Fiscal Sentiment and the Weak Recovery from the Great Recession: A Quantitative Exploration

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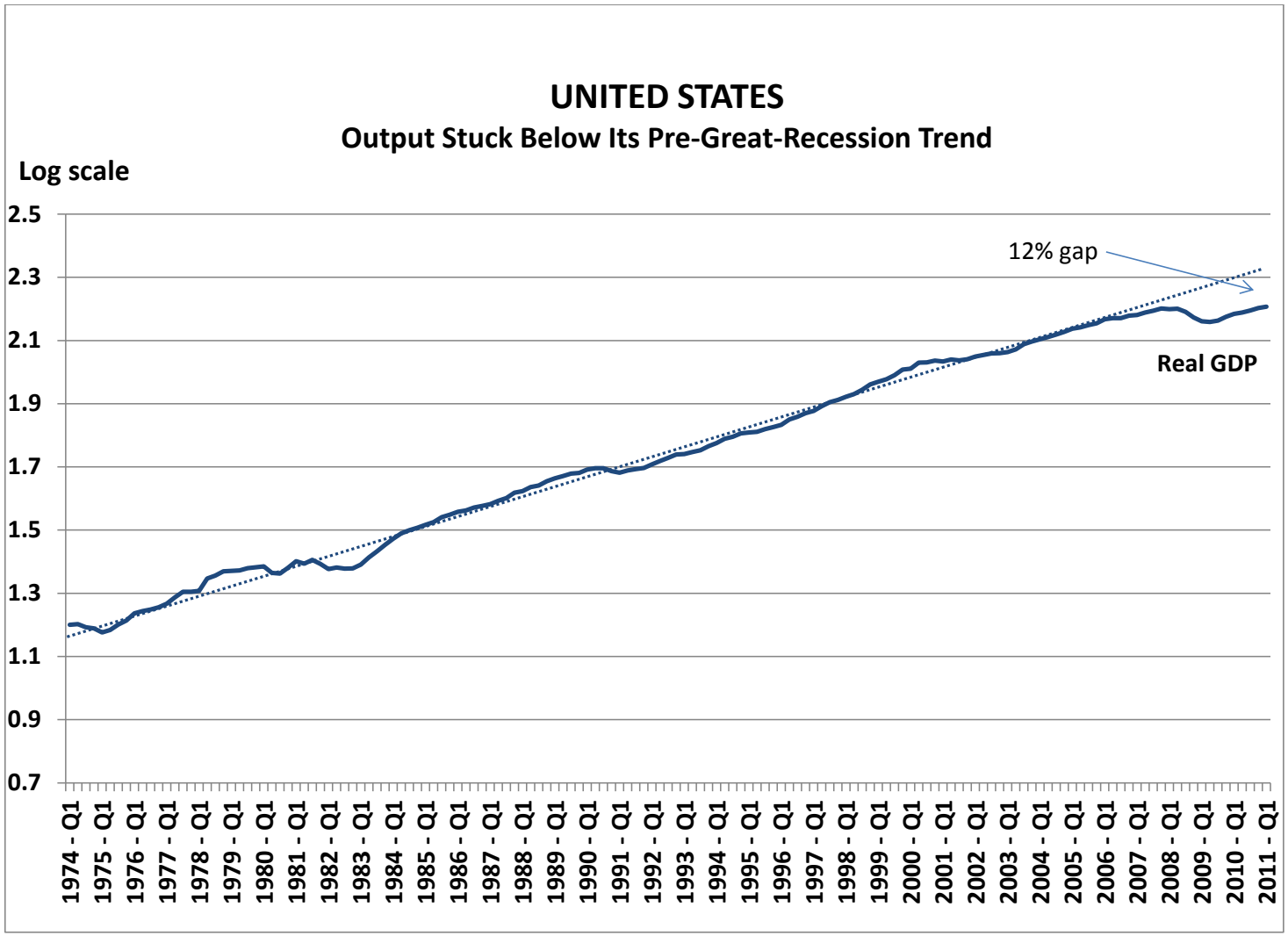
Growth, Rebalancing, and Macroeconomic Adjustments after Large Shocks
Worshop at Magyar Nemzeti Bank, Budapest, Hungary

September 20, 2013

Disclaimer

- The views expressed in this presentation are those of the authors and do not necessarily reflect those of the Federal Reserve Bank of Dallas, or the Federal Reserve System.

Motivation


UNITED STATES
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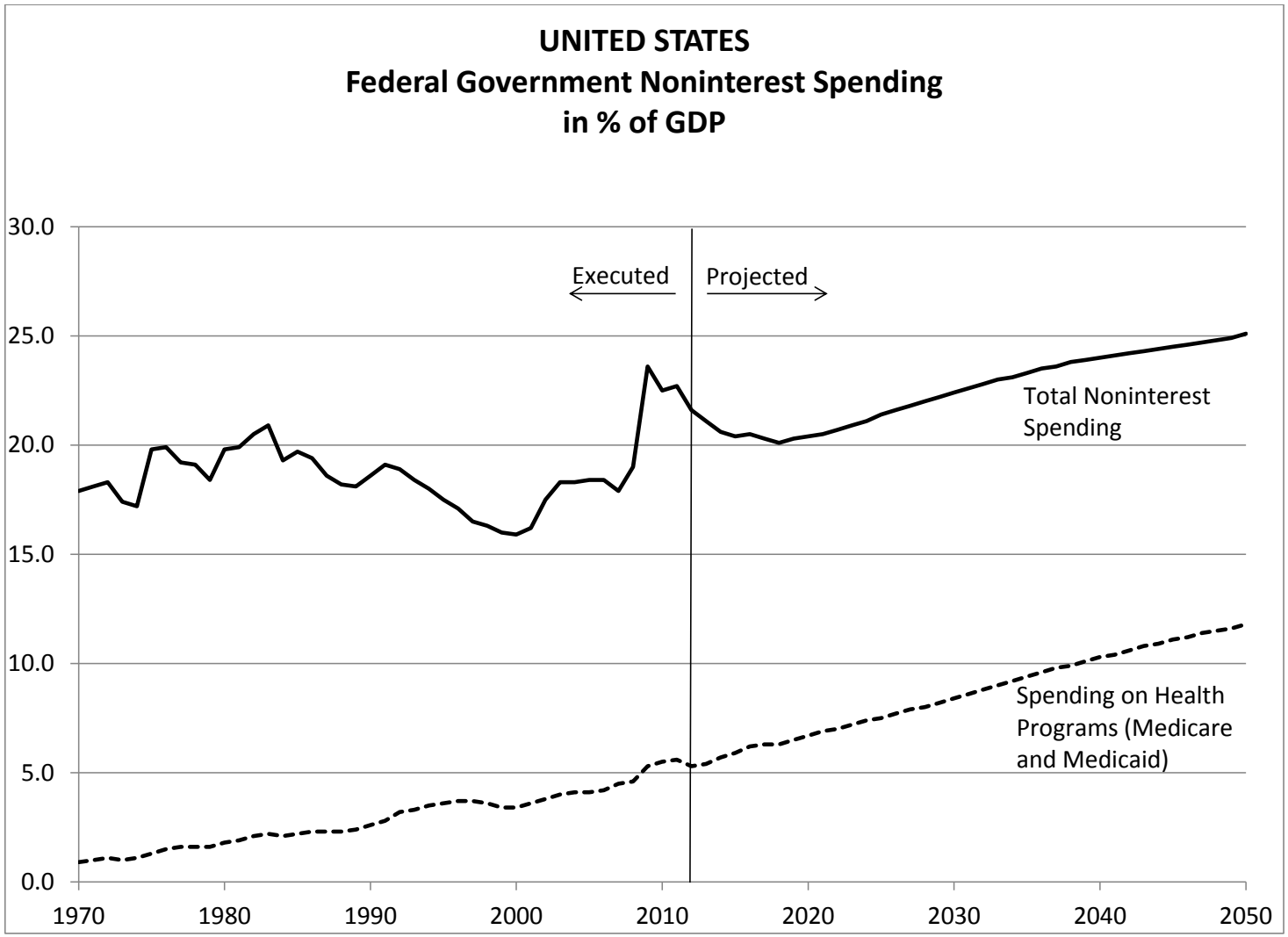
    - Reinhart-Rogoff's famous (infamous?) finding of negative correlation between growth and government debt.

US Rising Federal Noninterest Spending



Motivation

The "fiscal sentiment" conjecture

Summarized by Robert E. Lucas, Jr. in Spring 2011 Wall Street Journal interview:

> *"A healthy economy that falls into recession has higher than average growth for a while and gets back to the old trend line. We haven't done that. I have plenty of suspicions but little evidence. I think people are concerned about high tax rates... But none of this has happened yet. You can't look at evidence. The taxes haven't really been raised yet."*

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The Fiscal Sentiment Conjecture

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- Lucas himself helped develop "policy experiment" tools to overcome this difficulty!
- No one has used them yet to explore the *quantitative* relevance of the fiscal sentiment hypothesis.
    - This is exactly what the paper sets out to do.

Goal of the paper

Contribute to the debate on the causes behind the disappointing recovery from the Great Recession by exploring the fiscal sentiment hypothesis *quantitatively*.

Preview of the results

Prospects of higher taxes matter more than critics of the hypothesis typically concede, but less than what its advocates typically believe.

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- Neoclassical growth model.

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- How far can fiscal sentiment hypothesis go *without* distortions other than future higher taxes?

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- Why?
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- No reference to financial frictions in Lucas's characterization of the weak recovery.
- How far can fiscal sentiment hypothesis go *without* distortions other than future higher taxes?
  - Size of the "residual" potentially useful to infer the potential quantitative role of the "missing" frictions (financial among them) in the weakness of the recovery.

Measurement issues

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- They are right!
- But has output declined from trend as much as 12%?

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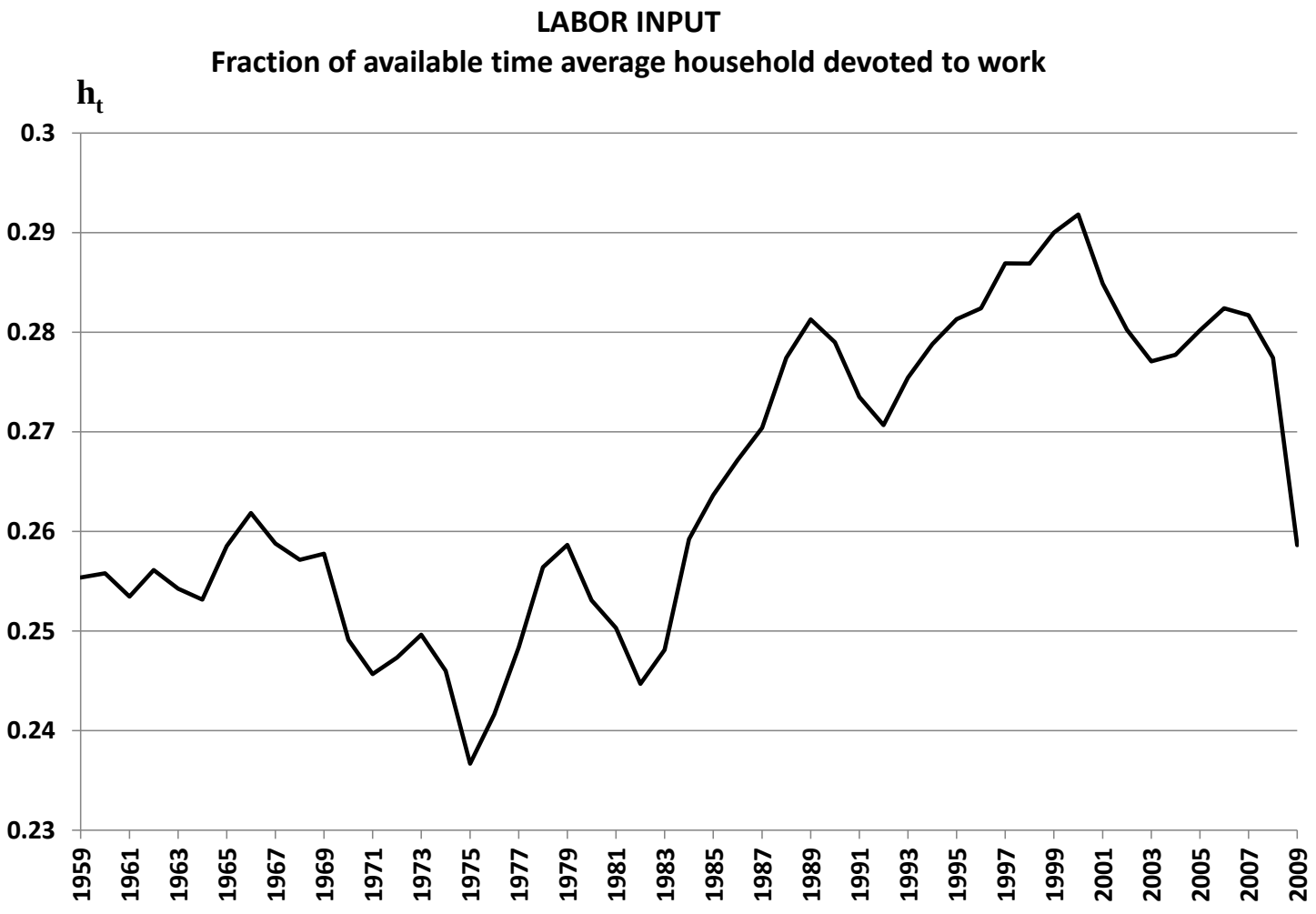
  - It hasn't been stationary, as it's supposed to be along a "balanced-growth" path.


