

# The Channels of Financial Distress During the Great Recession: Some Evidence on the Aggregate Effects

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# Background

- ▶ Since Great Recession (GR): explosion of research on financial crises
  - ▶ Now a broad understanding of forces at work during GR
- ▶ Literature emphasizes two main channels
  1. Impact of house price bust on household balance sheets and spending
  2. Transmission of banking distress to real activity
- ▶ Evidence for both (1) and (2) being operative during GR
  - ▶ Typically based on cross-sectional data (e.g. Mian/Sufi, Chodorow-Reich)
  - ▶ But largely silent on relative importance for aggregate activity

## What We Do

- ▶ Present evidence on aggregate employment effects of each channel
- ▶ Use quarterly panel of state level data
- ▶ Identification exploits both panel data and time series methods
  - ▶ Cross-state variation identifies household balance sheet channel (as in M/S)
  - ▶ Time series methods identify orthogonal shocks to:
    - ▶ House prices (both aggregate and local)
    - ▶ Banking distress (aggregate)
- ▶ Econometric framework and shocks → historical decomposition
  - ▶ Both for aggregate times series and cross-state variation

## Main Findings

- ▶ Both channels important; but banking distress key in turning recession into GR
  - ▶ Absent banking distress, recession would have resembled 90-91 or 01-02
  - ▶ Banking distress accounts for enhanced, protracted decline
- ▶ House price shocks account for cross state variation (as in M/S)
  - ▶ Household balance sheet channel important for regional variation
- ▶ Aggregate house price shocks have stronger effects than local ones
  - ▶ Consistent with theory (traded employment affected as well as nontraded).

# Literature

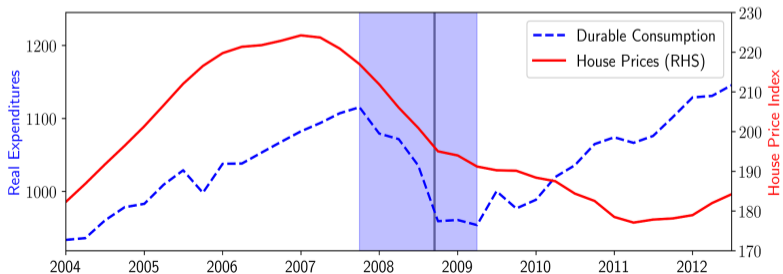
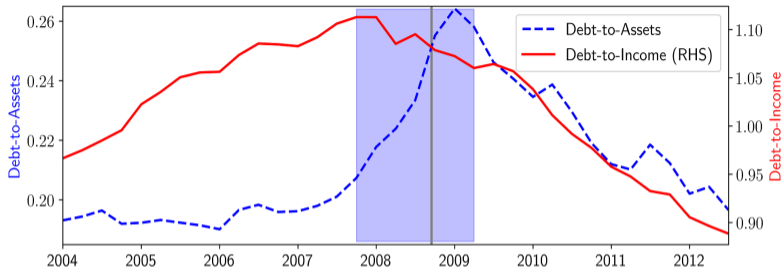
- ▶ Cross-sectional studies of Great Recession
  - ▶ Mian/Sufi 2014; Kaplan et. al. 2017, Chodorow-Reich 2014, Huber 2018
- ▶ Time series studies
  - ▶ Christiano/Eichenbaim/Trabandt 2015, Gertler/Gilchrist 2018, Bernanke 2019, Midrigan et. al.
- ▶ From micro-evidence to macro effects using models
  - ▶ Nakamura/Steinsson (2018), Hurst et. al. (2019), Beraja (2018)
- ▶ From micro-evidence to macro effects using time series identification
  - ▶ Sarto 2018

Descriptive Evidence From The Great Recession

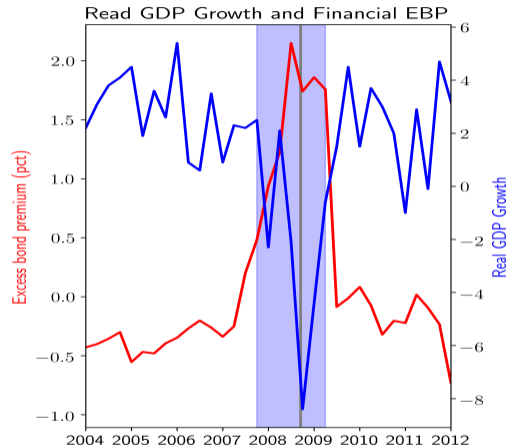
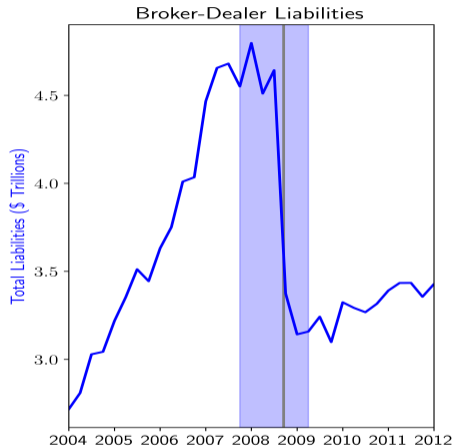
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Household Balance Sheet and Banking Distress Channels

