Does Indivisible Labor Explain the Difference Between Micro and Macro Elasticities? A Meta-Analysis of Extensive Margin Elasticities

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Micro vs. Macro Elasticities

- Pure equilibrium macro models require large labor supply elasticities to fit data
    - Matching fluctuations in hours over business cycle requires Frisch elasticities of 2-4 in leading models
    - Explaining variation in hours of work across countries with different tax systems requires Hicksian elasticities around 0.5
- Micro studies estimate much smaller intensive-margin elasticities
    - Below 0.25 for most groups except high income earners
    - Saez et al. JEL survey: "the profession has settled on a value for this elasticity close to zero."

Indivisible Labor

- One prominent explanation: indivisible labor (Rogerson 1988, Hansen 1985, Ljungqvist and Sargent 2006)
  - Individuals cannot choose hours freely or face fixed costs, changes in wage rates → *extensive margin* response
  - Extensive response large if reservation wage distribution has substantial density at the margin
  - Small wage cut could cause large drop in aggregate hours by reducing employment rates
  - Yet same wage cut may not affect hours of work conditional on employment
  - → Large extensive elasticities and small intensive elasticities could potentially reconcile micro and macro evidence

This Paper

- Modern macro models treat extensive elasticity as a free parameter
- We argue that macro models should be calibrated to match micro estimates of extensive elasticities as well
  - Same marginal density of reservation wage distribution determines impacts of tax or wage changes on employment
- Are modern micro estimates of extensive elasticities consistent with macro calibrations?
  - Yes, for steady state (Hicksian) elasticities
  - No, for business cycle (Frisch) elasticities

Outline

1. Terminology

2. Simulations of three quasi-experiments in calibrated macro model

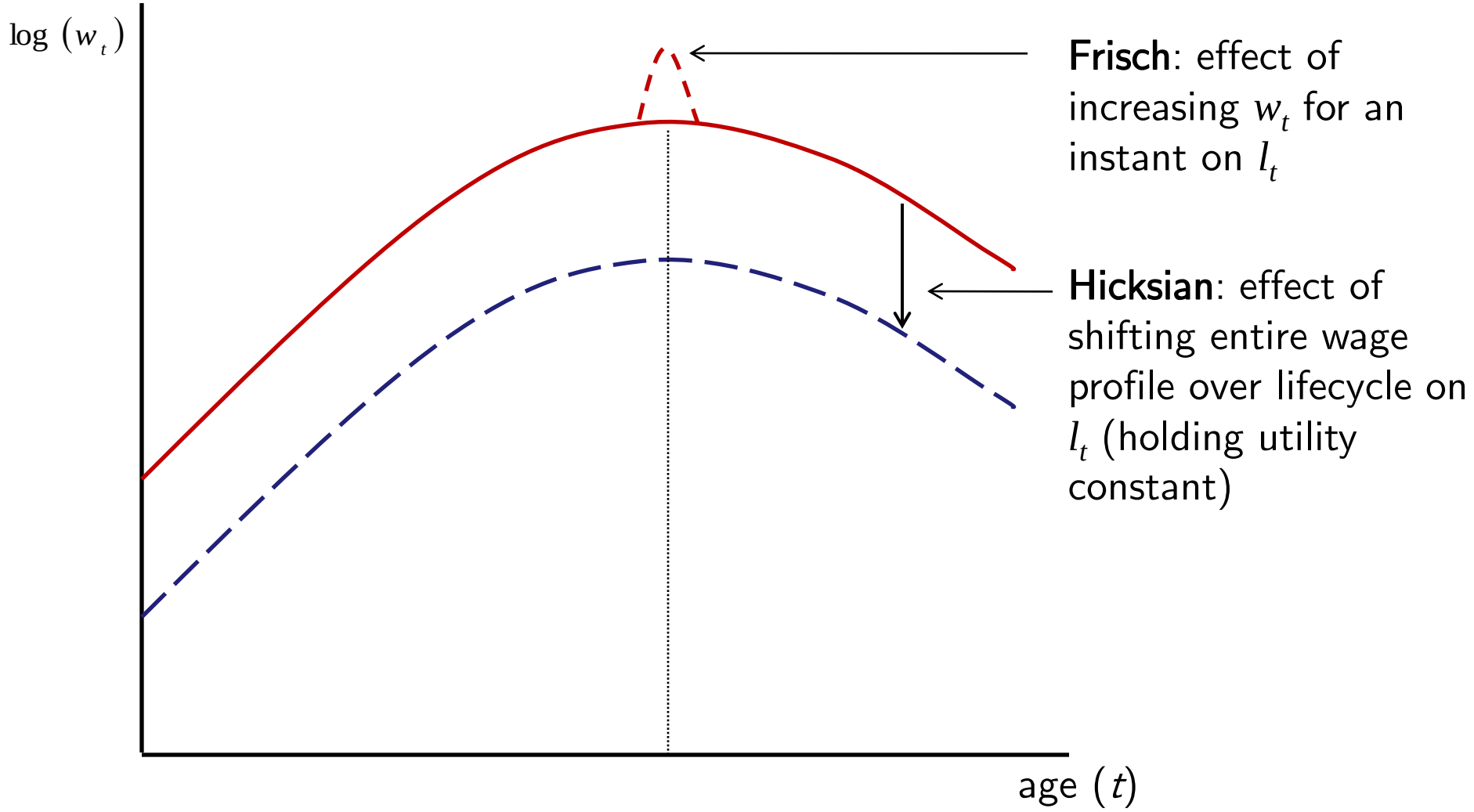
3. Meta-analysis of 15 micro estimates of extensive elasticities

4. Micro vs. macro: steady-state and intertemporal substitution

Terminology

- We use "micro" and "macro" to characterize source of variation
  - Macro: cross-country, bus. cycle; micro: quasi-experimental
- We distinguish between elasticities on two dimensions
  - Intensive vs. extensive
  - Frisch vs. Hicksian
- Aggregate hours elasticity = intensive + extensive elasticity

Hicksian vs. Frisch Elasticities (MaCurdy 1981)



Terminology

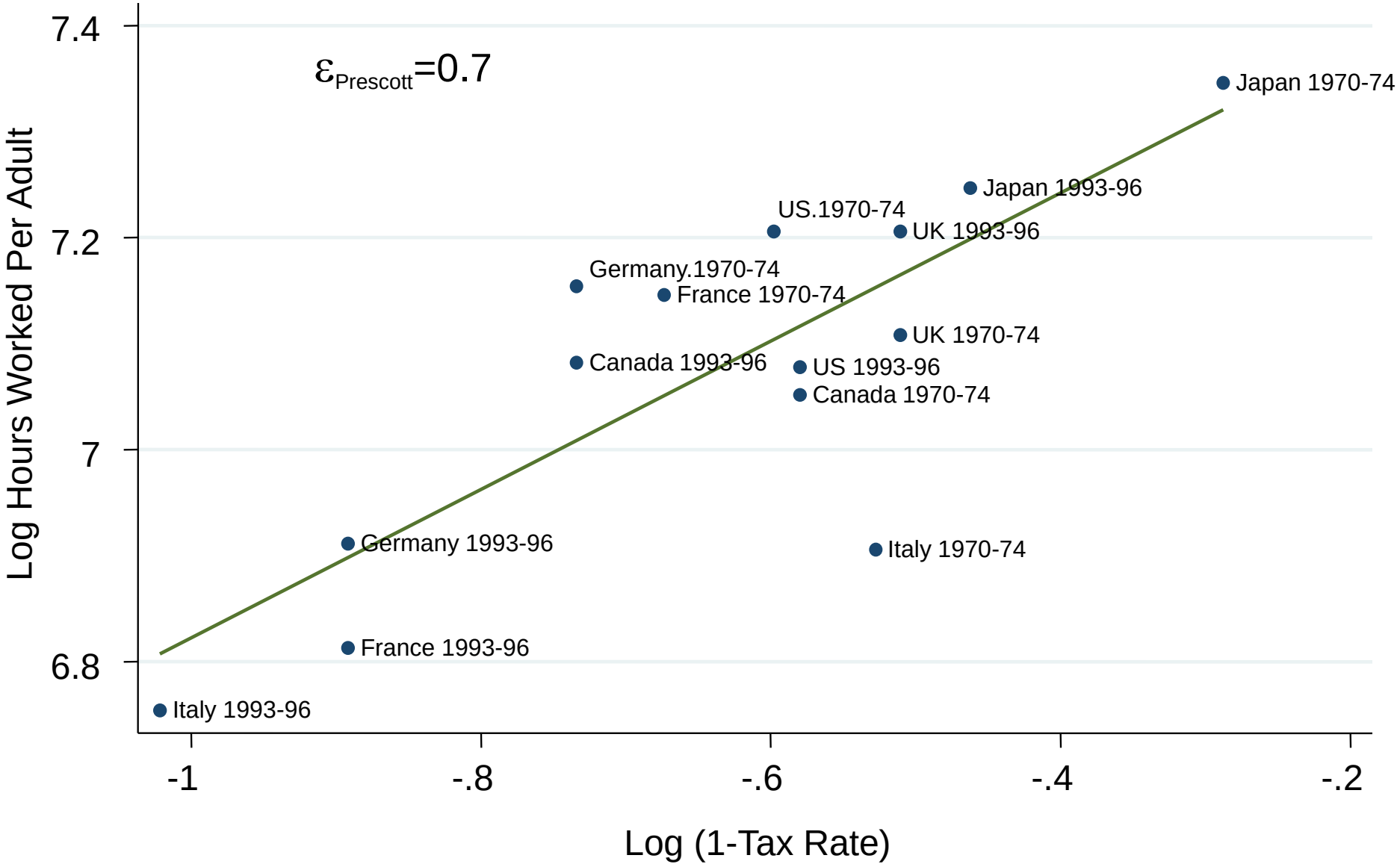
- Macro literature uses different terminology
  - "macro" elasticity = Frisch elasticity of **aggregate** hours
  - "micro" elasticity = Frisch elasticity on **intensive** margin
- Two issues with this terminology:
  1. Intensive elasticity is no more "micro" than extensive
  2. Frisch vs. Hicksian distinction is critical
     - Frisch matters for business cycle fluctuations
     - Hicksian matters for steady state comparisons and impact of tax changes on revenue and welfare

