

Interest Rates, Revealed Preferences, and the Open Economy

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 - ▶ the substitution effect has to be negative
- ▶ (Preliminary!) WARP violations are massive. The model SOE fails to rationalize most switches observed in the data and is clearly rejected.

Literature review

- ▶ tests of the small open economy (SOE) model:
 - based on Campbell's (1987) Present Value Model: Sheffrin, Woo (JME, 1990), Ghosh (EJ, 1995), Bergin, Sheffrin (EJ, 2000), Gruber (JME, 2004)
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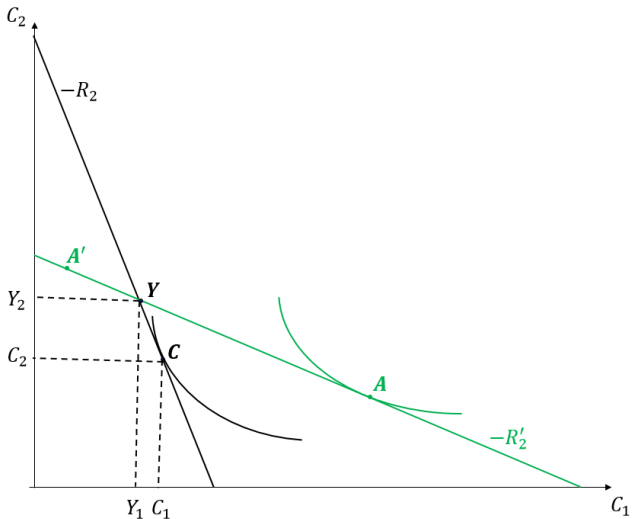
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- ▶ revealed preferences and inter-temporal choice: Echenique et al. (2017), Crawford (2010), Adams et al. (2014)

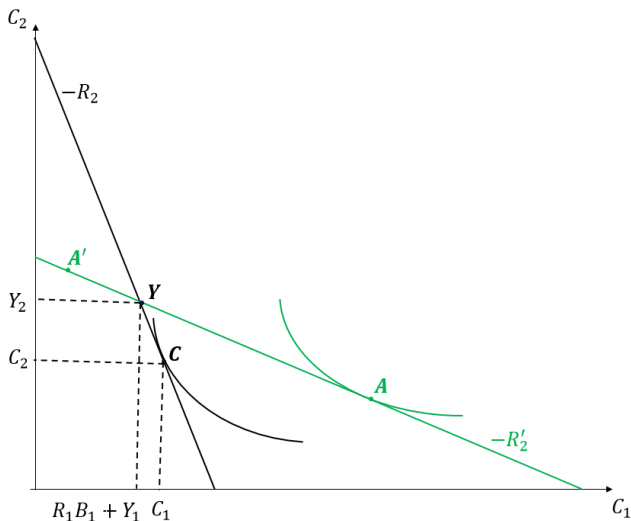
Basic idea with 2-period endowment economy

Switches in net exports:



Basic idea with 2-period endowment economy, cont.

Switches in net foreign asset positions:

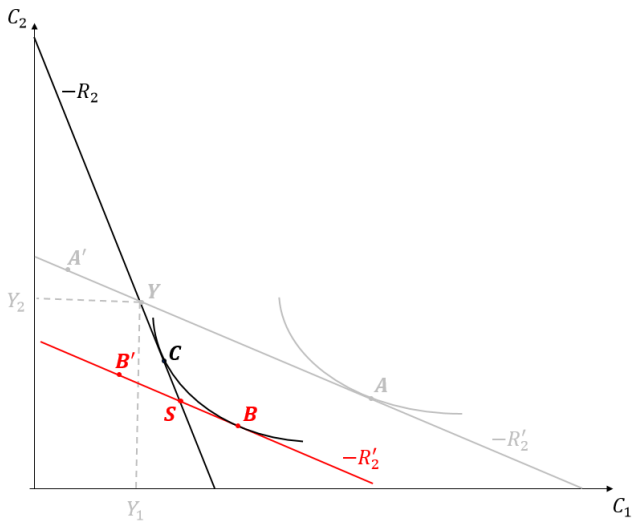


At point **C** we have $R_1 B_1 + Y_1 - C_1 = B_2 < 0$

So, following the change, we need $B'_2 < 0$ as well.