# Household Balance Sheets, House Prices and Spending



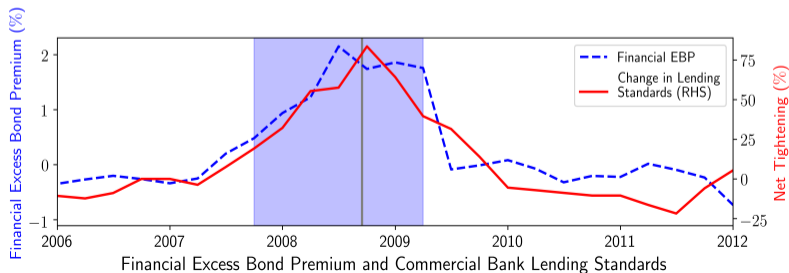
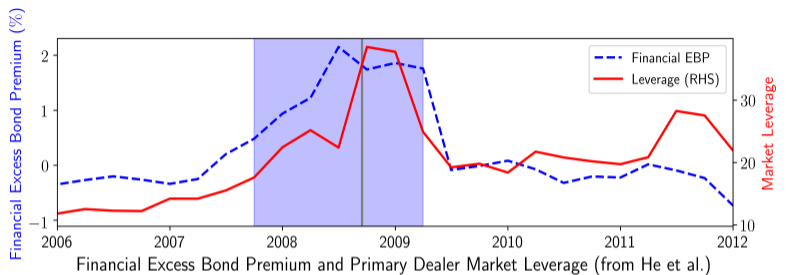
# Banking Distress and Real Activity



Excess Bond Premium = rate of return on corporate bonds minus return on similar maturity government bonds, with default premium removed.



# (Large) Bank Market Leverage, Financial EBP and Lending Standards



## New Evidence from a Panel of State-Level Data

## Starting point: Mian/Sufi (2014)

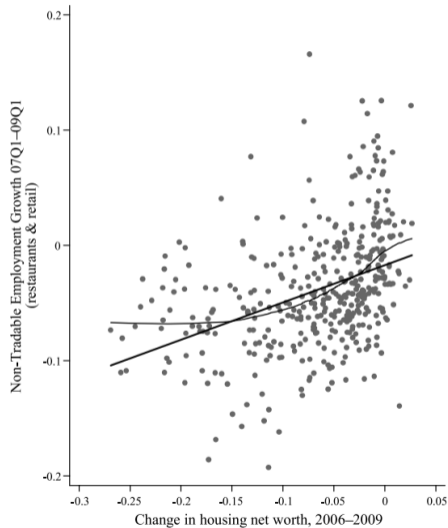
- ▶ Micro Evidence on Household Balance Sheet Channel
- ▶ Exploits regional variation in mortgage debt (MD) and house prices (HP)
- ▶ Motivation: Regions w. large buildup of MD and HP pre-crisis → large declines in HP and employment
- ▶ M/S (2014): cross-sectional regression over 2007-09

$$\Delta e_i^{NT} = \alpha + \eta \left( \frac{p_i^H H_i}{N_i^H} \cdot \Delta p_i^H \right) + \epsilon_i$$

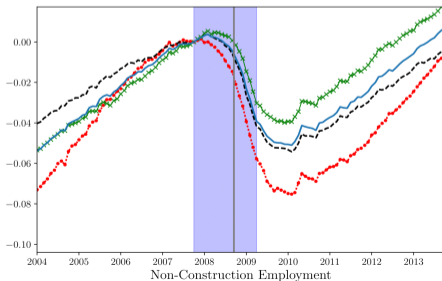
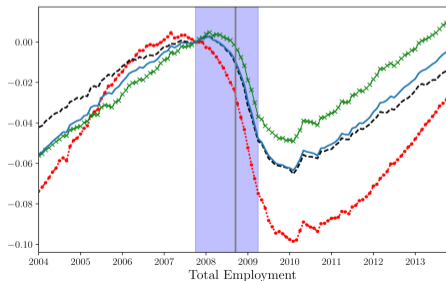
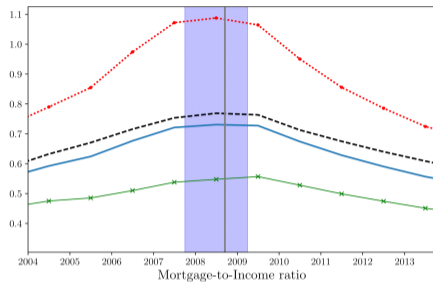
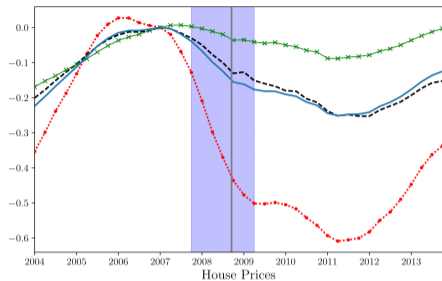
$e_i^{NT} \equiv$  nontradable employment in region  $i$ ;  $p_i^H \equiv$  housing prices