Terminology: Frisch vs. Hicksian Elasticities

- Prescott (2004) reports an elasticity of 3 using cross-country data
- Davis and Henrekson (2005) find 0.33 using similar data

- Most of the difference: Frisch vs. Hicksian
  - Prescott's data yields a Hicksian elasticity of 0.7

Aggregate Hours vs. Net-of-Tax Rates Across Countries (Prescott Data)



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- Most of the difference: Frisch vs. Hicksian
  - Prescott's data yields a Hicksian elasticity of 0.7
- Prescott maps Hicksian of 0.7 to Frisch of 3 using specific parametric modelling assumptions

Simulations of Quasi-Experiments

- Use Rogerson and Wallenius (2009) model
  - Aggregates across individuals over lifecycle as in Ljungqvist and Sargent (2006)
  - Features both an extensive and intensive margin
- OLG continuous-time lifecycle model
  - New generation born at each instant
  - Productivity varies over lifecycle
  - Can be solved analytically and aggregated over generations
- Qualitative results generalize to other macro models that match employment fluctuations using indivisible labor

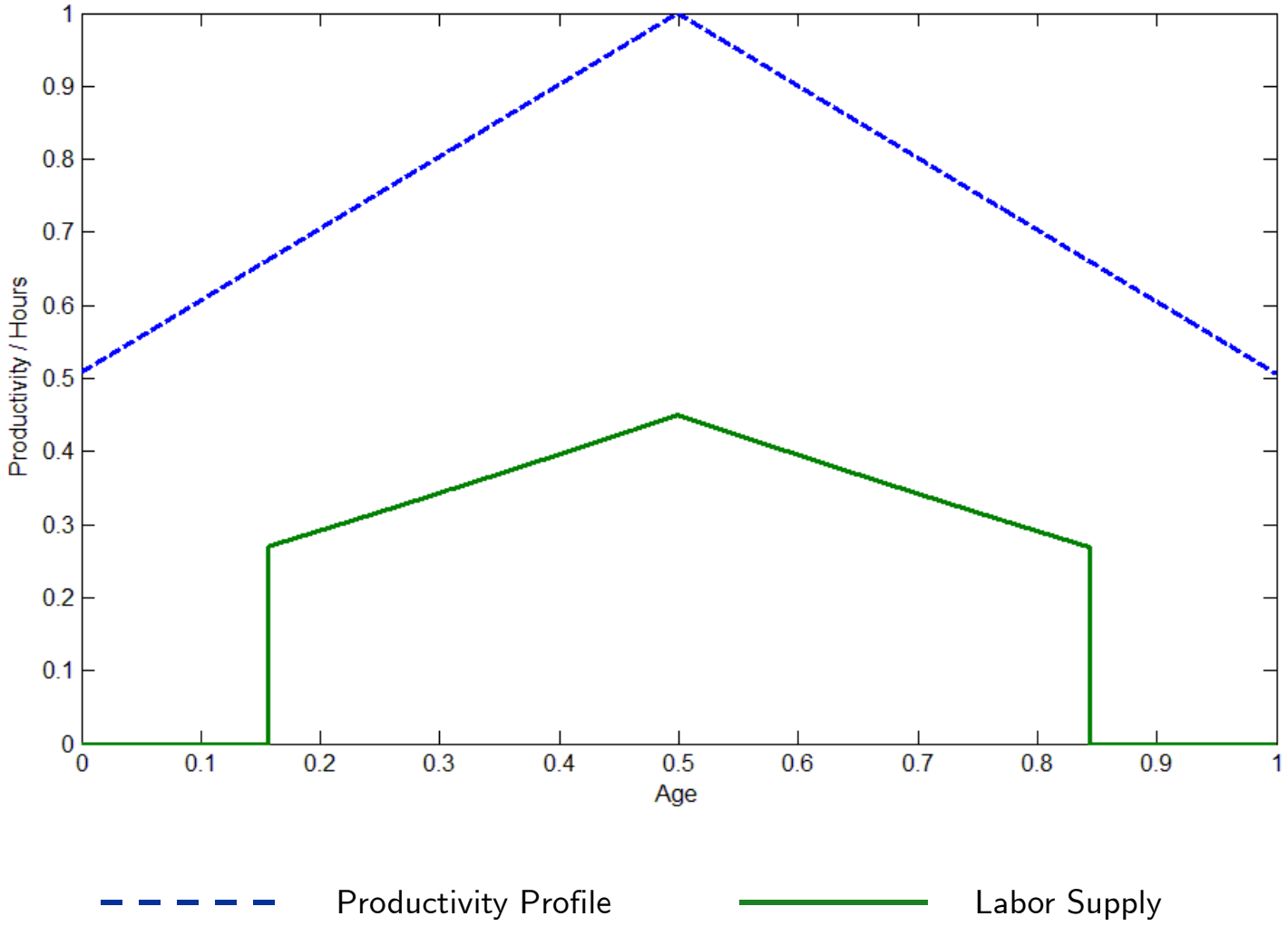
Rogerson-Wallenius Model: Setup

- Each generation solves

$$\max_{c,h(a)} \log(c) - \alpha \int_0^1 \frac{h(a)^{1+\gamma}}{1+\gamma} da \quad \text{s.t. } c = (1-\tau) \int_0^1 e(a) \max(h(a) - \bar{h}, 0) da + T$$

- Initial hours yield no return ($\bar{h} > 0$) → extensive margin
- Convexity of disutility of labor ($\gamma > 0$) → intensive margin
- RW calibration of {$\bar{h}$, γ, α, e(a)} generates:
  - Intensive Frisch elasticity $= 1/\gamma = 0.5$
  - Aggregate hours Frisch elasticity > 2
- We calibrate model to match labor force participation rate in pre-period

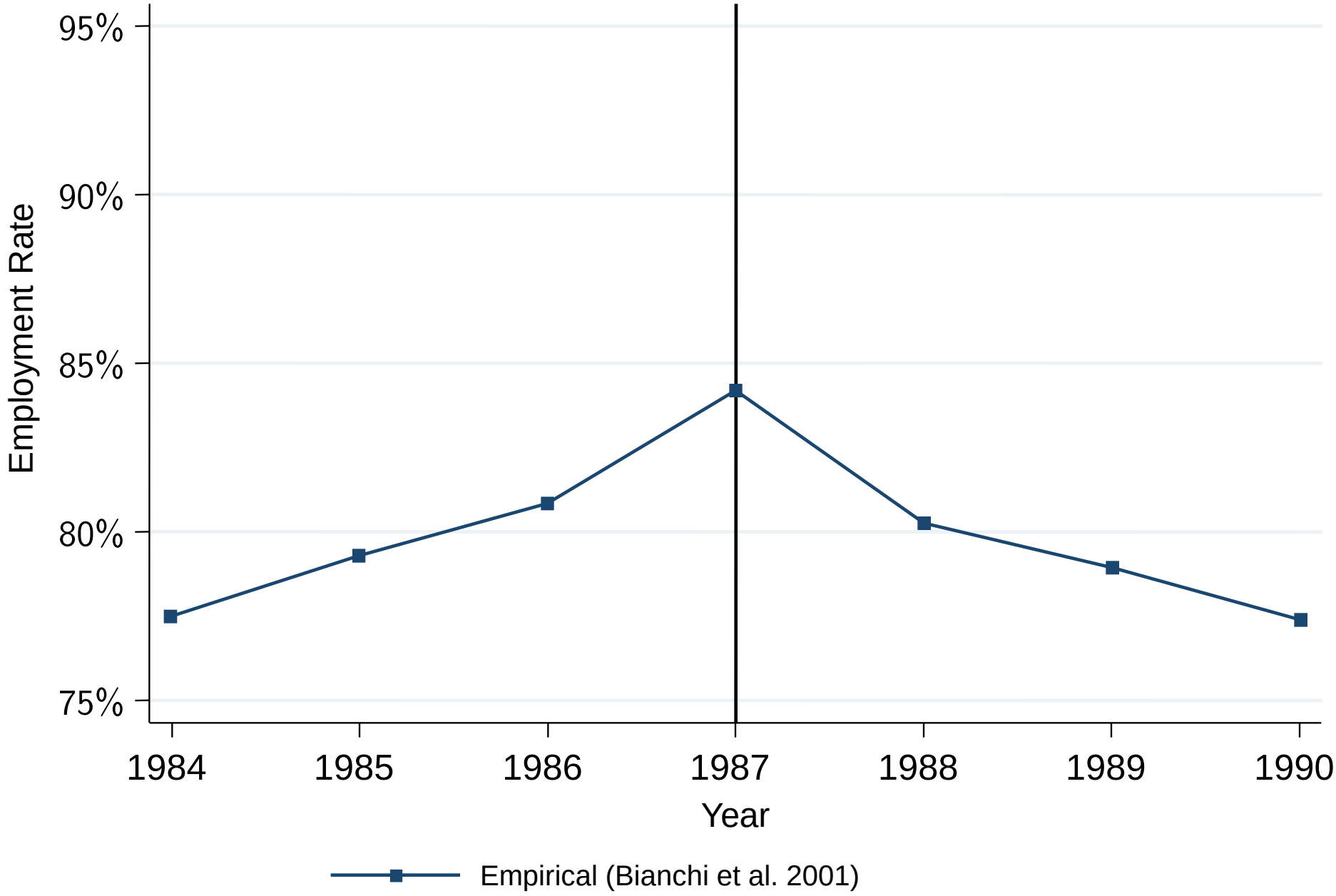
Rogerson-Wallenius Model: Setup



Experiment 1: Tax Holiday in Iceland

- In 1987, Iceland transitioned from paying taxes on previous year's income to current earnings
- Average tax rate of 14.5% in 1986, 0% in 1987, 8% in 1988
- Announced in late 1986 → unanticipated temporary tax change
- Temporary change in incentives → ideal quasi-experiment to estimate Frisch (intertemporal substitution) elasticity
- Compare impacts predicted by RW model on employment to empirical estimates of Bianchi et al. (AER 2001)

