A Tale of Two Workers: The Macroeconomics of Automation

Nir Jaimovich, Itay Saporta-Eksten , Henry Siu , Yaniv Yedid-Levi

UZH & CEPR, TAU & UCL, UBC & NBER, IDC

May 2019

Motivation: why are we here?

- Automation, computing, robotics ("automation technology"):
  - These words have become part of our everyday lexicon as the processes behind them have transformed the nature of work.
- These advances have not only made us more productive:
  - Induce large-scale shifts in the types of jobs performed in the economy (e.g. Autor, Katz, and Kearney (2006)).

Motivation: why are we here?

- The U.S. economy has seen a sharp drop in the fraction of the population employed in Routine occupations:
  - Focused on a relatively narrow set of job tasks that can be performed by following well-defined instructions and procedures and which, by their nature, are prime candidates to be performed by new automation technologies.
- Routine occupations tend to represent middle-class jobs $\rightarrow$
  - Increasing polarization of the labor market, as employment shares have shifted toward non-routine cognitive occupations and non-routine manual occupations.

So what is new?

- Data: New (hopefully important) facts
- Quantitative Theory: Can it explain the key facts?
  - Yes...

So what is new?

- Data: New (hopefully important) facts
- Quantitative Theory: Can it explain the key facts?
  - Yes...
- How do we evaluate the types of **macro** policies that have been discussed yesterday?
- How do you run your business?

So what is new?

- Data: New (hopefully important) facts
- Quantitative Theory: Can it explain the key facts?
  - Yes...
- How do we evaluate the types of **macro** policies that have been discussed yesterday?
- How do you run your business?
  - Cost/Benefit
  - Welfare
  - Taxation
- $\rightarrow$ Policy evaluation: Use the model as a "lab"

What is Job Polarization?

A Quick Reminder: What is Job Polarization?

- **Non-Routine Cognitive** (high-skill): public relations manager, physician, financial analyst, teacher, computer programmer, economist

- **Routine** (Middle-Skill):
  - Cognitive: secretary, bank teller, retail salesperson, travel agent, mail clerk, office support worker, data entry keyer
  - Manual: machine operator, machine tender, fabricator/assembler, welder, mechanic, cement mason, dressmaker, butcher

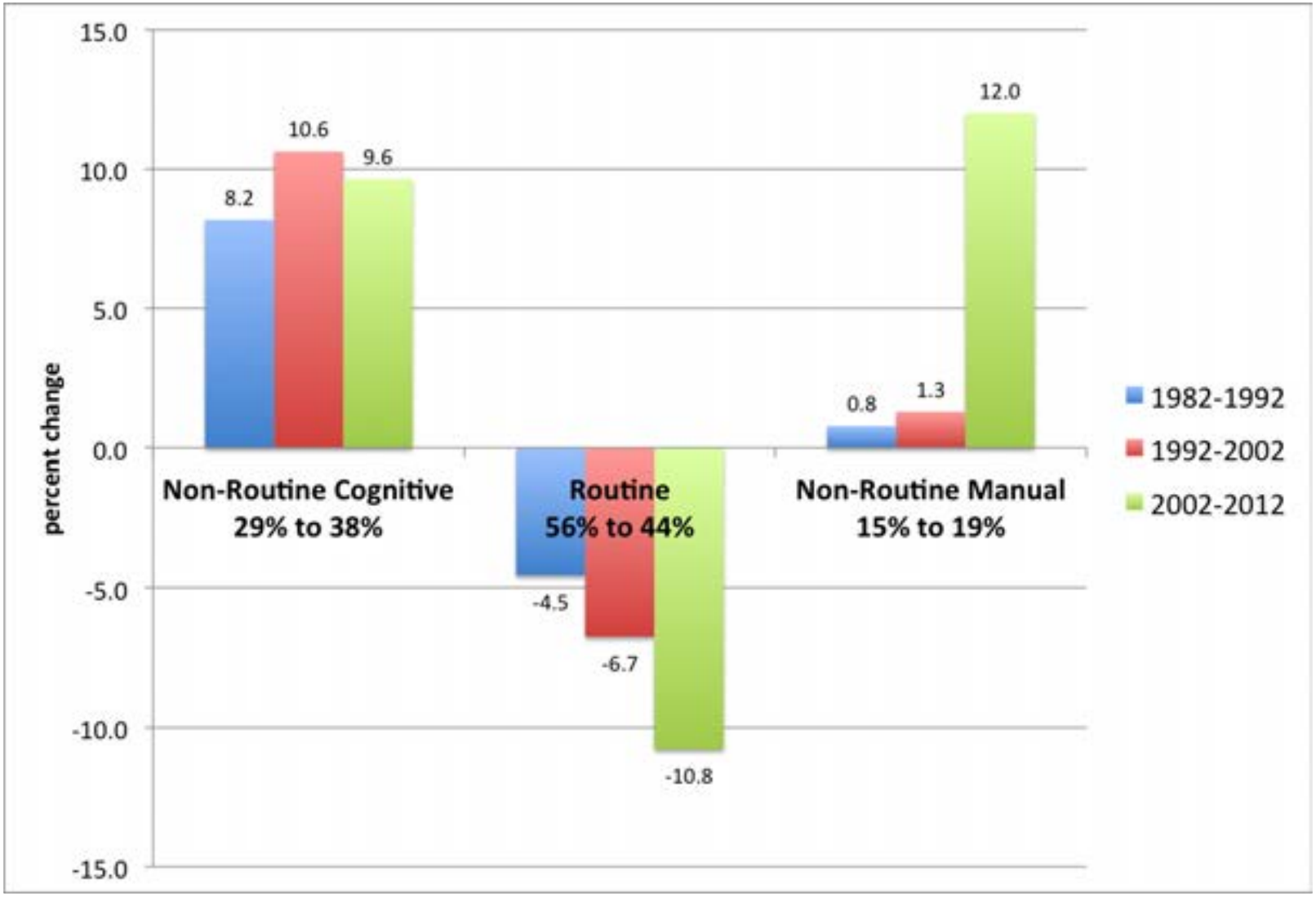
- **Non-Routine Manual** (low-skill): janitor, bus-boy, gardener, bartender, manicurist, personal care worker

A Quick Reminder: What is Job Polarization?

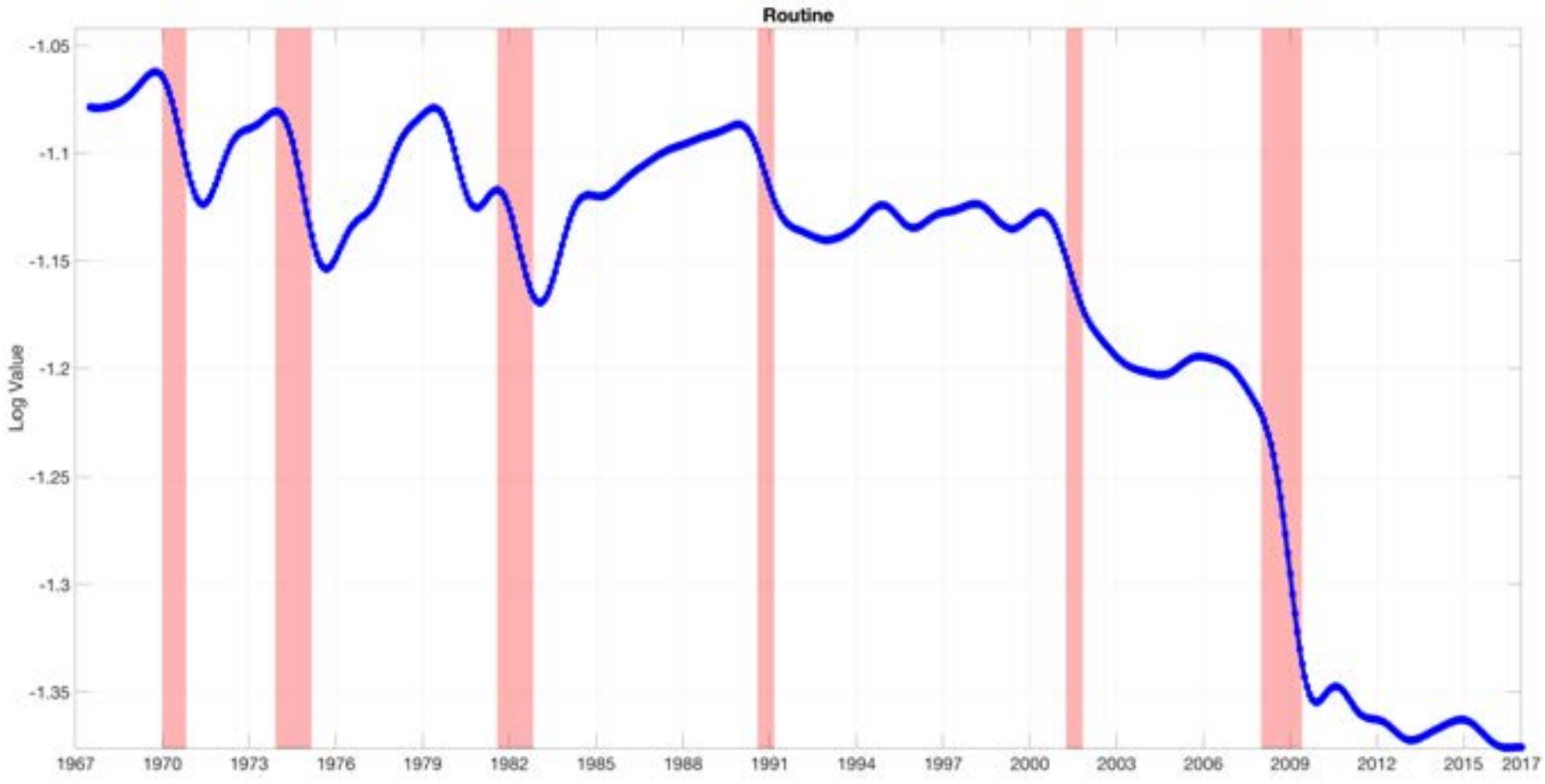
A Quick Reminder: What is Job Polarization?

A Quick Reminder: What is Job Polarization?

A Quick Reminder: What is Job Polarization?



A Quick Reminder: What is Job Polarization?



Job Polarization: According to Robert Steven Kaplan

WSJ, 10/10/2018

Job Polarization: According to Robert Steven Kaplan

WSJ, 10/10/2018

....In the middle ... two powerful forces going on, which are automation and globalization...

Job Polarization: According to Robert Steven Kaplan

WSJ, 10/10/2018

....In the middle ... two powerful forces going on, which are automation and globalization...

...The next thing CEO talk about is their plans to replace people with technology...oh my lord, you know, every industry is busy replacing people with technology and labor-saving devices

Job Polarization: According to Robert Steven Kaplan

WSJ, 10/10/2018

....In the middle ... two powerful forces going on, which are automation and globalization...

...The next thing CEO talk about is their plans to replace people with technology...oh my lord, you know, every industry is busy replacing people with technology and labor-saving devices

The concerning things are this issue of lagging education, lagging skills training .... that could take advantage of all this technology investment.. That's probably the primary concern I have

Data

What happened to people with "Routine Characteristics"?

- Study the evolution of people with Routine characteristics.
  - Have they become Economics professors?
  - Have they become janitors?
  - Have they simply stopped working?

What happened to people with "Routine Characteristics"?

- Study the evolution of people with Routine characteristics.
  - Have they become Economics professors?
  - Have they become janitors?
  - Have they simply stopped working?
- But wait a sec...what are "Routine characteristics"?

How to classify the routine workers?

- **This is a classical machine learning classification problem**

- Use pre-polarizartion data of employed (CPS 1984-1989) to train a "Random Forest Algorithm" to classify TYPES or workers:
  - Flexibly uses age, education, gender, race.
  - With an eye on the theoretical model, classify into:
    1. Non-routine-cognitive (NRC)
    2. Other occupations (Non-NRC; "Unskilled")

▸ Precision and Recall ▸ Extraction of clean series

Lost R are found in NLF (2/3) and NRM (1/3)

	"Unskilled"	
	(1)	(2)
	1989	2015
Fraction in R	**0.67**	**0.56**

Lost R are found in NLF (2/3) and NRM (1/3)

	"Unskilled"	
	(1)	(2)
	1989	2015
Fraction in R	**0.67**	**0.56**
Fraction in NRM	0.11	0.15

Lost R are found in NLF (2/3) and NRM (1/3)

	"Unskilled"	
	(1)	(2)
	1989	2015
Fraction in R	**0.67**	**0.56**
Fraction in NRM	0.11	0.15
Fraction in NLF	0.17	0.25

Lost R are found in NLF (2/3) and NRM (1/3)

	"Unskilled"	
	(1)	(2)
	1989	2015
Fraction in R	**0.67**	**0.56**
Fraction in NRM	0.11	0.15
Fraction in NLF	0.17	0.25
Fraction in NRC	~0	~0
Fraction in Unemployment	0.05	0.05
Unemployment rate	0.06	0.07
Population Weight	0.65	0.53

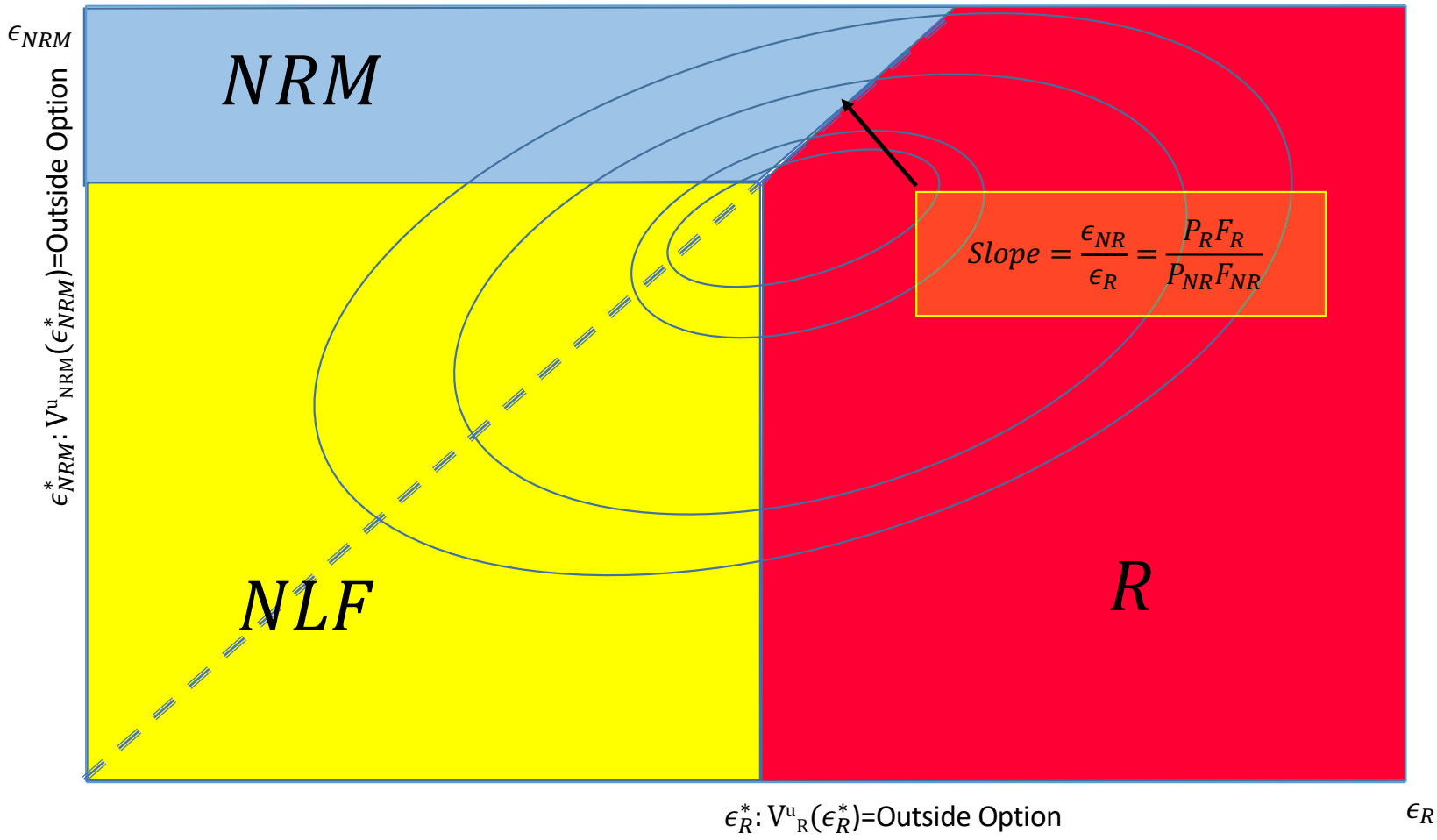
1. NLF accounts for 2/3 of the fall in ER, and ENRM for 1/3.
2. Employment at NRC and unemployment are stable.
3. Changes in NLF and NRM are NOT observed for NRC

Model

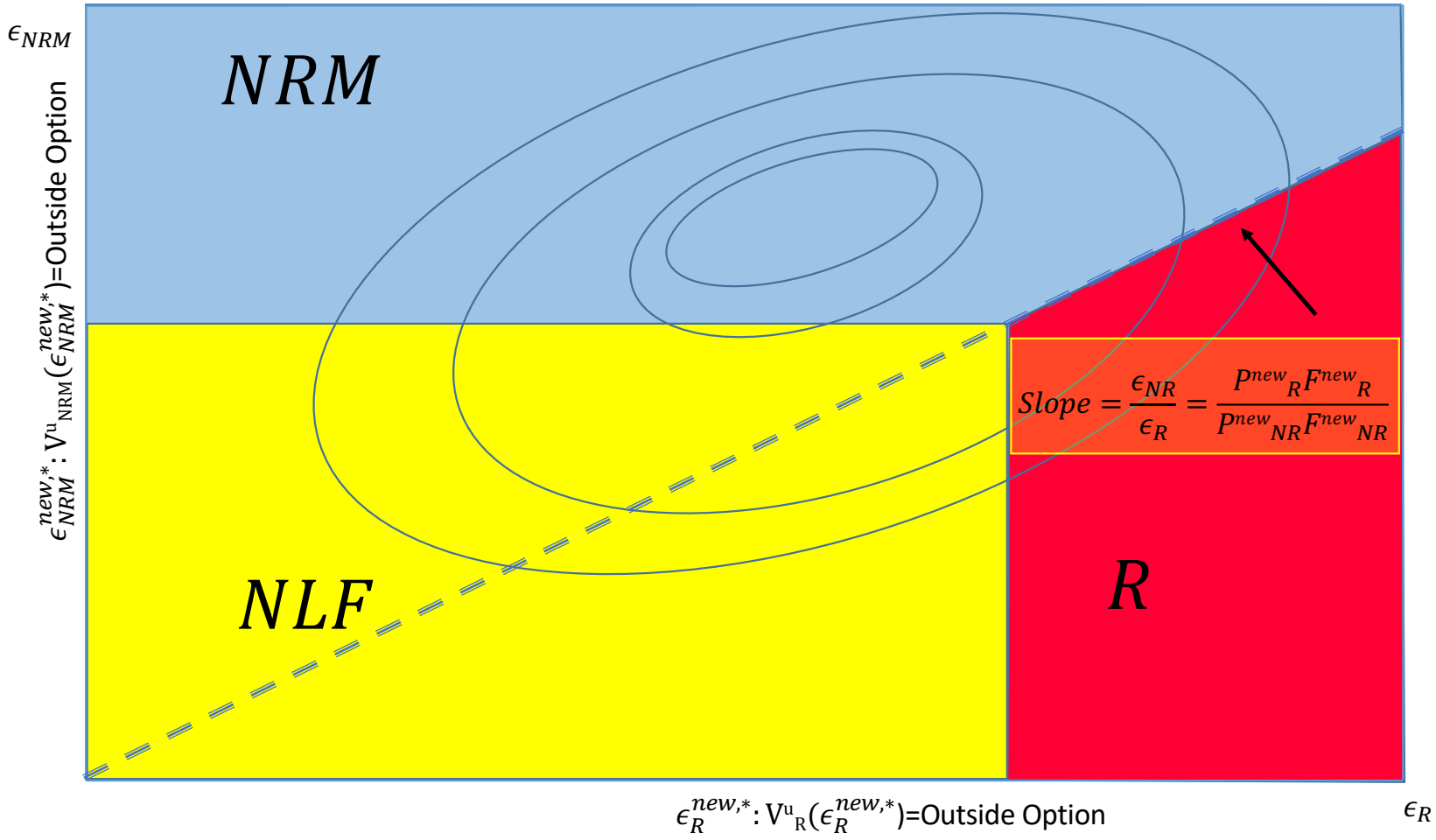
The Basic Story

- Workers have abilities as factory workers and personal care
- Given equilibrium prices, outside options, taxes, sort across:
  - Occupation (R,NRM)
  - Labor status (E,U,NLF)
- Optimal (profit maximization) decisions by firm
- In General Equilibrium: Everything is consistent....
- In technical terms: A GE Roy Model with lots of stuff...

