surplus-to-debt ratio still predicts future exchange rate movements.

II. Discussion

A. Key Mechanisms

I develop a reduced-form model to discuss my empirical results. There are two countries, US and foreign. Let m_{t+1} denote the US investors' log real pricing kernel, let q_t denote the log real exchange rate of the dollar, and let r_t and r_t^* denote the US and foreign log real interest rates. A higher q_t means a stronger dollar. The log real excess return $rx_{t+1}^{\$}$ of the dollar in foreign currency terms is

$$\exp(rx_{t+1}^{\$}) = \exp(r_t - r_t^* + \Delta q_{t+1}).$$

The US investors have the following Euler equations:

$$\begin{aligned} \mathbb{E}_t[\exp(m_{t+1} + r_t)] &= 1, \\ \mathbb{E}_t[\exp(m_{t+1} + r_t^* - \Delta q_{t+1})] &= 1, \end{aligned}$$

which, under joint normality of $(m_{t+1}, \Delta q_{t+1})$, imply that the expected real excess return of the dollar depends on the covariance between the US pricing kernel m_{t+1} and the foreign currency's appreciation $-\Delta q_{t+1}$:

$$\mathbb{E}_t[rx^{\$}_{t+1}] = cov_t(m_{t+1}, -\Delta q_{t+1}) + \frac{1}{2} var_t(\Delta q_{t+1}); \tag{1}$$

when this covariance is more negative, US investors require a higher risk premium to hold the foreign currency. In this case, the dollar has a lower expected excess return against the foreign currency.

If the real exchange rate is stationary with an unconditional mean of $\lim_{k\to\infty} \mathbb{E}_t[q_{t+k}] = \bar{q}$, we can iterate Eq. (1) forward to express the dollar's real exchange rate as the infinite sum of expected real interest rate differentials minus the infinite sum of expected dollar risk premia (Froot and Ramadorai (2005); Jiang, Krishnamurthy and Lustig (2018)):

$$\begin{aligned} q_t &= \sum_{k=0}^{\infty} \mathbb{E}_t \left[r_{t+k} - r^*_{t+k} \right] \\ &- \sum_{k=0}^{\infty} \mathbb{E}_t \left[cov_{t+k}(m_{t+k+1}, -\Delta q_{t+k+1}) + \frac{1}{2} var_{t+k}(\Delta q_{t+k+1}) \right] + \bar{q}. \end{aligned} \tag{2}$$

In this equation, the real interest rate differentials can be regarded as the cash flows of the dollar, and the dollar risk premia can be regarded as the discount rates. The positive relationship between the dollar's value and expected return requires the cash flows and the discount rates to move in the same direction. The following two mechanisms offer a solution.

On the one hand, the fiscal theory of the price level shows that a currency is priced as the real present value of government surpluses divided by the nominal quantity of government debt:

$$\frac{1}{P_t} = \frac{1}{B_{t-1}} \mathbb{E}_t \left[\sum_{j=0}^{\infty} \left(\prod_{k=1}^{j} m_{t+k} \right) s_{t+j} \right], \tag{3}$$

where P_t is the US price level, B_{t-1} is the nominal quantity of US government debt, and s_t is the real government surplus of the US. Fixing B_{t-1} and m_{t+k}, higher government surpluses s_{t+j} lead to a lower price level P_t and a higher nominal value of the dollar.

When prices are sticky, the price level P_t does not respond to an increase in government surpluses immediately. To equilibrate this equation, the US pricing kernel m_{t+1} must discount the higher government surpluses at a higher real interest rate r_t, which increases the dollar's real exchange rate q_t in Eq. (2).

On the other hand, higher government surpluses indicate US expansions. Let m^*_{t+1} denote the foreign real pricing kernel. Lustig, Roussanov and Verdelhan (2014) show that if markets are complete, the dollar's real risk premium can also be expressed as

$$\mathbb{E}_t[rx^{\$}_{t+1}] \quad = \quad \frac{1}{2}var_t\left(m^*_{t+1}\right) - \frac{1}{2}var_t\left(m_{t+1}\right).$$

In a large class of consumption-based asset pricing models, US investors have a less volatile pricing kernel m_{t+1} during US expansions. As they require a lower compensation for holding the foreign currency, the dollar has a higher expected excess return $\mathbb{E}_t[rx^{\$}_{t+1}]$.

In this way, during US expansions, higher government surpluses increase the dollar's cash flows while lower risk premia increase the dollar's discount rates. The next section completes this model.

B. A Simple Model with Sticky Prices

Let x_t denote the US output, π_t denote the US inflation, and b_t denote the real quantity of US government debt, which is the nominal quantity divided by the price level. The textbook new-Keynesian sticky-price model (Gali and Monacelli (2005); Cochrane (2017)) contains the IS curve

$$x_t \quad = \quad \mathbb{E}_t[x_{t+1}] - \sigma r_t + \varepsilon_t, \tag{4}$$

the Fisher equation

$$r_t = i_t - \mathbb{E}_t[\pi_{t+1}], \tag{5}$$

and the new-Keynesian Phillips curve

$$\pi_t = \beta \mathbb{E}_t[\pi_{t+1}] + \kappa x_t. \tag{6}$$

The output shock ε_t follows an AR(1) process:

$$\varepsilon_t = \zeta \varepsilon_{t-1} + \omega u_t.$$

Then, I embed the two key equations Eq. (1) and Eq. (3). The government budget condition Eq. (3) is expressed in the linearized flow form:

$$b_{t-1} - \pi_t = s_t + \beta(b_t - i_t). \tag{7}$$

This linearization is derived in Cochrane (2018*a*). The left-hand side is the real quantity of debt the US government has to pay back in quarter t. The right-hand side provides two sources of funding: government surplus s_t and the proceeds of the issuance of new debt $\beta(b_t - i_t)$. Keeping the debt quantity b_t and the nominal interest rate i_t constant, a higher government surplus s_t reduces inflation π_t.

For simplicity, I set the foreign real interest rate to be zero:

$$r_t^* = 0,$$

the US nominal interest rate to be a constant:

$$i_t = \bar{i},$$

and the US real government surplus and the foreign currency's risk premium to be proportional to the output x_t:

$$
\begin{aligned}
s_t &= \theta x_t, \\
\mathbb{E}_t[-rx^{\$}_{t+1}] &= -\frac{1}{2}var_t(\Delta q_{t+1}) - cov_t(m_{t+1}, -\Delta q_{t+1}) = -\gamma x_t;
\end{aligned}
$$

a higher output leads to a higher US government surplus ($\theta > 0$) and a lower foreign currency risk premium ($\gamma > 0$).

C. Impulse Responses

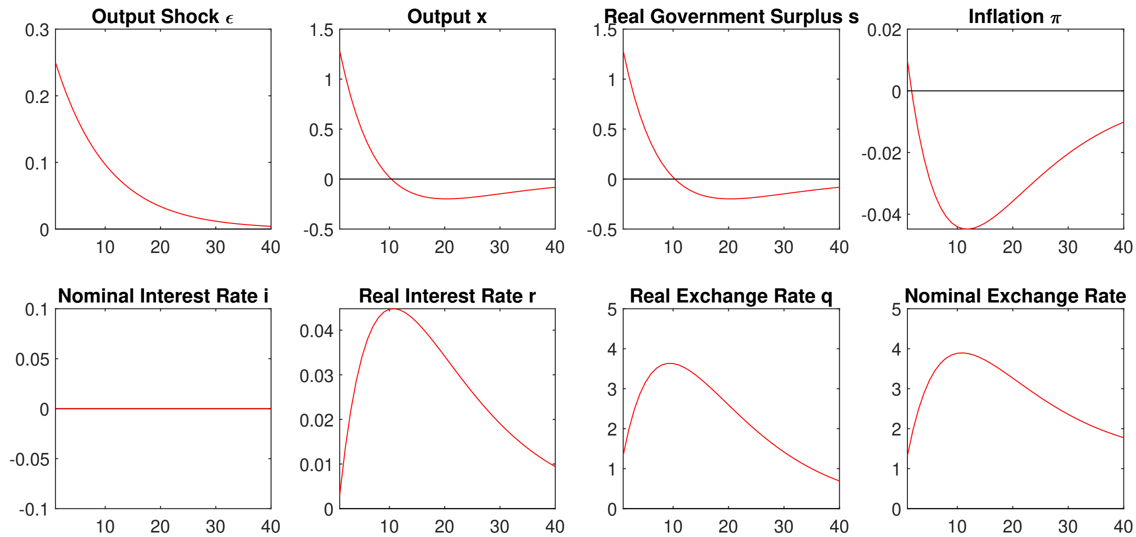
Figure 4 shows the impulse responses to a 0.25% output shock u_1. It leads to a higher output x_t in the next 10 quarters. By assumption, a higher output x_t proportionally raises the real government surplus s_t of the US and lowers the risk premium $\mathbb{E}_t[-rx^{\$}_{t+1}]$ the US investors require to hold the foreign currency.