LABOR INPUT
Fraction of available time average household devoted to work
h_t
0.3
0.29
0.28
0.27
0.26
0.25
0.24
0.23
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009

Measurement issues

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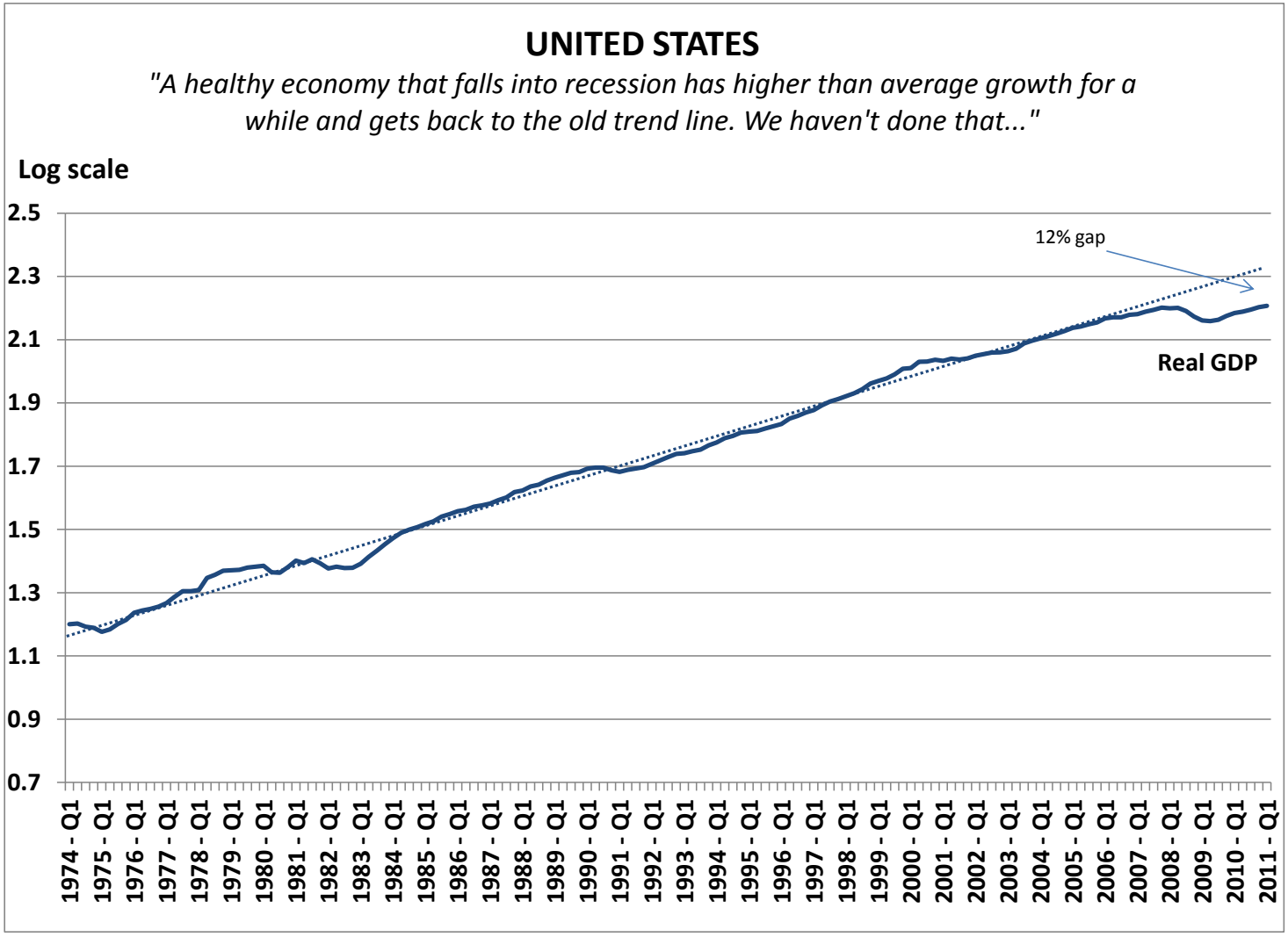
- Fiscal sentiment hypothesis has a shot at accounting for this smaller decline from trend.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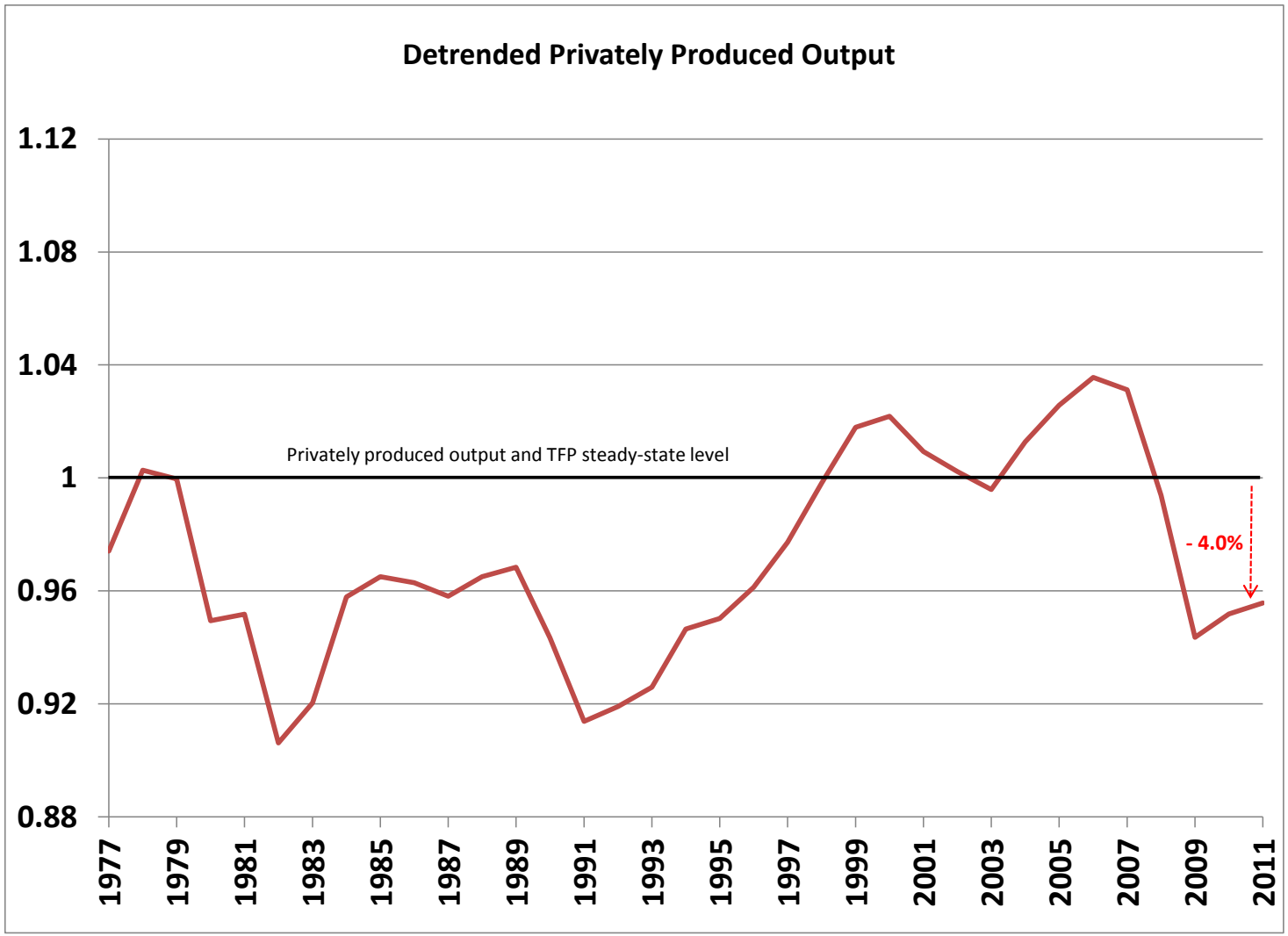
Detrended Privately Produced Output
1.12
1.08
1.04
1
0.96
0.92
0.88
Privately produced output and TFP steady-state level
- 4.0%
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011

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- "Private sector economy" approach in Gomme-Rupert (2000) particularly suitable to that end.
    - Paper updates approach to incorporate latest NIPA methodological changes.
- Conference participants will be spared the tedious steps, critical nevertheless for trusting the quantitative results of the model.

Government Budget Constraint

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  - Can be answered on a first pass abstracting from government debt dynamics:
    - Balanced budget, additional revenues rebated as lump-sum transfers.
  - Quantitative discipline needed to limit size of expected tax increases.

Government Policies

- Trivial ones:
  - stochastic public sector labor input demand
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  - stochastic public sector labor input demand
  - iid shocks to share of value added by the public sector (used to infer private sector output).
- Important one: anticipated switch to a higher taxes regime:

$$\left\{ \{\tau^h_{t+i}, \tau^k_{t+i}\}_{i=0}^{j}, \{\tau^h_{t+j+n}, \tau^k_{t+j+n}\}_{n=1}^{\infty} \right\}_{t=s};$$

$$\tau^h_{t+j+n} > \tau^h_{t+i} \text{ and/or } \tau^k_{t+j+n} > \tau^k_{t+i}, \text{ for all } i \text{ and } n.$$

Model

Stand-in household's choice problem:

$$\underset{\{c_t, l_t, k_{t+1}\}}{Max} \; E \sum_{t=s}^{\infty} [\beta(1+n)(1+\gamma)^{\alpha(1-\sigma)}]^t \frac{[c_t^{\alpha}(1-h_t)^{1-\alpha}]^{1-\sigma} - 1}{1-\sigma}$$

subject to:

$$\begin{aligned} c_t + x_t &= (1-\tau_t^h) w_t (h_t^{pr} + h_t^{ge} + h_t^{gc}) + \\ &\quad [r_t - \tau_t^k (r_t - \delta)] k_t + c k_t^{ge} + \tau_t \end{aligned}$$

$$(1+n)(1+\gamma) k_{t+1} = x_t + (1-\delta) k_t$$

$$1 = l_t + h_t^{pr} + h_t^{ge} + h_t^{gc}$$

government policies

Model

Representative firm's choice problem:

$$\underset{h_t^{pr},\ k_t}{Max}\ [y_t^{pr} - w_t h_t^{pr} - r_t k_t]$$

subject to:

$$y_t^{pr} = \frac{1}{e^{(1-\theta)\gamma t}} A e^{z_t} k_t^{\theta} [e^{\gamma t} h_t^{pr}]^{1-\theta},$$

where

$$z_t = \rho z_{t-1} + \varepsilon_t$$

- TFP long-run growth rate γ assumed deterministic (to capture "rubber band" growth effect implied by Lucas.)

- Nominal variables deflated by implicit price deflator for nondurable consumption goods and services.
- Deflating procedure and Cobb-Douglas technology incorporate investment-specific technological progress in manner consistent with balanced growth.
- Depreciation rate should be interpreted as *economic* depreciation rate.

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- Important step, as decision rules will be computed with perturbation methods around the steady-state.
- Parameter calibrated using historical averages:

x/y (private sector investment-output ratio)	0.19
δ (*economic* depreciation rate)	0.05
gy (general government output absorption)	0.086
vy (value added by government enterprises)	0.013
τ_t^k (capital income tax rate)	0.40
τ_t^h (labor income tax rate)	0.23
γ (private sector TFP annual growth rate)	0.7 %
$\frac{k}{y^{pr}}$ (private sector capital-output ratio)	2.7
θ (private sector capital income share)	0.35

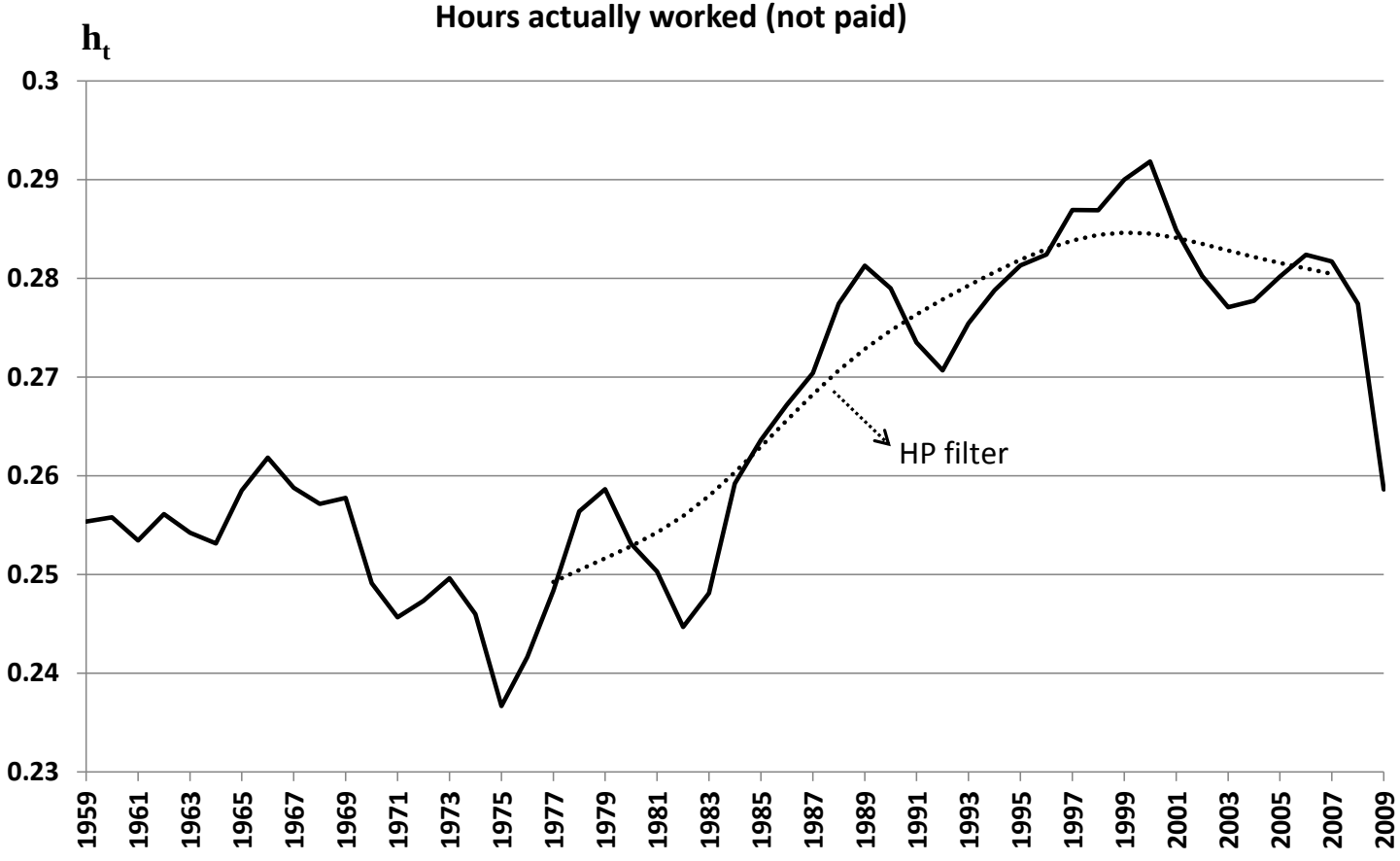
Calibration

- Utility parameter α particularly difficult to calibrate.
- Typical approach uses steady-state version of intratemporal marginal rate of substitution between consumption and leisure:

$$\alpha = \frac{1}{\frac{1-h^{pr}-h^{pu}}{h^{pr}} \frac{(1-\tau^h)(1-\theta)}{1+vy-gy-\frac{x}{y^{pr}}} + 1}$$

- But... what is the stationary value of h^{pr}?

