Housing Spillovers around the World

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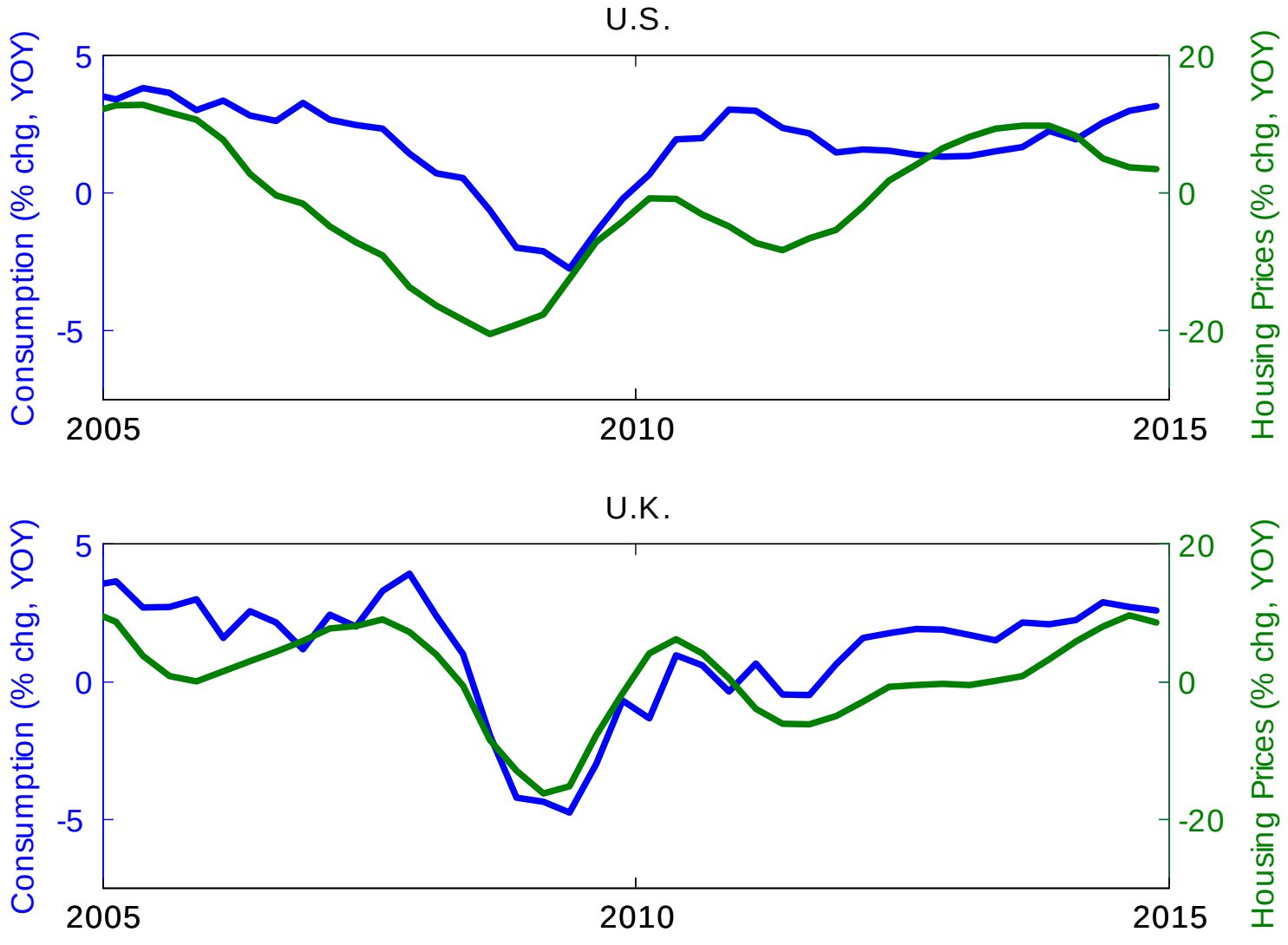
Motivation

- House Price Declines Have Played an Important Role in the event that have culminated with the Global Financial Crisis and its aftermath
- House Prices have affected directly the economies in which they have fallen...
- ...and indirectly economies where they did not fall – through trade, financial and other channels –

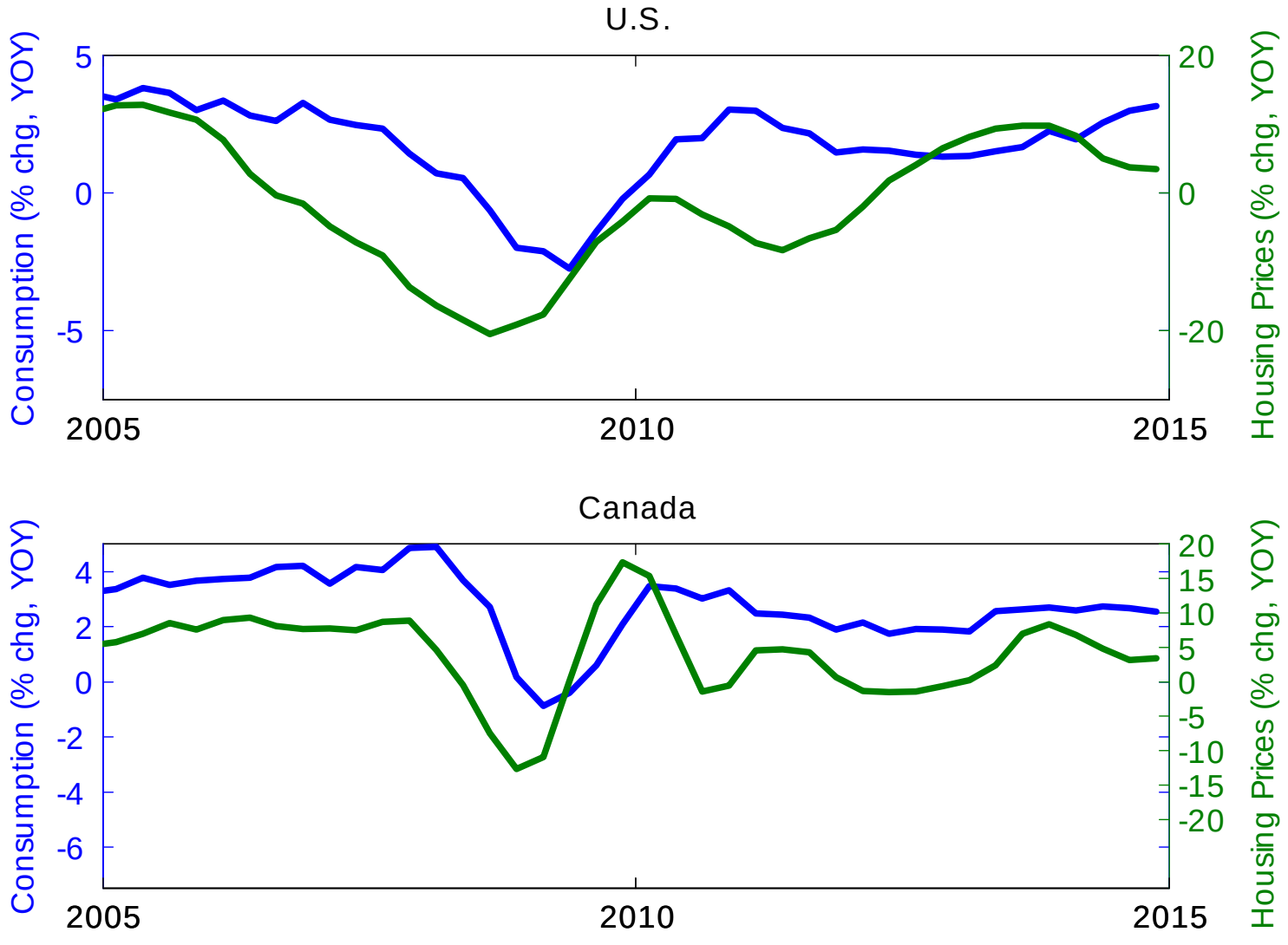
Two Questions

- How Large was the contribution of the Housing Slowdown to the Global Financial Crisis?
- How Large were the Housing Spillovers across countries?
  Want to think of a way of measuring spillovers, using little theory and abundant data
- So I looked at data on housing prices and consumption for the world economies

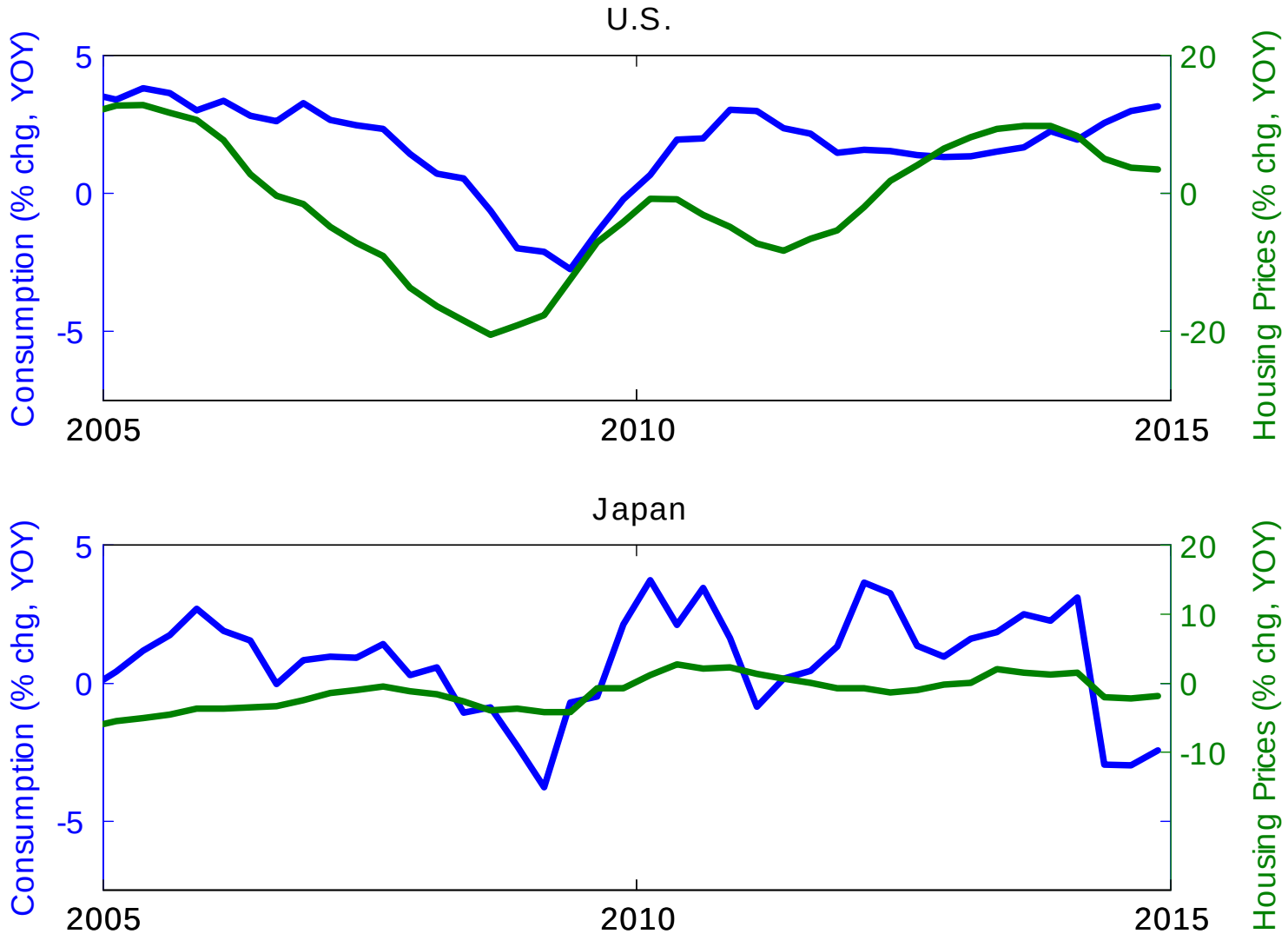
House Prices and Consumption, U.S and U.K.