Figure 1: 1987 Tax Holiday in Iceland



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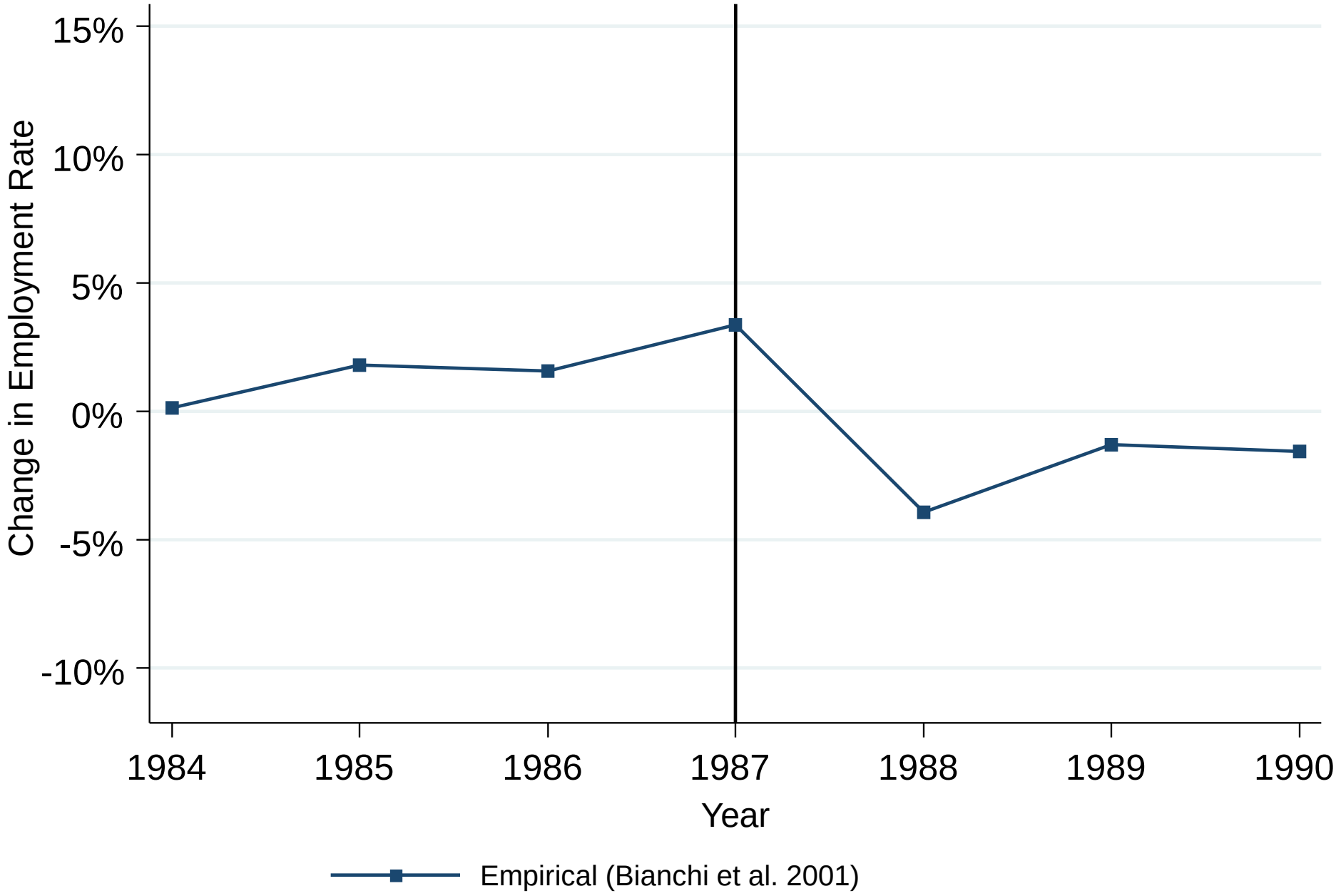

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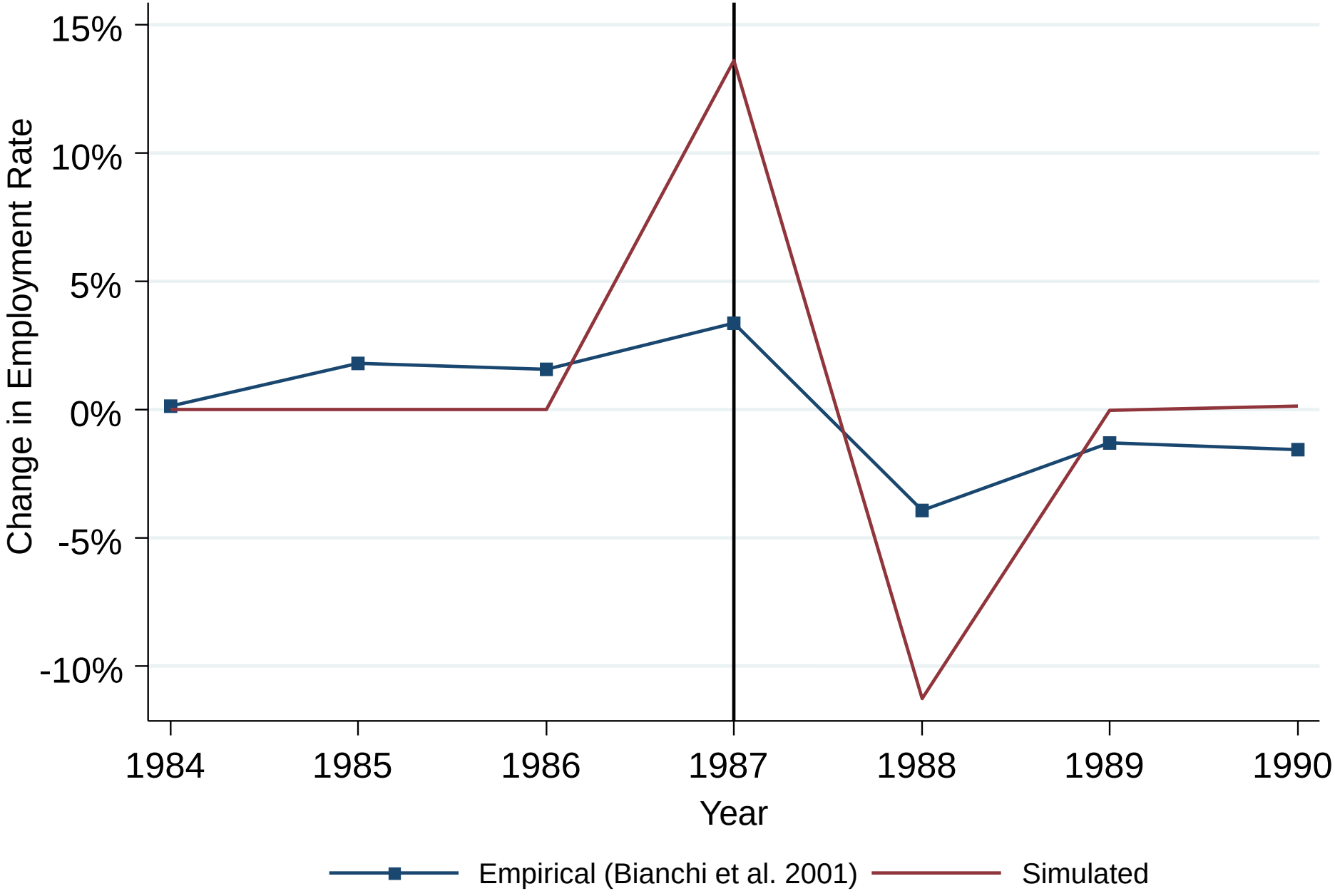
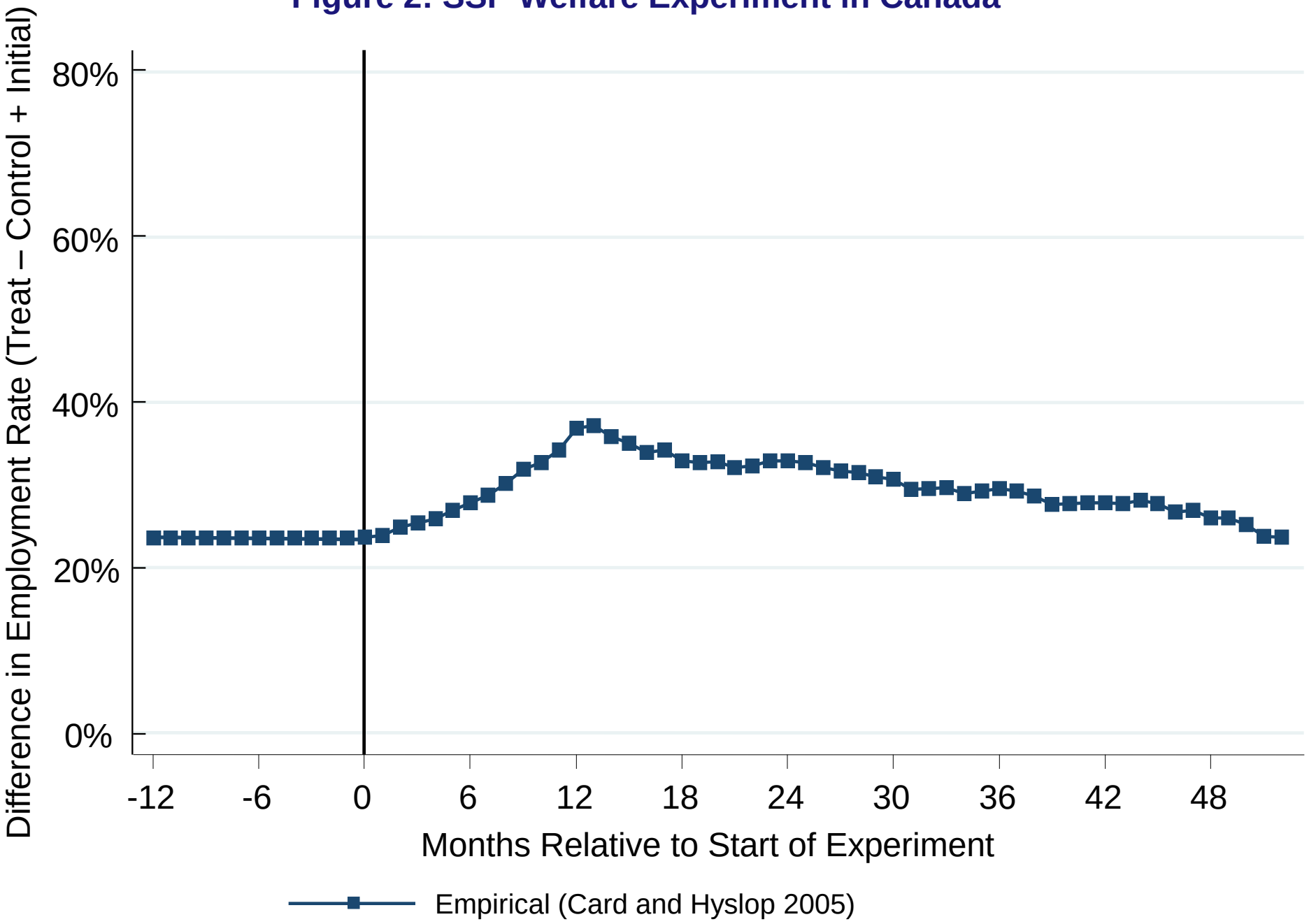


