Non-Linear Effects of Fiscal Policy on the Yield Curve

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Abstract

We develop a multi-regimes no-arbitrage term structure model that focuses on the role of fiscal policy. The regimes are identified based on the degree of sustainability of government debt path. Fiscal policy is deemed unsustainable if current fiscal policy fails to target the deficit that is required to stabilize the debt ratio. The model comprises latent yield curve factors and macroeconomic factors that are not spanned by the yield curve. We apply our macro-finance model to US data for the period 1972 to 2011. Results suggest that accounting for the stance of fiscal policy is important to appraise bond risk premia and the effects of deficit shocks on interest rates. Typically, expected excess returns are systematically larger in the unsustainable debt regime as compared to a single regime and a sustainable regime. One percentage point fiscal policy shocks identified by recursive identification scheme and sign restrictions increase yields by between 98 and 107 basis points, the increase in bond yields being larger in the sustainable regime than the unsustainable regimes. Variance decompositions indicate that fiscal shocks matter more for long maturities. Fiscal shocks are also more important in the unsustainable regime.

Main Literature

- Despite ambiguous theoretical and empirical results (Gale and Orszag, 2003), a trend seems to emerge: fiscal policy leads to higher interest rates (e.g. Dai and Philippon (2005), Laubach (2009)).
- Afonso and Martins (2012) estimate the effects of an increase in deficit on Nelson-Siegel yield factors. A one percentage point increase in growth rate of the debt-ratio increases US long-term rates by about 70 basis points.
- Joslin, Priebsch and Singleton (2014) have challenged the view that macro risk factors can be perfectly recovered from a collection of yields (i.e. macro risk factors are spanned by the yield curve). As a consequence, macro risks do not enter the pricing kernel of bonds. However, they do matter for expectations of bond yields.
- Davig and Leeper (2007, 2011) and Favero and Monacelli (2005) estimate changes in the stances of fiscal policy in the United States. Their results suggest that the stance of fiscal policy towards debt sustainability has not been constant.

Research Questions

1. What are the impacts of fiscal policy on the yield curve in the United States? Does it depend on the sustainability of fiscal policy?
2. How does the sustainability of fiscal policy affect risk premia?

Contributions to the literature

- We build a term structure model that emphasizes the role of fiscal policy. Macro factors (output gap, core inflation, primary deficit) are assumed to be unspanned (i.e. they contain valuable information to predict future bond yields, but current bond pricing is not affected (Joslin, Priebsch and Singleton (2014))).
- We present a regime-dependent term structure model with regimes that are economically grounded. We estimate regime-dependent term structure models based on the degree with which current fiscal policy is compatible with debt stabilization.

Methodology

Estimation of regimes

- We condition the model according to the degree with which the current fiscal policy instrument is compatible with debt stabilization.
- Formally, we estimate the rule of Favero and Monacelli (2005) in a Markov-switching framework:

$$\begin{aligned} d_t &= \rho^{s_t^F} d_{t-1} + \left(1-\rho^{s_t^F}\right) d_t^* + \sigma^{s_t^F} \epsilon_t^{s_t^F} \\ d_t^* &= c^{s_t^F} + \gamma_y^{s_t^F} (y_t - y_t^*) + \delta^{s_t^F} d_t^S \end{aligned} \quad (1)$$

where d_t is the primary deficit, $(y_t - y_t^*)$ denotes the output gap, and d_t^S is the deficit consistent with debt stabilization. The superscript s_t^F indicates the fiscal policy regime at time t.

- Characterization of fiscal policy:
  - sustainable if: $c = 0\,;\, |\rho| < 1\,;\, \delta = 1$
  - unsustainable if: $\delta < 1$.

A Dynamic Term Structure Model with Unspanned Macro Risks

The macro-finance term structure model contains:

1) Latent yield curve factors (Level, Slope, Curvature) treated as observable (Joslin, Singleton and Zhu (2011))
2) Inflation, Output gap, Primary deficit

Any Dynamic Term Structure model is composed of three elements:

1) a Time series model of the risk factors under the **real-world probability measure** $\mathbb{P}$:

$$Z_t = \mu + \Phi Z_{t-1} + \epsilon_t,\ \epsilon_t \overset{i.i.d.}{\sim} N(0, \Sigma_{\mathcal{N}}) \quad (2)$$

2) a Dynamic representation of the priced risk factors under the **risk-neutral probability measure** $\mathbb{Q}$ (here, unspanned macro risks (Joslin, Priebsch and Singleton (2014)):

$$P_t^L = \mu_{\mathscr{P}}^{\mathbb{Q}} + \Phi_{PP}^{\mathbb{Q}} P_{t-1}^L + \epsilon_{P,t}^{\mathbb{Q}},\ \Sigma_L^{\mathbb{Q}} \epsilon_{P,t}^{\mathbb{Q}} \overset{i.i.d.}{\sim} N(0, I_L) \quad (3)$$

3) a function that links the **short-term interest rate** to the priced factors:

$$r_t = \rho_0 + \rho_1' P_t^L. \quad (4)$$

The model expressed above is **regime-dependent**. Most of the difference shows in the real-world risk factors dynamics.

