A convenient truth:
The convenience yield and implications for fiscal policy

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The views expressed do not necessarily reflect the official position of De Nederlandsche Bank.
The ‘what’ yield?

- Govt bonds may be valued for things other than their pecuniary return
  - Superior safety and liquidity (money-like properties)
  - Can be used as collateral
  - Convenience yield captures this additional value (‘convenience benefit’)

Empirical definition:
(e.g. Krishnamurthy and Vissing-Jorgensen, 2012, hereafter KVJ; Paret and Weber, 2019; Caramp and Singh, 2020)

\[
\text{convenience yield} = \text{Aaa long-maturity corporate bond yield} - \text{long-maturity govt bond yield}
\]

Theoretical definition:
(e.g. Canzoneri et al., 2008)

\[
\text{convenience yield} = \text{yield on risk-free bond} - \text{yield on govt bond}
\]
The convenience yield spikes during financial crises

The US convenience yield (1919-2010)

Notes: The convenience yield is measured as in KVJ, i.e. as the percentage spread between Moody’s Aaa-rated long-maturity corporate bond yield and the yield on long-maturity Treasury bonds, both taken from the FRED Economic Database. Shaded areas refer to dates of US banking crises and stock market crashes as identified by Reinhart and Rogoff (2011).
What I do in this paper

- What does the convenience yield imply for fiscal policy?
  - Macroeconomic stabilization properties of fiscal policy
  - Fiscal trade-off between govt debt and macroeconomic stabilization
  - Optimal fiscal policy
  - Fiscal requirements for govt debt sustainability

- Use simple theoretical model, provide analytical and numerical results
Main results: three ‘convenient truths’

- The convenience yield...
  1. renders counter-cyclical fiscal policy stabilizing/welfare enhancing
  2. improves trade-off between govt debt and macroeconomic stabilization
  3. loosens debt sustainability requirements under counter-cyclical fiscal policy

- Fiscal policy recommendations: when convenience yield > 0...
  ▶ focus more (less) on output (govt debt) stabilization
  ▶ pursue and enhance counter-cyclical fiscal policies
  ▶ in times of crisis, flood market with govt bonds
A New Keynesian model
with preferences over government bonds
The household problem (1/2)

- A representative household aims to maximize expected lifetime utility:

$$E_t \sum_{k=0}^{\infty} \beta^k z_{D,t+k} \left( \frac{c_{t+k}^{1-\sigma}}{1-\sigma} - \frac{n_{t+k}^{1+\varphi}}{1+\varphi} + \chi \frac{b_{t+k}^{1-\sigma_b}}{1-\sigma_b} \right)$$

subject to the period budget constraint:

$$c_t + b_t + \tau_t \leq w_t n_t + \frac{R_{t-1}}{\pi_t} b_{t-1} + \mathcal{P}_t$$

with $c_t$ consumption, $n_t$ hours worked, $b_t$ govt bonds, $\tau_t$ taxes, $w_t$ wage, $R_t$ govt bond rate, $\pi_t$ inflation, $\mathcal{P}_t$ firm profits, $z_{D,t}$ demand shock, $\beta \in (0, 1)$ discount factor, $\sigma > 0$ risk aversion, $1/\varphi > 0$ Frisch elasticity.
Euler equation, with $\lambda_t$ marginal utility of consumption:

$$1 = \beta E_t \left[ \frac{\lambda_{t+1}}{\lambda_t} \frac{R_t}{\pi_{t+1}} \right] + z_{D,t} \theta_t, \quad \theta_t = \text{convenience yield} \equiv \frac{\chi b_t^{b-\sigma_b}}{\lambda_t} \quad (3)$$

Key parameters:

- $\sigma_b$: determines curvature of demand schedule for govt bonds
- $\chi$: determines long-run level of $\theta$, shocks to $\chi \approx \text{‘flight to safety shocks’}$
The government

• Government budget constraint:

\[ b_t + \tau_t = \frac{R_{t-1}}{\pi_t} b_{t-1} + \text{govt cons} \]  \hspace{2cm} (4)

• Tax rule:

\[ \tau_t - \tau = \gamma_b (b_{t-1} - b) + \gamma_y \text{ (output gap)} \]  \hspace{2cm} (5)

• Key parameters:
  - \( \gamma_b \): fiscal response to govt debt (effort to stabilize debt)
  - \( \gamma_y \): fiscal response to economic conditions (effort to stabilize output)