Experiment 2: Welfare Demonstration in Canada

- Some subgroups – e.g. near retirement or low wage – are more elastic on extensive margin
- Does the RW model predict responses for these groups more accurately?
- Canadian Self Sufficiency Project: randomized experiment that gave welfare recipients an earnings subsidy for 3 years in 1990s
- 3-year temporary tax cut from average rate of 74.3% to 16.7%
- Compare to empirical estimates of Card and Hyslop (ECMA 2005)

Figure 2: SSP Welfare Experiment in Canada



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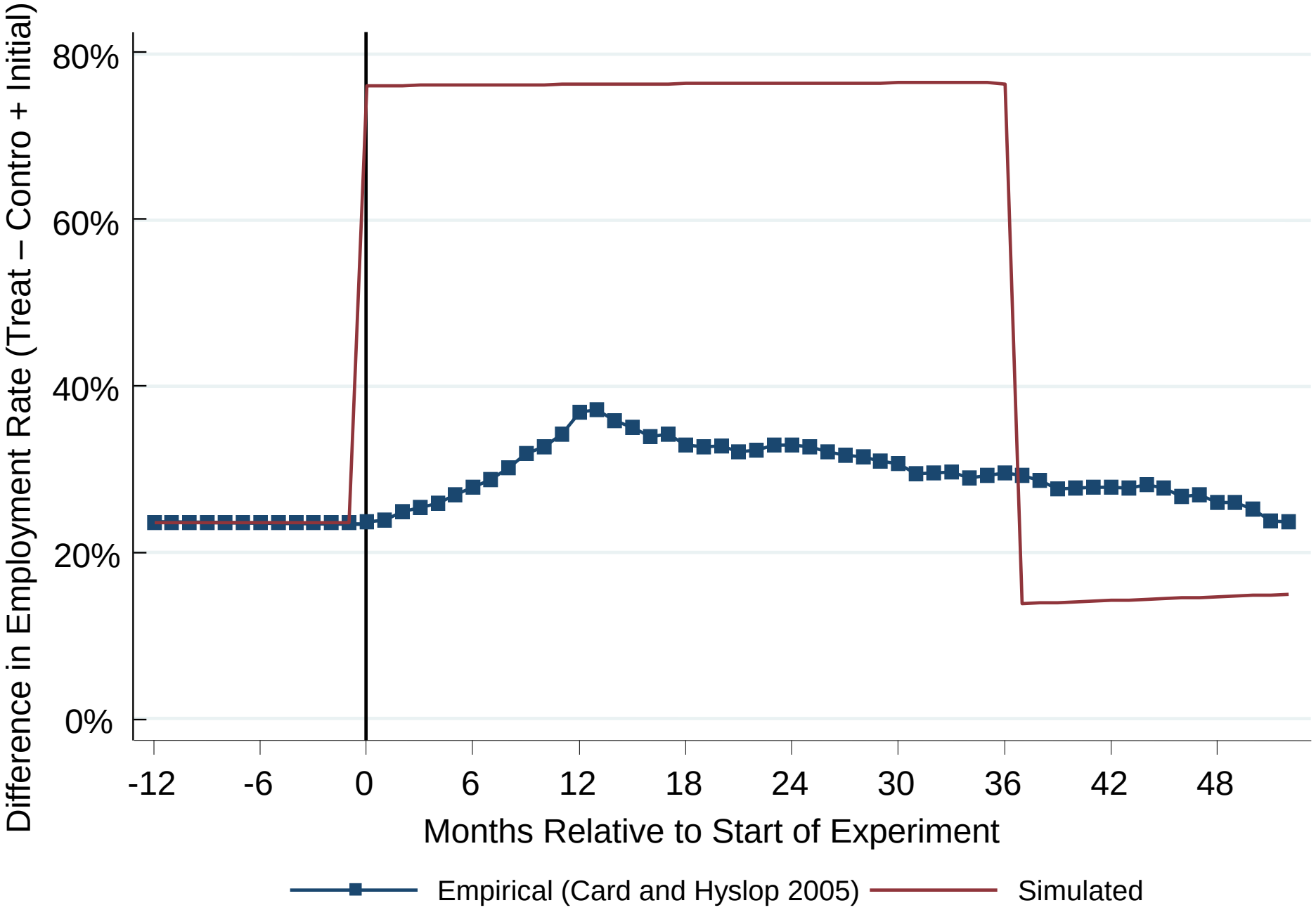


