The Labor Productivity Puzzle

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The Current State of Macroeconomics

- After 2008-2009, many think
  - Existing theory failed
  - New theory is needed
- Is there evidence?

Is There Evidence Supporting

1. A significant deviation from existing theory?
2. Alternative theories with, for example,
    - Large shocks to productive capital and
    - Dysfunctional capital and labor markets?

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1. A significant deviation from existing theory?

2. Alternative theories with, for example,

    - Large shocks to productive capital and

    - Dysfunctional capital and labor markets?

Today, I'll focus on Q1 and conclude: No.

Existing Theory

- Theory used to study the once-puzzling 1990s boom
- 2000s are "flip side" of 1990s:
  - GDP and hours depressed, but booming in '90s
  - Labor productivity high, but low in '90s

$\Rightarrow$ Use ideas from study of 1990s to assess 2000s

Ideas from 1990s Boom

- Observations are puzzling if abstract from
  - Intangible investment that is expensed
  - Nonneutral technology change w.r.t. its production
- Because,
  - NIPA GDP = model output
  - Labor wedge = constant

Ideas from 1990s Boom

- Observations are not puzzling with
  - Intangible investment that is expensed
  - Nonneutral technology change w.r.t. its production
- Because,
  - NIPA GDP = model output − intangible investment
  - Labor wedge = time-varying

Theory

Theory

- Household/Business owners solve

$$\max E \sum_{t=0}^{\infty} \beta^t [\log c_t + \psi \log(1 - h_t)] N_t$$

subject to

$$c_t + x_{Tt} + q_t x_{It} = r_{Tt} k_{Tt} + r_{It} k_{It} + w_t h_t$$
$$- \text{taxes}_t + \text{transfers}_t + \text{nonbusiness}_t$$
$$k_{T,t+1} = (1 - \delta_T) k_{Tt} + x_{Tt}$$
$$k_{I,t+1} = (1 - \delta_I) k_{It} + x_{It}$$

where subscript T/I denotes tangible/intangible

Technology

- Production of final goods and services

$$y_b = A^1 F(k_T^1, k_I, h^1)$$

- Production of new intangible capital

$$x_I = A^2 G(k_T^2, k_I, h^2)$$

Total intangible stock used in two activities

Hypothesis for the 1990s

- Technological change was nonneutral: $A_t^2/A_t^1 \uparrow$

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$$w_t^{NIPA} \propto \frac{y_{bt}}{h_t^1 + h_t^2}$$

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$\Rightarrow$ NIPA compensation per hour w_t^{NIPA} falls

While true compensation per hour w_t rises

$$w_t \propto \frac{y_{bt}}{h_t^1} = \frac{y_{bt} + q_t x_{It}}{h_t^1 + h_t^2}$$

Hypothesis for 2008-2009

- Nonneutrality still a factor but quantititatively less so
- Intangibles key even if A_t^2/A_t^1 fixed,
  - Decline in $q_t x_{It}$ bigger than y_{bt}
  - Leads to labor wedge with $w_t^{NIPA} \uparrow$ and $w_t \downarrow$

$$w_t^{NIPA} \propto \frac{y_{bt}}{h_t^1 + h_t^2}, \qquad w_t \propto \frac{y_{bt} + q_t x_{It}}{h_t^1 + h_t^2}$$

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$\Rightarrow$ Labor productivity puzzle not so puzzling

Quantitative Predictions

Starting Point: National Accounts

NIPA INCOME	NIPA PRODUCT
Capital consumption	Personal consumption
Taxes on production	Government consumption
Compensation **less sweat**	Government investment
Profits **less expensed**	Private tangible investment
Net interest	Net exports

Revised National Accounts

TOTAL INCOME	TOTAL PRODUCT
Capital consumption	Personal consumption
Taxes on production	Government consumption
Compensation **less sweat**	Government investment
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Net interest	Net exports
Capital gains	**Intangible investment**

Revised National Accounts

TOTAL INCOME	TOTAL PRODUCT
Capital consumption	Personal consumption
Taxes on production	Government consumption
Compensation	Government investment
Profits	Private tangible investment
Net interest	Net exports
	Intangible investment

Parameters and Exogenous Processes

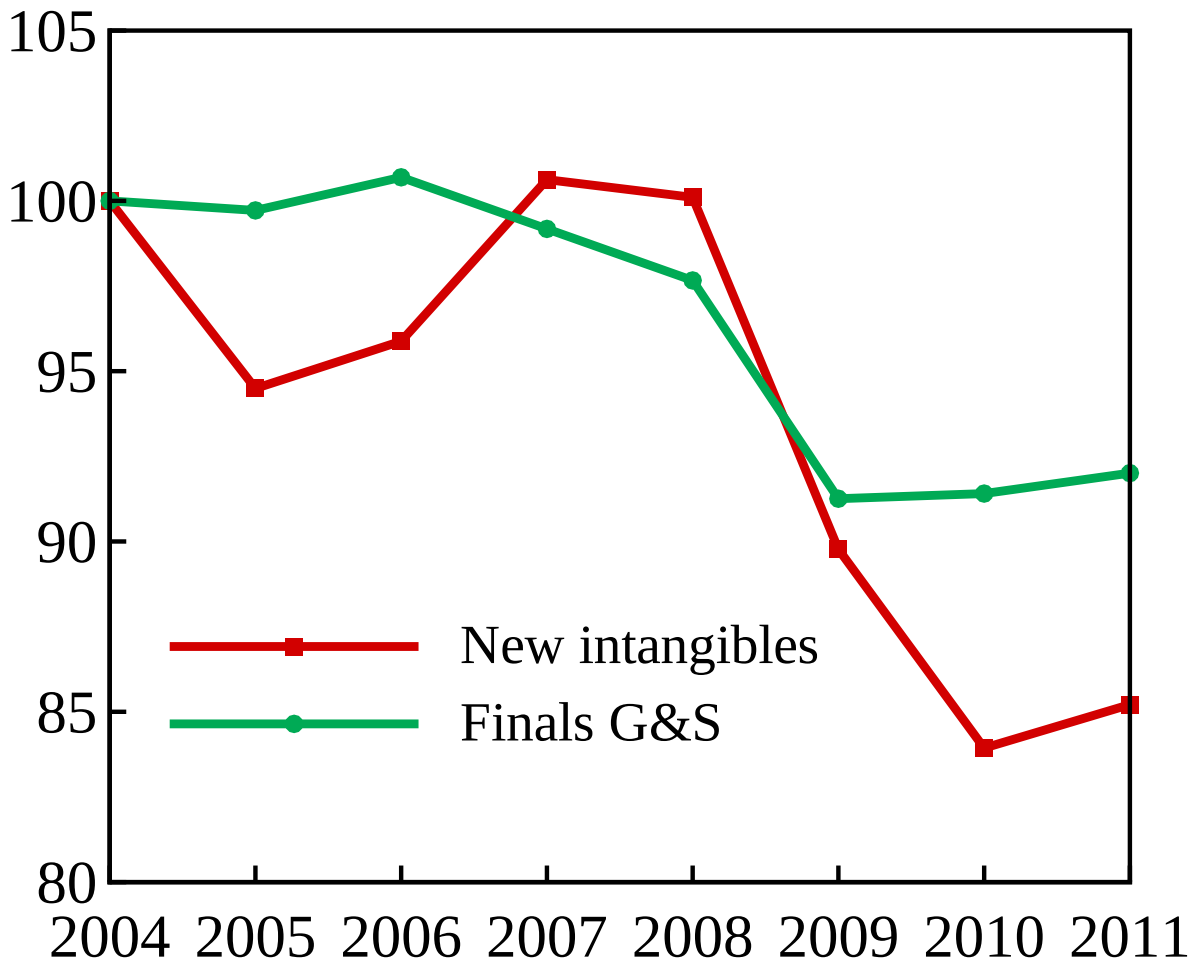
- Parameters set to match NIPA accounts and hours in 2004
- Exogenous variables:
  - TFPs
  - Tax rates on consumption and labor
  - Nonbusiness activities (paths set to US)
- Household expectations
  - 2004–2006 expect policies to continue
  - 2007–2011 perfect foresight of future path

Identifying TFPs

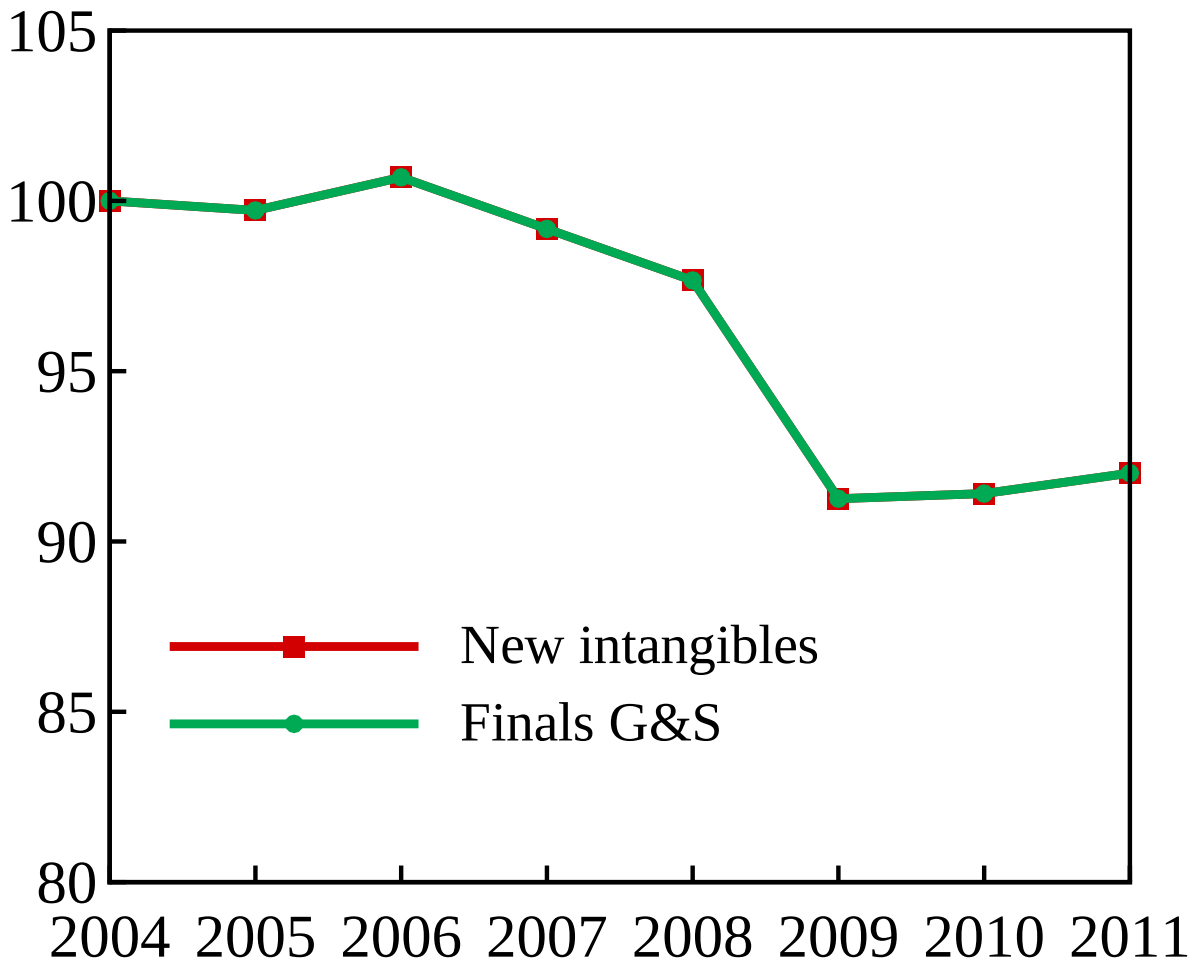
- Easy in one-sector economy: $A_t = GDP_t^{US} / F(k_t^{US}, h_t^{US})$
- Tricky here since k_{It} latent
- Two possible approaches:
  1. Use a subset of FOCs plus US data
  2. Choose TFPs so $\text{GDP}_t^{mod} = \text{GDP}_t^{US}$, $h_t^{mod} = h_t^{US}$