• Defining the cyclical fiscal stance:

\[
\text{Fiscal policy} = \begin{cases} 
\text{counter-cyclical} & \text{if } \gamma_y > 0 \\
\text{a-cyclical} & \text{if } \gamma_y = 0 \\
\text{pro-cyclical} & \text{if } \gamma_y < 0 
\end{cases}
\]
Monetary policy, production and market clearing

- Interest rate rule:
  \[ \frac{R_t}{R} = \left( \frac{\pi_t}{\pi} \right)^{\phi_{\pi}} \]  
  \[ (6) \]
  with \( \phi_{\pi} > 1 \) (i.e. Taylor Principle is always satisfied)

- Firm \( i \in [0, 1] \) produces \( y_t(i) \) using linear production function:
  \[ y_t(i) = n_t(i) \]  
  \[ (7) \]

- Firms cannot adjust prices with probability \( \theta_p \in (0, 1) \)

- Goods and labor market clearing:
  \[ y_t = c_t + \text{govt cons} = n_tD_t^{-1} \]  
  \[ (8) \]
  with \( y_t \) aggregate income and \( D_t \) measure of price dispersion
Focus on interaction between $\gamma_b$, $\gamma_y$ and $\theta$

Table: Calibration of model parameters (quarterly frequency)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma_b$</td>
<td>Fiscal response to govt debt</td>
<td>$[0, 0.1]$</td>
</tr>
<tr>
<td>$\gamma_y$</td>
<td>Fiscal response to output</td>
<td>$[-4, 4]$</td>
</tr>
<tr>
<td>$\chi$</td>
<td>Utility weight of govt bonds (Rannenberg, 2019)</td>
<td>$[0, 1.7]$</td>
</tr>
<tr>
<td>$\sigma_b$</td>
<td>Curvature parameter</td>
<td>0.5</td>
</tr>
<tr>
<td>$\beta$</td>
<td>Household discount factor</td>
<td>0.9926</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Elasticity of intertemporal substitution</td>
<td>2</td>
</tr>
<tr>
<td>$\varphi$</td>
<td>Inverse Frisch elasticity of labor supply</td>
<td>3</td>
</tr>
<tr>
<td>$\phi_\pi$</td>
<td>Monetary policy response to inflation</td>
<td>1.5</td>
</tr>
<tr>
<td>$\theta_p$</td>
<td>Probability of non-price adjustment</td>
<td>0.75</td>
</tr>
<tr>
<td>$\rho_D$</td>
<td>Auto-correlation coefficient demand shock</td>
<td>0.9</td>
</tr>
<tr>
<td>$c/y$</td>
<td>Steady-state consumption ratio</td>
<td>0.6</td>
</tr>
<tr>
<td>$b/y$</td>
<td>Steady-state govt debt ratio (annualized)</td>
<td>0.4</td>
</tr>
</tbody>
</table>
The convenience yield
and macroeconomic stabilization
A simplified model
A simplified model

- Assume central bank keeps real interest rate constant
- Solution for consumption is of the following form, with \( \hat{x}_t \equiv \left( x_t - x \right) / x \):

  \[
  \hat{c}_t = \psi_1 \hat{b}_{t-1} + \psi_2 \hat{z}_{D,t}
  \]

- Apply method of undetermined coefficients to find \( \psi_1 \) and \( \psi_2 \):

  \[
  \psi_1 = \frac{1}{2\beta R \gamma_y} \left[ \left( \xi_1^2 - 4\beta R \gamma_y \frac{c}{b} \xi_2 \right)^{\frac{1}{2}} - \xi_1 \right] \frac{b}{c} \]  \hspace{1cm} (9)

  \[
  \psi_2 = \frac{1}{\sigma} \frac{(1 - \theta)(1 - \rho_D)}{1 - (1 - \theta) \rho_D + [(1 - \theta) \psi_1 + \theta \sigma_b / \sigma] \gamma_y \frac{c}{b}} \]  \hspace{1cm} (10)

where \( R = (1 - \theta) / \beta \), \( \xi_1 \equiv 1 + \gamma_y \theta \sigma_b / \sigma c / b - \beta R (R - \gamma_b) \) and \( \xi_2 \equiv -\theta \sigma_b / \sigma (R - \gamma_b) \)
Case 1 ($\theta = 0$): The Ricardian equivalence case