As discussed in Eq. (2), higher government surpluses s_t increase the dollar's real interest rates r_{t+k} when prices are sticky, which immediately increase the dollar's value. At the same time, the lower risk premium of the foreign currency increases the expected excess return on the dollar in the next 10 quarters.

In the long run, the shocks to real interest rates and currency risk premia dissipate. By Eq. (2), the dollar's real exchange rate q_t will revert back to its steady-state level. On top of this effect, the real interest rate r_t is still above its steady-state value when the output x_t falls back to its steady-state value. Through the IS curve Eq. (4), the higher real interest rate r_t forces the output x_t to continue to fall below its steady-state value. By assumption, the lower output x_t raises the risk premium of the foreign currency, leading to a lower expected return on the dollar in the long run. These predictions are consistent with the impulse response of the dollar index in Figure 2(a) and the coefficient estimates in Figure 5 in the next section.

Appendix A reports and discusses the parameter values I use to calibrate the model. In

FIGURE 4. IMPULSE RESPONSES TO A PERSISTENT OUTPUT SHOCK IN THE MODEL.



Note: This panel plots the impulse responses to a 0.25% output shock u_1. All responses are in percentage points.

particular, the parameter values imply that firms reset their prices once every 13.5 quarters. This high level of price stickiness has two effects: First, it allows the shock to have a persistent effect on output. Because the currency risk premium comoves perfectly with the output, the dollar will continue to appreciate in the next 10 quarters. Second, it induces the real and the nominal exchange rates to comove. Both effects are absent if prices are not sticky enough, as shown in Figure A1.

Prices in this model are about 3 times as sticky as estimated by Kehoe and Midrigan (2015). Alternatively, if agents have persistent risk premia such as in the habit model or the long-run risk model, the currency risk premium can be persistent with less sticky prices.

III. US Fiscal Cycle as an Explanation of Asset Pricing Patterns

A. *Forward Premium Puzzle and Engel (2016)*

A higher forward premium predicts a higher currency excess return in the short run (Fama (1984); Engel (2014)). Table 2 shows that both the dollar's forward premium and the dollar's excess return are driven by the US government surplus-to-debt ratio—The US government surplus-to-debt ratio explains 43% of the variation in the dollar's forward premium against the basket of foreign currencies, and 18% in the dollar's excess return in the next 4 quarters. Once I control for the US government surplus-to-debt ratio, the dollar's forward premium no longer predicts the dollar's excess return in the next 4 quarters.

Therefore, the US fiscal cycle offers a source of variation that drives common movements in forward premia and currency expected returns. Consistent with the specialness of the US fiscal cycle, Table B3 in Appendix documents that the forward premium puzzle disappears when I use 7 out of 10 foreign currencies as the base currency.

Moreover, Engel (2016) shows that not only does a higher forward premium predict a *higher* excess return on the dollar in the short run, but it also predicts a *lower* excess return on the dollar in the long run. In the single time series of the dollar against the basket of 10 foreign currencies, I regress the dollar's cumulative excess return in the next h quarters on the dollar's current forward premium:

$$r_{t,h} \quad = \quad \alpha_h + \beta_h fp_t + \varepsilon^h_{t+h}.$$

Table 2—US Fiscal Cycle Explains Forward Premia.

	Dependent variable:							
	(1)–(3): Forward Premium			(4)–(8): Future Dollar Excess Return				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
US Government Surplus-Debt Ratio (%)	0.43***		0.44***		6.01***	4.45***		5.95***
	(0.14)		(0.14)		(1.77)	(1.65)		(1.28)
US Government Debt-GDP Ratio (%)		0.001	0.001*				0.03*	0.04***
		(0.001)	(0.001)				(0.01)	(0.01)
Forward Premium (%)				8.04*		3.67	7.54	1.50
				(4.54)		(4.64)	(4.82)	(4.09)
Observations	133	133	133	130	130	130	130	130
R^2	0.43	0.02	0.47	0.14	0.18	0.20	0.19	0.29

Note: Dependent variables are the forward premium of the dollar against the basket of foreign currencies (fp), and the dollar excess return in the next 4 quarters (r_4). A higher forward premium means a higher US nominal interest rate relative to foreign nominal interest rates. Standard errors are HAC consistent. *p<0.1; **p<0.05; ***p<0.01.

The left panel of Figure 5 reports the coefficient β_h as a function of the forecast horizon h. This coefficient is positive in the short run and negative in the long run, confirming the finding in Engel (2016).

Then, I regress the dollar's cumulative excess return in the next h quarters on the dollar's forward premium and the US government's surplus-to-debt ratio:

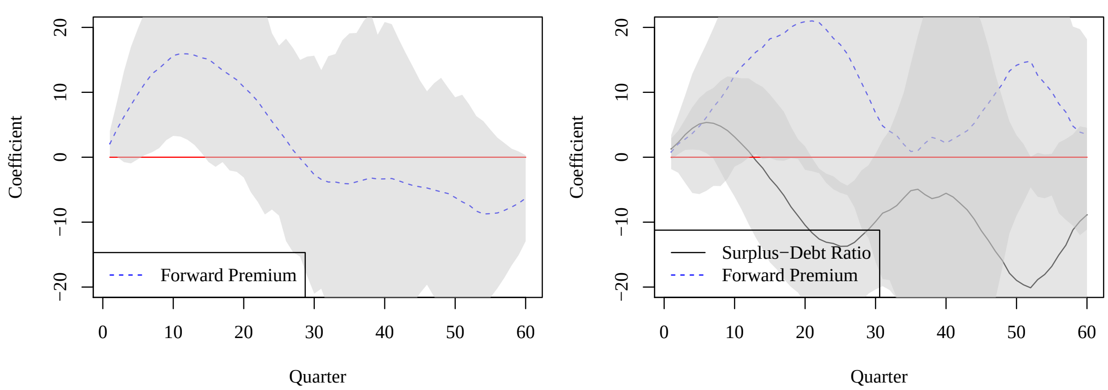
$$r_{t,h} \quad = \quad \alpha_h + \beta_h fp_t + \gamma_h \frac{surplus_t}{debt_{t-1}} + \varepsilon^h_{t+h}.$$

The right panel of Figure 5 reports the coefficients β_h and γ_h in this bivariate regression. A higher US forward premium predicts a higher excess return on the dollar regardless of the forecast horizon h, whereas a higher US government surplus-to-debt ratio predicts a higher excess return on the dollar in the short run and a lower excess return in the long run.

This result is consistent with my model's prediction. As shown in Figure 4, an increase in the US government surplus-to-debt ratio predicts a higher excess return on the dollar in the short run and a lower excess return on dollar in the long run.

In the Appendix, I estimate the coefficients β_h and γ_h using a panel regression. As shown in Figure B6, they have similar point estimates and smaller standard errors.

Figure 5. Expected Cumulative Excess Returns of the Dollar.



Note: I report the point estimates and the 95% confidence intervals of the regressions coefficients β_h and γ_h as functions of the forecast horizon h. Standard errors are HAC consistent.

B. Bond Risk Premia

Table 3 shows that a higher US government surplus-to-debt ratio is associated with a lower term premium and a lower Cochrane and Piazzesi (2005) bond factor, both of which reflect the risk premia of long-term US government bonds. The US government surplus-to-debt ratio alone explains 35% of the variation in the term premium, and 37% in Cochrane and Piazzesi (2005) bond factor. Consistent with the model's prediction, this result suggests that US investors have a lower risk premium when the US government surplus-to-debt ratio is high.

Lustig, Stathopoulos and Verdelhan (2017) find that the predictability of foreign bond returns decreases as the maturity of the bonds increases, and conclude that the local currency term premia offset the currency risk premia. The US fiscal cycle offers one source of variation that drives opposite movements in currency risk premia and US term premia. In univariate regressions, a 1% higher US government surplus-to-debt ratio predicts a 6% higher excess return on the dollar and a 3% lower excess return on the 5-year US Treasury.