Check for internal deviations and external inconsistencies

Implied TFPs

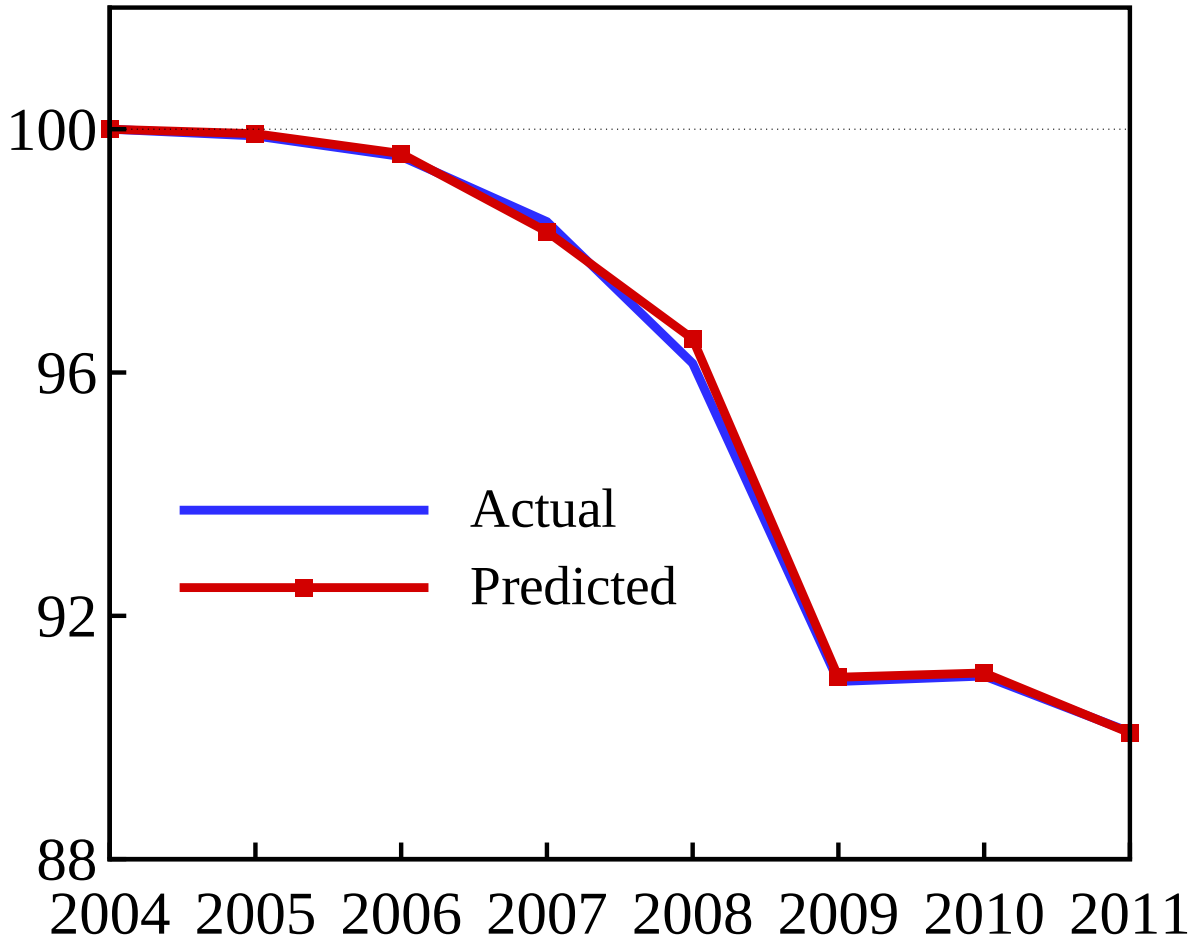


Alternative with Neutral TFPs



Results

GDP relative to trend



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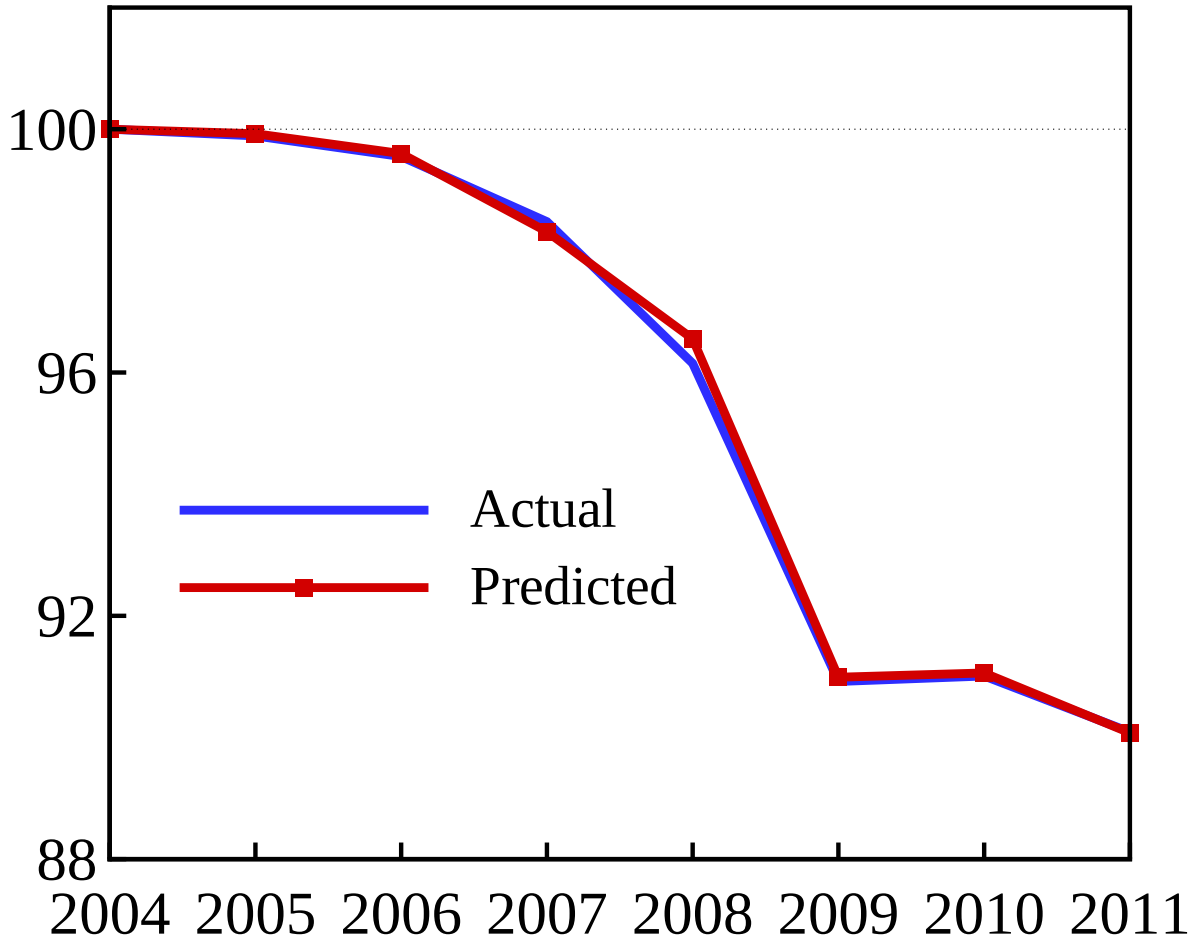
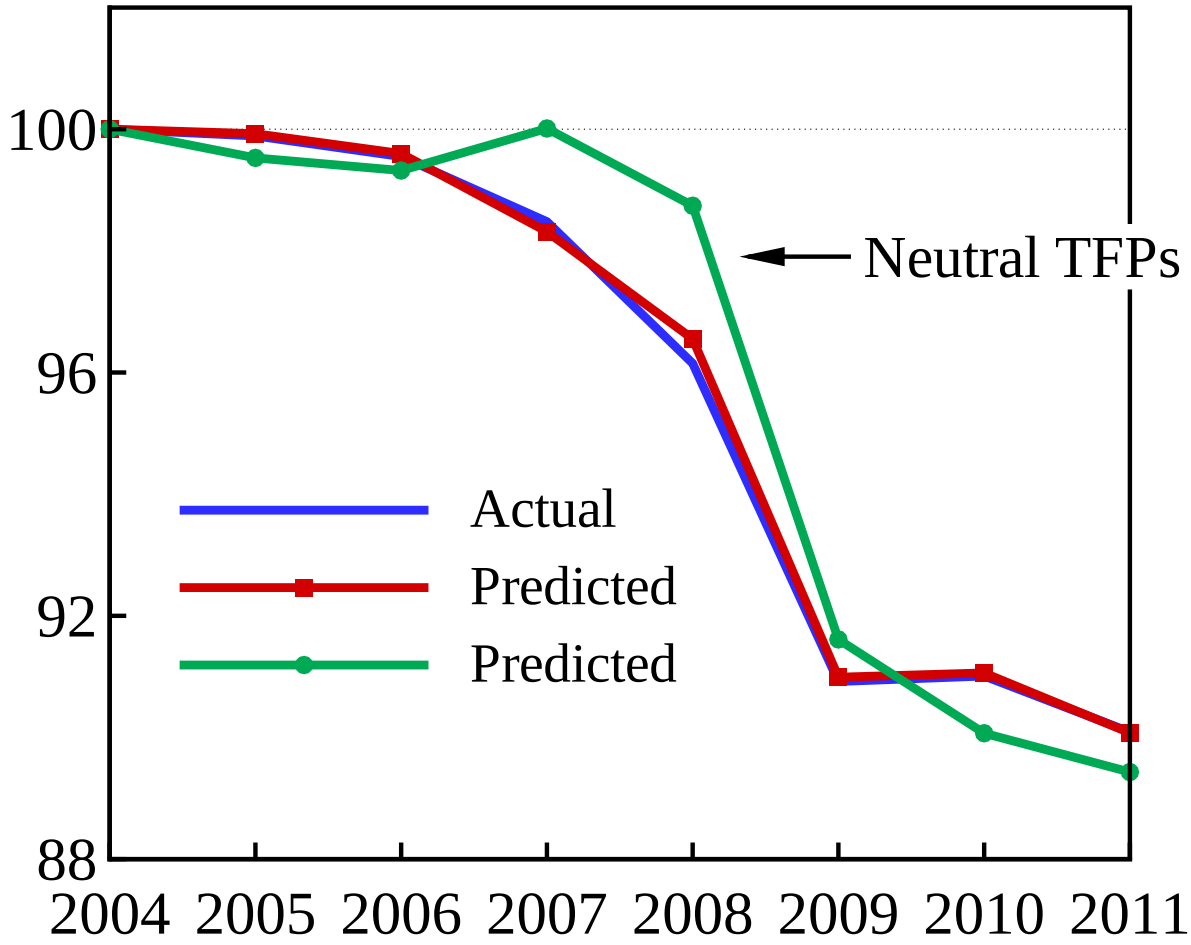


- Punchline: model can generate observed patterns

GDP relative to trend



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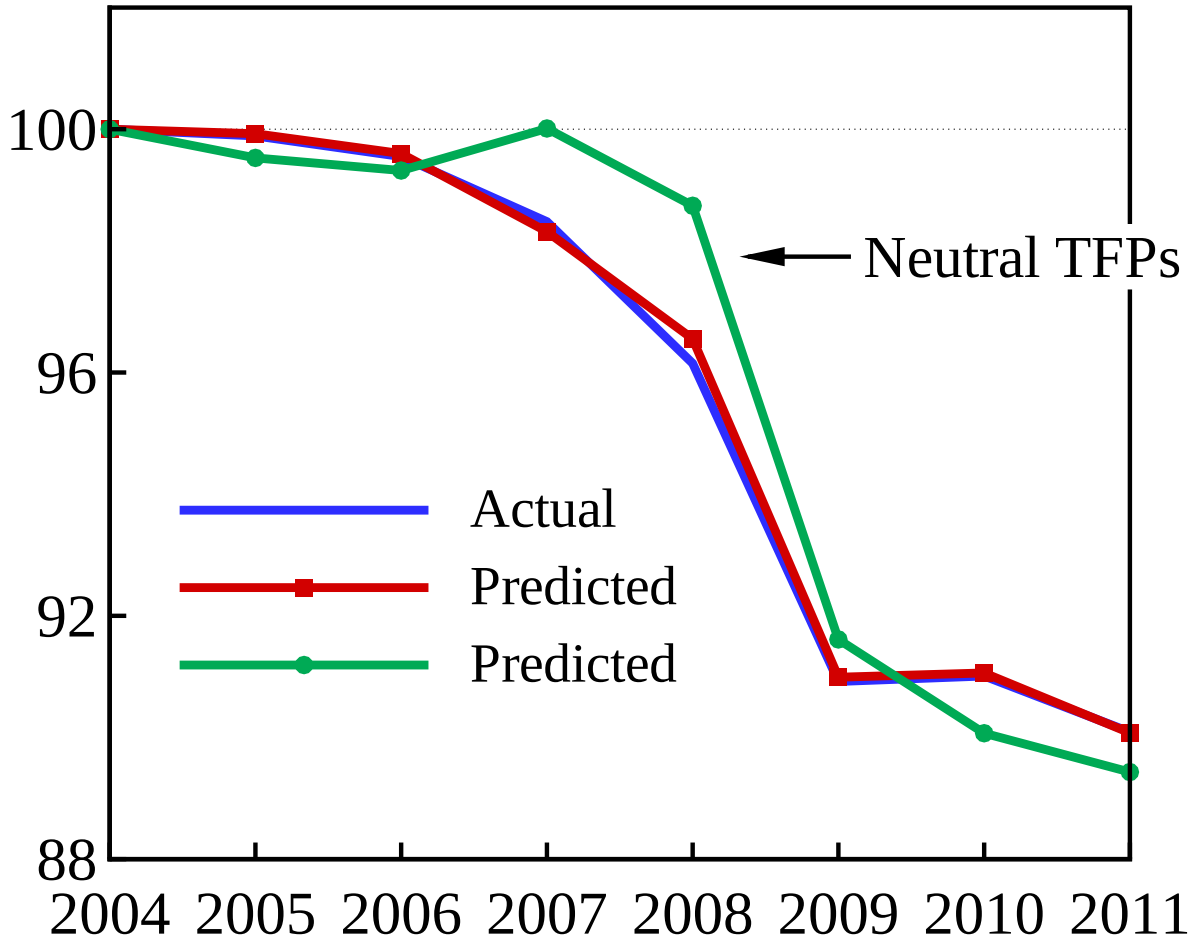
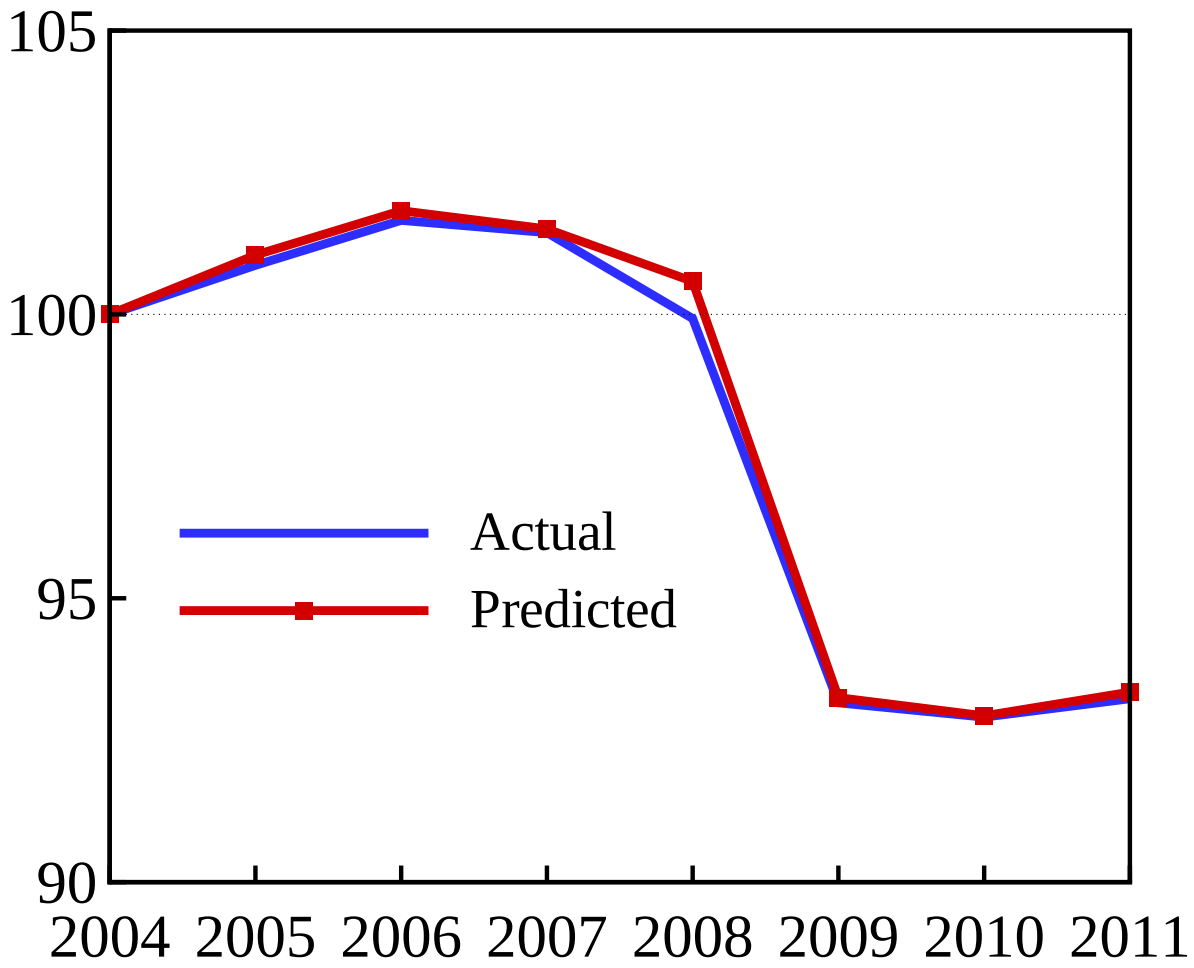


