

# **The End of the Global Savings Glut and the Future of the U.S. Economy**

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## **Introduction**

The United States has borrowed heavily from rest of world since 1990s.

Recent European experience suggests low interest rates and successful debt auctions may not be good indicators of future.

What happens when the United States starts to repay debt?

What happens if foreigners stop lending suddenly rather than gradually?

## **Global savings glut**

[O]ver the past decade a combination of diverse forces has created a significant increase in the global supply of saving — a global saving glut — which helps to explain both the increase in the U.S. current account deficit and the relatively low level of long-term real interest rates in the world today.

Ben Bernanke, 2005

A large literature seeks to explain savings glut

Example: Financial integration with asymmetric financial development (Mendoza et al., 2009; Caballero et al. 2008)

We focus on its long run consequences

## **What we do**

- Interpret savings glut as shocks to rest of world's discount factor.
- Build model consistent with key facts about U.S. economy since 1992.
- Assess long-run implications of end to savings glut for U.S. economy.
- Emphasize reallocation effects on goods, services, construction sectors.

## **Exit scenarios**

### 1. Gradual rebalancing

Demand for U.S. bonds falls slowly over time

### 2. Orderly sudden stop

Foreigners suddenly stop lending

Spain during 1992–1993 ERM crisis

### 3. Disorderly sudden stop

TFP drops when lending ceases

Mexico (1995), South Korea (1997), PIIGS (now)

## Findings

End of savings glut has long-run consequences:

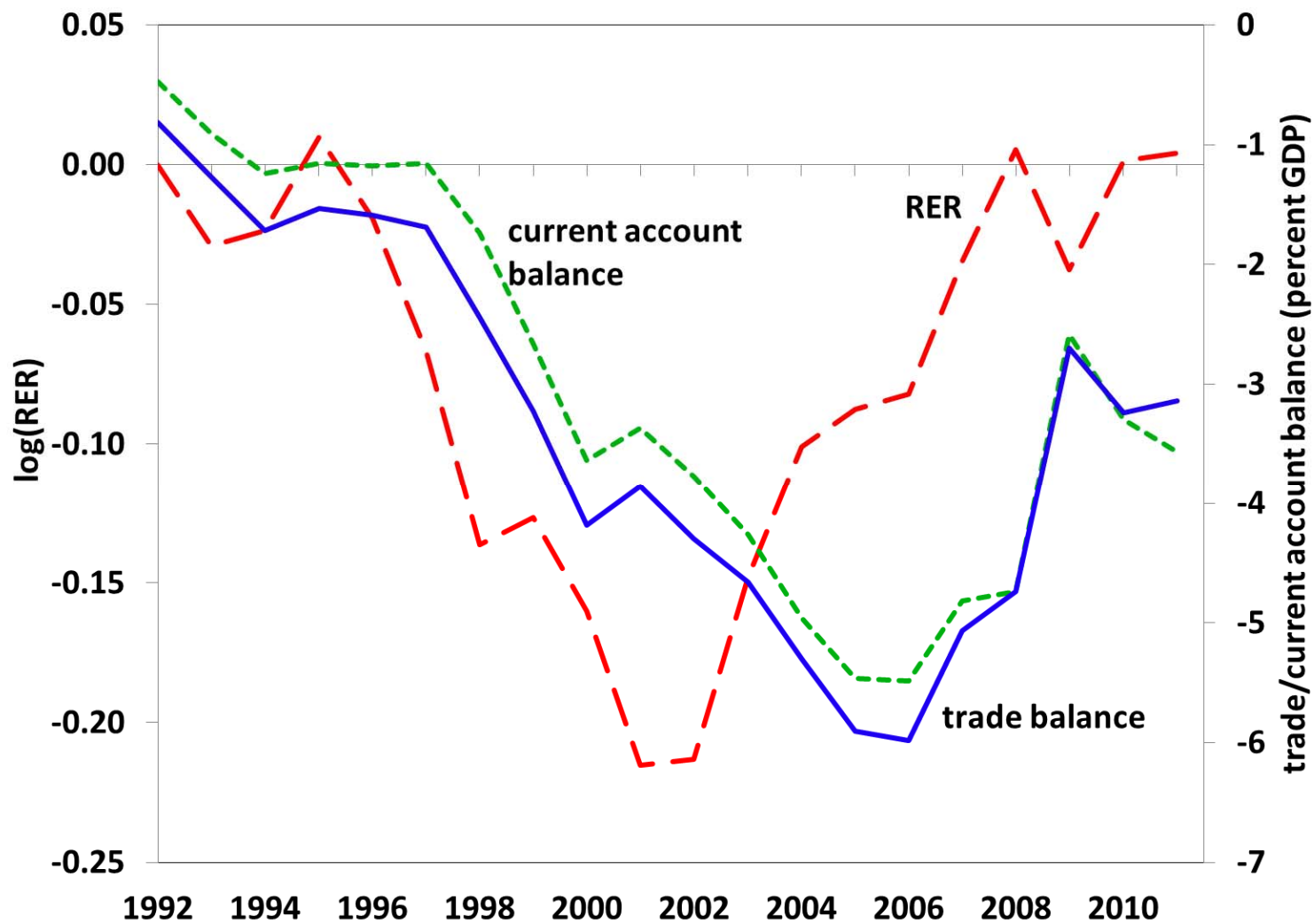
- Trade balance reversal.
- Real exchange rate depreciation.
- Reallocation to goods from construction.

Sudden stop causes changes to occur immediately.

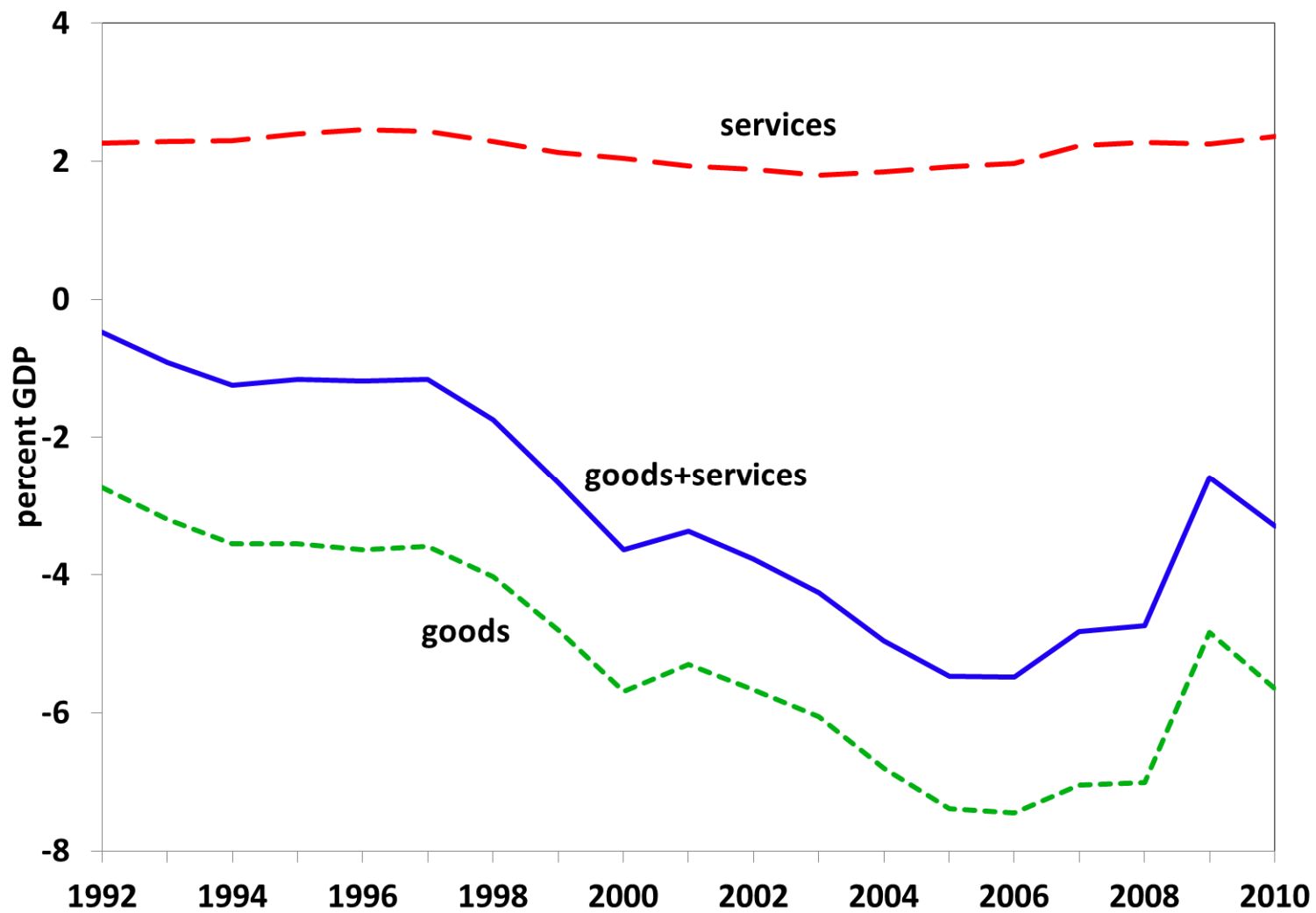
Reallocation into goods is limited by services' export orientation and structural change.

Exit scenarios differ in short run but have similar long-run effects.

## Real exchange rate, trade balance, and current account balance



## Disaggregated trade balances





## **Model's in-sample performance**

Model matches key facts about U.S. economy since 1992:

1. Trade deficit grew.
2. Trade balance dynamics driven by goods, not services.
3. RER appreciated.

## Modeling the savings glut

Dynamic, stochastic general equilibrium model with two countries, United States (US) and rest of the world (RW).

Key assumptions for modeling savings glut:

- RW's discount factor is same as that of US in long run.
- RW's discount factor varies over time (deterministically in some cases and stochastically in others) and is calibrated to match the path of the trade balance 1992–2011.

We could also calibrate RW's discount factor to match the RER 1992–2011.

## **Uncertainty and unexpected shocks**

In 1992, agents expect economy to follow deterministic path without savings glut.

In 1998 savings glut unexpectedly starts and lasts until 2011.

During 1998–2010 agents assign a probability of 0.10 to the savings glut ending the next year.

After 2011, agents expect economy to follow deterministic path.

In the sudden stop exit scenarios a sudden stop unexpectedly occurs in 2015–2016.

In the disorderly sudden stop exit scenario there is a negative shock to productivity of 5 percent; in the orderly sudden stop exit scenario there is not.

## Production in US

Domestic goods and services:

$$y_{djt}^{us} = \min \left[ z_{gjt}^{us} / a_{gj}, z_{sjt}^{us} / a_{sj}, A_j (k_{jt}^{us})^{\alpha_j} (\gamma^t \ell_{jt}^{us})^{1-\alpha_j} \right], j = g, s$$

Armington aggregators:

$$y_{jt}^{us} = M_j^{us} \left( \mu_j^{us} (x_{djt}^{us})^{\zeta_j} + (1 - \mu_j^{us}) (x_{mjt}^{us})^{\zeta_j} \right)^{\frac{1}{\zeta_j}}, j = g, s$$

Construction:

$$y_{ct}^{us} = \min \left[ z_{gct}^{us} / a_{gc}, z_{sct}^{us} / a_{sc}, A_c (k_{ct}^{us})^{\alpha_j} (\gamma^t \ell_{ct}^{us})^{1-\alpha_j} \right]$$

Investment good:

$$y_{it}^{us} = G \left( z_{git}^{us} \right)^{\theta_g} \left( z_{sit}^{us} \right)^{\theta_s} \left( z_{cit}^{us} \right)^{\theta_c}.$$

## Households

Adult equivalent population:

$$n^i = \bar{\ell}_t^i + \frac{\tilde{n}_t^i - \bar{\ell}_t^i}{2}, \quad i = us, rw,$$

where  $\tilde{n}_t^i$  is population and  $\bar{\ell}_t^i$  is working-age population.

