Explaining the Effects of Government Spending Shocks on Consumption and the Real Exchange Rate

M. Ravn  S. Schmitt-Grohé  M. Uribe

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Effects of Government Spending Shocks: 
SVAR Evidence

A rise in government spending leads to

- **An increase in private consumption.**
  (Fatás and Mihov, 2001; Blanchard and Perotti, 2002; Galí et al., 2007; Perotti, 2007.)

- **A real exchange rate depreciation.**
  (Monacelli and Perotti, 2006.)

- An increase in output and wages
  (Rotemberg and Woodford, 1992; Blanchard and Perotti, 2002; Perotti, 2007.)

- **A trade balance deterioration.**
  (Corsetti and Müller, 2006; Monacelli and Perotti, 2006.)
This Paper

- produces SVAR evidence using a panel approach.
  - To gain efficiency
  - To obtain a single benchmark against which to evaluate theoretical explanations.

- presents a *theoretical explanation* of the observed effects of government spending shocks on consumption, the real exchange rate, output, and the trade balance based on the *deep-habit mechanism*. 
Effects of Government Spending Shocks: Evidence from the Narrative Approach

- In response to a rise in government spending
  - Output increases.
  - Consumption fails to increase.
  - Wages fail to rise.

(Ramey and Shapiro, 1998; Burnside, Eichenbaum, and Fisher, 2004; Ramey, 2006)
Estimation of Impulse Responses to a Government Spending Shock

- **The Structural VAR Model**

\[ AX_t = B(L)X_{t-1} + \epsilon_t \]

where \( X_t = \begin{bmatrix} \log g_t \\ \log y_t \\ \log c_t \\ \frac{nxt}{yt} \\ \log e_t \end{bmatrix}'

- **Identification**: Government spending is not affected contemporaneously by structural innovations to any variable other than government spending itself.

- **Panel of Countries**: Australia, Canada, U.K., and U.S.

- **Sample**: Quarterly data from 1975Q1 to 2005Q4.

- **4 lags.**
Estimated Impulse Response Functions To A Unit Innovation in Domestic Government Purchases
Habit Formation

Period Utility Function: $U(x_t, h_t)$

**Superficial Habit Formation:**

$$x_t = c_t - \theta \tilde{c}_{t-1} \quad \text{with} \quad c_t = \left[ \int_0^1 c_{it}^{1-\frac{1}{\eta}} \frac{1}{1-\frac{1}{\eta}} \right]$$

**Implied Demand Functions:**

$$c_{it} = \left( \frac{P_{it}}{P_t} \right)^{-\eta} x_t$$

**Deep Habit Formation:**

$$x_t = \left[ \int_0^1 (c_{it} - \theta \tilde{c}_{it-1})^{1-\frac{1}{\eta}} \frac{1}{1-\frac{1}{\eta}} \right]$$

**Implied Demand Functions:**

$$c_{it} = \left( \frac{P_{it}}{P_t} \right)^{-\eta} x_t + \theta \tilde{c}_{it-1}$$
A Two-Country Model of Pricing to Habits

- Production economy without capital.

- Preferences
  \[
  E_0 \sum_{t=0}^{\infty} \beta^t [\phi \ln(x_t) + (1 - \phi) \ln(1 - h_t)]
  \]

- Two goods: \(a\) and \(b\)
  \[
  x_t = \left[ \omega x_{a,t}^{c \frac{1-\frac{1}{\xi}}{1-\frac{1}{\xi}}} + (1 - \omega) x_{b,t}^{c \frac{1-\frac{1}{\xi}}{1-\frac{1}{\xi}}} \right]^{\frac{1}{1-\frac{1}{\xi}}}
  \]
Habit-adjusted consumption of good $a$

\[
x^c_{a,t} = \left[ \int_0^1 (c_{i,a,t} - \theta^c s^c_{i,a,t-1})^{1-\frac{1}{\eta}} di \right]^{\frac{1}{1-\frac{1}{\eta}}}
\]

\[
s^c_{i,a,t} = \rho s^c_{i,a,t-1} + (1 - \rho) \tilde{c}_{i,a,t}
\]

