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# Higher Order Impacts of Hurricanes: evidence from county level analysis using synthetic control methodology of comparative case studies

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# The Higher Order Impacts of Hurricane: Evidence from County Level Analysis

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## MOTIVATION

- Continued rise in tolls from disasters
- Increased burden to taxpayers to provide relief to disaster victims
- Inherent difficulty to generate empirical estimates of indirect impacts of disaster
- Underrepresented area of research: local labor market response to disasters
- Gap between theory and empirics about adaptation impacts on natural disasters
- “The United States has been – and still is – creating for itself increasingly catastrophic future disasters” (Mileti, 1999)

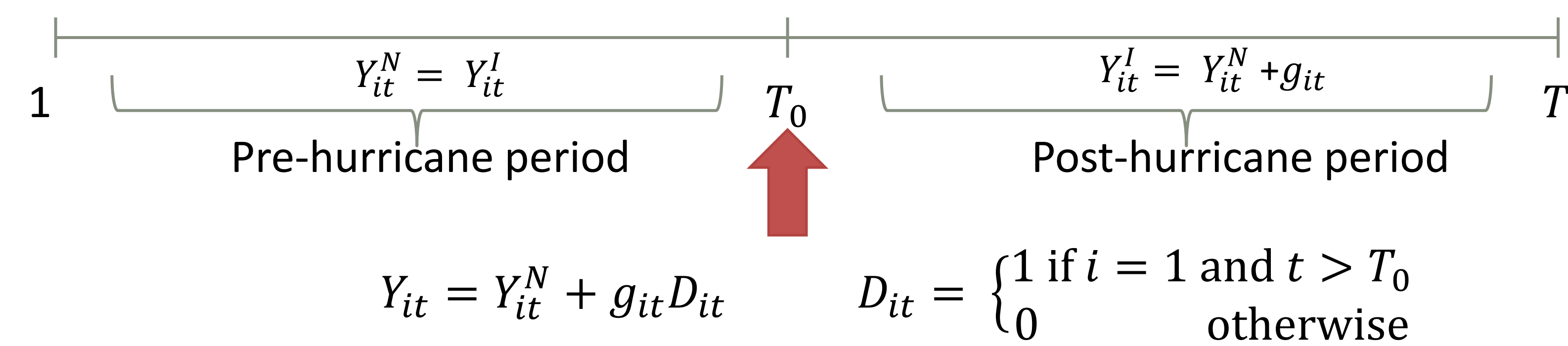
## RESEARCH QUESTION

How flexible the local markets are and how quickly they adjust to hurricane disaster shocks

- Employment and per worker earning impacts of hurricanes
- Sectoral distribution of impacts: Tradable vs. Local Sector
- Effectiveness of public adaptation measures in terms of mitigating employment impacts of hurricane disaster
- Sector spillover effects of hurricane disaster

## METHODOLOGY: Synthetic Control Method (Abadie et al, 2010)

$i = 1$  : affected county; Remaining counties serve as potential controls:  $j = 2, \dots, J + 1$