House Prices and Consumption, U.S and Canada



House Prices and Consumption, U.S and Japan



Three alternative stories

1. **Common Activity Shock**
   U.K and U.S.: Activity slows down in U.K. and U.S. because a (possibly) common GDP shock, with house prices just just the reflection of weak economic outlook.

2. **Domestic Housing Shock**
   Canada and the U.S.: Activity slows down in Canada and the U.S. because of country-specific housing shock that drives activity down in both countries. Activity recovers more quickly in Canada as housing recovers more quickly.

3. **Foreign Housing Shock Abroad, and its Spillovers**
   Japan and the U.S.: Activity slows down in Japan because of the negative GDP effects of the U.S. housing shock

Methodology

- I said I was going to use little theory...
- ... but I did not say I was not going to use any theory at all.
- I set up a VAR that mimics the theory and empirical approach in the closed economy housing model of Guerrieri and Iacoviello (GIH, 2015)
- In GIH, housing price changes have
  - asymmetric effects on consumption, and
  - produce larger effects on consumption at high levels of debt

The Basic Idea

- Household maximizes $U = E_0 \sum_{t=0}^{\infty} \beta^t \left(\log c_t + j \log h_t \right)$ subject to

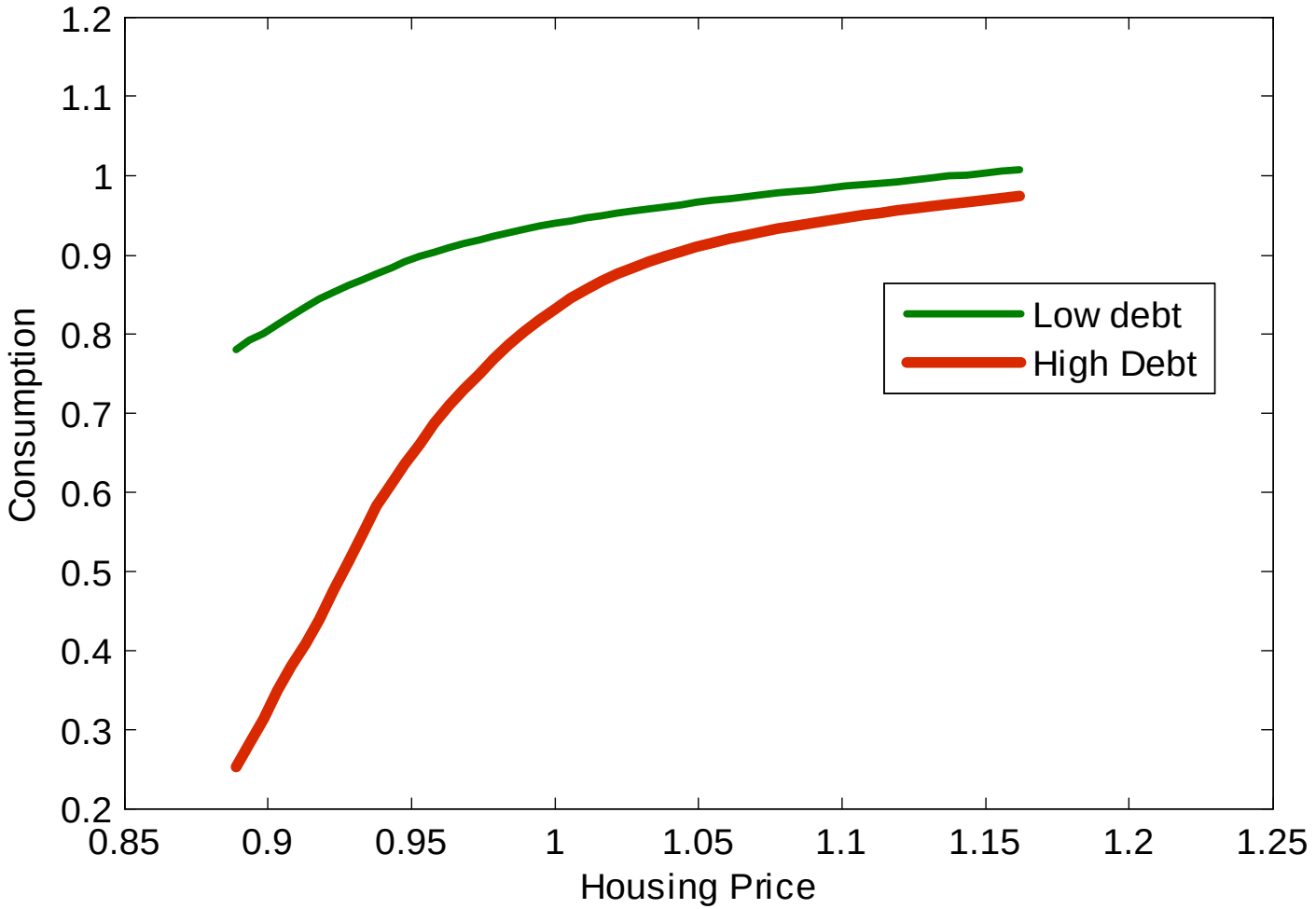
$$\begin{aligned} c_t + q_t h_t &= y + b_t - R b_{t-1} + q_t h_{t-1} (1 - \delta) \\ b_t &\leq m q_t h_t \\ \log q_t &= \rho \log q_{t-1} + e_t, \; e_t \sim N\left(0, \sigma^2\right) \end{aligned}$$

- Assume impatience ($\beta R < 1$), fix $y = 1$. The solution of this problem is a consumption function of the form

$$c_t = C\left(q_t, b_{t-1}, h_{t-1}\right)$$

- Consumption function will have the property that consumption increases with house prices, but at a decreasing rate.
  q low –> constraint binds –> consumption moves in lockstep with q
  q high –> constraint is slack –> consumption is less sensitive to q

The Consumption Function in a Model with Housing Collateral Constraints



Roadmap

1. Data

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2. Country-level regressions: credit and asymmetries

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3. World panel VAR: Impulse responses to domestic and foreign housing shocks

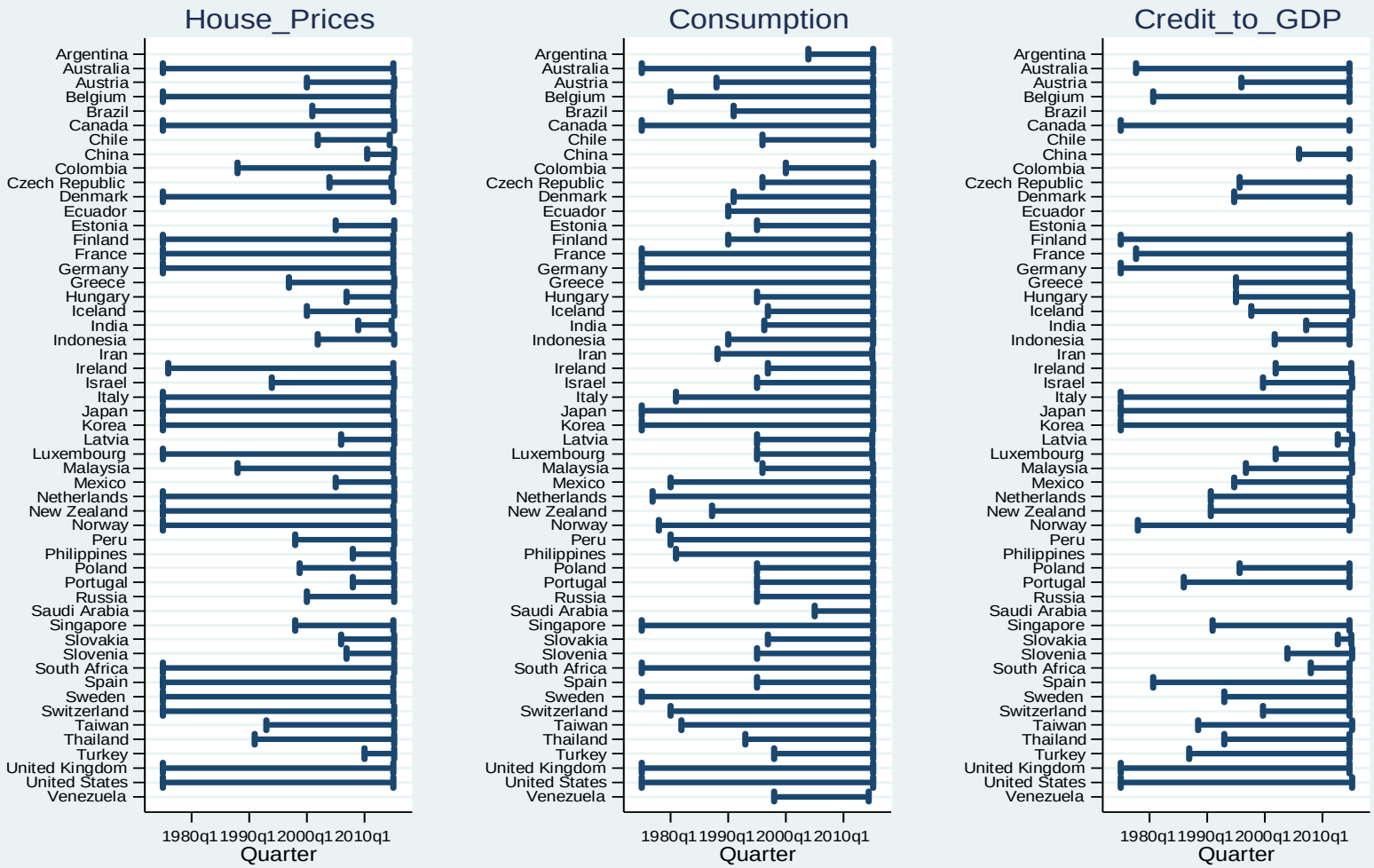
Roadmap

1. Data
2. Country-level regressions: credit and asymmetries
3. World panel VAR: Impulse responses to domestic and foreign housing shocks
4. World panel VAR: Historical decompositions

Data

- I use a quarterly panel of world economies from 1975:Q1 trhough 2014:Q4
- Use data on **Housing prices**, **Consumption**, and **the ratio of Household Debt to GDP**
- My initial sample includes about 40 countries, small and large, accounting for 80 percent of world GDP
- As in every panel, I want to exploit time series and cross-sectional dimension
- I limit the sample to country for which I have at least 80 quarters of observations
- That leaves me with a sample of 19 countries, accounting for 60 percent of world
  (similar qualitative results with a larger number of countries)

Data Coverage



Do the Data Support the Idea that Credit Matters?