Habit-adjusted consumption of good $b$

\[
x^c_{b,t} = \left[ \int_0^1 (c_{i,b,t} - \theta^c s^c_{i,b,t-1})^{1-\frac{1}{\eta}} di \right]^{\frac{1}{1-\frac{1}{\eta}}}
\]

\[
s^c_{i,b,t} = \rho s^c_{i,b,t-1} + (1 - \rho) \tilde{c}_{i,b,t}
\]
The Public sector

$$\max \chi(x^g_{a,t}, x^g_{b,t})$$

$$x^g_{a,t} = \left[ \int_0^1 (g_{i,a,t} - \theta g^g_{s_{i,a,t-1}})^{1-\frac{1}{\eta}} di \right]^{\frac{1}{1-\frac{1}{\eta}}}$$

$$s^g_{i,a,t} = \rho s^g_{i,a,t-1} + (1 - \rho)g_{i,a,t}$$

$$x^g_{b,t} = \left[ \int_0^1 (g_{i,b,t} - \theta g^g_{s_{i,b,t-1}})^{1-\frac{1}{\eta}} di \right]^{\frac{1}{1-\frac{1}{\eta}}}$$

$$s^g_{i,b,t} = \rho s^g_{i,b,t-1} + (1 - \rho)g_{i,b,t}$$

$$\int_0^1 (P_{i,a,t}g_{i,a,t} + P_{i,b,t}g_{i,b,t}) di = P^y_t g_t$$
- **Domestic Demand for good $a$**

\[
d_{i,a,t} = \left( \frac{P_{i,a,t}}{P_{a,t}} \right)^{-\eta} x_{a,t} + \theta s_{i,a,t-1}
\]

Price elasticity \(= -\eta \left( 1 - \theta \frac{s_{i,a,t-1}}{d_{i,a,t}} \right)\)

- **Foreign Demand for good $a$**

\[
d_{i,a,t}^* = \left( \frac{P_{i,a,t}^*}{P_{a,t}^*} \right)^{-\eta} x_{a,t}^* + \theta s_{i,a,t-1}^*
\]

Price elasticity \(= -\eta \left( 1 - \theta \frac{s_{i,a,t-1}}{d_{i,a,t}^*} \right)\)
Firms

- Firms can price discriminate internationally.

- Production Function: $y_{i,a,t} = h_{i,a,t}$

- Optimal pricing

\[
P_{a,t} = \left[ 1 - \frac{1}{\eta \left( 1 - \theta \frac{d_{a,t} - 1}{d_{a,t}} \right)} + \theta \Omega_{a,t} \right]^{-1} MC_t
\]

\[
P_{a,t}^* = \left[ 1 - \frac{1}{\eta \left( 1 - \theta \frac{d_{a,t}^* - 1}{d_{a,t}^*} \right)} + \theta \Omega_{a,t}^* \right]^{-1} MC_t
\]
The Real Exchange Rate

Domestic price index: \( P_t = \gamma P_{a,t} + (1 - \gamma) P_{b,t} \)

Foreign price index: \( P_t^* = (1 - \gamma) P_{a,t}^* + \gamma P_{b,t}^* \)

Real exchange rate, \( e_t = \frac{P_t^*}{P_t} = f \left( \frac{P_{a,t}^*}{P_{a,t}}, \frac{P_{b,t}^*}{P_{b,t}}, \frac{P_{b,t}}{P_{a,t}} \right) + \pm \)
Calibration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
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<tbody>
<tr>
<td>$\beta$</td>
<td>0.99</td>
<td>Subjective discount factor (quarterly)</td>
</tr>
<tr>
<td>$\phi$</td>
<td>0.15</td>
<td>Preference parameter</td>
</tr>
<tr>
<td>$\omega$</td>
<td>0.5</td>
<td>Preference parameter</td>
</tr>
<tr>
<td>$\xi$</td>
<td>1.5</td>
<td>Elasticity of substitution composite</td>
</tr>
<tr>
<td>$\eta$</td>
<td>5</td>
<td>Elasticity of substitution varieties</td>
</tr>
<tr>
<td>$s_g, s_g^*$</td>
<td>0.2</td>
<td>Government shares</td>
</tr>
</tbody>
</table>