- Punchline: $\approx 10\%$ drop even if A_t^2/A_t^1 constant

Hours per capita



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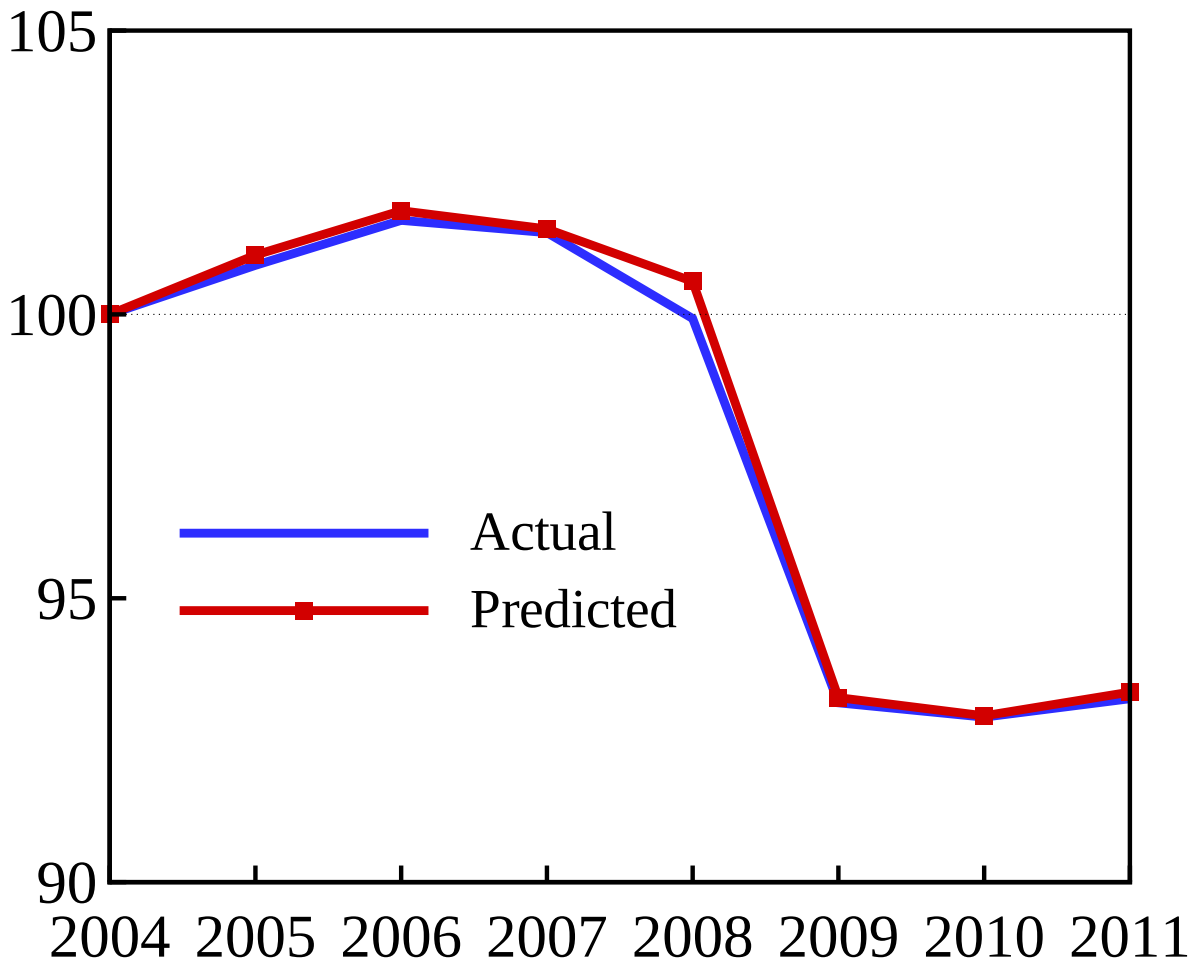

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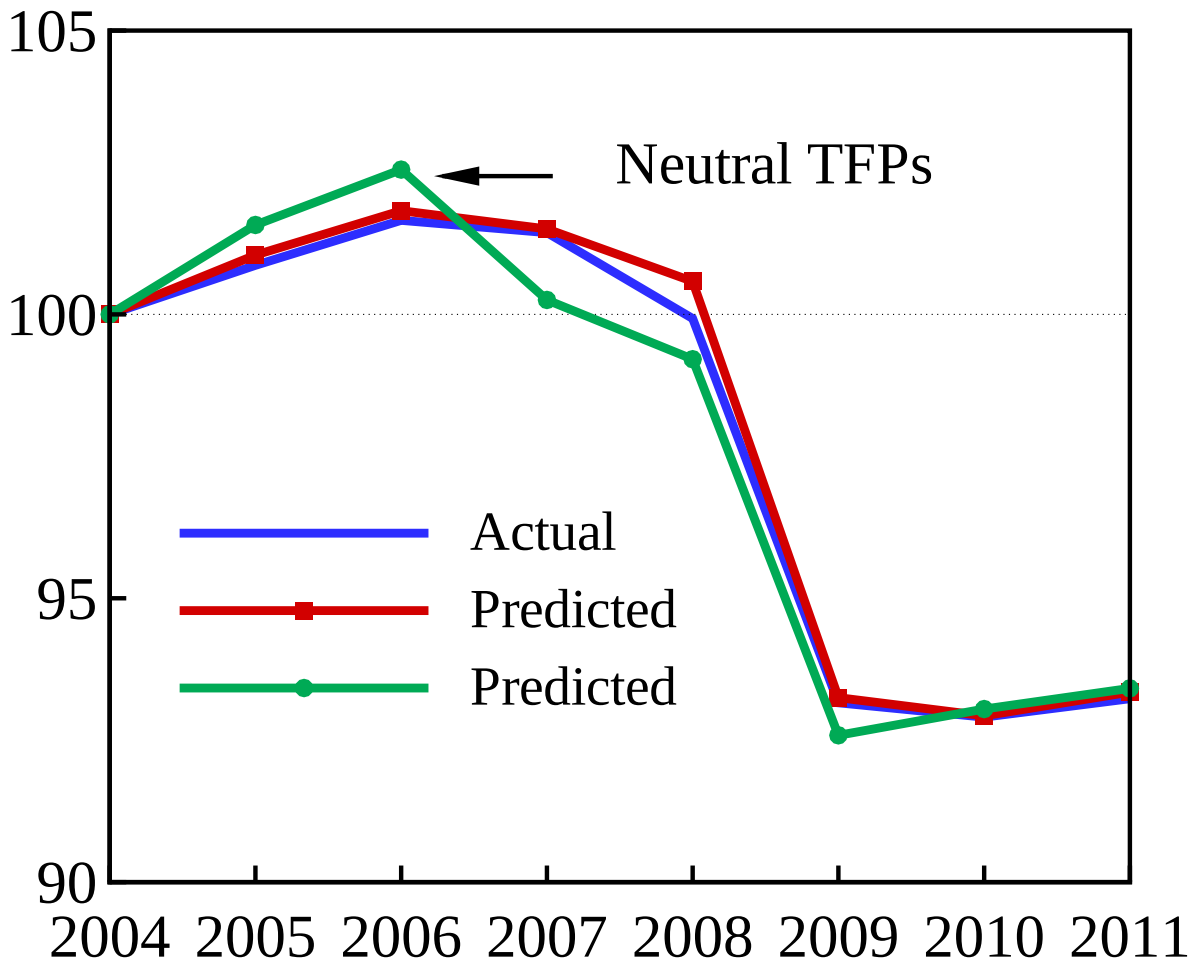