- Using my panel, I estimate for each country i

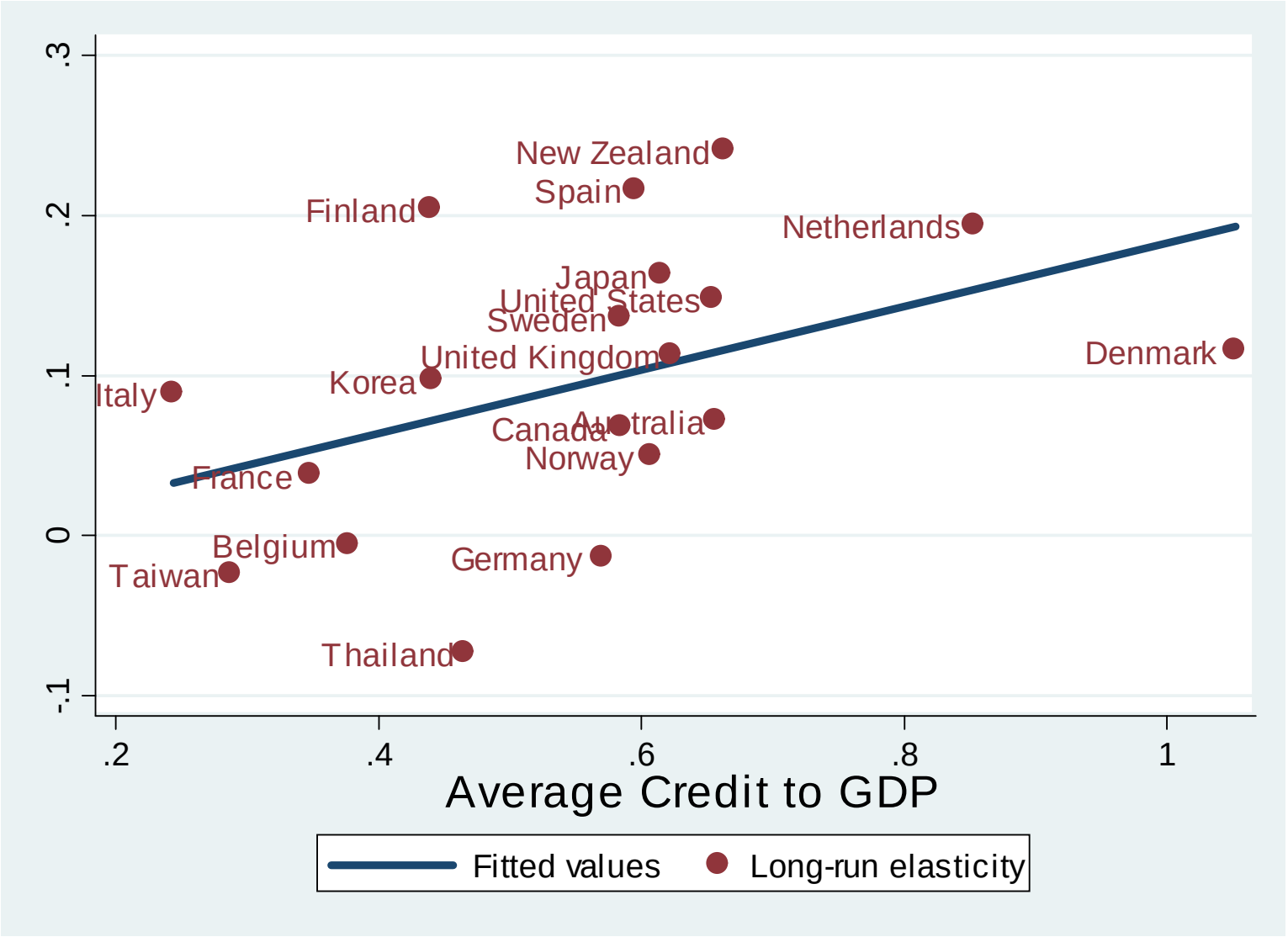
$$\Delta c_{i,t} = \alpha_i + \rho_i \Delta c_{i,t-1} + \beta_i \Delta hp_{i,t-1} + \varepsilon_{i,t}$$

- For each country, I compute the long-run response of consumption to a unit shock to housing prices,

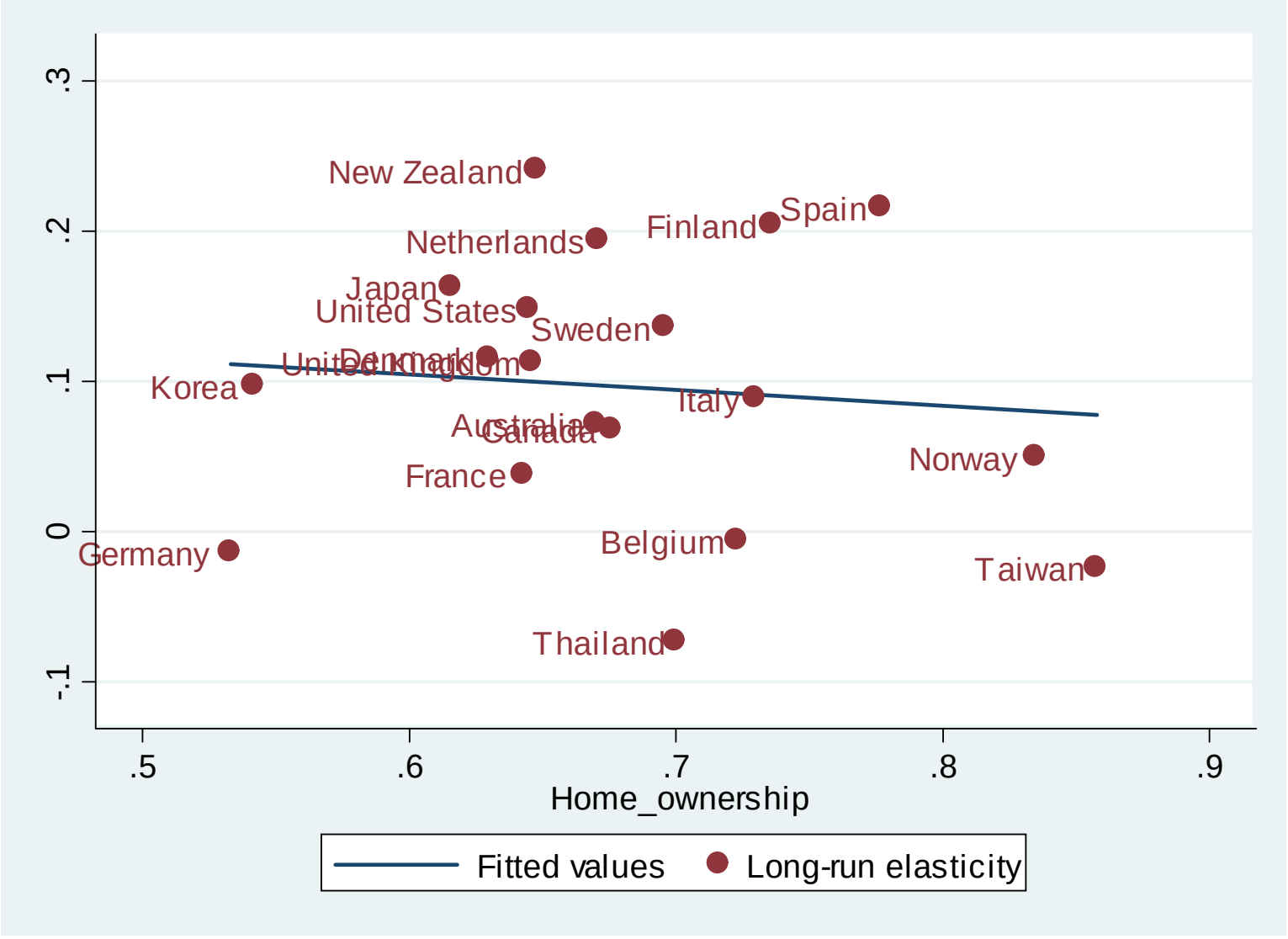
$$\frac{\Delta c}{\Delta hp} = \frac{\beta_i}{1 - \rho_i}$$

- I then plot for each country this long-run coefficient against the average household debt to GDP ratio for the sample period

The housing wealth effect is larger with high debt



The housing wealth effect varies little with homeownership



Do the Data Support the Idea that Changes in Housing Prices have Asymmetric Effects?