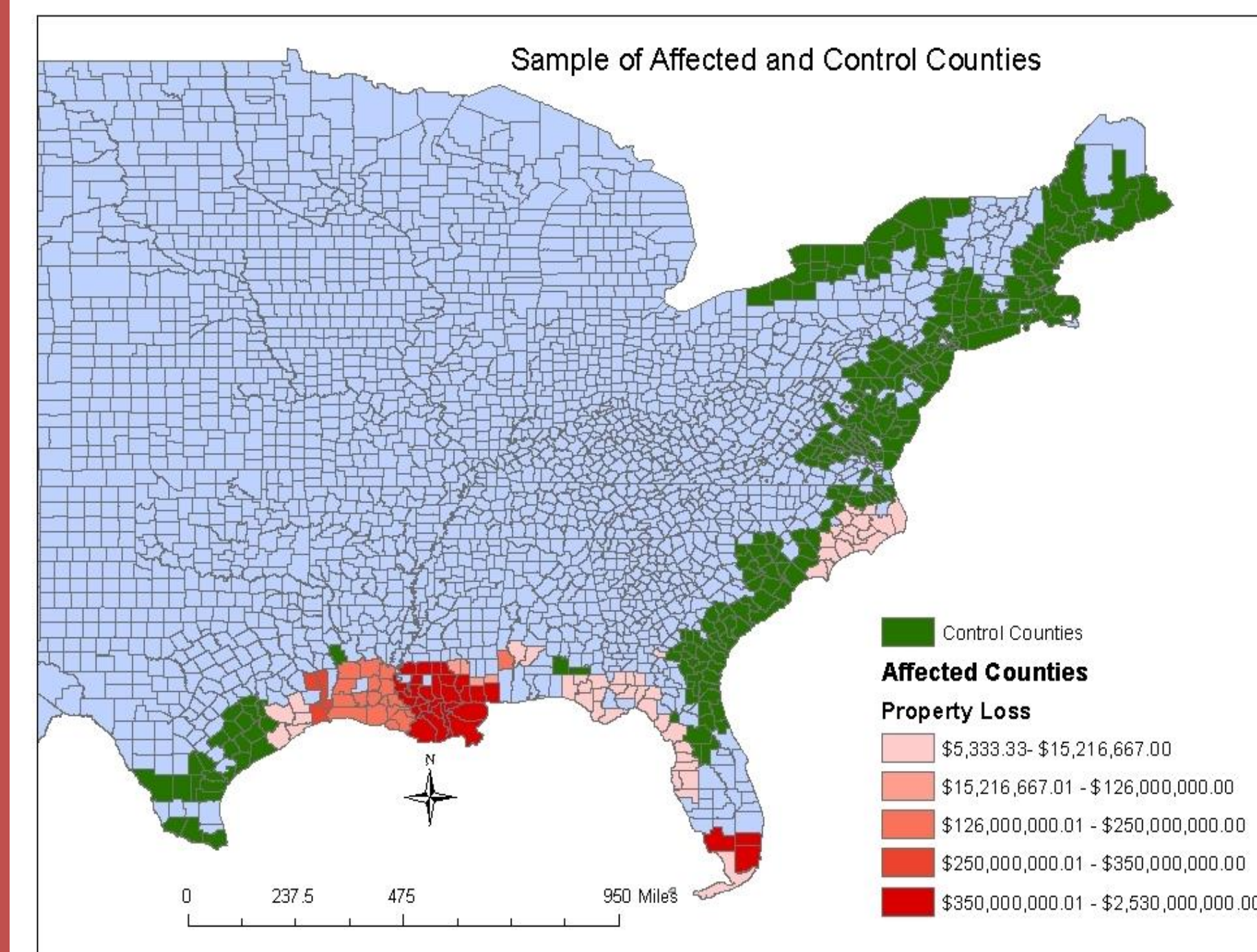


### Implementation:

- Select weights such that  $\sum_{j=2}^{J+1} w_j^* Y_{jt} = Y_{1t}$  and  $\sum_{j=2}^{J+1} w_j^* Z_j = Z_1$  for  $\forall t \in (1, \dots, T_0)$
- Apply weights to controls in the post hurricane period to generate gaps:

$$\hat{g}_{1t} = Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt} \text{ for } t \in (T_0, \dots, T)$$