The Basic Story



The Basic Story



Policies

- In equilibrium policies are statements about:
  1. Changes in the slope of the diagonal
  2. Potentially changing the ability distribution
  3. Potentially departing from a "straight" diagonal and introducing curvature

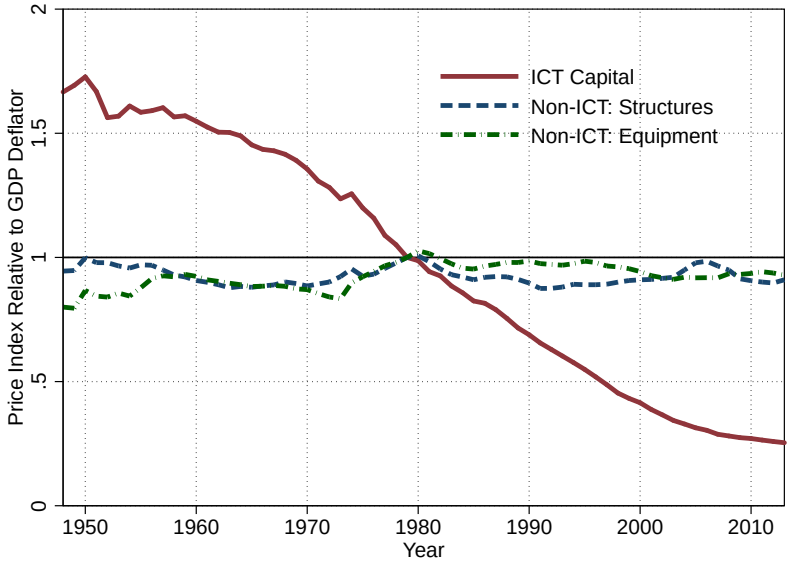
Description of the Model

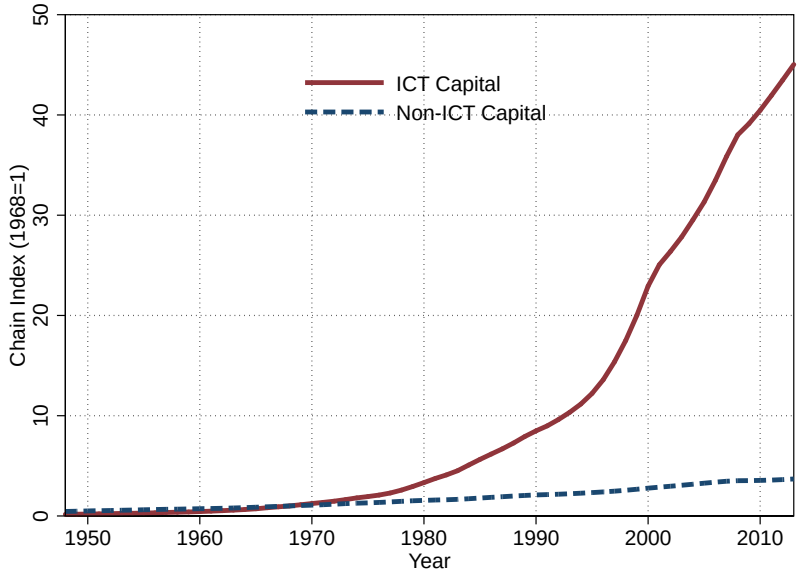
- How do we produce "stuff"?

$$Y_t = Z_t K_t^{\gamma} \left((1-\eta) \left[(1-\alpha) Y_{NRC,t}^{\frac{EOS1}{\nu}} + \alpha \left[X_A^{\nu} + Y_{R,t}^{\nu} \right]^{\frac{EOS1}{\nu}} \right]^{\frac{EOS2}{EOS1}} + \eta Y_{NRM,t}^{EOS2} \right)^{\frac{1-\gamma}{EOS2}}$$

- Two types of capital
  - **Important:** degree of adoption of ICT is **endogenous** in a GE model
  - Responds to shocks and policy $\rightarrow$ affects R
- Three occupations
  - Employment, Unemployment (DMP model) and LF

ICT Cost





Data: Eden and Gaggl (2018) from BEA detailed fixed asset accounts (quality adjusted *prices* and *stocks* of ICT)

Value Functions I

- Assume a worker with $\epsilon = \{\epsilon_R, \epsilon_{NR}\}$
- **Worker's value if employed in R:**

$$V_{e,R,\epsilon}(\Lambda) =$$

$$\max_{C_{e,R,\epsilon}} \left\{ \begin{array}{l} U(C_{e,R,\epsilon}) + \beta(1-\delta_R) \times \\ E[\max\{V_{e,R,\epsilon}(\Lambda'), V_{u,R,\epsilon}(\Lambda'), V_{u,NRM,\epsilon}(\Lambda'), V_{o,\epsilon}(\Lambda')\}] + \\ \beta\delta_R \times E[\max\{V_{u,R,\epsilon}(\Lambda'), V_{u,NRM,\epsilon}(\Lambda'), V_{o,\epsilon}(\Lambda')\}] \end{array} \right\}$$

$$\text{s.t. : } C_{e,R,\epsilon} = \omega_{R,\epsilon}(1 - T_{e,R,\epsilon}) + \text{Gov Transfer}$$

Description of the Model

- Basically: Tons of equations...
- But importantly: everything holds together in a GE model of the economy
- Can evaluate policies and the response of the economy

Model Results

Or: why should we care about the policy implications?

Moments to Remember

	Data	Model	Relevant Parameters
First Moments : Targeted			
Aggregate Labor Share	0.629	0.629	$\alpha, \eta, F_R, \tau_R$
Routine Labor Share	0.30	0.30	$\alpha, \eta, F_R, \tau_R$
ICT Share	0.029	0.029	$\alpha, \eta, F_R, \tau_R$
Indifference Condition	▸ Consistency		$\alpha, \eta, F_R, \tau_R$
Second Moments : Targeted			
Change in ratio of XA/ER	8.45	8.45	$\nu, EOS_1, \Delta\phi_A$
Fraction of ΔR: NLF	0.66	0.66	$\nu, EOS_1, \Delta\phi_A$
Relative fall in ϕ	0.4	0.4	$\nu, EOS_1, \Delta\phi_A$

Moments to Remember

	Data	Model
% Fall in ER	-0.18	-0.125

Moments to Remember

	Data	Model
% Fall in ER	-0.18	-0.125
Change in Labor Share: Agg	-0.0476	-0.041

Moments to Remember

	Data	Model
% Fall in ER	-0.18	-0.125
Change in Labor Share: Agg	-0.0476	-0.041
Change in Labor Share: R	-0.0961	-0.0804

Moments to Remember

	Data	Model
% Fall in ER	-0.18	-0.125
Change in Labor Share: Agg	-0.0476	-0.041
Change in Labor Share: R	-0.0961	-0.0804
Change in Labor Share: NRC	0.0417	0.039

Moments to Remember

	Data	Model
% Fall in ER	-0.18	-0.125
Change in Labor Share: Agg	-0.0476	-0.041
Change in Labor Share: R	-0.0961	-0.0804
Change in Labor Share: NRC	0.0417	0.039
Change in Labor Share: NRM	0.0067	0

Ok: looks like a good description of the economy! So what are the effects?!

The Effects of Automation

- Output increases by 13%
- Overall, economy wide: welfare increases by 2.5%

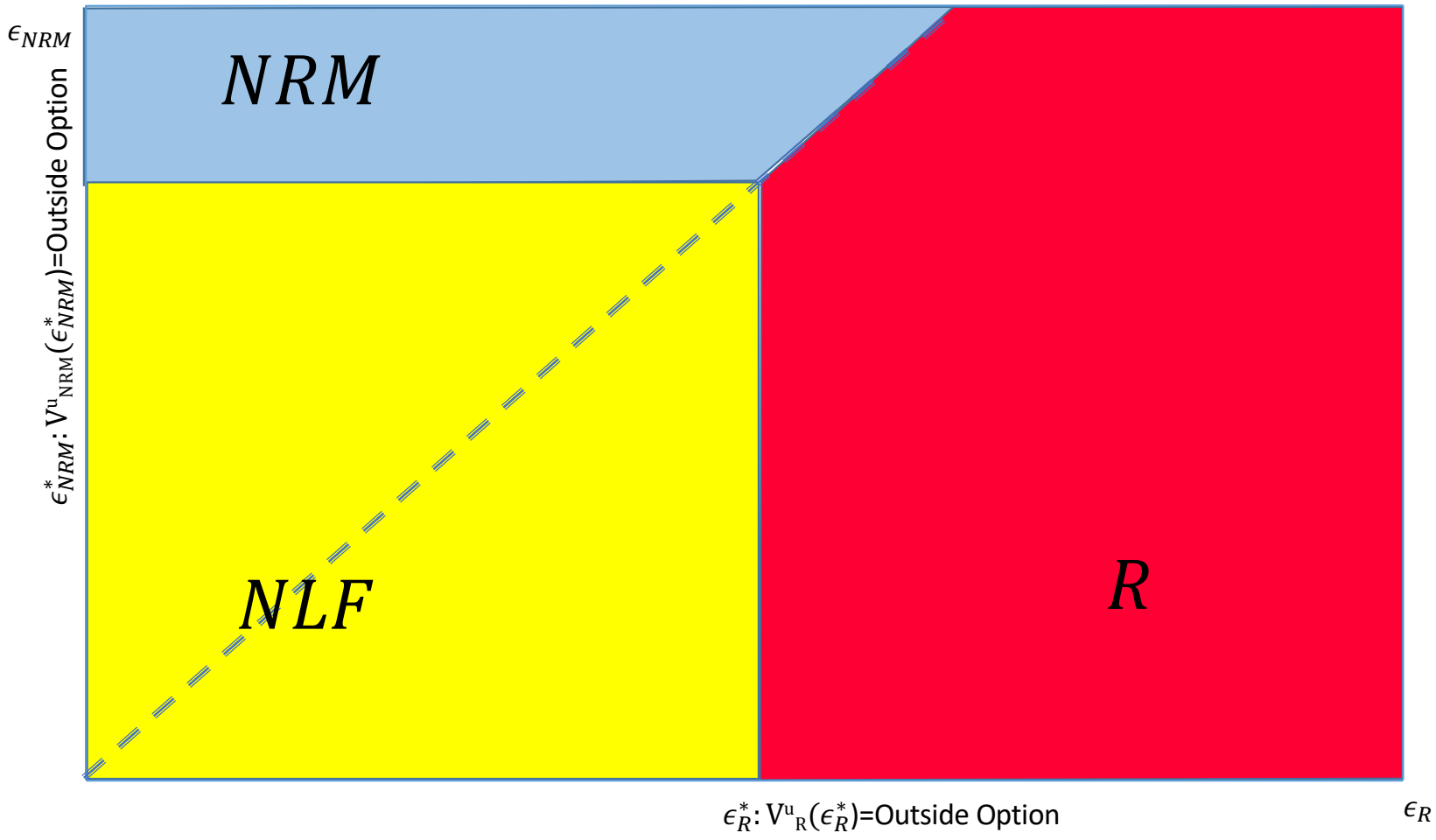
The Effects of Automation

- Output increases by 13%
- Overall, economy wide: welfare increases by 2.5%
- NRC: welfare increases by 25%
  - Labor market: benefit from complementarity with ICT
  - Hold firm equity

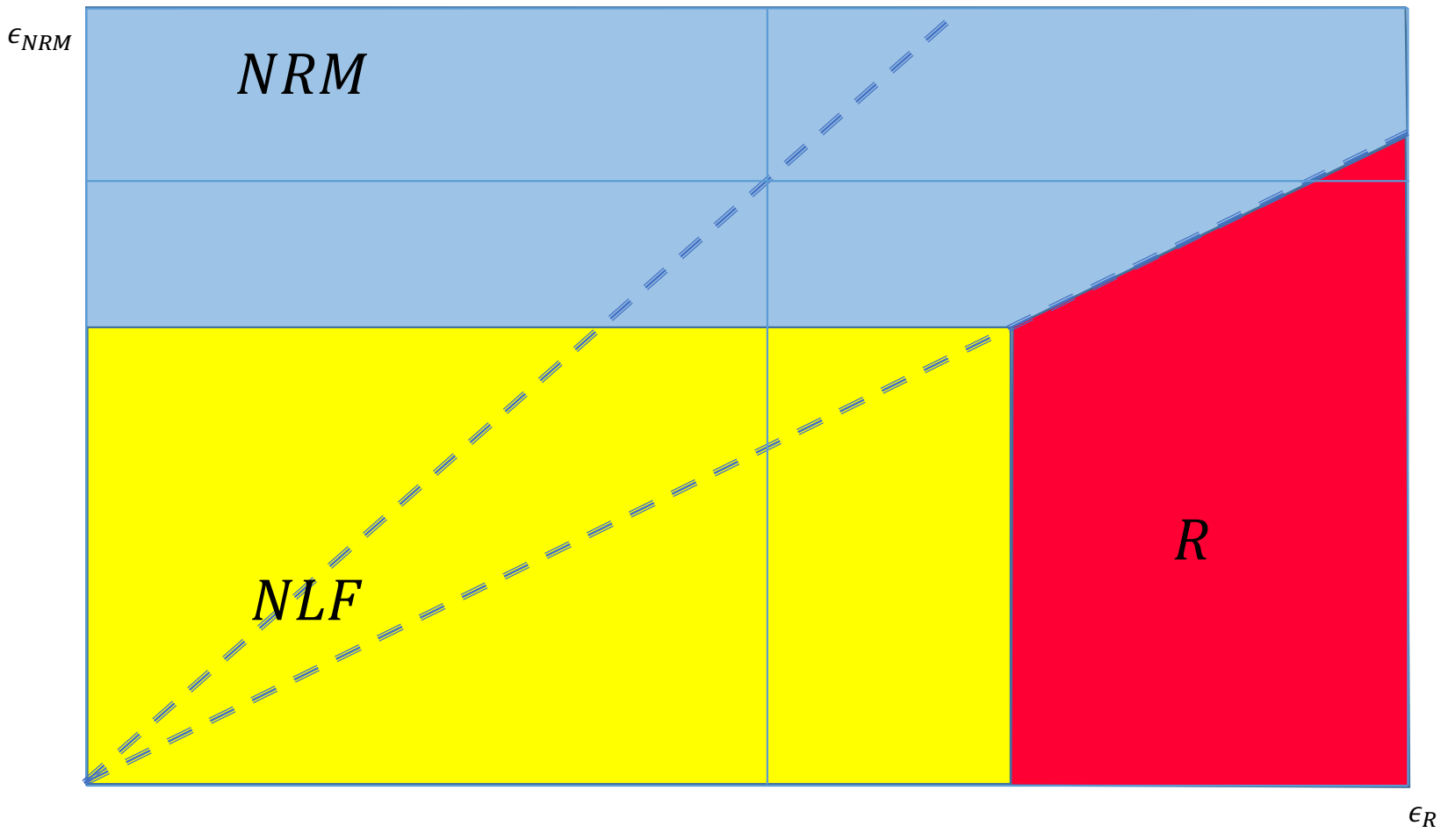
The Effects of Automation

- Output increases by 13%
- Overall, economy wide: welfare increases by 2.5%
- NRC: welfare increases by 25%
  - Labor market: benefit from complementarity with ICT
  - Hold firm equity
- But...for "Unskilled"
  - LF decreases by 4.5 pp
  - R falls by 6.5pp
  - NRM increases by 2pp