- Using my panel, I estimate for each country

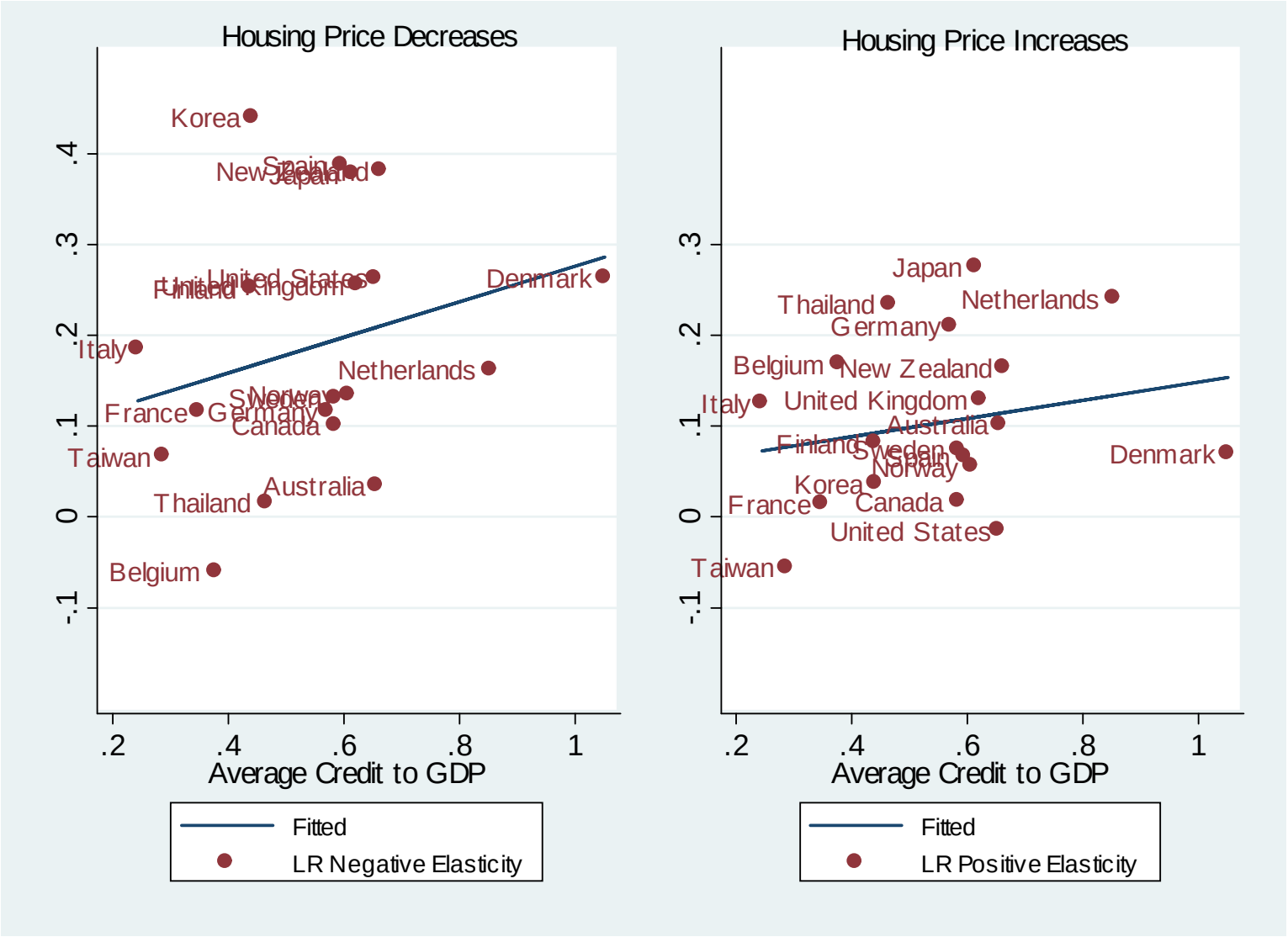
$$\begin{aligned}
\Delta c_{i,t} &= \alpha_i + \rho_i \Delta c_{i,t-1} + \beta_{POS,i} \Delta hp^{+}_{i,t-1} + \beta_{NEG,i} \Delta hp^{-}_{i,t-1} \\
\Delta hp^{+}_{i,t} &= \max\left(\Delta hp_{i,t}, 0\right) \\
\Delta hp^{-}_{i,t} &= \min\left(\Delta hp_{i,t}, 0\right)
\end{aligned}$$

- For each country, I construct a long-run response to decreases and increases in housing prices

$$\begin{aligned}
\beta_{LR,POS} &= \frac{\beta_{POS,i}}{1-\rho_i} \\
\beta_{LR,NEG} &= \frac{\beta_{NEG,i}}{1-\rho_i}
\end{aligned}$$

- I plot these coefficients against average credit to GDP for each country...

Negative Housing Effect is Stronger than Positive One



Summary

- Cross-country basic evidence supports the importance of collateral effects...
- ... and asymmetries
- ...but we want an empirical model that better captures cross-border spillovers and interaction effects.

The Empirical Model

- Basic VAR idea: want to capture cross-country linkages

Idea 1: A Standard Panel VAR

A standard panel VAR looks like this

$$
\begin{aligned}
c_{i,t} &= \beta_{cc}(L)\, c_{i,t-1} + \beta_{cq}(L)\, q_{i,t-1} + \varepsilon_{i,t} \\
q_{i,t} &= \beta_{qc}(L)\, c_{i,t} + \beta_{qq}(L)\, q_{i,t-1} + u_{i,t} \\
E\varepsilon\varepsilon' &= \Sigma_c \\
Euu' &= \Sigma_u
\end{aligned}
$$

- $c_{i,t}$: log consumption growth, $q_{i,t}$: log real house price growth
- It is a good idea, but with limitations
  1. It only exploits within–country variation in house prices and consumption
  2. Does not allow for spillovers across countries

Idea 2: A VAR for the Global Economy

A VAR for the Global Economy may look like this:

$$
\begin{aligned}
c_{1,t} = \; & \beta_{cc}^{1}(L)\, c_{1,t-1} + \beta_{cq}^{1}(L)\, q_{1,t-1} \\
& + \beta_{cc}^{2}(L)\, c_{2,t-1} + \beta_{cq}^{2}(L)\, q_{2,t-1} \\
& + \beta_{cc}^{3}(L)\, c_{3,t-1} + \beta_{cq}^{3}(L)\, q_{3,t-1} \\
& + ... \\
& + \beta_{cc}^{N}(L)\, c_{N,t-1} + \beta_{cq}^{N}(L)\, q_{N,t-1} \\
& + \varepsilon_{1,t}
\end{aligned}
$$

$$
q_{i,t} = \beta_{qc}(L)\, c_{i,t} + \beta_{qq}(L)\, q_{i,t-1} + ...u_{i,t}
$$

- $c_{1,t}$: log consumption growth of country 1, and so on...
- It is a very good idea, but with limitations
  1. It exploits cross–country linkages through the cross-country terms
  2. It becomes quickly intractable ($Nk > T$), requires messing up with priors, or too many coefficients to estimate

Striking a Compromise between these two extremes

I go for something in between:

1. I allow spillovers from other countries, but do not differentiate among them
2. I keep this flexibility to model asymmetries...
3. ... and leverage effects

Essentially, I am very close to a GVAR, as discussed for instance in Dees et al. (2007)

Basic VAR with Asymmetries

I specify a multi-equation model of consumption and housing prices at the global level given by the following equations

$$
\begin{aligned}
c_{i,t} &= \beta_{cc}(L)\, c_{i,t-1} + \beta_{cC}(L)\, C_{t-1} \\
&\quad + \beta_{cq}(L)\, q_{i,t-1} \\
&\quad + \beta_{cQ}(L)\, Q_{t-1} + \varepsilon_{i,t} \\
C_t &\equiv \textstyle\sum_{i=1}^{N} \omega_{i,t} c_{i,t} \\
q_{i,t} &= \beta_{qc}(L)\, c_{i,t} + \beta_{qq}(L)\, q_{i,t-1} + \beta_{qC}(L)\, C_t + \beta_{qQ}(L)\, Q_{t-1} + u_{i,t} \\
Q_t &\equiv \textstyle\sum_{i=1}^{N} \omega_{i,t} q_{i,t} \\
E\varepsilon\varepsilon' &= \Sigma_c \\
Euu' &= \Sigma_u
\end{aligned}
$$

Basic VAR with Asymmetries (contd)

I specify a multi-equation model of consumption and housing prices at the global level given by the following equations

$$
\begin{aligned}
c_{i,t} &= \beta_{cc}(L)\, c_{i,t-1} + \beta_{cC}(L)\, C_{t-1} \\
&\quad + \beta_{cq}(.)\, q_{i,t-1} + \beta_{cd}(L)\, q_{i,t-1} d_i \\
&\quad + \beta_{cQ}(.)\, Q_{t-1} + \beta_{cD}(L)\, Q_{t-1} d_i + \varepsilon_{i,t} \\
C_t &\equiv \textstyle\sum_{i=1}^{N} \omega_{i,t} c_{i,t} \\
q_{i,t} &= \beta_{qc}(L)\, c_{i,t} + \beta_{qq}(L)\, q_{i,t-1} + \beta_{qC}(L)\, C_t + \beta_{qQ}(L)\, Q_{t-1} + u_{i,t} \\
Q_t &\equiv \textstyle\sum_{i=1}^{N} \omega_{i,t} q_{i,t} \\
E\varepsilon\varepsilon' &= \Sigma_c \\
Euu' &= \Sigma_u
\end{aligned}
$$

Basic VAR with Asymmetries (contd)

I specify a multi-equation model of consumption and housing prices at the global level given by the following equations

$$
\begin{aligned}
c_{i,t} &= \beta_{cc}(L)\, c_{i,t-1} + \beta_{cC}(L)\, C_{t-1} \ldots \\
&\quad + \beta_{cq}(.)\, q_{i,t-1} + \bar{\beta}_{cq}(L)\, \bar{q}_{i,t-1} + \beta_{cd}(L)\, q_{i,t-1} d_i + \bar{\beta}_{cd}(L)\, \bar{q}_{i,t-1} d_i \ldots \\
&\quad + \beta_{cQ}(.)\, Q_{t-1} + \bar{\beta}_{cQ}(L)\, \bar{Q}_{t-1} + \beta_{cD}(L)\, Q_{t-1} d_i + \bar{\beta}_{cD}(L)\, \bar{Q}_{t-1} d_i + \varepsilon_{i,t} \\
C_t &\equiv \textstyle\sum_{i=1}^{N} \omega_{i,t} c_{i,t} \\
q_{i,t} &= \beta_{qc}(L)\, c_{i,t} + \beta_{qq}(L)\, q_{i,t-1} + \beta_{qC}(L)\, C_t + \beta_{qQ}(L)\, Q_{t-1} + u_{i,t} \\
Q_t &\equiv \textstyle\sum_{i=1}^{N} \omega_{i,t} q_{i,t}
\end{aligned}
$$

Note that: $E\left(\begin{bmatrix} \varepsilon \\ u \end{bmatrix} \begin{bmatrix} \varepsilon & u \end{bmatrix}\right) = \begin{bmatrix} \Sigma_c & \Sigma_{cq} \\ \Sigma_{cq} & \Sigma_q \end{bmatrix}$