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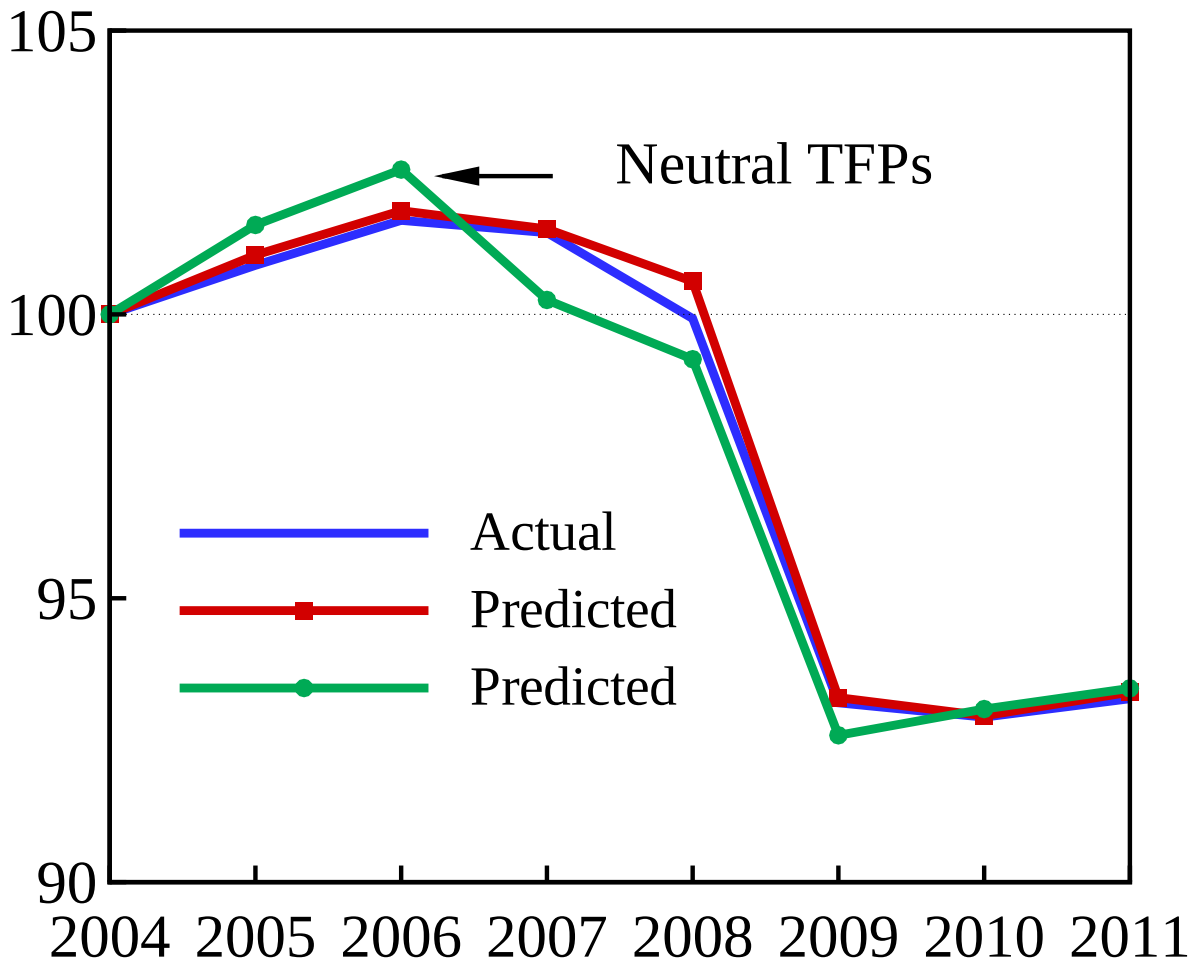
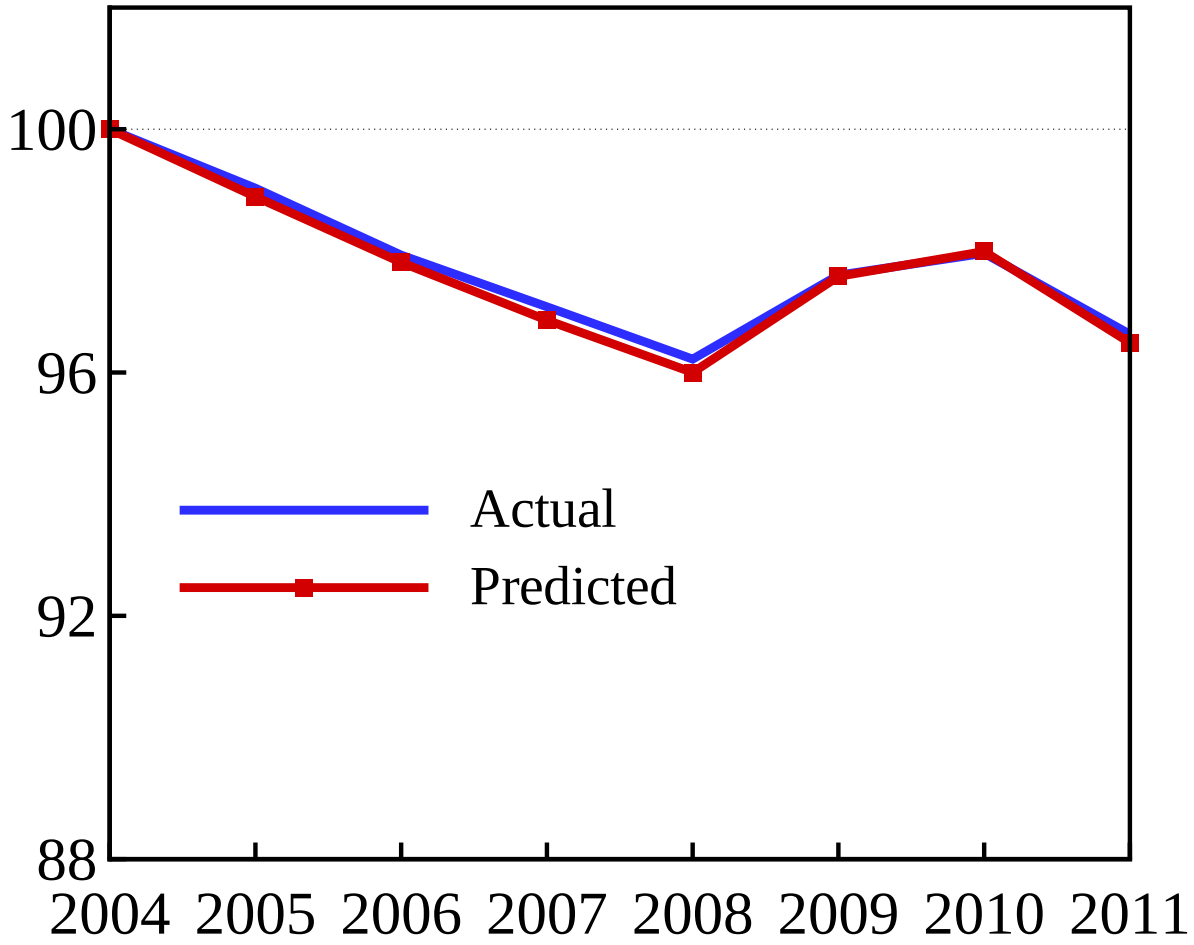
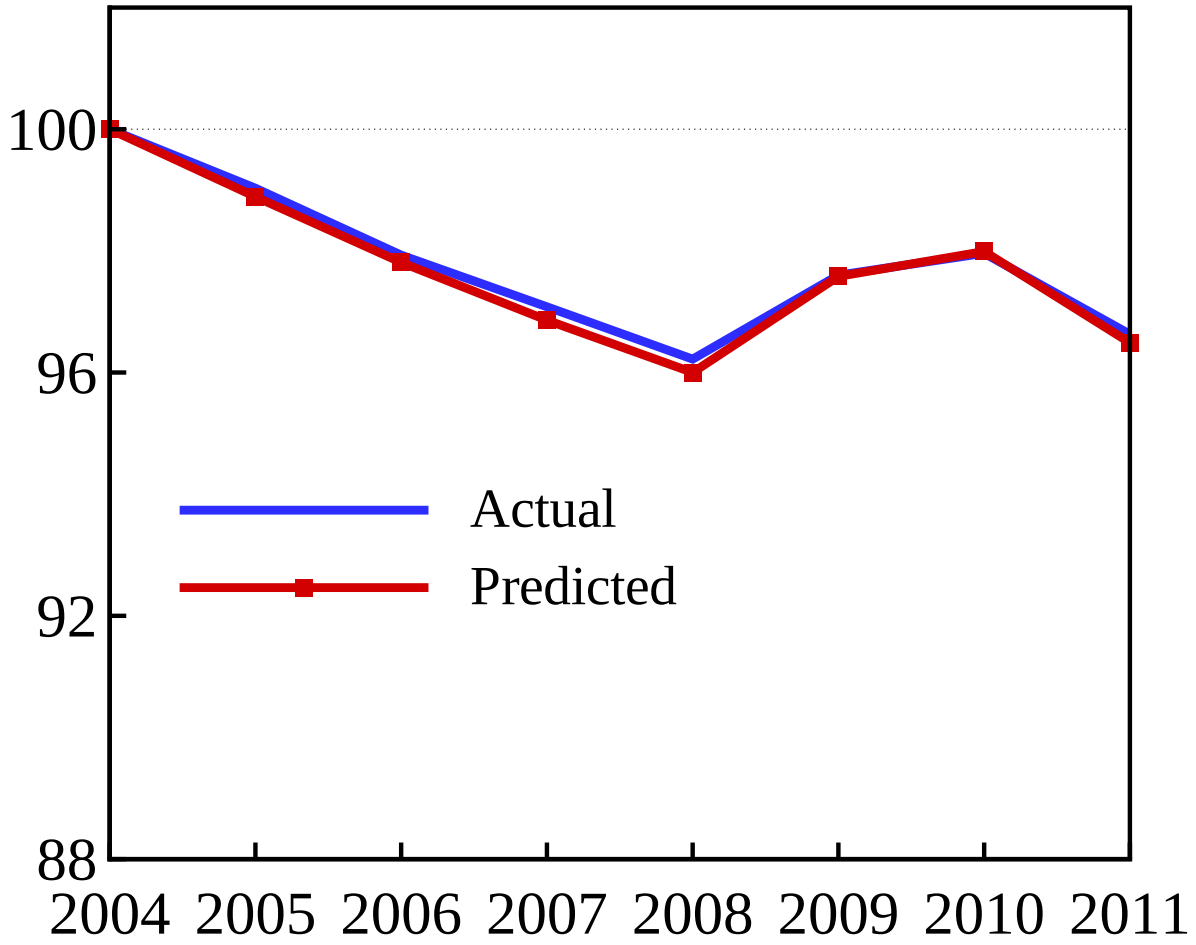


- Punchline: $\approx 7\%$ drop even if A_t^2/A_t^1 constant

GDP PER HOUR


100
96
92
88
2004
2005
2006
2007
2008
2009
2010
2011
Actual
Predicted

GDP per hour



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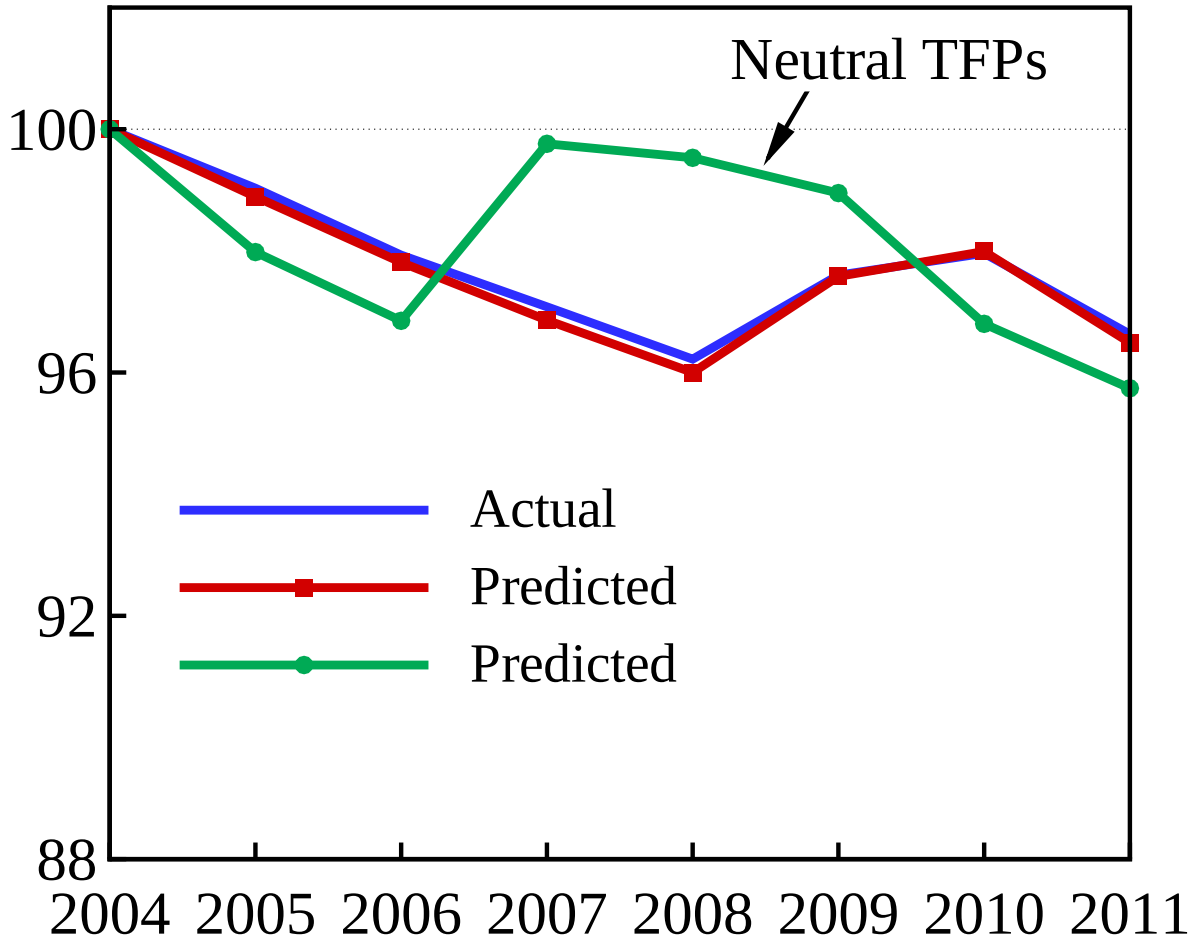
GDP PER HOUR


Neutral TFPs
100
96
92
88
Actual
Predicted
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2006
2007
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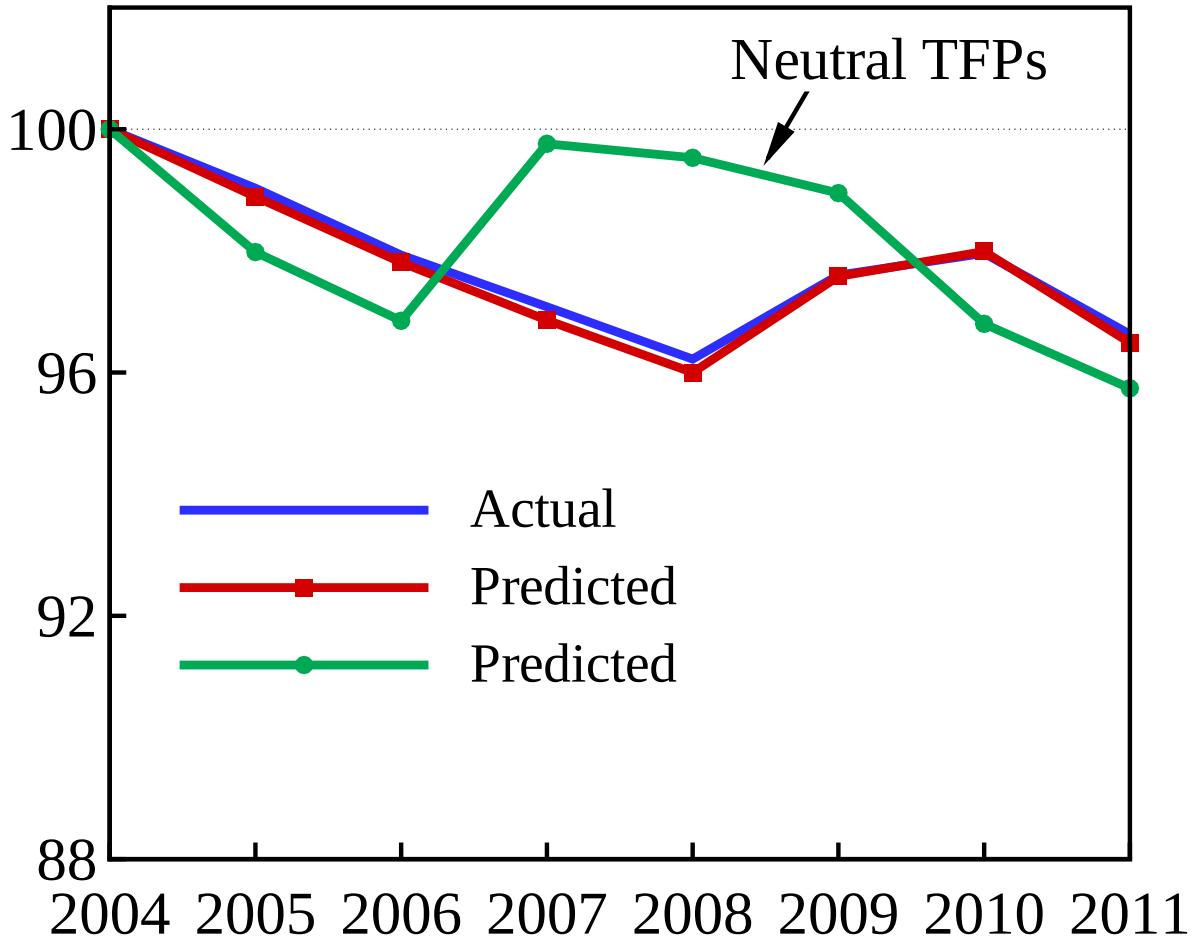
2011