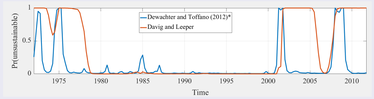
Taking regime-switching into account

For forecasts and impulse responses, we compute 2^{H^*} possible histories of switches (i.e. at each horizon $h = 1, \ldots, H^*$ one can observe a switch or a non-switch) for $h \leq H^*$ and compute the IRFs accordingly. We then weight each of the paths by its likelihood of occurrence such that unlikely histories carry little weight in the final value of the IRF. For $h > H^*$ we consider that the regime occuring at horizon H^* will perdure indefinitely.

Results

Fiscal policy regimes

Eq. (1) uncovers 4 short-lived episodes of unsustainable fiscal policy: 1973, 1975, 2002-3, 2008-9, broadly consistent with Davig and Leeper (2007, 2011).



Impulse Response Functions

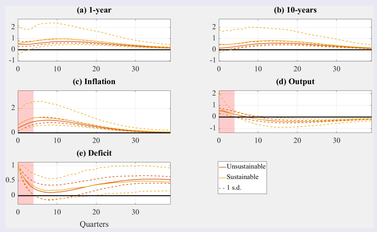
We identify three shocks:

1) Aggregate Supply
2) Aggregate Demand
3) Deficit shocks.

These shocks must respect the following conditions (adapted from Forni and Gambetti, 2010):

Variable\Shock	AD	AS	Deficit
Inflation	+	-	+
Output	+	+	+
Deficit/GDP	-	?	+

Note: A question mark indicates that the response is left unrestricted. The longest horizon up until which the sign restrictions apply is fixed at four quarters.



Note: shaded in light red are the periods on which the sign restrictions are imposed.

Four results stand out:

1) a positive deficit shock undoubtedly increases yields of all maturities. The responses peak at about 12 to 15 quarters.
2) However, the responses are more pronounced for short maturities than for long maturities.
3) Yields peak at 107 basis points in the **sustainable** regime, and 98 basis points in the **unsustainable** regime.
4) Responses of yields mostly due to Level factor (not shown).

Variance Decomposition

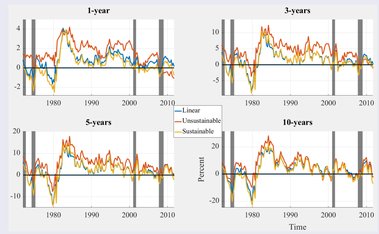
Shock to:	*Others*	*AS*	*AD*	*Deficit*
1-year				
Single				
4	71	9	14	**6**
40	72	9	12	**6**
Unsustainable				
4	63	6	18	**13**
40	62	6	23	**9**
Sustainable				
4	72	7	12	**9**
40	74	7	10	**9**
10-years				
Single				
4	56	6	21	**17**
40	54	6	19	**21**
Unsustainable				
4	51	4	10	**35**
40	48	5	10	**36**
Sustainable				
4	55	6	20	**19**
40	57	6	16	**22**

Note: A question mark indicates that the response is left unrestricted. The longest horizon up until which the sign restrictions apply is fixed at four quarters.

We derive three important results:

1) AD and deficit shocks make up the most of the explained shocks.
2) $FEVD_{deficit}^{yields}$ is larger in the unsustainable regime.
3) The importance of deficit shocks increases with maturity in the unsustainable regime.

Risk Premia and Excess Returns



Note: the gray area corresponds to episodes of unsustainable fiscal policy.

- In accordance with the literature (e.g. Cochrane and Piazzesi (2005, 2009)):
  - clear business-cycle pattern,
  - strong negative excess returns match with the start of the Volcker monetary policy experiment.
- Risk premia are higher in the unsustainable regime, especially for short maturities. This pattern vanishes from 2010 onward: risk premia associated with the sustainable regime are larger than in its unsustainable counterpart for short maturities.

Conclusions

Results suggest that deficits shocks increase bond yields and that that effect depends whether fiscal policy is sustainable or not. Typically, a one percentage point increase in the deficit/GDP raises interest rates by about 100 basis points after 3 years. Most of the responses in yields are due to the Level factor. Variance decomposition shows that fiscal policy shocks matter more for long horizons, and are especially important in the unsustainable regime. In terms of risk premia, unsustainable fiscal policy imposes a larger premium on short maturities.

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