- Recall the policy function for consumption:

$$\hat{c}_t = \psi_1 \hat{b}_{t-1} + \psi_2 \hat{z}_{D,t}$$

- If $\theta = 0$, then $\psi_1 = 0$:
  - Fiscal policy has no effect on consumption due to Ricardian equivalence: changing govt debt delivers a zero net wealth effect

- If $\theta = 0$, then $\psi_2 = 1/\sigma$:
  - Effects of aggregate shocks on consumption independent from fiscal policy
Case 2 ($\theta > 0$): The case for fiscal stabilization policy

- Recall the policy function for consumption:

  \[ \hat{c}_t = \psi_1 \hat{b}_{t-1} + \psi_2 \hat{z}_{D,t} \]

- If $\theta > 0$, then $\psi_1 > 0$ (Ricardian equivalence breaks down):
  - If debt ↑ ⇒ marginal utility of holding debt ↓ ⇒ consumption ↑

- If $\theta > 0$, then $\psi_2 \to 0$ if $\theta \to 1$
  - CY dampens business cycle fluctuations, regardless of fiscal stance

- If $\theta > 0$, then $\psi_2 \to 0$ if $\gamma_y \to \infty$
  - Counter-cyclical fiscal policy can fully stabilize consumption

- If $\theta > 0$, then $\partial \psi_2 / \partial \gamma_y \to 0$ if $\gamma_b \to \infty$
  - Greater focus on debt stabilization weakens ability to stabilize economy
Interpreting Case 2

- When $\theta > 0$, positive co-movement between debt and consumption

- Govt bonds provide transaction services, stimulates consumption
  (Canzoneri and Diba, 2005; Linnemann and Schabert, 2010)

- Govt bonds can be used as collateral, stimulates lending/borrowing
  (Falagiarda and Saia, 2017; Lakdawala et al., 2018)
Consumption sensitivity to shocks ($\psi_2$)

A more counter-cyclical fiscal stance reduces consumption sensitivity to shocks.
Consumption sensitivity to shocks ($\psi_2$)

Higher $\theta$ reduces consumption sensitivity to shocks, regardless of fiscal policy.
Consumption sensitivity to shocks ($\psi_2$)

More debt stabilization means less macroeconomic stabilization

![Graph showing consumption sensitivity to shocks ($\psi_2$)]
Back to the full model
Responses to negative demand shock w/o CY

In the absence of the convenience yield ($\theta = 0$), changing cyclical fiscal stance has no real effects.

Notes: We set $\gamma_y = \{-3, 0, 3\}$.
Responses to negative demand shock with CY

In the presence of the convenience yield ($\theta > 0$):
consumption and output responses muted...

Notes: We set $\theta = 0.08$. 
Responses to negative demand shock with CY

In the presence of the convenience yield ($\theta > 0$): faster return to steady state under counter-cyclical fiscal policy...

Notes: We set $\theta = 0.08$. 
Responses to negative demand shock with CY

In the presence of the convenience yield ($\theta > 0$):

...slower return to steady state under pro-cyclical fiscal policy

Notes: We set $\theta = 0.08$. 
CY improves debt vs output stabilization trade-off

Each dot shows the output-debt variability pair for different combinations of $\gamma_b$ and $\gamma_y$, and for different values of $\theta$. Units are in percentages.
Optimal fiscal mix favors output stabilization

Welfare gain compared to steady state with a-cyclical fiscal policy

*Notes:* We set $\theta = 0.02$. Welfare units are measured in consumption perpetuities.
CY has important implications for macro stabilization

- Convenient truths #1 and #2: the convenience yield....
  - renders counter-cyclical fiscal policy stabilizing/welfare enhancing
    (by exploiting positive relationship between consumption and debt)
  - improves trade-off between debt and output stabilization
    (by dampening business cycle fluctuations, regardless of fiscal stance)

- Combined, these results imply an optimal fiscal policy that supports monetary policy by being more geared towards output stabilization
The convenience yield, fiscal policy and government debt sustainability
Deriving the model’s stability conditions

- A reduced version of the linearized model:

\[
\sigma \hat{c}_t = \sigma \beta RE_t \hat{c}_{t+1} - \beta R (\phi_i \hat{\pi}_t - E_t \hat{\pi}_{t+1}) + \sigma_b \theta \hat{b}_t
\]