Table 3—US Fiscal Cycle Explains Bond Risk Premia

	Dependent variable:							
	(1)–(4): Term Premium				(5)–(8): Cochrane-Piazzesi Factor			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
US Government Surplus-Debt Ratio (%)	−0.63***			−0.28*	−7.37***			−3.71*
	(0.10)			(0.15)	(1.21)			(1.90)
Forward Premium (%)		−0.97***		−0.78**		−10.46***		−8.20**
		(0.23)		(0.31)		(3.19)		(3.52)
US Government Debt-GDP Ratio (%)			0.001	0.002			0.02**	0.02
			(0.001)	(0.001)			(0.01)	(0.02)
US Treasury Basis (bps)				0.001				0.01
				(0.004)				(0.05)
Observations	133	133	133	118	133	133	133	118
R^2	0.35	0.36	0.02	0.47	0.37	0.32	0.05	0.50

Note: Term premium is 5-year US government debt yield minus 1-year US government debt yield; Cochrane-Piazzesi factor is the single factor defined in Cochrane and Piazzesi (2005). Standard errors are HAC consistent. *p<0.1; **p<0.05; ***p<0.01.

C. Dollar Carry Trade

Lustig, Roussanov and Verdelhan (2014) construct a *dollar carry trade* that buys foreign currencies against the dollar whenever the US forward premium is below 0, which typically occurs during U.S. recessions, and shorts foreign currencies against the dollar otherwise. This simple strategy produces an annual Sharpe ratio in excess of 0.50, higher than those on both the carry trade and the U.S. stock market.

Table 2 shows that US government surplus-to-debt ratio alone explains 43% of the variation in the forward premium. So, whenever the dollar carry trade takes a long position on foreign currencies because the US forward premium is negative, the US government surplus-to-debt ratio is also likely to be low.

Therefore, I can construct a *dollar fiscal strategy* that buys foreign currencies against the dollar whenever the US government surplus-to-debt ratio is below −1%, and shorts foreign currencies otherwise. The threshold −1% roughly corresponds to the value of the US government surplus-to-debt ratio that corresponds to a forward premium of 0 in the linear fit. The result is robust to other choices of the threshold.

Table 4 reports the results using different thresholds. The dollar fiscal strategy has a similar quarterly average excess return and a similar quarterly Sharpe ratio as those of the dollar carry strategy. Its return is also strongly correlated with the return of the dollar carry strategy. When I control for the dollar fiscal strategy's returns, the dollar carry strategy

TABLE 4—THE DOLLAR CARRY STRATEGY AND THE DOLLAR FISCAL STRATEGY

Strategy	Average Return (%)	Sharpe Ratio	α	β
Dollar Carry	1.00 (0.35)	0.24 (0.09)		
Dollar Fiscal, Threshold −1.50%	0.95 (0.36)	0.23 (0.09)	0.39 (0.29)	0.64 (0.10)
Dollar Fiscal, Threshold −1.25%	1.12 (0.35)	0.27 (0.09)	0.19 (0.26)	0.72 (0.09)
Dollar Fiscal, Threshold −1.00%	1.12 (0.35)	0.27 (0.09)	0.20 (0.26)	0.72 (0.09)
Dollar Fiscal, Threshold −0.75%	0.95 (0.36)	0.23 (0.09)	0.31 (0.28)	0.72 (0.09)
Dollar Fiscal, Threshold −0.50%	0.78 (0.36)	0.19 (0.09)	0.46 (0.28)	0.69 (0.09)

Note: This table reports the quarterly average excess returns and the quarterly Sharpe ratios of these strategies. The coefficients α and β are obtained from the regression of the dollar carry strategy's returns on each dollar fiscal strategy's returns. Standard errors in parenthesis are from bootstrapping.

does not have statistically significant abnormal returns.

D. Currency Return Momentum

Burnside, Eichenbaum and Rebelo (2011); Moskowitz, Ooi and Pedersen (2012); Asness, Moskowitz and Pedersen (2013) find that currencies that have higher returns in the past year tend to have higher returns in the near future. This finding can be seen from the following panel regression:

$$r_{t,k}^{US,i} = \alpha + \beta sign(r_{t-4,4}^{US,i}) + \gamma e_t^{US,i} + \varepsilon_t^{US,i},$$

where $r_{t,k}^{US,i}$ is the excess return of the dollar against each foreign currency i from quarter t to quarter $t+k$. $sign(r_{t-4,4}^{US,i})$ is 1 if the excess return of the same currency pair from quarter $t-4$ to quarter t is non-negative, and 0 otherwise; this indicator function is less noisy than the raw return. $e_t^{US,i}$ is the nominal exchange rate of the same currency pair; controlling for the exchange rate level is important because the exchange rate is mean-reverting.

Panel A in Table 5 reports the results. A positive excess return of the dollar against a foreign currency i in the past 4 quarters predicts a 1.5% higher excess return of the dollar against the same foreign currency in the next quarter and a 2.8% higher excess return in the next year. On the other hand, a higher level of the dollar's nominal exchange rate predicts a lower excess return of the dollar.

Next, I add the US government surplus-to-debt ratio as an explanatory variable in this panel regression:

$$r_{t,k}^{US,i} = \alpha + \beta sign(r_{t-4,4}^{US,i}) + \gamma e_t^{US,i} + \delta \frac{surplus_t}{debt_{t-1}} + \varepsilon_t^{US,i}.$$

Panel B in Table 5 reports the results. The US government surplus-to-debt ratio increases the R^2 dramatically, and drives out the forecasting power of the past currency return. This result is consistent with the paper's main argument: When the government fiscal condition improves, the dollar's exchange rate appreciates and is expected to have a higher expected return, leading to a positive correlation between past and future currency returns in the short run.

TABLE 5—US FISCAL CYCLE EXPLAINS CURRENCY RETURN MOMENTUM.

Panel A: Past Return Predicting Future Return				
	Dependent variable:			
	r_1	r_2	r_4	r_8
	(1)	(2)	(3)	(4)
Past 4Q Currency Return (%)	1.46**	2.21**	2.83**	2.03
	(0.63)	(0.88)	(1.11)	(1.57)
Level of Exchange Rate (%)	−0.09***	−0.19***	−0.33***	−0.56***
	(0.02)	(0.04)	(0.05)	(0.08)
Observations	1,290	1,280	1,260	1,220
R^2	0.04	0.06	0.08	0.11

Panel B: Controlling for the US Government Surplus-to-Debt Ratio				
	Dependent variable:			
	r_1	r_2	r_4	r_8
	(1)	(2)	(3)	(4)
Past 4Q Currency Return (%)	0.78	0.74	−0.11	−2.45**
	(0.62)	(0.85)	(0.98)	(1.19)
Level of Exchange Rate (%)	−0.11***	−0.22***	−0.40***	−0.67***
	(0.02)	(0.03)	(0.05)	(0.07)
US Government Surplus-Debt Ratio (%)	1.68***	3.47***	6.84***	10.37***
	(0.55)	(0.75)	(0.92)	(1.26)
Observations	1,290	1,280	1,260	1,220
R^2	0.07	0.13	0.22	0.27

Note: I report the results of the panel regressions with country-level fixed effects. Data are quarterly and start from 1984. Errors are clustered by time, and the standard errors are calculated using Arellano (1987) which corrects for heteroskedasticity and autocorrelation. *p<0.1; **p<0.05; ***p<0.01.

E. Cross-Border Capital Flows

The US investors' risk premium should affect both the expected returns of foreign currencies and capital flows into foreign risky assets. If their risk aversion comoves with the US government surplus-to-debt ratio, then the US fiscal cycle should also explain cross-border capital flows.

I obtain capital flow data from Bertaut and Tryon (2007); Bertaut and Judson (2014).

Let pos_t^{stock} denote the dollar value of foreign equities held by US investors at the end of quarter t. Let $flow_{t,k}^{stock}$ denote the capital flows into foreign stocks from the end of quarter t to the end of quarter $t+k$. The capital flows do not include the changes in the foreign asset positions that are due to changes in asset valuation. Let pos_t^{bond} and $flow_{t,k}^{bond}$ denote the corresponding variables for the US investors' holdings of foreign bonds. All these flows and quantities are normalized by the US GDP in corresponding quarters. Then I regress current asset positions and future flows on the US government surplus-to-debt ratio and the US government debt-to-GDP ratio.