## US CPI

$$P_{cpit}^{us} = \frac{P_{gt}^{us} C_{g1992}^{us} + P_{st}^{us} C_{s1992}^{us}}{P_{g1992}^{us} C_{g1992}^{us} + P_{s1992}^{us} C_{s1992}^{us}}$$

## Households in US

Maximize

$$E_0 \left[ \sum_{t=0}^{\infty} (\beta^{us})^t \left( \left( \varepsilon^{us} \left( \frac{c_{gt}^{us}}{n_t^{us}} \right)^{\rho} + (1 - \varepsilon^{us}) \left( \frac{c_{st}^{us}}{n_t^{us}} \right)^{\rho} \right)^{\frac{\eta\psi}{\rho}} \left( \frac{\bar{\ell}_t^{us} - \ell_t^{us}}{\bar{\ell}_t^{us}} \right)^{(1-\eta)\psi} - 1 \right) / \psi \right]$$

subject to

$$p_{gt}^{us} c_{gt}^{us} + p_{st}^{us} c_{st}^{us} + p_{it}^{us} i_t^{us} + q_t b_{t+1}^{us} = w_t^{us} \ell_t^{us} + p_{cpit}^{us} b_t^{us} + (1 - \tau_k^{us}) r_{kt}^{us} k_t^{us} - T_t^{us},$$

$$k_{t+1}^{us} = (1 - \delta) k_t^{us} + i_t^{us},$$

non-negativity, initial endowments  $\bar{k}_{1992}^{us}$  and  $\bar{b}_{1992}^{us}$ , no Ponzi schemes.

## Households in RW

Maximize

$$E_0 \left[ \sum_{t=0}^{\infty} (\beta^{rw})^t \omega_t^{rw} \left( \left( \varepsilon^{rw} \left( \frac{c_{gt}^{rw}}{n_t^{rw}} \right)^\rho + (1 - \varepsilon^{rw}) \left( \frac{c_{st}^{rw}}{n_t^{rw}} \right)^\rho \right)^{\frac{\psi}{\rho}} - 1 \right) / \psi \right]$$

subject to

$$p_{gt}^{rw} c_{gt}^{rw} + p_{st}^{rw} c_{st}^{rw} + q_t b_{t+1}^{rw} = p_{dgt}^{rw} y_{dgt}^{rw} + p_{dst}^{rw} y_{dst}^{rw} + p_{cpit}^{us} b_t^{rw}$$

non-negativity, initial endowment  $\bar{b}_{1992}^{rw}$ , no Ponzi schemes.

RW also has Armington aggregators for  $c_{gt}^{rw}$ ,  $c_{st}^{rw}$ .

## Bonds

Bonds pay off in US CPI baskets. If  $r_{kt}^{us}$  is the rental rate on capital, arbitrage implies

$$E_t \left[ \frac{P_{cpit+1}^{us}}{q_t} \right] = E_t \left[ \frac{(1 - \tau^{us}) r_{kt+1}^{us} + p_{it+1}^{us} (1 - \delta)}{P_{it}^{us}} \right].$$

## Real exchange rate

$$RER_t = \frac{P_{cpit}^{rw}}{P_{cpit}^{us}}$$



# Government

Maximize

$$\left(g_{gt}^{us}\right)^{\varepsilon^g} \left(g_{st}^{us}\right)^{1-\varepsilon^g}$$

subject to

$$p_{gt}^{us} g_{gt}^{us} + p_{st}^{us} g_{st}^{us} = v_t GDP_t^{us}.$$

Government budget constraint:

$$p_{gt}^{us} g_{gt}^{us} + p_{st}^{us} g_{st}^{us} - p_{cpit}^{us} b_t^g = \tau_k^{us} r_{kt}^{us} k_t^{us} + T_t^{us} - q_t b_t^g.$$

Government debt:

$$b_t^g = v_t GDP_t^{us}.$$

## Market clearing

Domestic production:

$$x_{djt}^{us} = y_{djt}^{us}, \quad x_{djt}^{rw} = y_{djt}^{rw}, \quad j = g, s$$

US Armington aggregates:

$$c_{jt}^{us} + g_{jt}^{us} + x_{mjt}^{rw} + z_{gjt}^{us} + z_{sjt}^{us} + z_{cjt}^{us} + z_{jit}^{us} = y_{jt}^{us}, \quad j = g, s$$

US construction:

$$z_{cit}^{us} = y_{dt}^{us}.$$

US investment:

$$i_t^{us} = y_{it}^{us}.$$

RW Armington aggregates:

$$c_{jt}^{rw} + x_{mjt}^{us} = y_{tjt}^{rw}, \quad j = g, s.$$

Factor markets:

$$k_{gt}^{us} + k_{st}^{us} + k_{ct}^{us} = k_t^{us}$$

$$l_{gt}^{us} + l_{st}^{us} + l_{ct}^{us} = l_t^{us}.$$

Bonds:

$$b_t^{us} + b_t^g + b_t^{rw} = 0.$$

## **Calibration**

U.S. input-output matrix for 1992

CBO estimates for government expenditure and debt

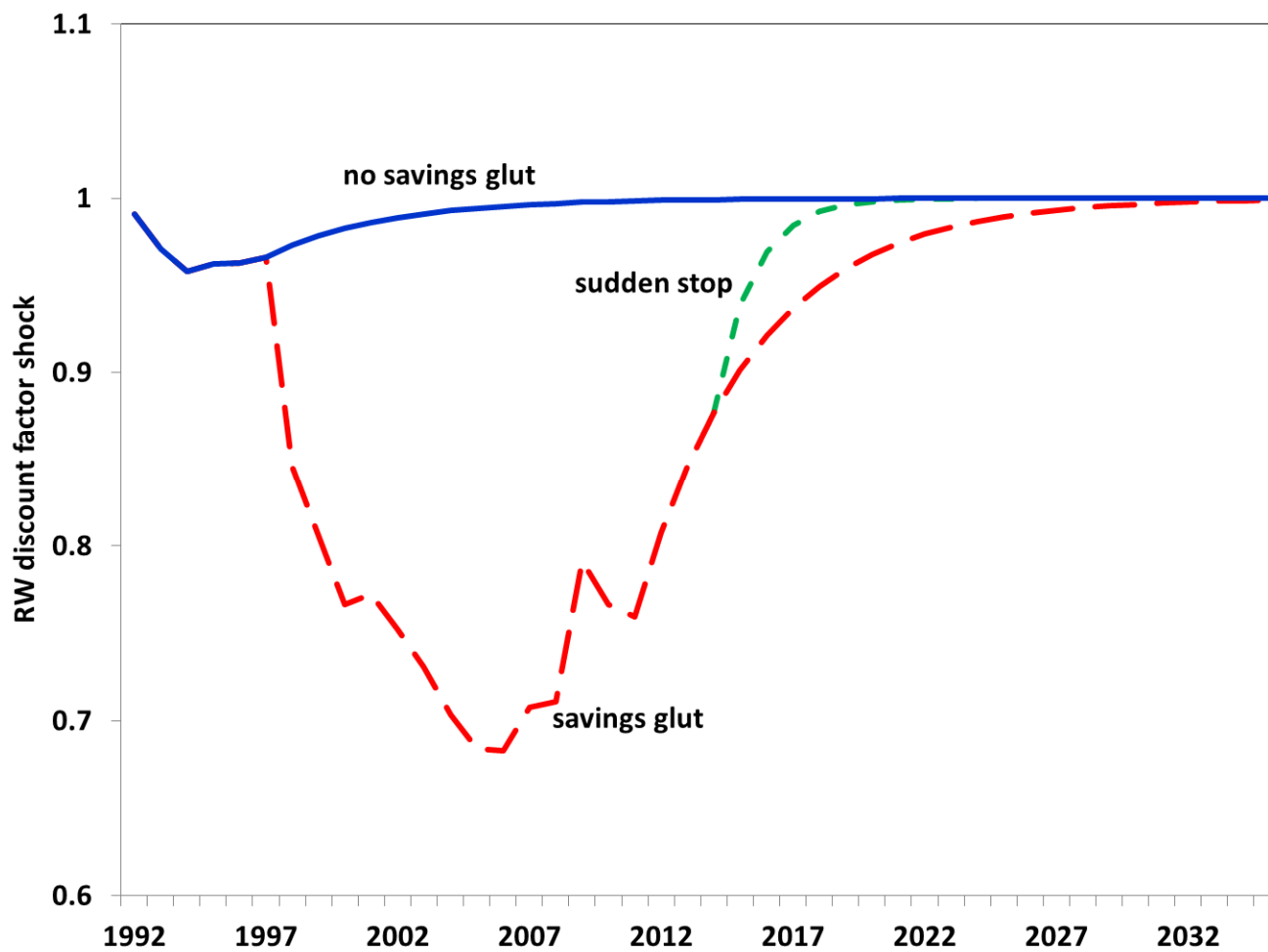
UN World Population Prospects

Armington elasticity of 3 for goods, 1 for services

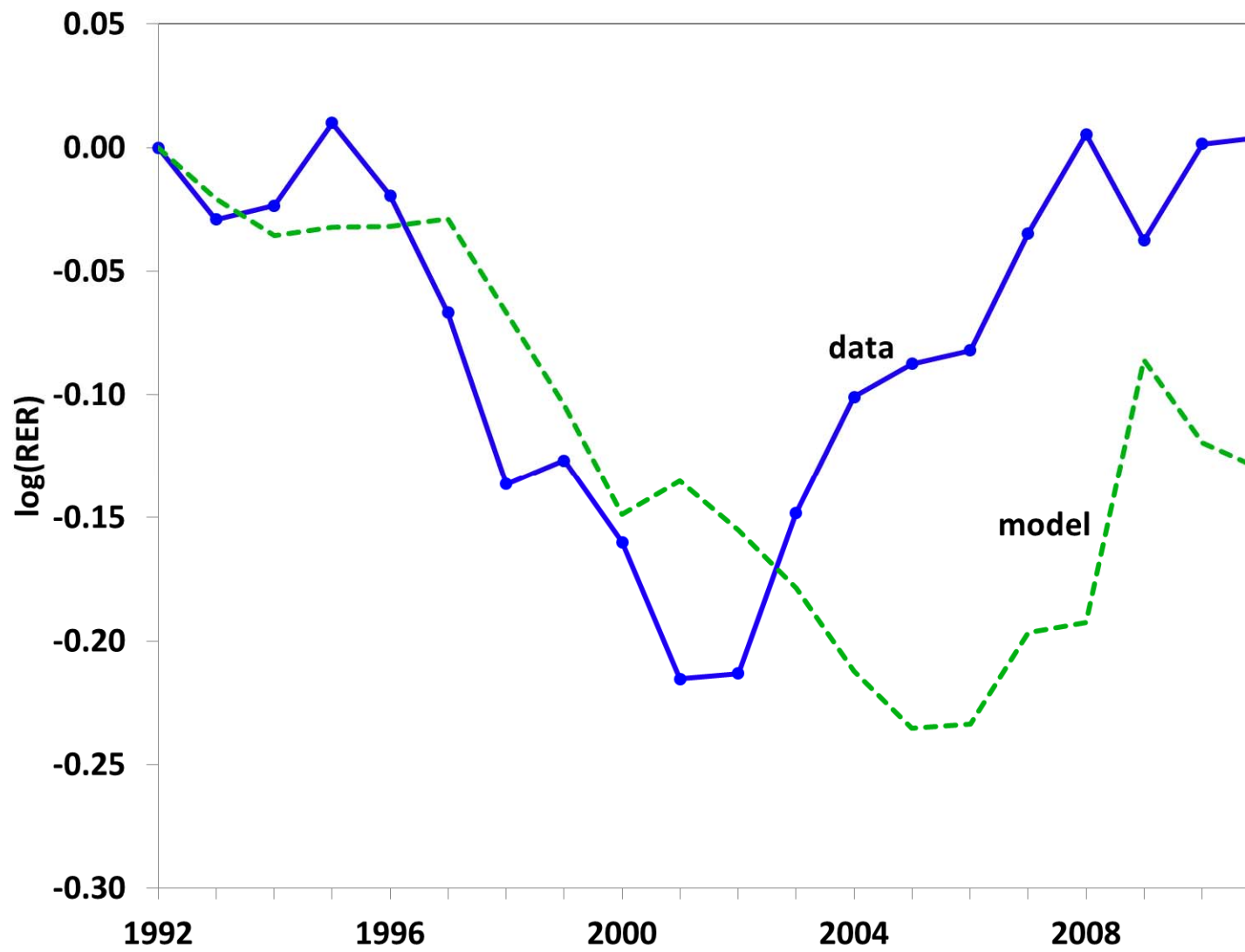
Discount factor calibrated to 3 percent per year interest rate in balanced growth path