$\frac{p_i^H H_i}{N_i^H} \equiv$  2006 ratio of housing values to housing equity (measure of HH leverage)

# Household Balance Sheet Effects on Employment (Mian/Sufi)



# Regional and Temporal Variation



--- Top 20%    --- Next 30%    -x- Bottom 50%    - - - All

## Panel Data VAR

- ▶ Quarterly data: 1992 -2014
- ▶ Variables
  - ▶ State-level employment growth  $\Delta e_{jt}$
  - ▶ State-level house price growth  $\Delta p_{jt}$
  - ▶ Financial excess bond premium,  $s_t$ , (measure of financial conditions).
- ▶ Allow for effects of housing prices via household balance sheets (as in Mian/Sufi)
- ▶ Compare the aggregate effects of housing price versus financial shocks.
  - ▶ Employ time series methods to identify aggregate shocks
- ▶ Distinguish between the effects of local versus aggregate house price shocks

# Financial and House Price Shocks

- ▶ Aggregate financial conditions  $s_t$ :

$$s_t = \eta_{s0}\Delta e_t + \gamma_{s0}\Delta p_t + \sum_{i=1}^4 (\alpha_{si}s_{t-i} + \eta_{si}\Delta e_{t-i} + \gamma_{si}\Delta p_{t-i}) + \varepsilon_t^s$$

- ▶ State-level house prices  $p_{j,t}$ :

$$\Delta p_{jt} = \eta_{p0}\Delta e_{jt} + \sum_{i=1}^4 (\alpha_{pi}s_{t-i} + \alpha_{pi}\Delta e_{jt-i} + \gamma_{pi}\Delta p_{jt-i}) + \varepsilon_j^p + \varepsilon_{jt}^p$$

- ▶ Structural shocks  $\varepsilon_t^s$  and  $\varepsilon_{jt}^p$  identified via timing restrictions

- ▶  $s_t$  depends on  $\Delta e_t = \sum \omega_j \Delta e_{jt}$  and  $\Delta p_t = \sum \omega_j \Delta p_{jt}$
- ▶  $\Delta p_{jt}$  depends on  $\Delta e_{jt}$  but NOT  $s_t$
- ▶  $\Delta e_{jt}$  depends Neither on  $\Delta p_{jt}$  Nor  $s_t$

## Aggregate Versus Idiosyncratic House Price Shocks

$\varepsilon_{jt}^P \equiv$  state housing price shock;  $\varepsilon_t^P \equiv$  aggregate house price shock

- ▶  $\varepsilon_{jt}^P$  depends on aggregate ( $\varepsilon_t^P$ ) and idiosyncratic ( $\psi_{jt}^P$ ) components.

$$\varepsilon_{jt}^P = \theta_j \varepsilon_t^P + \psi_{jt}^P$$

with  $\sum \omega_j \theta_j = 1$

- ▶ Allow for differential sensitivities of  $\varepsilon_{jt}^P$  to  $\varepsilon_t^P$ 
  - ▶ e.g. due to differential land supply elasticities, etc.
- ▶  $\varepsilon_t^P$  corresponds to common factor in  $\varepsilon_{jt}^P$ 
  - ▶  $\theta_j$  is state  $j$  factor loading



## State Employment Growth Cond. on House Price + Financial Shocks

$M_j \equiv$  mortgage debt/income, state  $j$  2006;  $I(Crisis) \equiv$  crisis dummy (2007:1-09:4)

- ▶ Employment growth in state  $j$  over horizon  $h \geq 1$

$$E_t\{e_{jt+h} - e_{jt} | \varepsilon_{jt}^P, \varepsilon_t^P, \varepsilon_t^S\} = \{\beta_{ph} + \beta_{mh}[I(Crisis)]M_j\}\varepsilon_{jt}^P + \beta_{sh}\varepsilon_t^S \\ + \lambda_h E_t\{e_{t+h} - e_t | \varepsilon_t^P, \varepsilon_t^S\}$$

- ▶ Top right: Local effects of state house price and aggregate financial shocks;
  - ▶ Dummy  $\rightarrow$  balance sheet effect of housing price decline (as in Mian/Sufi)
- ▶ Bottom right:  $\rightarrow$  Aggregate spillovers via tradable goods