Fraction of available time average household devoted to work
Population in working age (16-65 years old)
Hours actually worked (not paid)



Source: own calculations and Cociuba, Prescott, and Ueberfeldt (2012)

Calibration

Heroic decision:

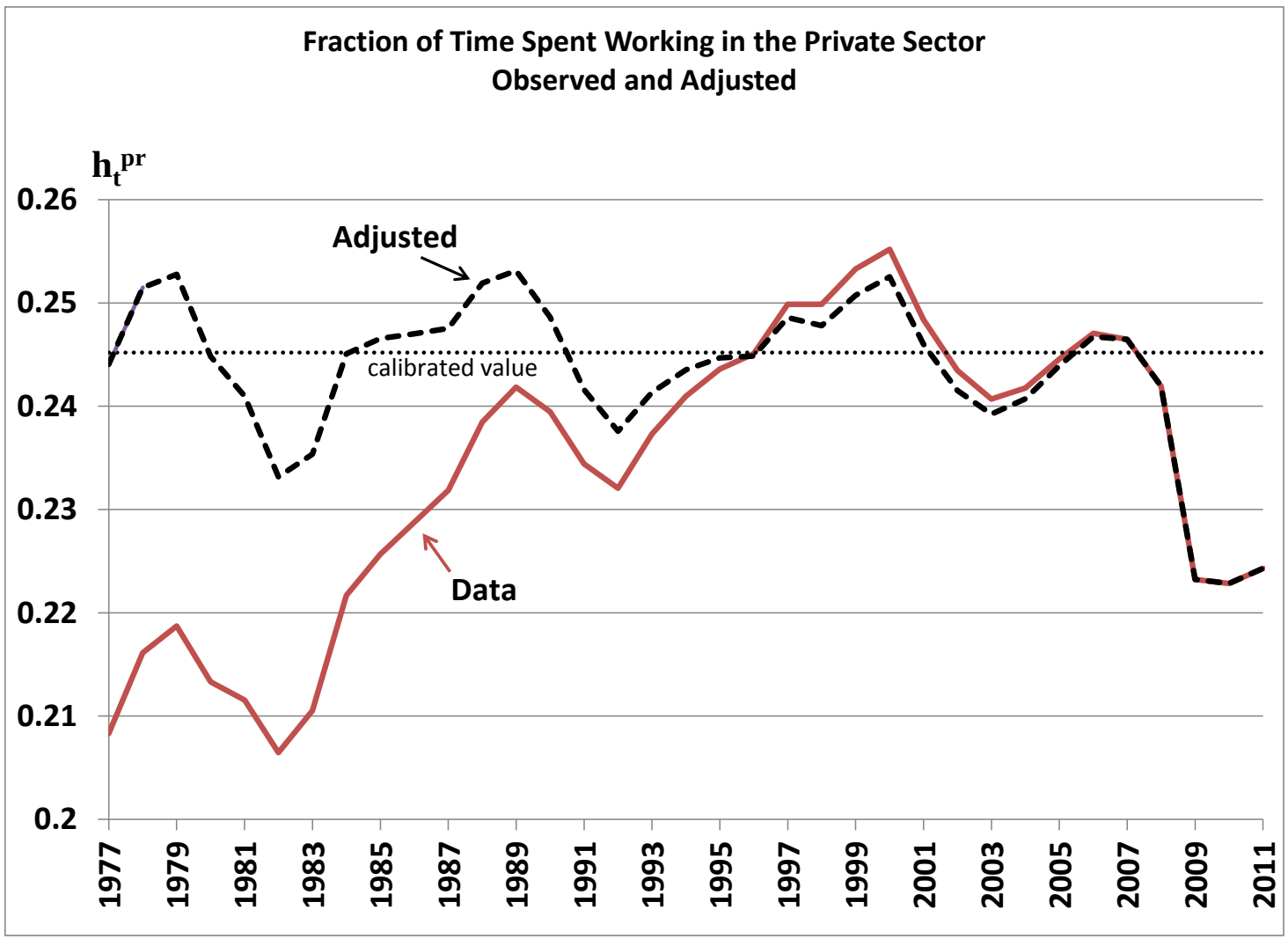
$$h = h(HPF)_{2007} = 0.28045$$

$$h^{pr} = h^{pr}(HPF)_{2007} = 0.24519$$

$$h^{pu} = h - h^{pr} = 0.03526$$

Calibration

Effects of heroic decision:



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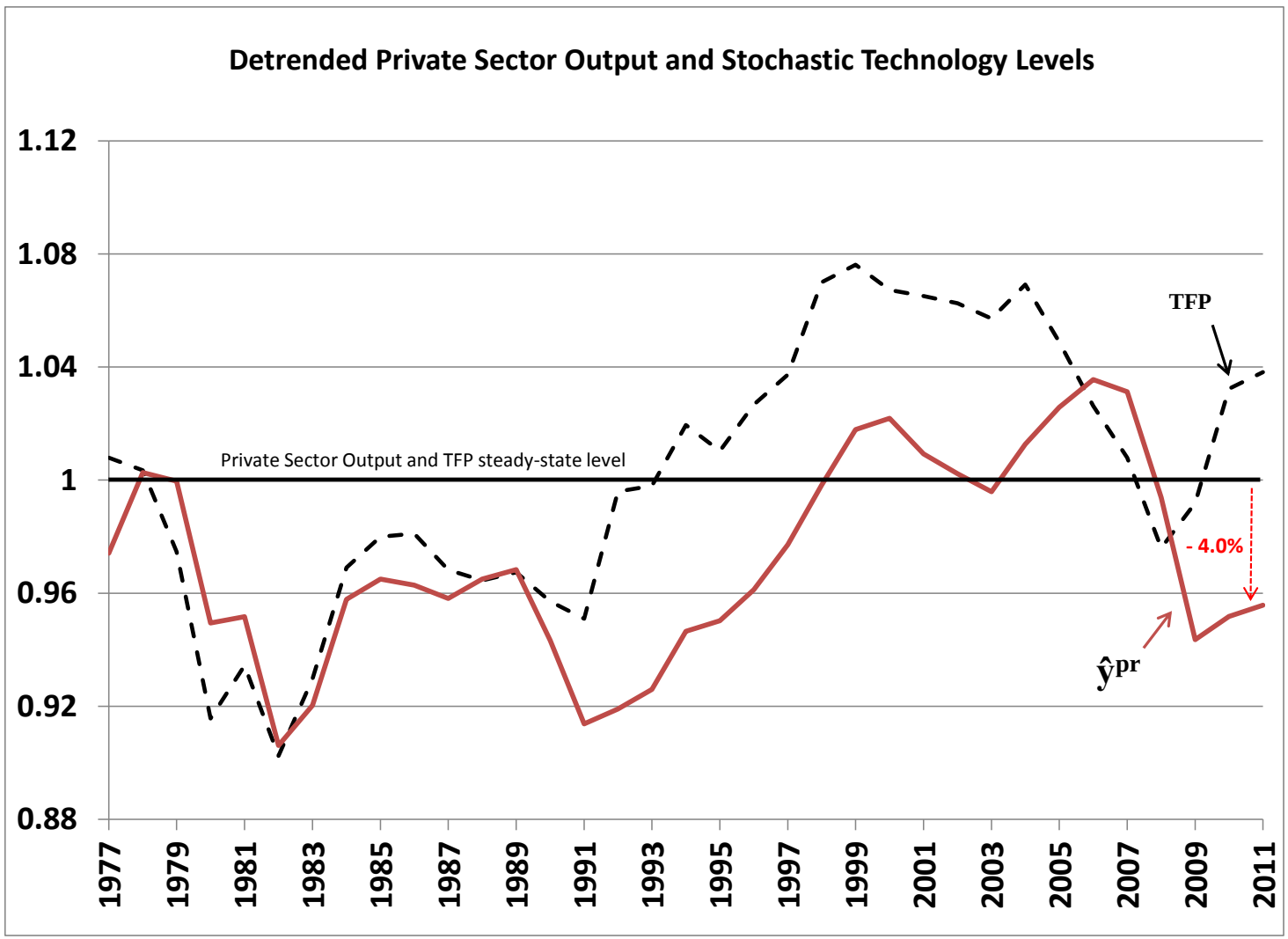
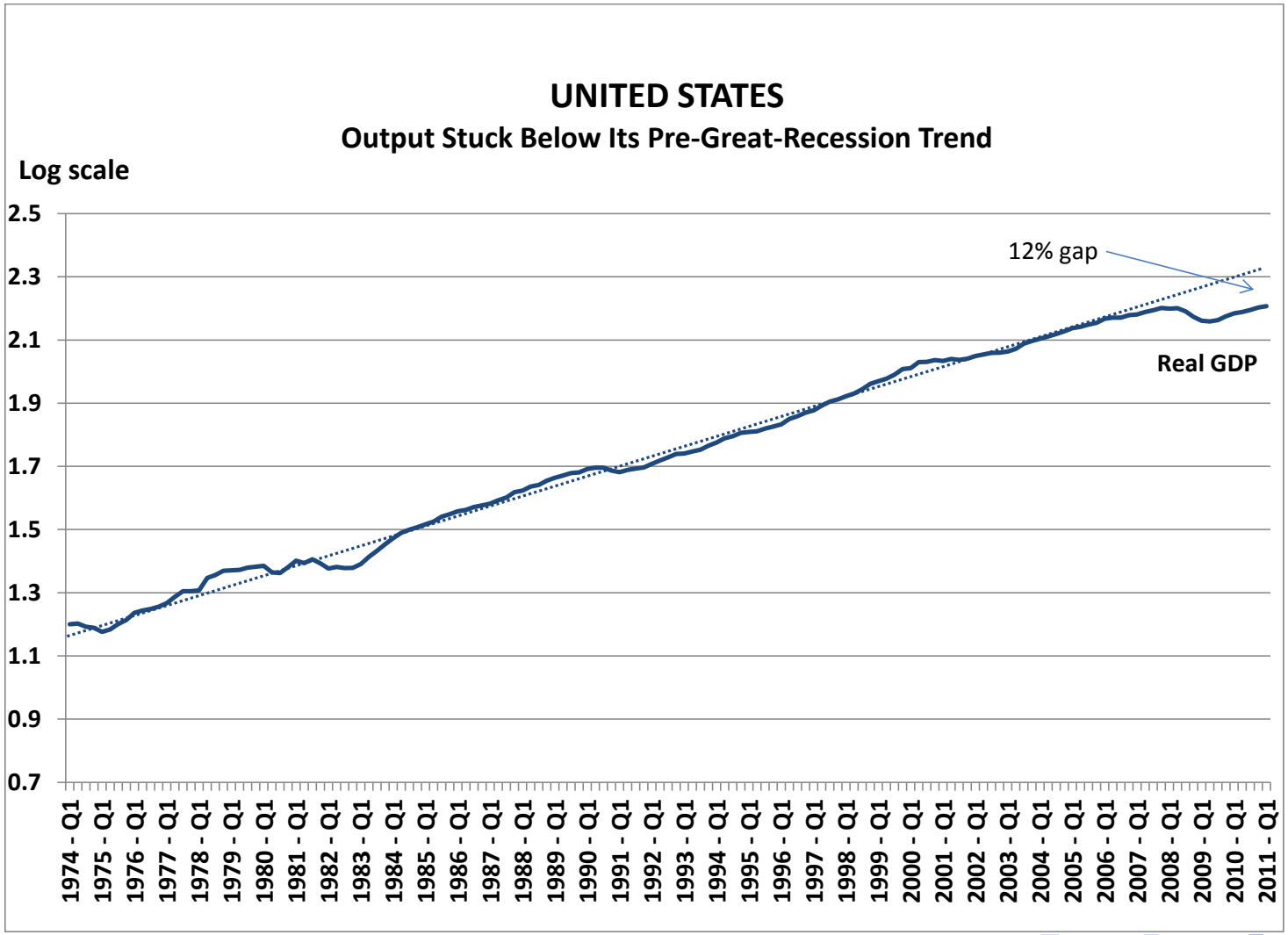


Contrast with 12% output decline from trend without correcting for non-stationarity of labor input



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- Paper agnostic on this issue: reports results with and without technology shocks.

Calibration

- Benchmark: $\sigma = 2 \Longrightarrow$ Intertemporal Elasticity of Substitution $= 0.5$,
  - less than the larger value of 1 proposed in the typical calibration of RBC models.
- In combination with calibrated value for $\alpha \Longrightarrow$ Frisch elasticity $= 1.7$,
  - intermediate value between larger value of at least 3 proposed in the RBC literature and smaller value of 0.5 suggested by microeconomic studies for the *intensive* margin of labor supply.
- Results *sensitive* to the choice of these parameter values.

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- Modest extra revenues of 0.3% of GDP thereafter (to cover rising costs of government-sponsored health care programs.)

Numerical Experiments

Restrictions on Tax Regime Change

Search over tax rates that can deliver targeted additional revenues, within the following class:

$$\left\{ \{\tau^h_{t+i}, \tau^k_{t+i}\}_{i=0}^{3}, \{\tau^h_{t+3+i}, \tau^k_{t+3+i}\}_{i=1}^{10}, \{\tau^h_{t+13+i}, \tau^k_{t+13+i}\}_{i=1}^{\infty} \right\}_{t=2009}$$

$$\begin{aligned}
\tau^h_{2009+i} &= 0.23;\ \tau^k_{2009+i} = 0.40 \text{ for } 0 \leq i \leq 3, \\
\tau^h_{2013+i} &= \tau^h_{2013};\ \tau^k_{2013+i} = \tau^k_{2013} \text{ for } 0 \leq i \leq 9, \\
\tau^h_{2023+i} &= \tau^h_{2023};\ \tau^k_{2023+i} = \tau^k_{2023} \text{ for all } i > 0.
\end{aligned}$$

- Higher labor income taxes and higher capital income taxes considered one at a time:
  - As in Christiano, Eichenbaum, and Rebelo 2011 JPE paper on the size of fiscal multipliers.

Numerical Experiments

Computational approach

- Innovations (iid shocks) to all stochastic processes are set equal to zero
- Computation uses second order perturbation approximation around the steady state.
  - Why?
  - Paper compares data and model predictions for *level* of variables.
  - Ignoring precautionary savings could bias results *in favor* of the fiscal sentiment hypothesis.

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  - Higher taxes on labor income tomorrow should induce households to work harder today.
  - Output should be above trend before the regime change materializes.
  - For the sake of completion, analyze this regime anyway.