In base case, productivity growth of 2 percent per year in all sectors

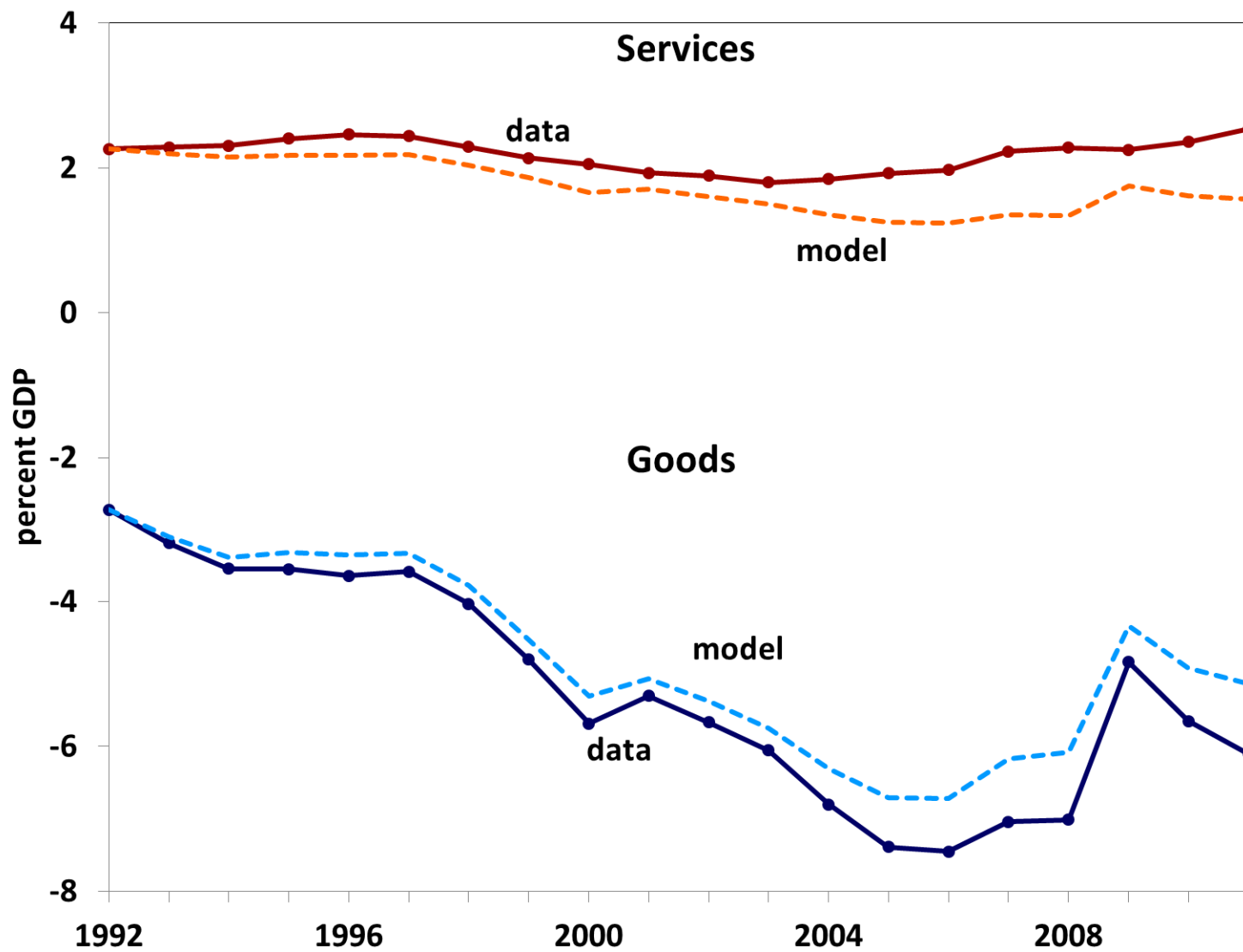
## RW discount factor shocks to match trade balance



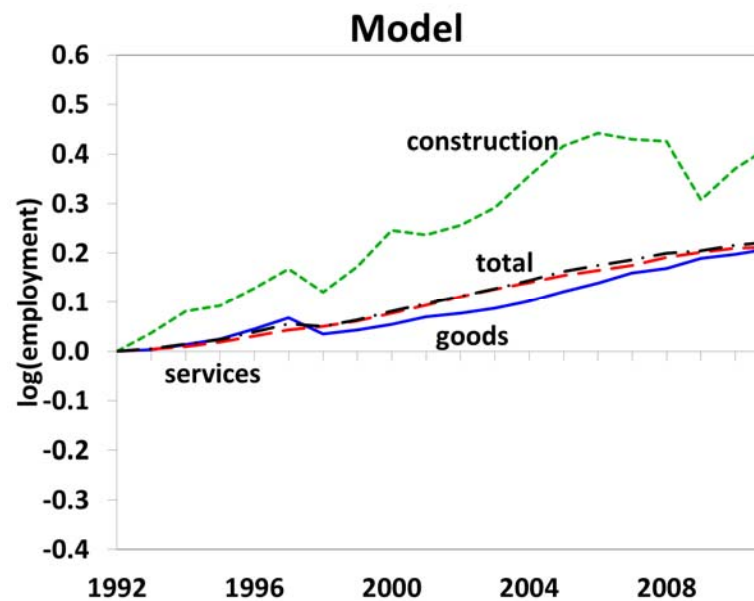
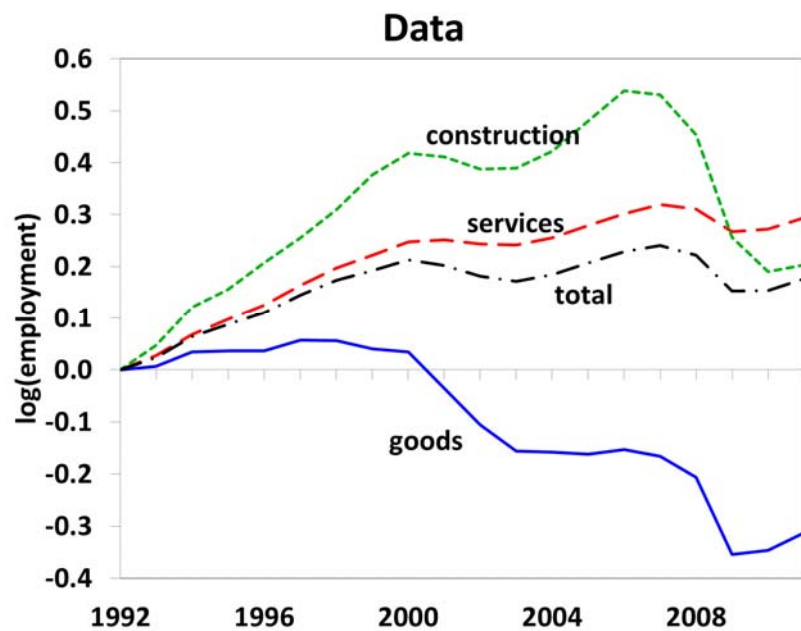
## Real exchange rate