## Conditional Aggregate Employment Growth

$$\varepsilon_{jt}^P = \theta_j \varepsilon_t^P + \psi_{jt}^P; \quad \rightarrow \quad \sum_j \omega_j \varepsilon_{jt}^P = \varepsilon_t^P \text{ and } \sum_j \omega_j M_j \varepsilon_{jt}^P = \overline{M\theta} \varepsilon_t^P \rightarrow$$

- ▶ Aggregating across states

$$E_t \{e_{t+h} - e_t | \varepsilon_t^P, \varepsilon_t^S\} = \{ \beta_{ph} + \beta_{mh} [I(\text{crisis})] \overline{M\theta} \} \varepsilon_t^P + \beta_{sh} \varepsilon_t^S \\ + \lambda_h E_t \{e_{t+h} - e_t | \varepsilon_t^P, \varepsilon_t^S\}$$

→

$$E_t \{e_{t+h} - e_t | \varepsilon_t^P, \varepsilon_t^S\} = \frac{1}{1 - \lambda_h} \{ \{ \beta_{ph} + \beta_{mh} [I(\text{crisis})] \overline{M\theta} \} \varepsilon_t^P + \beta_{sh} \varepsilon_t^S \}$$

- ▶  $\frac{1}{1 - \lambda_h}$  is general equilibrium effect.

## State Employment Growth: Local vs. Aggregate Variation

- ▶  $\widehat{\varepsilon}_{jt}^p \equiv$  Local house price shock for state  $j \rightarrow$

$$\varepsilon_{jt}^p = \theta_j \varepsilon_t^p + \psi_{jt}^p = \varepsilon_t^p + \widehat{\varepsilon}_{jt}^p$$

with

$$\widehat{\varepsilon}_{jt}^p = (\theta_j - 1) \varepsilon_t^p + \psi_{jt}^p$$

- ▶ Conditional state employment growth:

$$E_t \left\{ e_{jt+h} - e_{jt} \mid \widehat{\varepsilon}_{jt}^p, \varepsilon_t^p, \varepsilon_t^s \right\} = \{ \beta_{ph} + \beta_{mh} [I(\text{crisis})] M_j \} \widehat{\varepsilon}_{jt}^p +$$
$$\frac{1}{1 - \lambda_h} \left\{ \{ \beta_{ph} + \beta_{mh} [I(\text{crisis})] \overline{M\theta} \} \varepsilon_t^p + \beta_{sh} \varepsilon_t^s \right\}$$

Top right: Local variation; Bottom right: Aggregate variation

## Estimation

- ▶ State employment growth over horizon  $h$

$$e_{jt+h} - e_{jt} = \beta_{ph} \widehat{\varepsilon}_{jt}^p + \beta_{mh} [I(\text{crisis})] M_j \widehat{\varepsilon}_{jt}^p +$$

$$\frac{\beta_{ph}}{1 - \lambda_h} \varepsilon_t^p + \frac{\beta_{mh}}{1 - \lambda_h} [I(\text{crisis})] \overline{M\theta} \varepsilon_t^p + \frac{\beta_{sh}}{1 - \lambda_h} \varepsilon_t^s + \varphi_j + \varphi_{jht}$$

- ▶ RHS variables are orthogonal shocks  $\rightarrow$  can estimate using OLS (Jorda)
- ▶ Generalization of Mian/Sufi to panel VAR setting
  - ▶ Captures cross state effects of house price decline (top right)
  - ▶ Differences:
    - ▶ Identify aggregate effects of house price shocks (bottom right)
    - ▶ Also identifies aggregate effects of financial shocks (bottom right)

## Estimation and Historical Decomposition: Implementation

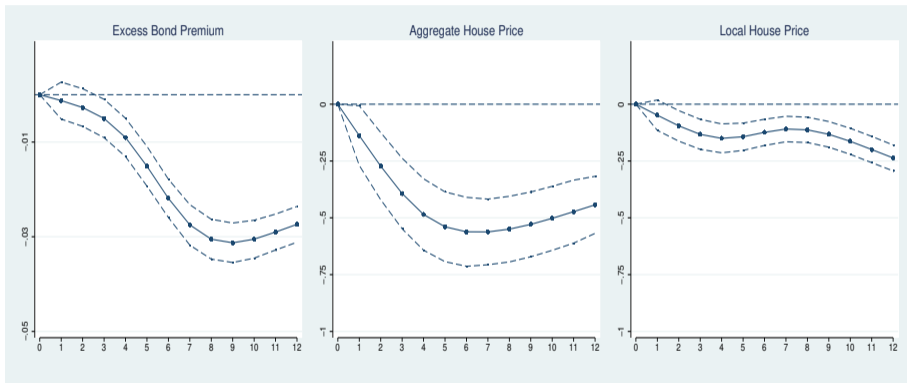
- ▶ 12 quarter state  $j$  employment growth:

$$e_{jt+12} - e_{jt} = \sum_{h=1}^{12} \left\{ \beta_{jph}^* \widehat{\varepsilon}_{jt+12-h}^p + \frac{\beta_{ph}^*}{1 - \lambda_h} \varepsilon_{t+12-h}^p + \frac{\beta_{sh}}{1 - \lambda_h} \varepsilon_{t+12-h}^s \right\} \\ + \sum_{i=1}^4 \delta_i \Delta e_{jt-i} + \varepsilon_j^e + \varphi_{jt,t+12}^e$$

$$\beta_{jph}^* \equiv \beta_{ph} + \beta_{mh}[I(\text{crisis})]M_j; \quad \beta_{ph}^* = \beta_{ph} + \beta_{mh}[I(\text{crisis})]\overline{M\theta}$$

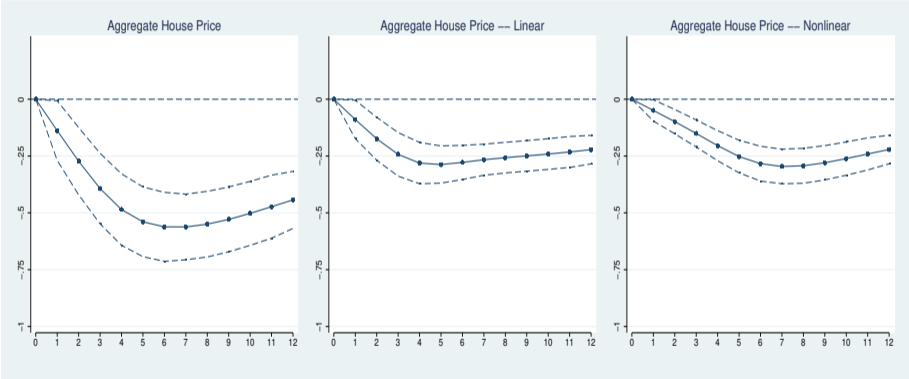
- ▶  $\{\cdot\}$  gives contribution of  $\left\{ \widehat{\varepsilon}_{jt+12-h}^p, \varepsilon_{t+12-h}^s, \varepsilon_{t+12-h}^p \right\}_{h=1}^{12}$  to  $e_{jt+12} - e_t$
- ▶  $\sum_{i=1}^4 \delta_i \Delta e_{jt-i}$  controls for effect of shocks prior to  $t$  on  $e_{jt+12} - e_t$

# Employment Responses to Financial vs. Housing Price Shocks



Left panel: shock is 100bp in Financial EBP; Middle and Right: 100bp decrease in house price

# Decomposing Employment Response to Aggregate Housing Price Shock: Linear vs. Nonlinear (Balance Sheet) Effects



# Historical Decomposition of Aggregate Employment

- ▶ Aggregating across states:

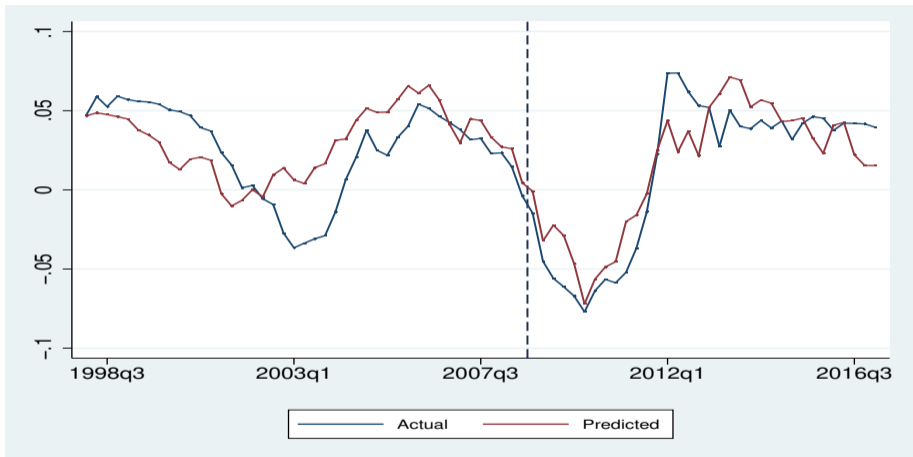
$$e_{t+12} - e_t = \sum_{h=1}^{12} \left\{ \frac{\beta_{ph}^*}{1 - \lambda_h} \varepsilon_{t+12-h}^p + \frac{\beta_{sh}}{1 - \lambda_h} \varepsilon_{t+12-h}^s \right\} + \sum_{i=1}^4 \delta_i \Delta e_{t-i} + \varepsilon^e + \varphi_{t,t+12}^e$$