## SAMPLE



## RESULTS

Figure 1: Sample Average

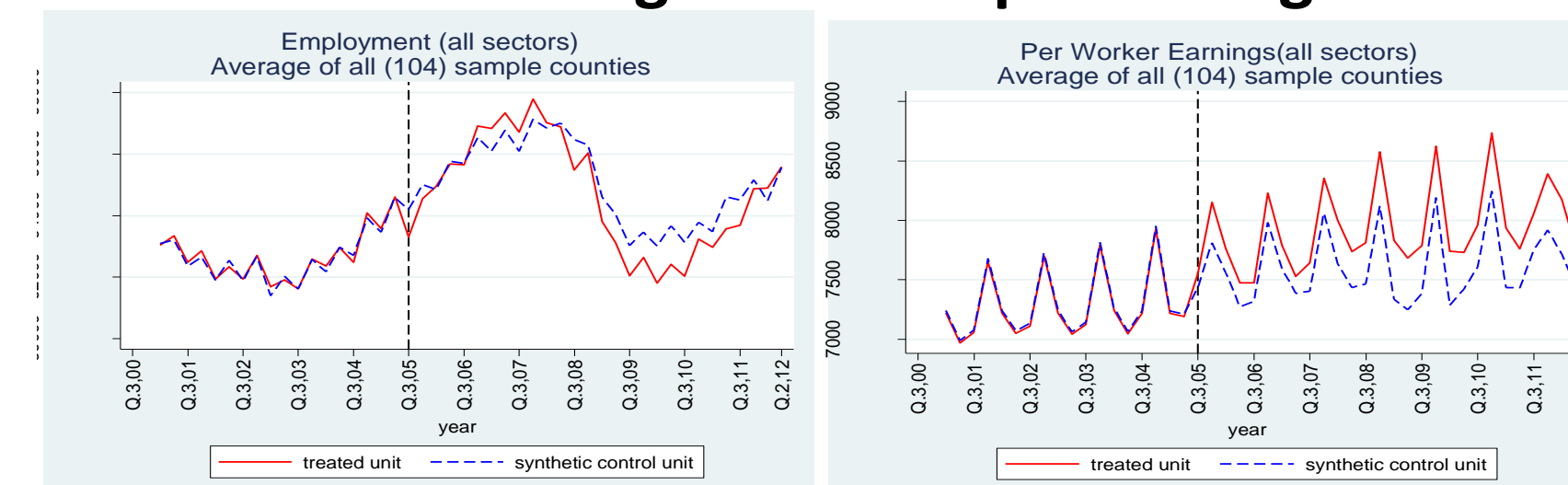


Figure 2: Average of 75<sup>th</sup> percentile damaged county