# Disaggregated trade balances

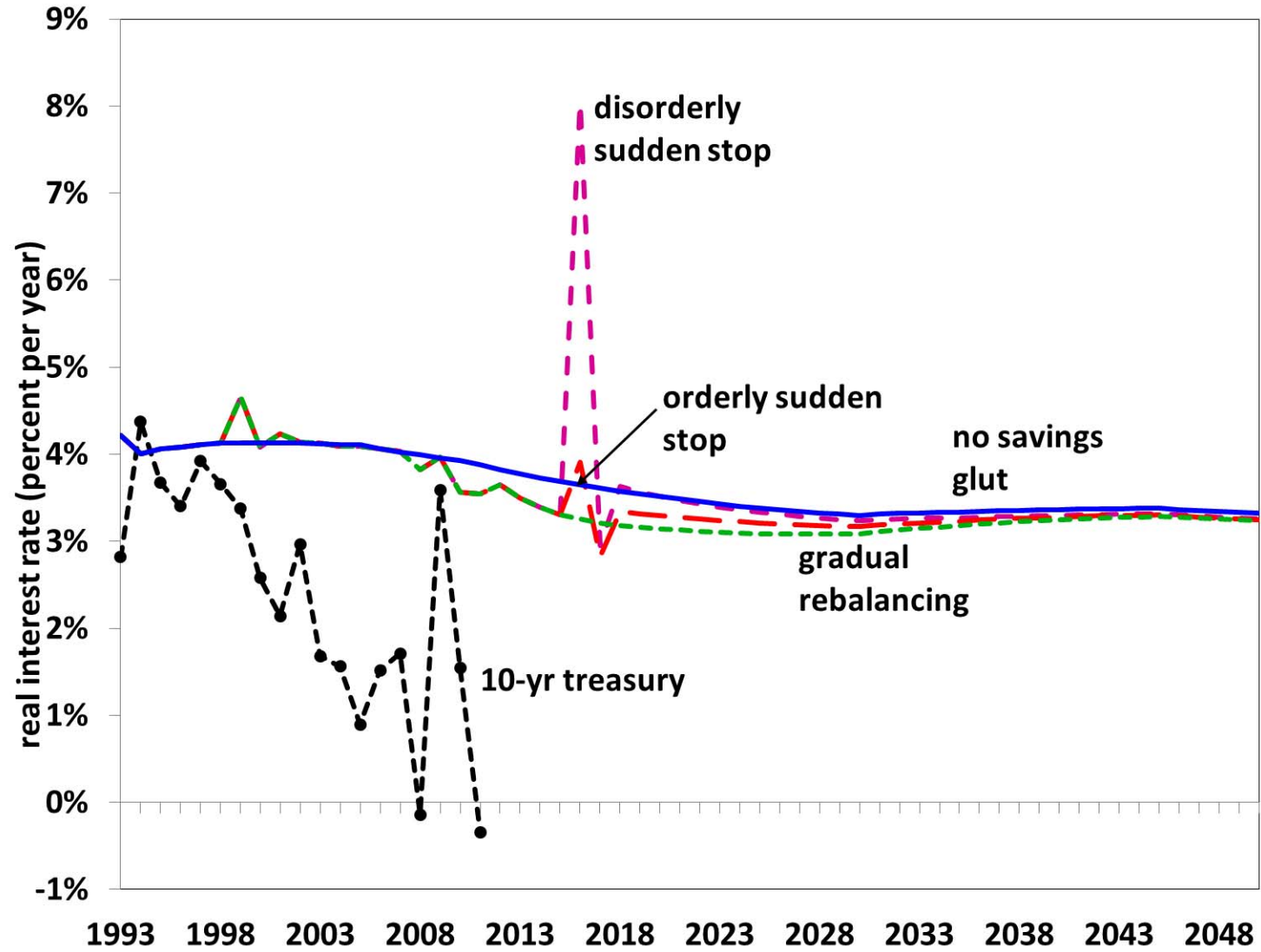


# Sector-level employment growth

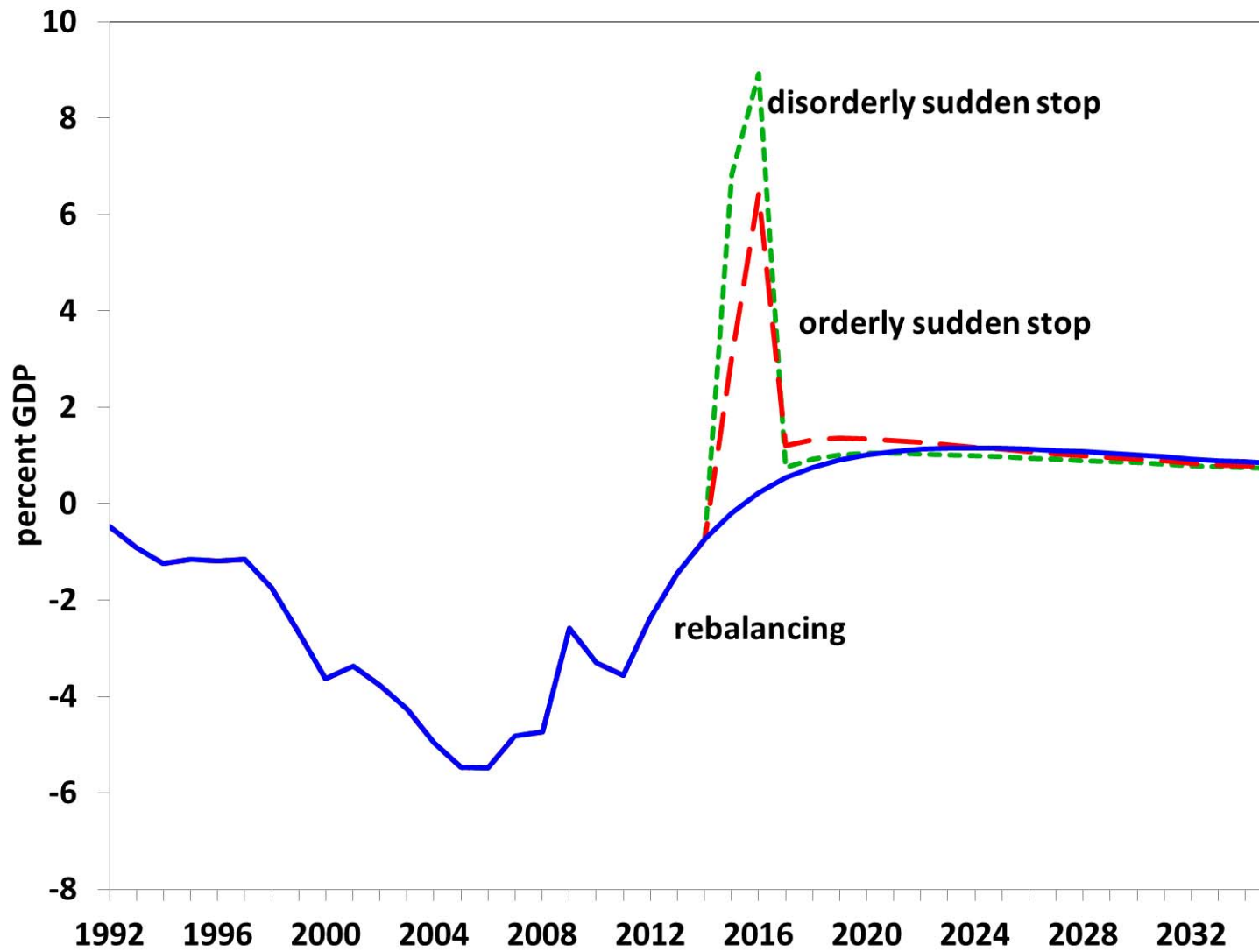




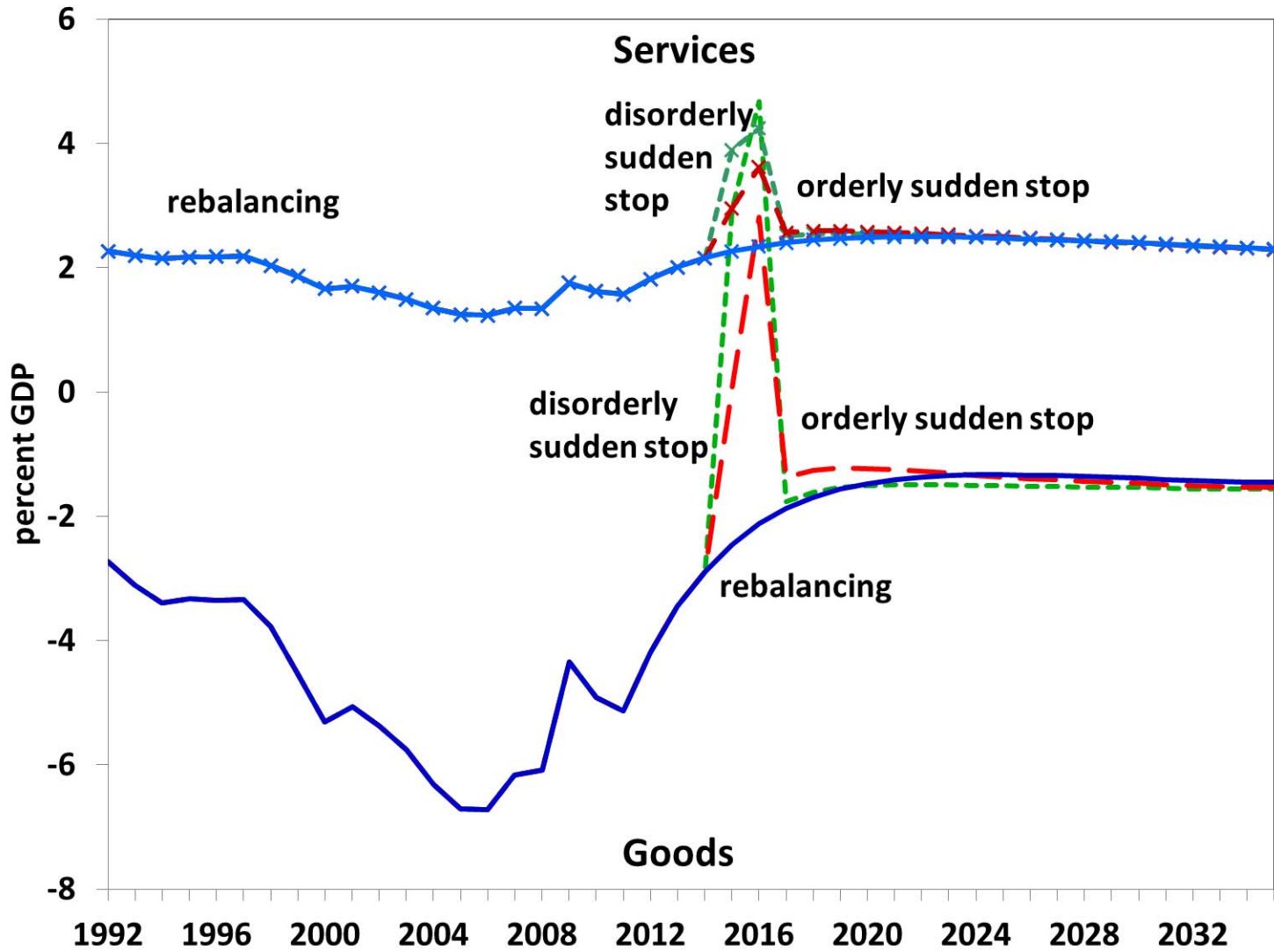
# Real interest rates on US bonds



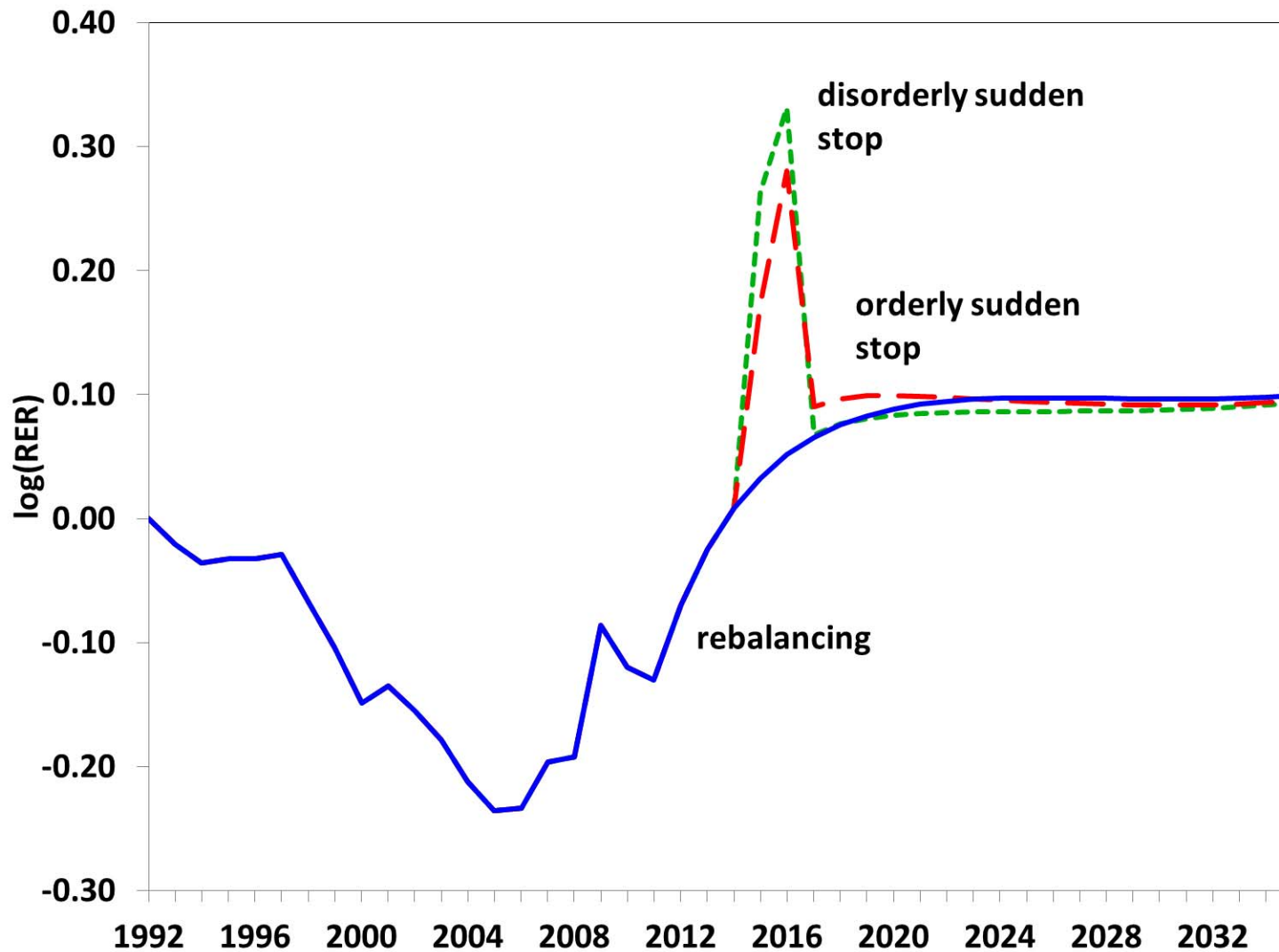