- ▶  $\Gamma_{t,t+12} \equiv (e_{t+12} - e_t) - \left( \sum_{i=1}^4 \delta_i \Delta e_{t-i} + \varepsilon^e \right) \equiv$  unexpected 3 year employment growth

$$\Gamma_{t,t+12} = \sum_{h=1}^{12} \left\{ \frac{\beta_{ph}^*}{1 - \lambda_h} \varepsilon_{t+12-h}^p + \frac{\beta_{sh}}{1 - \lambda_h} \varepsilon_{t+12-h}^s \right\} + \varphi_{t,t+12}^e$$



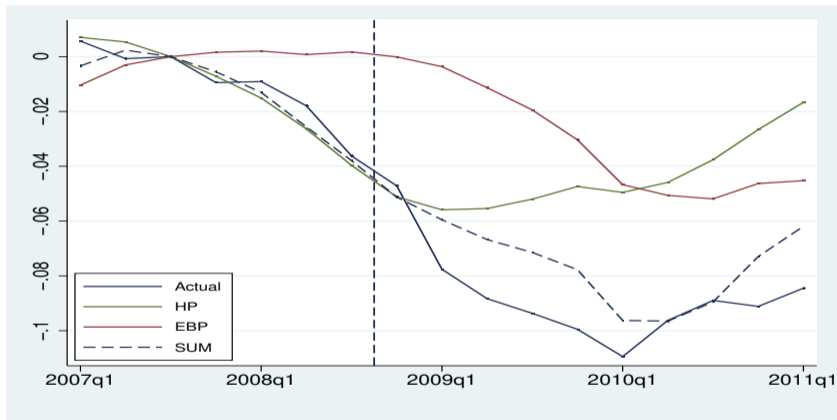
## Employment: Actual vs. Fitted



Actual: Unexpected 3 year growth

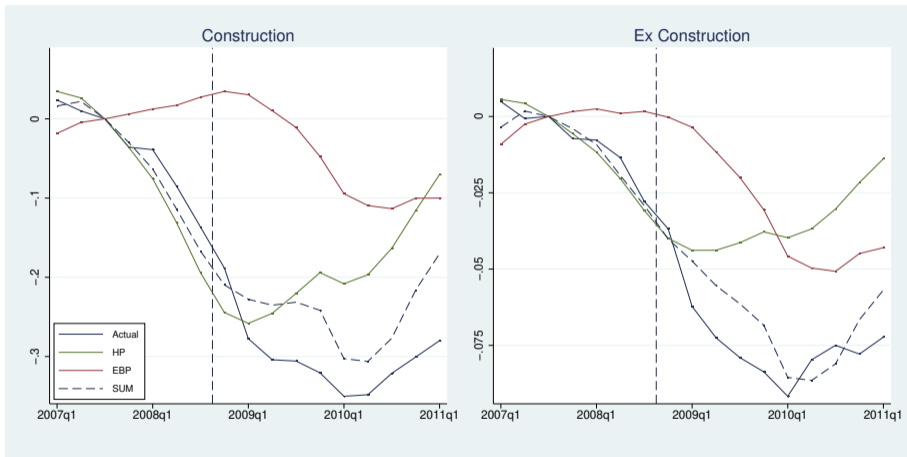
Fitted: Component explained by financial and house price shocks

# Contribution of Housing Price vs. Financial Shocks to Employment



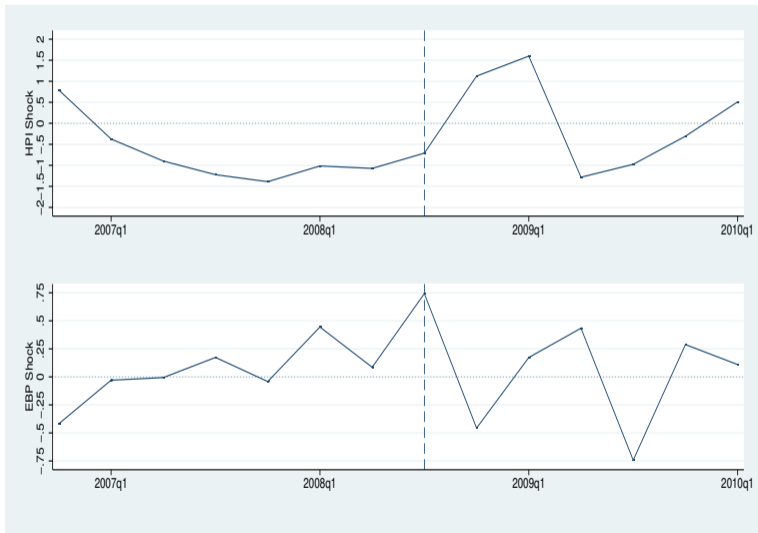
Actual: Unexpected 3 year employment growth