(11)

\[
\hat{\pi}_t = \beta E_t \hat{\pi}_{t+1} + \kappa \omega \hat{c}_t
\]

(12)

\[
\hat{b}_t = R (\phi_i \hat{\pi}_{t-1} - \hat{\pi}_t) + (R - \gamma_b) \hat{b}_{t-1} - \gamma y \frac{c}{b} \hat{c}_t
\]

(13)

where \( \kappa \equiv (1 - \theta_p) (1 - \beta \theta_p) / \theta_p \) and \( \omega \equiv \varphi c / y + \sigma \)

- State-space representation:

\[
E_t x_{t+1} = A x_t
\]

(14)

- Stability requires \( A \) to have two eigenvalues outside unit circle (Blanchard and Kahn, 1980)

- Find condition for \( \gamma_b \) that satisfies this stability requirement
The stability requirement for fiscal policy

**Proposition 1.** Given the benchmark parameter calibration in Table 1 and a fiscal rule of the form (5), a sufficient condition for a stable and unique rational expectations equilibrium is given by

\[
\gamma_b > R - 1 - \sigma_b \theta \left[ \frac{\gamma_y c/b (1/\beta - 1) - 1/\beta (\phi_\pi - 1) R\kappa \omega}{\sigma \theta (1/\beta - 1) + (\phi_\pi - 1) R\kappa \omega} \right],
\]

provided that \( \gamma_b < R + 1 + \sigma_b \theta/\beta [\phi_1 + (1 + \beta) c/b \gamma_y] / (\phi_1 + \phi_2) \) with \( \phi_1 \equiv (1 + \phi_\pi) R\kappa \omega \) and \( \phi_2 \equiv \sigma (2 - \theta) (1/\beta + 1) \).

- When \( \theta \neq 0 \), stability requirement depends on cyclical fiscal stance, \( \gamma_y \)
Counter-cyclical FP loosens stability requirement

Stability properties as a function of $\gamma_b$, $\gamma_y$ and $\theta$

$Fiscal\ response\ to\ outstanding\ public\ debt,\ \gamma_b$

$Notes:\ Gray = stable\ and\ unique\ equilibrium;\ white = no\ stable\ equilibrium\ exists.$
CY has important implications for debt sustainability

- Convenient truth #3: the convenience yield...
  - loosens debt sustainability requirements under counter-cyclical fiscal policy

- In the presence of the convenience yield....
  - policies *without* debt-reduction efforts are feasible
  - counter-cyclical fiscal policies *expand* stability region
  - pro-cyclical fiscal policies *contract* stability region
Wrapping up
Conclusions and model extensions

- The convenience yield...
  1. renders counter-cyclical fiscal policy stabilizing/welfare enhancing
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- Model extensions:
  - Limited asset market participation
  - Effective lower bound on nominal interest rate
  - Physical capital and investment
  - Alternative fiscal instruments (income taxes, VAT, govt consumption)
  - Risks of high public debt
Questions?
Other slides
Links to existing literature

- Role of fiscal policy in times of low interest rates:
  - Blanchard (2019): sustainable fiscal policy w/o surpluses when \( r < g \)
  - Blanchard and Summers (2017): greater role for fiscal policy at ELB
  - Eichenbaum (2019): automatic stabilizers more potent at ELB
  - De Grauwe et al. (2019): favorable fiscal policy trade-offs when \( r < g \)
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- **Role of fiscal policy under secular stagnation:**
  - Del Negro et al. (2017): convenience yield main driver of decline in $r^*$
  - Rachel and Summers (2019): govt debt can raise $r^*$
  - Cuba-Borda and Singh (2018): govt spending can pull economy out secular stagnation steady state
Government bonds in the utility function: why?

- Can reflect many things:
  - Smith (1822): social status, moral prestige associated with wealth
  - Kaplan and Violante (2018): short-cut to precautionary savings
  - Fisher (2015), KVJ: govt bonds offer superior safety and liquidity compared to alternative assets of similar maturity

For our purposes: regardless of its source, there exists an excessive demand for govt bonds such that the corresponding yield is below the risk-free interest rate.

Recent applications:
- Cuba-Borda and Singh (2018), Michau (2018): study negative $r^*$
- Michaillat and Saez (2019), Rannenberg (2019): study government spending and forward guidance at ELB
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