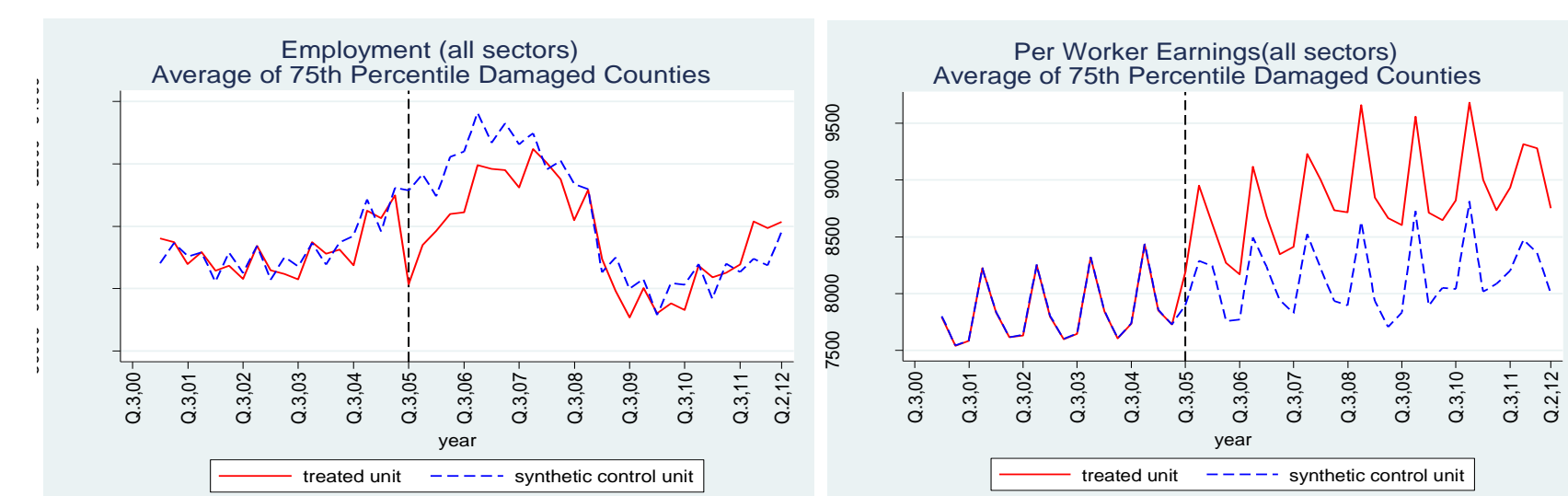
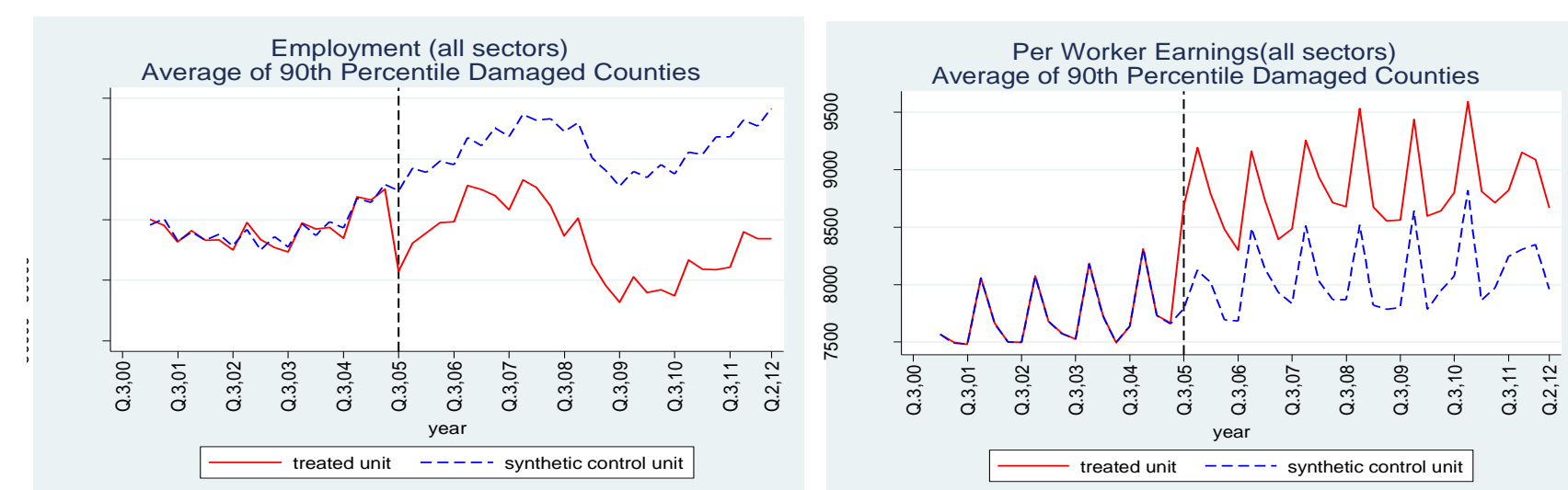
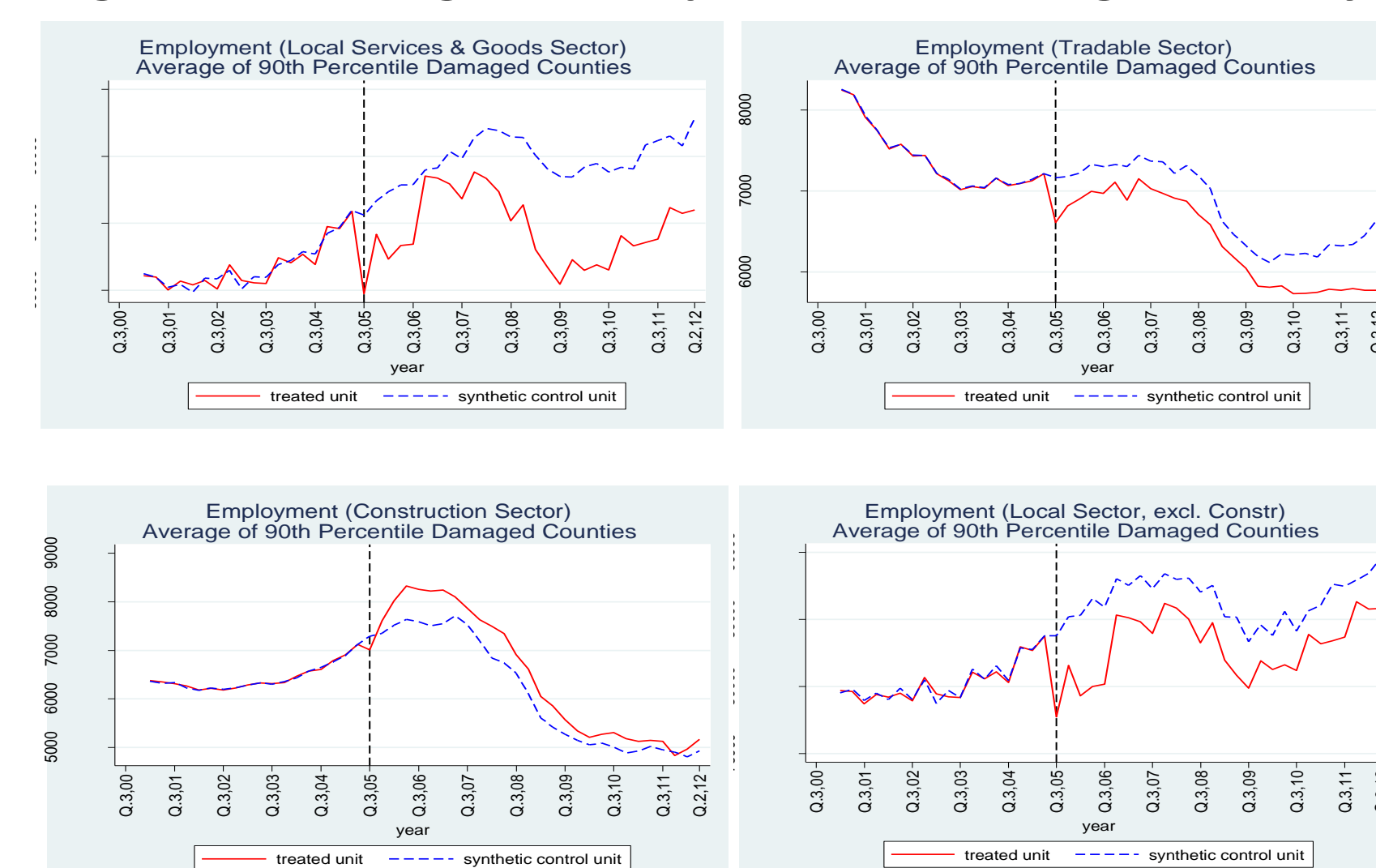