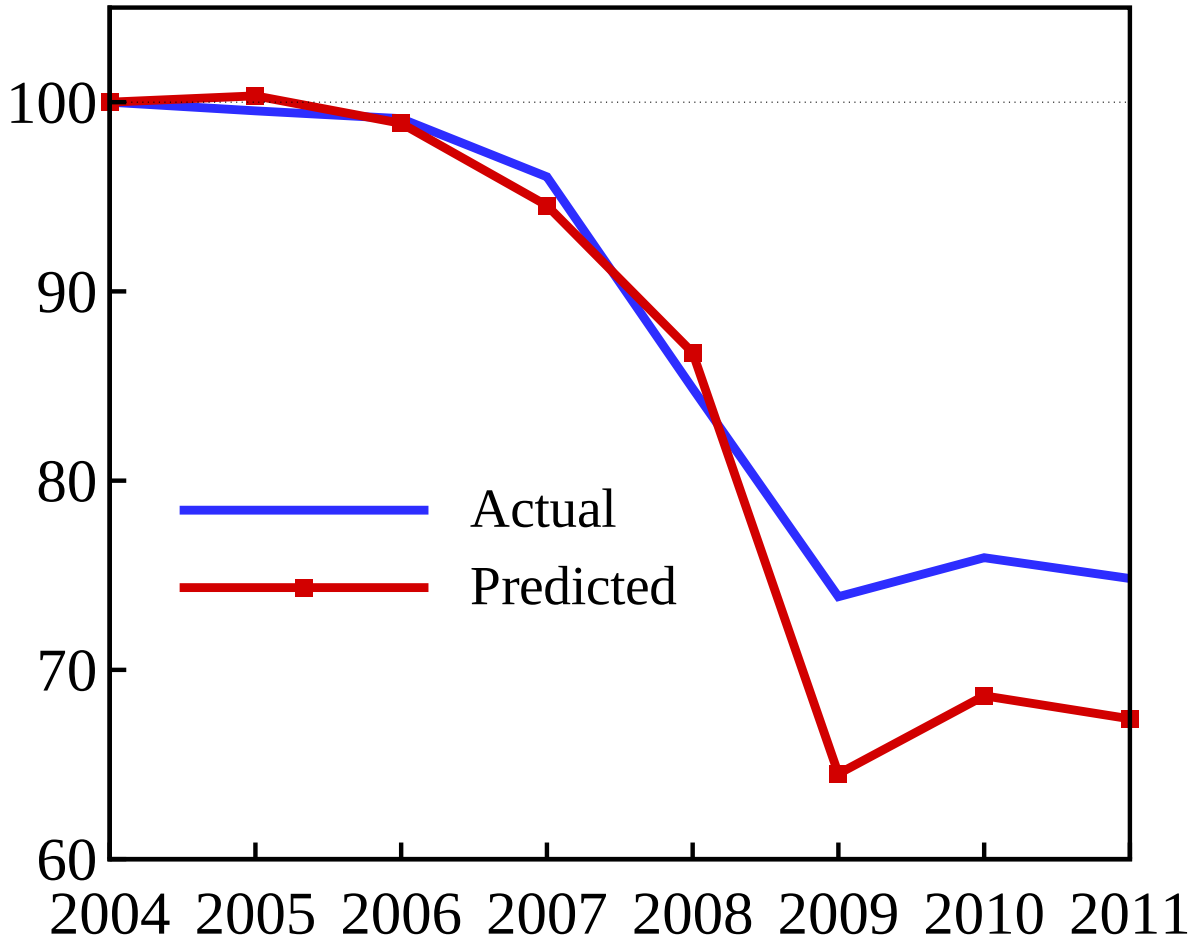
GDP per hour



- Punchline: increase occurs earlier if A_t^2/A_t^1 constant

Are There Significant Deviations in Investment and Consumption?

Total Investment relative to trend



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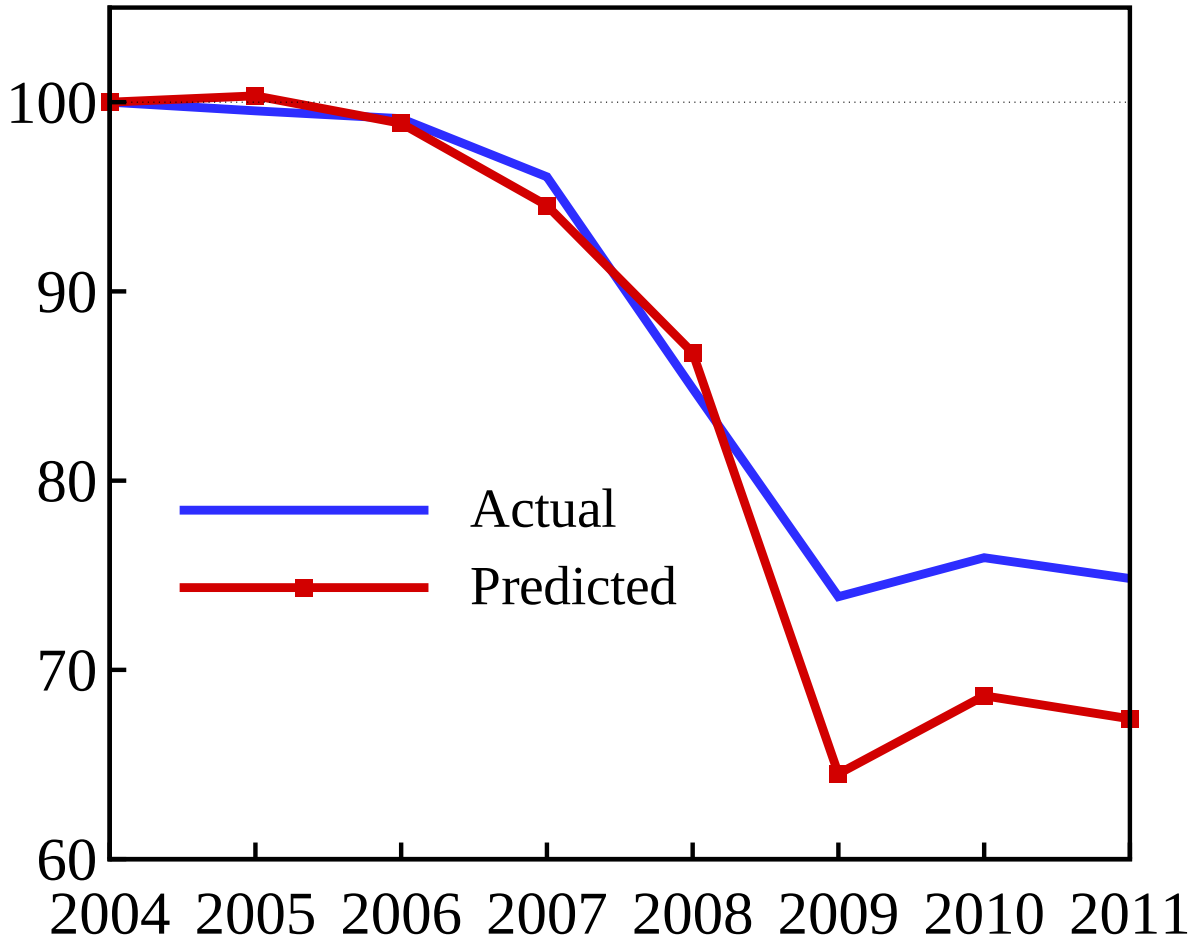

- Punchline: model wo/ frictions overpredicts fall

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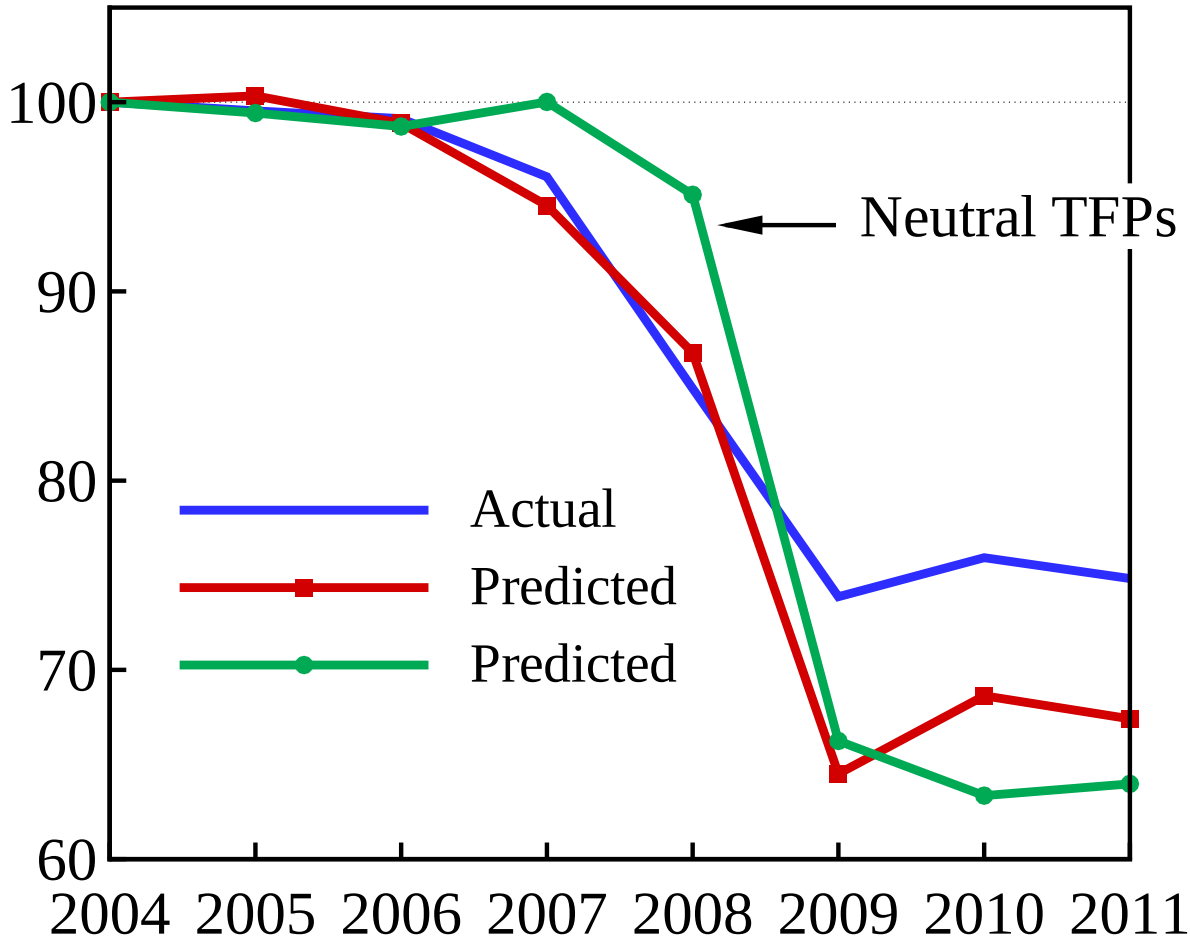
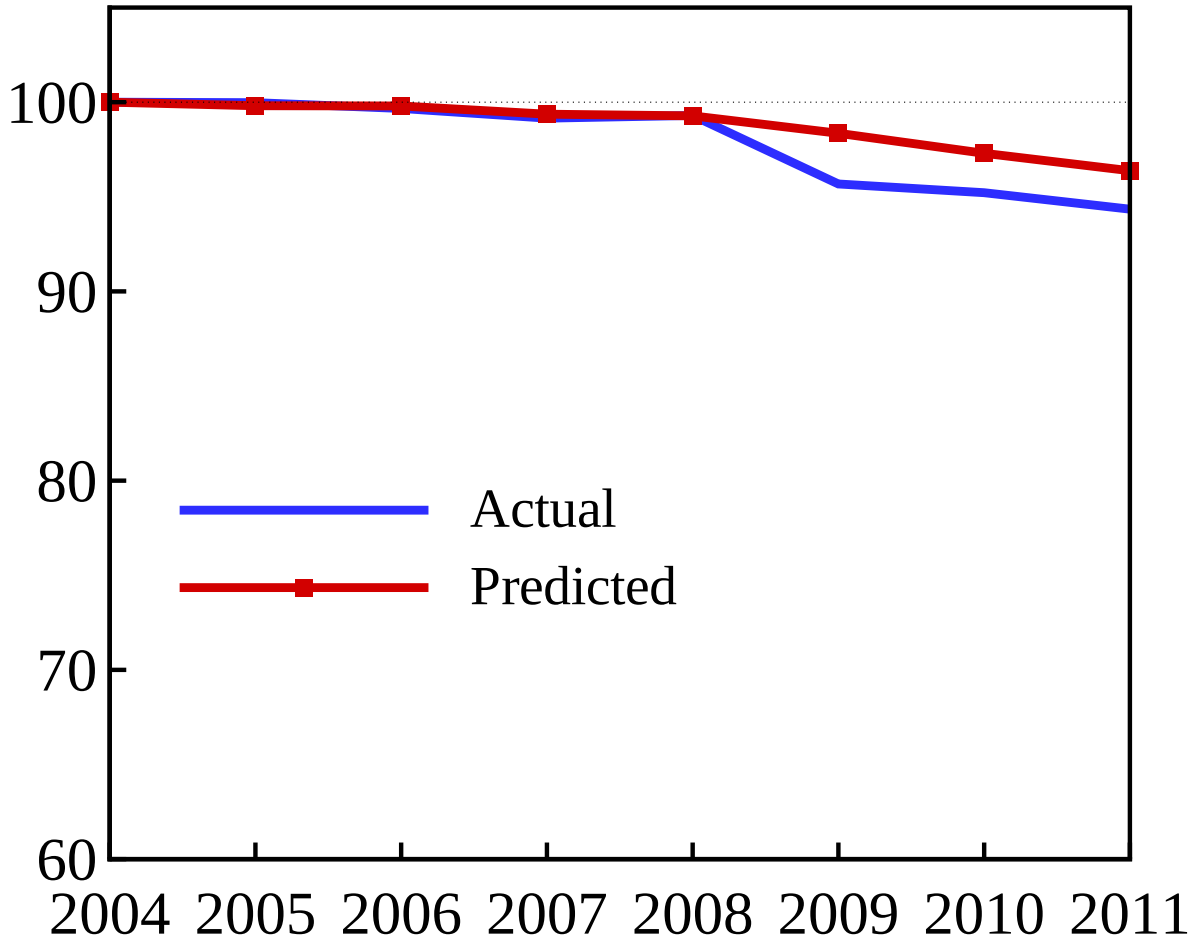