Table 6 reports the result. A 1% increase in the US government surplus-to-debt ratio corresponds to 6.59% higher holdings of foreign stocks and 0.95% lower holdings of foreign bonds as fractions of the US quarterly GDP. The 1% increase in the surplus-to-debt ratio also predicts that the US investors will continue to allocate 0.88% of the US quarterly GDP into foreign stocks and remove 0.69% of the US quarterly GDP out of foreign bonds in the following 4 quarters. This result is consistent with the comovement between the US fiscal cycle and the US investors' risk premium. As the US fiscal condition is stronger and US investors are less risk averse, they will invest more in foreign stocks and less in foreign bonds.

Table 6—US Flows into Foreign Assets.

	Dependent variable:							
	pos_t^{stock}	$flow_{t,1}^{stock}$	$flow_{t,2}^{stock}$	$flow_{t,4}^{stock}$	pos_t^{bond}	$flow_{t,1}^{bond}$	$flow_{t,2}^{bond}$	$flow_{t,4}^{bond}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
US Government Surplus-Debt Ratio (%)	6.59**	0.26**	0.51***	0.88***	−0.95*	−0.33*	−0.69***	−0.69***
	(2.68)	(0.11)	(0.16)	(0.28)	(0.51)	(0.17)	(0.27)	(0.27)
US Government Debt-GDP Ratio (%)	0.33***	0.001	0.003*	0.01**	0.12***	−0.005**	−0.01**	−0.01**
	(0.06)	(0.001)	(0.001)	(0.003)	(0.01)	(0.002)	(0.004)	(0.004)
Observations	91	90	89	87	91	90	89	89
R^2	0.53	0.07	0.14	0.21	0.76	0.23	0.29	0.29

Note: Data are quarterly and start from 1994Q1 to 2016Q4. Standard errors are HAC consistent. *p<0.1; **p<0.05; ***p<0.01.

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Appendix A: Model Calibration

Table A1 shows the parameter values used in calibration. The model is calibrated at the quarterly frequency. The real discount rate β is 0.99, implying a real discount rate of 1% per quarter at the steady state. The parameter σ in the IS curve is 1, which is consistent with the elasticity of intertemporal substitution as implied by a log utility.

The parameter κ governing price stickiness is 0.01. In the textbook new-Keynesian model with the production technology linear in labor, this parameter is a function of the frequency of price reset ϕ, discount rate β, and the steady-state labor input $\bar{n}$:

$$\kappa \equiv \frac{(1-\phi)(1-\phi\beta)}{\phi}\frac{1}{1-\bar{n}}.$$

When $\beta = 0.99$ and $\bar{n} = 1/3$, this parameter value implies $\phi = 0.9259$. That is, 92.6% of the firms do not reset their prices in each quarter, or firms reset their prices once every 13.5 quarters.

When the output shock is 1%, the government surplus rises by $\theta \times 1\% = 1\%$ and the risk premium of the foreign currency goes down by $-\gamma \times 1\% = -0.5\%$. These parameters are set so that the real exchange rate movement is 1.25 times as volatile as the growth rate of output. In the data the real exchange rate movement is about 4 times as volatile, but the real exchange rate is also driven by other shocks.

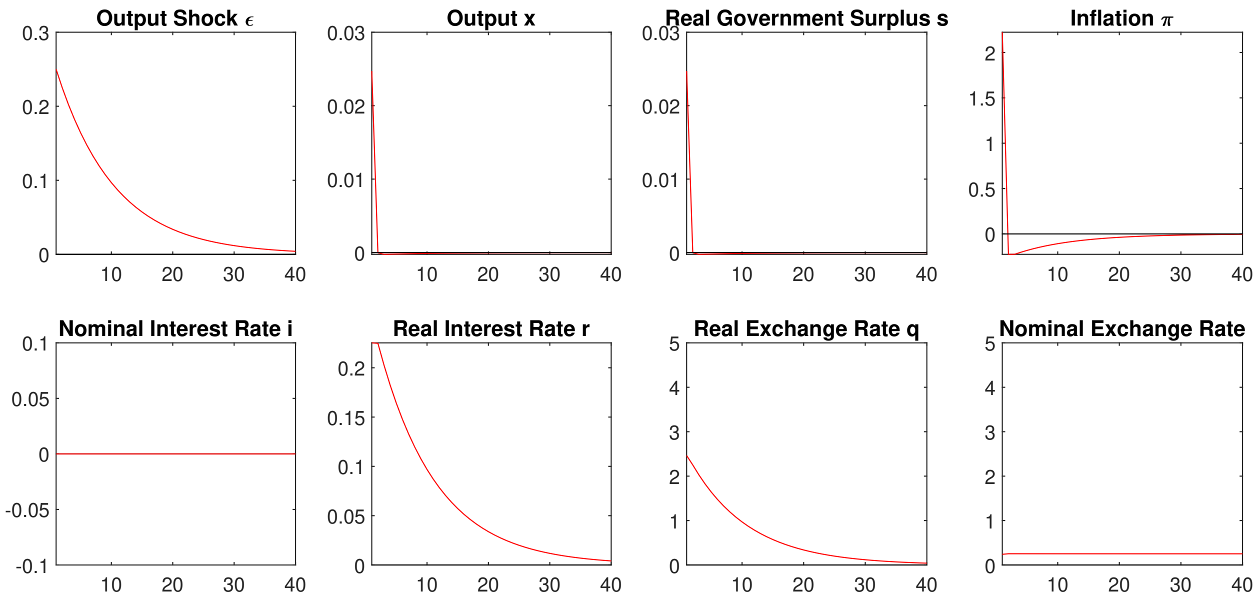
The output shock u_t has an autocorrelation of $\rho = 0.9$. This parameter is set so that a positive output shock increases output for 10 quarters (2 and half years).

Table A1—Parameter Values.

Parameter	Notation	Value
Real Discount Rate	β	0.99
Elasticity of Intertemporal Substitution	σ	1
Price Stickiness	κ	0.01
Cyclicality of Government Surplus	θ	1
Cyclicality of Currency Risk Premium	γ	0.5
Persistence of Output Shock	ρ	0.9

Figure A1 shows the impulse responses when the prices are not sticky. Although the shock ε_t is persistent, the real interest rate adjusts so the response in output is not persistent. The dollar does not continue to appreciate after the output shock, and the nominal and the real exchange rates do not comove.

Figure A1. Impulse Responses to a Persistent Output Shock in the Model, $\kappa = 99$.



Note: This panel plots the impulse responses to a 0.25% output shock u_1. The price stickiness parameter κ is 99, implying 98.5% of the firms reset their prices every quarter. All responses are in percentage points.

Appendix B: Robustness Tests

I fix a currency as the base currency and calculate its nominal exchange rate, forward premium and currency return with respect to the equal-weighted basket of other currencies. In Table B1, I regress the currency's nominal exchange rate on its own government surplus-to-debt ratio and government debt-to-GDP ratio.

Table B1—Surplus-to-Debt Ratio Explaining Nominal Exchange Rate

	Dependent variable:										
	e										
	(1) US	(2) Australia	(3) Canada	(4) Denmark	(5) Germany	(6) Japan	(7) New Zealand	(8) Norway	(9) Sweden	(10) Switzerland	(11) UK
Surplus-Debt Ratio (%)	10.01***	−0.30	−1.01	0.81	−1.14***	−12.92***	−0.45**	−0.25	3.30***	5.32	2.83***
	(1.93)	(0.23)	(0.86)	(0.66)	(0.29)	(4.00)	(0.21)	(0.44)	(0.81)	(3.55)	(0.30)
Debt-GDP Ratio (%)	−0.06**	0.09**	−0.10***	−0.002	−0.01	0.0001	0.22*	0.02	0.02	−0.19	−0.12***
	(0.02)	(0.04)	(0.02)	(0.04)	(0.03)	(0.02)	(0.11)	(0.05)	(0.04)	(0.17)	(0.01)
Forward Premium (%)	−5.94	14.44**	−1.04	5.44**	4.08	6.80	20.80***	3.40	26.24***	−1.89	6.19**
	(3.92)	(6.35)	(4.90)	(2.63)	(4.10)	(9.65)	(4.70)	(2.32)	(6.58)	(10.44)	(2.43)
Observations	112	112	112	112	112	112	112	112	112	112	112
R^2	0.49	0.34	0.35	0.18	0.16	0.43	0.40	0.04	0.53	0.38	0.82

Note: The dependent variable is the currency's nominal exchange rate against the basket of other currencies. The government surplus-to-debt ratio and the government debt-to-GDP ratio both refer to the country in question, and the forward premium is the average forward premia of that country's currency against the basket of other currencies. Data start at 1990Q1 to make sure all countries have comparable time series. The constant is not reported. Standard errors are HAC-consistent. *p<0.1; **p<0.05; ***p<0.01.