# Trade balance



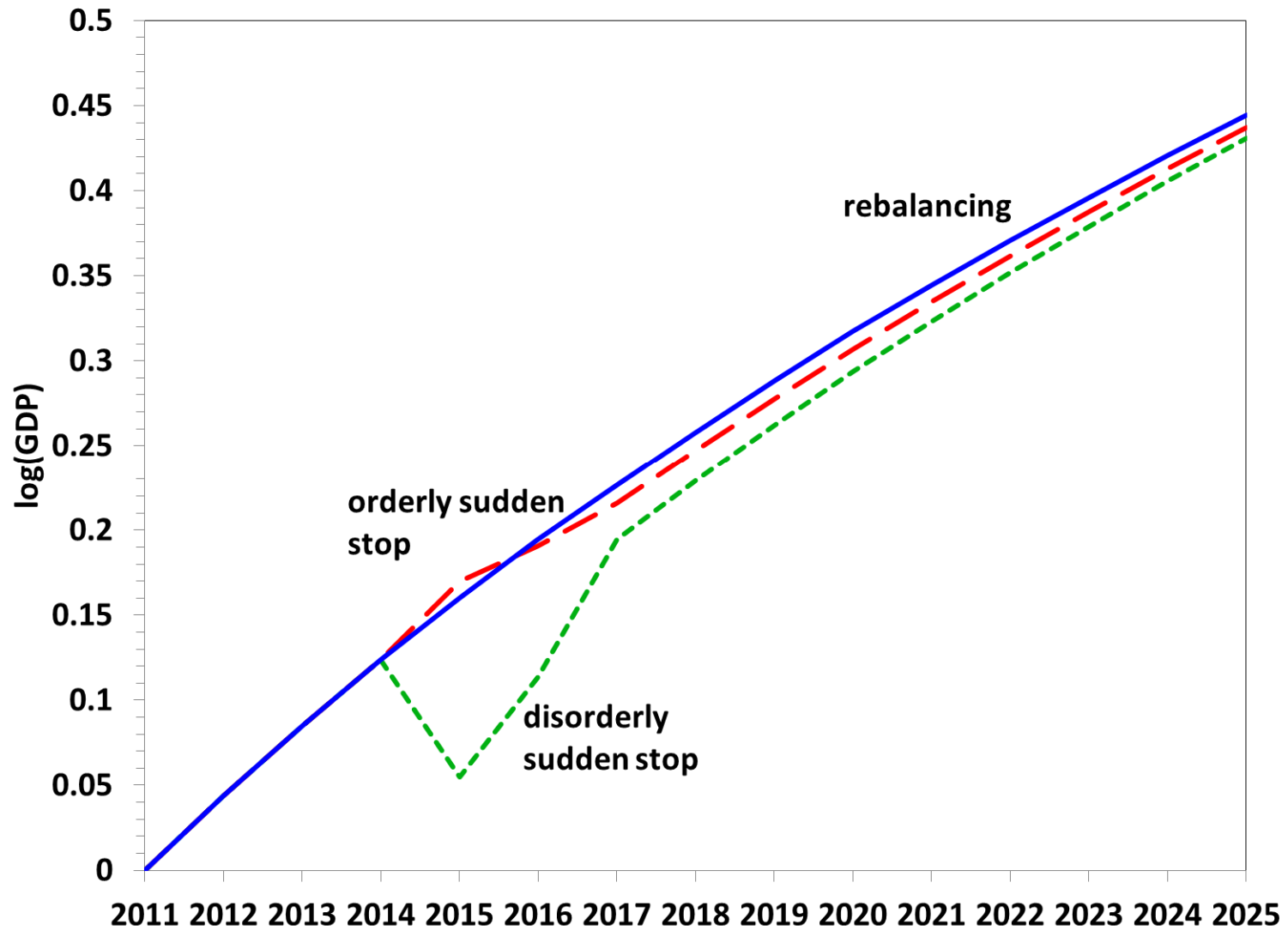
# Disaggregated trade balance



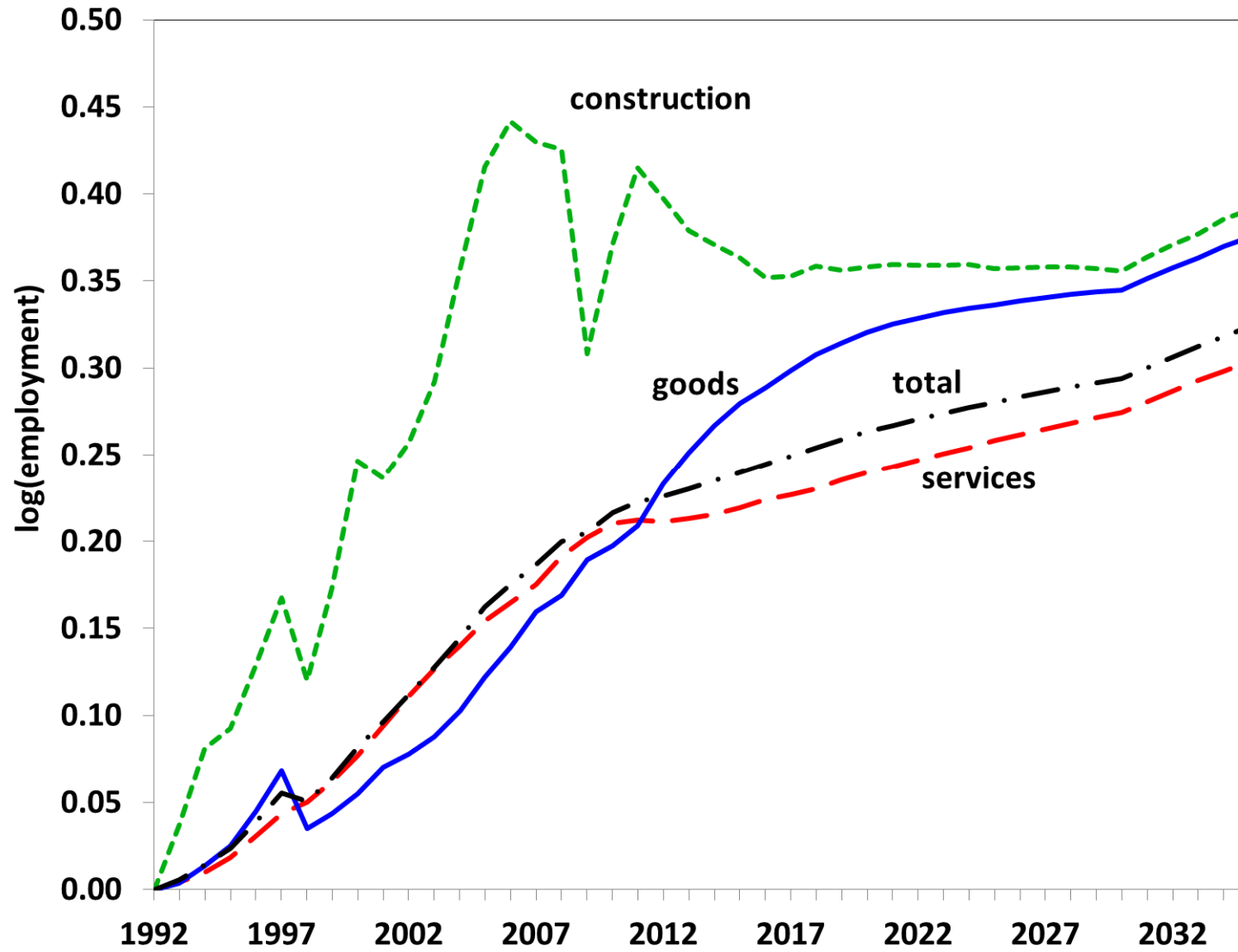
# Real exchange rate



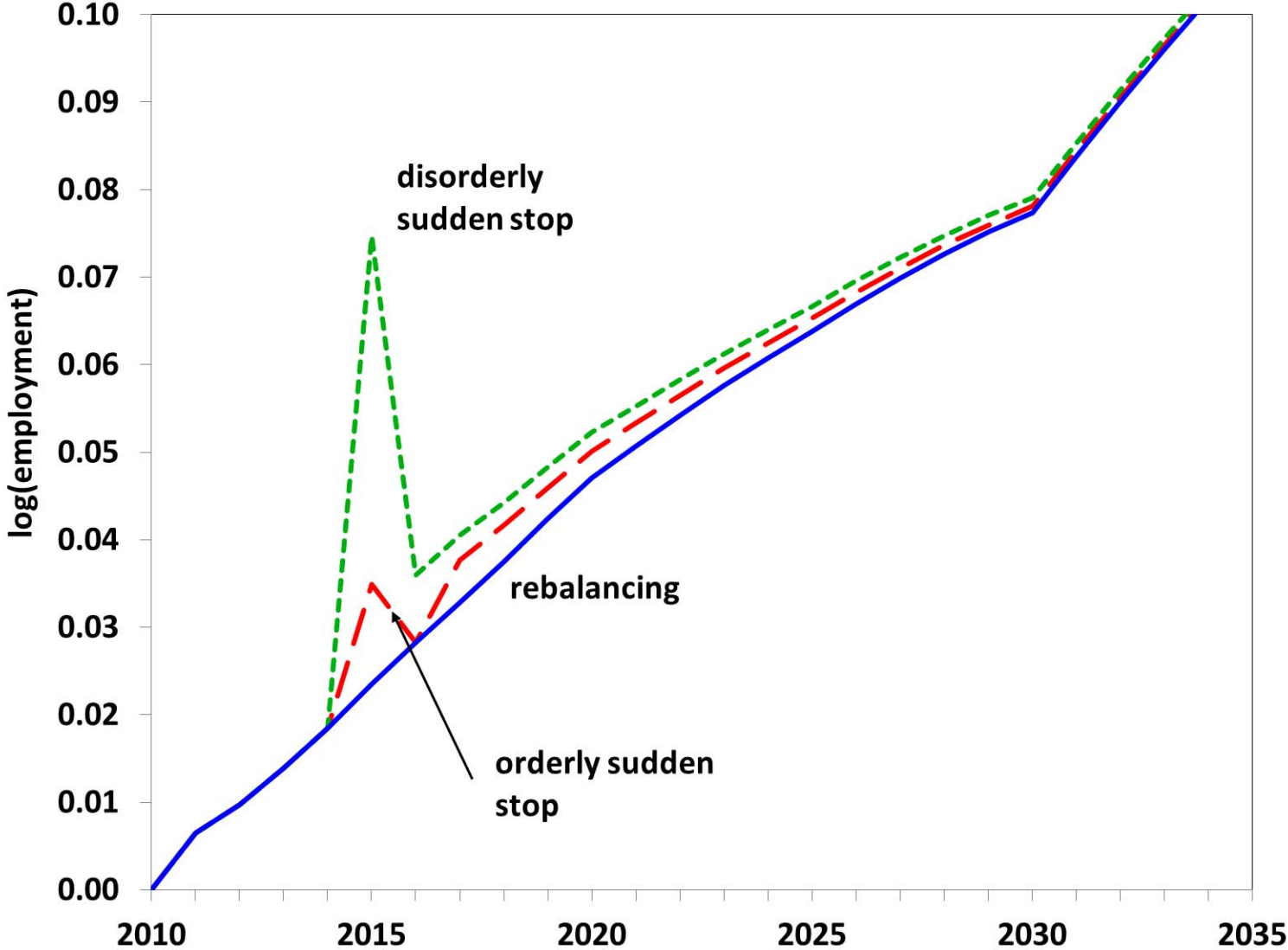
## Real GDP projections



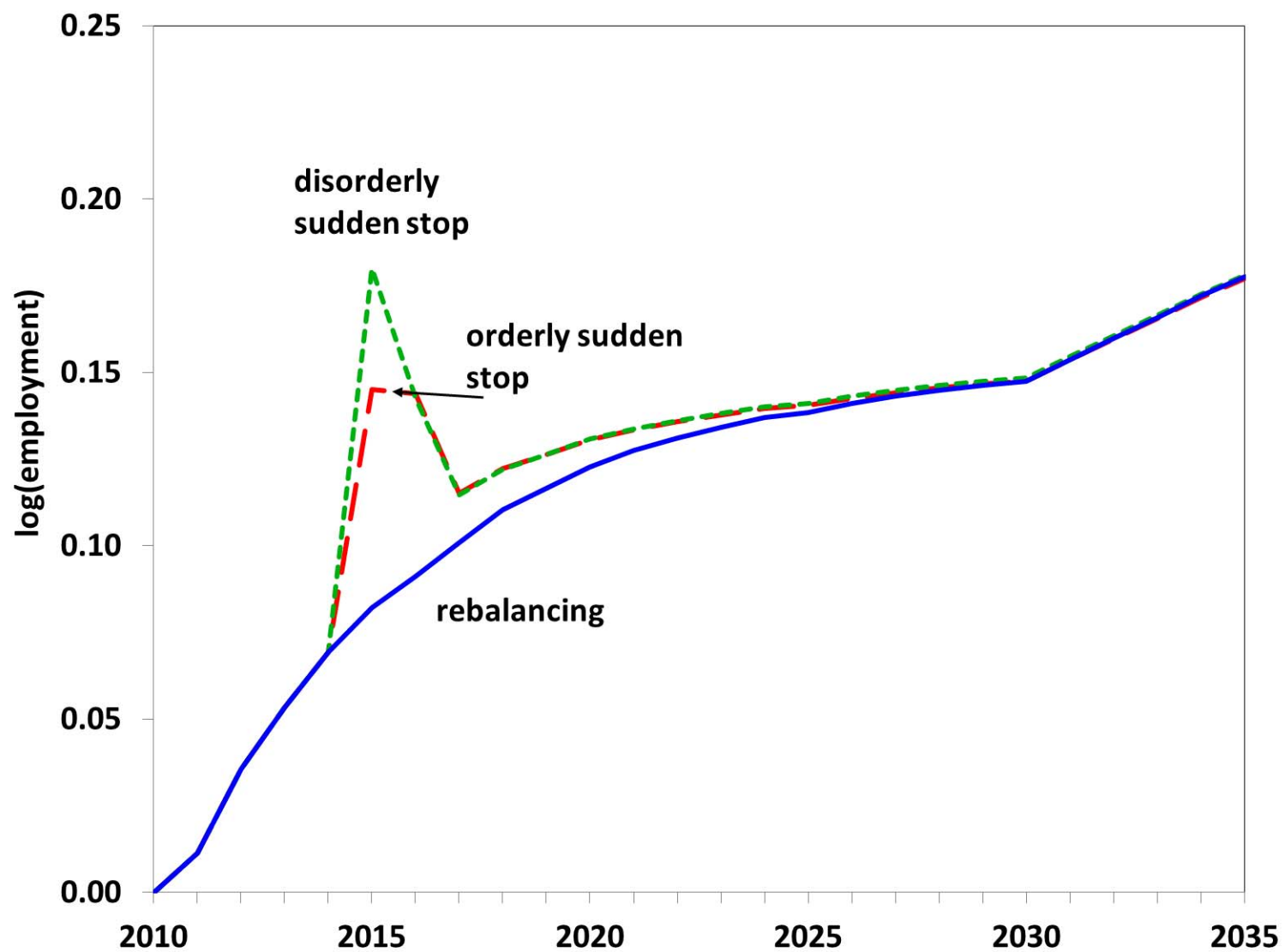
## Sector-level employment projections, gradual rebalancing