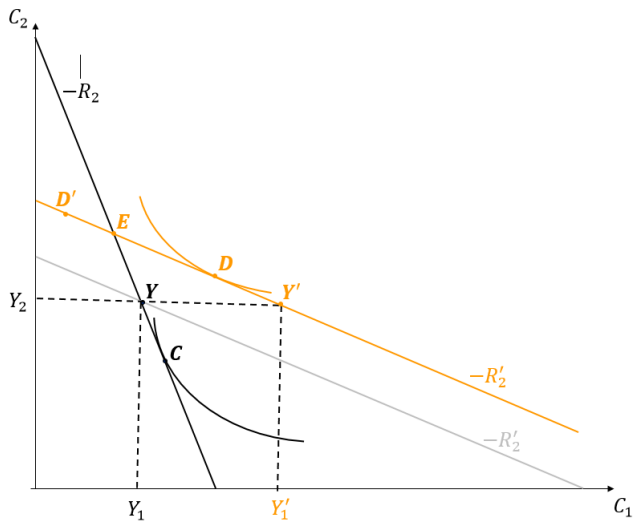
Basic idea with 2-period endowment economy, cont.

Substitution effect:



Following interest rate drop, substitution effect reduces NX/NFAP.

Methodological difficulty



Interpretation of the test

- ▶ if there were no changes in inter-temporal wealth (Y , B), we could apply standard revealed preference tests directly on the data (without any models)
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- ▶ any violations can be then be due to misbehavior of preferences or misspecification of the model
- ▶ assuming that (aggregate) preferences do exist and are well-behaved, we end up testing the SOE model
- ▶ alternative interpretation: violations reflect the aggregation of preferences and point to the non-existence of the representative agent

The model

Agents maximize

$$U_t = \sum_{i=0}^{\infty} \beta^i \frac{C_{t+i}^{1-\sigma}}{1-\sigma}$$

subject to the budget constraint

$$C_t + \frac{W_{t+1}}{R} = W_t$$

where beginning-of-period-t wealth W_t is given by

$$W_t = RB_t + Y_t + \frac{Y_{\geq t+1}}{R}$$

and

$$Y_{\geq t+1} = \sum_{i=1}^{\infty} \frac{Y_{t+i}}{R^{i-1}}$$

The model, cont.

Consumers' problem can still be thought of as 2-period, due to Bellman's formulation:

$$V(W_t; R) = \max_{C_t} \left\{ \frac{C_t^{1-\sigma}}{1-\sigma} + \beta V(W_{t+1}; R) \right\}$$

subject to

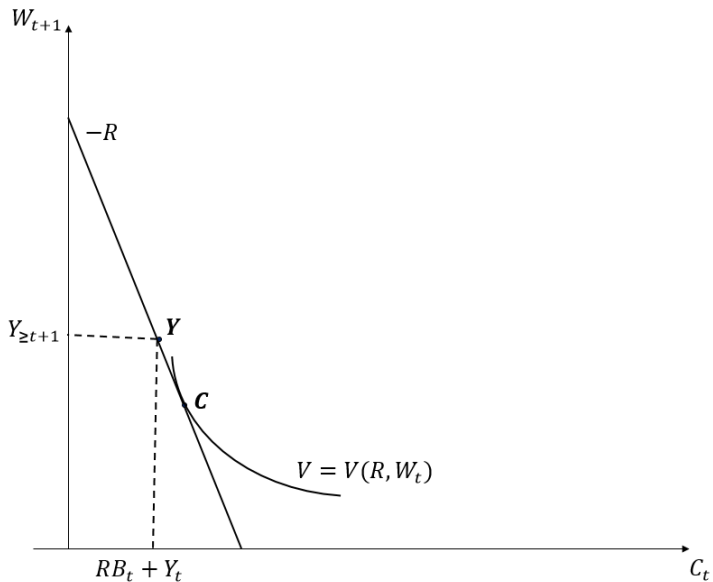
$$W_{t+1} = R(W_t - C_t)$$

Assumption of constant interest rate R allows for a closed-form solution for V :

$$V(R, W_t) = \left[1 - \beta^{\frac{1}{\sigma}} R^{\frac{1}{\sigma} - 1} \right]^{-\sigma} \frac{W_t^{1-\sigma}}{1-\sigma}$$

which carries over the properties of the utility function (concavity, continuity)

Infinite horizon



Solving the model

- ▶ the model consists of 2 equations:
 - Euler, which captures optimal choice between C_t and W_{t+1}
 - budget constraint (expenditure on C_t and W_{t+1} , given W_t)

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- ▶ the model consists of 2 equations:
 - Euler, which captures optimal choice between C_t and W_{t+1}
 - budget constraint (expenditure on C_t and W_{t+1} , given W_t)
- ▶ eliminate W_{t+1} by combining both equations. This gives the Marshallian demand function (consumption C_t as function of wealth W_t)

Solving the model, cont.