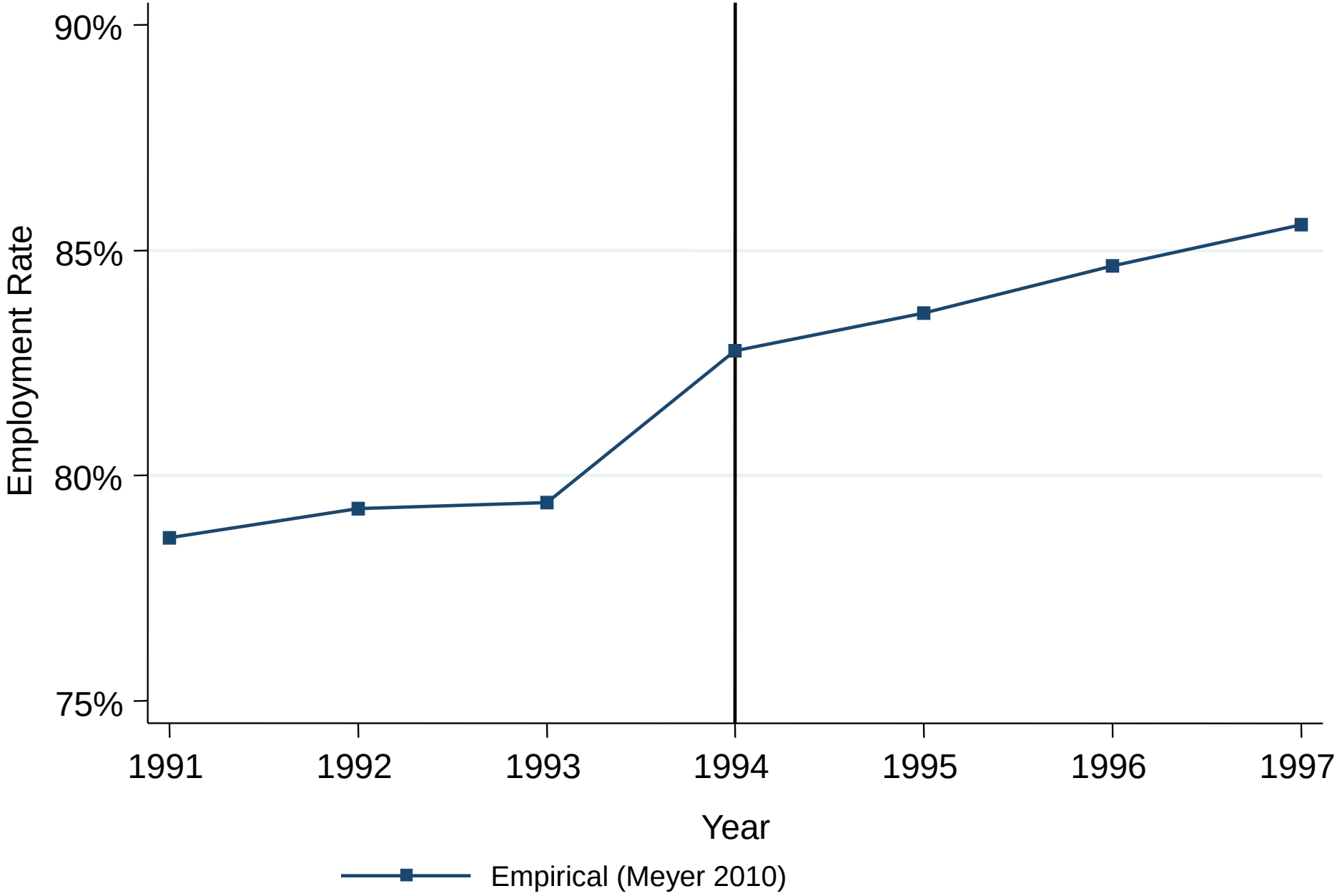
What Generates The Large Spike?

- In OLG model, fraction of cohorts close to being indifferent between working and not working is large
    - Temporary increase in net-of-tax wage rates induces large group of agents to work
    - Precisely the mechanism that generates a large Frisch elasticity in the RW model
- General conclusion applies more broadly than RW model
    - Any model that generates large aggregate hours Frisch elasticity but has small intensive elasticity will overpredict response

Experiment 3: EITC Expansion in the US

- Experiments 1 and 2 focused on temporary tax changes and identified intertemporal substitution elasticities
- Now consider a permanent intervention whose impact is determined by Hicksian elasticity
- 1994 expansion of Earned Income Tax Credit permanently reduced effective avg. tax rates from 50.8% in 1992 to 43.6% in 1996 for single mothers
- Compare RW model prediction to empirical estimates of Meyer and Rosenbaum (QJE 2001), updated by Meyer (2010)

Figure 3: 1994 EITC Expansion in the United States



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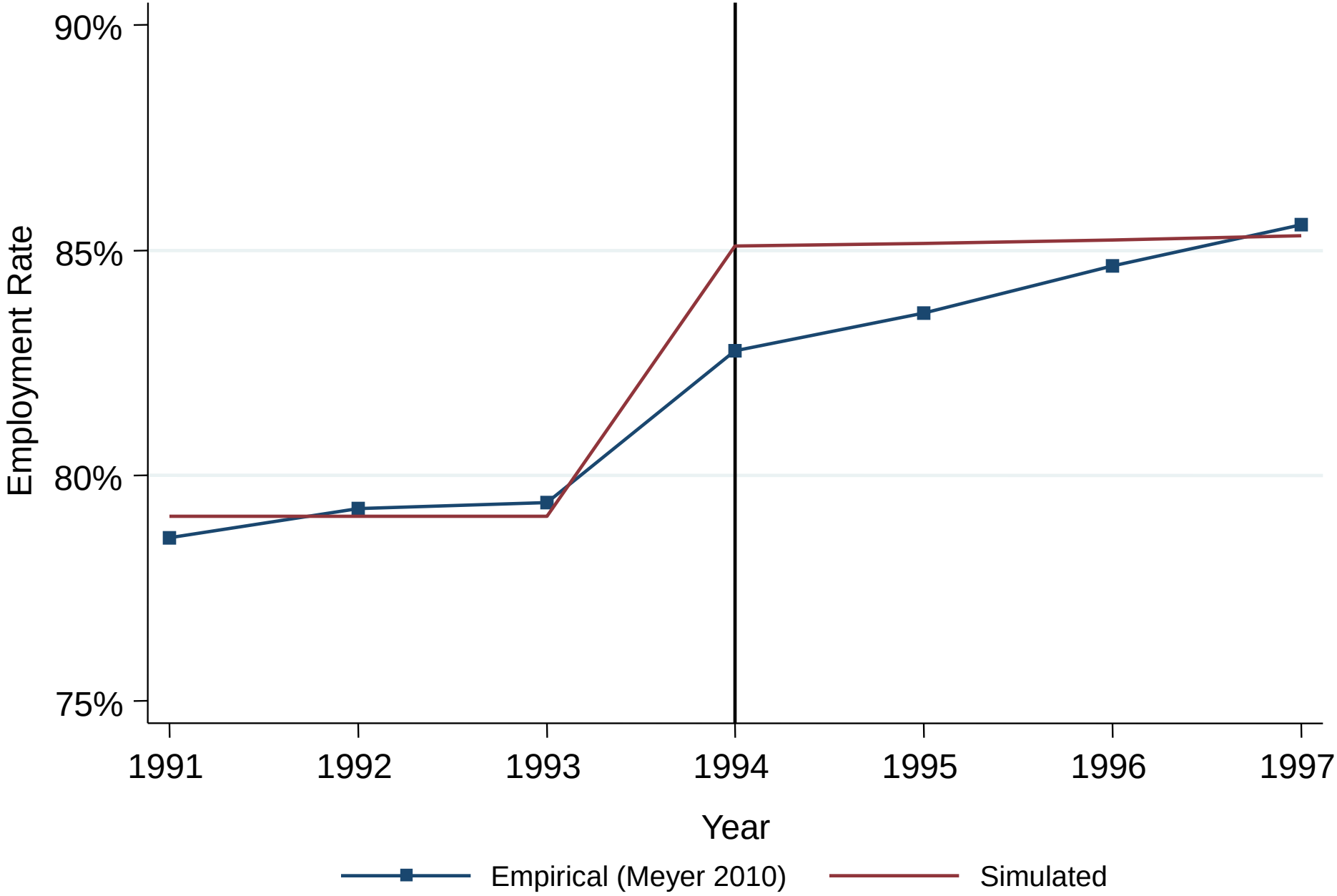

Steady-State vs. Intertemporal Substitution Elasticities

- Macro predictions about *steady-state* impacts of taxes on employment are much closer to micro estimates

- Why? RW model generates a much smaller Hicksian than Frisch elasticity
  - Permanent change → everyone works more in periods when they are most productive
  - Temporary change → large incentive to work more for all generations during tax cut
  - Individuals do not have strong preferences over *when* they work → large intertemporal substitution extensive elasticity
- Reducing intertemporal extensive elasticities to match micro evidence would eliminate ability to explain business cycle

Meta-Analysis of Extensive Margin Elasticities

- Are the three simulations representative of the broader literature?

- Meta-analysis of 15 quasi-experimental studies of extensive margin response
  - Span broad range of countries, demographic groups, time periods, and sources of variation
  - Studies capture partial equilibrium effects, netting out wage changes
  - Structural estimates not covered here; see Keane and Rogerson (2010) for a review

- Extensive elasticity = Δlog employment rate/Δlog (1-avg tax rate)

Table 1: Quasi-Experimental Extensive Margin Elasticity Estimates

Study	Elasticity	Population and Variation
A. Steady State Elasticities		
1. Juhn, Murphy, and Topel (1991)	0.13	Men, skill-specific trends, ’71-’90
2. Eissa and Liebman (1996)	0.30	Single Mothers, U.S. ’84-’90
3. Graversen (1998)	0.24	Women, Denmark 1986 tax reform
4. Meyer and Rosenbaum (2001)	0.43	Single Women, U.S. Welfare Reforms ’85-’97
5. Devereux (2004)	0.17	Married Women, U.S. wage trends ’80-’90
6. Eissa and Hoynes (2004)	0.15	Low-Income Indivs., US EITC expansions ’84-’96
7. Liebman and Saez (2006)	0.15	Women with high inc. spouses, U.S. tax reforms ‘91-97
8. Meghir and Phillips (2010)	0.40	Low-Education Men, U.K. wage trends, ’94-’04
9. Blundell, Bozio, and Laroque (2011)	0.30	Prime-age Men and Women, U.K., tax reforms ’78-’07
Unweighted Mean Estimate	**0.25**	
B. Intertemporal Substitution Elasticities		
10. Carrington (1996)	0.43	Full Population of Alaska, Trans-Alaska Pipeline, 1968-83
11. Gruber and Wise (1999)	0.23	Men, Age 59, variation in soc. sec. replacement rates
12. Bianchi, Gudmunndsson, Zoega (2001)	0.42	Iceland 1987 zero tax year
13. Card and Hyslop (2005)	0.38	Single Mothers, Canadian Self Sufficiency Project
14. Brown (2009)	0.18	Teachers near retirement, Calif. Pension cutoffs
15. Manoli and Weber (2010)	0.25	Workers Aged 55-70, Austrian severance pay cutoffs
Unweighted Mean Estimate	**0.32**	