- Punchline: model overpredicts fall even if TFPs neutral

Total Consumption relative to trend



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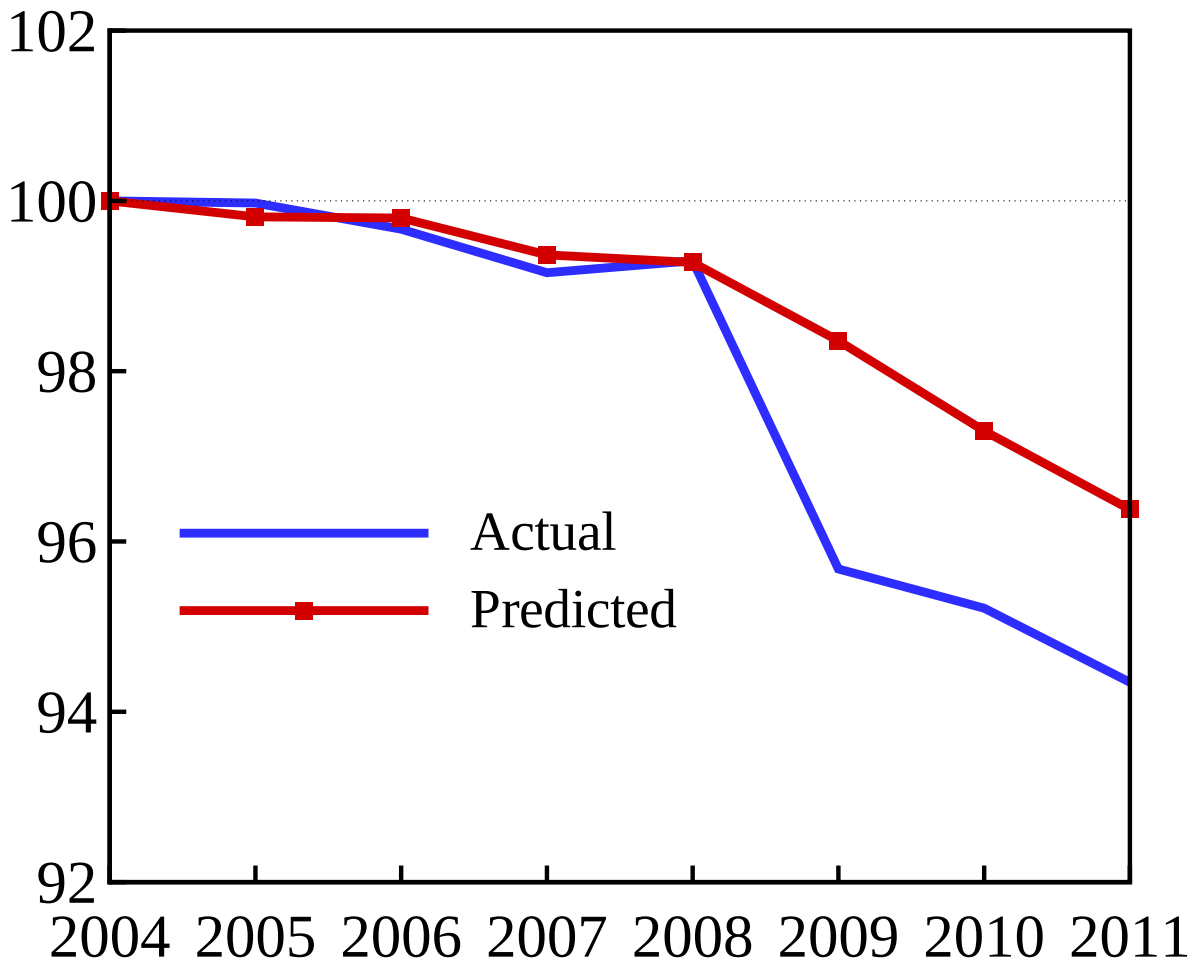
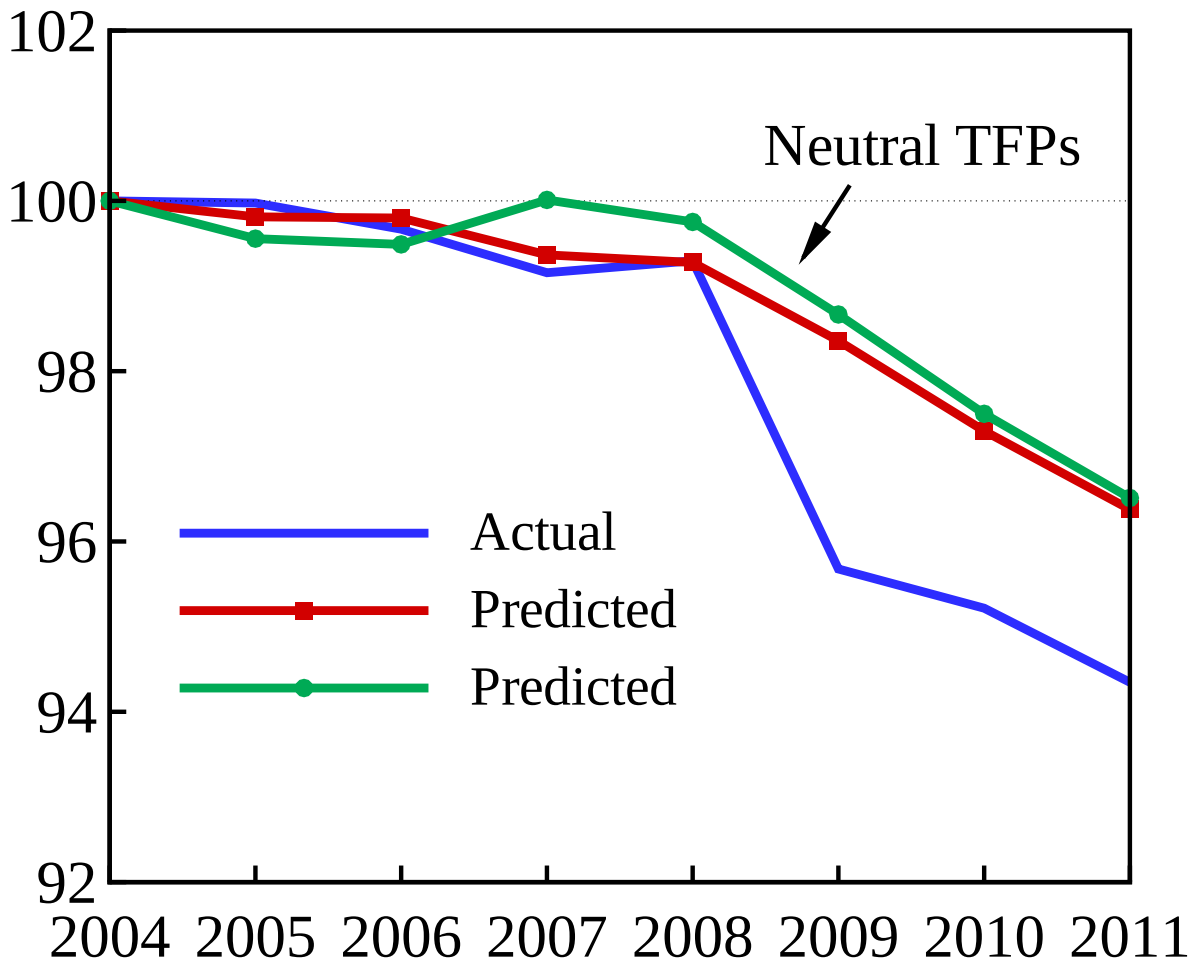


- Punchline: deviation is about 2%

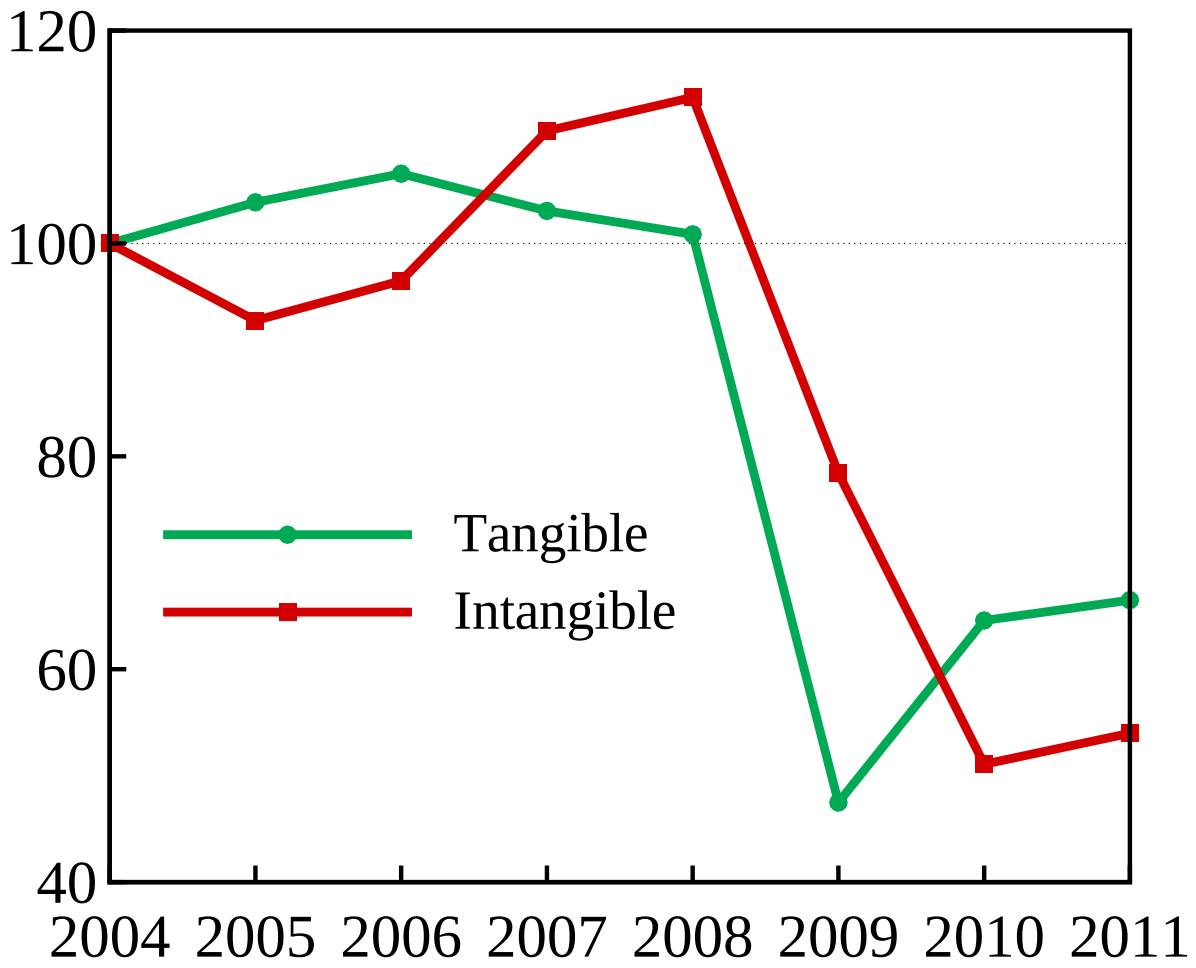
Total Consumption relative to trend



- Punchline: model predictions similar with neutral TFPs

Do Intangible Investments Look Crazy?