Numerical Experiments

Higher labor income tax regime

Labor tax rates implied by additional revenues target:

$$\begin{aligned}
\tau^h_{2009+i} &= 0.23;\ \tau^k_{2009+i} = 0.40 \text{ for } 0 \leq i \leq 3, \\
\tau^h_{2013+i} &= 0.27;\ \tau^k_{2013+i} = 0.40 \text{ for } 0 \leq i \leq 9, \\
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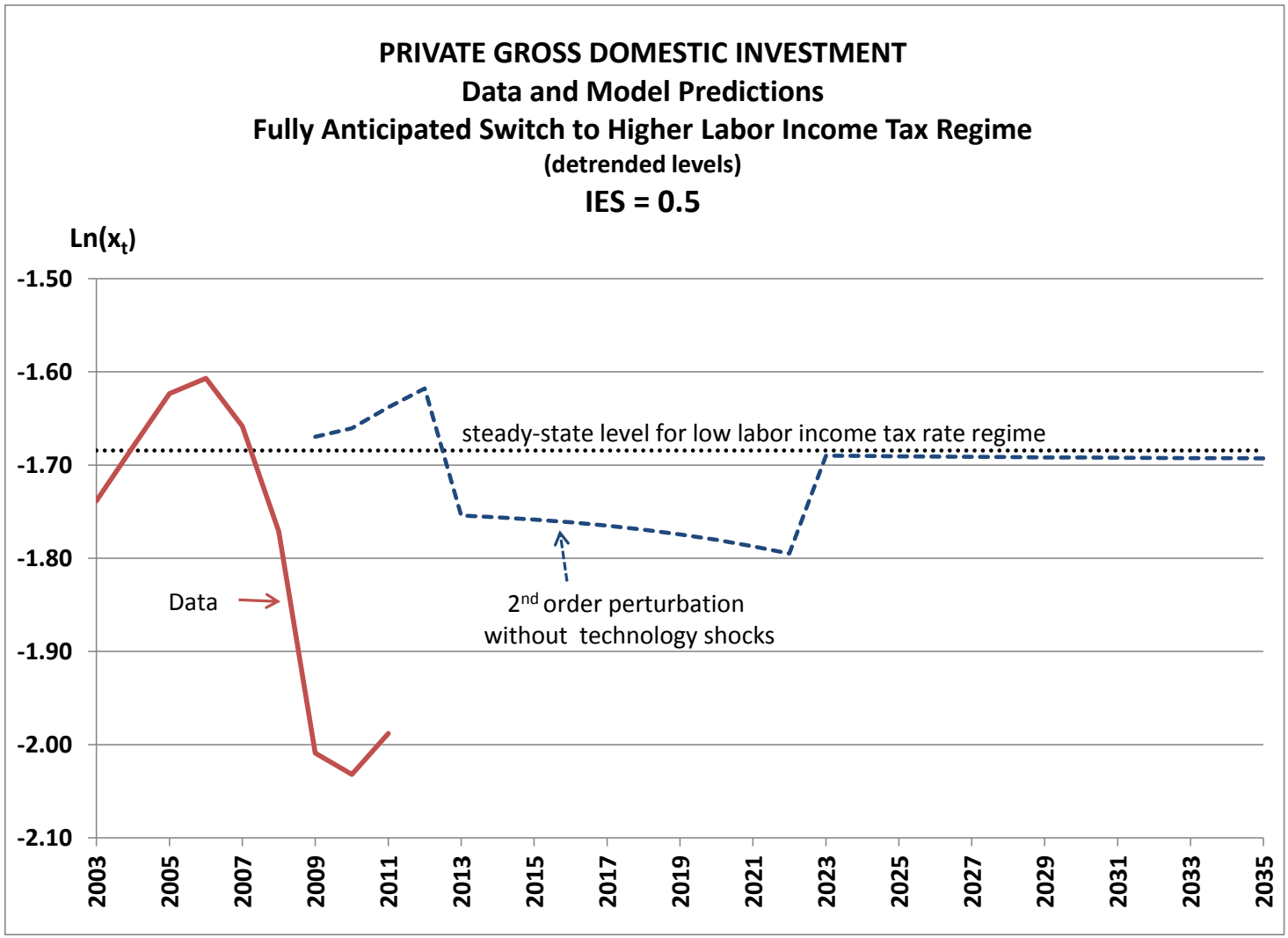
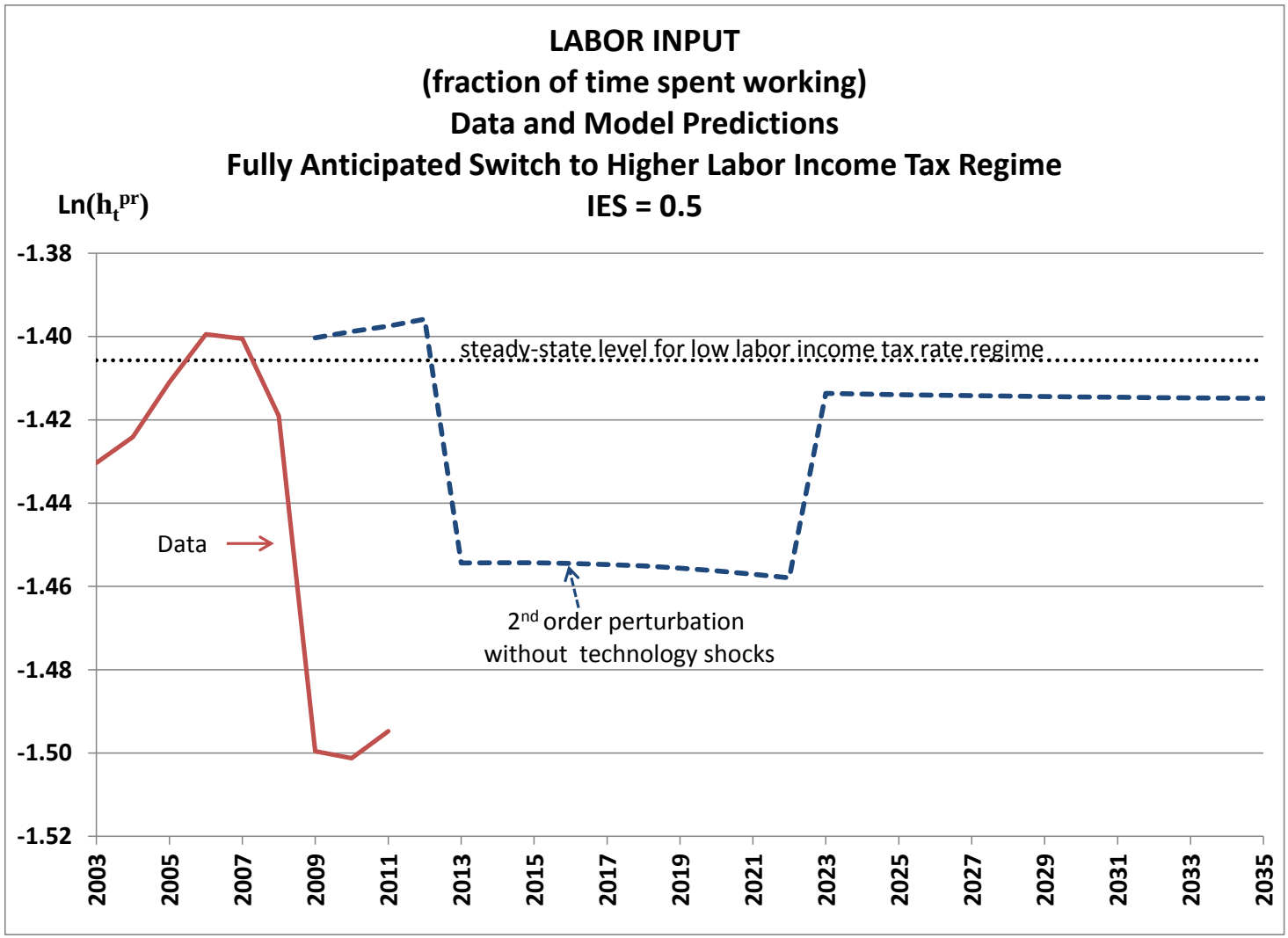

PRIVATE GROSS DOMESTIC INVESTMENT
Data and Model Predictions
Fully Anticipated Switch to Higher Labor Income Tax Regime
(detrended levels)
IES = 0.5
Ln(x_t)
-1.50
-1.60
-1.70
-1.80
-1.90
-2.00
-2.10
steady-state level for low labor income tax rate regime
Data
2nd order perturbation
without technology shocks
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035


LABOR INPUT
(fraction of time spent working)
Data and Model Predictions
Fully Anticipated Switch to Higher Labor Income Tax Regime
IES = 0.5
Ln(h_t^pr)
-1.38
-1.40
-1.42
-1.44
-1.46
-1.48
-1.50
-1.52
steady-state level for low labor income tax rate regime
Data
2nd order perturbation
without technology shocks
2003
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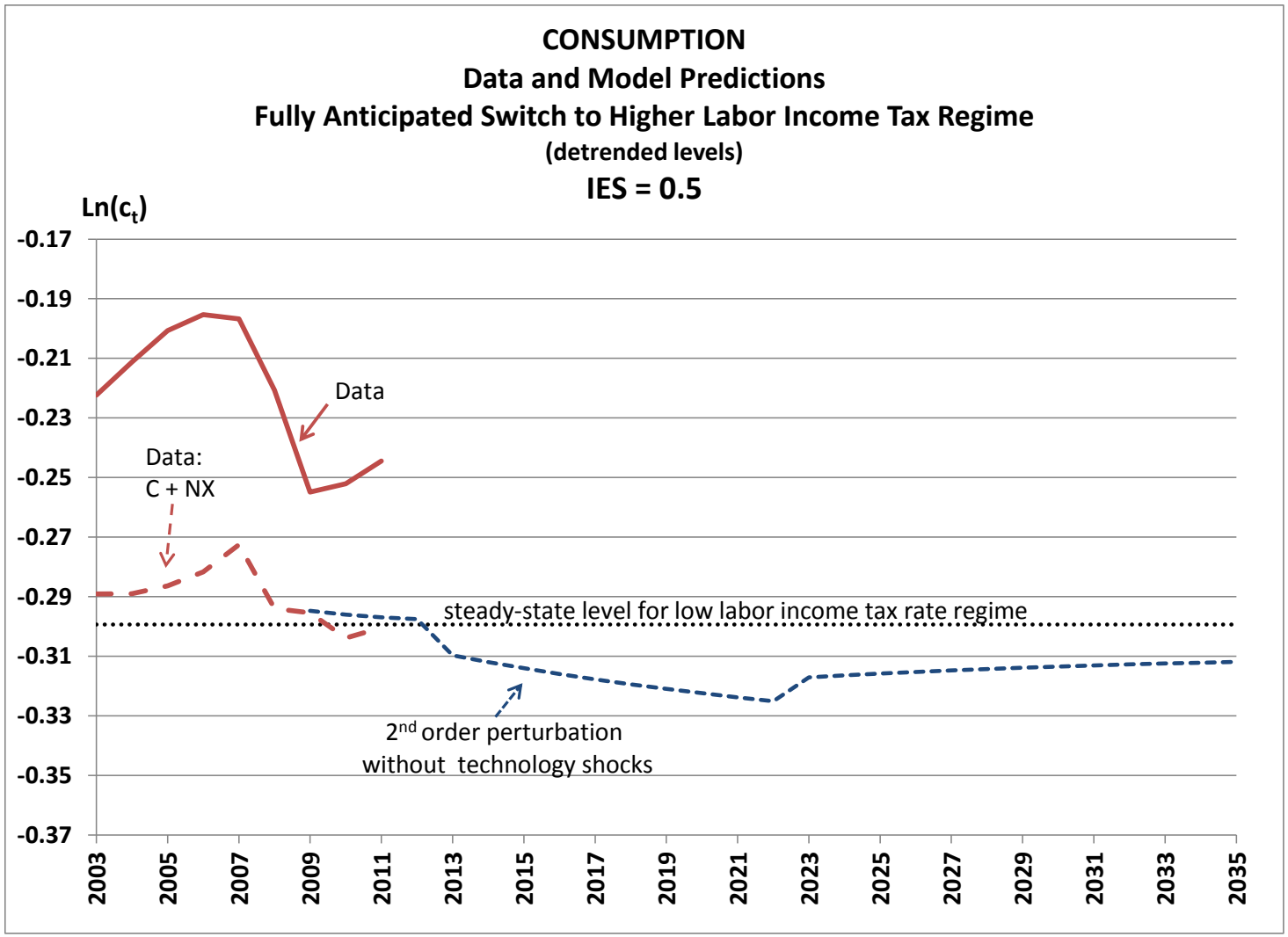
CONSUMPTION
Data and Model Predictions
Fully Anticipated Switch to Higher Labor Income Tax Regime
(detrended levels)
IES = 0.5
Ln(c_t)
-0.17
-0.19
-0.21
-0.23
-0.25
-0.27
-0.29
-0.31
-0.33
-0.35
-0.37
Data
Data:
C + NX
steady-state level for low labor income tax rate regime
2nd order perturbation
without technology shocks
2003
2005
2007
2009
2011
2013
2015
2017
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Numerical Experiments

Higher capital income tax regime

- Future higher tax rates on capital income can do the job in theory.

Numerical Experiments

Higher capital income tax regime

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  - Why fear higher taxes on just capital income?