# Construction vs. Ex-Construction Employment: House Price vs EBP effect



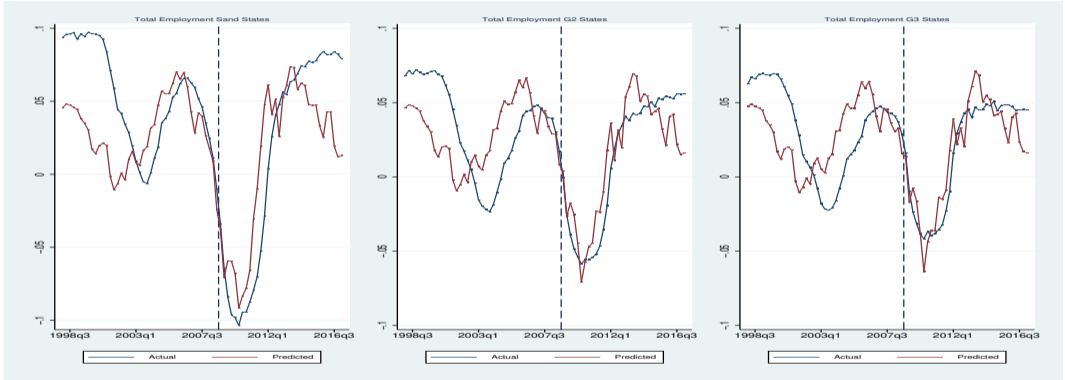
Actual: Unexpected 3 year employment growth

# Aggregate Housing Price and Financial Shocks



## Accounting for Regional Variation

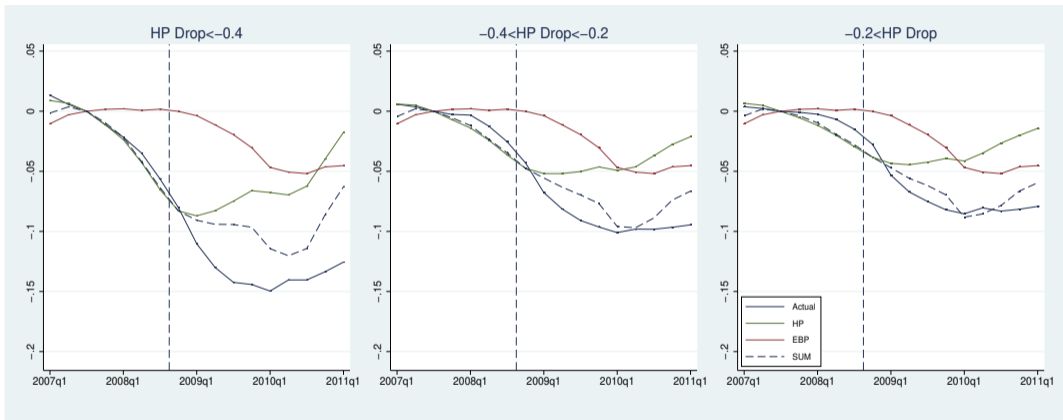
# Regional Employment: Actual vs. Fitted



Actual: Unexpected 3 year growth

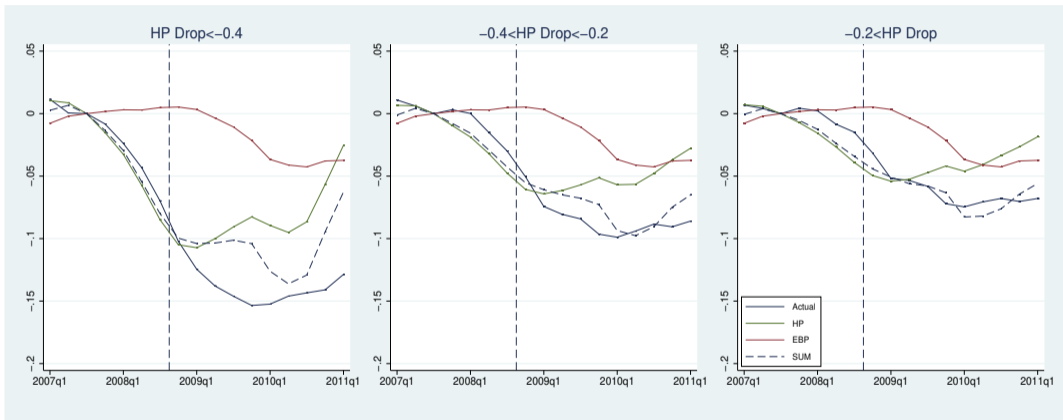
Fitted: Component explained by financial and house price shocks