Predicted Business Investments



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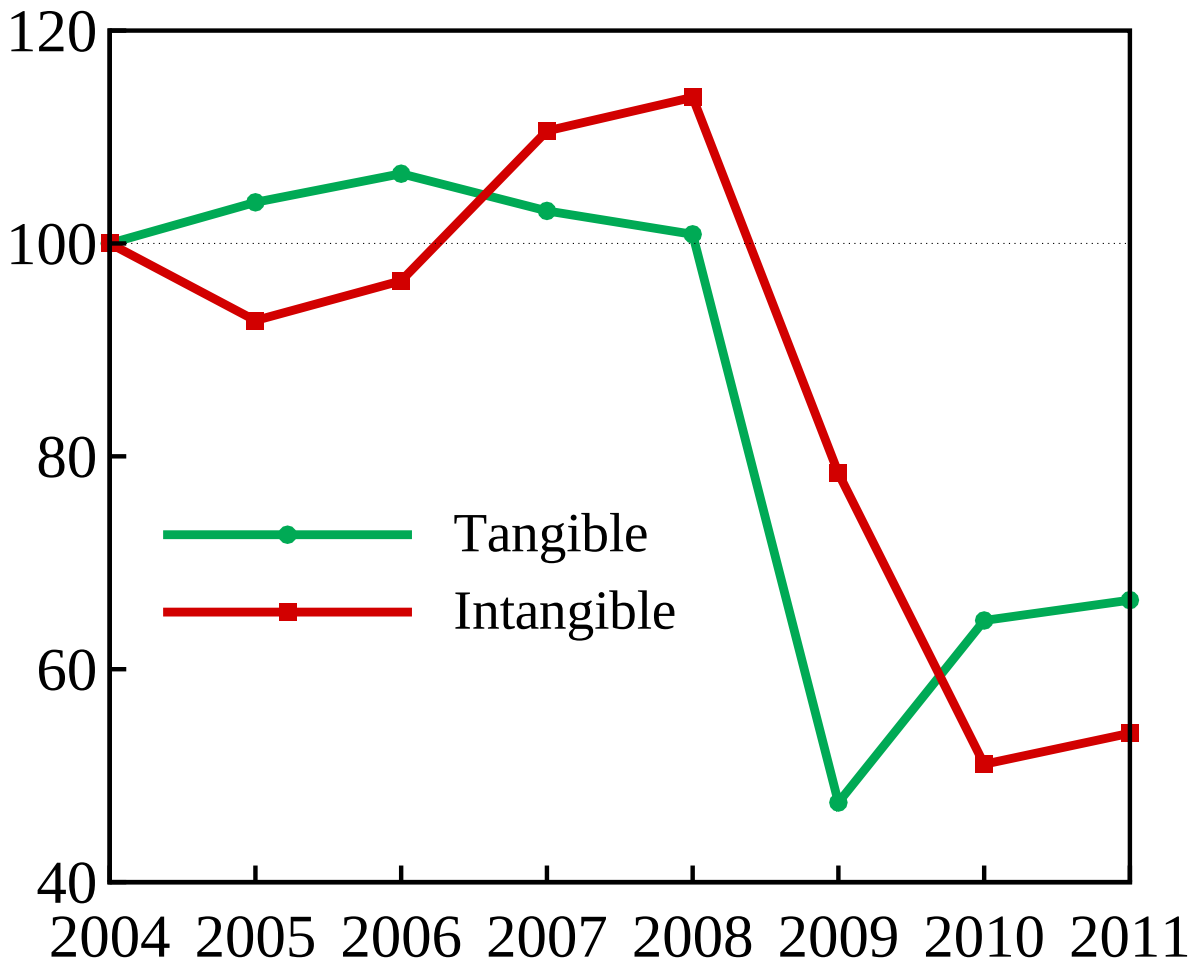
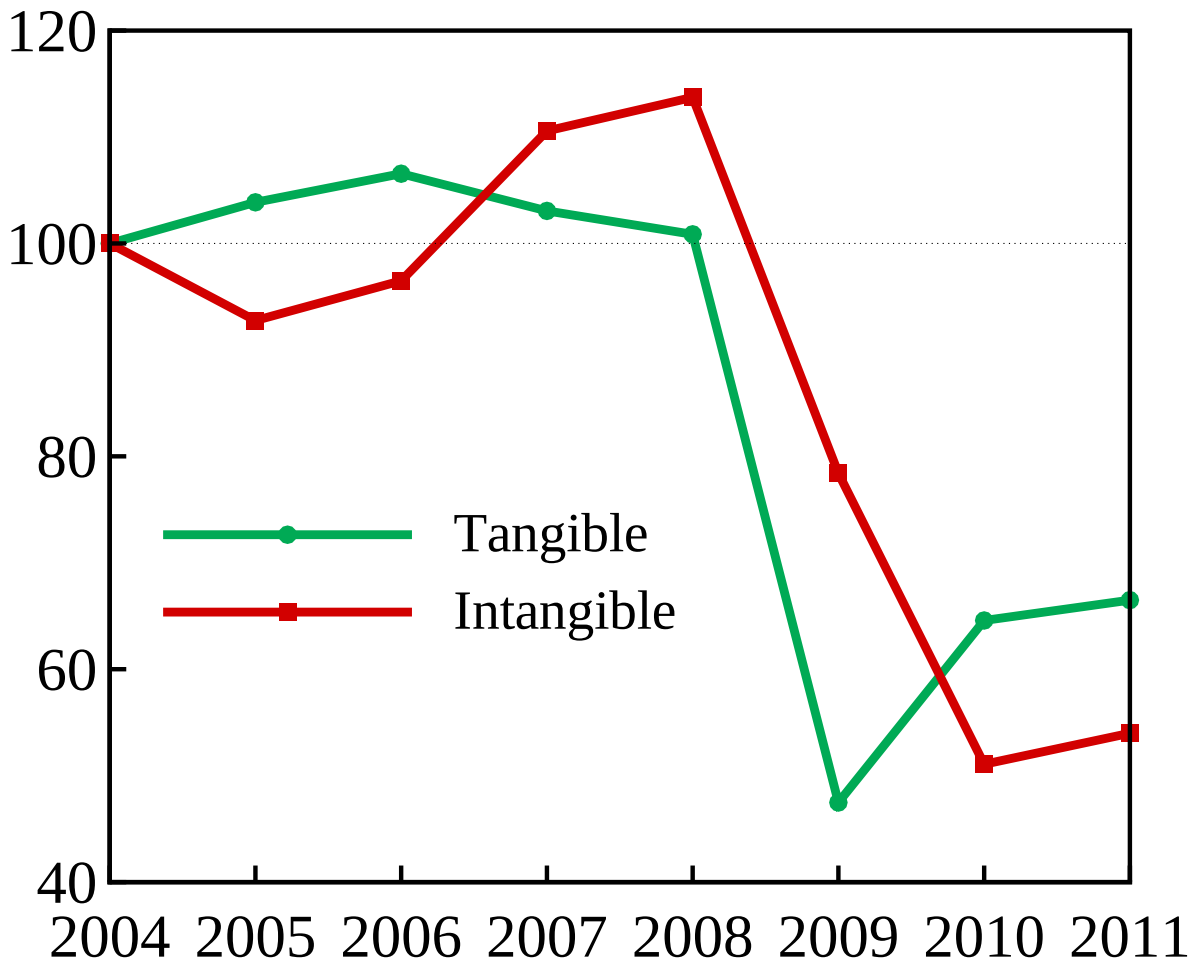


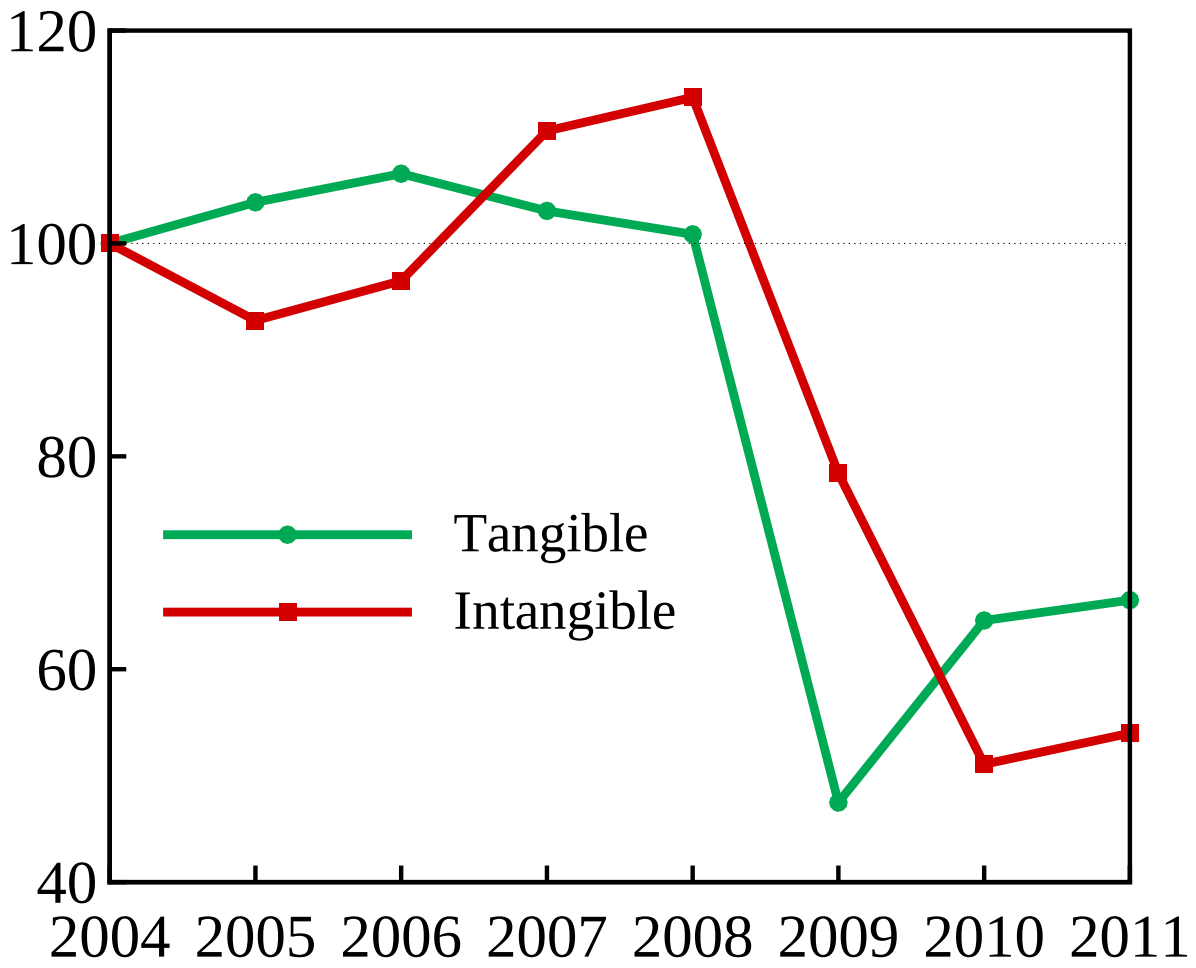
- Punchline: model doesn't predict negative intangibles

Predicted Business Investments



- Punchline: model instead predicts similar declines

Predicted Business Investments



- Punchline: what evidence do we have for the US?

Summary of Deviations in Investments

2009–2011 Averages, % Below Trend

	Tangible Investment		Intangible Inv.
	Aggregate	Business	Business
Model	-33	-40	-40
Data	-25	-23	$\{-33, -13\}$

$\Uparrow$

$\{\text{Advertising, R\&D}\}$

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⇑

{Advertising, R&D}

- In US, tangible decline in range of intangible declines

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$\Uparrow$

$\{$Advertising, R&D$\}$

- In model, tangible decline same as intangible decline

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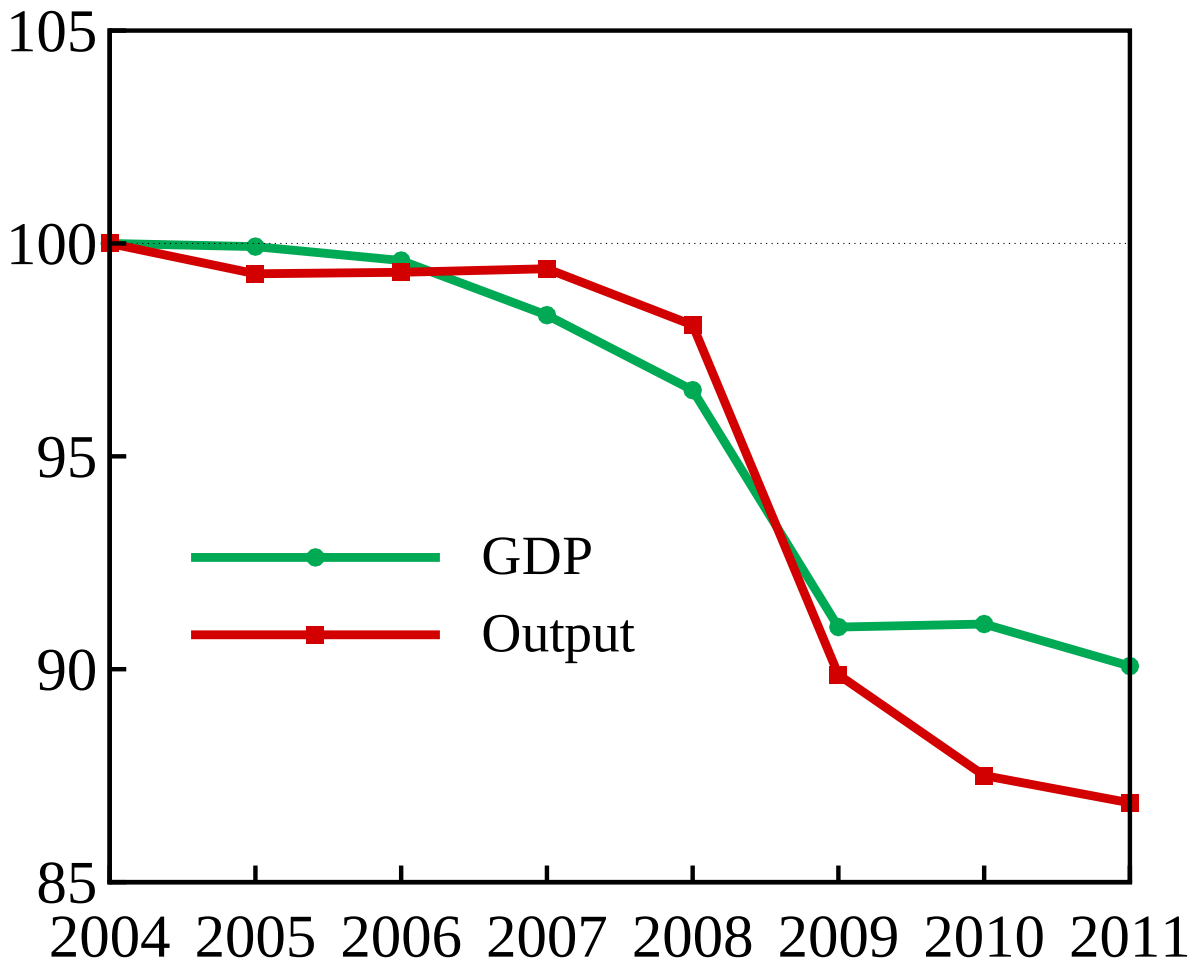
⇑

{Advertising, R&D}

- But overall, model overpredicts fall in investment

What is the predicted fall in output?