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Two Potential Concerns

- Concern #1: Quasi-experimental studies may not identify structural primitives of reservation wage distribution in models with frictions
    - Reduced-form estimates combine preferences and frictions
- If business cycle fluctuations induce similar variation, then reduced-form parameter may be the relevant sufficient statistic
    - "Structural" elasticity (e.g. using estimates from cab drivers or stadium vendors) not necessarily the right predictor
- Reduced-form estimates provide guidance on orders of magnitude
    - Approximately 0.25 is reasonable, above 1 is not

Heterogeneity in Elasticities

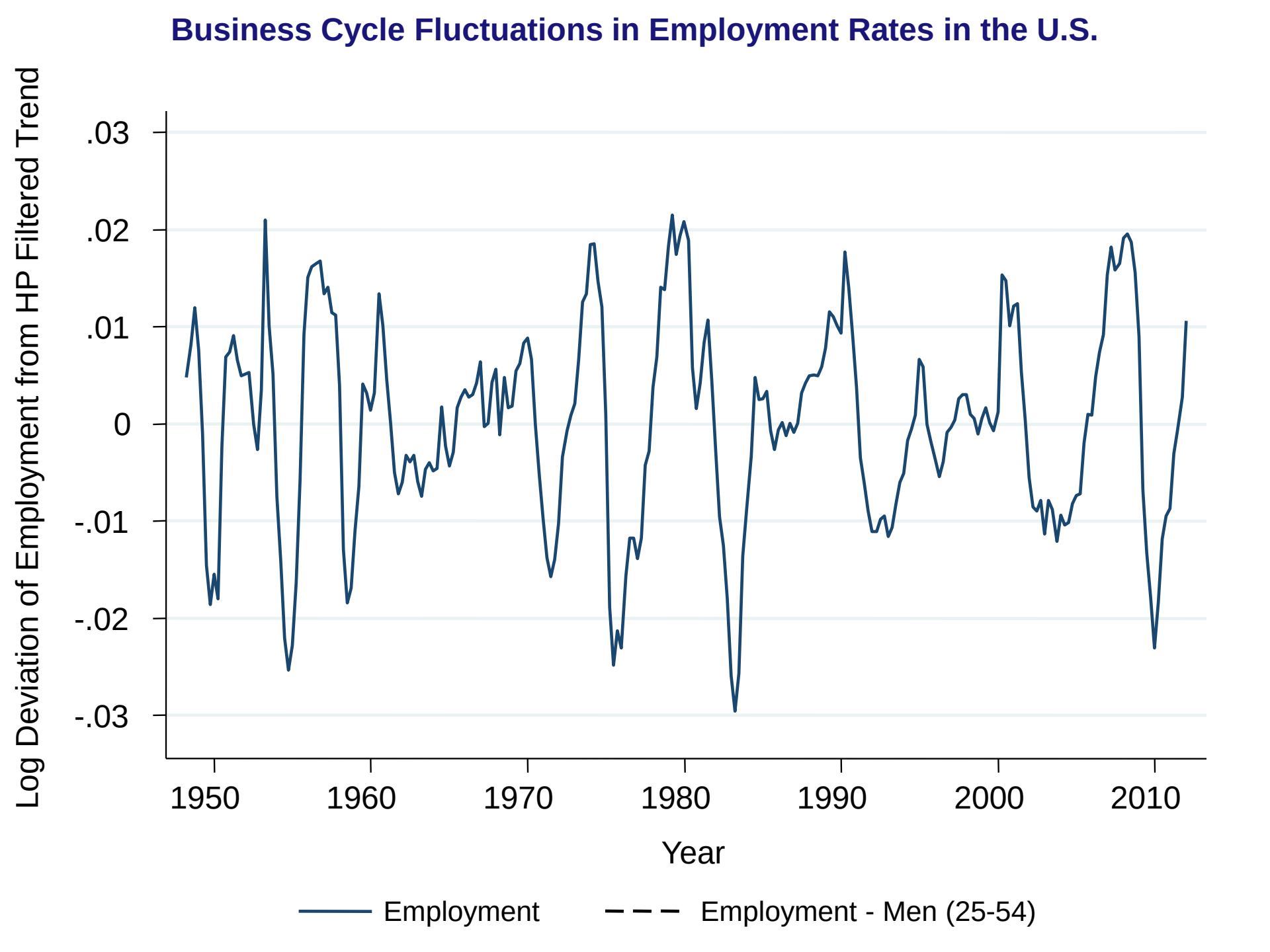
- Concern #2: Heterogeneity complicates mapping from micro to macro estimates (Chang and Kim, 2006 & 2007; Dyrda et al., 2012)
    - Elasticities higher for groups that are less attached to labor force (single mothers, workers near retirement)
    - Extensive elasticities near zero for prime-age workers
    - → Population average extensive elasticity likely below 0.25
- Same critique could be applied to intensive margin estimates
- Again, micro studies provide guidance on order of magnitude
    - Approximately 0.25 is reasonable, above 1 is not

Heterogeneity in Elasticities

- Heterogeneity across subgroups reinforces our conclusions

- Mirrors cross-country steady state comparisons
    - Employment rates vary the most across countries for those near-retirement and secondary earners (Rogerson and Wallenius 2009, Blundell, Bozio, and Laroque 2011)

- But amplifies discrepancy between micro and macro estimates of extensive intertemporal substitution elasticities
    - Fluctuations in employment rates substantial even for prime-age men (Clark and Summers 1981; Jaimovich and Siu 2009)
    - But micro estimates of extensive elasticities are near zero for this large group


Business Cycle Fluctuations in Employment Rates in the U.S.
Log Deviation of Employment from HP Filtered Trend
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1950
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1970
1980
1990
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2010
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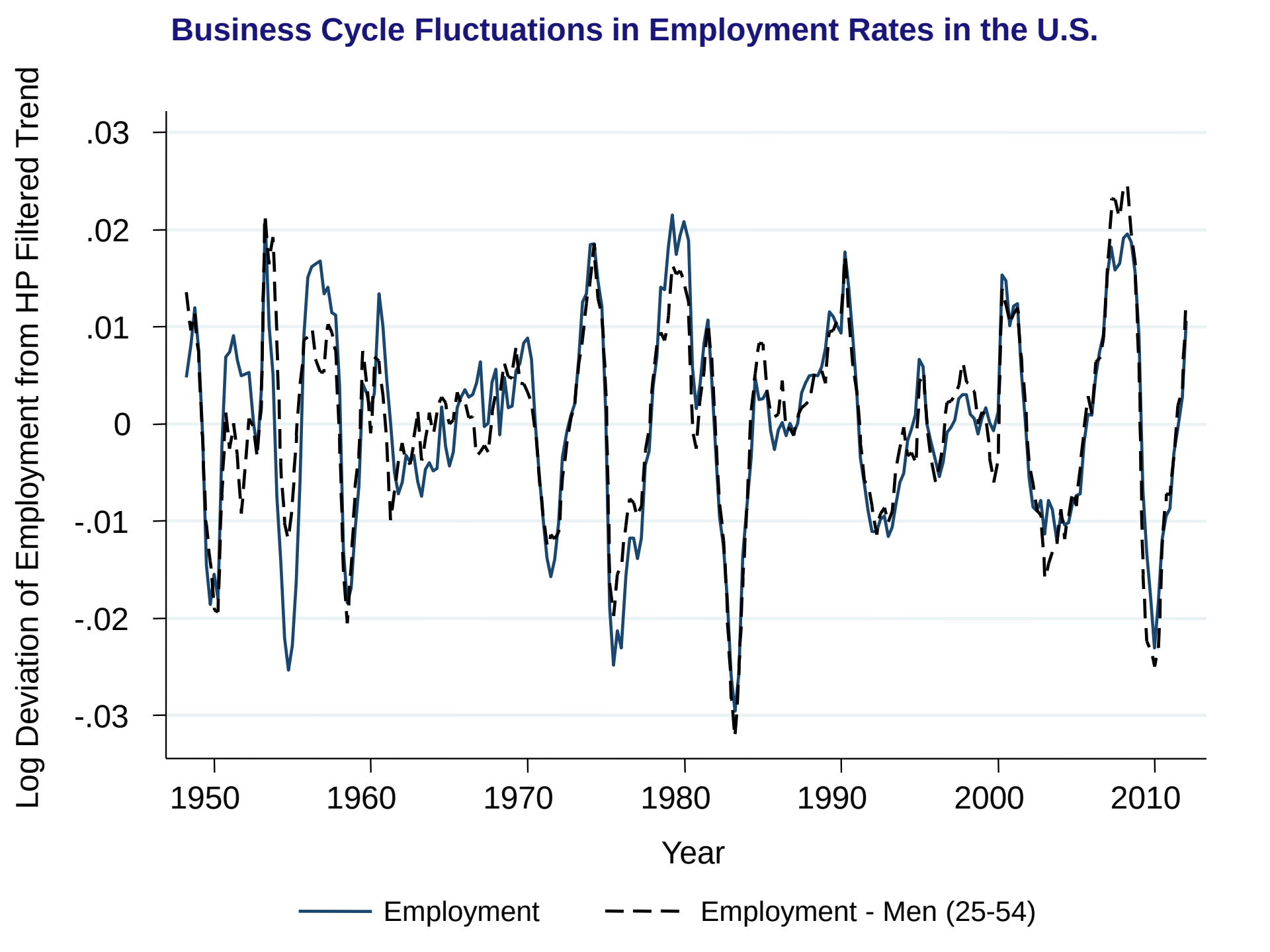
Employment - Men (25-54)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Comparing Macro and Micro Elasticities