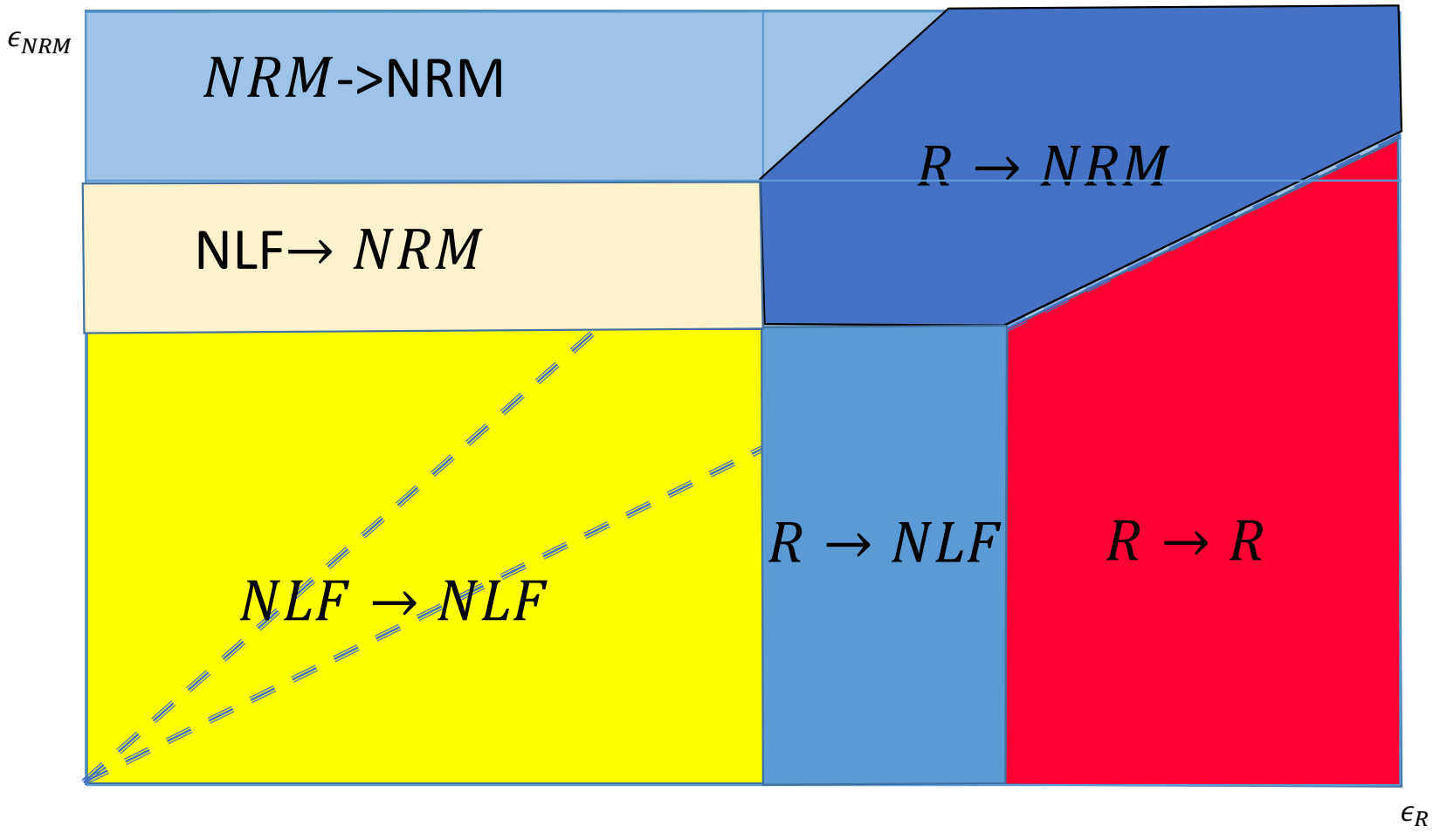
Welfare Results



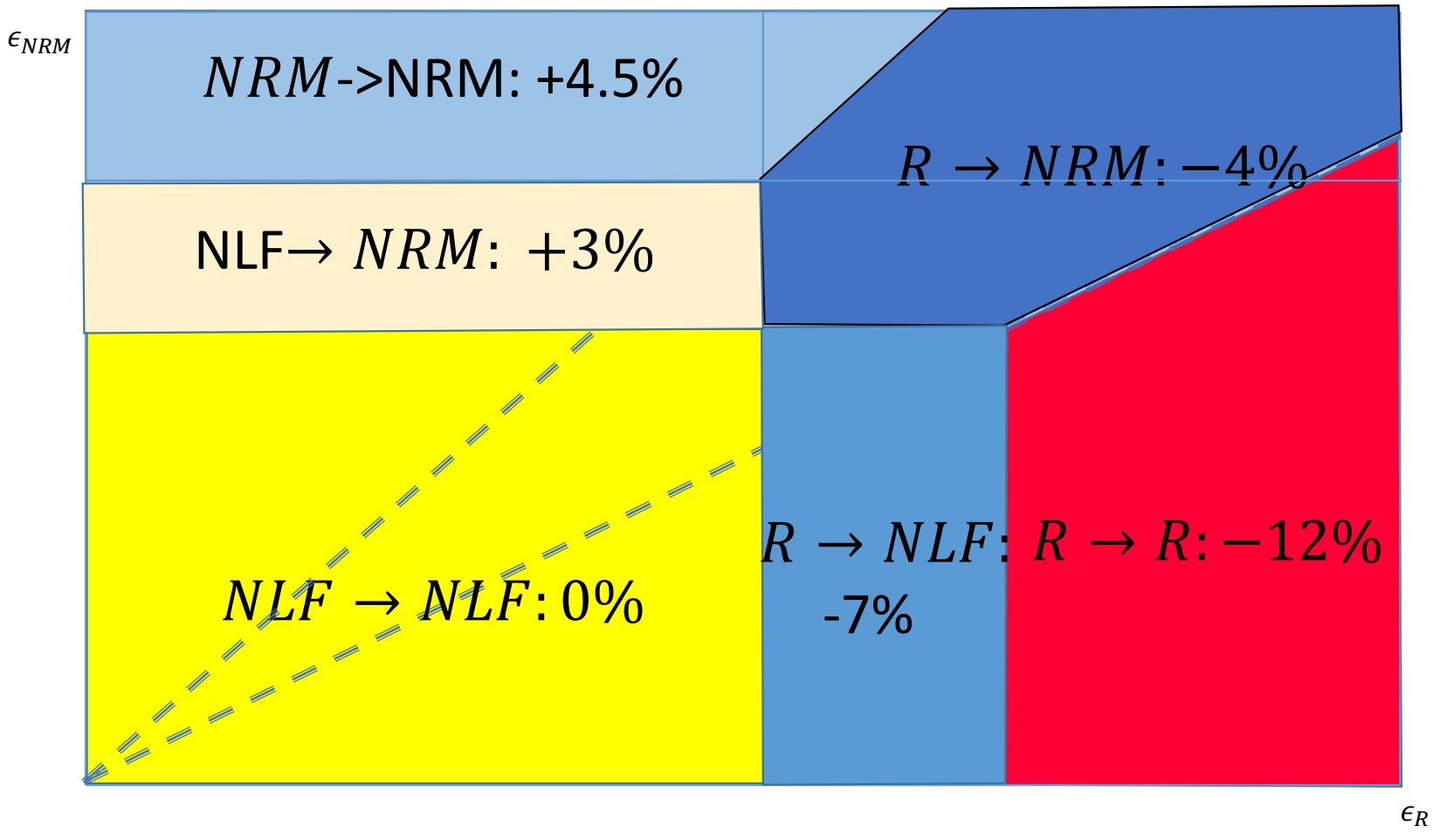
Welfare Results



Welfare Results



Welfare Results



Experiments: Return LF to Initial Level

Policy Experiments

- GE empirically relevant model: worthwhile to evaluate policies
- Unfortunately policies have to be financed...consider:
  - Profit taxation
  - Analyze the distributional consequences policies.

Policy Experiments: Two Sets of Policies

- Study the effects of policies that are aimed directly at counteracting the negative effects of ICT.
  - **ICT taxing**
  - Analyze the equilibrium consequences of policies that change the abilities of workers in the face of changes in ICT.
    1. **From MFG to Personal Care Worker (the skills of tomorrow)**
    2. From MFG to better MFG worker (the skills of yesterday)
    3. From MFG to Economist (the no skills?!)

Policy Experiments: Two Sets of Policies

- Study the effects of policies that could address challenges associated with employment disappearance
  - **Universal Basic Income: Two alternative methods**
  - Different reforms in unemployment insurance benefits
  - Changes in "Disability" transfers
  - Changes in minimum wages

Experiments

All you need to know about Robots Taxing

- Optimal ICT investment:

$$\phi_A = \frac{\beta}{(1 - \beta(1 - \delta_A))} MPA$$

Experiments

All you need to know about Robots Taxing

- Optimal ICT investment:

$$\phi_A = \frac{\beta}{(1-\beta(1-\delta_A))} MPA$$

$$\rightarrow (1+\tau_A)\phi_A = \frac{\beta}{(1-\beta(1-\delta_A))} MPA$$

- There is a tax that "turns back the clock"

Experiments

All you need to know about Robots Taxing

- Optimal ICT investment:

$$\phi_A = \frac{\beta}{(1-\beta(1-\delta_A))} MPA$$

$$\rightarrow (1+\tau_A)\phi_A = \frac{\beta}{(1-\beta(1-\delta_A))} MPA$$

- There is a tax that "turns back the clock"
- As ICT prices keep on falling required tax keeps on increasing...
- Do we really think a 300% tax rate is realistic?

Experiments: From MFG to Personal Care Worker

Increase NRM ability

- "Retrain" a segment of the population:
  - Those who are NLF after the ICT change
- Solve for the GE allocation

Experiments: From MFG to Personal Care Worker

Increase NRM ability

- Overall, economy wide: welfare increases by 4.2%

Experiments: From MFG to Personal Care Worker

Increase NRM ability

- Overall, economy wide: welfare increases by 4.2%
- Output increases by 2.9%

Experiments: From MFG to Personal Care Worker

Increase NRM ability

- Overall, economy wide: welfare increases by 4.2%
- Output increases by 2.9%
- R does not change $\rightarrow$ increase in NRM

Experiments: From MFG to Personal Care Worker

Increase NRM ability

- Overall, economy wide: welfare increases by 4.2%
- Output increases by 2.9%
- R does not change $\rightarrow$ increase in NRM
- Tax on profits falls by 8%

Experiments: From MFG to Personal Care Worker

Increase NRM ability

- Overall, economy wide: welfare increases by 4.2%
- Output increases by 2.9%
- R does not change $\rightarrow$ increase in NRM
- Tax on profits falls by 8%
- NRC: welfare increases by 25%

Experiments: From MFG to Personal Care Worker

Increase NRM ability

- Overall, economy wide: welfare increases by 4.2%
- Output increases by 2.9%
- R does not change $\rightarrow$ increase in NRM
- Tax on profits falls by 8%
- NRC: welfare increases by 25%
- But...for Unskilled
  - Some winners and some losers...
  - Those who get the retraining win: $+11\%$

Experiments: From MFG to Personal Care Worker

Increase NRM ability

- Overall, economy wide: welfare increases by 4.2%
- Output increases by 2.9%
- R does not change $\rightarrow$ increase in NRM
- Tax on profits falls by 8%
- NRC: welfare increases by 25%
- But...for Unskilled
  - Some winners and some losers...
  - Those who get the retraining win: $+11\%$
  - Displacing existing NRM workers: -16%

Experiments: From MFG to Personal Care Worker

Increase NRM ability

- Overall, economy wide: welfare increases by 4.2%
- Output increases by 2.9%
- R does not change $\rightarrow$ increase in NRM
- Tax on profits falls by 8%
- NRC: welfare increases by 25%
- But...for Unskilled
  - Some winners and some losers...
  - Those who get the retraining win: $+11\%$
  - Displacing existing NRM workers: -16%
- But someone has to pay for the program....

Experiments: From MFG to Personal Care Worker

Increase NRM ability

- Movement of 7pp into of LF: "Treated population"
- Gains in GDP 2.9%
- As long as program cost per participant is less than 44% of GDP per capita it pays off
- Cost could be higher if profit taxation is rolled back to initial level

Experiments: UBI

13% of average routine wage

LF	+4.5pp
ER	+2.8pp
NRM	+1.7pp

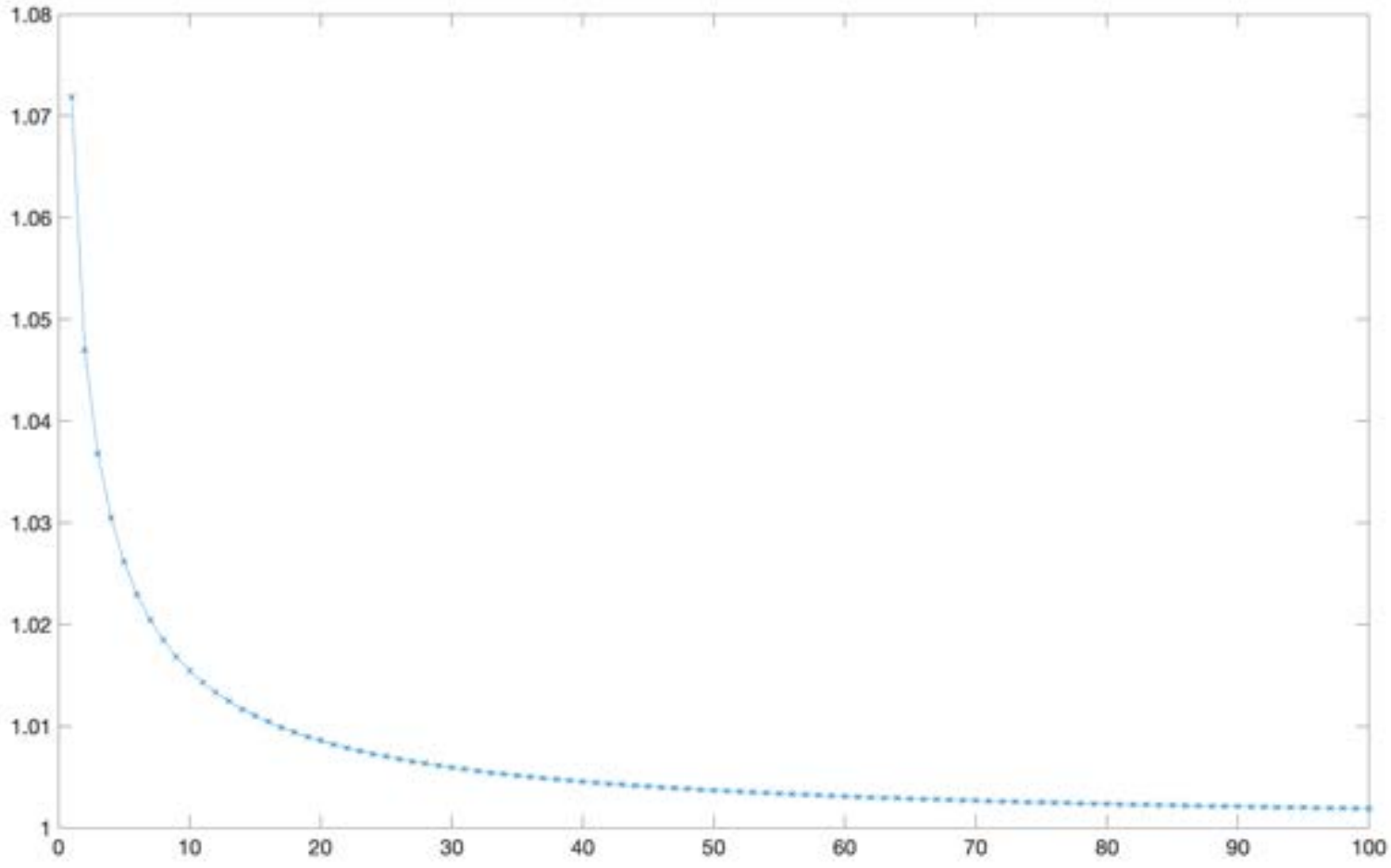
Experiments: UBI

13% of average routine wage

LF	+4.5pp
ER	+2.8pp
NRM	+1.7pp
ΔGDP	-8.7%

Experiments:UBI

Wages by ability vs. benchmark case



Experiments: UBI

13% of average routine wage

LF	4.5pp
ER	+2.8pp
NRM	+1.7pp
ΔGDP	-8.7%
Employment Rate ER	80%
Employment Rate ENRM	80%
Agg Labor Share	-0.0343
Routine labor share	-0.0108

Experiments: UBI

13% of average routine wage

- Overall, economy wide: welfare increases by 18%

Experiments: UBI

13% of average routine wage

- Overall, economy wide: welfare increases by 18%
- Output decreases by 8.7%

Experiments: UBI

13% of average routine wage

- Overall, economy wide: welfare increases by 18%
- Output decreases by 8.7%
- NRC: welfare decreases by 16%

Experiments: UBI

13% of average routine wage

- Overall, economy wide: welfare increases by 18%
- Output decreases by 8.7%
- NRC: welfare decreases by 16%
- For "Unskilled": welfare increase by about 30%

Experiments: UBI

13% of average routine wage

- Overall, economy wide: welfare increases by 18%
- Output decreases by 8.7%
- NRC: welfare decreases by 16%
- For "Unskilled": welfare increase by about 30%
- But someone has to pay for the program....taxes on profit increases by 15%

Conclusions

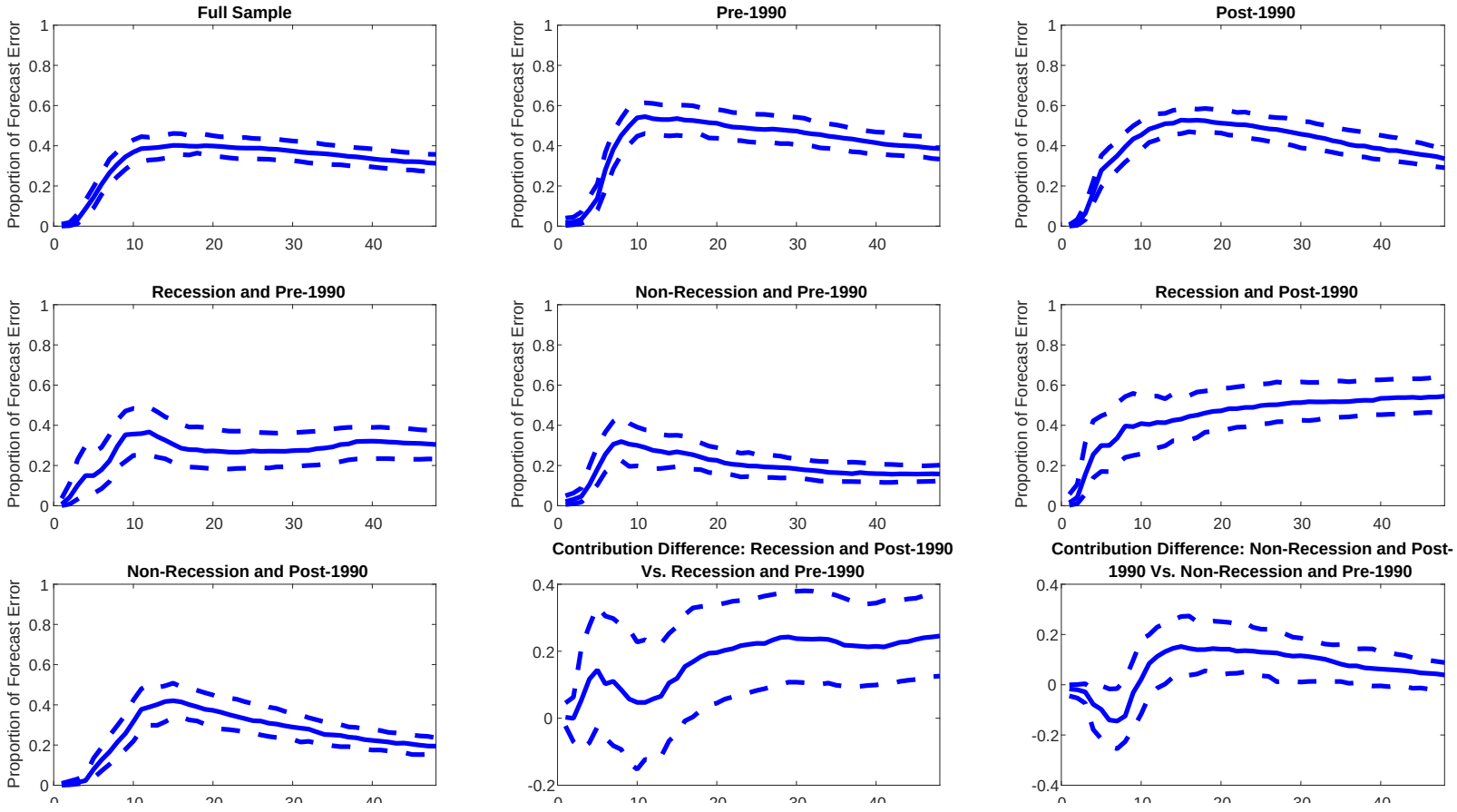
- NLF accounts for 2/3 of the fall in ER, and ENRM for 1/3
- Quantitative GE model of Automation
  - Significant winners and losers
- Policy experiments
  - Consider a variety of experiments
  - Retraining offers the "best" return
- Exciting (at least to us) framework to analyze the consequence of a variety of policies
  - So which policy is on your mind?

Appendix

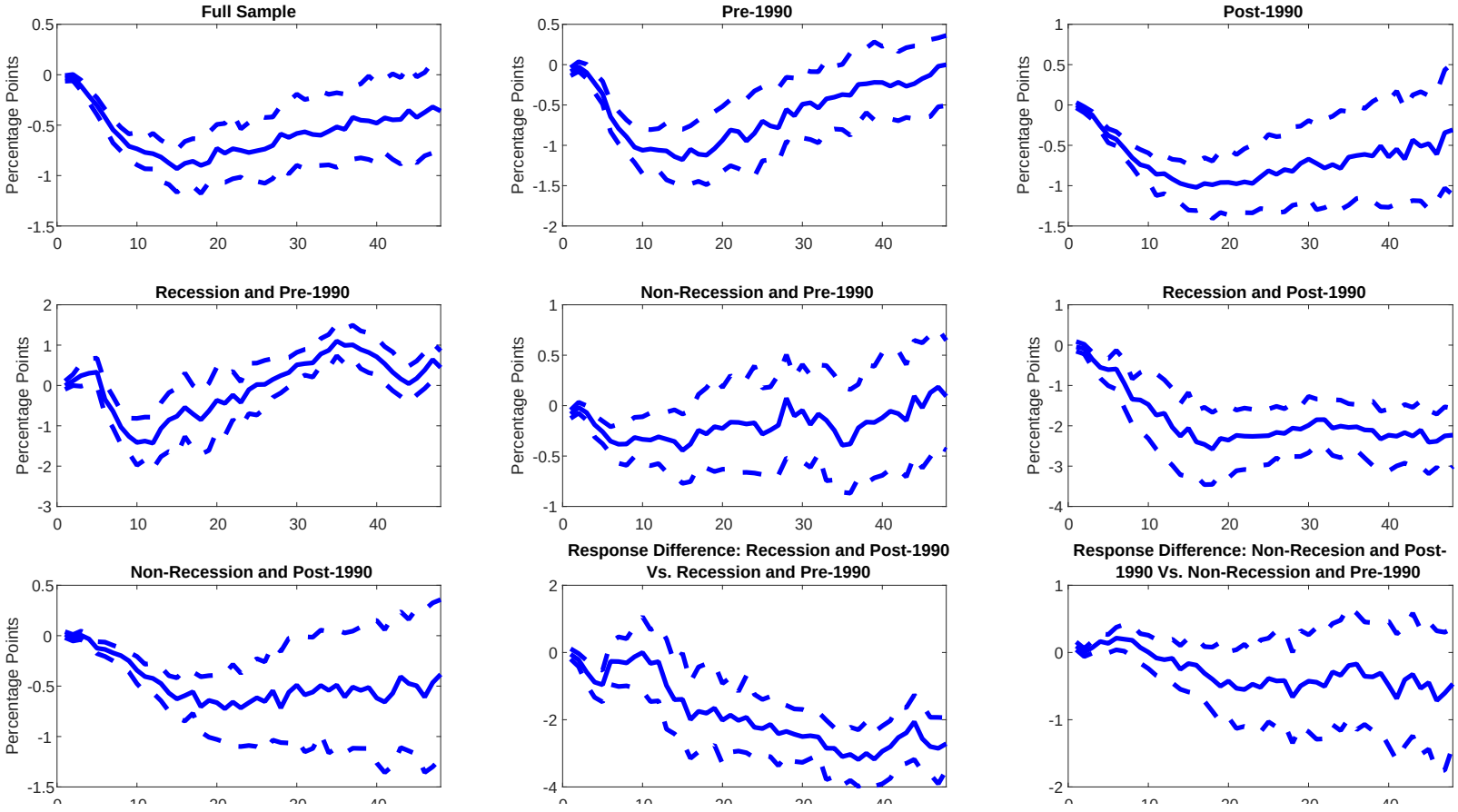
Looking at conditional responses

- A (business cycle) shock based explanation for jobless recoveries.
- Without getting into too many details....a six lag monthly VAR with employment, IP, stock prices
    1. "Local projection methods" (e.g. Jorda (2005) and Ramey and Zubairy (2018)): response to Financial, TFP, Monetary shocks.
    2. "Augmented" VAR sign restrictions.