The Driving Force

$$\hat{g}_t = B^1(L) \begin{bmatrix} \hat{g}_{t-1} \\ \hat{y}_{t-1} \\ \hat{c}_{t-1} \\ nxy_{t-1} \\ \hat{e}_{t-1} \end{bmatrix} + \epsilon^1_t$$
Estimation

• Goal: Estimate deep-habit parameters:

\[ \Theta \equiv [\theta^c \quad \theta^g \quad \rho] \]

• Strategy: Pick \( \Theta \) to minimize the distance between empirical and theoretical impulse responses of five variables.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Point Estimate</th>
<th>Standard Deviation</th>
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</thead>
<tbody>
<tr>
<td>( \theta^c )</td>
<td>0.52</td>
<td>0.08</td>
</tr>
<tr>
<td>( \theta^g )</td>
<td>0.57</td>
<td>0.15</td>
</tr>
<tr>
<td>( \rho )</td>
<td>0.9876</td>
<td>0.03</td>
</tr>
</tbody>
</table>
Predicted and Estimated Impulse Responses

\( g_t \)

\( y_t \)

\( c_t \)

\( nxy_t \)

\( rer_t \)

--- Data

- - - Data ± 2std

\( \times \) Deep Habits
Response of the Domestic and Foreign Markups to a One-Percent Government Spending Shock

Diagram showing the percent deviation from trend of domestic and foreign markups over quarters after a shock.
Response of the Real Wage to a Government Spending Shock

![Graph showing the response of domestic and foreign wages to a government spending shock. The graph plots the percent deviation from trend against quarters after the shock. The domestic wage shows a sharp decline initially, followed by a gradual decrease. The foreign wage shows a slight increase over time.]
Response of the Real Exchange Rate to a Government Spending Shock

![Graph showing the response of the real exchange rate to a government spending shock over 8 quarters, with data points and lines representing different scenarios: Data, Data +2 std, Data -2 std, Deep, and Superficial. The x-axis represents quarters after the shock, and the y-axis represents percent deviation from trend. The graph illustrates how the exchange rate deviates from its trend in response to the shock.]
Response of Private Consumption to a Government Spending Shock

Percent deviation from trend vs. Quarters after the shock.
Anticipated Government Spending Shocks

\[ \ln\left(\frac{g_t}{\bar{g}}\right) = \rho^g \ln\left(\frac{g_{t-1}}{\bar{g}}\right) + \epsilon_t^0 + \epsilon_{t-2}^2 \]

\[ \rho^g = 0.87 \]
Impulse Responses To a Two-Period Anticipated Innovation in Government Spending

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Unanticipated Shock

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Anticipated Shock
Sensitivity Analysis: Home Bias and Less Persistent Habit Stock

- x-x-x-: Baseline  - o-o-o: Home bias, $\omega = 0.7$  - ◊ ◊ ◊: Less persistence, $\rho = 0.87$
Observed and Predicted Impulse Responses: HP Filtered Data
Conclusions

• Pricing to Habits can account quantitatively for the empirical regularity that in response to an *unanticipated* demand shock
  
  — private consumption rises
  
  — the real exchange rate depreciates
  
  — the trade balance deteriorates

• At the same time, Pricing to Habits can account for the empirical regularity that in response to an *anticipated* demand shock
  
  — private consumption fails to rise on impact
  
  — real product wages fails to rise on impact
Extras
Country-by-Country Regressions
United Kingdom

$g_t$

$y_t$

$c_t$

$nxy_t$

$rer_t$
United States

$g_t$

$y_t$

$c_t$

$nxy_t$

$rert$

$nxy_t$
Monte Carlo Experiment

- $g_t$
- $c_t$
- $r_{et}$
- $y_t$
- $nxy_t$

--- Point estimate
-- Median Monte Carlo
- - - Point estimate ± 2std