- Are extensive margin elasticities around 0.25 adequate to reconcile the gap between micro and macro elasticities?
- Compare micro and macro estimates of intensive and extensive elasticities
- Large confidence intervals + methodological disputes
  - Differences of 1 reflect fundamental discrepancies
  - Differences of 0.1 in estimates could be due to specification or statistical error

Table 2: Micro vs. Macro Labor Supply Elasticities

		Extensive Margin	Intensive Margin	Aggregate Hours
Steady State (Hicksian)	micro			
	macro			
Intertemporal Substitution (Frisch)	micro			
	macro			

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	macro	0.17		
Intertemporal Substitution (Frisch)	micro			
	macro			

Micro: meta analysis in this paper

Macro: Nickell (2003), Prescott(2004), Davis and Henrekson (2005) cross-country

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	macro	0.17	0.33	
Intertemporal Substitution (Frisch)	micro			
	macro			

Micro: Chetty (2012) meta analysis of intensive-margin quasi-experimental elasticities, adjusting for optimization frictions

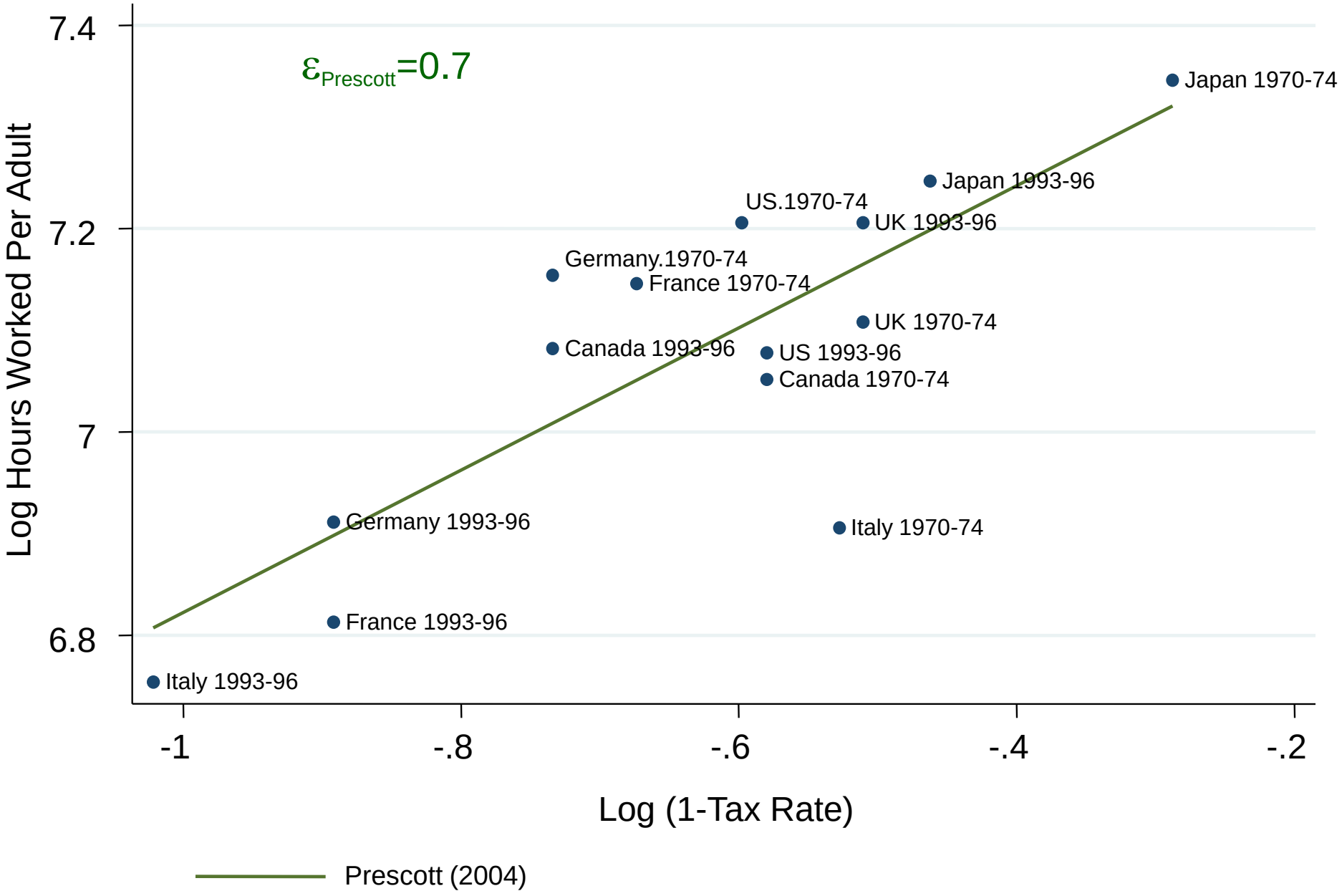
Macro: Prescott (2004), Davis and Henrekson (2005) cross-country

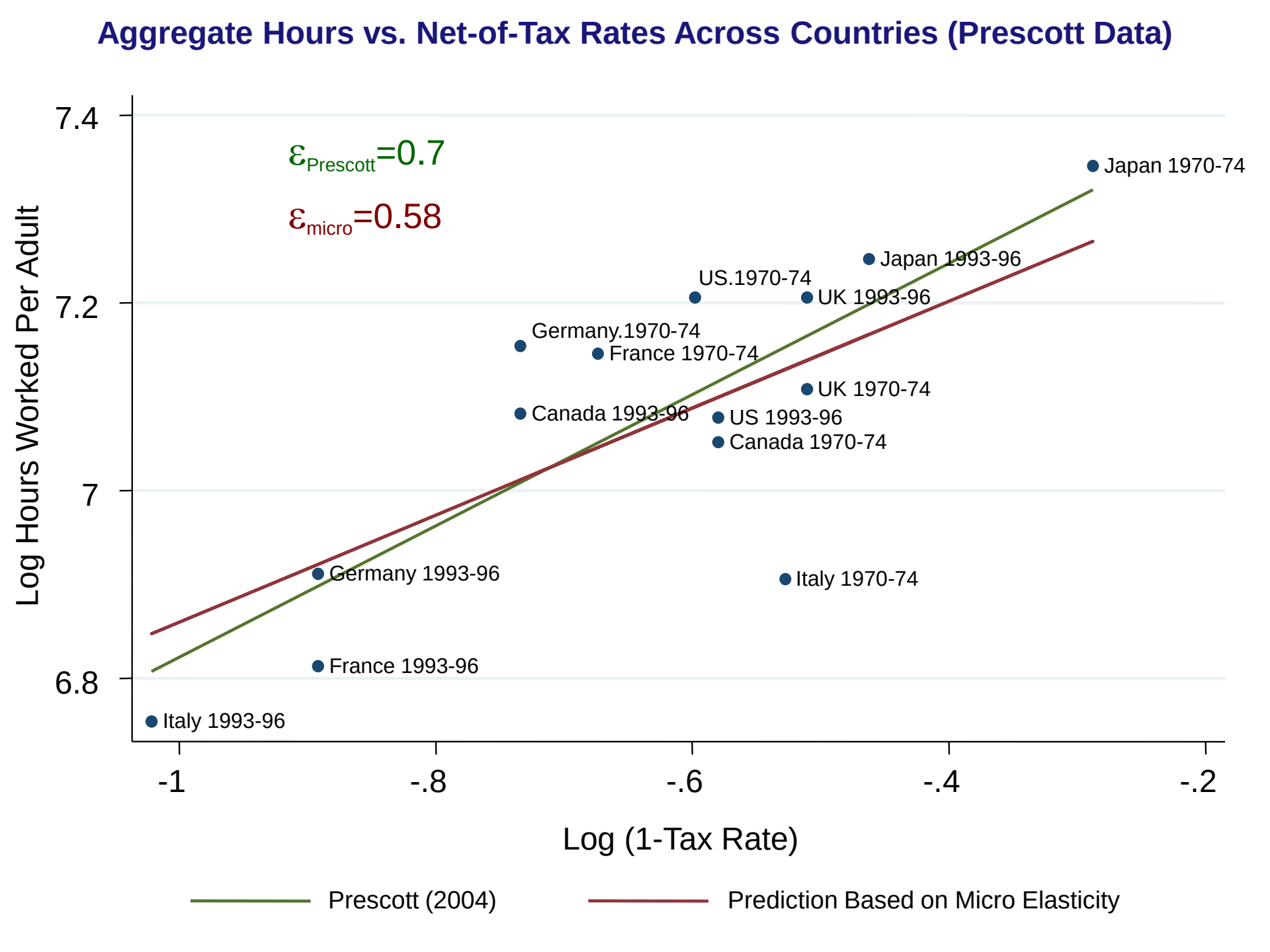
Table 2: Micro vs. Macro Labor Supply Elasticities

		Extensive Margin	Intensive Margin	Aggregate Hours
Steady State (Hicksian)	micro	0.25	0.33	0.58
	macro	0.17	0.33	0.50
Intertemporal Substitution (Frisch)	micro			
	macro			

→ Indivisible labor + frictions reconcile micro and macro steady-state elasticities