Numerical Experiments

Higher capital income tax regime

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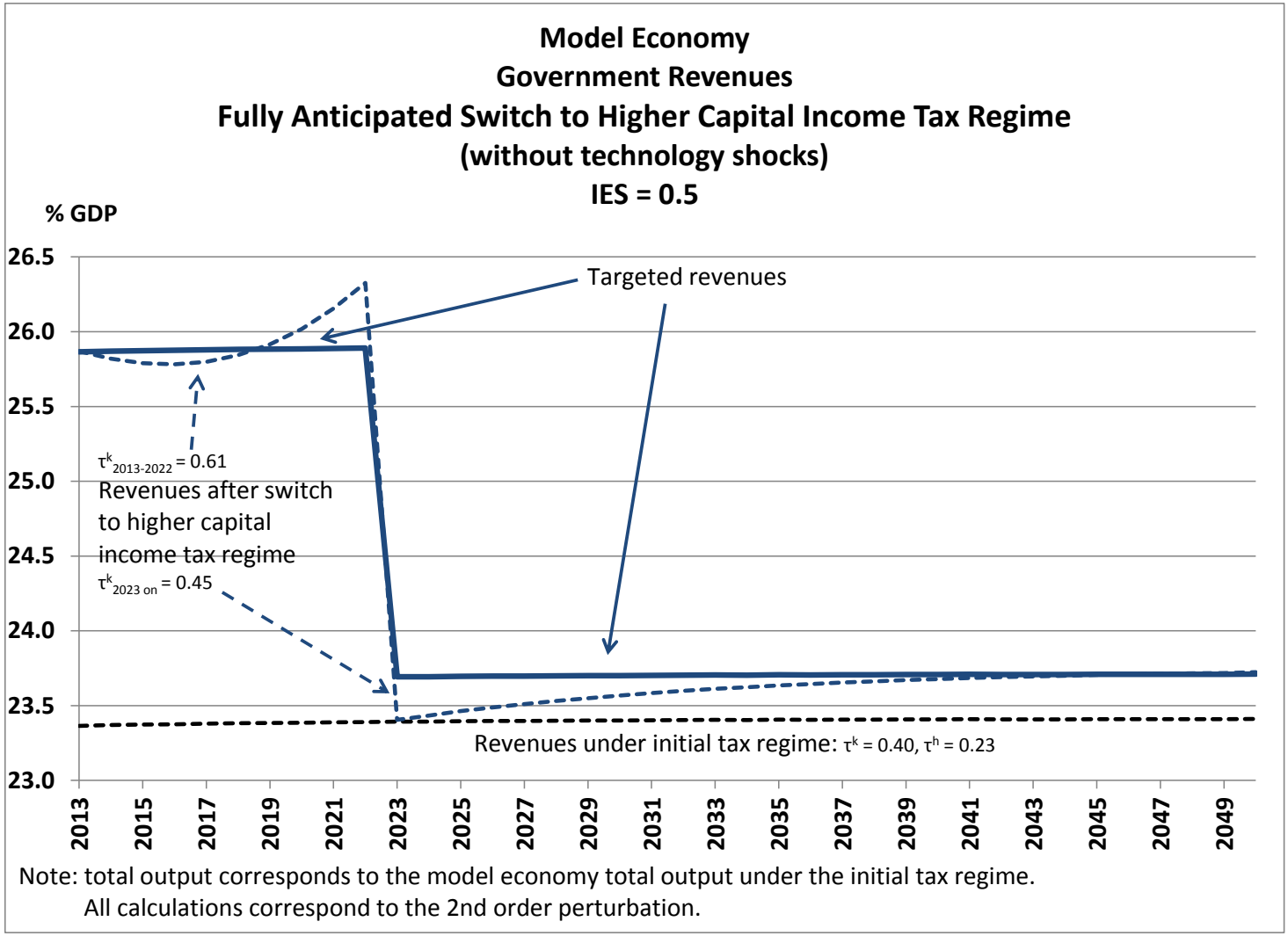
  - Why fear higher taxes on just capital income?
  - Because incentives of democratically elected officials is to correct structural fiscal imbalances with unanticipated taxation of capital (time inconsistency) rather than with entitlement reforms.

Numerical Experiments

Higher capital income tax regime

- Future higher tax rates on capital income can do the job in theory.
  - Why fear higher taxes on just capital income?
  - Because incentives of democratically elected officials is to correct structural fiscal imbalances with unanticipated taxation of capital (time inconsistency) rather than with entitlement reforms.
- Do these fears matter *quantitatively*?



Note: total output corresponds to the model economy total output under the initial tax regime.
All calculations correspond to the 2nd order perturbation.

How plausible are tax hikes of this magnitude?

- Higher capital income tax regime implies a 20 percentage points jump in the tax rate (from 40% to 61%).

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- Similar jump in 2013 under current law for:

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- Similar jump in 2013 under current law for:
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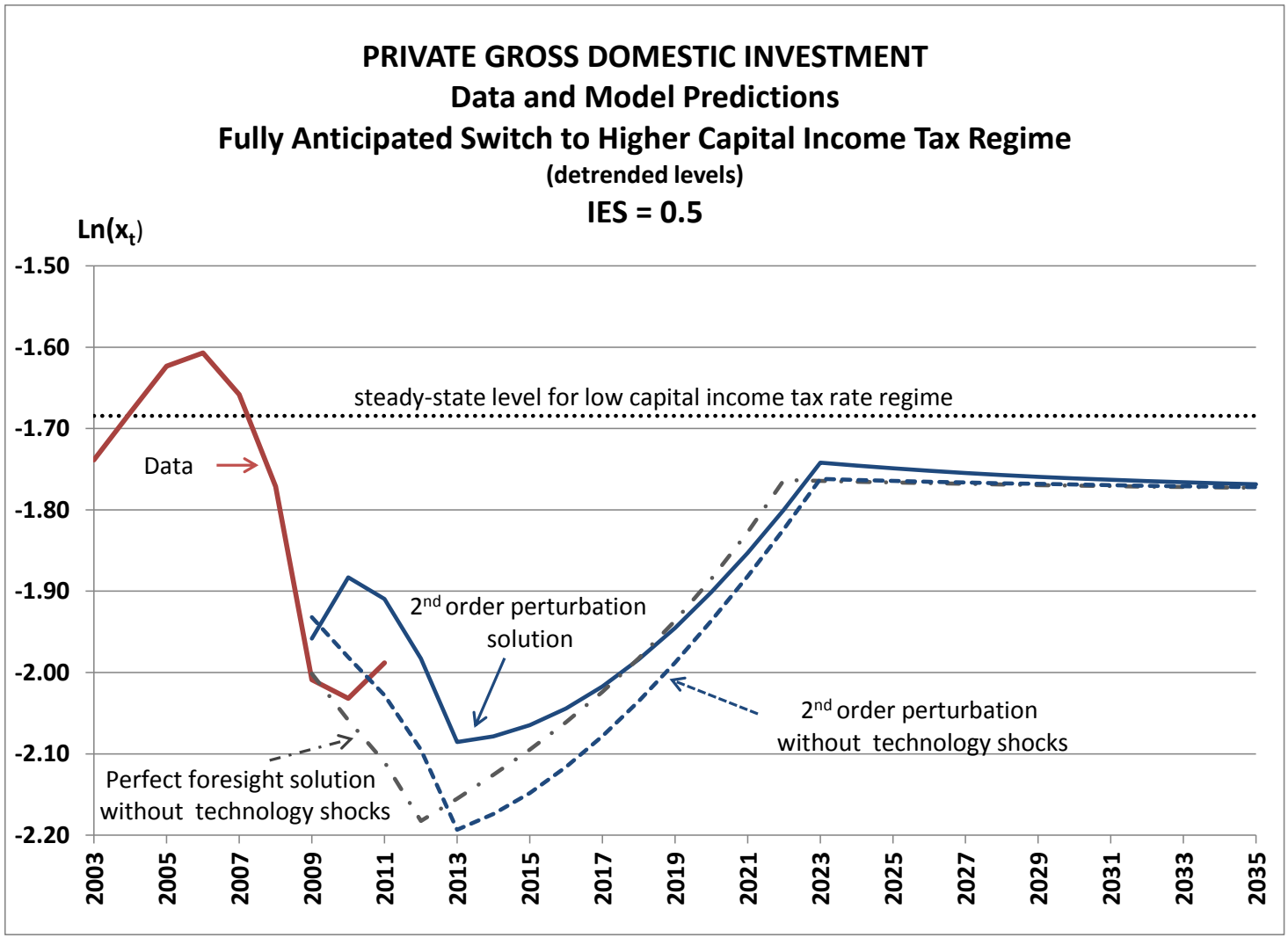
How plausible are tax hikes of this magnitude?

- Higher capital income tax regime implies a 20 percentage points jump in the tax rate (from 40% to 61%).
- Similar jump in 2013 under current law for:
  - top dividend tax rate (from 15% to 43.4%).
  - estate tax rate (from 35% to 55%).


PRIVATE GROSS DOMESTIC INVESTMENT
Data and Model Predictions
Fully Anticipated Switch to Higher Capital Income Tax Regime
(detrended levels)
IES = 0.5
Ln(x_t)
-1.50
-1.60
-1.70
-1.80
-1.90
-2.00
-2.10
-2.20
steady-state level for low capital income tax rate regime
Data
2nd order perturbation solution
2nd order perturbation without technology shocks
Perfect foresight solution without technology shocks
2003
2005
2007
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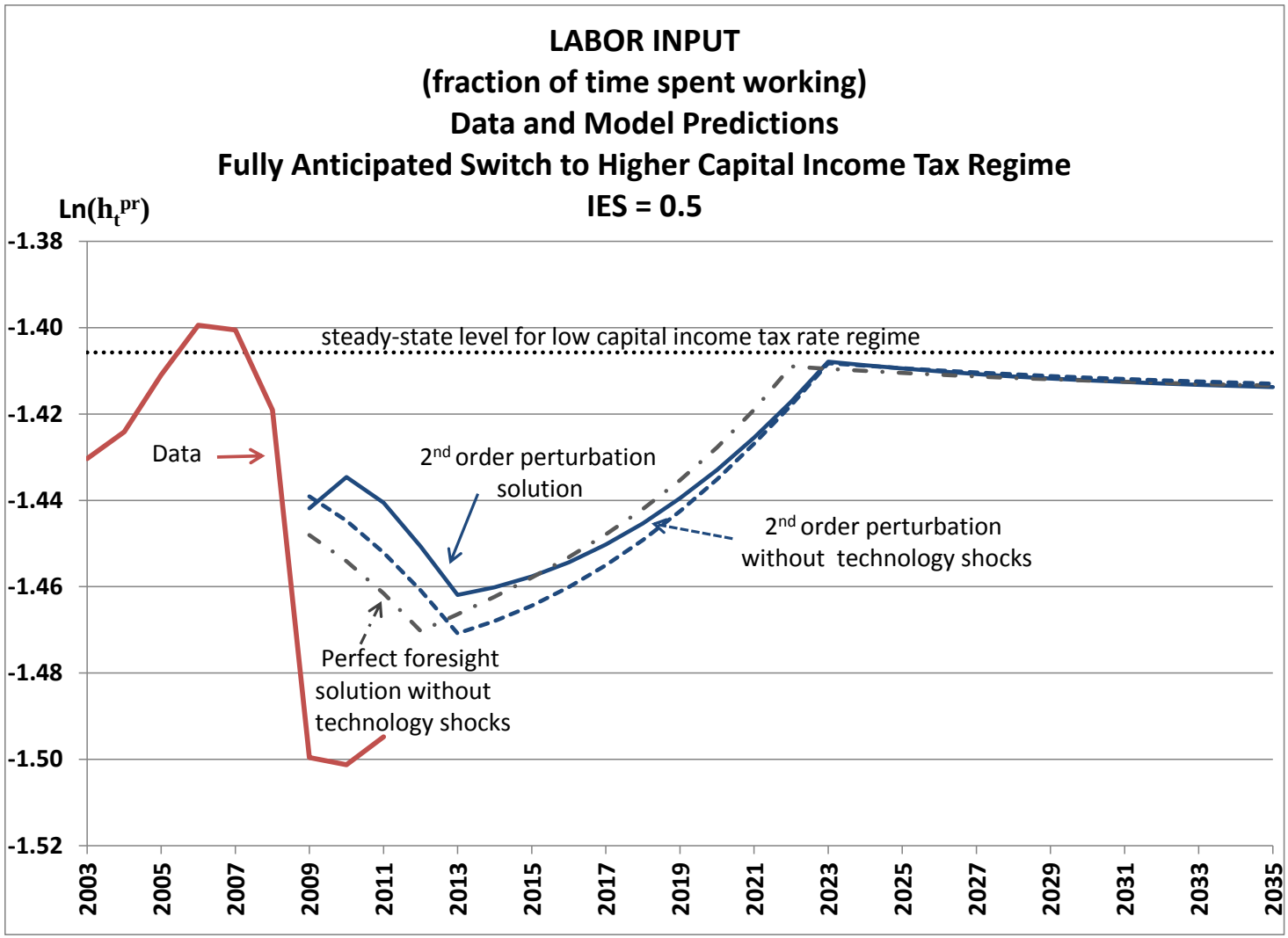
LABOR INPUT
(fraction of time spent working)
Data and Model Predictions
Fully Anticipated Switch to Higher Capital Income Tax Regime
IES = 0.5
Ln(h_t^pr)
-1.38
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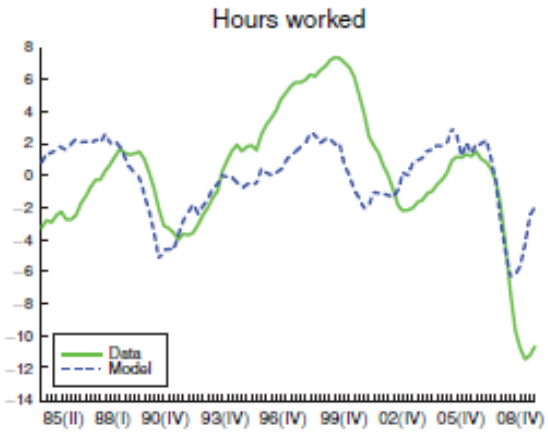
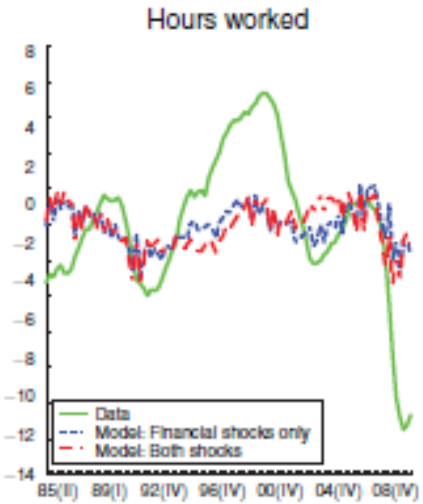
- Results for labor input better than in latest generation of complex financial frictions models, such as Jermann and Quadrini (AER, February 2012):