GDP vs. Total Output



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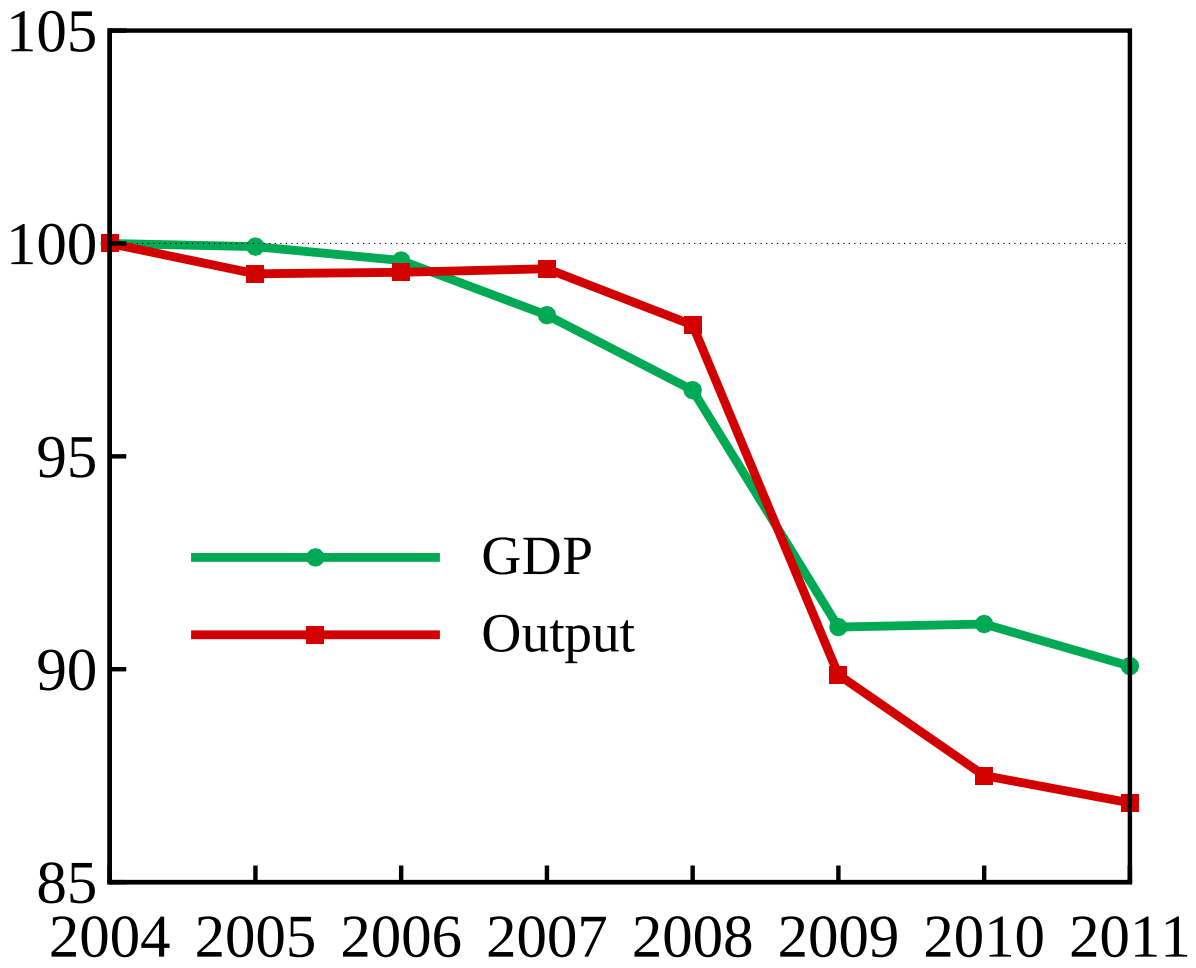
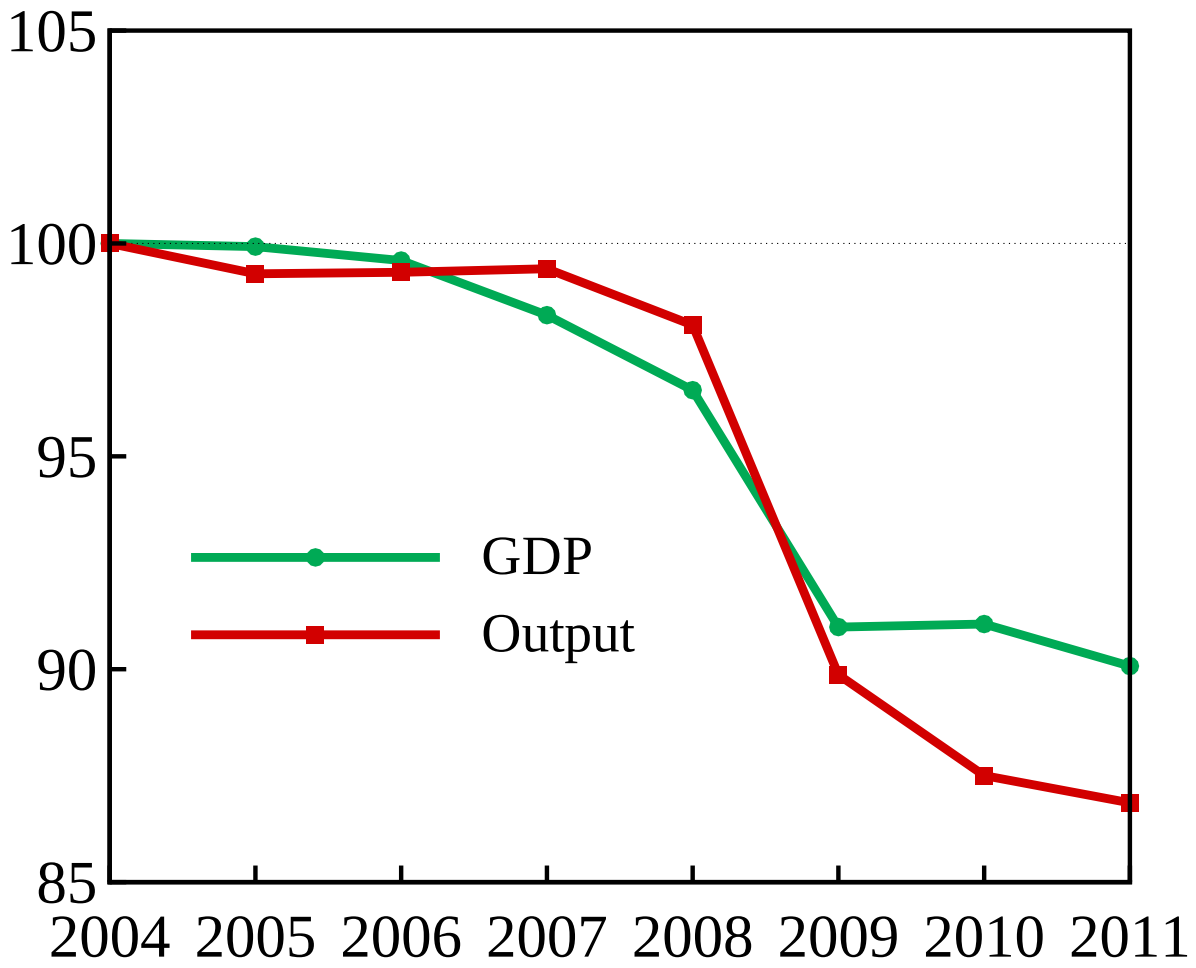


- Punchline: fall in predicted output is about 13%

GDP vs. Total Output



- Punchline: think of 13% fall as an upper bound

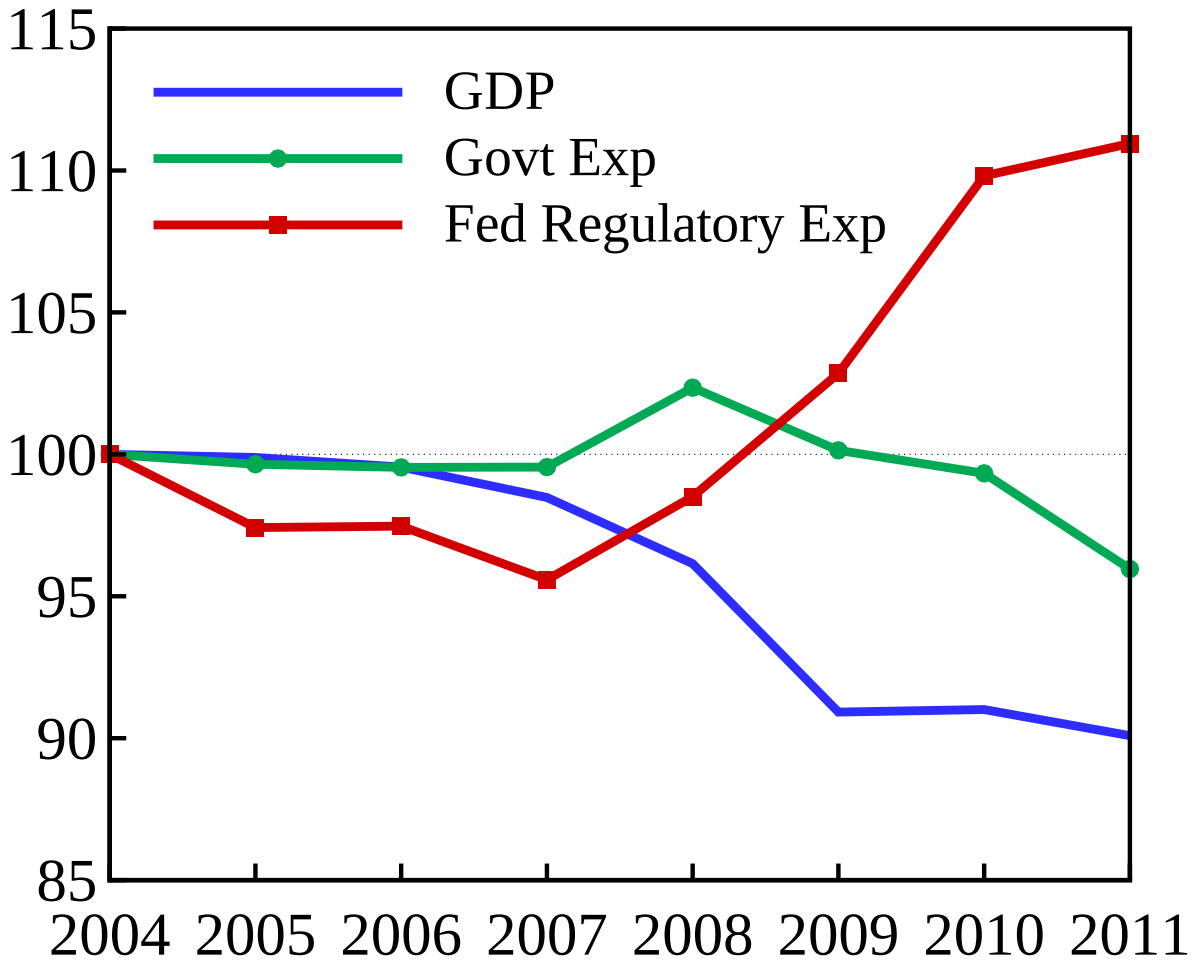
Any Evidence for Low TFPs?

Any Evidence for Low TFPs? Yes.

Increased Regulatory Costs

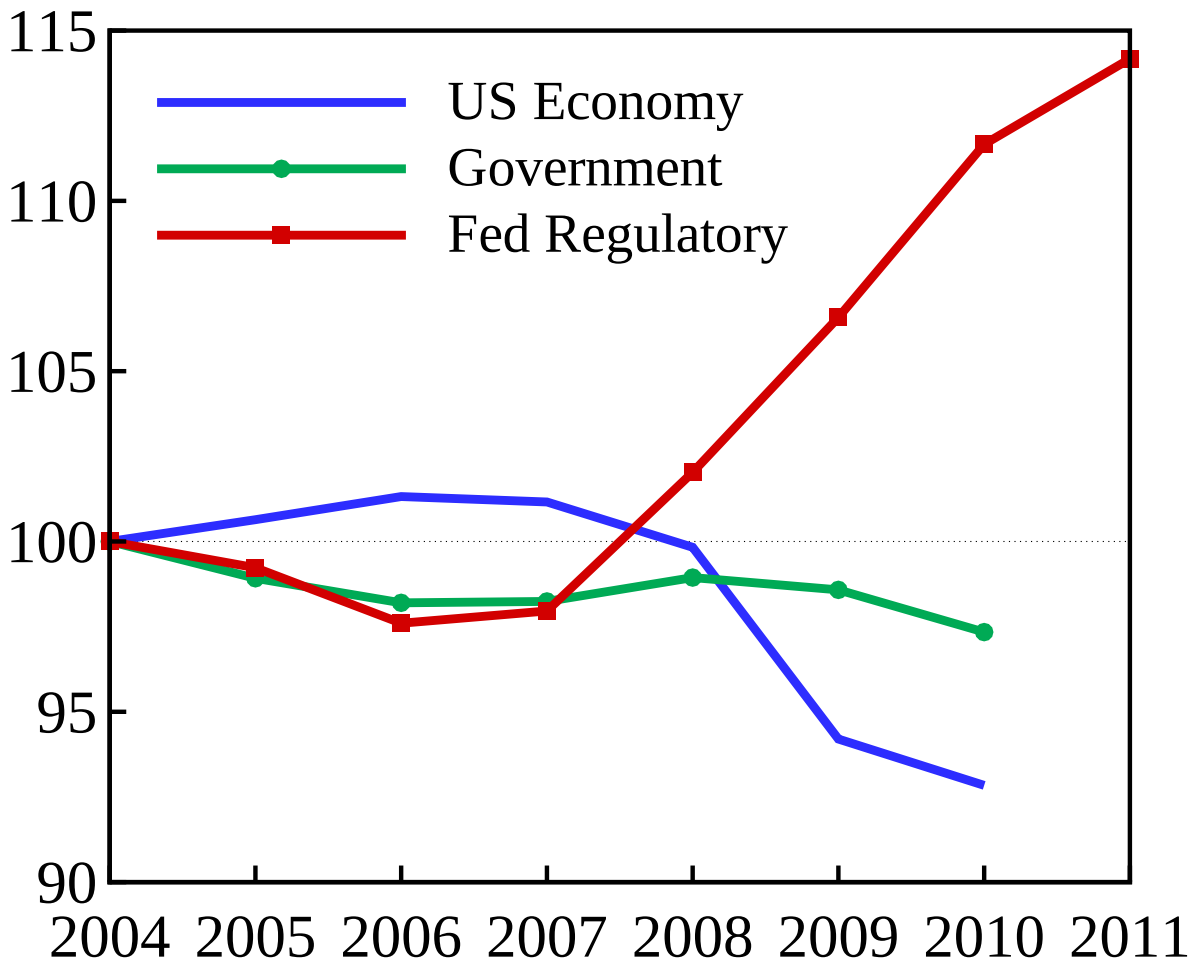
- Dramatic changes:
  - GDP and US employment fell
  - Federal regulatory spending and employment rose
- Time series look like mirror images...

GDP and Reugulatory Spending



- Punchline: GDP and spending paths are mirror images

US and Regulatory Employment



- Punchline: employment paths are mirror images

Conclusion

- Addressed claim that existing theory has failed
- Found that:
  - Theory does surprisingly well over 2004–2011
  - Deviations don't point where many are headed