Aggregate Hours vs. Net-of-Tax Rates Across Countries (Prescott Data)

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$\varepsilon_{Prescott}$=0.7
ε_{micro}=0.58
Japan 1970-74
Japan 1993-96
US.1970-74
UK 1993-96
Germany.1970-74
France 1970-74
UK 1970-74
Canada 1993-96
US 1993-96
Canada 1970-74
Germany 1993-96
Italy 1970-74
France 1993-96
Italy 1993-96
7.4
7.2
7
6.8
Log Hours Worked Per Adult
-1
-.8
-.6
-.4
-.2
Log (1-Tax Rate)
Prescott (2004)
Prediction Based on Micro Elasticity

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Intertemporal Substitution (Frisch)	micro			
	macro			3.31

Macro aggregate hours elasticities:

Real business cycle -- 4 (King and Rebelo 1999);

2.61 (Cho and Cooley 1994)

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Intertemporal Substitution (Frisch)	micro		0.54	
	macro		[0.54]	3.31

Micro: Bianchi et al. (2001), Pistaferri (2005)

Macro: set to match micro; consistent with Heckman (1984), Cho and Cooley (1994), Hall (2009)

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Intertemporal Substitution (Frisch)	micro	0.32	0.54	
	macro	[2.77]	[0.54]	3.31

Micro: meta analysis in this paper

Macro: 3.31 minus 0.54; consistent with Heckman (1984), Cho and Cooley (1994), Hall (2009)

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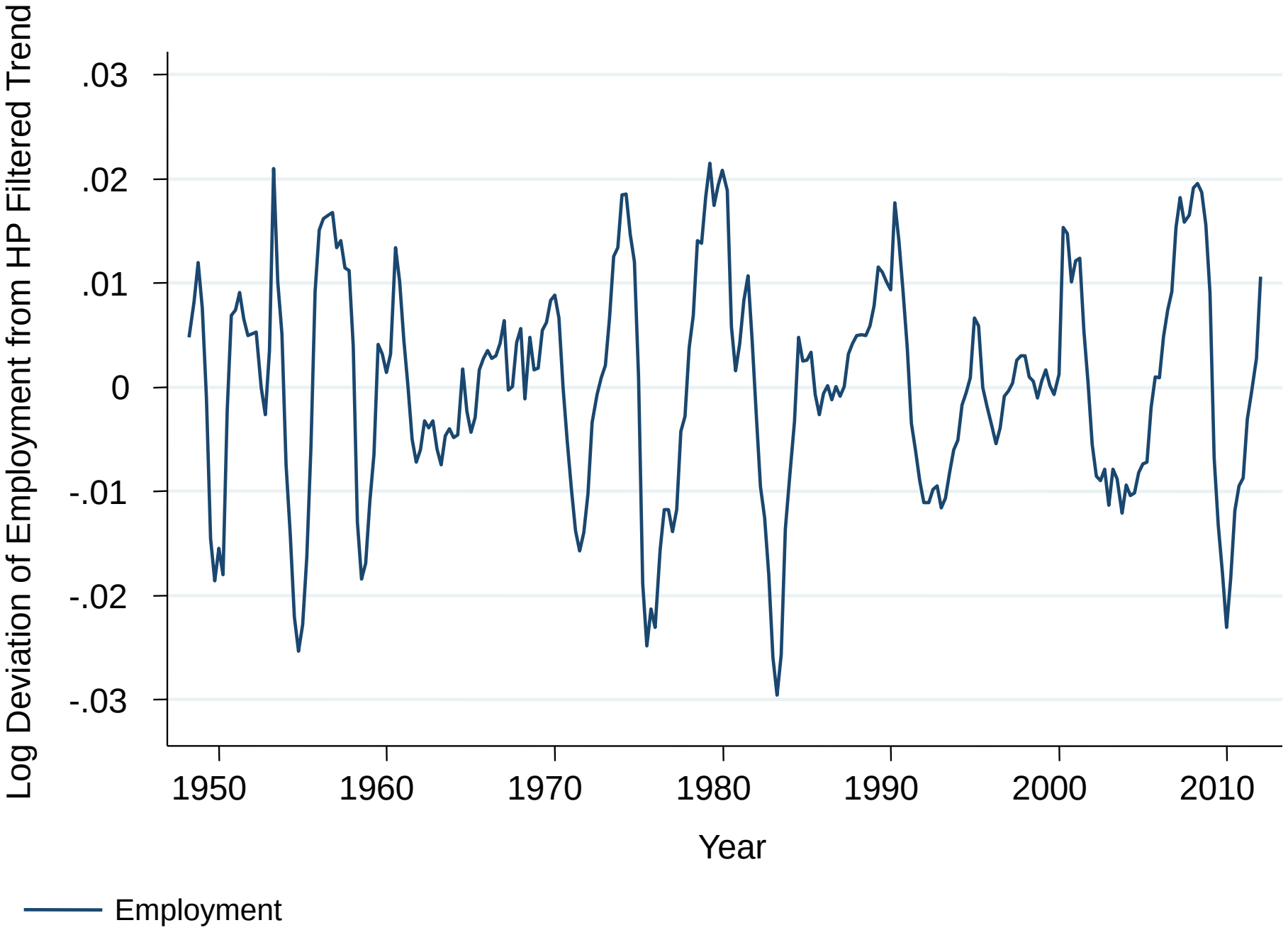

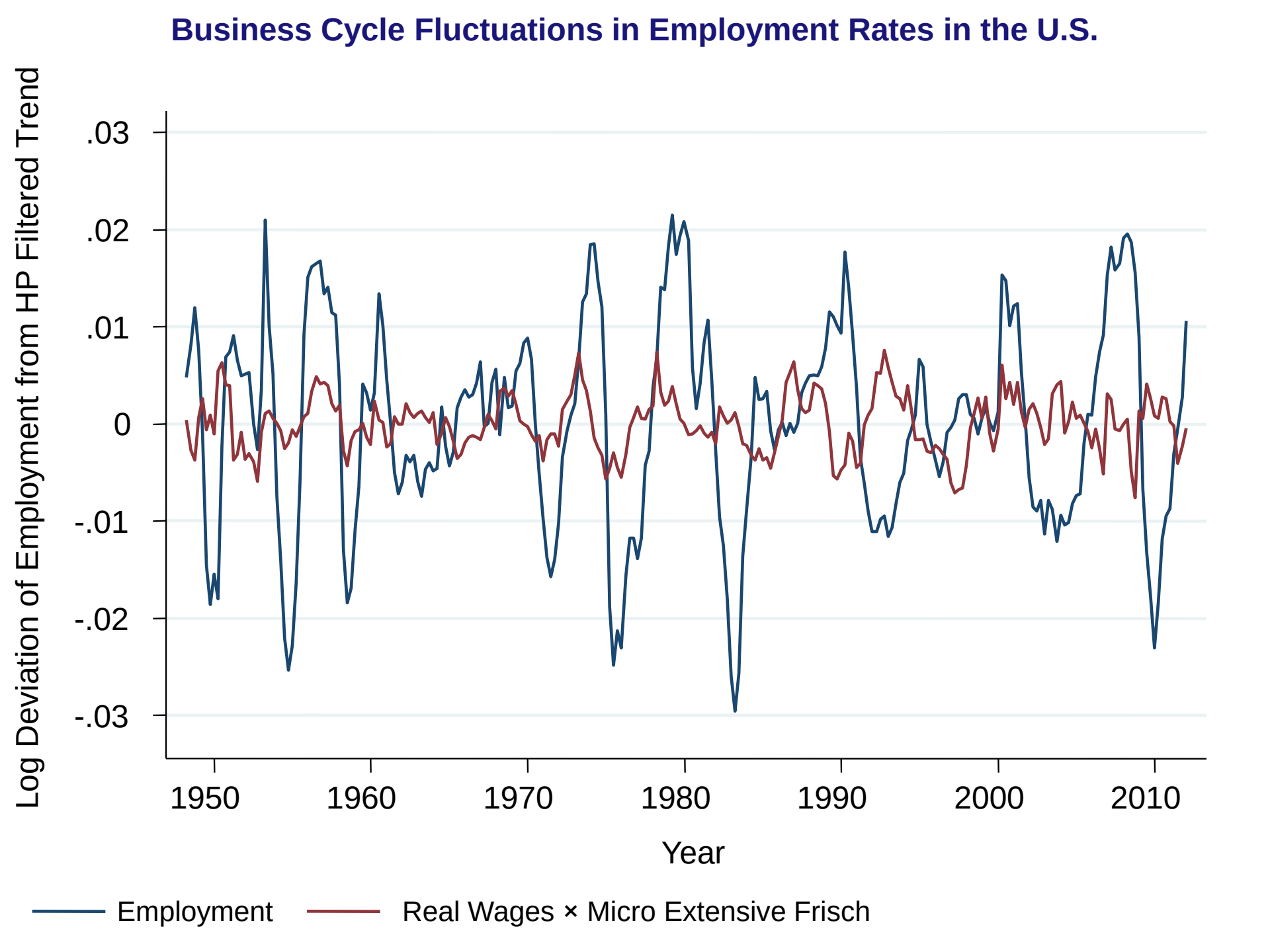
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	macro	[2.77]	[0.54]	3.31

→ Even with indivisible labor, Frisch elasticity of aggregate hours >1 is inconsistent with micro evidence

→ Challenge: matching employment flucs. with extensive Frisch of 0.3

- Search/labor wedge models provide one solution