In Table B2, I regress each currency's excess return in the next 4 quarters on its own government surplus-to-debt ratio and government debt-to-GDP ratio.

Table B2—Surplus-to-Debt Ratio Predicting Currency Excess Return

	Dependent variable:										
	r_4										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	US	Australia	Canada	Denmark	Germany	Japan	New Zealand	Norway	Sweden	Switzerland	UK
Surplus-Debt Ratio (%)	5.84***	−0.42*	1.53*	1.09	0.85**	2.72	−0.39***	0.21	0.49	0.93	0.66
	(0.95)	(0.23)	(0.78)	(1.01)	(0.39)	(3.89)	(0.13)	(0.29)	(1.28)	(0.98)	(0.50)
Debt-GDP Ratio (%)	0.03*	−0.05*	0.01	0.02	−0.04*	−0.01	−0.0003	−0.01	0.01	0.02	0.01
	(0.01)	(0.03)	(0.02)	(0.03)	(0.02)	(0.01)	(0.04)	(0.02)	(0.03)	(0.03)	(0.02)
Forward Premium (%)	−1.09	4.09*	6.22*	1.73	6.17*	3.06	1.16	0.13	1.04	17.13***	4.62
	(3.49)	(2.14)	(3.70)	(1.23)	(3.58)	(7.65)	(2.17)	(2.24)	(3.28)	(5.10)	(5.03)
Observations	109	109	109	109	109	109	109	109	109	109	109
R^2	0.20	0.12	0.10	0.06	0.18	0.06	0.06	0.02	0.005	0.27	0.06

Note: The dependent variable is the currency excess return of each currency in the next 4 quarters against the basket of other currencies. *p<0.1; **p<0.05; ***p<0.01.

In Table B3, I regress each currency's forward premium on its own government surplus-to-debt ratio and government debt-to-GDP ratio.

Table B3—Surplus-to-Debt Ratio Explaining Forward Premium

	Dependent variable:										
	fp										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	US	Australia	Canada	Denmark	Germany	Japan	New Zealand	Norway	Sweden	Switzerland	UK
Surplus-Debt Ratio (%)	0.41***	−0.01	0.06*	−0.004	0.04*	0.16**	0.03**	0.003	−0.20***	−0.06*	0.08**
	(0.15)	(0.02)	(0.04)	(0.04)	(0.03)	(0.07)	(0.01)	(0.01)	(0.02)	(0.03)	(0.03)
Debt-GDP Ratio (%)	0.001	−0.004***	0.001	0.002	−0.002	0.001***	−0.01***	−0.004*	−0.001	−0.005***	−0.003***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.0002)	(0.003)	(0.002)	(0.002)	(0.001)	(0.0004)
Observations	112	112	112	112	112	112	112	112	112	112	112
R^2	0.42	0.15	0.12	0.11	0.14	0.61	0.30	0.12	0.53	0.40	0.56

Note: The dependent variable is the forward premium of each country's currency against the basket of other currencies. *p<0.1; **p<0.05; ***p<0.01.

In Table B4, I repeat the main specification using trade-weighted exchange rates and currency returns. The weights are total trade weights provided in Foreign Exchange Rates - H.10 by the Federal Reserve Board. The weights are updated on an annual basis. In each year, I use the trade weighted based on the trade data in the previous year.

Table B4—What Explains Dollar's Value and Future Return, Trade-Weighted Time Series.

	Dependent variable:					
	e	r_1	r_2	r_4	r_8	r_{12}
	(1)	(2)	(3)	(4)	(5)	(6)
US Government Surplus-Debt Ratio (%)	7.34***	0.61	1.37**	3.01***	5.33***	5.72**
	(1.33)	(0.49)	(0.68)	(0.75)	(1.27)	(2.42)
US Treasury Basis (bps)	−0.04	−0.03*	−0.02	−0.01	0.03	0.04
	(0.04)	(0.01)	(0.02)	(0.03)	(0.03)	(0.03)
US Government Debt-GDP Ratio (%)	−0.03	0.01	0.01*	0.03***	0.07***	0.11***
	(0.02)	(0.003)	(0.01)	(0.01)	(0.01)	(0.01)
Forward Premium (%)	−11.35***	0.99	2.69**	5.79**	11.08**	14.03***
	(3.42)	(0.83)	(1.26)	(2.59)	(4.76)	(5.31)
Observations	118	118	118	116	112	108
R^2	0.51	0.10	0.14	0.31	0.48	0.56

Note: Dependent variables: e is the level of dollar index in percentage points; r_k is the excess return of the dollar against a basket of foreign currencies in the next k quarters, not annualized and in percentage points. Explanatory variables: forward premium and past innovation to Treasury basis are included as controls. The constant is not reported. Standard errors are HAC-consistent. *p<0.1; **p<0.05; ***p<0.01.

In Table B5, I run the univariate regression of currency value and future returns on the surplus-to-debt ratio, and report the point estimates after the Stambaugh (1999) adjustment.

Table B5—What Explains Dollar's Value and Future Return, Stambaugh (1999) Adjustment.

	Dependent variable:					
	e	r_1	r_2	r_4	r_8	r_{12}
	(1)	(2)	(3)	(4)	(5)	(6)
US Government Surplus-Debt Ratio (%)	9.70***	1.13*	2.20***	4.27***	5.30**	3.02
Before Adjustment	9.25***	1.31**	2.47***	4.66***	6.33***	4.44
	(1.68)	(0.58)	(0.78)	(1.11)	(2.20)	(3.39)
Observations	118	118	118	116	112	108
R^2	0.28	0.05	0.07	0.13	0.11	0.04

Note: Dependent variables: e is the level of dollar index in percentage points; r_k is the excess return of the dollar against a basket of foreign currencies in the next k quarters, not annualized and in percentage points. Standard errors are HAC-consistent. *p<0.1; **p<0.05; ***p<0.01.

In Table 1 in the main text, I report the standard Newey-West standard errors. In Table B6, I report the standard errors that use a truncation parameter of $1.3T^{1/2}$ to capture the long-run covariance (Lazarus et al. (2018)).

Table B6—What Explains Dollar's Value and Future Return, Lazarus et al. (2018) Standard Errors.

	Dependent variable:					
	e	r_1	r_2	r_4	r_8	r_{12}
	(1)	(2)	(3)	(4)	(5)	(6)
US Government Surplus-Debt Ratio (%)	9.66***	1.31***	2.58***	5.43***	7.64***	7.21
	(1.93)	(0.28)	(0.38)	(0.70)	(2.65)	(4.75)
US Treasury Basis (bps)	−0.05	−0.04***	−0.04**	−0.03	0.01	0.05*
	(0.06)	(0.01)	(0.02)	(0.04)	(0.05)	(0.03)
US Government Debt-GDP Ratio (%)	−0.06*	0.01**	0.01**	0.03**	0.08***	0.13***
	(0.03)	(0.003)	(0.01)	(0.01)	(0.02)	(0.02)
Forward Premium (%)	−6.25*	−0.61	−0.35	−0.46	3.61	7.86
	(3.24)	(0.73)	(1.59)	(3.30)	(5.70)	(6.85)
Observations	118	118	118	116	112	108
R^2	0.51	0.11	0.12	0.21	0.32	0.43

Note: Dependent variables: e is the level of dollar index in percentage points; r_k is the excess return of the dollar against a basket of foreign currencies in the next k quarters, not annualized and in percentage points. Standard errors are HAC-consistent with a truncation parameter of $1.3T^{1/2}$. *p<0.1; **p<0.05; ***p<0.01.

In Table B7, I disaggregate the single time-series used in Table 1 into a panel of 10 foreign countries and run a panel regression. In this panel regression, exchange rates and forward premia are bilateral rates between US and each foreign country.

Table B7—Panel Regression.