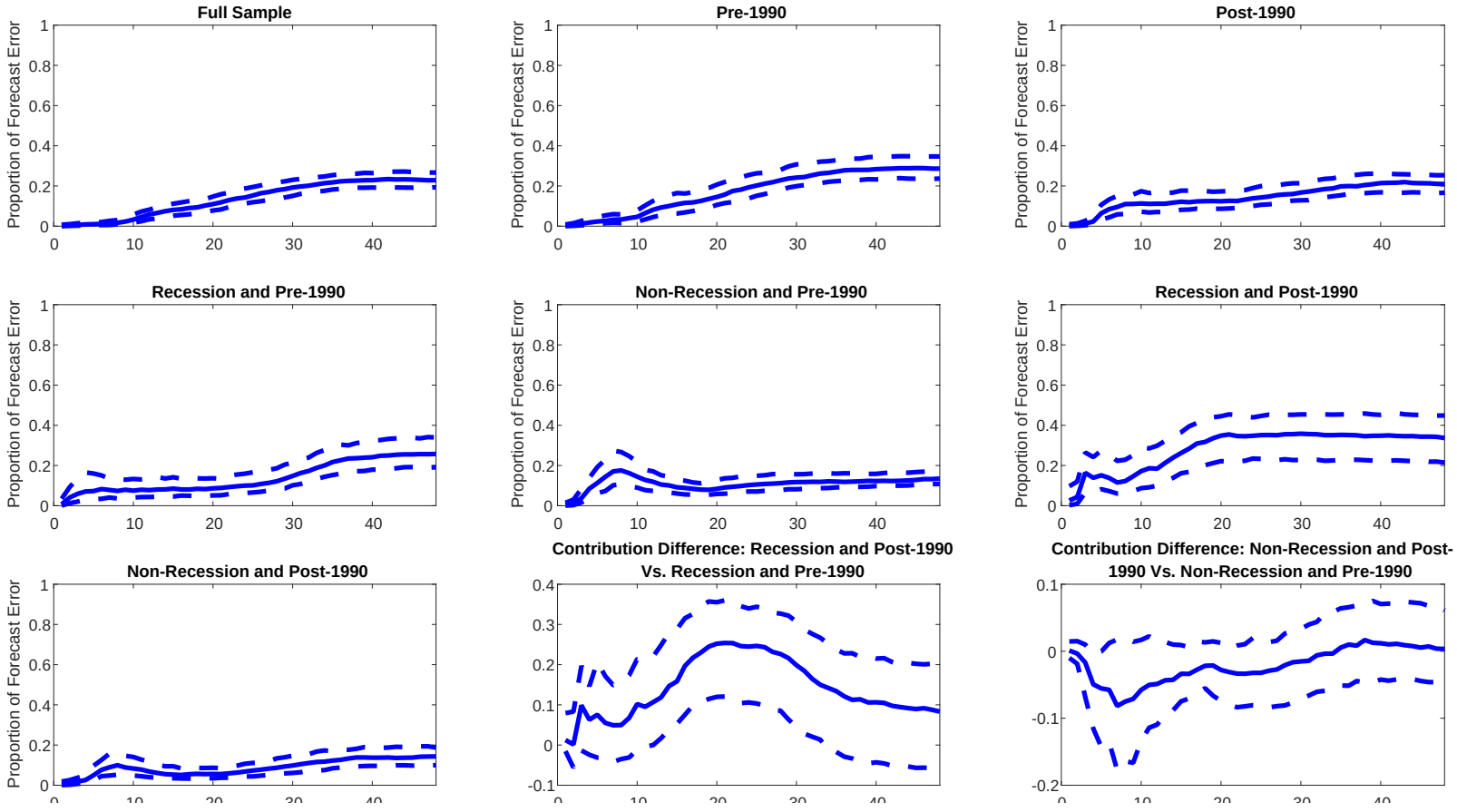
Employment response to Financial Shocks



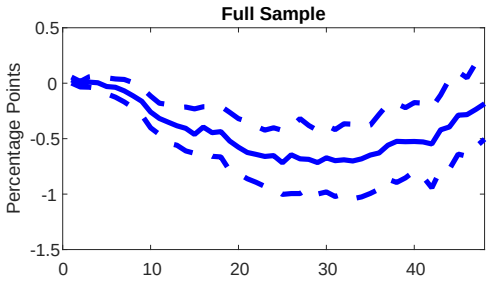
Employment response to Financial Shocks

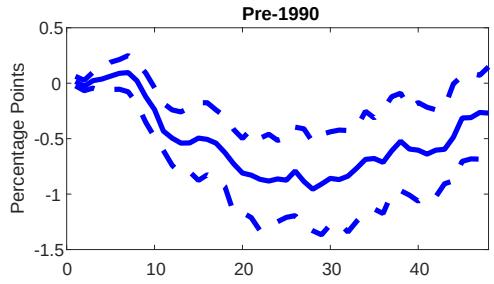


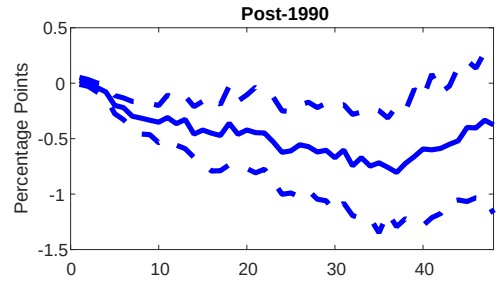
Employment response to TFP Shocks

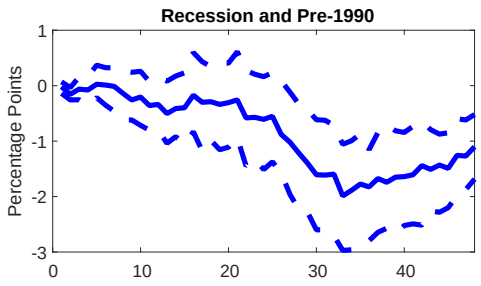


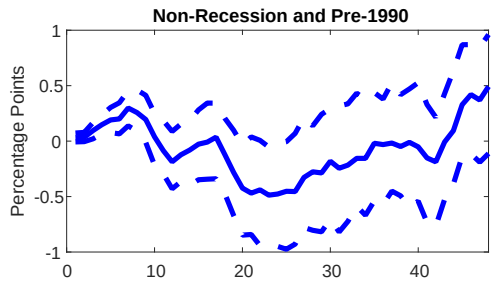
Employment response to TFP Shocks

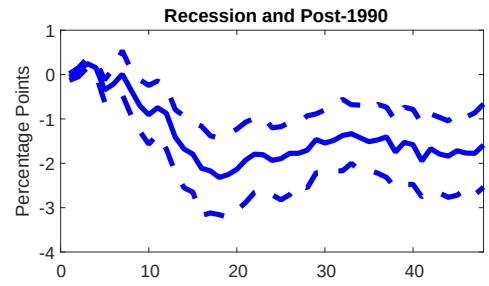


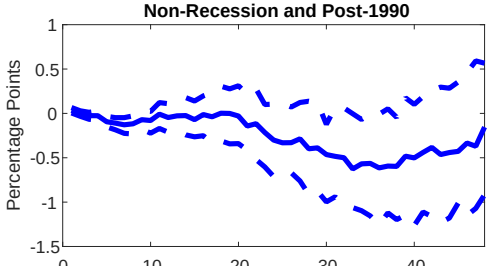


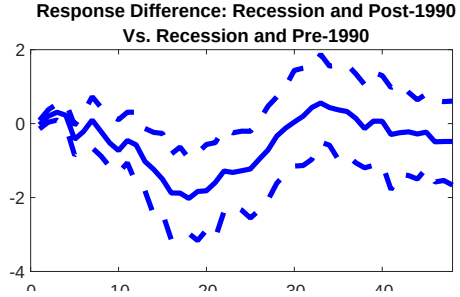


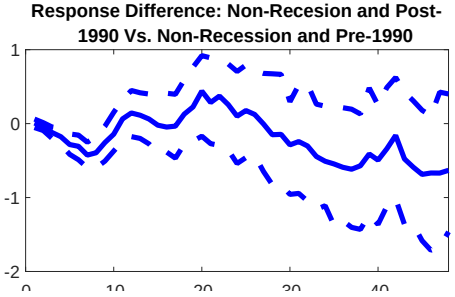




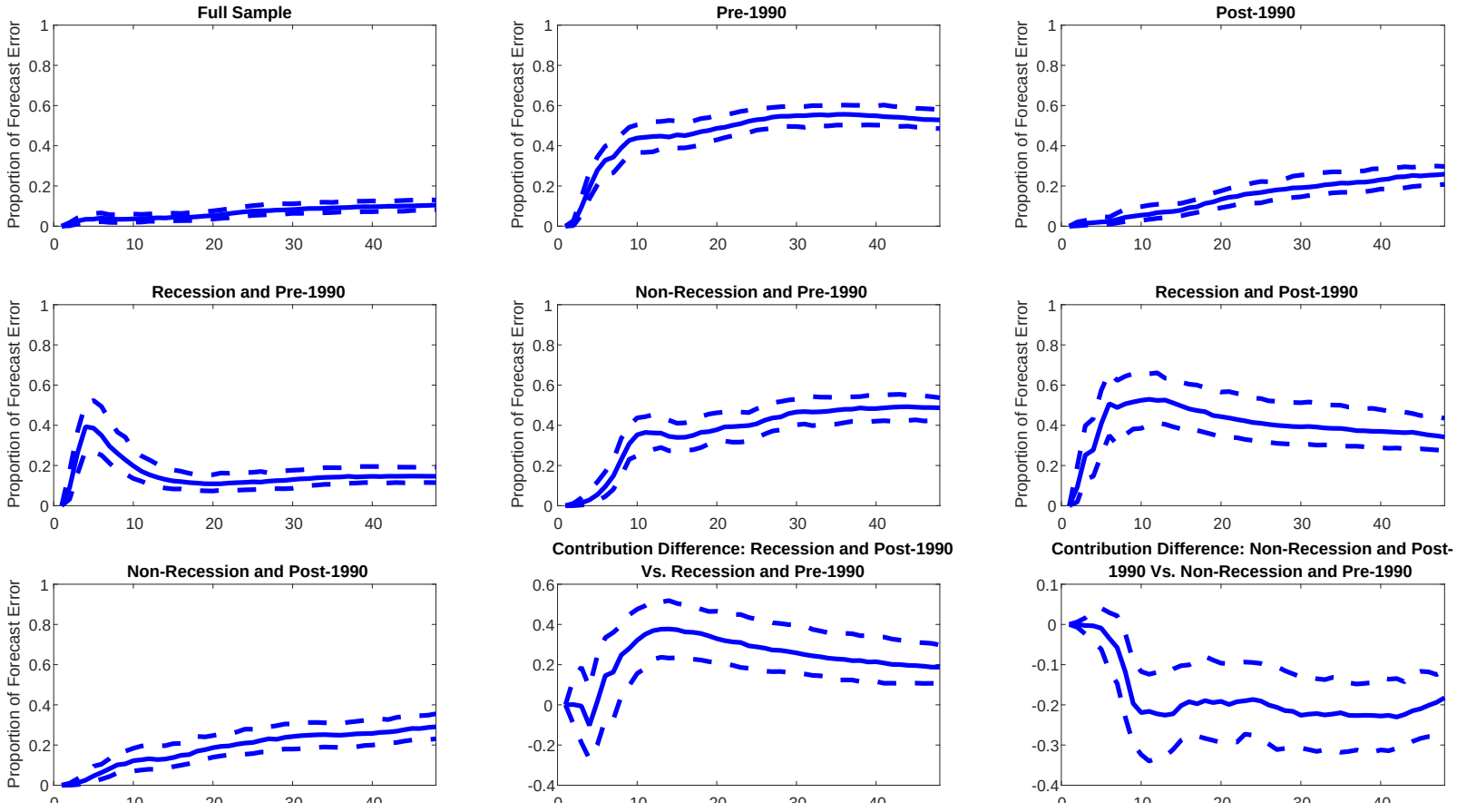




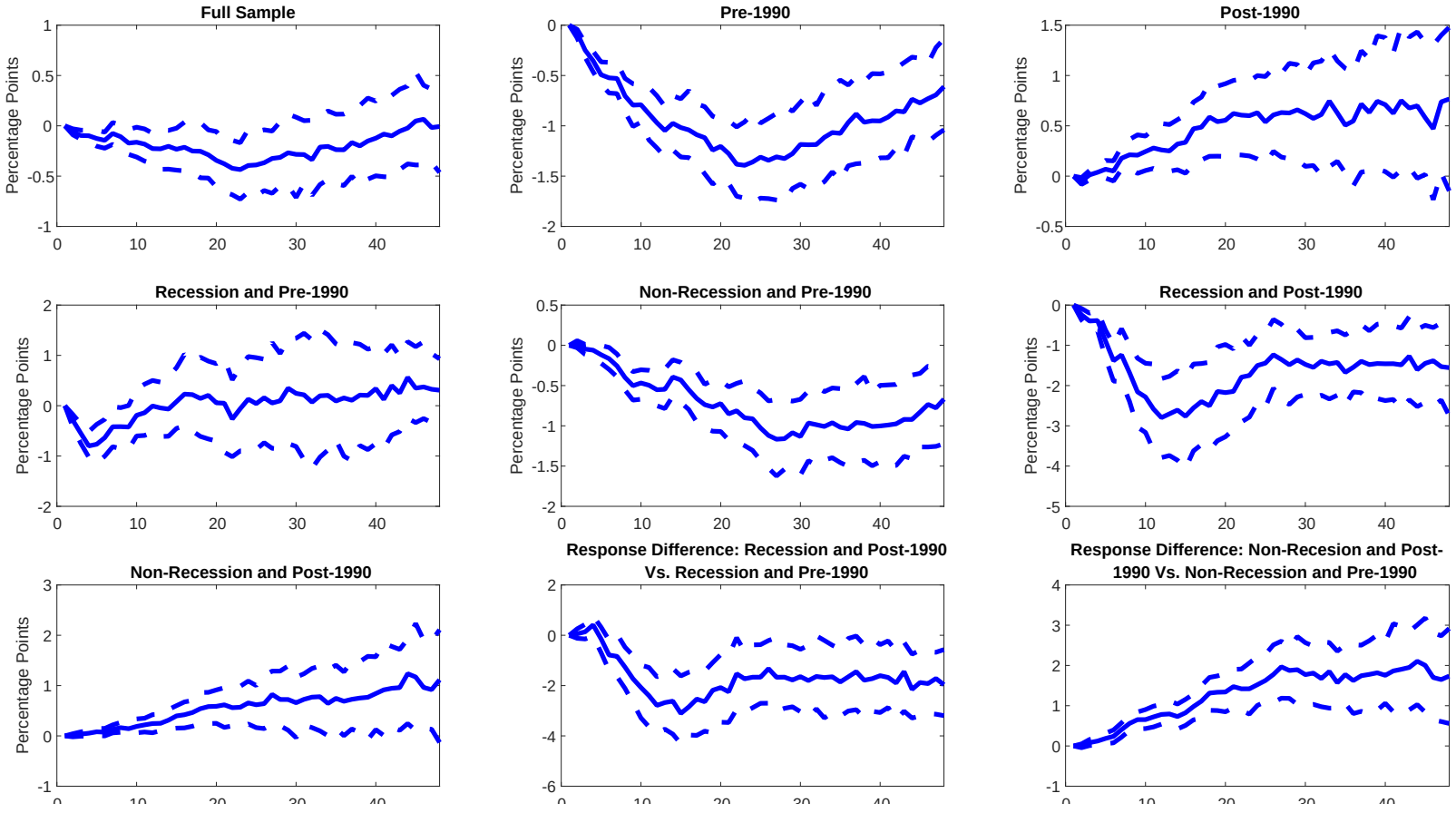




Employment response to Monetary Shocks



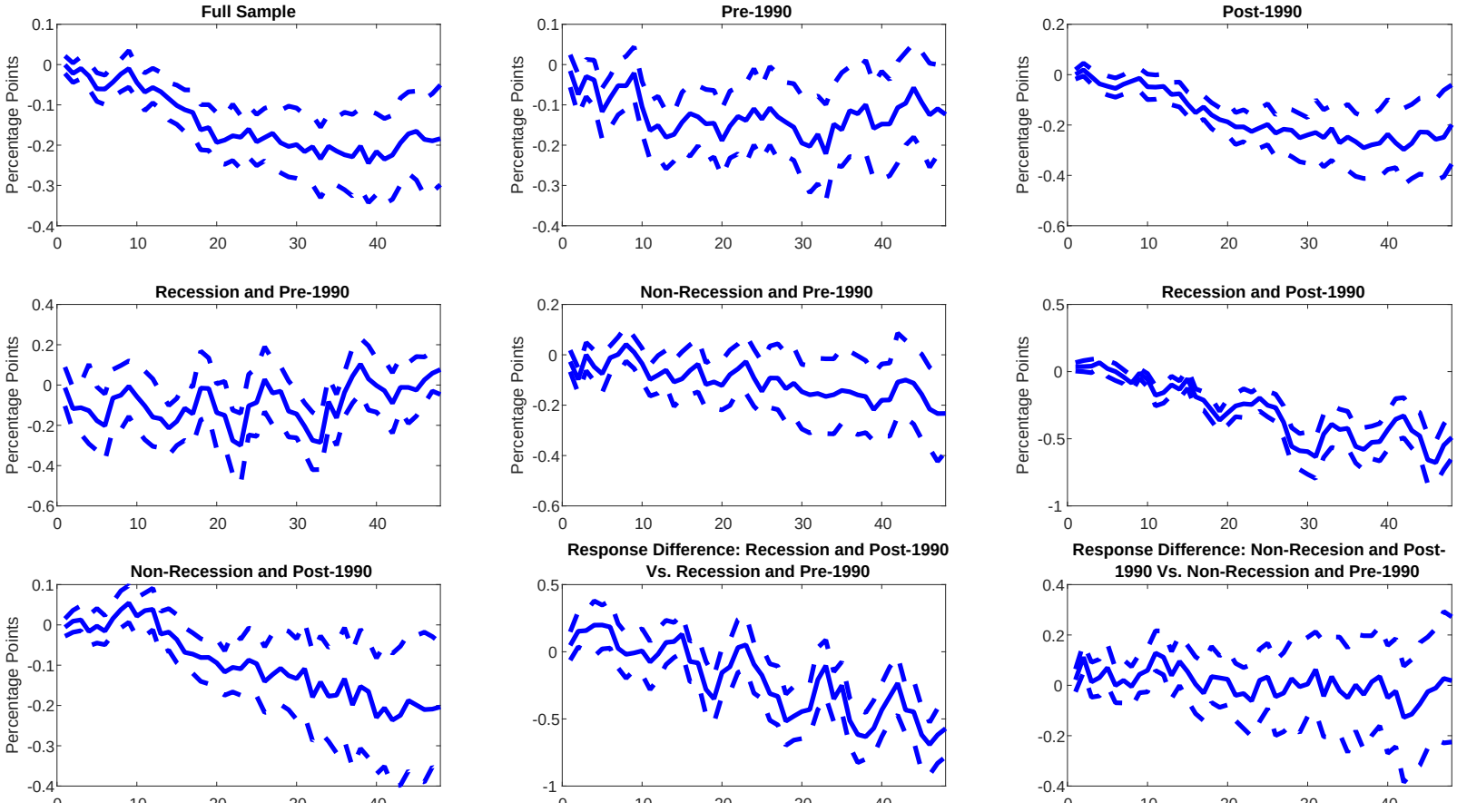
Employment response to Monetary Shocks



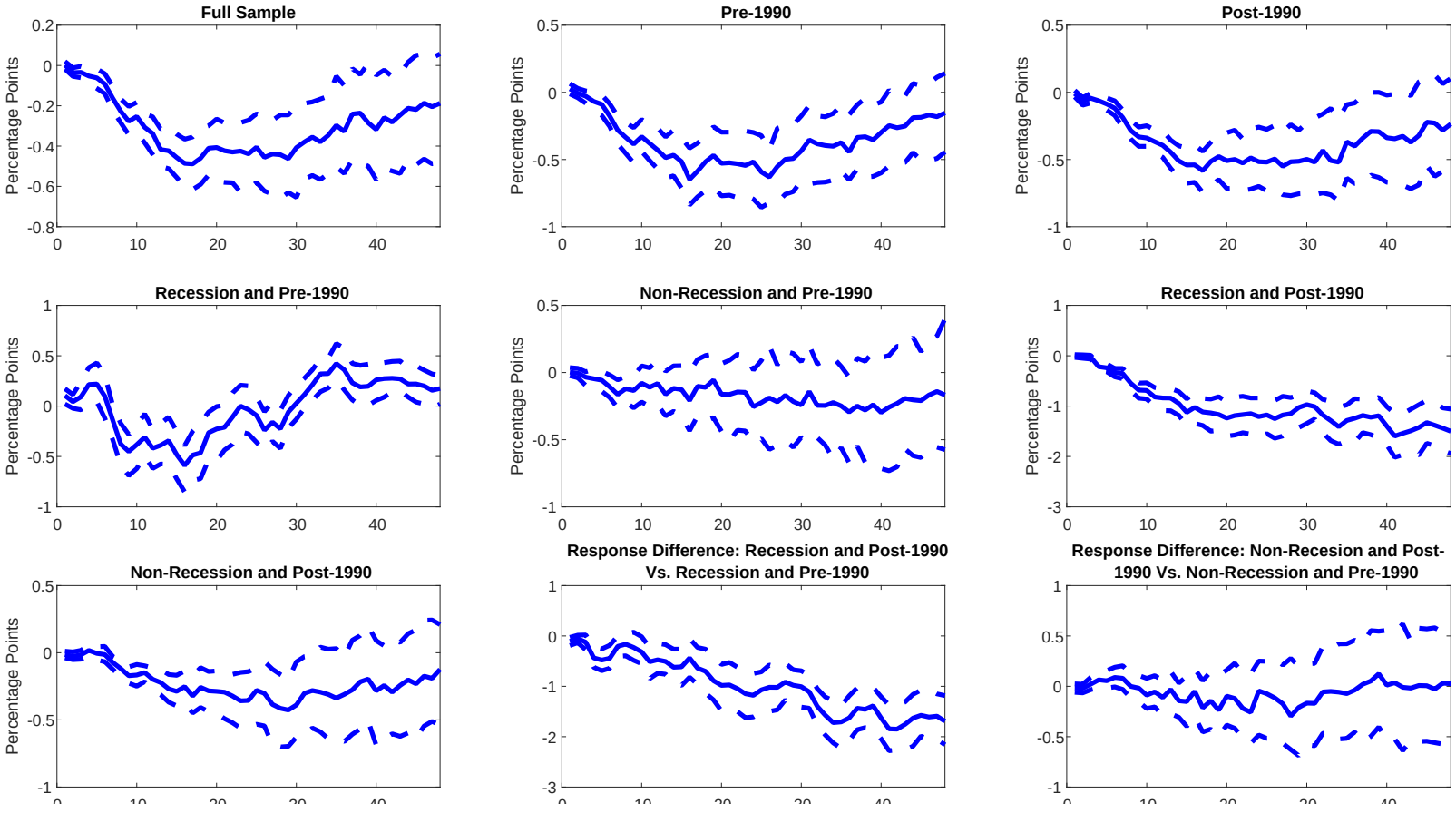
Summary

- Lack of employment recovery in response to all shocks post "polarization"
- Separate into *R&NR*