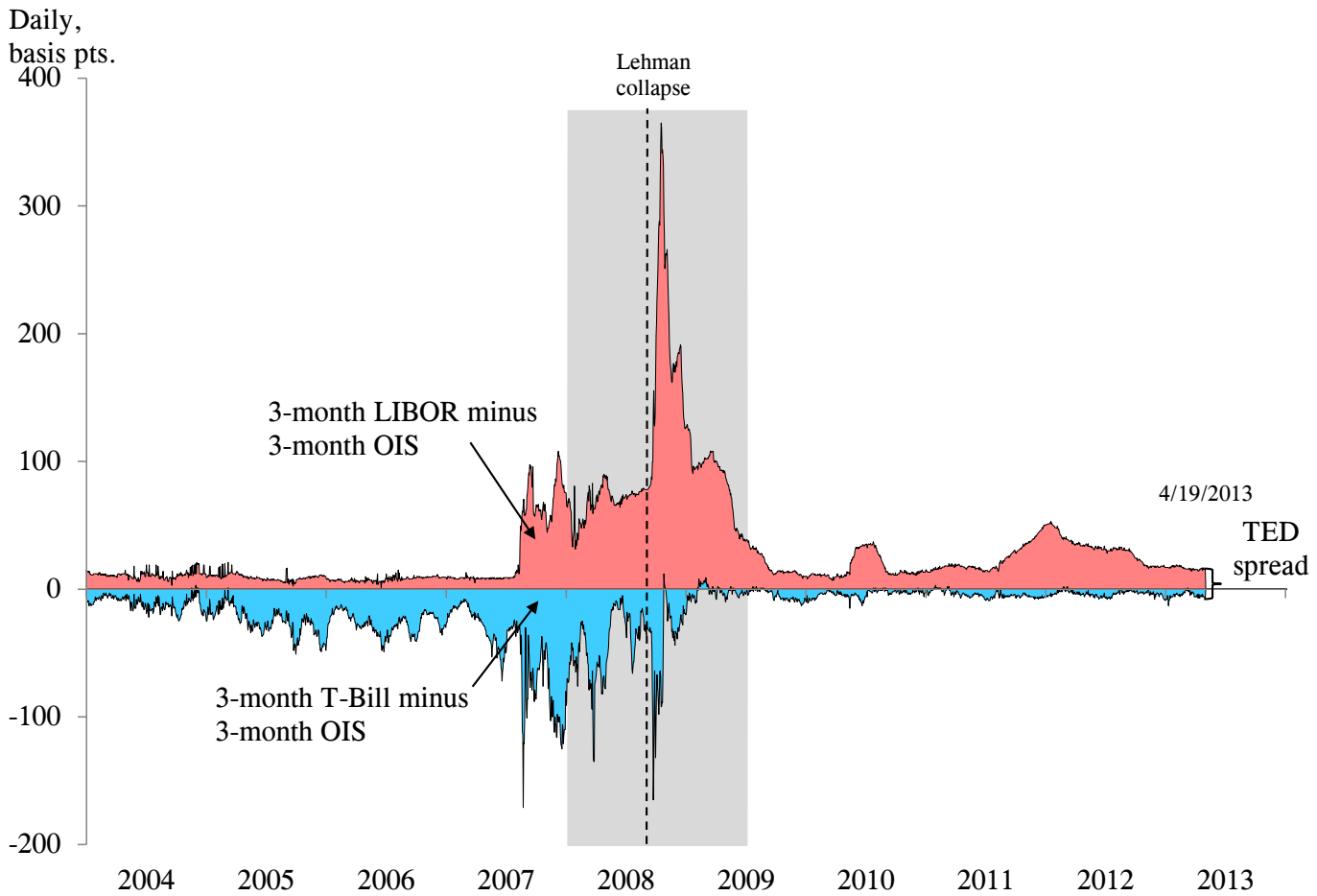


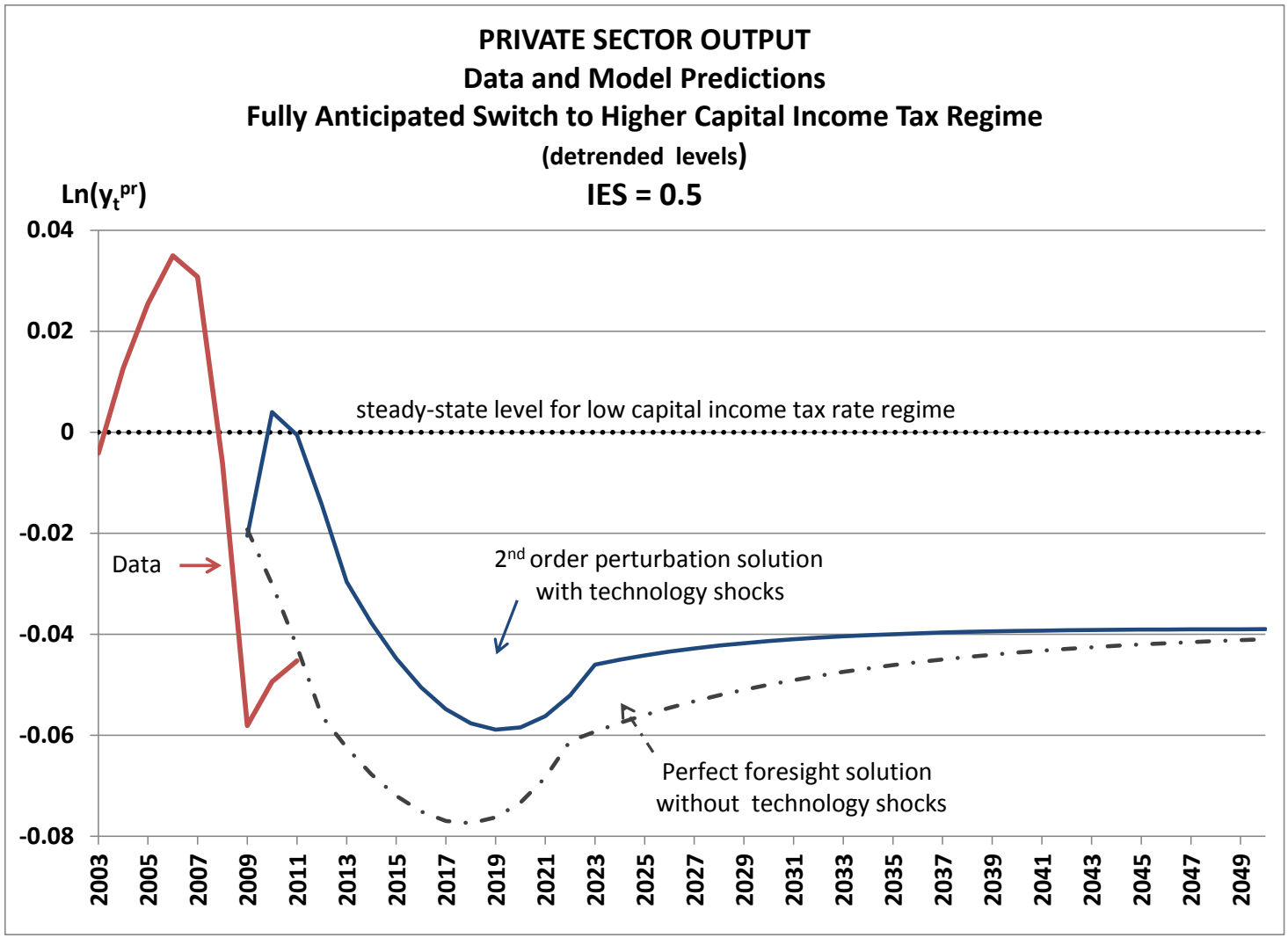


- Generic problem of models with financial frictions:

- Generic problem of models with financial frictions:
  - hard time accounting for weakness of the recovery because widely used indicators of financial stress are back to normal levels.

Financial frictions indicators back to normal levels in the recovery




PRIVATE SECTOR OUTPUT
Data and Model Predictions
Fully Anticipated Switch to Higher Capital Income Tax Regime
(detrended levels)
IES = 0.5
Ln(y_t^pr)
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
steady-state level for low capital income tax rate regime
Data
2nd order perturbation solution
with technology shocks
Perfect foresight solution
without technology shocks
2003
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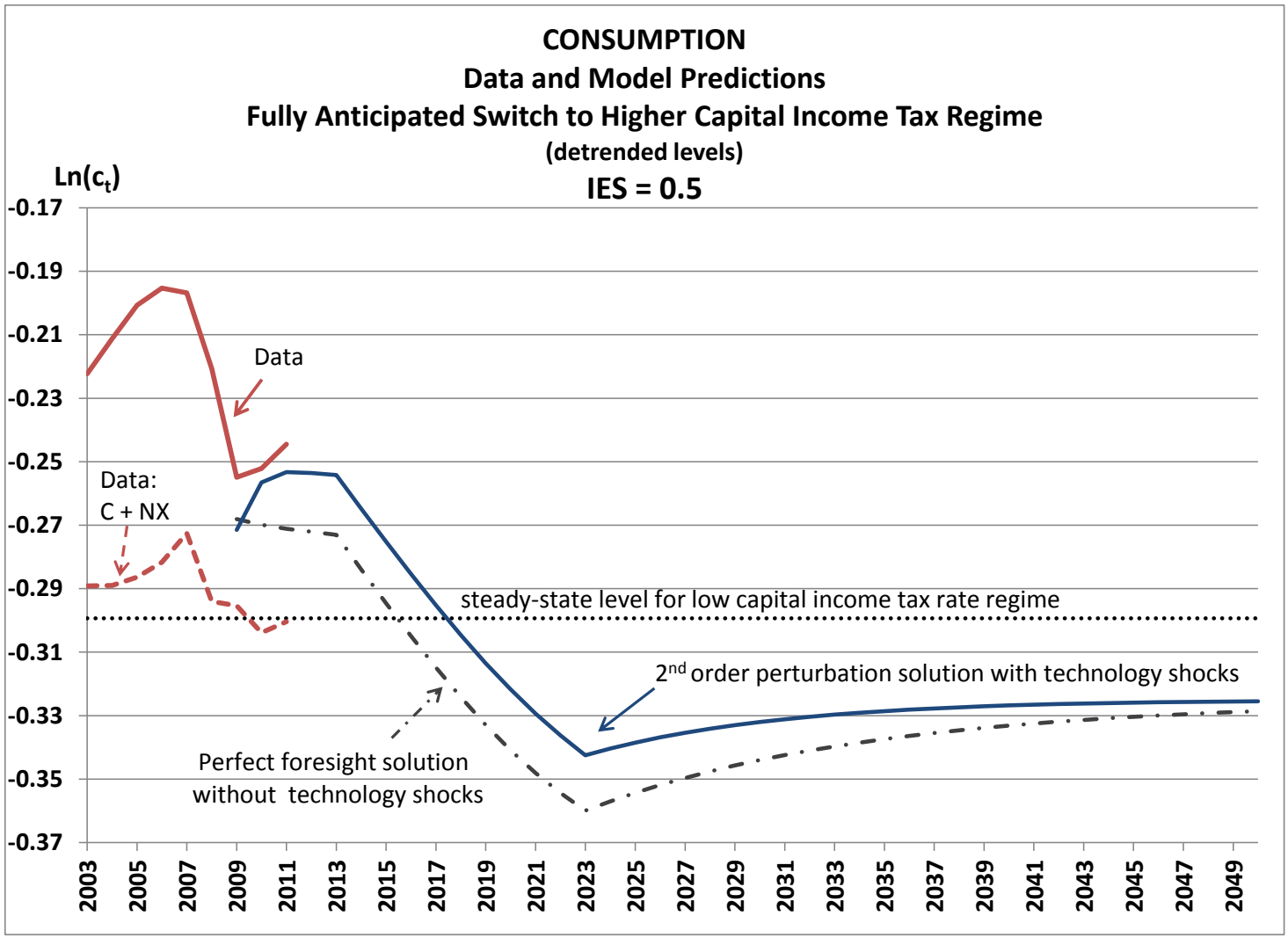
CONSUMPTION
Data and Model Predictions
Fully Anticipated Switch to Higher Capital Income Tax Regime
(detrended levels)
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Ln(c_t)
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2047
2049
Data
Data:
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steady-state level for low capital income tax rate regime
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Above-trend consumption prediction

- Consumption above steady-state prior to the regime change.

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- Most other interpretations of the weak recovery predict below steady-state consumption.
- Dynamics of consumption potentially critical to discriminate between alternative interpretations of the weak recovery.

Above-trend consumption prediction

Economic intuition

- Households made prior decisions assuming continuation of low capital income tax regime.

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    - No need to produce as many investment goods: work less.
    - Devote more output to consumption, less to investment.
    - Consumption and leisure shifted from future to present.
    - How much?
    - Depends on Intertemporal Elasticity of Substitution. Results are sensitive to this parameter value.

Summary of findings

- Quantitative exploration of fiscal sentiment hypothesis with frictionless neoclassical growth model delivers mixed (confusing?) results.

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- Cannot account for weakness of the recovery if higher taxes anticipated to fall on labor income.
- Can account for weakness of the recovery if higher taxes anticipated to fall on capital income.
    - How much depends on whether technology level fluctuate as much as suggested by Solow residuals:

Summary of findings

Higher capital income tax rates scenario:

- If true TFP relatively unchanged over the cycle, as RBC critics maintain, fiscal sentiment hypothesis accounts for:
  - more than all of the investment decline from pre-recession trend.
  - at least half of the labor input decline from pre-recession trend.
  - almost all of the output decline from pre-recession trend.

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- If TFP fluctuates over the cycle as much as suggested by Solow residuals, fiscal sentiment hypothesis accounts for:
  - three-fourths of investment decline from pre-recession trend.
  - one third of labor input decline from pre-recession trend.
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  - one third of labor input decline from pre-recession trend.
  - not much of output decline from pre-recession trend.
- **In both cases, fiscal sentiment hypothesis prediction of above trend consumption during the recovery seemingly validated by the data.**

Next steps

- Given importance of the dynamics of consumption, improve correspondence between consumption in the model and its empirical counterpart in the data.