- ▶ Take first order Taylor expansion of the Marshallian demand function $C_t = f(W_t)$ around ITS FORMER SELF, defining $\hat{C}_{t+1} = \frac{C_{t+1} - C_t}{C_t}$, etc.

Solving the model, cont.

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- ▶ Plug in the demand function $\hat{C}_{t+1} = g(\hat{W}_{t+1})$ to (Taylor expansions of) definition of net exports:

$$\widehat{NX}_{t+1} = Y_t \hat{Y}_{t+1} - C_t \hat{C}_{t+1}$$

where $\widehat{NX}_{t+1} = NX_{t+1} - NX_t$

Solving the model, cont.

Substituting \hat{W}_{t+1} for its components and rearranging terms gives

$$NX_{t+1} = NX_t - \frac{C_t R_t}{W_t} \hat{B}_{t+1} - \frac{C_t R_t B_t}{W_t} \hat{R}_{t+1} \\ - \frac{C_t \frac{Y_{\geq t+1}}{R_{t+1}}}{W_t} \hat{Y}_{\geq t+2} + \frac{Y_t (W_t - C_t)}{W_t} \hat{Y}_{t+1} \\ - \left\{ \underbrace{-\frac{C_t (W_t - C_t)}{W_t} \frac{1}{\sigma}}_{\text{Substitution effect}} + \underbrace{\frac{C_t (W_t - C_t)}{W_t}}_{\text{Income effect}} - \underbrace{\frac{C_t \frac{Y_{\geq t+1}}{R_{t+1}}}{W_t}}_{\text{Wealth effect}} + \underbrace{\frac{(W_t - C_t)^2}{W_t} \left(1 - \frac{1}{\sigma}\right)}_{\text{value function effect}} \right\} \hat{R}_{t+2}$$

where $\hat{R}_{t+2} = \frac{R_{t+2} - R_{t+1}}{R_{t+1}}$

R_{t+1} is the permanent R before the change ("MIT shock")

R_{t+2} is the new permanent R after the MIT shock

Testing

Construct "what if" variables \overline{NX}_{t+1} , \overline{B}_{t+2} and \overline{B}_{t+2}^{SUB} which remove the undesired impact of changes in wealth from their empirical counterparts.

- ▶ **Test 1:** Suppose $NX_t < 0$, $NX_{t+1} > 0$ and $R_{t+2} < R_{t+1}$. WARP is violated if $\overline{NX}_{t+1} > 0$.

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- ▶ **Test 2:** Suppose $NX_t > 0$, $NX_{t+1} < 0$ and $R_{t+2} > R_{t+1}$.
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- ▶ **Test 3:** Suppose $B_{t+1} < 0$, $B_{t+2} > 0$ and $R_{t+2} < R_{t+1}$. WARP is violated if $\overline{B}_{t+2} > 0$.

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- ▶ **Test 4:** Suppose $B_{t+1} > 0$, $B_{t+2} < 0$ and $R_{t+2} > R_{t+1}$. WARP is violated if $\overline{B}_{t+2} < 0$.

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- ▶ **Test 5:** Suppose $R_{t+2} < R_{t+1}$. WARP is violated if $\overline{B}_{t+2}^{SUB} > 0$.

Testing

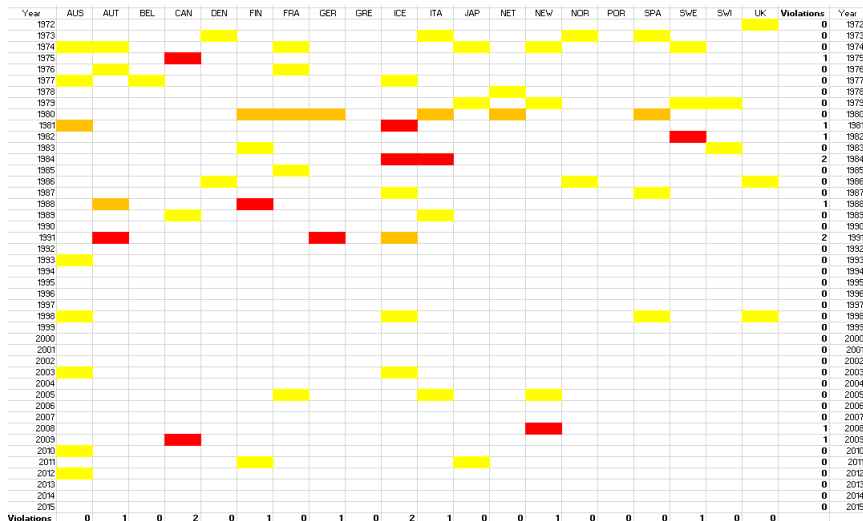
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- ▶ **Test 5:** Suppose $R_{t+2} < R_{t+1}$. WARP is violated if $\overline{B}_{t+2}^{SUB} > 0$.
- ▶ **Test 6:** Suppose $R_{t+2} > R_{t+1}$. WARP is violated if $\overline{B}_{t+2}^{SUB} < 0$.