	Dependent variable:					
	e	r_1	r_2	r_4	r_8	r_{12}
	(1)	(2)	(3)	(4)	(5)	(6)
US Government Surplus-Debt Ratio (%)	5.54***	0.90	2.02*	4.40**	8.94**	13.54**
	(1.03)	(0.64)	(1.19)	(2.19)	(3.92)	(5.65)
US Treasury Basis (bps)	−0.03	−0.04**	−0.07**	−0.13**	−0.21**	−0.22
	(0.03)	(0.02)	(0.03)	(0.06)	(0.10)	(0.14)
US Government Debt-GDP Ratio (%)	−0.06***	0.01	0.01*	0.03*	0.05**	0.07**
	(0.01)	(0.004)	(0.01)	(0.01)	(0.02)	(0.03)
Forward Premium (%)	2.64**	0.18	−0.14	−1.02	−1.63	−0.96
	(1.17)	(0.88)	(1.62)	(2.49)	(3.91)	(4.96)
Observations	1,298	1,298	1,298	1,298	1,298	1,298
R^2	0.28	0.06	0.07	0.09	0.09	0.09
R^2 without Surplus-Debt Ratio	0.23	0.05	0.06	0.06	0.06	0.05

Note: I report the results of the panel regressions with country-level fixed effects. Data are quarterly and start from 1988. Errors are clustered by time, and the standard errors are calculated using Arellano (1987) which corrects for heteroskedasticity and autocorrelation. *p<0.1; **p<0.05; ***p<0.01.

In Table B8, I use an alternative dataset of quarterly US government surpluses from Thomson Reuters International Comparable Economics (TRICE). This database contains each country's government surplus in the unit of US dollar.

Table B8—Alternative Database, TRICE Data.

	Dependent variable:					
	e	r_1	r_2	r_4	r_8	r_{12}
	(1)	(2)	(3)	(4)	(5)	(6)
US Treasury Basis (bps)	-0.25^{**}	-0.02	-0.02	-0.01	0.09	0.18^{***}
	(0.10)	(0.03)	(0.07)	(0.08)	(0.08)	(0.05)
US Government Debt-GDP Ratio (%)	-0.07^{**}	0.01	0.01	0.03	0.06^{**}	0.11^{***}
	(0.03)	(0.004)	(0.01)	(0.02)	(0.03)	(0.03)
US Government Surplus-Debt Ratio (%)	2.95^{***}	0.24	0.57	2.02^{***}	2.73^{**}	2.26
	(0.42)	(0.29)	(0.42)	(0.60)	(1.14)	(1.74)
Forward Premium (%)	-2.14	0.70	1.83	3.11	9.00	13.74^{*}
	(2.53)	(1.02)	(1.83)	(3.46)	(6.20)	(7.40)
Past Innovation to Treasury Basis (bps)	0.21^{***}	-0.04	-0.02	-0.05	-0.12^{**}	-0.17^{***}
	(0.07)	(0.04)	(0.07)	(0.05)	(0.06)	(0.05)
Observations	117	117	117	115	111	107
R^2	0.46	0.09	0.08	0.16	0.27	0.39
R^2 without Surplus-Debt Ratio	0.41	0.09	0.07	0.11	0.23	0.37

Note: Government surpluses are from Thomson Reuters International Comparable Economics (TRICE). Data are quarterly and start from 1988. The constant is not reported. Standard errors are HAC-consistent. *p<0.1; **p<0.05; ***p<0.01.

I use an alternative dataset of quarterly US government surpluses, government debt, GDP, and trade-weighted real dollar index from Federal Reserve Economic Data (FRED). The data start at 1973. In this dataset, US government surpluses have strong seasonal effects and the dollar index has a strong trend. I do not find significant results using the raw data.

In Table B9, I use the five-year changes in US government surplus-to-debt ratio, in US government debt-to-GDP ratio, and in the dollar index. The US government surplus-to-debt ratio predicts future dollar exchange rate movement, but does not explain dollar exchange rate movement in the earlier part of the sample.

In Table B10, I repeat the regression using the subsample starting from 1988. In this subsample, the US government surplus-to-debt ratio also explains the dollar exchange rate movement.

Figure B1 reports the five-year change in US government surplus-to-debt ratio and the future movement in the dollar index in the next four quarters.

Table B9—Alternative Database, FRED Data.

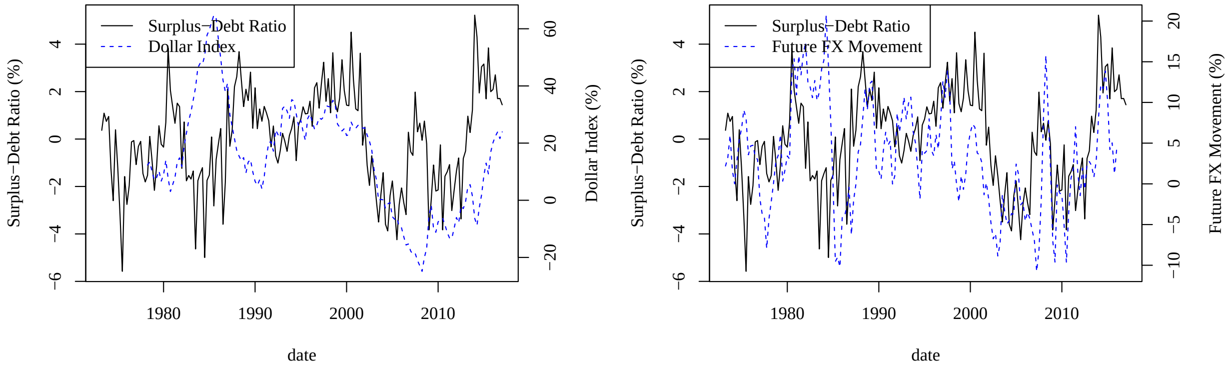
	Dependent variable:					
	q	dq_1	dq_2	dq_4	dq_8	dq_{12}
	(1)	(2)	(3)	(4)	(5)	(6)
US Government Surplus-Debt Ratio (%)	1.08	0.15	0.40*	1.01**	2.03***	2.79***
	(2.60)	(0.11)	(0.24)	(0.43)	(0.69)	(0.70)
US Government Debt-GDP Ratio (%)	−0.33*	−0.002	−0.003	0.02	0.12	0.30
	(0.19)	(0.01)	(0.03)	(0.07)	(0.14)	(0.23)
Observations	156	175	174	172	168	164
R^2	0.06	0.01	0.04	0.10	0.16	0.20

Note: The dependent variable dq_k is the movement of the US dollar index in the next k quarters. Data are quarterly and start from 1973. US government surplus-to-debt ratio, US government debt-to-GDP ratio, and the dollar index e are the changes relative to their value five years ago. The constant is not reported. Standard errors are HAC-consistent. *p<0.1; **p<0.05; ***p<0.01.

Table B10—Alternative Database, FRED Data, Starting from 1988.

	Dependent variable:					
	q	dq_1	dq_2	dq_4	dq_8	dq_{12}
	(1)	(2)	(3)	(4)	(5)	(6)
US Government Surplus-Debt Ratio (%)	3.66***	0.43***	0.84***	1.67***	2.95***	3.58***
	(0.94)	(0.11)	(0.16)	(0.21)	(0.40)	(0.49)
US Government Debt-GDP Ratio (%)	−0.43***	0.01	0.03	0.09**	0.27***	0.51***
	(0.11)	(0.01)	(0.02)	(0.04)	(0.07)	(0.12)
Observations	117	116	115	113	109	105
R^2	0.33	0.12	0.19	0.37	0.56	0.60

FIGURE B1. US GOVERNMENT SURPLUS-TO-DEBT RATIO, FRED DATA.



Note: Left figure: US government surplus-to-debt ratio and the dollar index q. Right figure: US government surplus-to-debt ratio and the movement of the dollar index in the next four quarters dq_4. US government surplus-to-debt ratio and the dollar index e are the changes relative to their value five years ago.