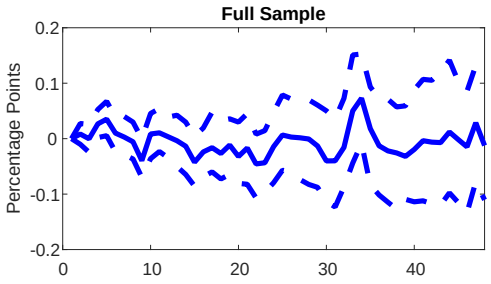
NR response to Financial Shocks

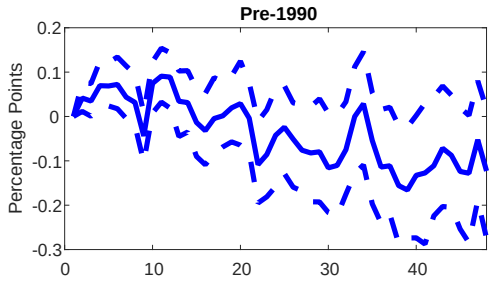


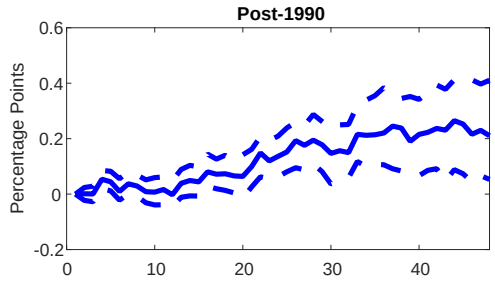
R response to Financial Shocks

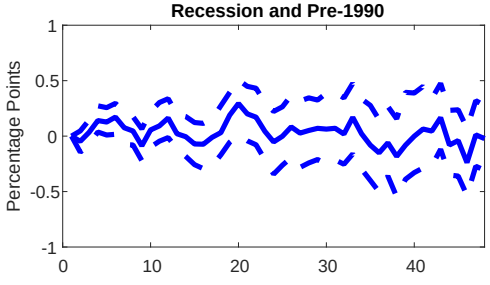


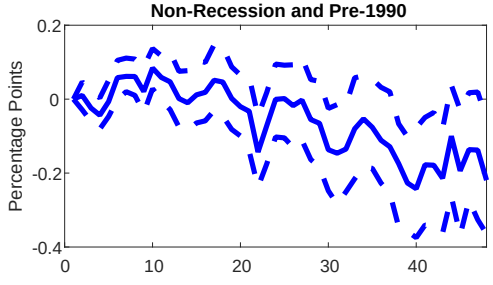
NR response to Monetary Shocks

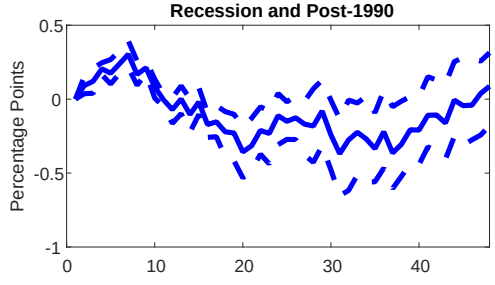


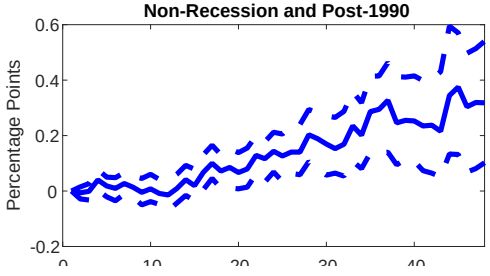


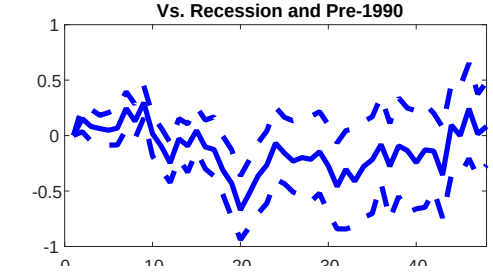


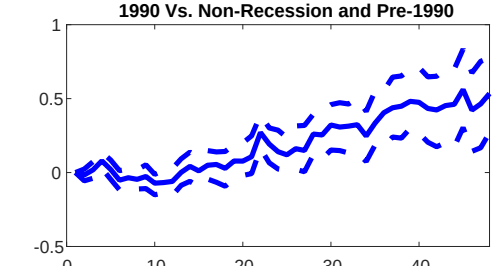




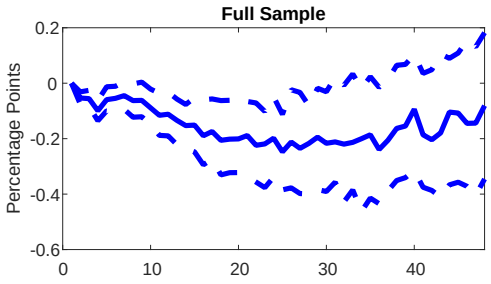


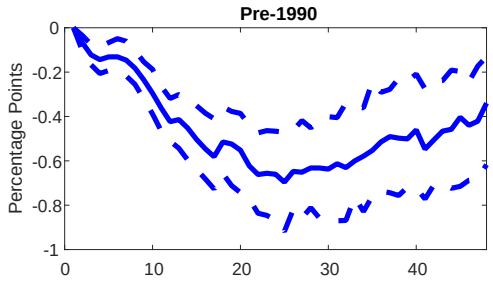


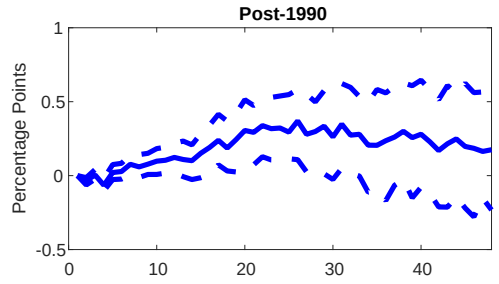


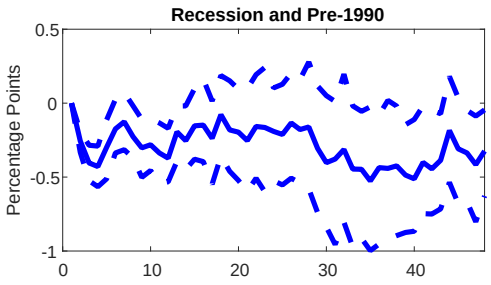


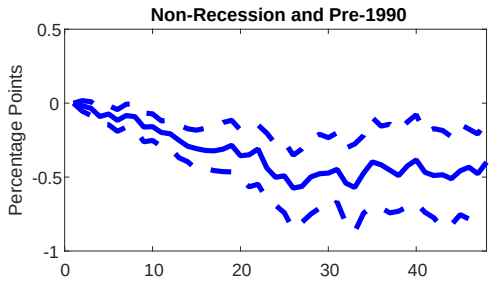
R response to Monetary Shocks

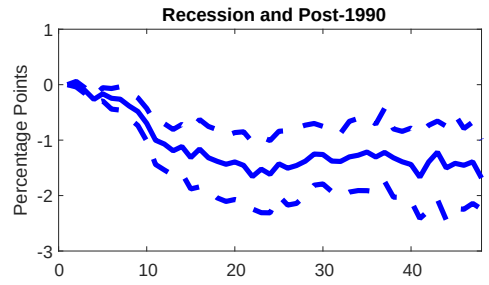


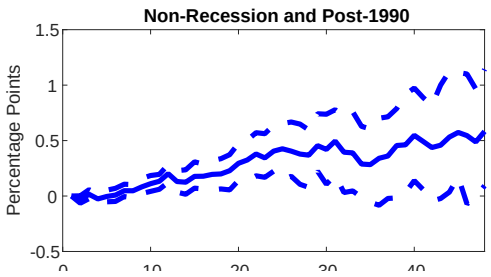


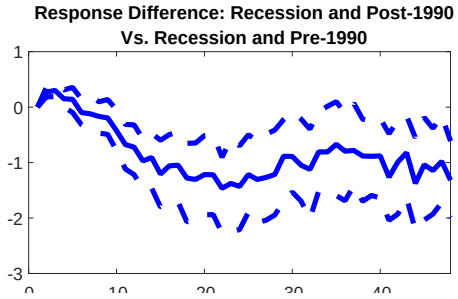


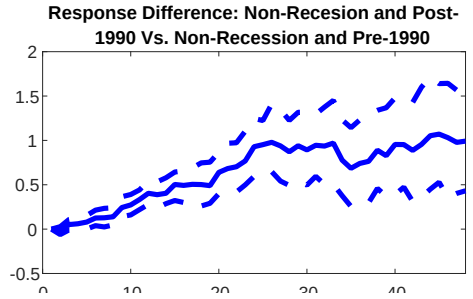




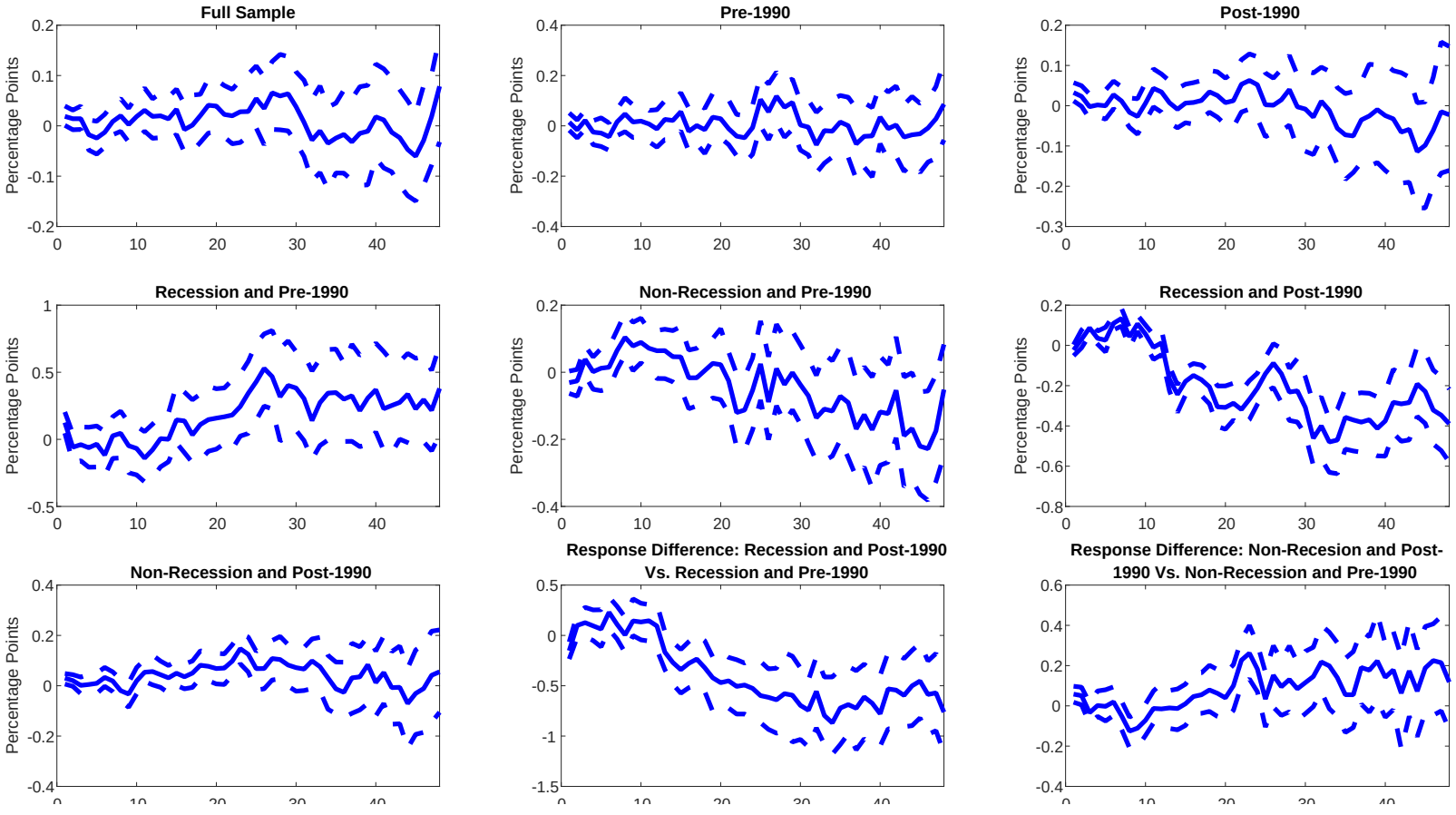




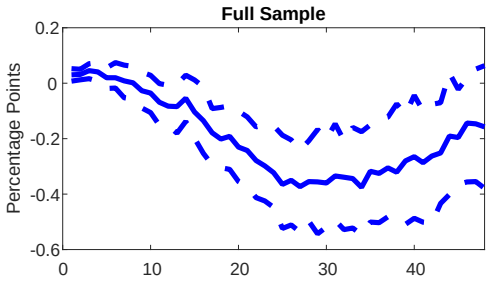


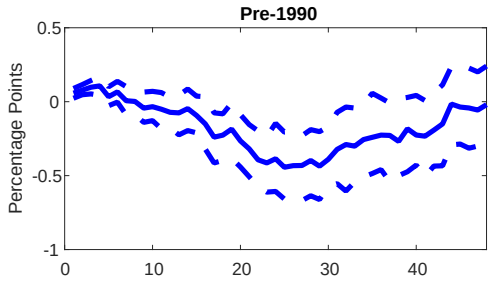


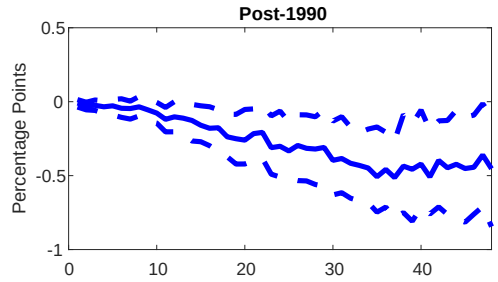
NR response to TFP Shocks

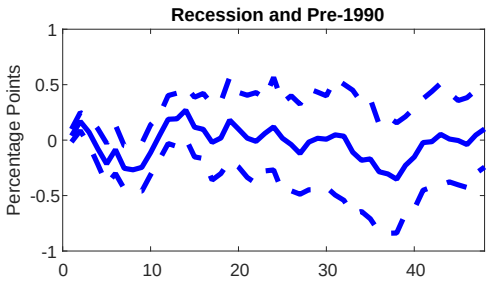


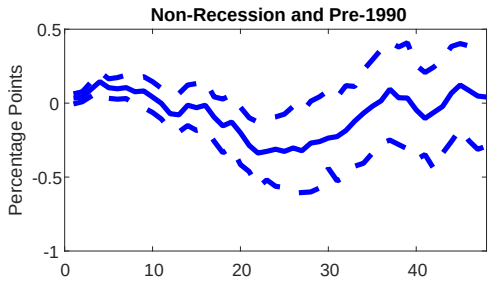
R response to TFP Shocks

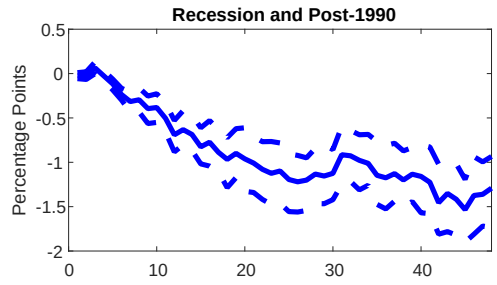


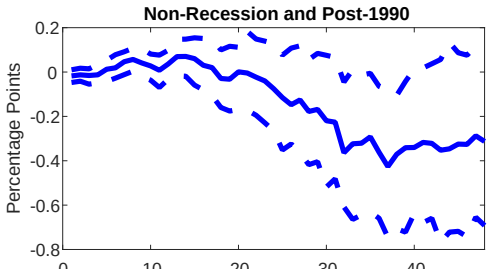


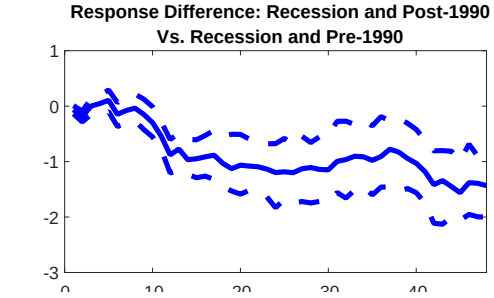


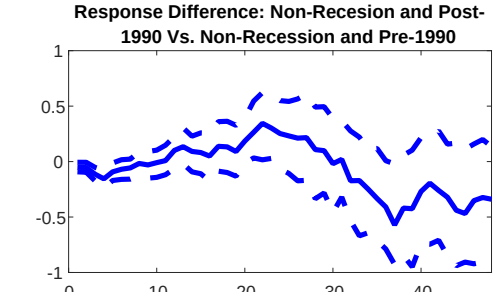




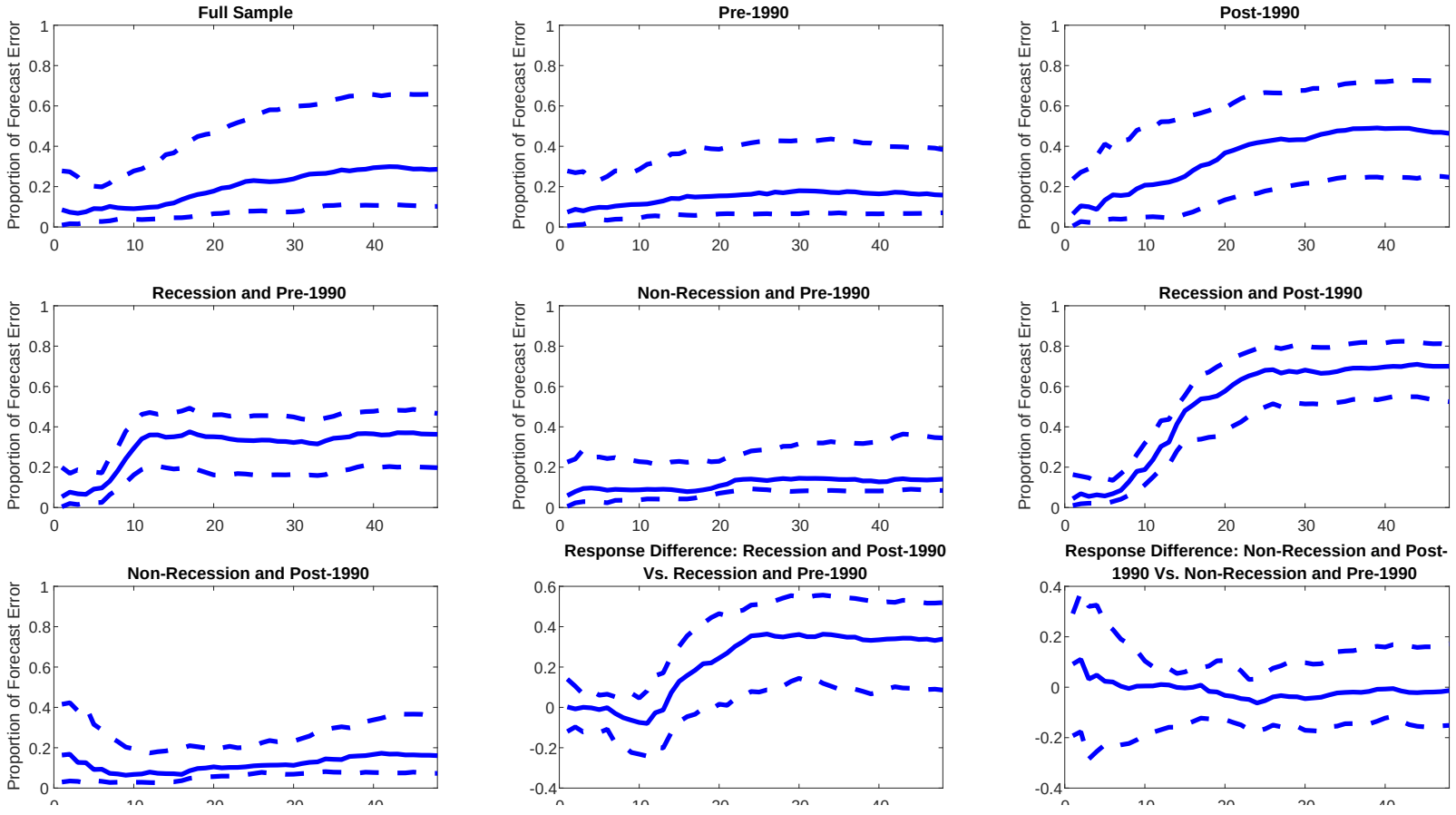




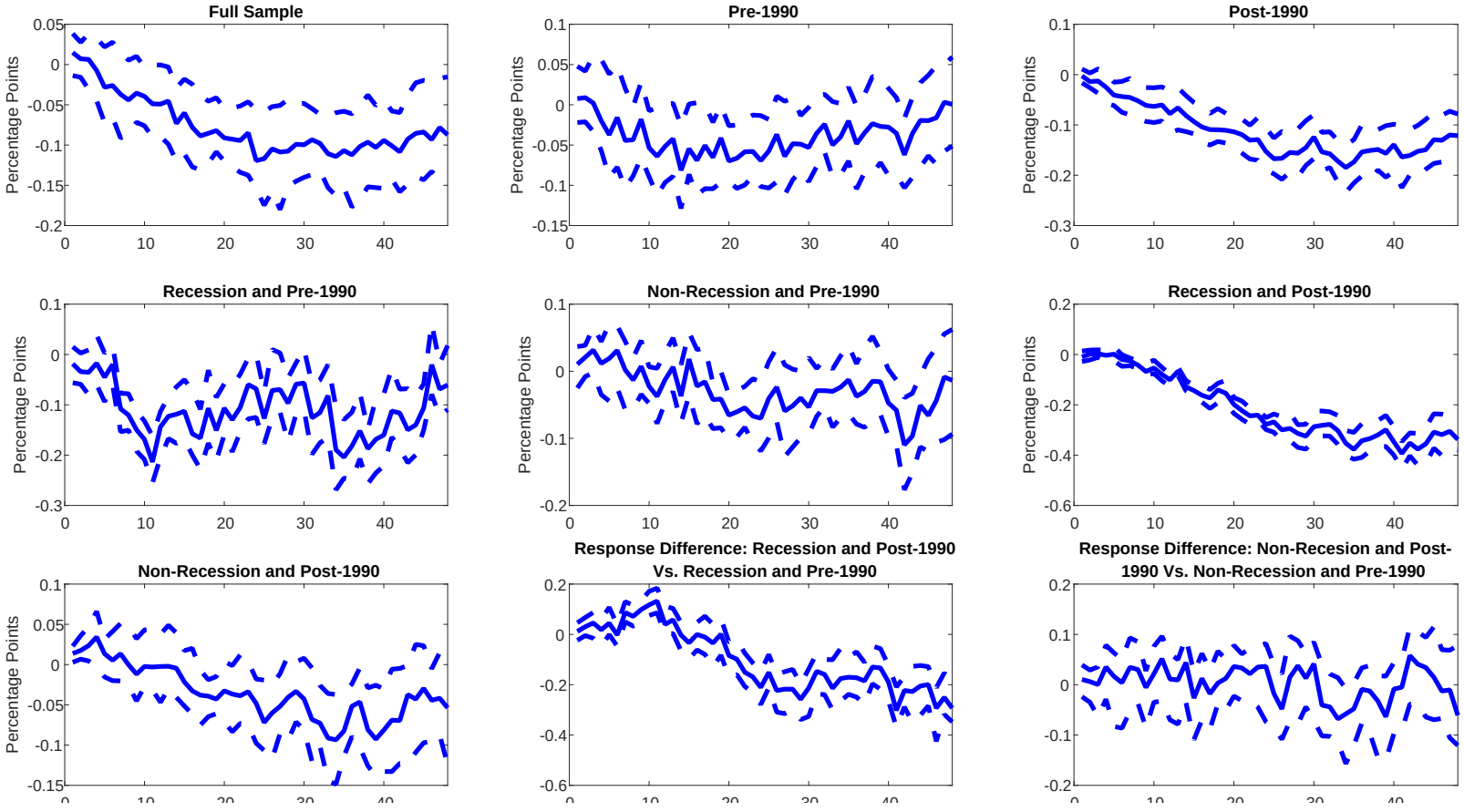




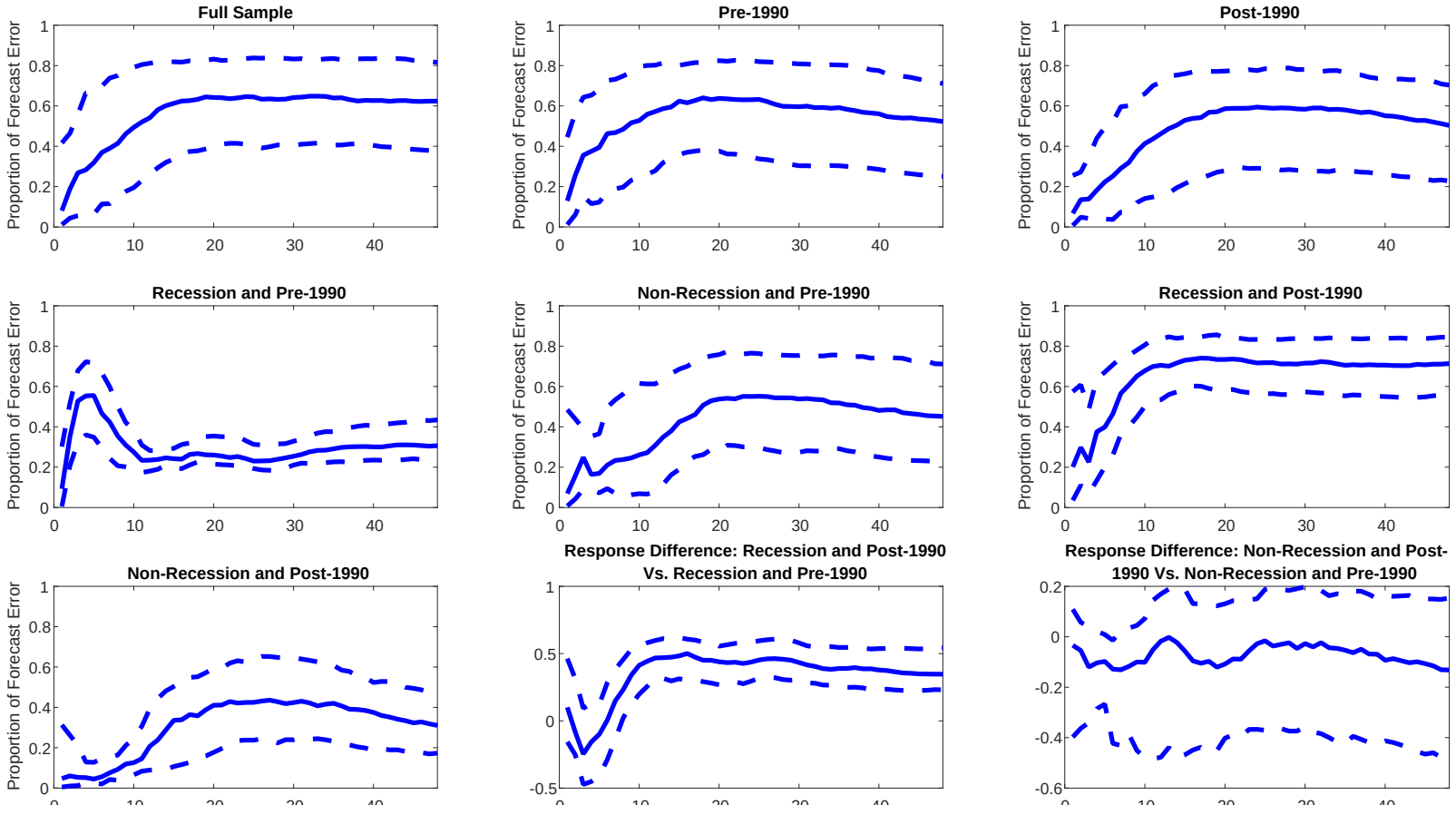
NR response to Bus Cycle Shocks



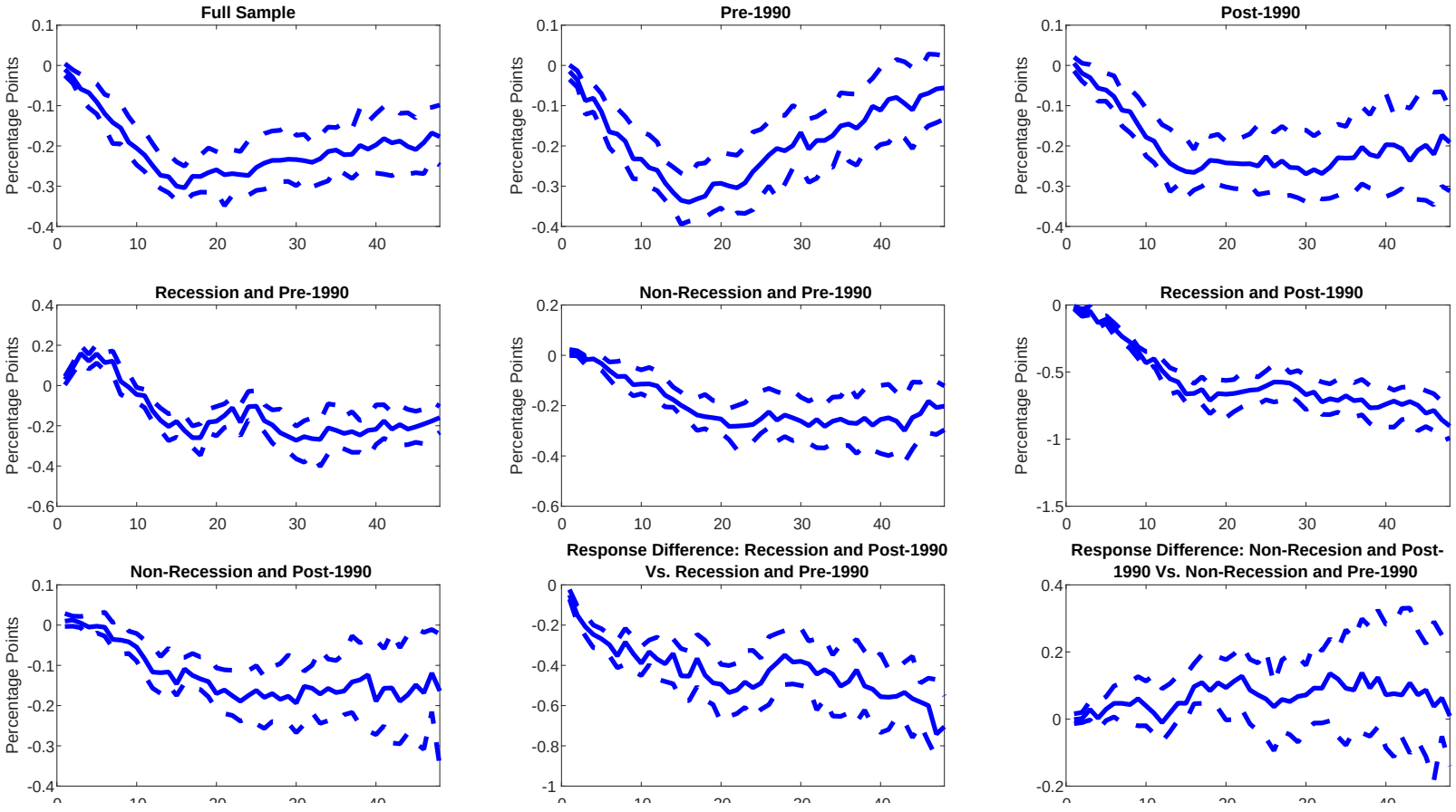
NR response to Bus Cycle Shocks



R response to Bus Cycle Shocks



R response to Bus Cycle Shocks



Summary