# Total employment projections, rebalancing vs. sudden stop

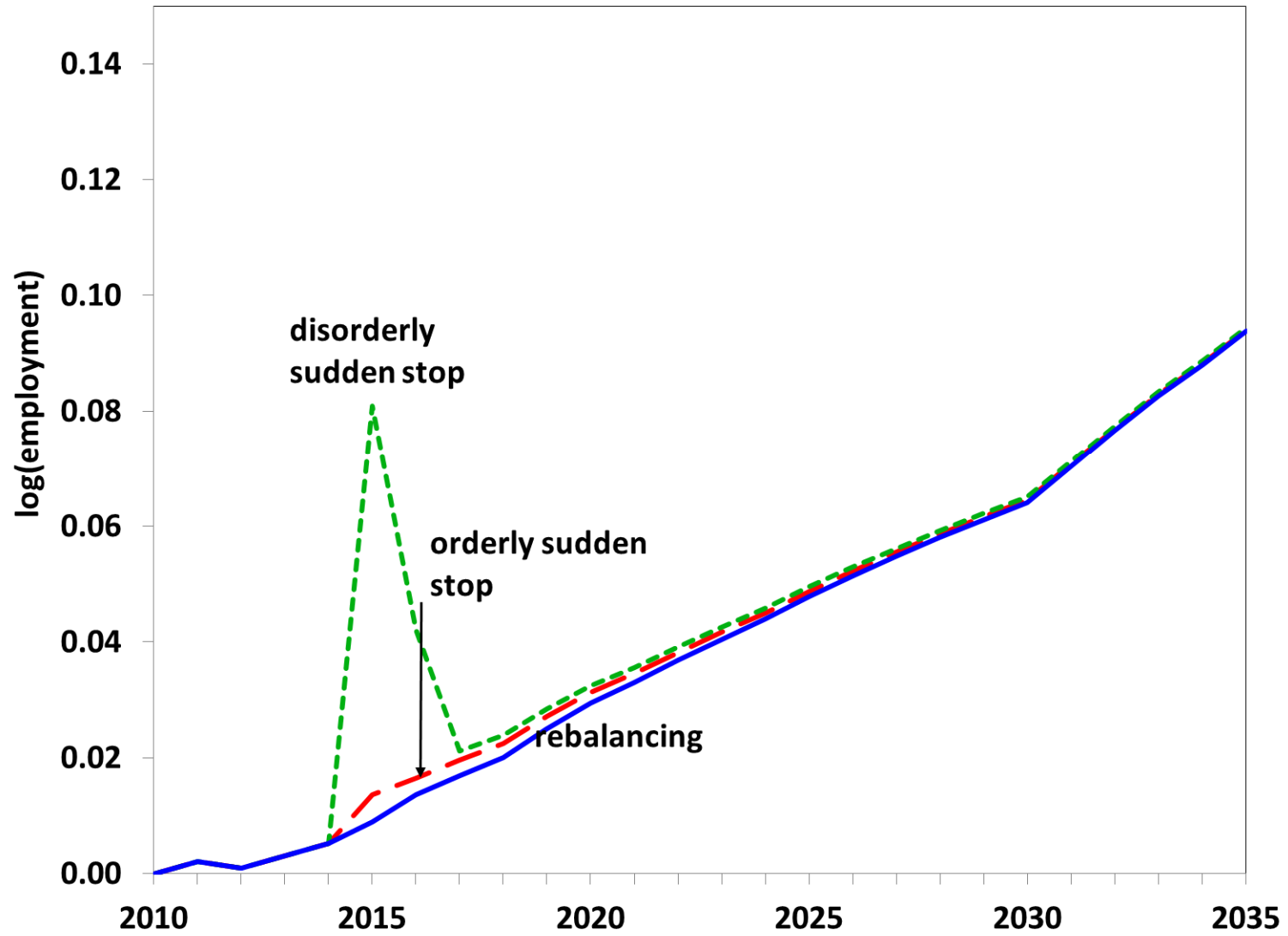


## Goods employment projections, rebalancing vs. sudden stop

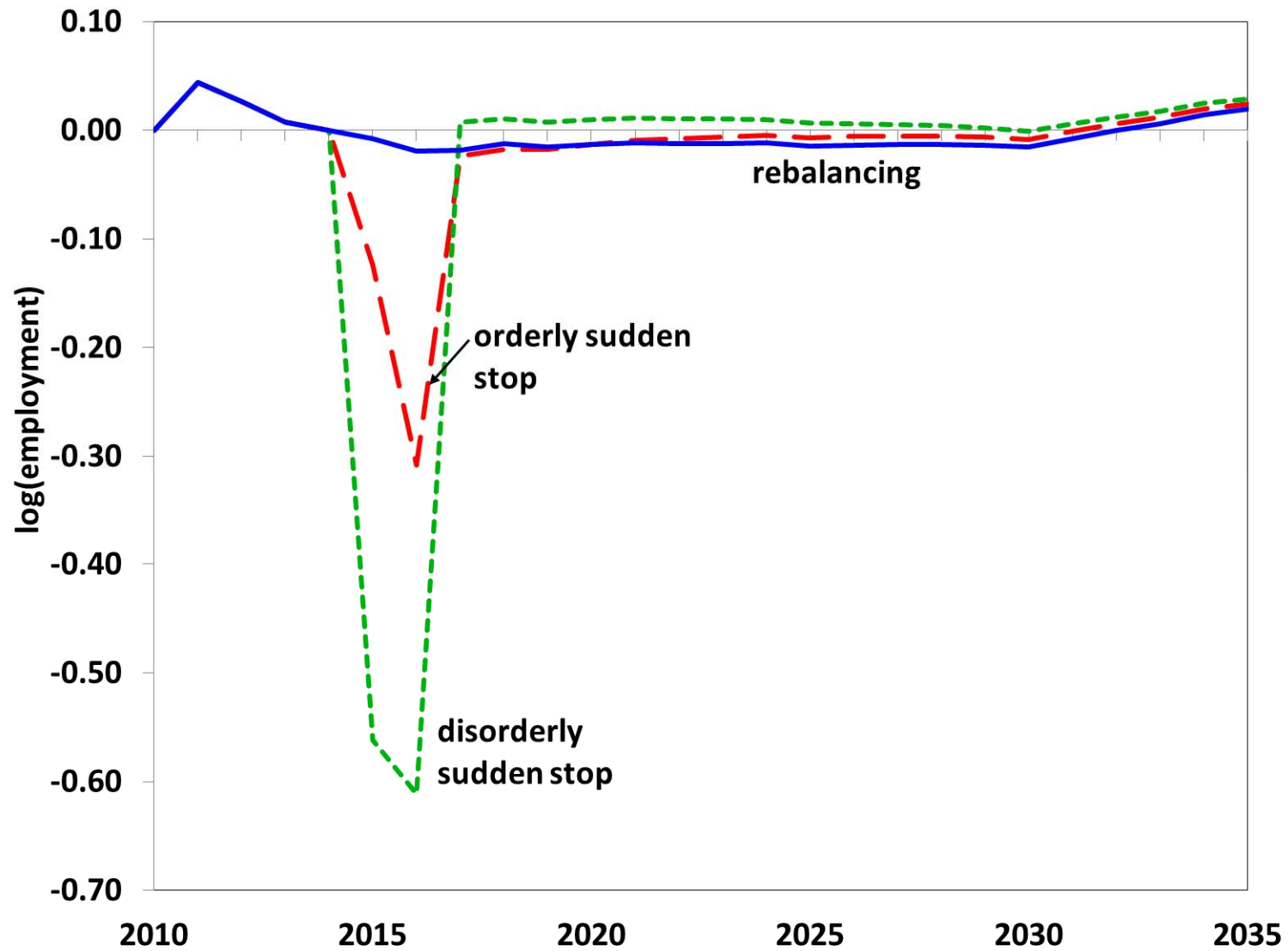




## Services employment projections, rebalancing vs. sudden stop

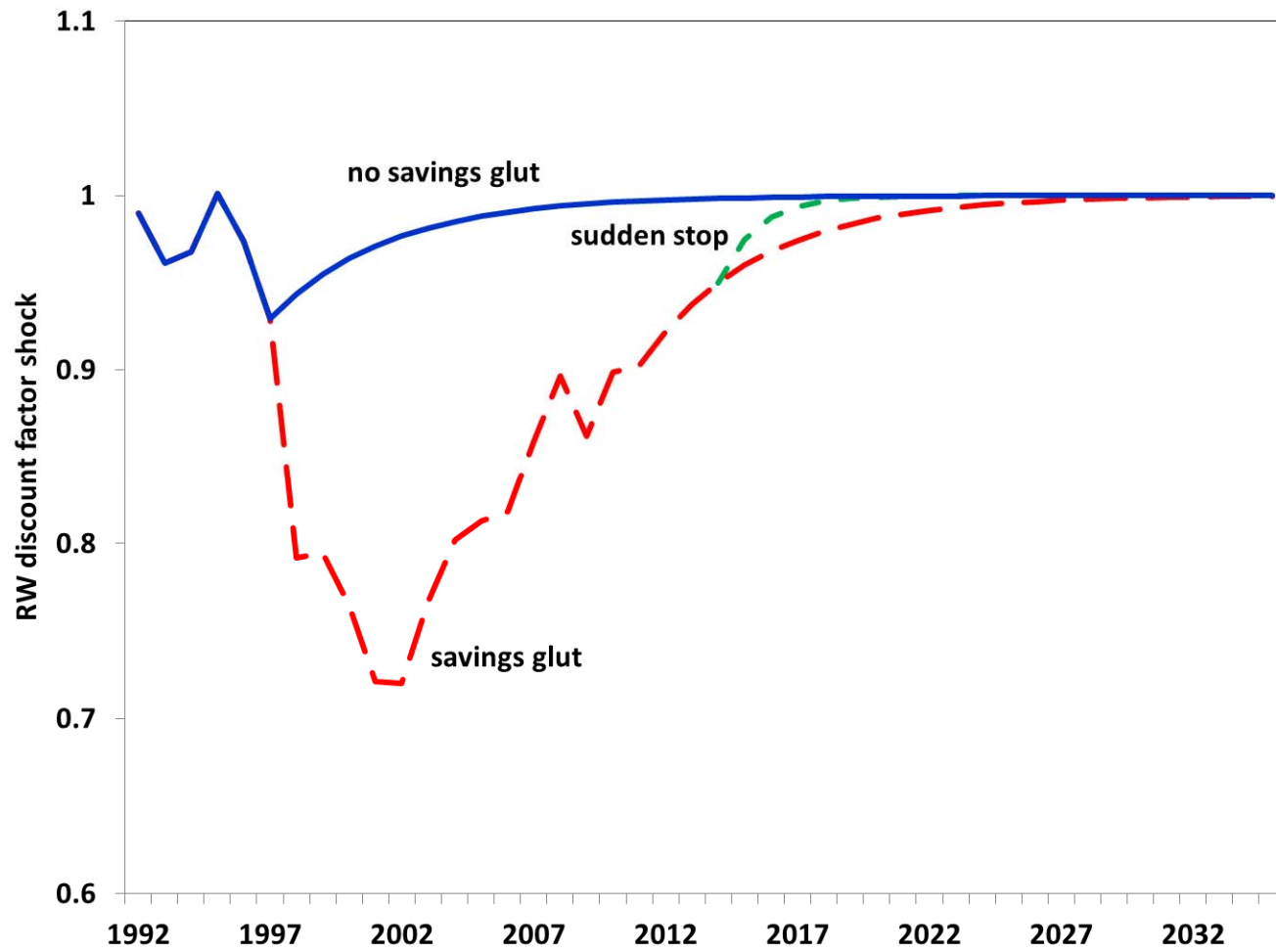