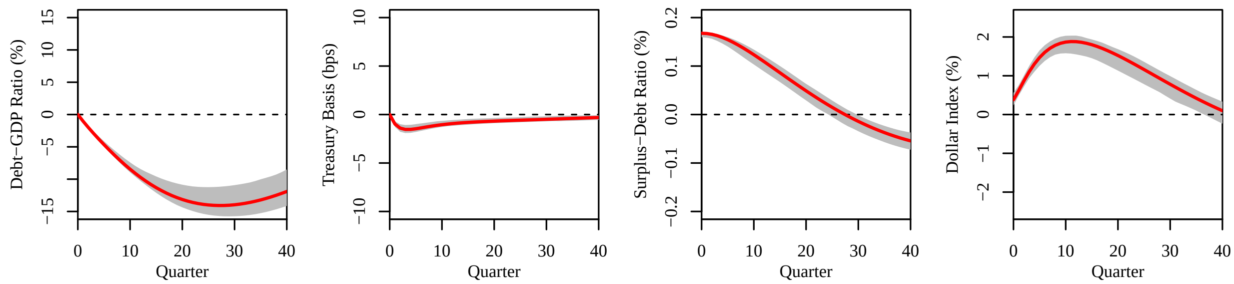
In Table B11, I run a horse race between the US government surplus-to-debt ratio, the US government debt-to-GDP ratio and the US current account-to-GDP ratio.

TABLE B11—HORSE RACE WITH US CURRENT ACCOUNT-GDP RATIO.

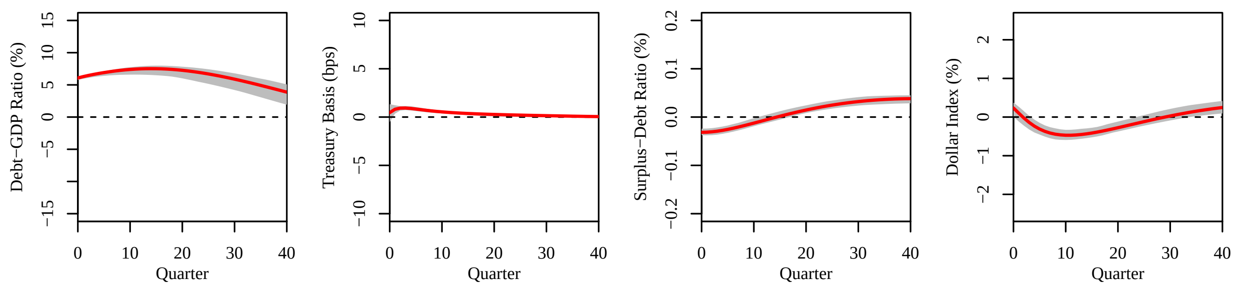
	Dependent variable:					
	e	r_1	r_2	r_4	r_8	r_{12}
	(1)	(2)	(3)	(4)	(5)	(6)
US Government Surplus-Debt Ratio (%)	7.51***	1.44**	2.78***	5.54***	8.97***	10.06***
	(1.39)	(0.64)	(0.89)	(1.24)	(2.20)	(3.75)
US Current Account-GDP Ratio (%)	1.14	0.07	0.12	0.57	1.29	1.89
	(1.20)	(0.28)	(0.49)	(0.51)	(0.94)	(1.69)
US Government Debt-GDP Ratio (%)	−0.07***	0.005	0.01	0.03**	0.07***	0.13***
	(0.02)	(0.005)	(0.01)	(0.01)	(0.02)	(0.02)
Observations	118	118	118	116	112	108
R^2	0.49	0.06	0.10	0.21	0.33	0.43

Note: I report the results of the panel regressions with country-level fixed effects. Data are quarterly and start from 1988. Errors are clustered by time, and the standard errors are calculated using Arellano (1987) which corrects for heteroskedasticity and autocorrelation. *p<0.1; **p<0.05; ***p<0.01.

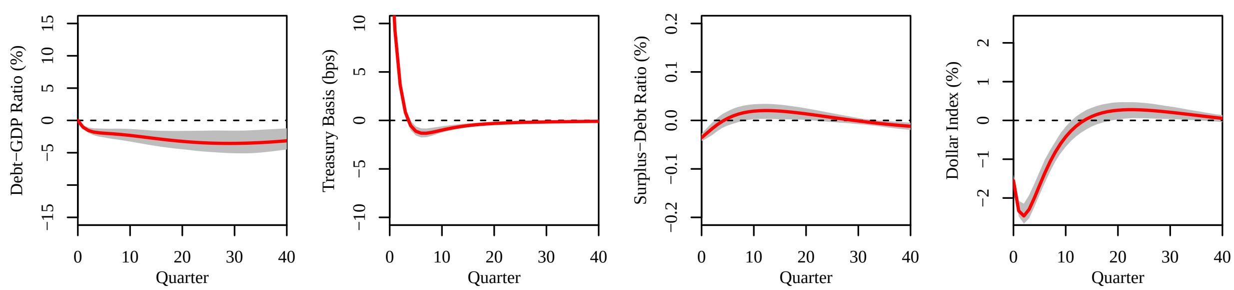
Figure B2. Impulse Responses, Alternative Ordering.



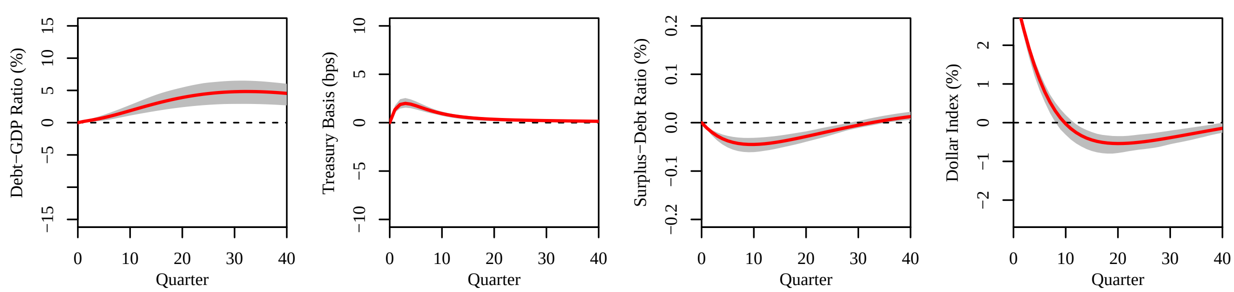
(a) Impulse Responses to a Government Surplus-to-Debt Shock.



(b) Impulse Responses to a Government Debt-to-GDP Shock.



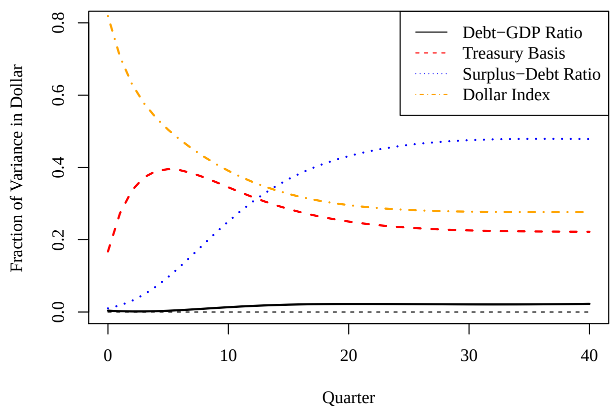
(c) Impulse Responses to a Treasury Basis Shock.



(d) Impulse Responses to a Cumulative Dollar Return Shock.

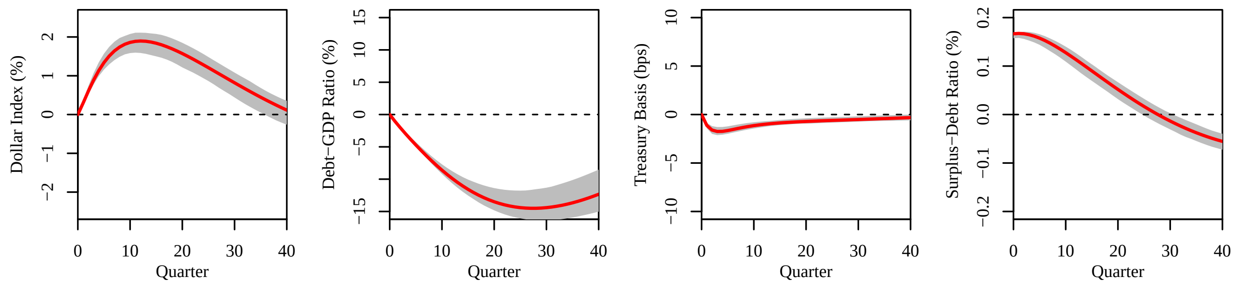
Note: This panel plots the impulse responses to one-standard-deviation shocks. The order of the VAR variables is US government debt-to-GDP ratio, US Treasury basis, US government surplus-to-debt ratio, and the dollar index. The grey area is the 95% confidence interval, obtained from 10,000 rounds of simulation.