- Results are informative as to:
  - Shock based explanation of employment dynamics
  - Shock based explanation of $R\&NR$ dynamics
  - When (i.e. state of the economy and type of shocks) routine workers are experience their adjustments.

Backup

Precision and Recall

		Observed		
		NRC	non-NRC	**Precision**
Predicted	NRC	848,364	444,759	**65.61%**
	non-NRC	483,632	2,380,753	**83.12%**
	Recall	**63.69%**	**84.26%**	

- **Precision**: Share of correctly classified within a predicted category.
- **Recall**: The share of true that were picked up by the prediction within a category.

Back

Precision and Recall by Gender

Men

		Observed NRC	Observed non-NRC	**Precision**
Predicted	NRC	506,002	294,252	**63.23%**
	non-NRC	242,256	1,213,131	**83.35%**
	Recall	**67.62%**	**80.48%**	

Women

		Observed NRC	Observed non-NRC	**Precision**
Predicted	NRC	342,362	150,507	**69.46%**
	non-NRC	241,376	1,167,622	**82.87%**
	Recall	**58.65%**	**88.58%**	

Back

Recover clean series for NRC and non-NRC

- Had there been no errors $\rightarrow$ recover dynamics of the NNRC characteristics.
- With classification errors, use the following two equations to recover clean series:

$$\begin{aligned} \hat{x}_{NRC} &= S_{NRC|NRC} + S_{NNRC|NRC} x_{NNRC} \\ \hat{x}_{NNRC} &= S_{NRC|NNRC} x_{NRC} + S_{NNRC|NNRC} x_{NNRC} \end{aligned}$$

where:

		Classified	
		NRC	NNRC
True	NRC	$S_{NRC\|NRC}$	$S_{NRC\|NNRC}$
	NNRC	$S_{NNRC\|NRC}$	$S_{NNRC\|NNRC}$

Back

Test case 2: NLSY79 cohort of workers in routine occupations

- Results so far informative with respect to what happens to people with identified "Routine characteristics"
- Complementary analysis:
  - Follow a **specific cohort**: what happens to them over time?