## Construction employment projections, rebalancing vs. sudden stop

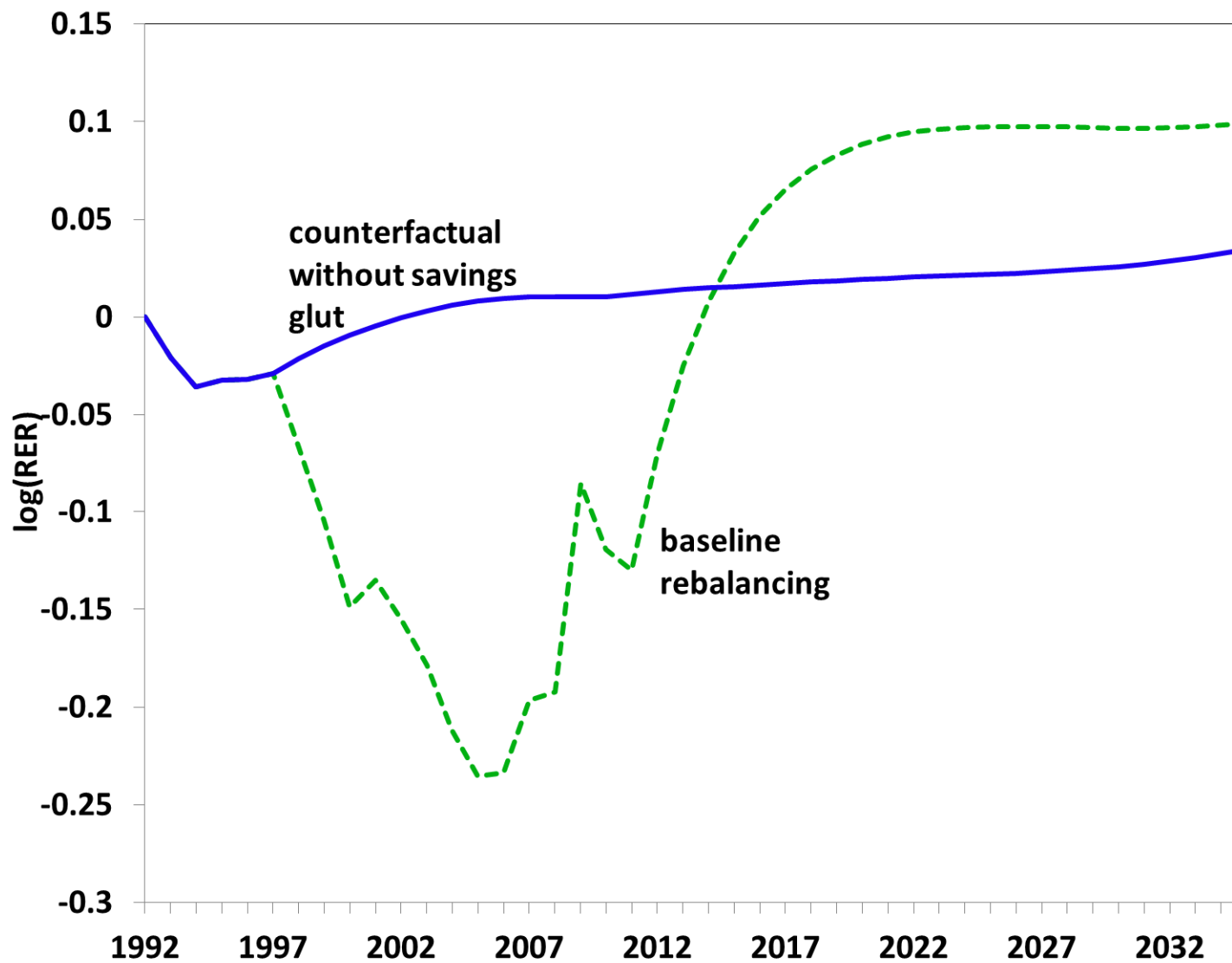


**Suppose that we calibrate RW discount factor shocks to match RER**

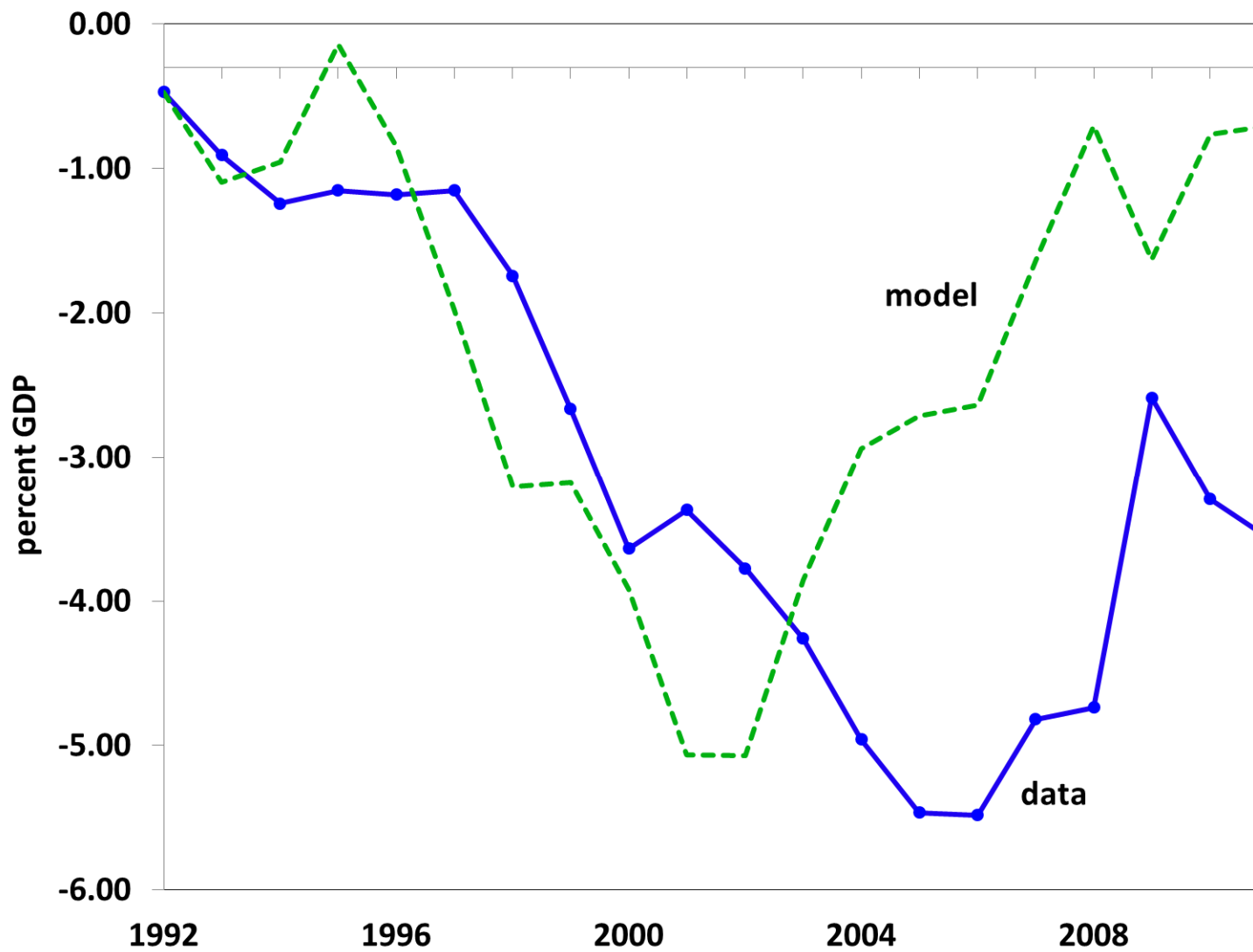
## RW discount factor shocks to match RER