Figure B3. Variance Decomposition, Alternative Ordering.

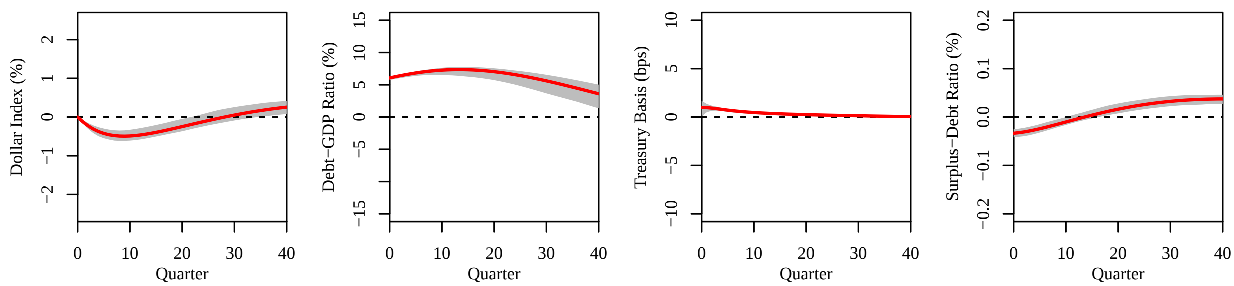


Note: This panel plots the variance of forecast error due to each orthogonalized shock, as implied from the VAR system. The order of the VAR variables is US government debt-to-GDP ratio, US Treasury basis, US government surplus-to-debt ratio, and the dollar index.

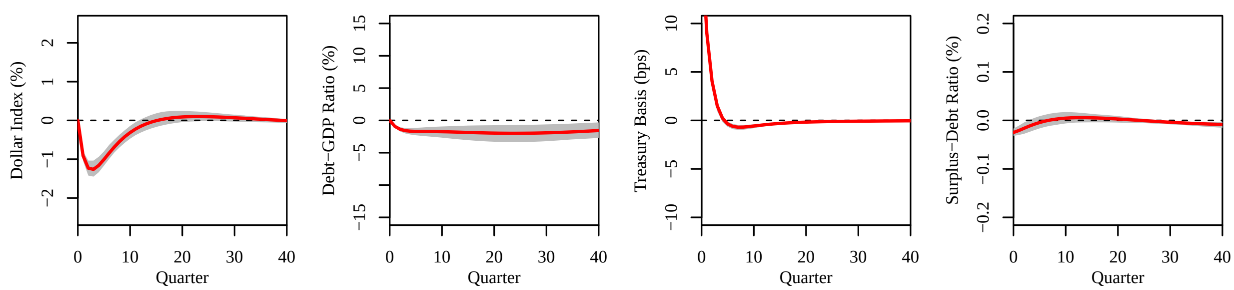
FIGURE B4. IMPULSE RESPONSES, ALTERNATIVE ORDERING.



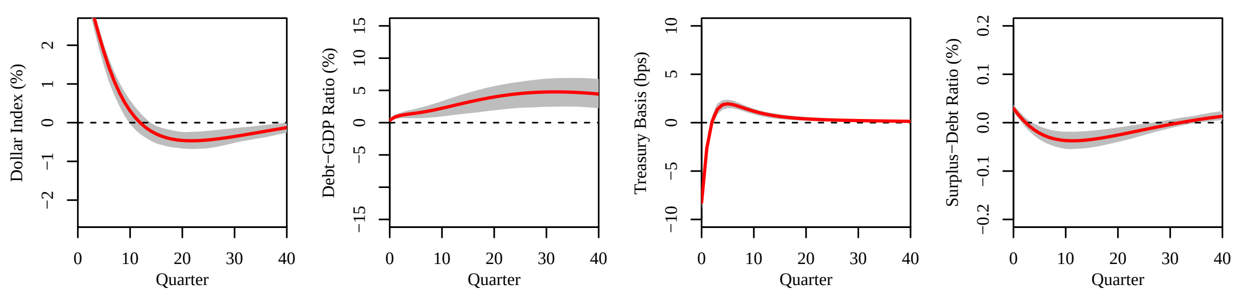
(a) Impulse Responses to a Government Surplus-to-Debt Shock.



(b) Impulse Responses to a Government Debt-to-GDP Shock.



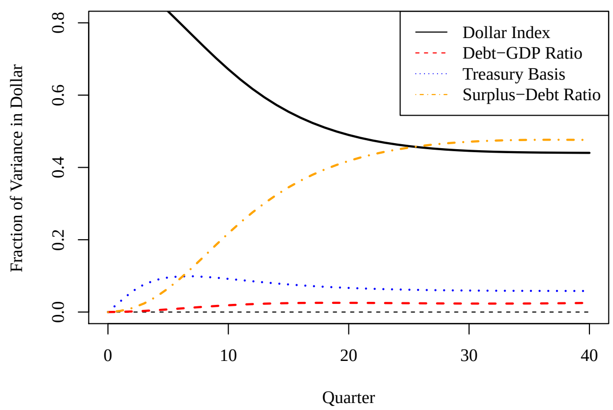
(c) Impulse Responses to a Treasury Basis Shock.



(d) Impulse Responses to a Cumulative Dollar Return Shock.

Note: This panel plots the impulse responses to one-standard-deviation shocks. The order of the VAR variables is the dollar index, US government debt-to-GDP ratio, US Treasury basis, and US government surplus-to-debt ratio. The grey area is the 95% confidence interval, obtained from 10,000 rounds of simulation.

Figure B5. Variance Decomposition, Alternative Ordering.



Note: This panel plots the variance of forecast error due to each orthogonalized shock, as implied from the VAR system. The order of the VAR variables is the dollar index, US government debt-to-GDP ratio, US Treasury basis, and US government surplus-to-debt ratio.

I run a panel regression of the dollar's cumulative excess return with respect to each foreign currency in the next h quarters on the dollar's forward premium with respect to each foreign currency:

$$r_{t,h}^{US,i} = \alpha^{h,US,i} + \beta_h fp_t^{US,i} + \varepsilon_{t+h}^{h,US,i},$$

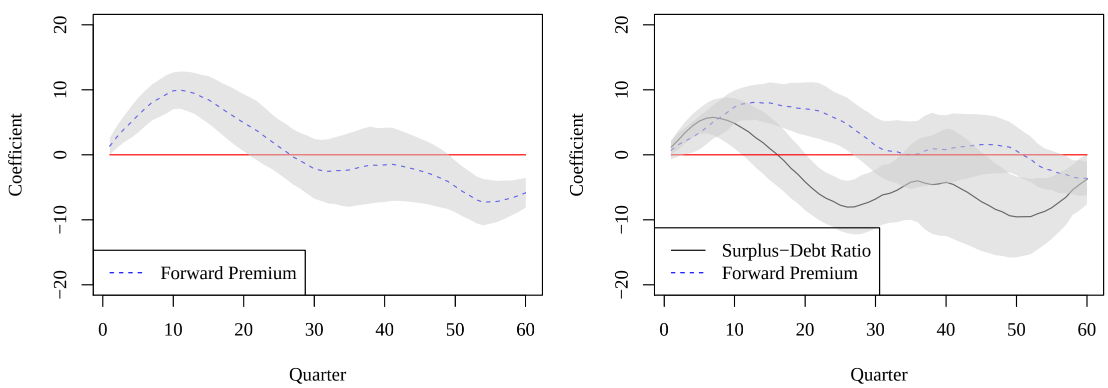
Similarly, I run a panel regression of the dollar's cumulative excess return with respect to each foreign currency in the next h quarters on the dollar's forward premium with respect to each foreign currency and the US government's surplus-to-debt ratio:

$$r_{t,h}^{US,i} = \alpha_{fp}^{h,US,i} + \beta_h fp_t^{US,i} + \gamma_h \frac{surplus_t}{debt_{t-1}} + \varepsilon_{t+h}^{h,US,i},$$

and report the regression coefficients.

Figure B6 reports the result. The coefficients have similar point estimates and much smaller standard errors.

Figure B6. Expected Cumulative Excess Returns of the Dollar, Panel Regression.



Note: I report the point estimates and the 95% confidence intervals of the regressions coefficients β_h and γ_h as functions of the forecast horizon. Country-level fixed effects are included, errors are clustered by time, and the standard errors are calculated using Arellano (1987) which corrects for heteroskedasticity and autocorrelation.