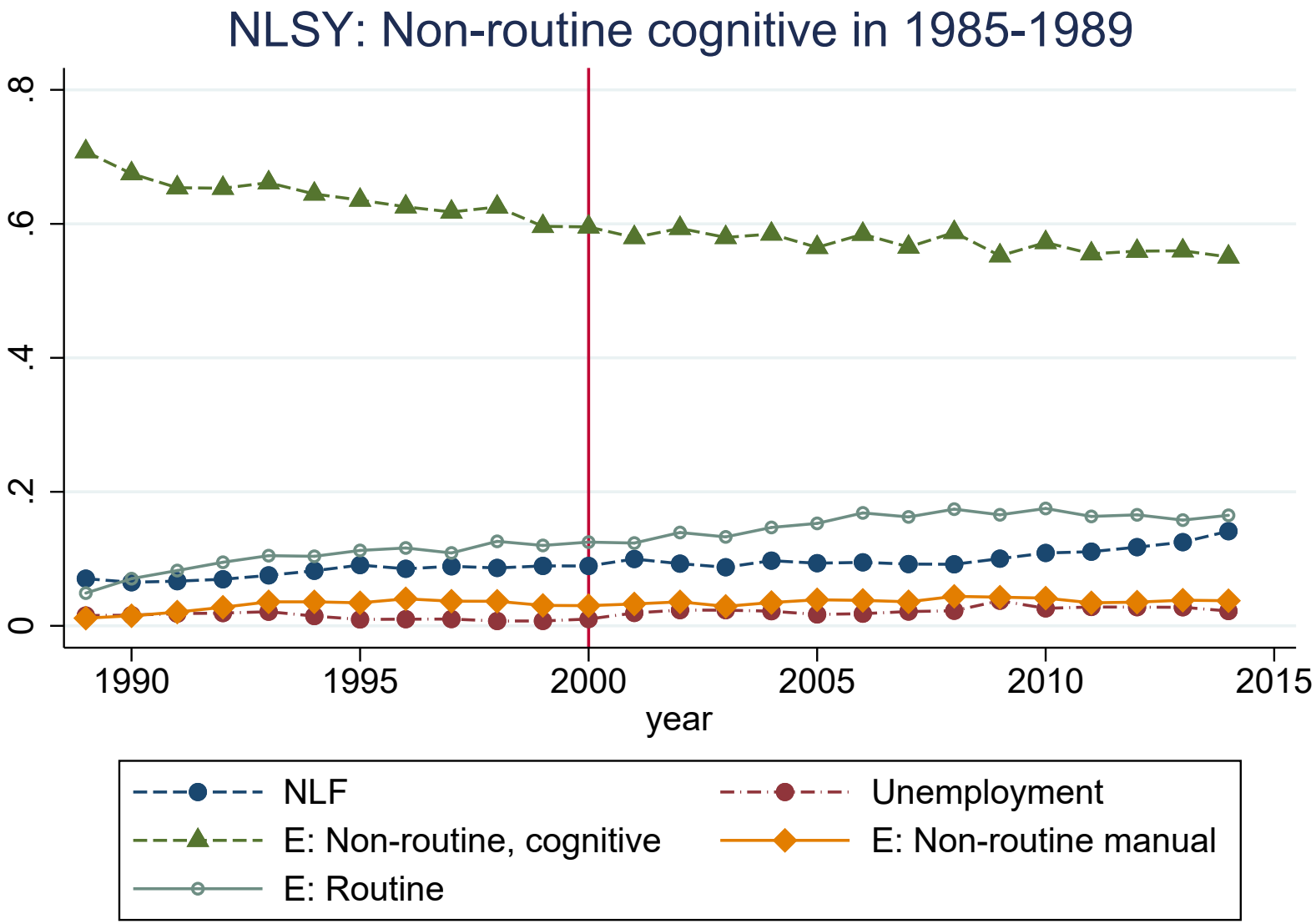
Back

NLSY

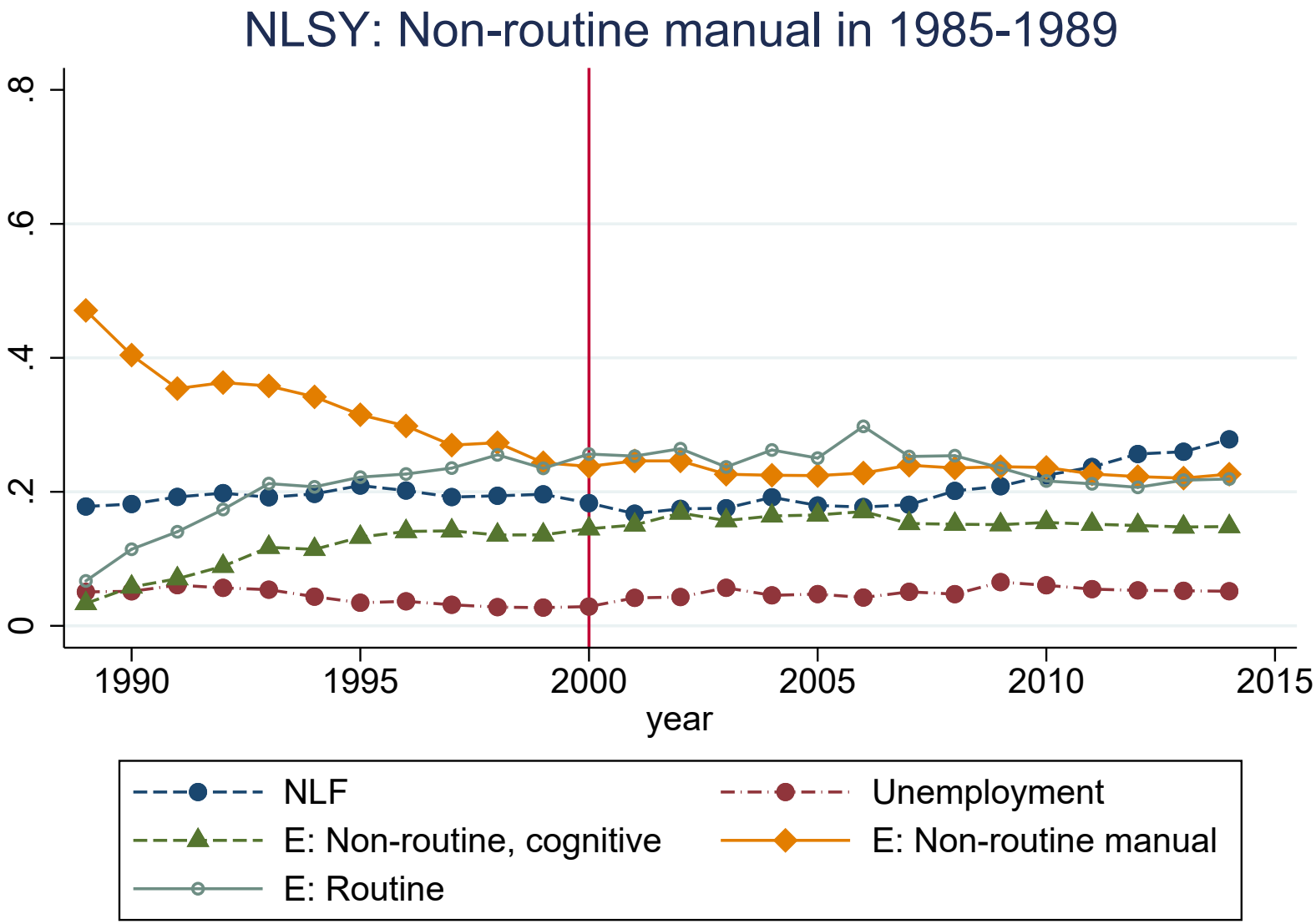
- Construct weekly employment and job histories
- Count the # of weeks a worker was working in R/NRM/NRC occupation during a baseline period (1985-1989)
- Define a worker of type R (for example) if worked in R occupation for the majority of weeks during the baseline period
- For each year after the baseline calculate the fraction of weeks a person was...
  - working in R/NRM/NRC
  - unemployed
  - not in the labor force

Back

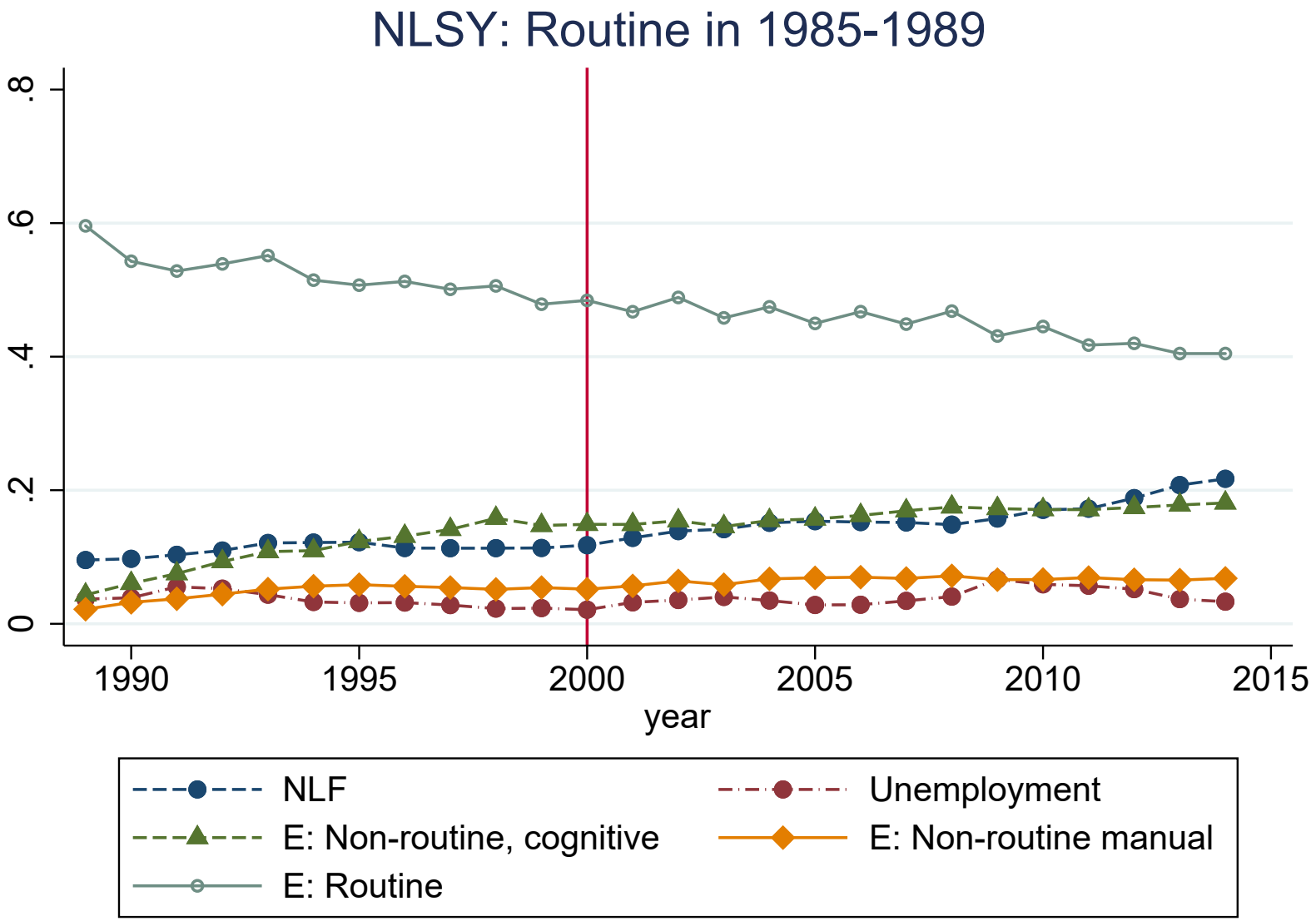
The Evolution of Employment Choices



The Evolution of Employment Choices



The Evolution of Employment Choices



The Evolution of Employment Choices

- In NRM and NRC:
  - Starting age 40 (year 2000): occupation life cycle "stabilizes" and converges
- In R:
  - R to R continues to fall.
  - Fall in R is mainly observed in rise in NLF.
  - For this specific cohort: not so much rise NRM

Back

The Evolution of Employment Choices

	To starting occ $1989 \rightarrow 2000$	To starting occ $2000 \rightarrow 2015$
NRM	-49.5%	-4.9%
NRC	-15.9%	-7.5%
R	-18.7%	-16.4%
	To NLF $1989 \rightarrow 2000$	**To NLF** $2000 \rightarrow 2015$
NRM	2.7%	51.9%
NRC	26.9%	58.1%
R	23.3%	84.4%
	To NRM $1989 \rightarrow 2000$	**To NRM** $2000 \rightarrow 2015$
NRM	-49.5%	-4.9%
NRC	163%	24.3%
R	137%	31.5%

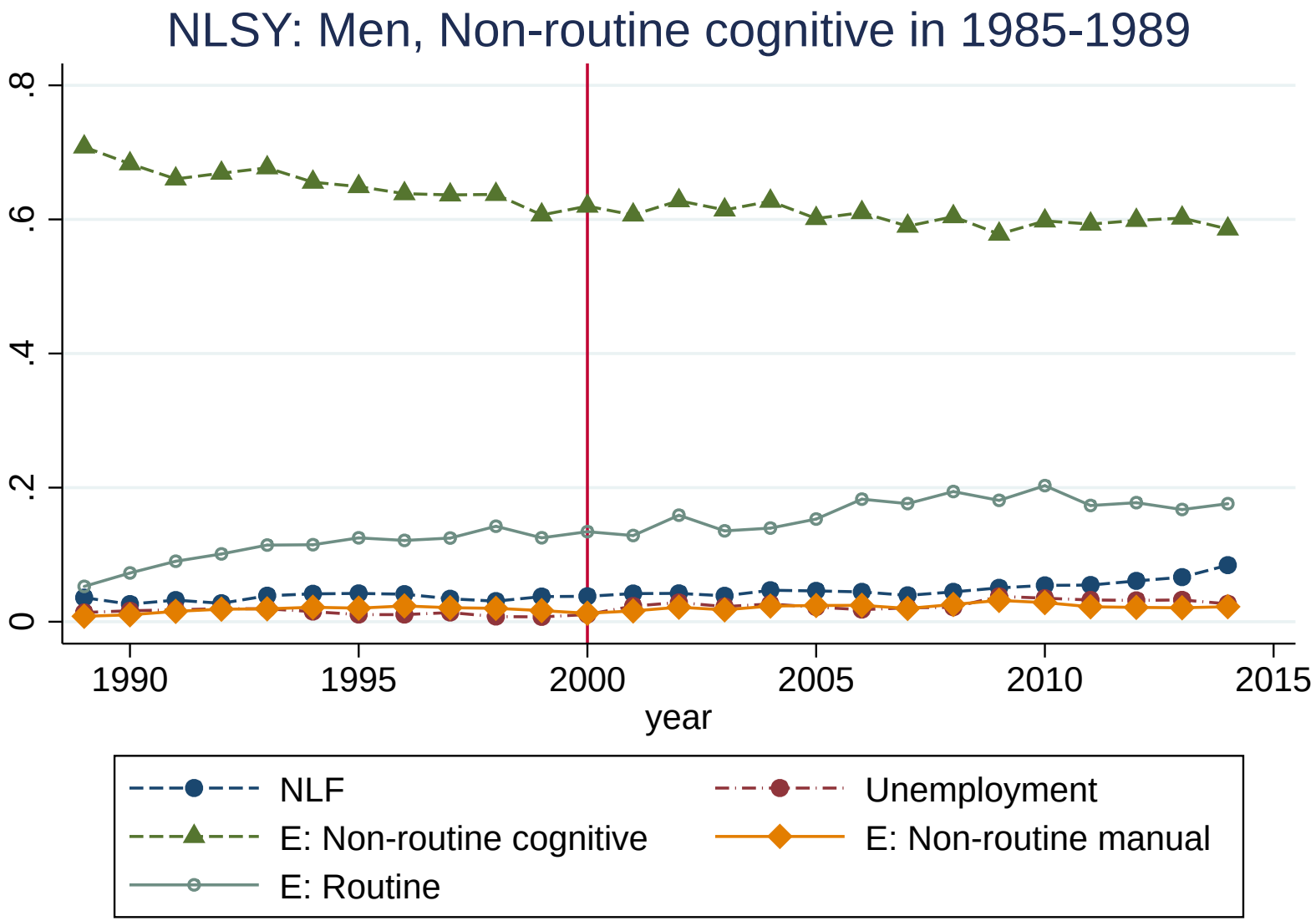
Back

The Evolution of Employment Choices (levels)

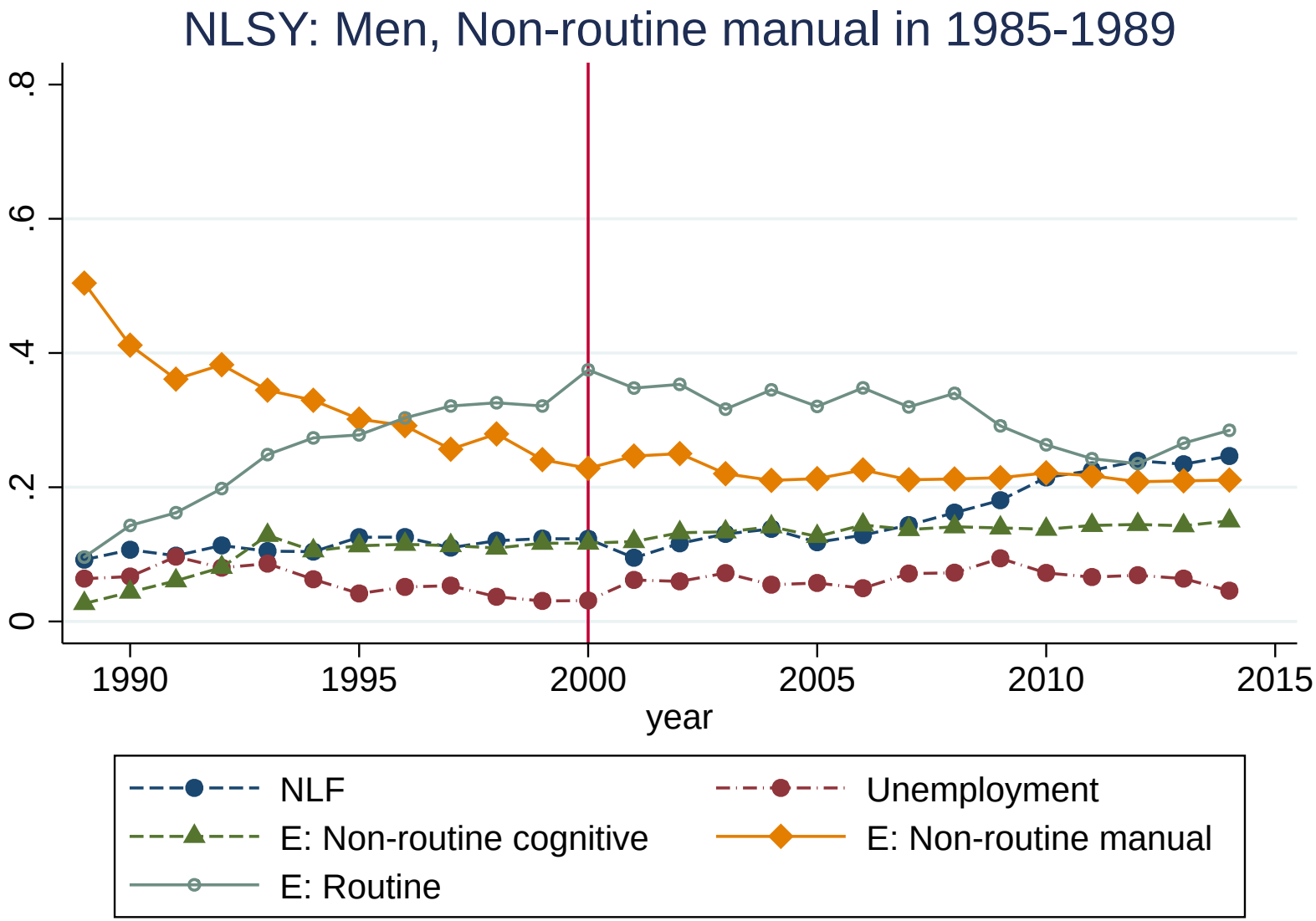
	To starting occ $1989 \rightarrow 2000$	To starting occ $2000 \rightarrow 2015$
NRM	-23.3%	-1.1%
NRC	-11.2%	-4.5%
R	-11.1%	-8.0%
	To NLF $1989 \rightarrow 2000$	**To NLF** $2000 \rightarrow 2015$
NRM	0.5%	9.5%
NRC	1.9%	5.1%
R	2.2%	9.9%
	To NRM $1989 \rightarrow 2000$	**To NRM** $2000 \rightarrow 2015$
NRM	-23.3%	-1.1%
NRC	1.9%	0.7%
R	3%	1.6%

Back

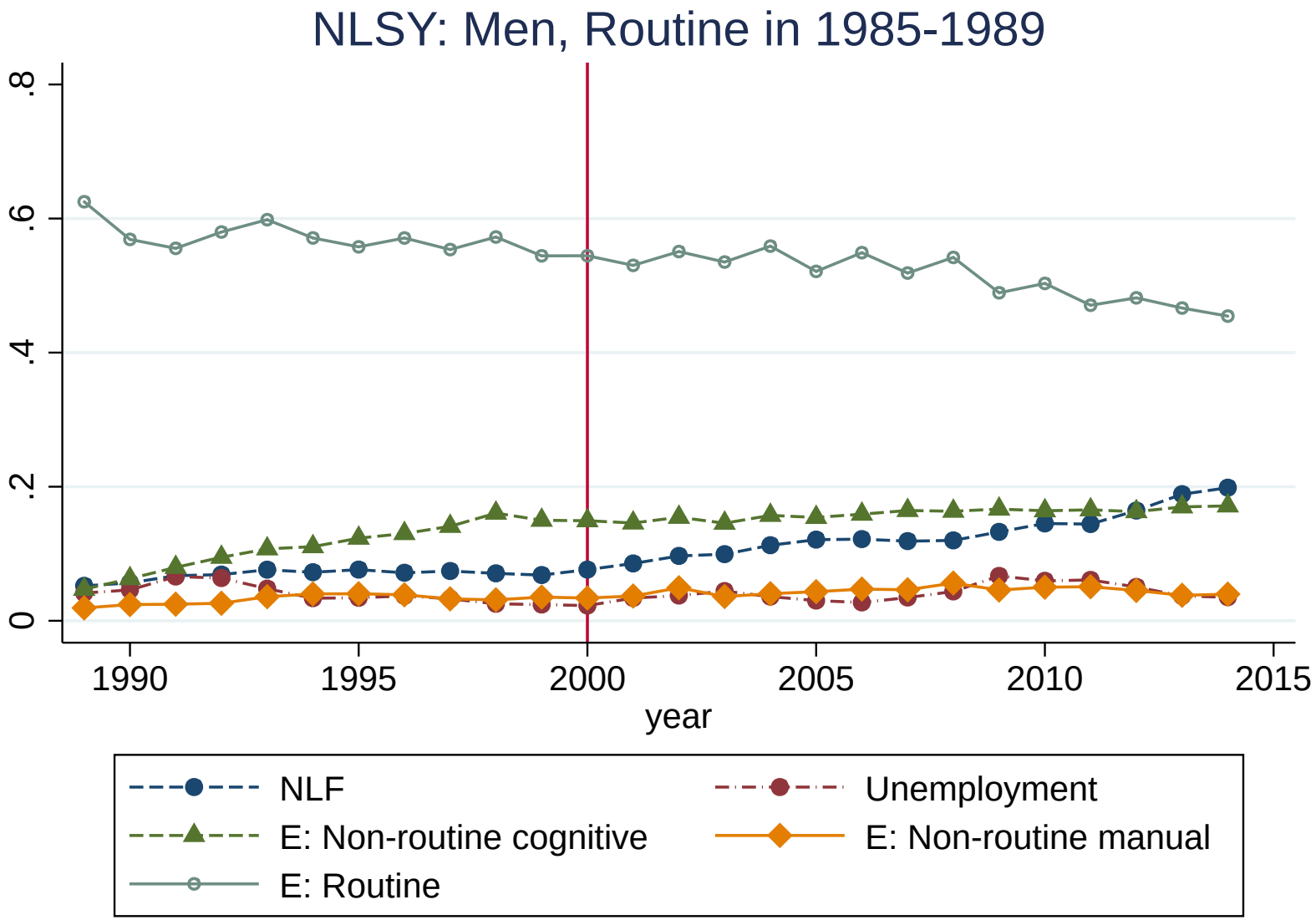
The Evolution of Employment Choices: Men