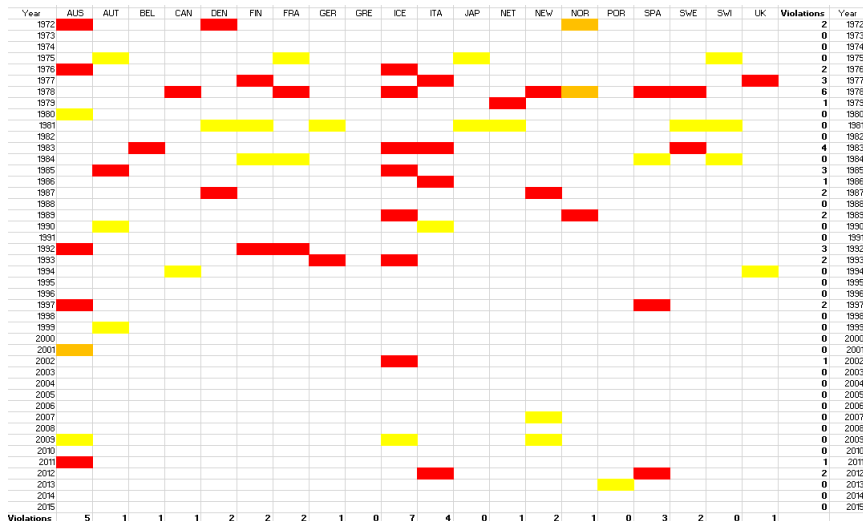
Data

- ▶ Annual (1970-2016) panel of 20 developed countries
- ▶ National accounts data (Eurostat, IFS, national statistical offices) for Y and C
- ▶ Lane and Milesi-Ferretti's External Wealth of Nations Mark II Database for B
- ▶ all variables are per capita, in real national currency
- ▶ Y is GDP less public consumption and investment (C is private consumption)
- ▶ GDP beyond 2016 is proxied by running an AR(1) regression (with constant and deterministic trend) on in-sample data
- ▶ World interest rate is (deflated) U.S. BAA corporate bonds