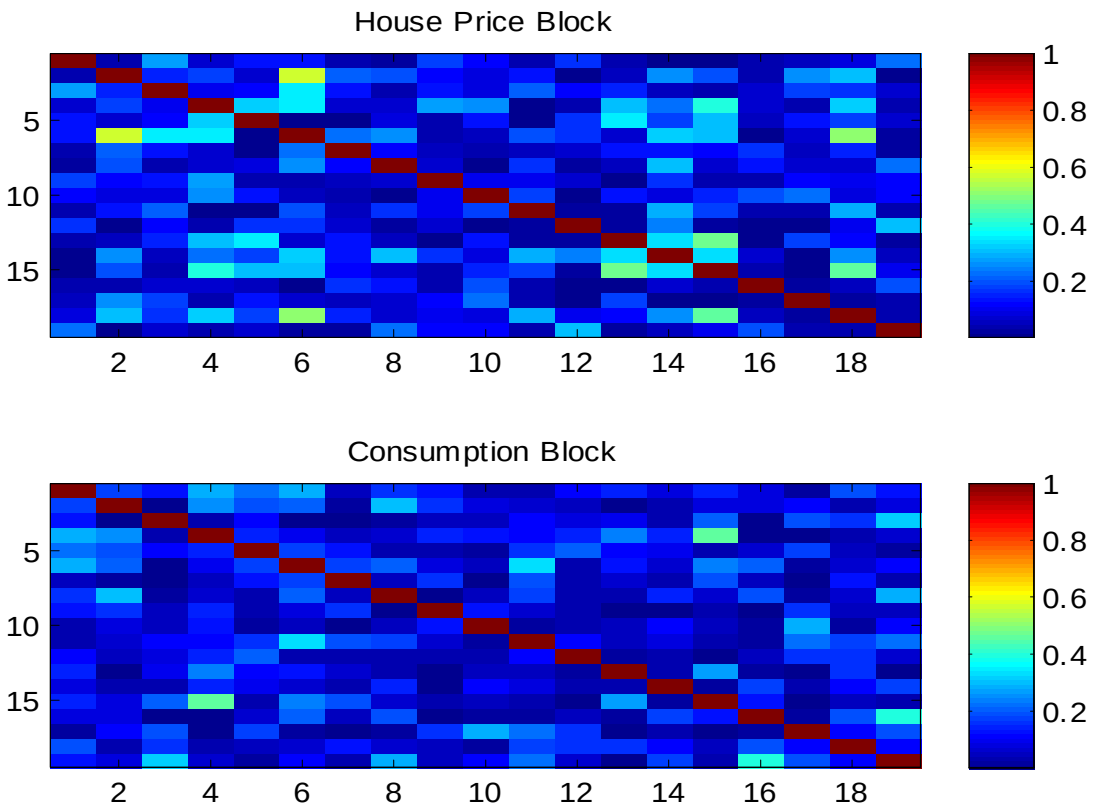
The World Panel VAR Assumptions

1. Aggregate consumption shocks can affect housing prices contemporaneously
2. Housing shocks affect consumption with one period delay
3. Allow for asymmetries of housing prices on consumption
4. Response across countries allowed to vary according to parameter d_i, measuring credit dependency

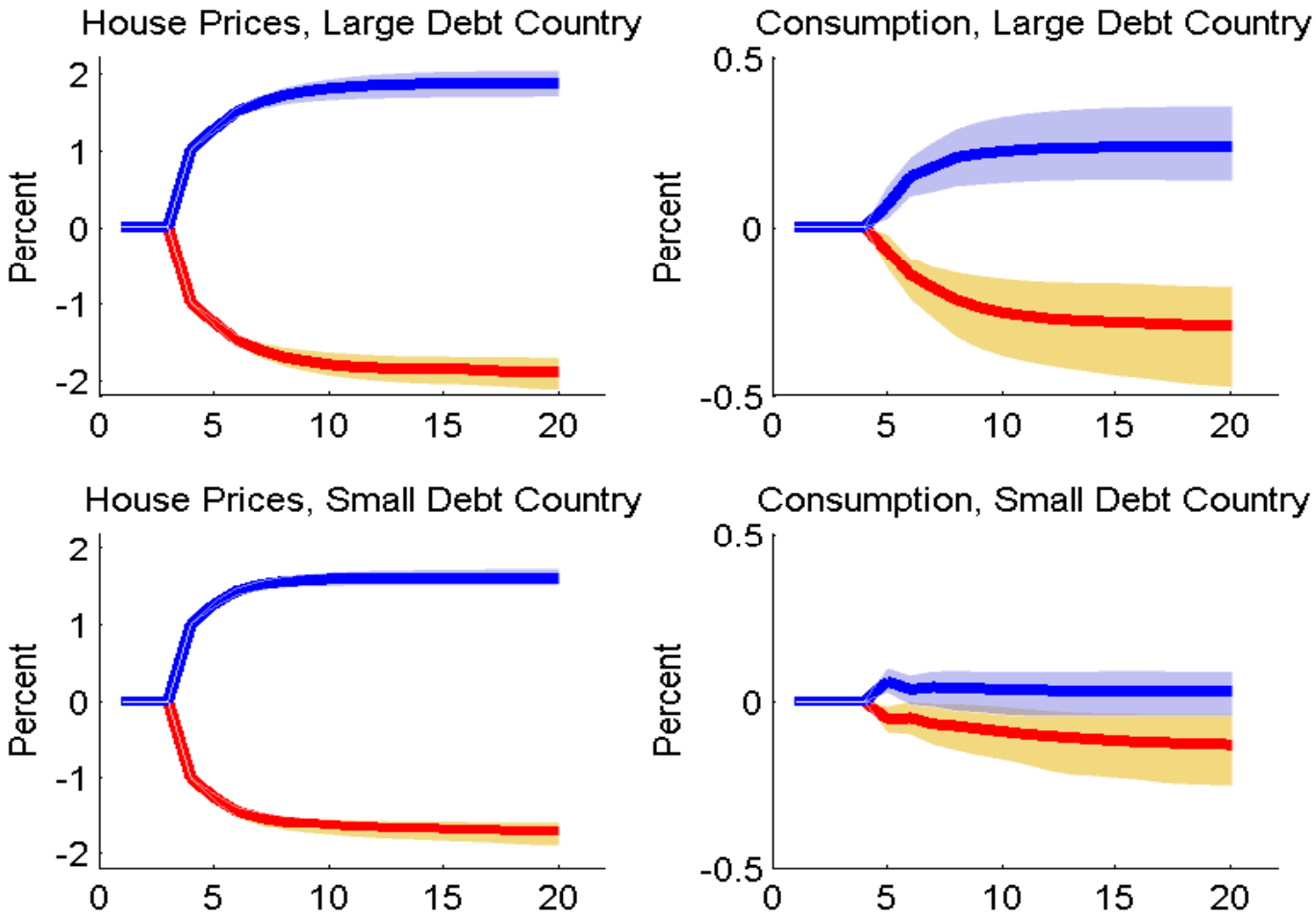
The VAR Results

- As usual in a VAR, coefficients are hard to interpret
- To understand the properties of the estimated VAR, I report impulse responses and historical simulations
  I will report impulse response* of country i to its own housing shock ε_i
  ...and to the combined housing shock of all other countries, ε_j for all $j \neq i$
- There is asymmetry and nonlinear credit effects...

Shocks are not orthogonalized: care should be used in interpreting the results. However, the (absolute values of the) correlation matrix of VAR residuals shows small off-diagonal correlations, both within consumption and house price blocks (correlation matrices for Σ_c and Σ_q below) and across blocks (not shown).

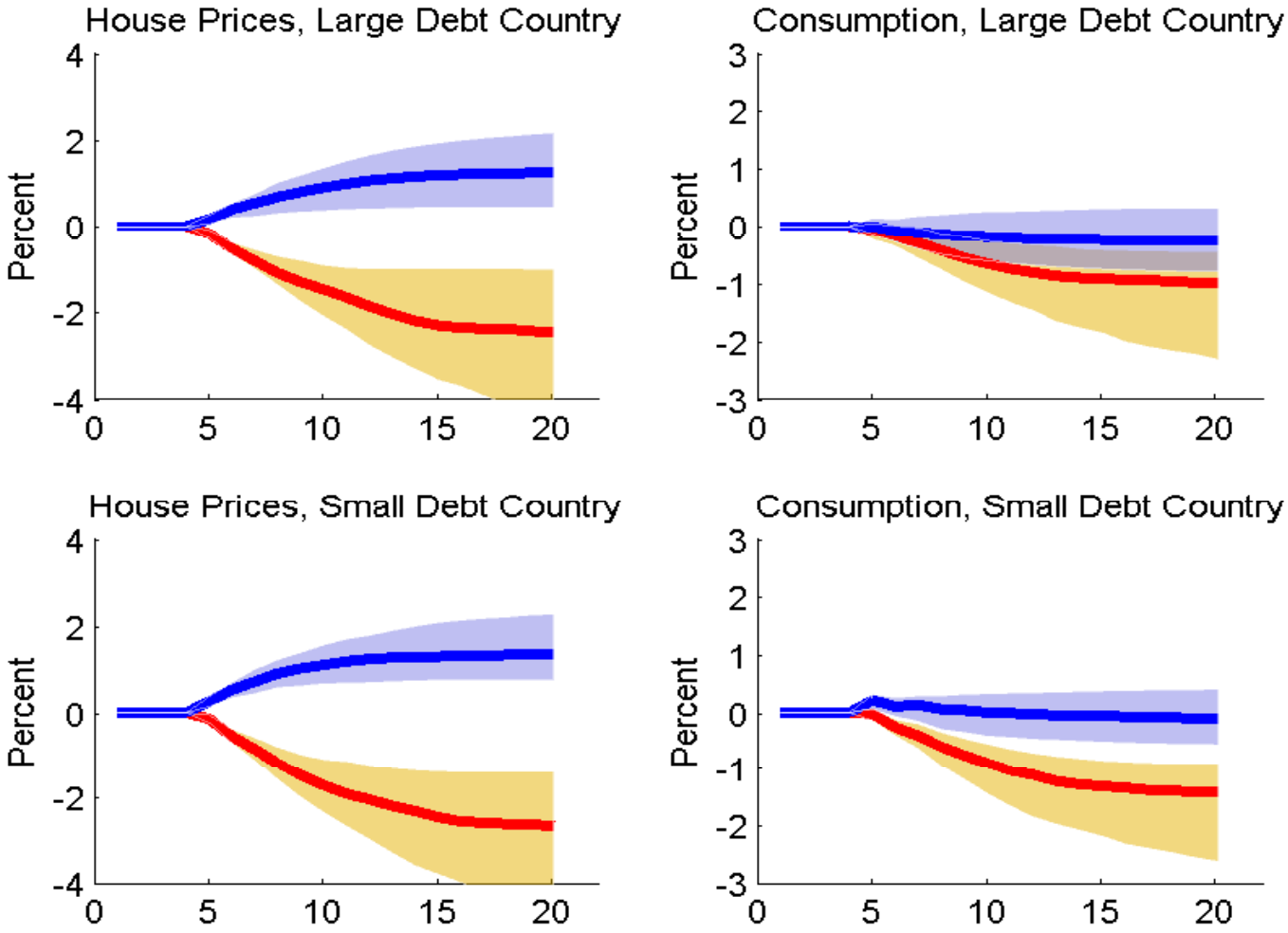


Responses to Domestic Housing Shocks in Small vs Large Debt Country



Shaded areas are 68 confidence intervals, obtained via bootstrap

Responses to Foreign Housing Shocks in Small vs Large Debt Countries



Shaded areas are 68 confidence intervals, obtained via bootstrap

The VAR Results

- There is asymmetry and nonlinear credit effects.
- Differences for common shocks are smaller than for idiosyncratic ones
- Lower (higher) household debt dampens (amplifies) domestic housing shocks
- Lower debt amplifies foreign housing shocks
  (Countries with less debt (e.g. Italy) slightly more exposed to foreign housing shocks.
-