The Evolution of Employment Choices: Men



The Evolution of Employment Choices: Men



The Evolution of Employment Choices: Men

	To starting occ $1989 \rightarrow 2000$	To starting occ $2000 \rightarrow 2015$
NRM	-54.7%	-7.7%
NRC	-12.5%	-5.5%
R	-12.9%	-16.5%
	To NLF $1989 \rightarrow 2000$	**To NLF** $2000 \rightarrow 2015$
NRM	33.8%	100%
NRC	5.6%	122%
R	46.4%	160%
	To NRM $1989 \rightarrow 2000$	**To NRM** $2000 \rightarrow 2015$
NRM	-54.7%	-7.7%
NRC	55.6%	77.0%
R	77.4%	16.7%

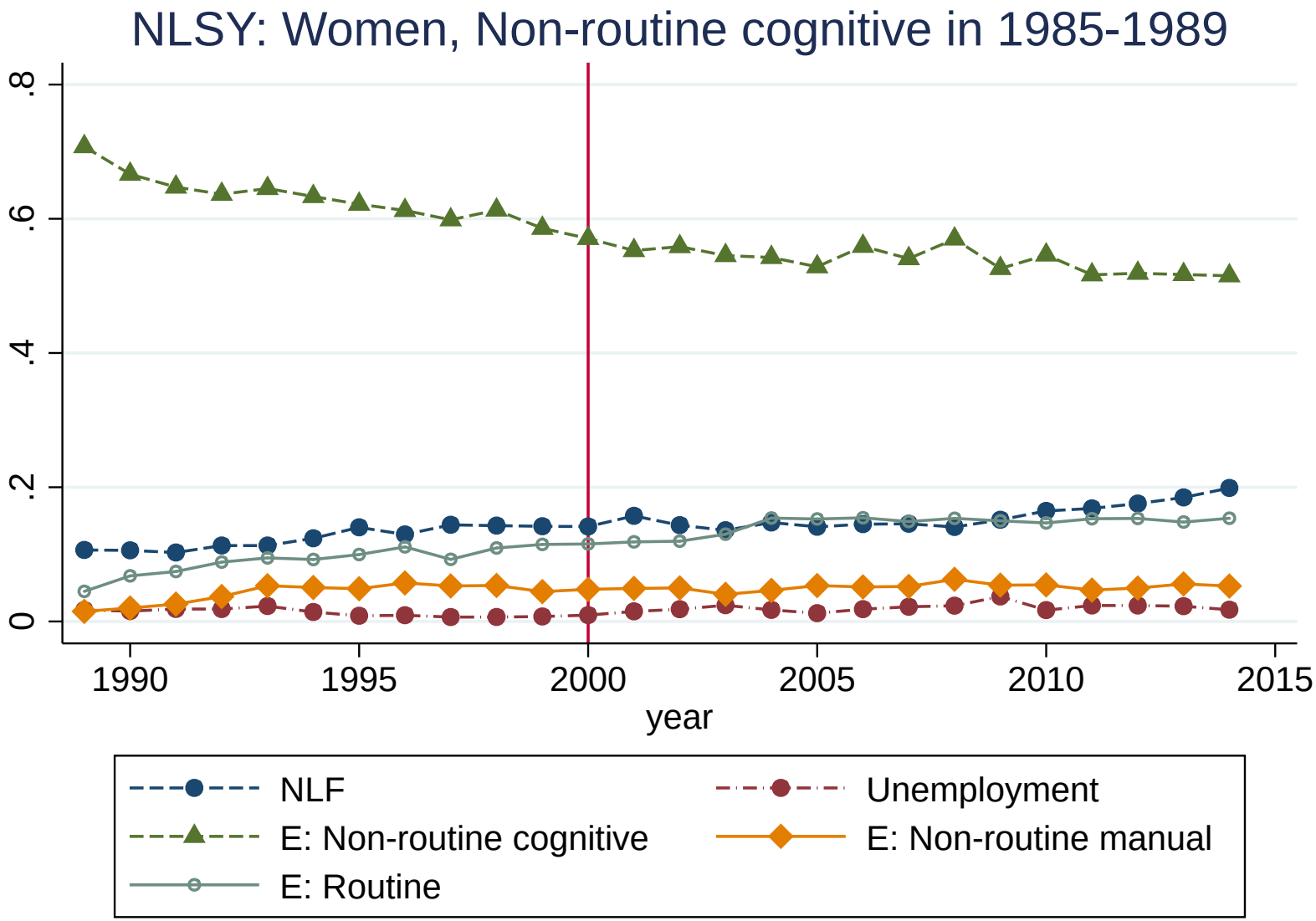
Back

The Evolution of Employment Choices (levels): Men

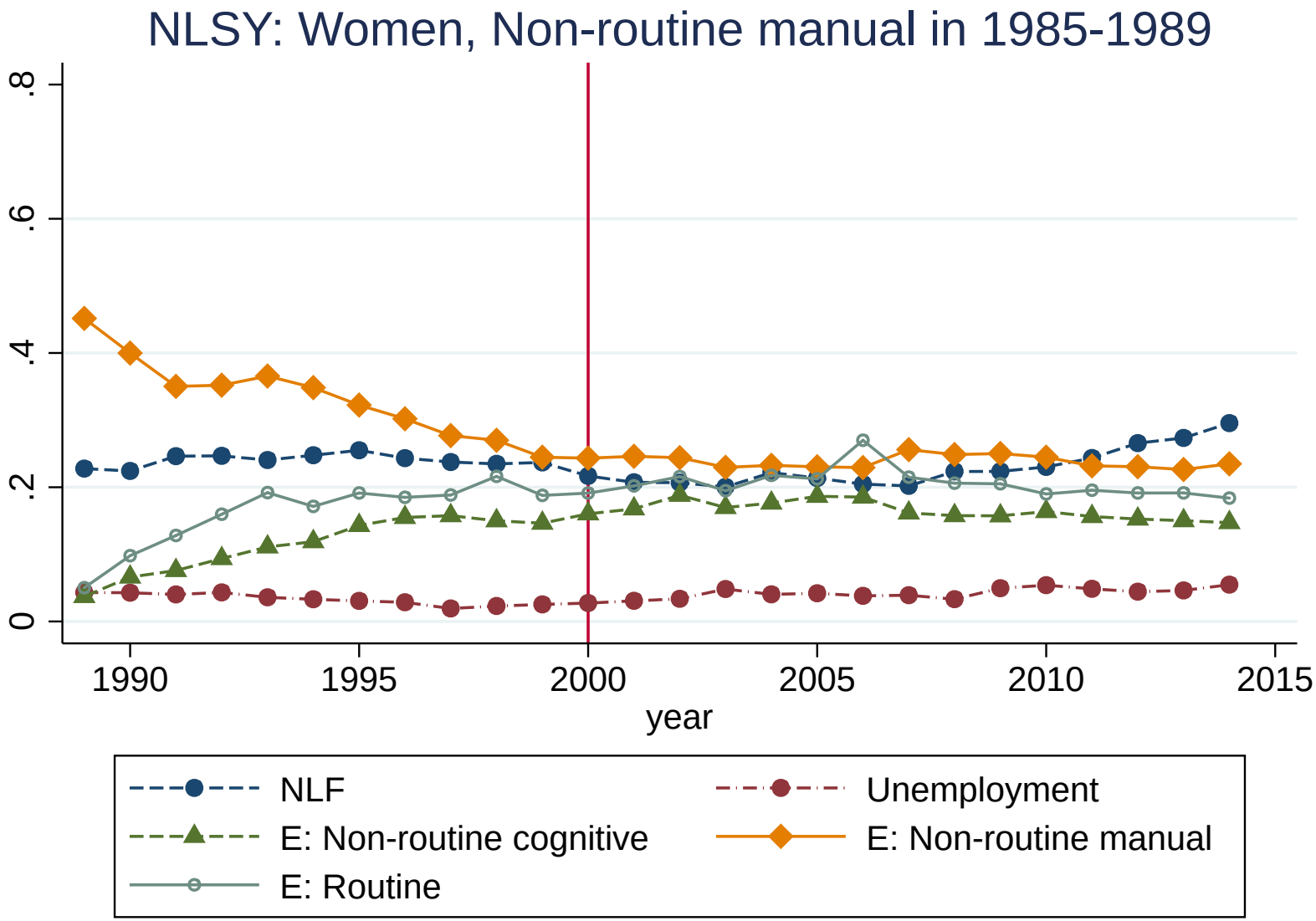
	To starting occ $1989 \rightarrow 2000$	To starting occ $2000 \rightarrow 2015$
NRM	-27.6%	-1.8%
NRC	-8.8%	-3.4%
R	-8.1%	-9.0%
	To NLF $1989 \rightarrow 2000$	**To NLF $2000 \rightarrow 2015$**
NRM	3.1%	12.4%
NRC	0.2%	4.6%
R	2.4%	12.2%
	To NRM $1989 \rightarrow 2000$	**To NRM $2000 \rightarrow 2015$**
NRM	-27.6%	-1.8%
NRC	0.4%	1.0%
R	1.5%	0.6%

Back

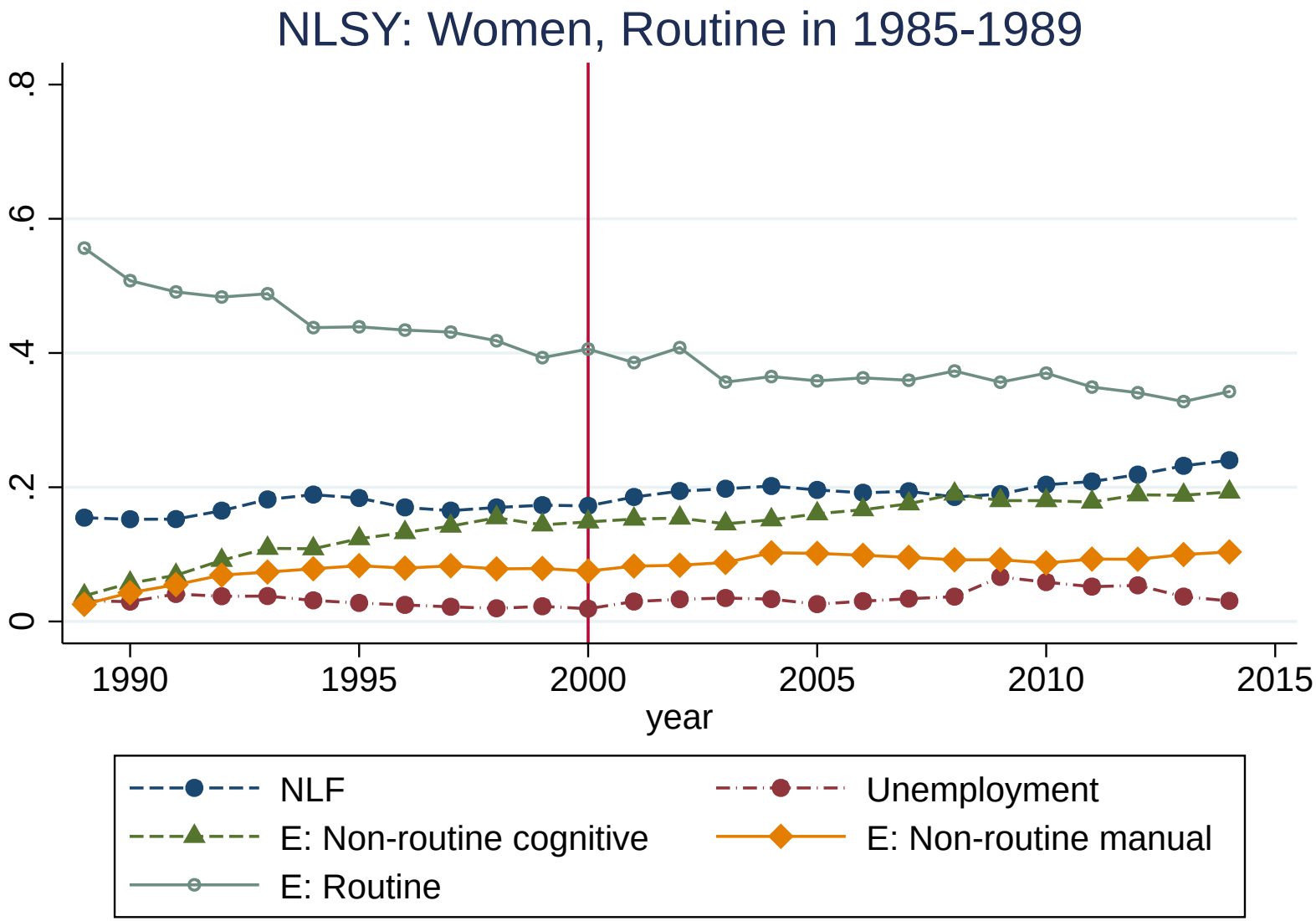
The Evolution of Employment Choices: Women



The Evolution of Employment Choices: Women



The Evolution of Employment Choices: Women



The Evolution of Employment Choices: Women

	To starting occ $1989 \rightarrow 2000$	To starting occ $2000 \rightarrow 2015$
NRM	-46.1%	-3.4%
NRC	-19.3%	-9.7%
R	-27.0%	-15.6%
	To NLF $1989 \rightarrow 2000$	**To NLF** $2000 \rightarrow 2015$
NRM	-4.8%	36.3%
NRC	32.9%	40.1%
R	11.4%	39.4%
	To NRM $1989 \rightarrow 2000$	**To NRM** $2000 \rightarrow 2015$
NRM	-46.1%	-3.4%
NRC	219%	10.1%
R	195%	38.1%

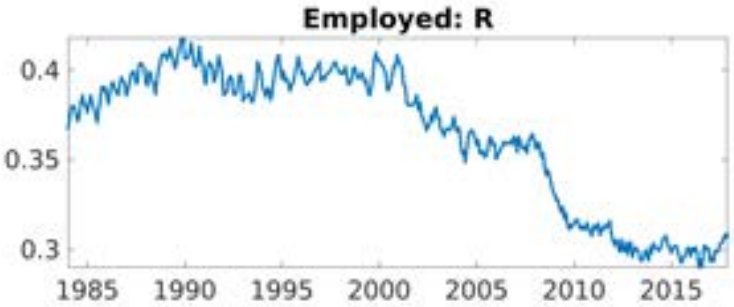
Back

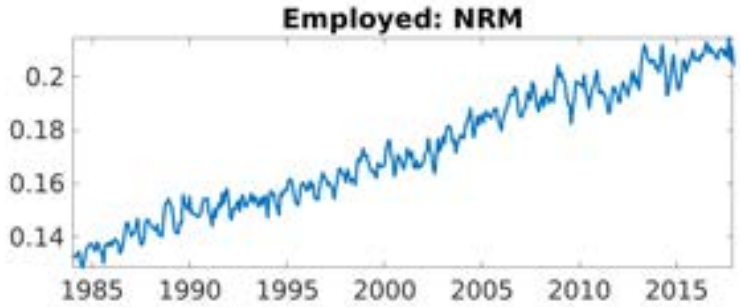
The Evolution of Employment Choices (levels): Women

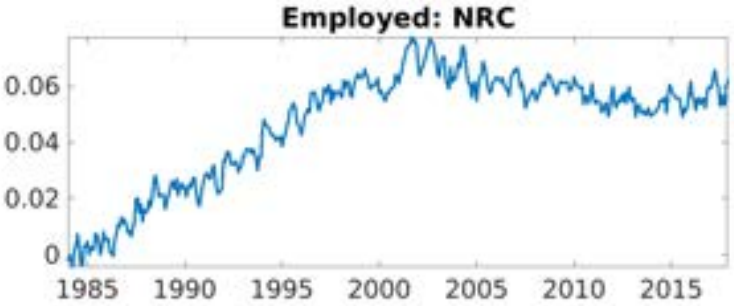
	To starting occ $1989 \rightarrow 2000$	To starting occ $2000 \rightarrow 2015$
NRM	-20.8%	-0.8%
NRC	-13.7%	-5.6%
R	-15.0%	-6.3%
	To NLF $1989 \rightarrow 2000$	**To NLF $2000 \rightarrow 2015$**
NRM	-1.1%	7.9%
NRC	3.5%	5.7%
R	1.8%	6.8%
	To NRM $1989 \rightarrow 2000$	**To NRM $2000 \rightarrow 2015$**
NRM	-20.8%	-0.8%
NRC	3.3%	0.5%
R	5.0%	2.9%

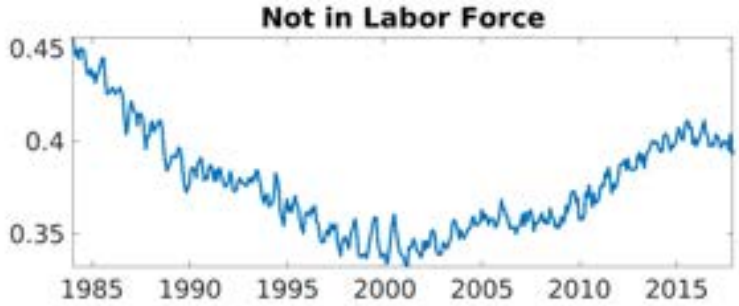
Back

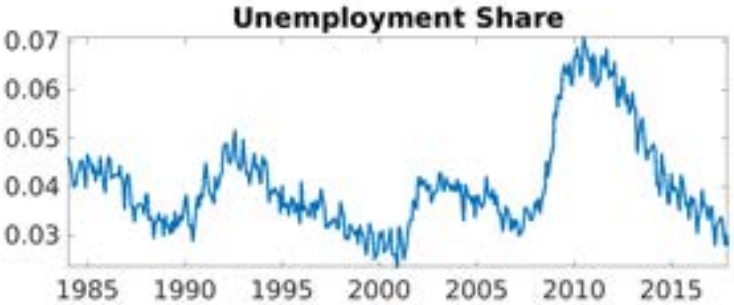
Non-NRC type Women

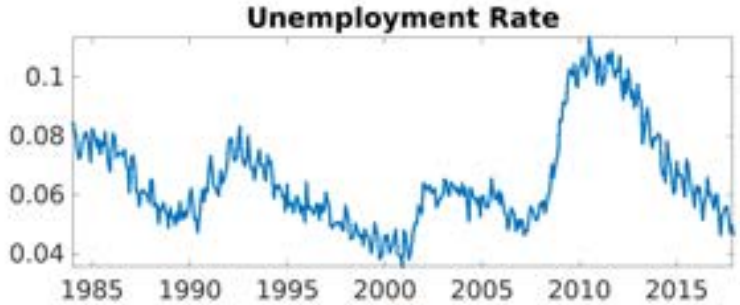












▸ Back

Women: 2001-2015

	non-NRC		NRC	
	(1) 2001	(2) 2015	(3) 2001	(4) 2015
Population Weight	0.58	0.53	0.42	0.47
Fraction in R	0.64	0.56	0.06	0.07
Fraction in NRM	0.12	0.15	~0	0.01
Fraction in NRC	0.01	~0	0.92	0.89
Fraction in NLF	0.19	0.25	0.02	0.03
Fraction in Unemployment	0.04	0.05	0.01	~0
Unemployment rate	0.05	0.07	0.01	~0

Back

Men: 2001-2015

	non-NRC		NRC	
	(1) 2001	(2) 2015	(3) 2001	(4) 2015
Population Weight	0.68	0.57	0.32	0.43
Fraction in R	0.39	0.30	0.11	0.12
Fraction in NRM	0.17	0.20	~0	0.01
Fraction in NRC	0.07	0.05	0.74	0.72
Fraction in NLF	0.34	0.41	0.15	0.14
Fraction in Unemployment	0.03	0.04	0.01	0.02
Unemployment rate	0.05	0.07	0.02	0.01

Back