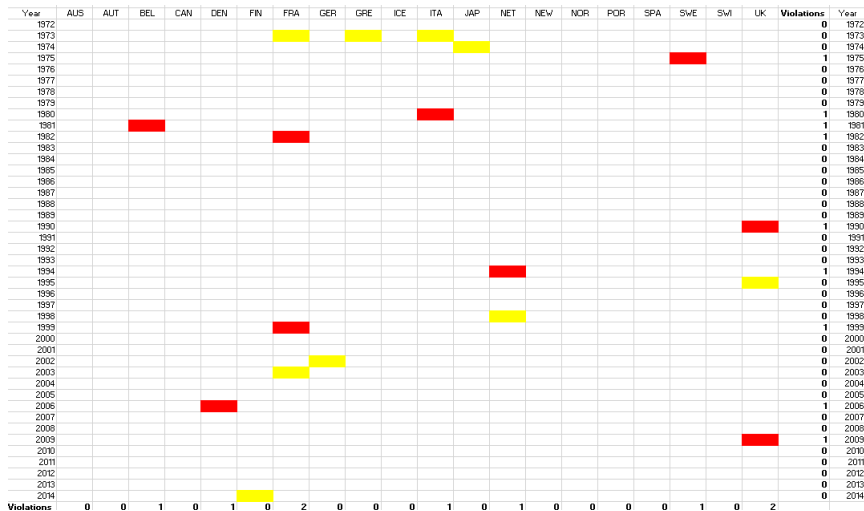
Switches from surplus to deficit



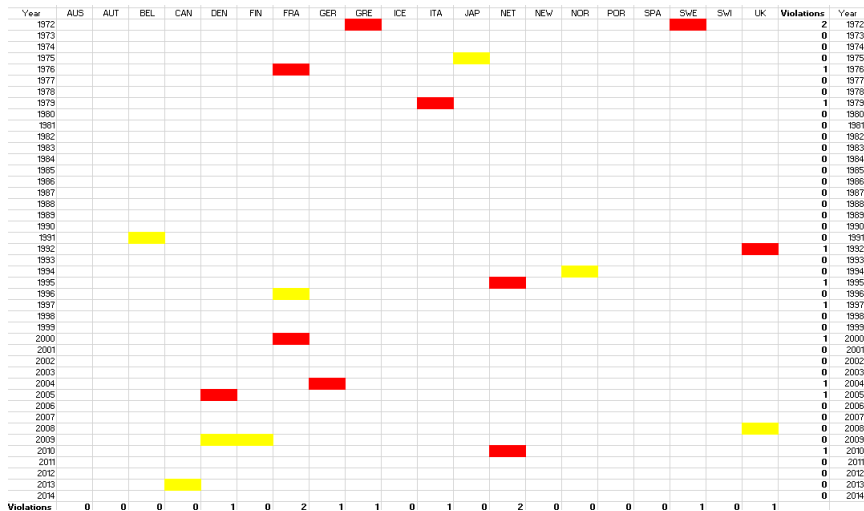
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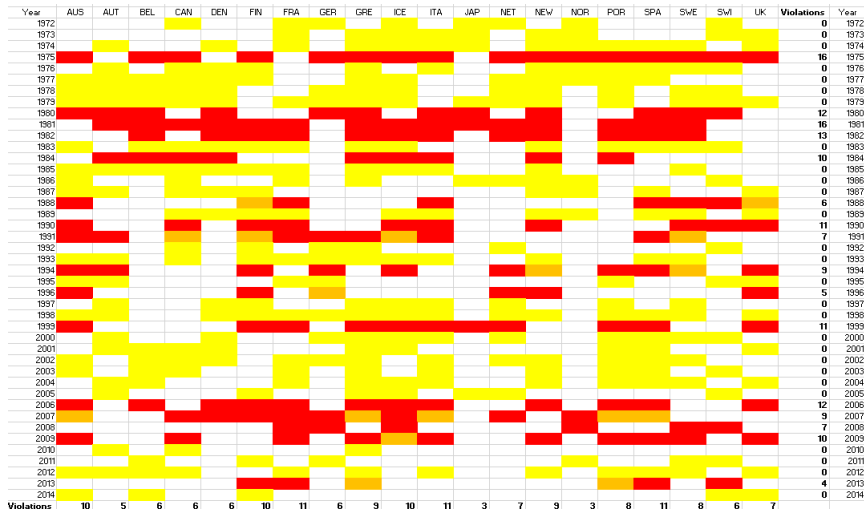
Switches from creditor to debtor



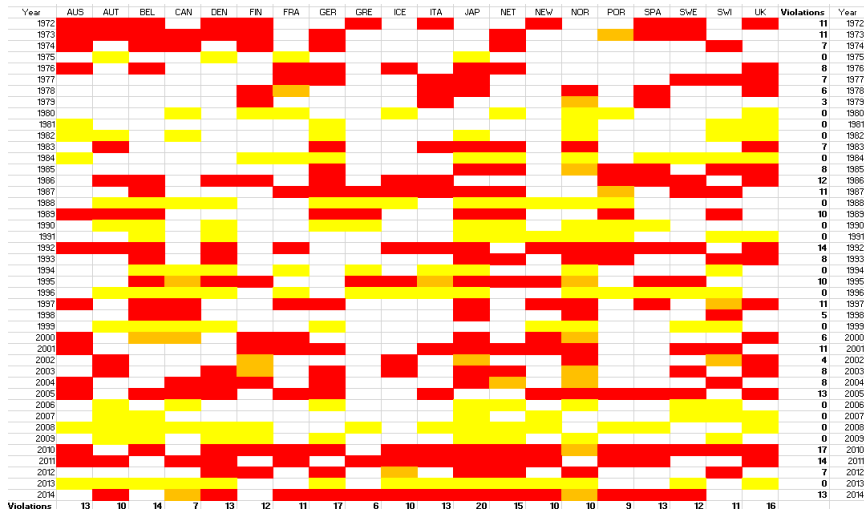
Switches from debtor to creditor



Substitution effect with increasing R



Substitution effect with decreasing R



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- ▶ uncertainty
 - it's another margin along which agents may violate