	Type of Housing shock	
	domestic shock	**foreign shock**
Role of		
debt	lower debt dampens	lower debt amplifies
asymmetry	symmetric effects	only negative shocks matter

Measuring the Spillovers

- For each country, can decompose consumption as follows

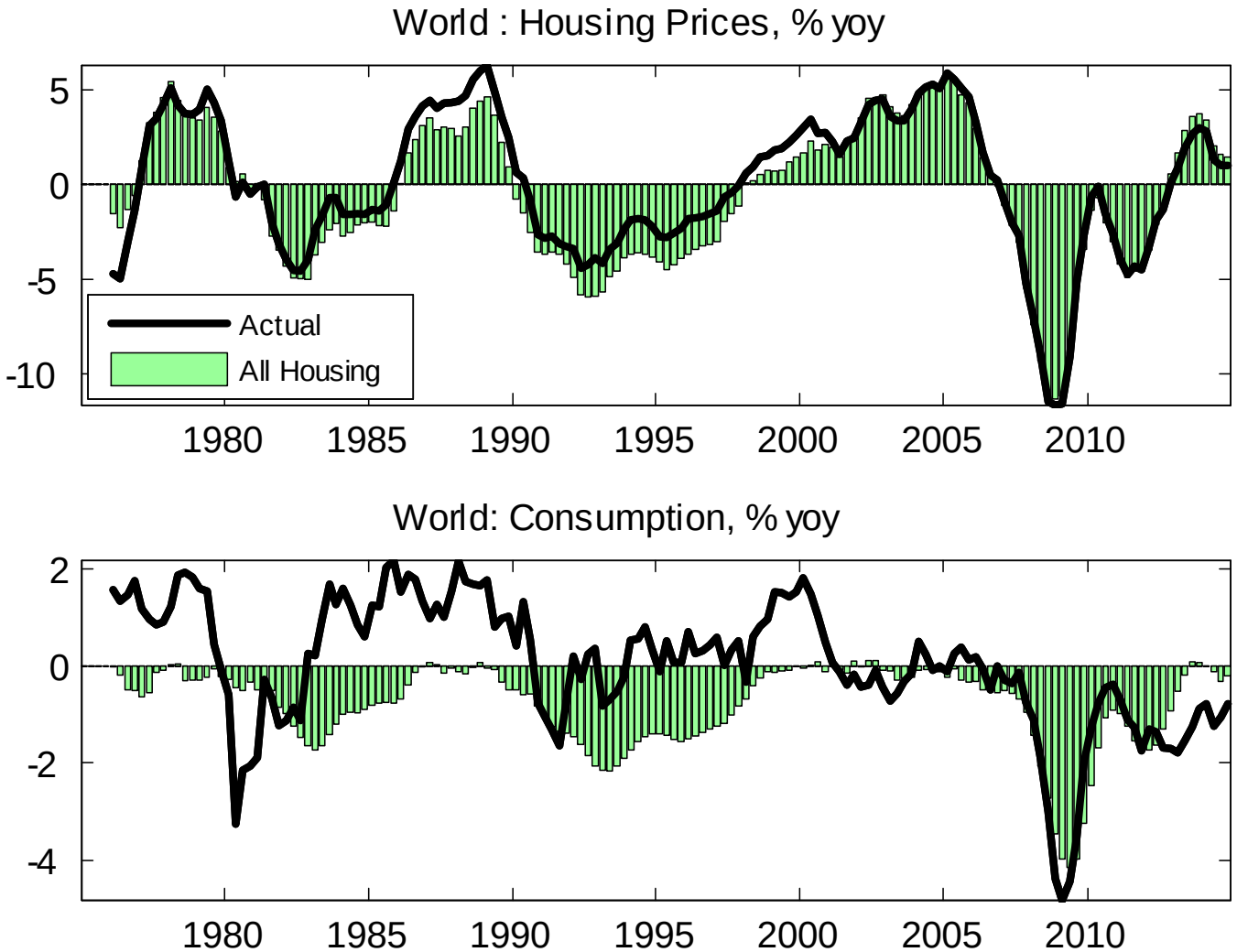
$$c_{i,t} = \underbrace{c^{C}_{i,t}}_{\text{Activity Shocks}} + \underbrace{c^{H,DOM}_{i,t}}_{\text{Domestic Housing, } i} + \underbrace{c^{H,FOR}_{i,t}}_{\text{Foreign Housing, all } j}$$

- I define housing spillovers for each country as the effect of all the housing shocks but the country-specific one

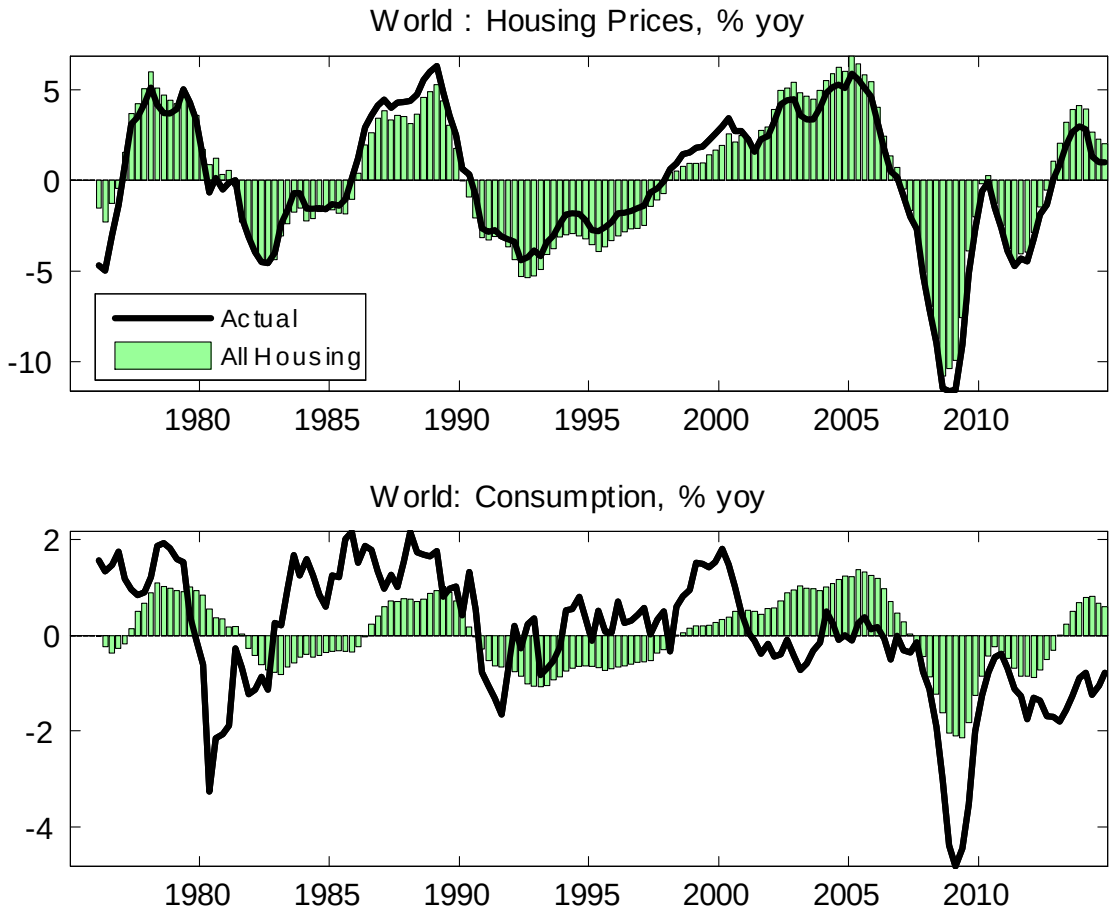
Housing Shocks in the Global Economy

- To get a sense of importance of housing shocks in the global economy, I look at their historical decomposition for world activity
- (I also consider the counterfactual case without allowing for asymmetry)

Housing Shocks and Global Consumption, Benchmark



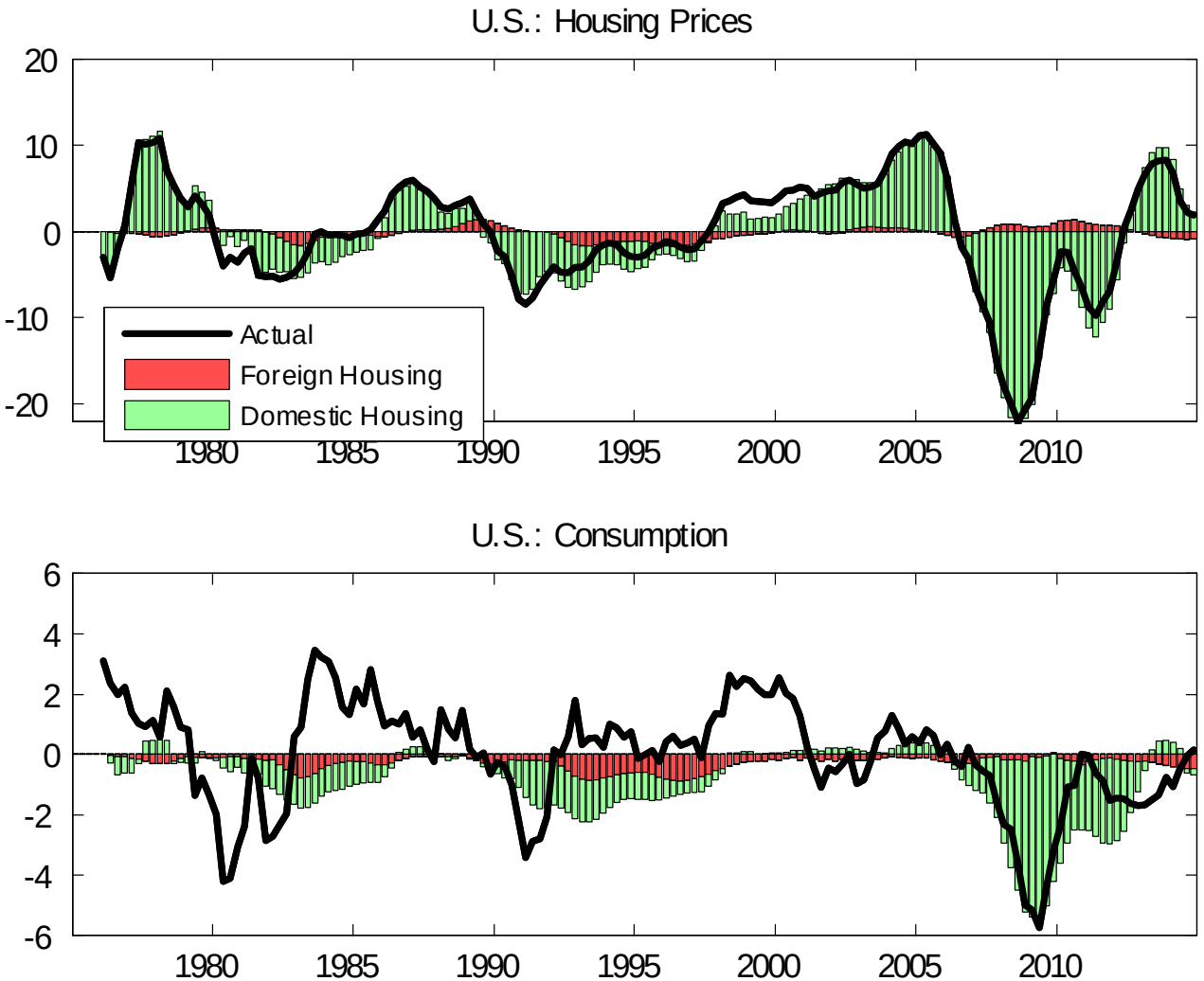
(Digression) Housing Shocks and Consumption, No Asymmetries