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Next steps

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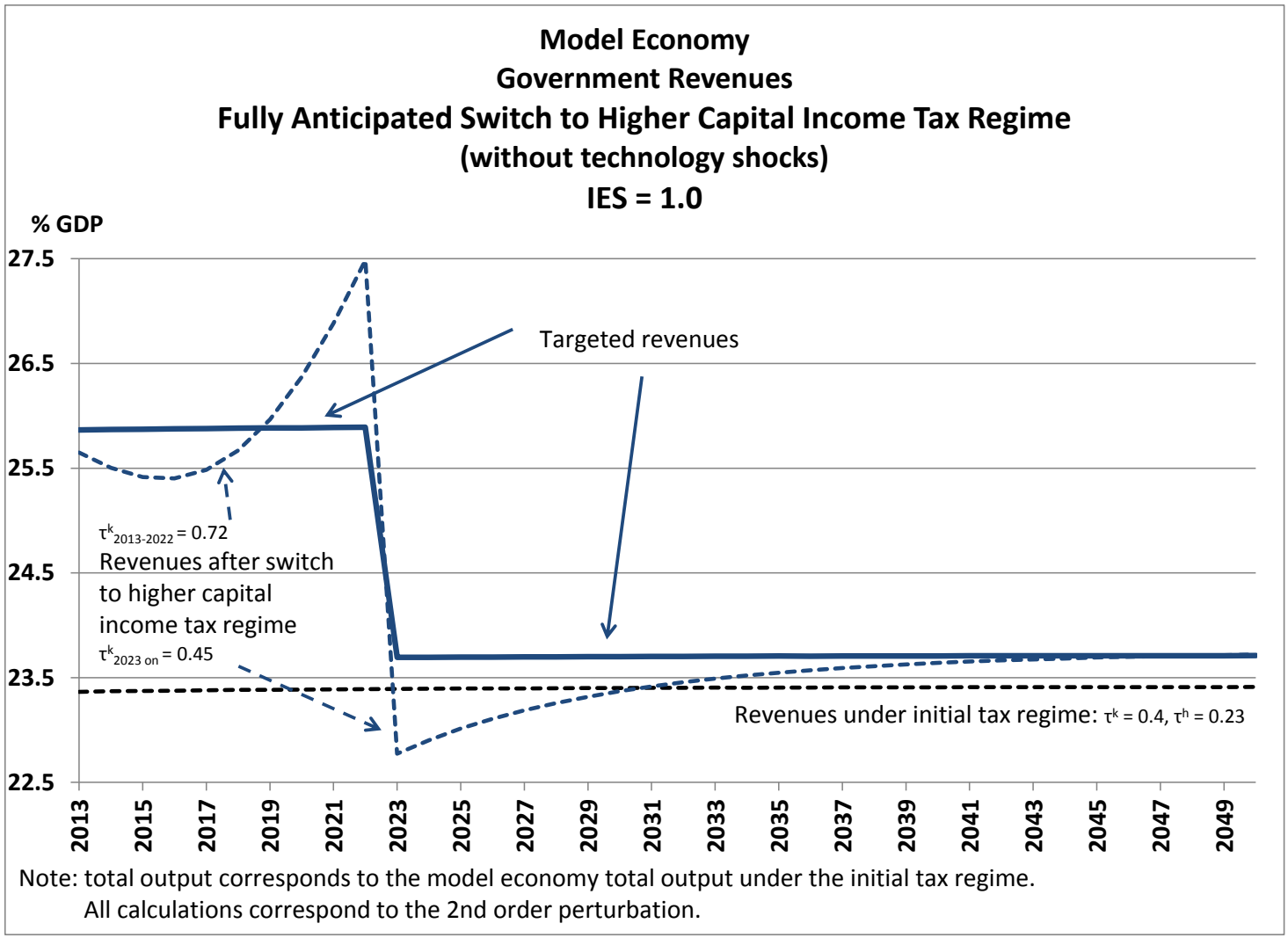
- ... *perhaps* preserving critical prediction of above trend consumption.

WINE TASTING COMING SOON



Note: total output corresponds to the model economy total output under the initial tax regime.
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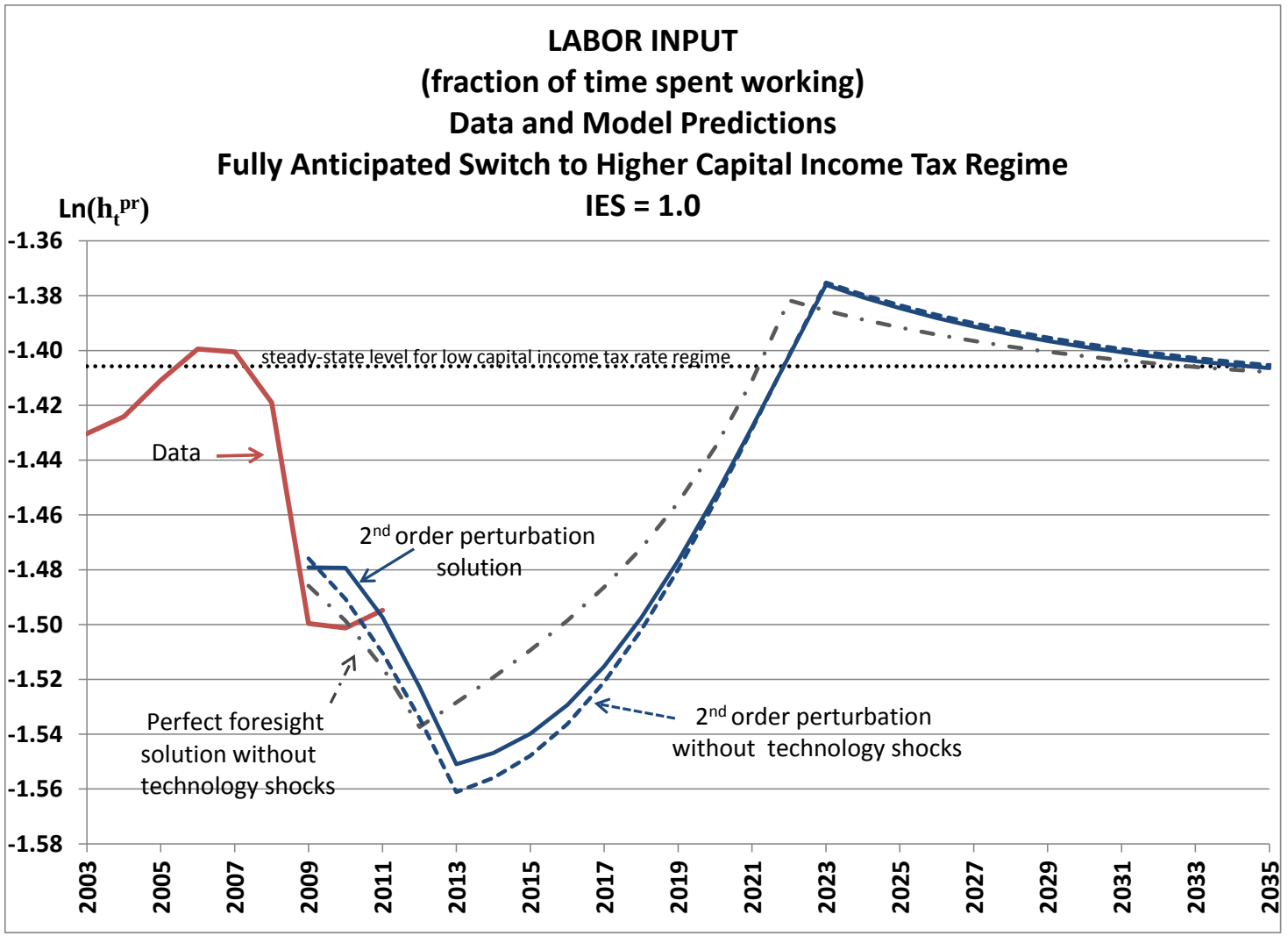
LABOR INPUT
(fraction of time spent working)
Data and Model Predictions
Fully Anticipated Switch to Higher Capital Income Tax Regime
IES = 1.0
Ln(h_t^pr)
-1.36
-1.38
-1.40
-1.42
-1.44
-1.46
-1.48
-1.50
-1.52
-1.54
-1.56
-1.58
2003
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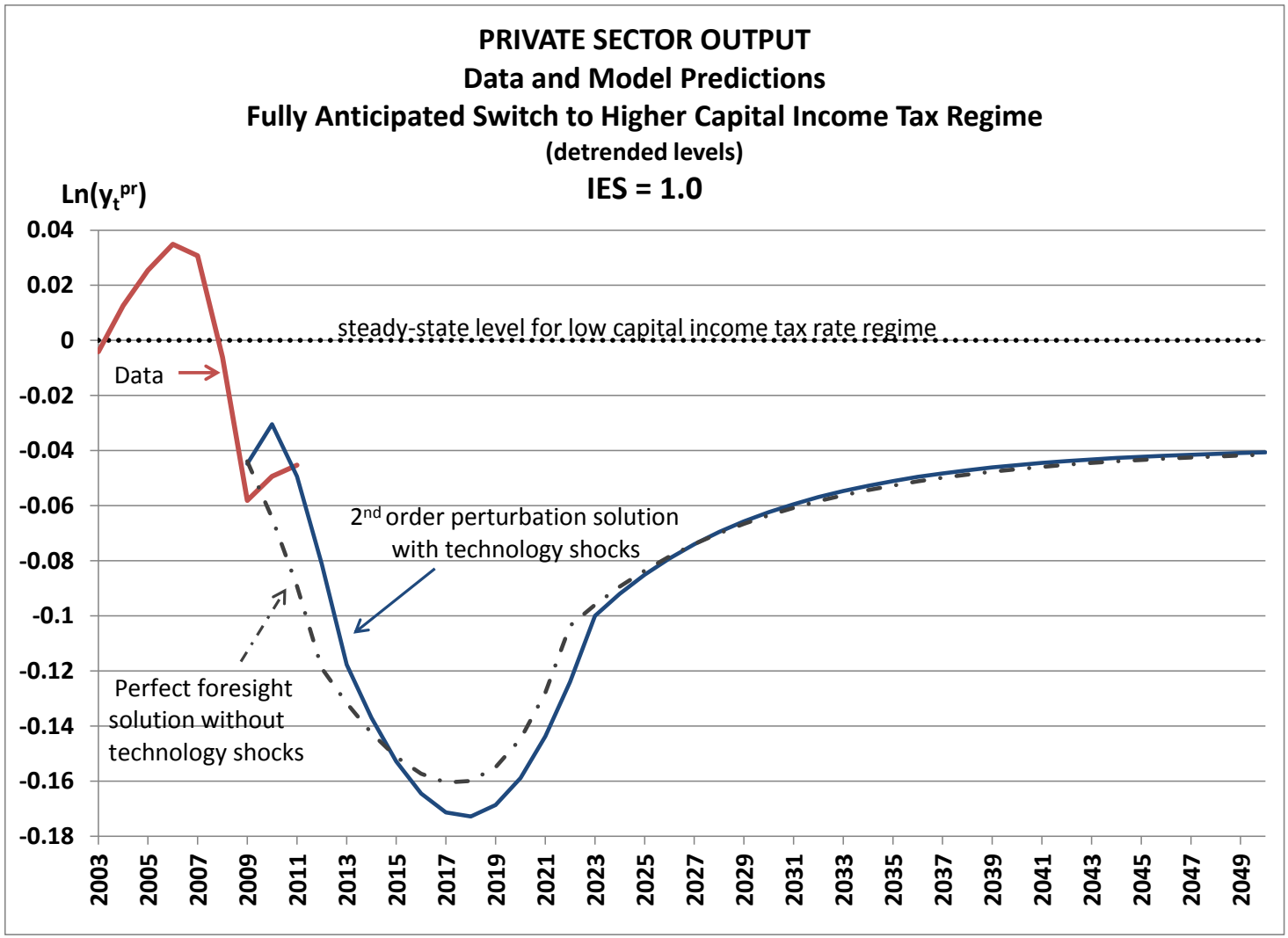
2031
2033
2035
steady-state level for low capital income tax rate regime
Data
2nd order perturbation solution
Perfect foresight solution without technology shocks
2nd order perturbation without technology shocks