Figure 3: Average of 90<sup>th</sup> percentile damaged county



## SECTOR RESULTS

Figure 4: Average of 90<sup>th</sup> percentile damaged county



## EMPLOYMENT GAP

$$\hat{g}_{it} = \beta_0 + \beta_1[\ln GDP_{it}^*] + \beta_2[\ln GDP_{it}^*]^2 + \beta_3[\#of MD\&EM]_{it} + \beta_4[\# in poverty]_{it}^* + \beta_5[\#with college degree \& up]_{it}^* + \beta_6[FEMA MIT]_{it}^* + \beta_7[FEMA PA]_{it}^* + \beta_8[CRS points]_{it}^*_{-5} + \beta_9[UI]_{it}^* + \gamma Quarterly Dummies + c_i + u_{it}$$

Dependent variable: per capita employment loss; Defined as gap = synthetic control – actual employment	FE	RE	IV FE
Log of per capita GDP	-3.397*** (0.912)	-1.383+ (0.808)	-3.387*** (0.368)
GDP squared	0.160*** (0.044)	0.0671+ (0.040)	0.159*** (0.018)
# of Presidential Disaster and Emergency Declaration	0.00240** (0.001)	0.00246** (0.001)	0.00245** (0.001)
Log of cumulative investment in FEMA Mitigation Projects	-0.0000104+ (0.000)	-0.0000123+ (0.000)	-0.0000109** (0.000)
Log of cumulative investment in FEMA Public Assistance Projects	0.00000620*** (0.000)	0.00000781*** (0.000)	0.00000616*** (0.000)
5-year lag of CRS total credit points	-0.00139* (0.001)	-0.000846+ (0.000)	-0.00146*** (0.000)
Per capita # of people with college degree & higher	-0.0069 (0.012)	0.00515 (0.012)	-0.00374 (0.010)
Per capita # of people in poverty	0.218*** (0.059)	0.224*** (0.057)	0.215*** (0.038)
Per capita unemployment insurance transfers	0.0195 (0.015)	0.0308+ (0.016)	0.0241** (0.009)
Constant	17.97*** (4.774)	7.063+ (4.073)	
Number of Observations	1136	1136	1114

## LOCAL MULTIPLIERS

$$(\hat{Y}_{it}^{NT} - Y_{it}^{NT}) = \beta_0 + \beta_1(\hat{Y}_{it}^T - Y_{it}^T) + \beta_2 TDUM + \varepsilon_{it}$$

IV FE:  $\hat{\beta}_1 = 7.131$

## MAJOR FINDINGS & POLICY IMPLICATIONS

- Persistent employment impacts for an average of 90<sup>th</sup> percentile of damaged county
  - 7% employment loss relative to no hurricane scenario
  - No sign of recovery 7 years after the 2005 hurricanes
- Similar pattern observed for tradable and local services sector employment
- Construction sector booms aftermath of disasters & impact dissipates in 5.5. years
- Large local multipliers: 1 job lost in tradable sector implies 7.131 additional jobs lost in the local services sector
- FEMA Mitigation & Local Adaptation (CRS) projects are very effective
- Two sources of **moral hazard** problem:
  - FEMA PA: 1% increase in cumulative spending  $\rightarrow$  1.65% increase in employment loss
  - UI Benefits: 1% increase in per capita UI spending  $\rightarrow$  1.58% increase in employment loss

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