Country Detail

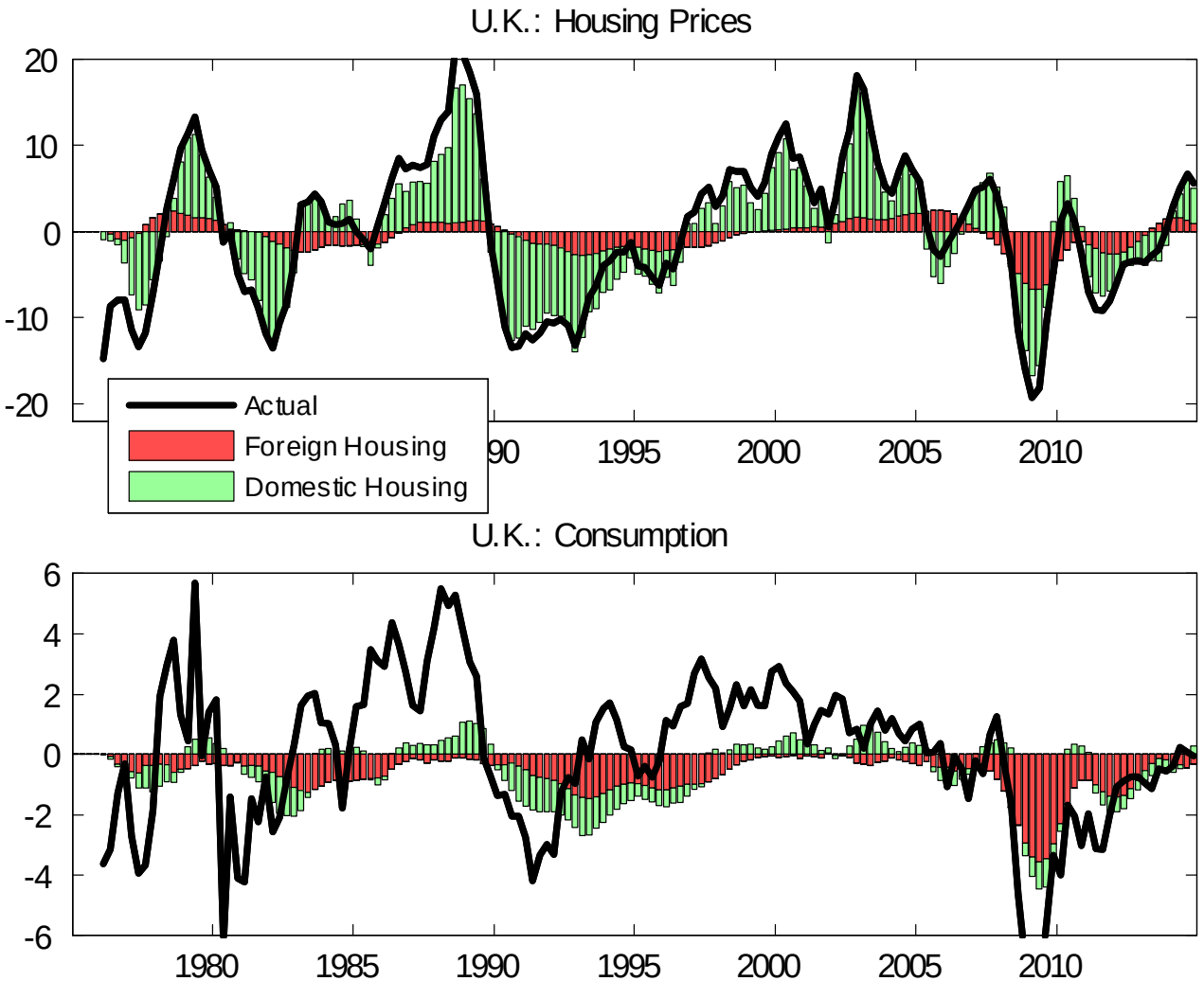
Next, I consider country detail

Global vs U.S. Housing Shocks, United States



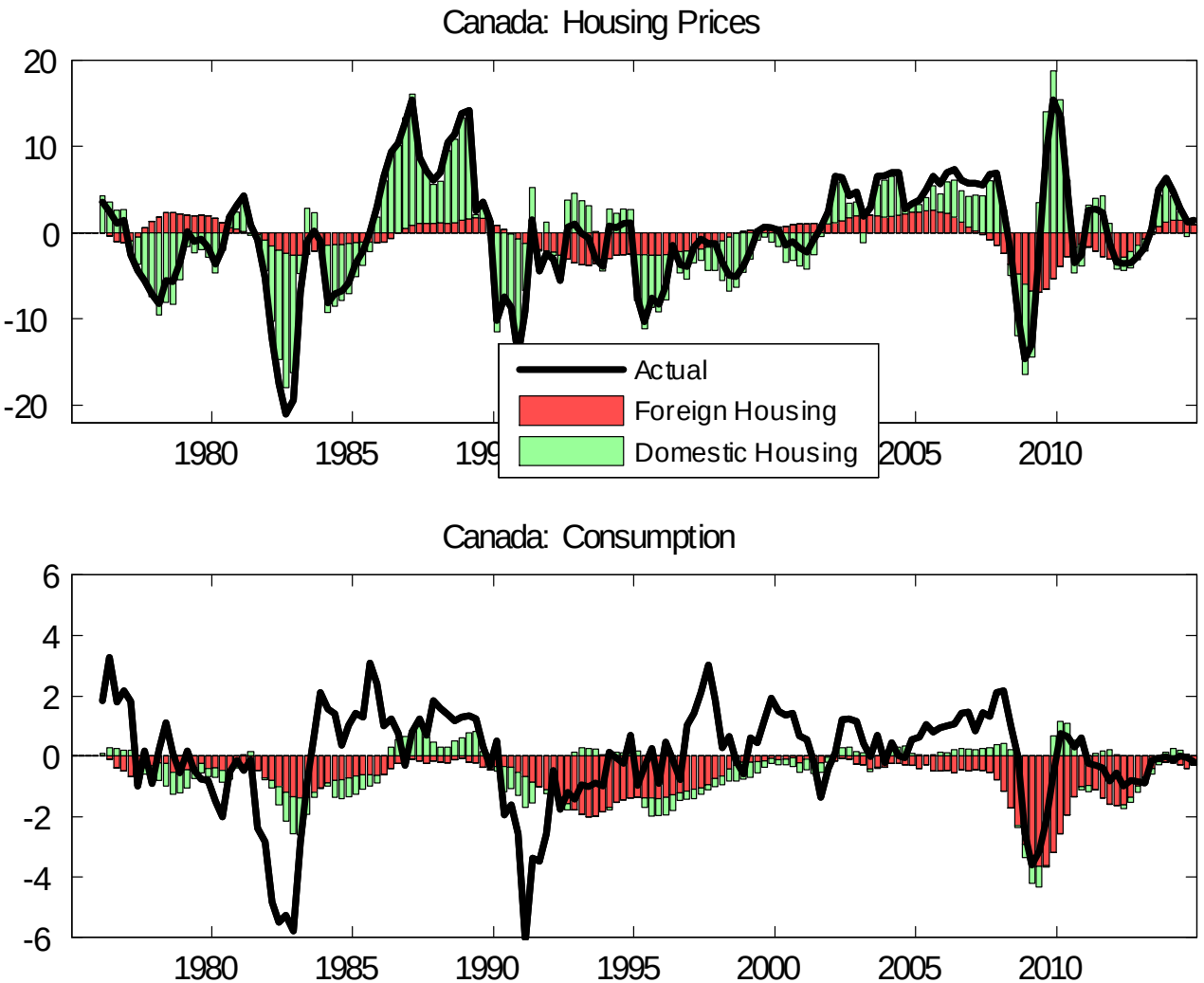
Note: Consumption and Housing Prices in YOY growth rates, % (demeaned)

Global vs U.S. Housing Shocks, United Kingdom



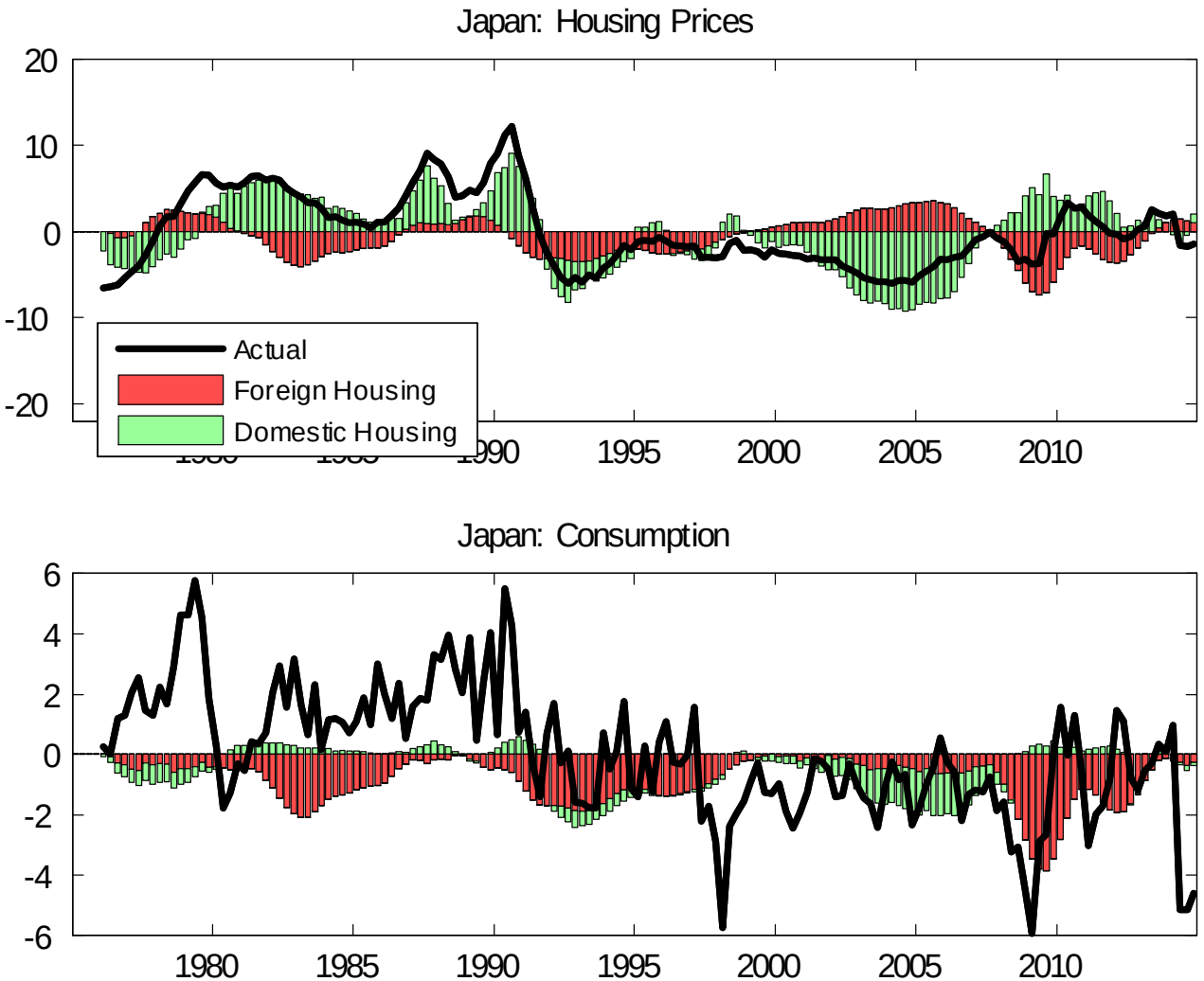
Note: Consumption and Housing Prices in YOY growth rates, % (demeaned)