PRIVATE SECTOR OUTPUT
Data and Model Predictions
Fully Anticipated Switch to Higher Capital Income Tax Regime
(detrended levels)
IES = 1.0
Ln(y_t^pr)
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
-0.18
steady-state level for low capital income tax rate regime
Data
2nd order perturbation solution with technology shocks
Perfect foresight solution without technology shocks
2003
2005
2007
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2011
2013
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2023
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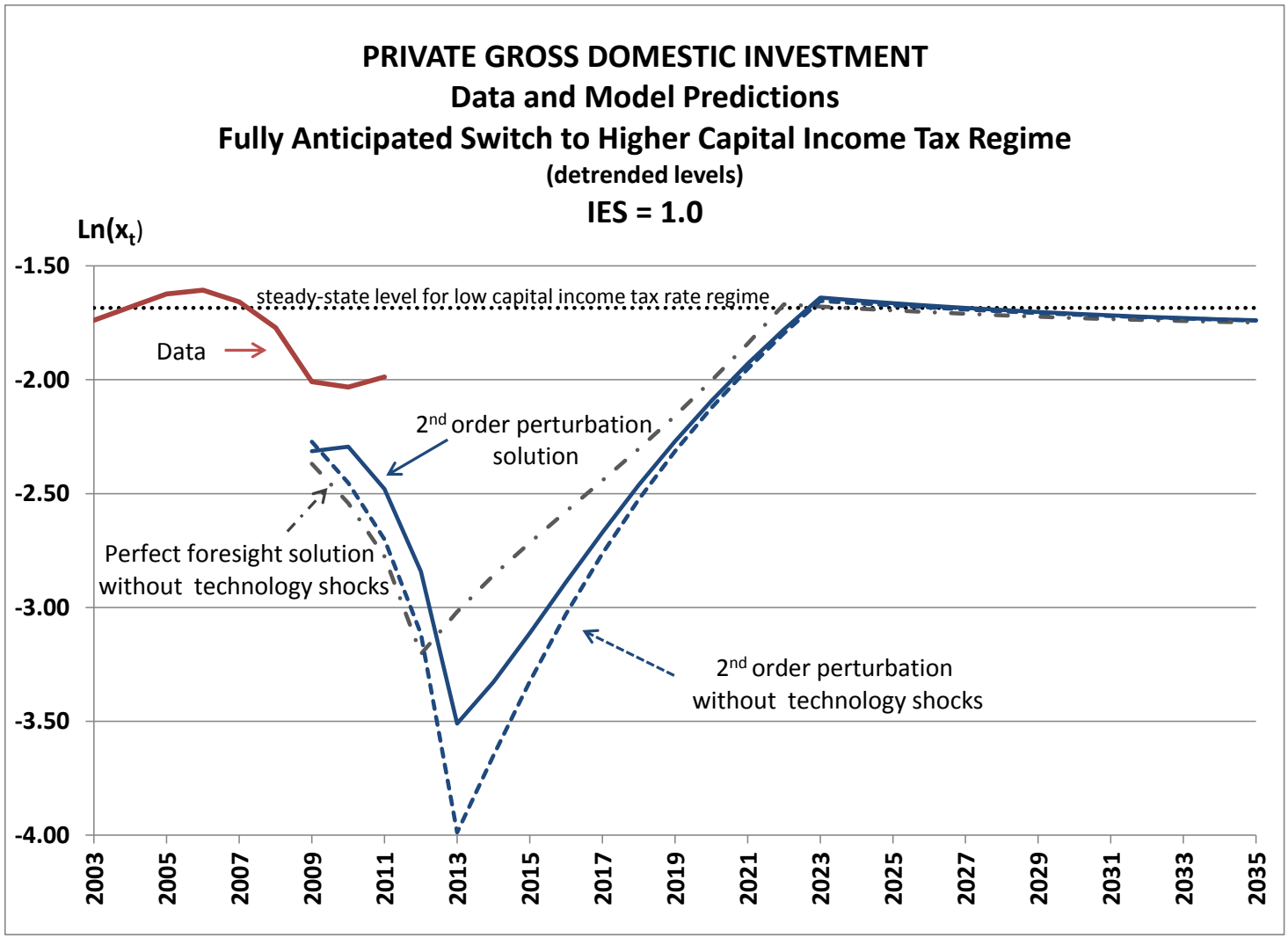
PRIVATE GROSS DOMESTIC INVESTMENT
Data and Model Predictions
Fully Anticipated Switch to Higher Capital Income Tax Regime
(detrended levels)
IES = 1.0
Ln(x_t)
-1.50
-2.00
-2.50
-3.00
-3.50
-4.00
steady-state level for low capital income tax rate regime
Data
2nd order perturbation solution
Perfect foresight solution without technology shocks
2nd order perturbation without technology shocks
2003
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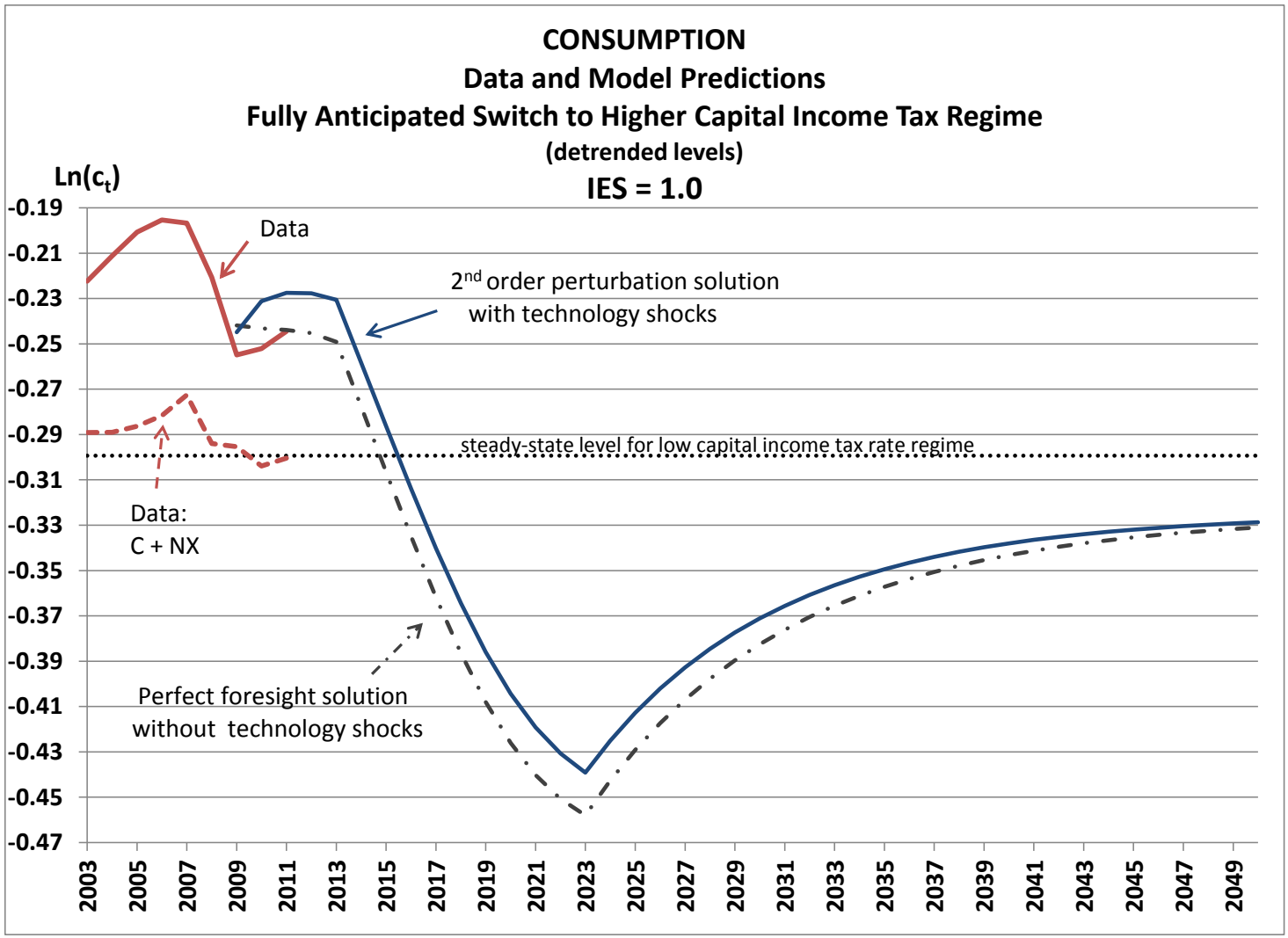
CONSUMPTION
Data and Model Predictions
Fully Anticipated Switch to Higher Capital Income Tax Regime
(detrended levels)
IES = 1.0
Ln(c_t)
-0.19
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-0.45
-0.47
2003
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Data
2nd order perturbation solution
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steady-state level for low capital income tax rate regime
Data:
C + NX
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- Model with IES $=1$ and targeted revenues criterion above produces unreasonable results.

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- Alternative approach:

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- Alternative approach:
  - Search over capital income tax rate that approximates dynamics of investment in the data.

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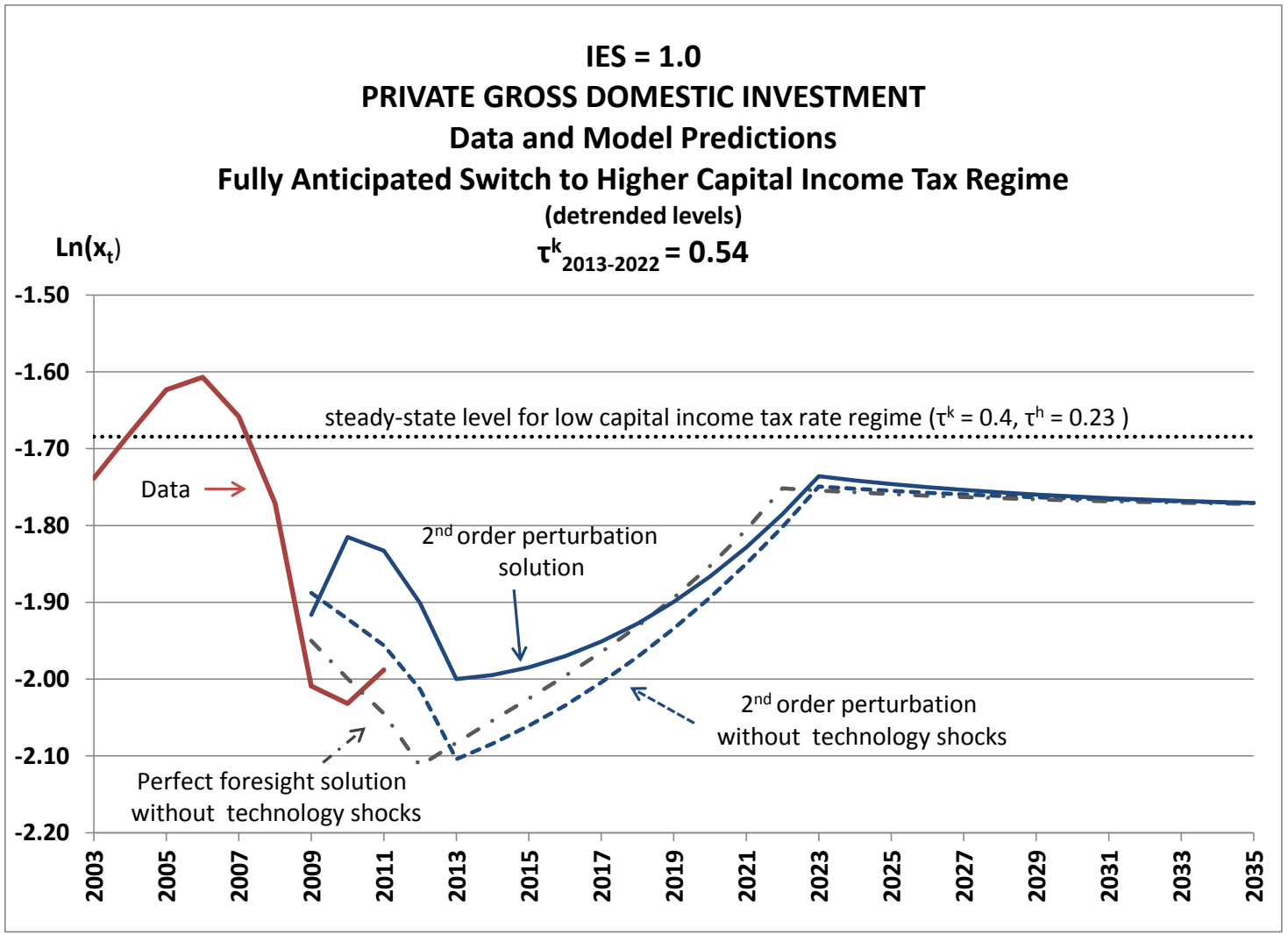
- Alternative approach:
  - Search over capital income tax rate that approximates dynamics of investment in the data.
  - Check predictions for labor input.


IES = 1.0
PRIVATE GROSS DOMESTIC INVESTMENT
Data and Model Predictions
Fully Anticipated Switch to Higher Capital Income Tax Regime
(detrended levels)
$\tau^k_{2013\text{-}2022} = 0.54$
$Ln(x_t)$
-1.50
-1.60
-1.70
-1.80
-1.90
-2.00
-2.10
-2.20
steady-state level for low capital income tax rate regime ($\tau^k = 0.4$, $\tau^h = 0.23$)
Data
2nd order perturbation solution
2nd order perturbation without technology shocks
Perfect foresight solution without technology shocks
2003
2005
2007
2009
2011
2013
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2019
2021
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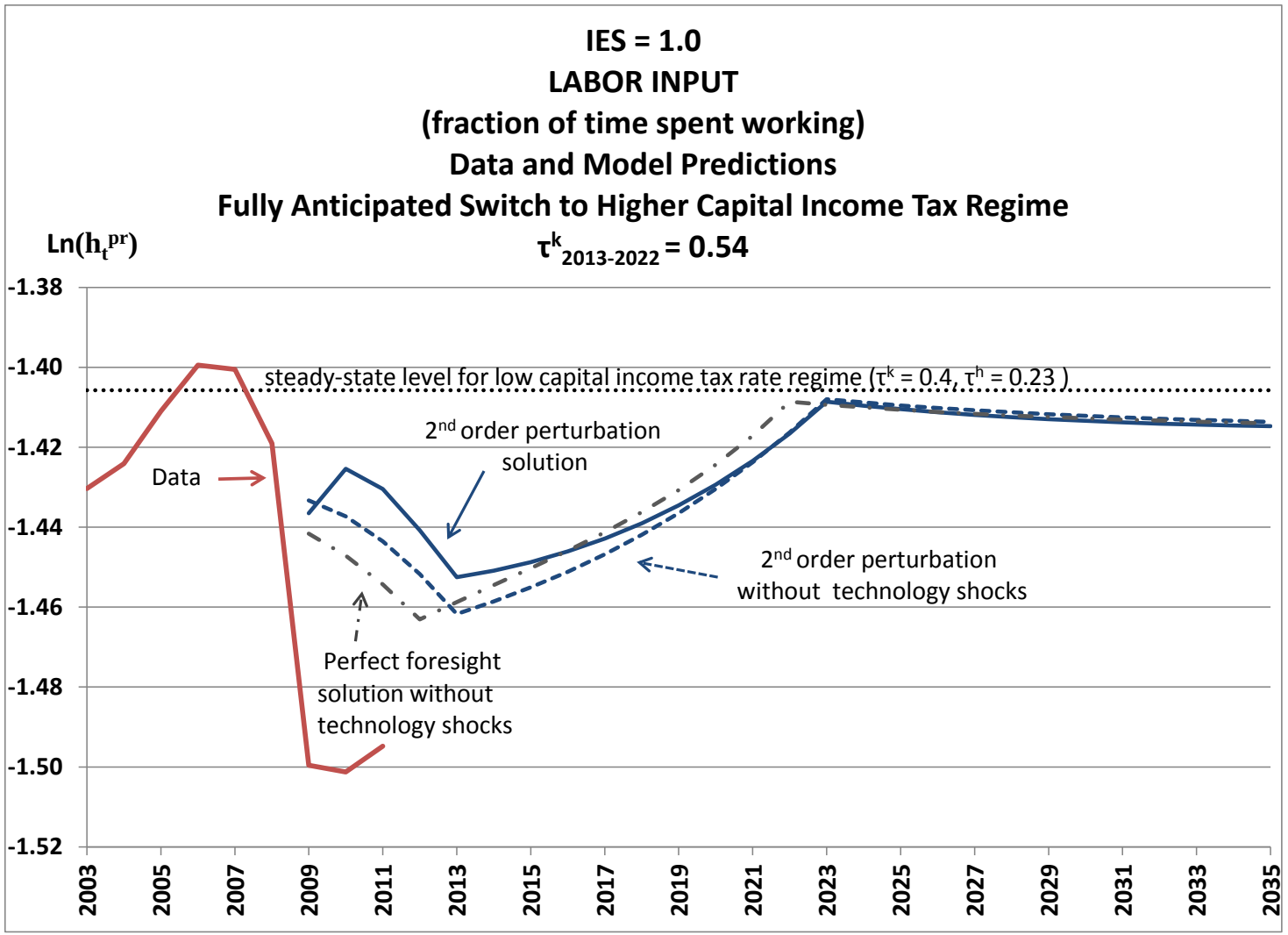
IES = 1.0
LABOR INPUT
(fraction of time spent working)
Data and Model Predictions
Fully Anticipated Switch to Higher Capital Income Tax Regime
$\tau^k_{2013\text{-}2022} = 0.54$
$Ln(h_t^{pr})$
-1.38
-1.40
-1.42
-1.44
-1.46
-1.48
-1.50
-1.52
2003
2005
2007
2009
2011
2013
2015
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2019
2021
2023
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2029
2031
2033
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steady-state level for low capital income tax rate regime ($\tau^k = 0.4$, $\tau^h = 0.23$)
Data
2nd order perturbation solution
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