# House Price vs. Financial Shocks and Regional Employment



Actual: Unexpected 3 year employment growth

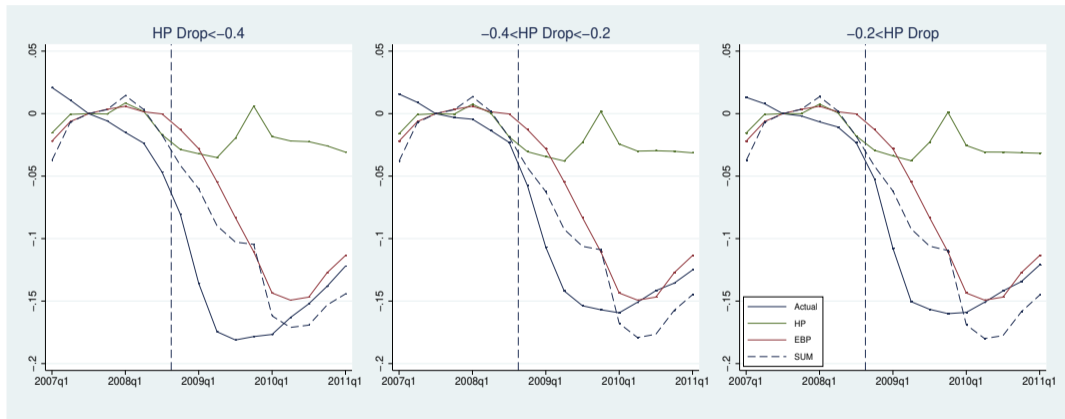
# House Price vs. Financial Shocks and Regional Retail Employment



Actual: Unexpected 3 year employment growth

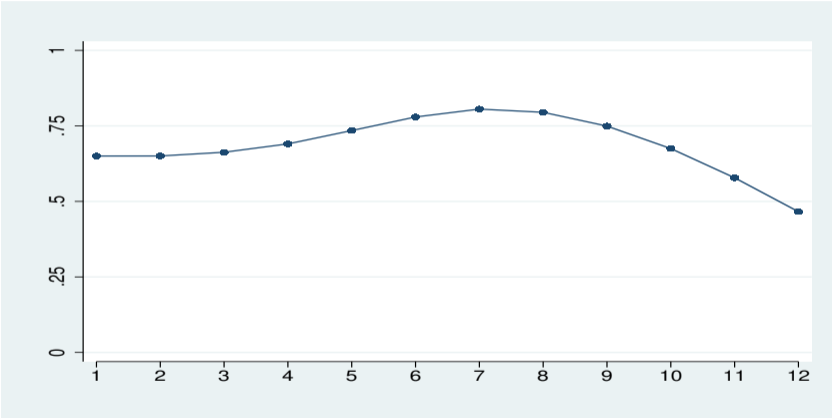


# House Price vs Financial Shocks and Regional Manufacturing Employment

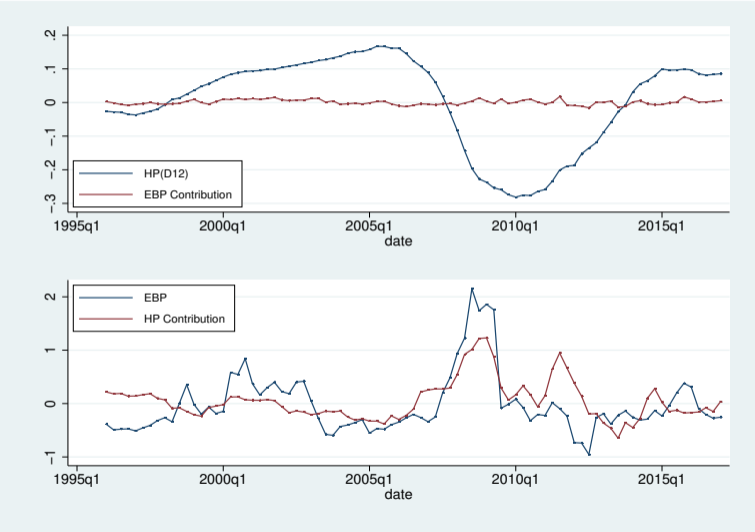


Actual: Unexpected 3 year employment growth

# Spillovers



# What Drives Housing Prices and the EBP?



## Summary Remarks

- ▶ Present evidence on channels of financial distress to real activity during GR
- ▶ Combine cross-sectional and time series methods
  - ▶ Identify local effects of house price shocks off cross-section
  - ▶ Times series methods to identify general equilibrium effects of house price and financial shocks.
- ▶ Key findings
  - ▶ Both house price and financial shocks important in the aggregate
    - ▶ But financial shocks turned “normal” recession into GR
  - ▶ Household price channel important for regional variation
- ▶ Extensions
  - ▶ Allowing for regional heterogeneity of financial shocks
  - ▶ Structural modeling (to account better for propagation)