Global vs U.S. Housing Shocks, Canada



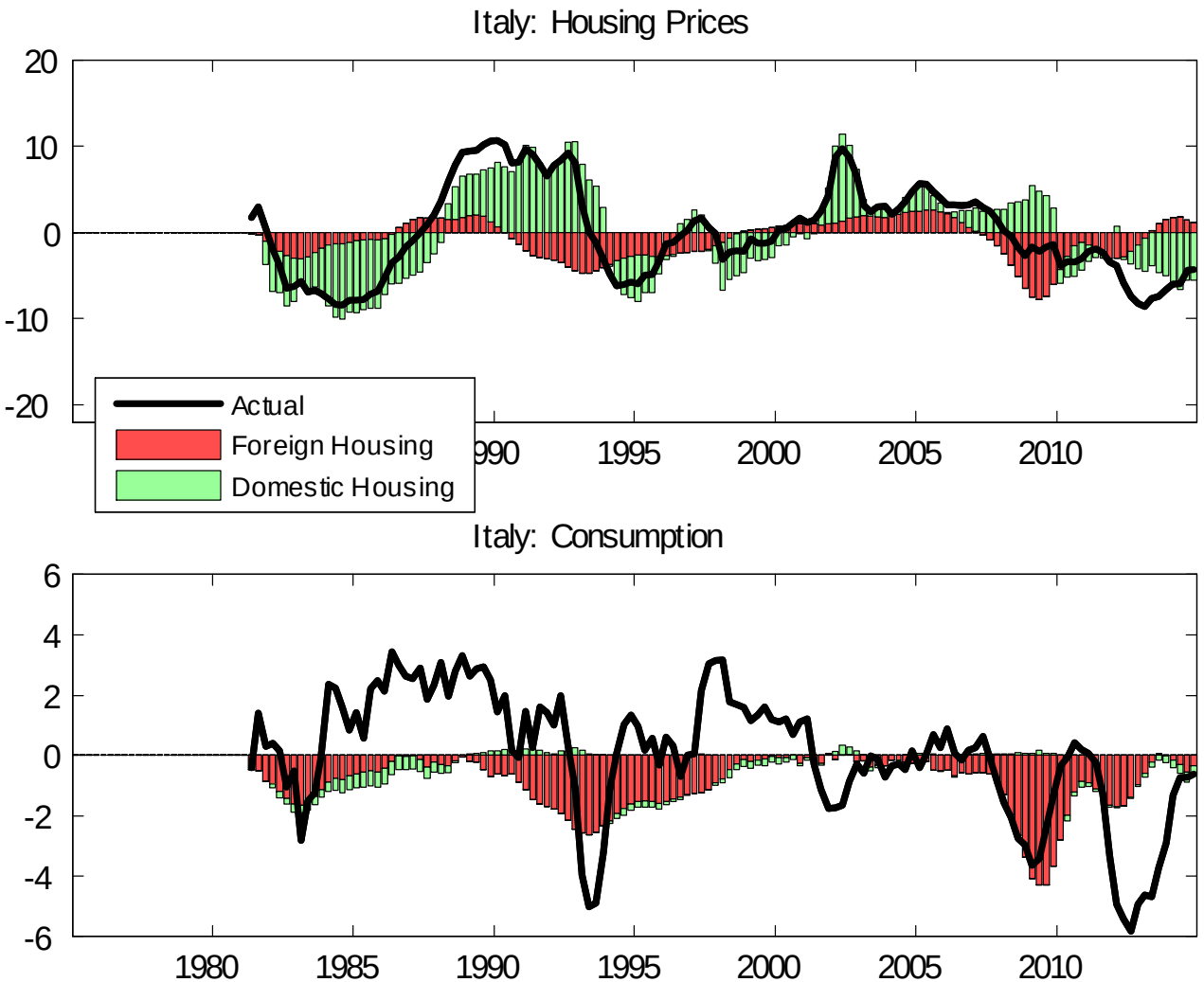
Note: Consumption and Housing Prices in YOY growth rates, % (demeaned)

Global vs U.S. Housing Shocks, Japan



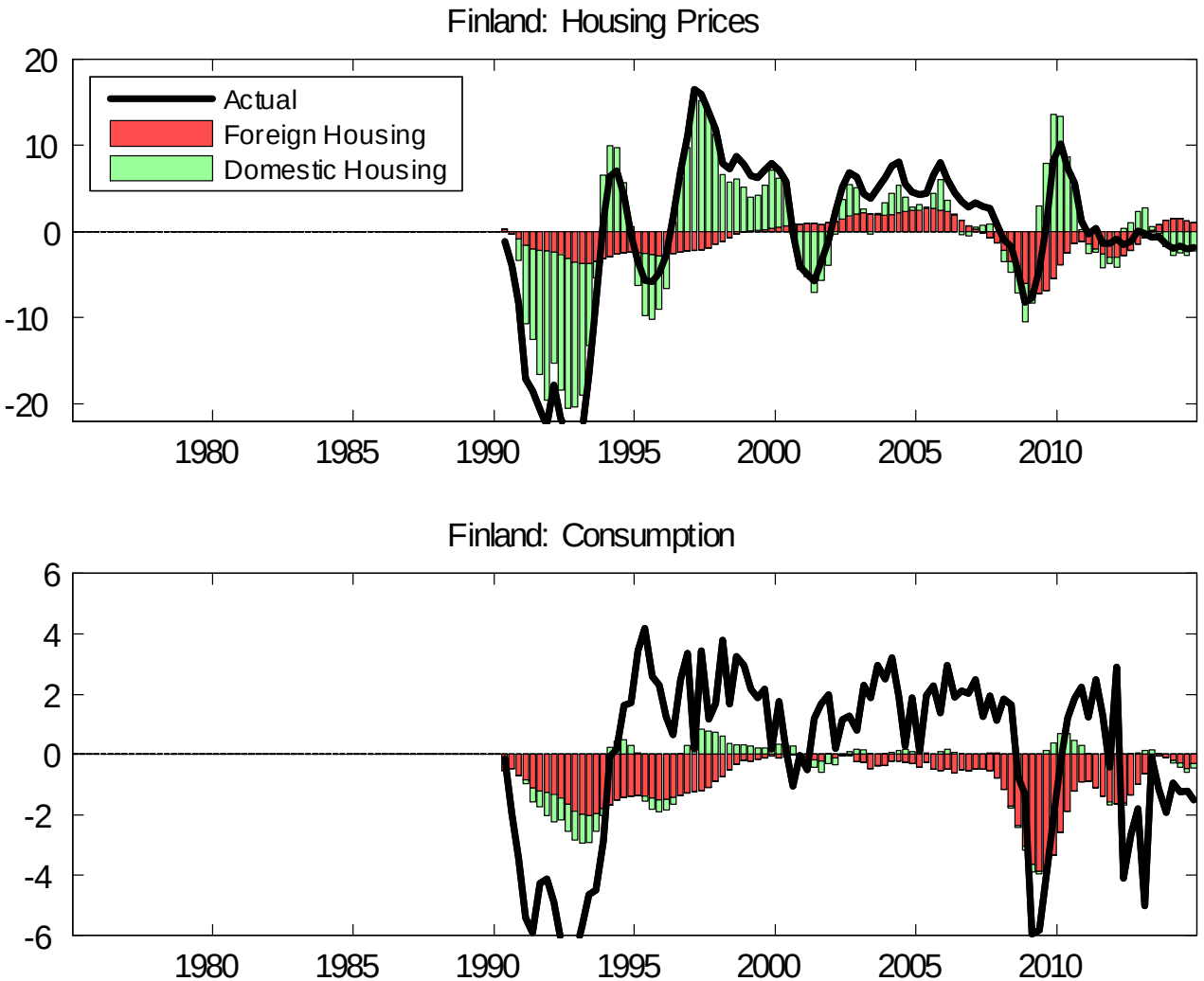
Note: Consumption and Housing Prices in YOY growth rates, % (demeaned)

Global vs U.S. Housing Shocks, Italy



Note: Consumption and Housing Prices in YOY growth rates, % (demeaned)

Global vs Finnish Housing Shocks, Finland



Note: Consumption and Housing Prices in YOY growth rates, % (demeaned)

The Three alternative stories

1. Common Activity Shock
2. **Domestic Housing Shock**
3. **Spillovers from Foreign Housing Shock Abroad**

The VAR offers little evidence of 1 in explaining the Global Financial Crisis. 2 and 3 explain the lion's share in many countries.

Conclusions

This is work in progress, so many of the conclusions here are still tentative

- There are large differences across countries for domestic housing shocks
  There are more muted differences for foreign housing shocks
- The role of the foreign housing shocks is important, maybe suggesting that channels other than colateral (trade, global banks) are also important
- What do we learn from these results for the effectiveness of macroprudential policy?
  If macroprudential policy mitigates domestic shocks, does it become less effective when it comes to foreign shocks, since responses to foreign shocks are independent of the level of debt?
  Should asymmetries become more important in thinking about macroprudential policy?