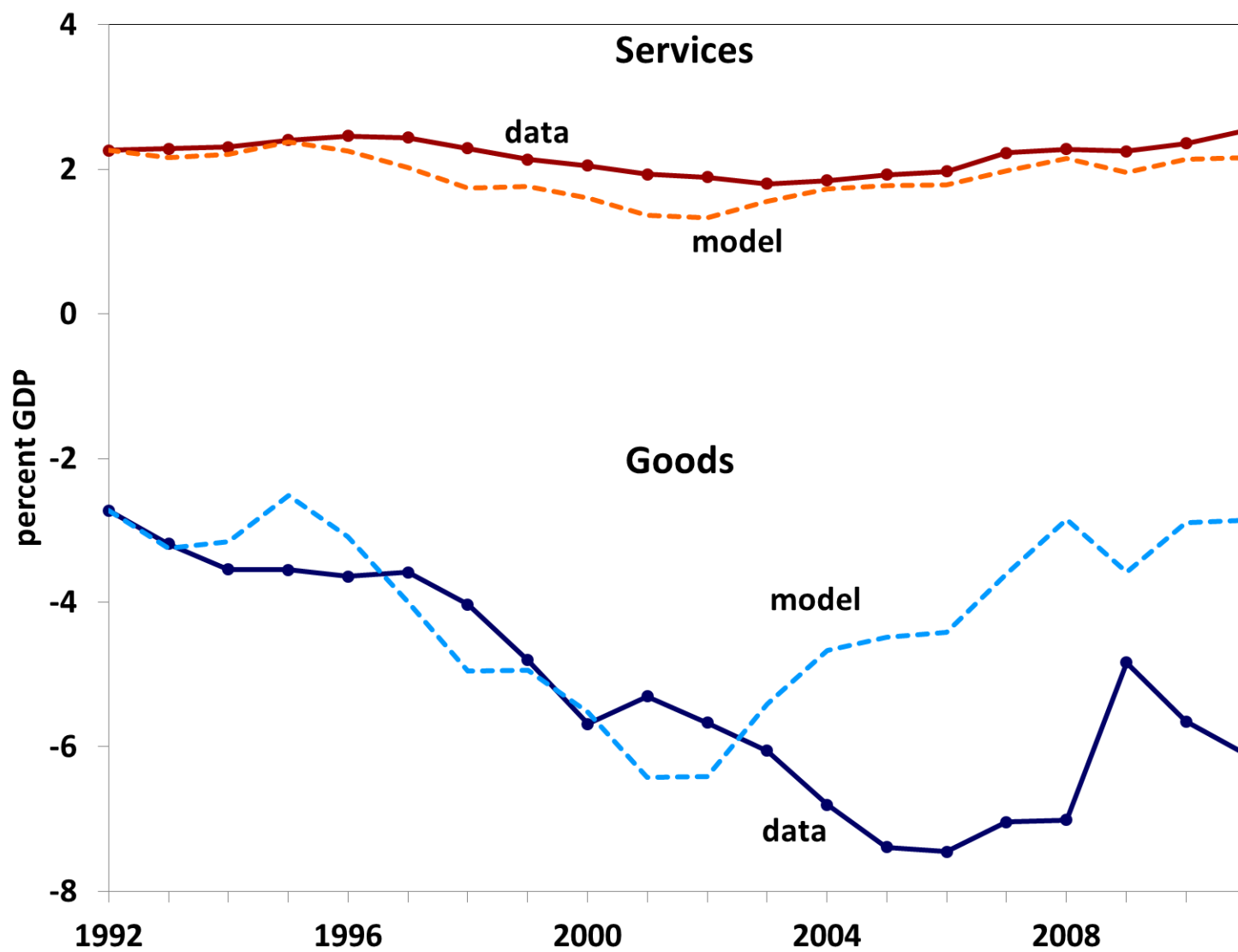
# Real exchange rate counterfactual



## Trade balance when targeting real exchange rate



## Disaggregated trade balances when targeting real exchange rate

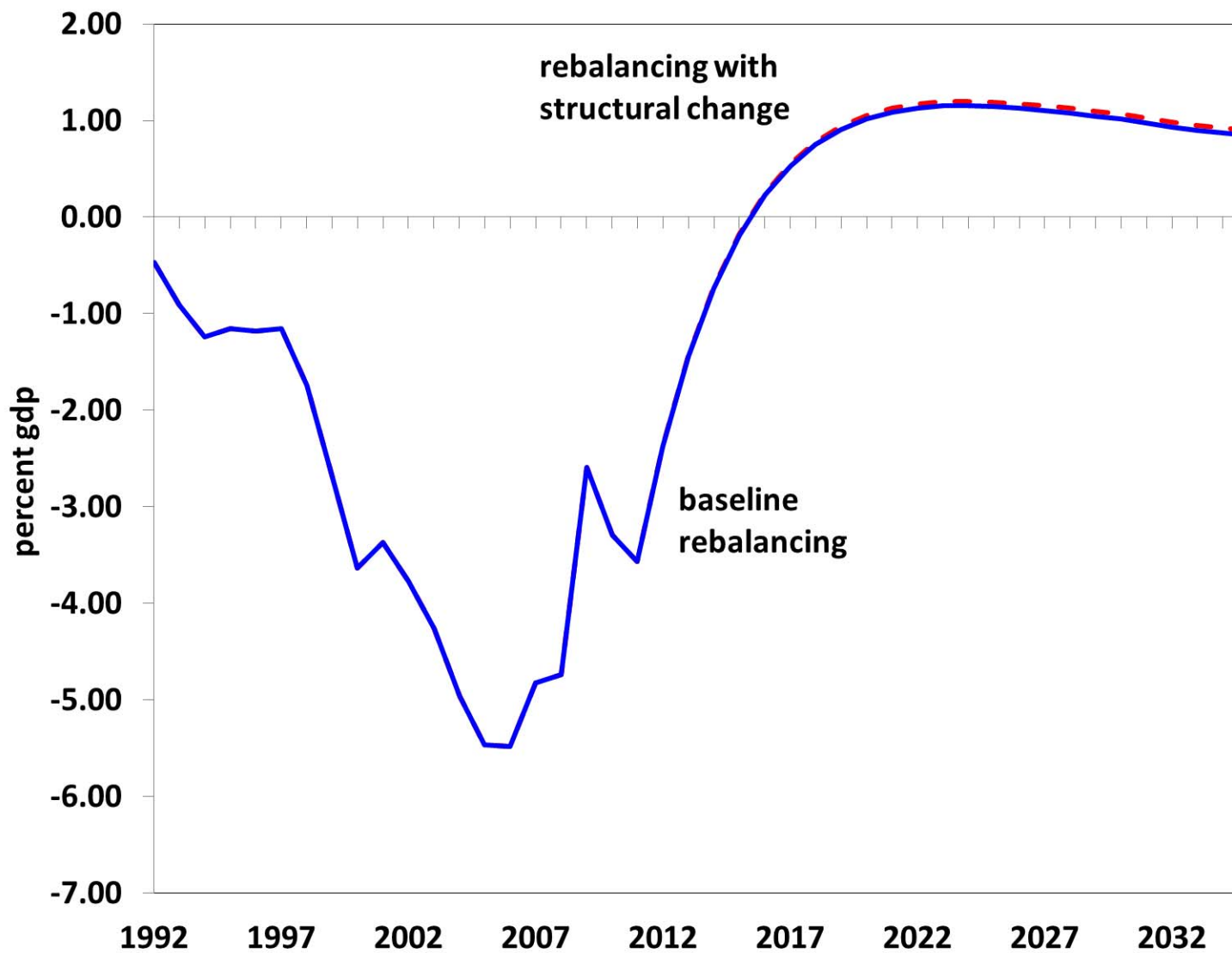


**Suppose that productivity growth in goods is much higher than in services and construction.**

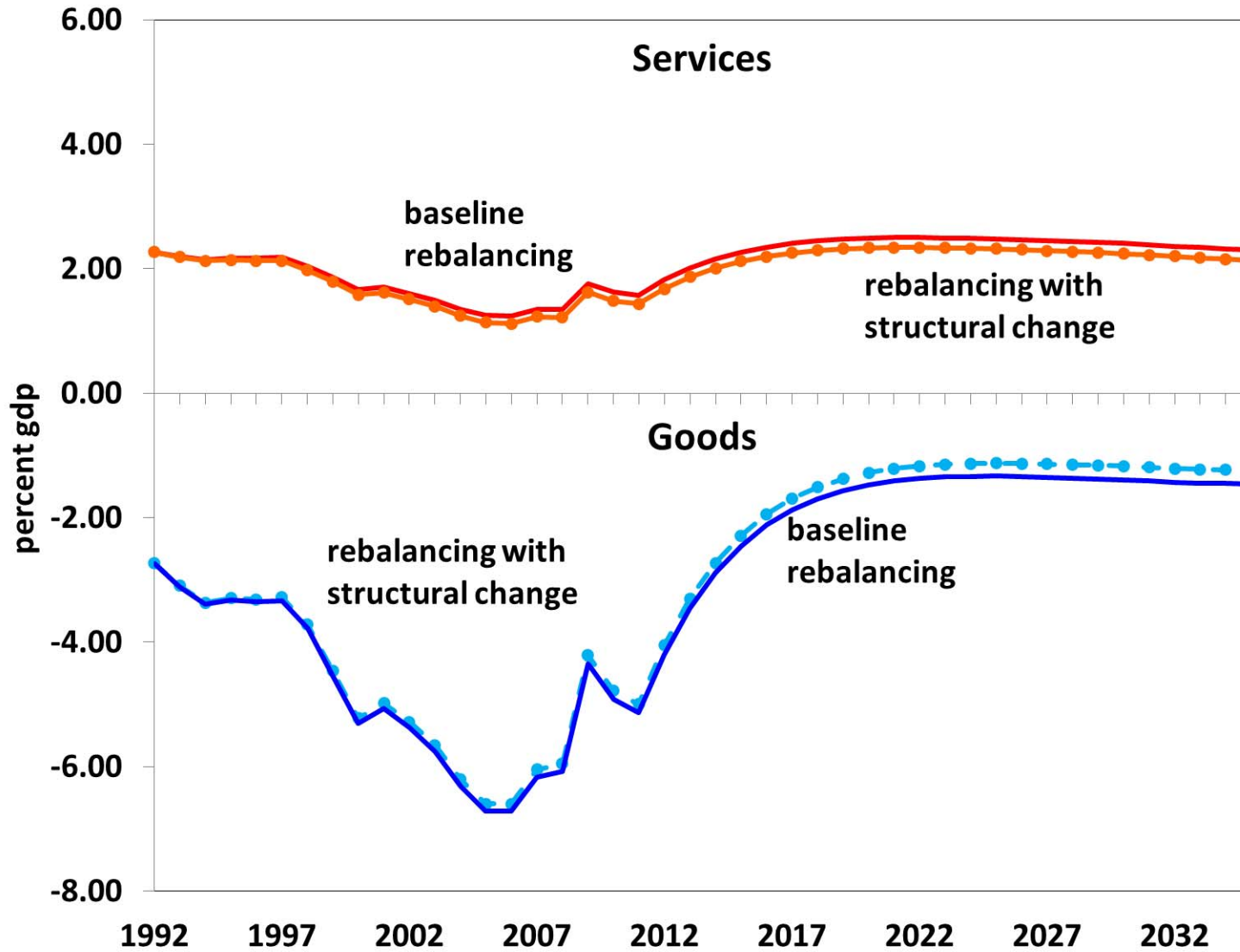
Labor reallocation into goods is sensitive to assumptions about structural change; other variables are not.



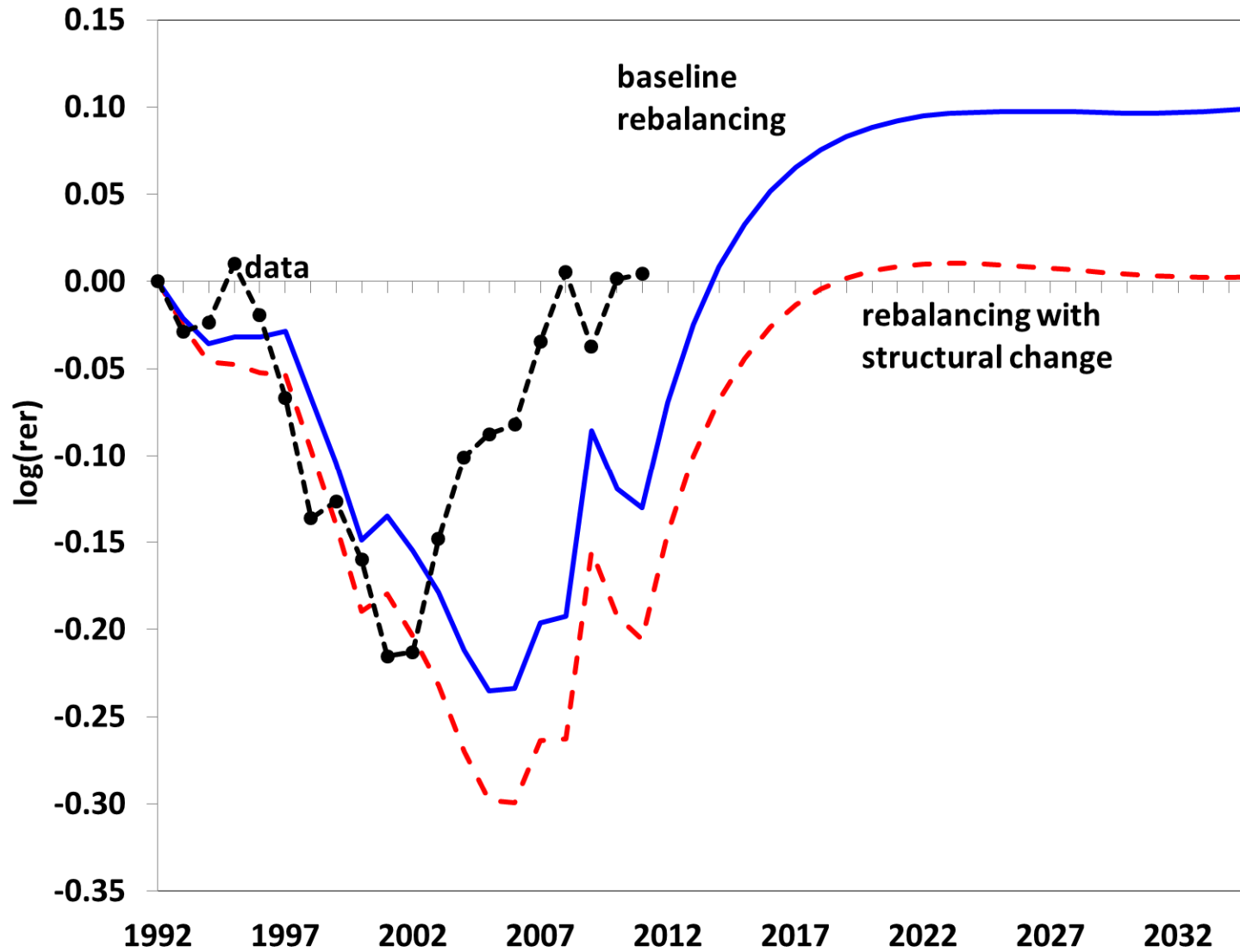
## Trade balance with structural change



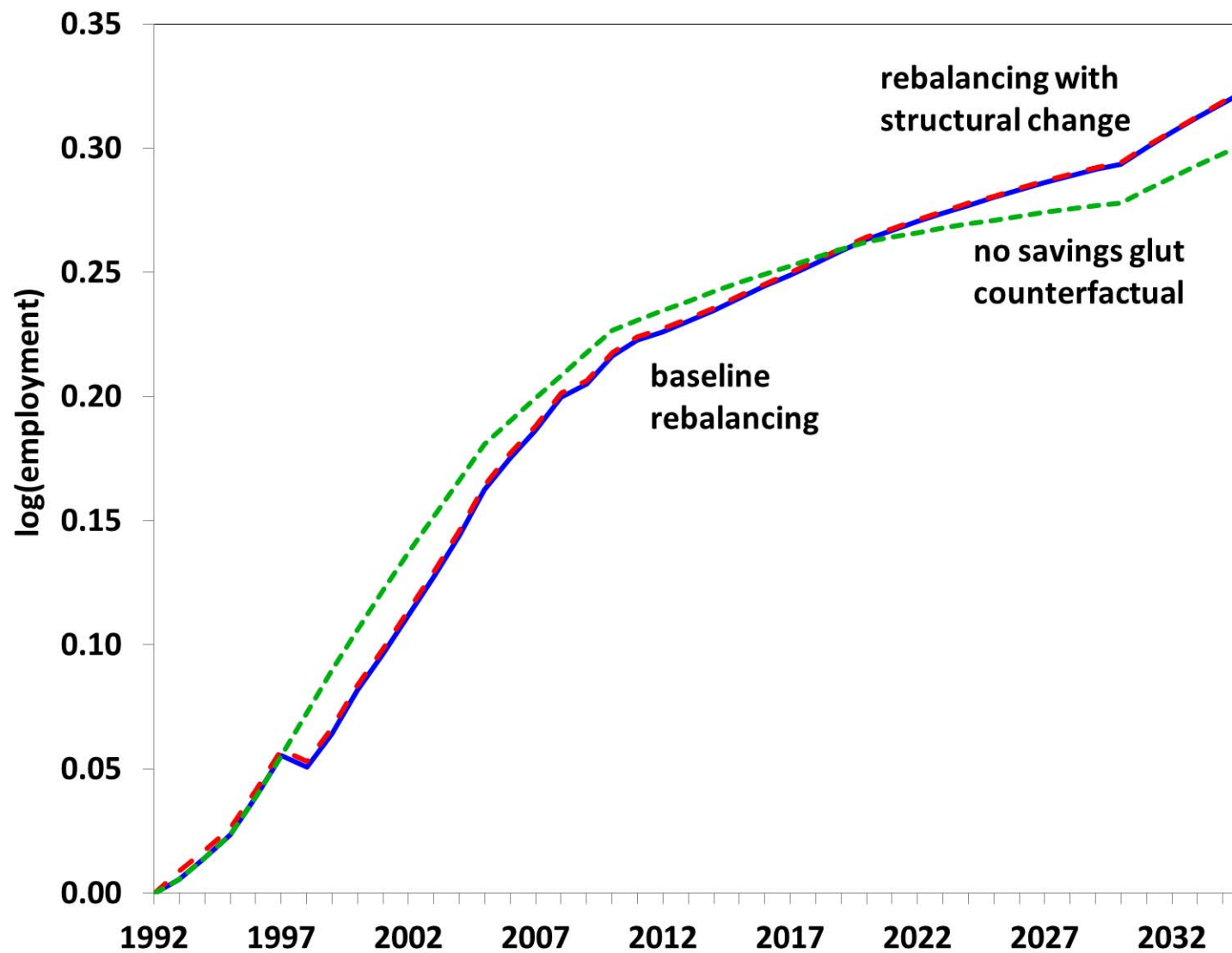
# Disaggregated trade balances with structural change



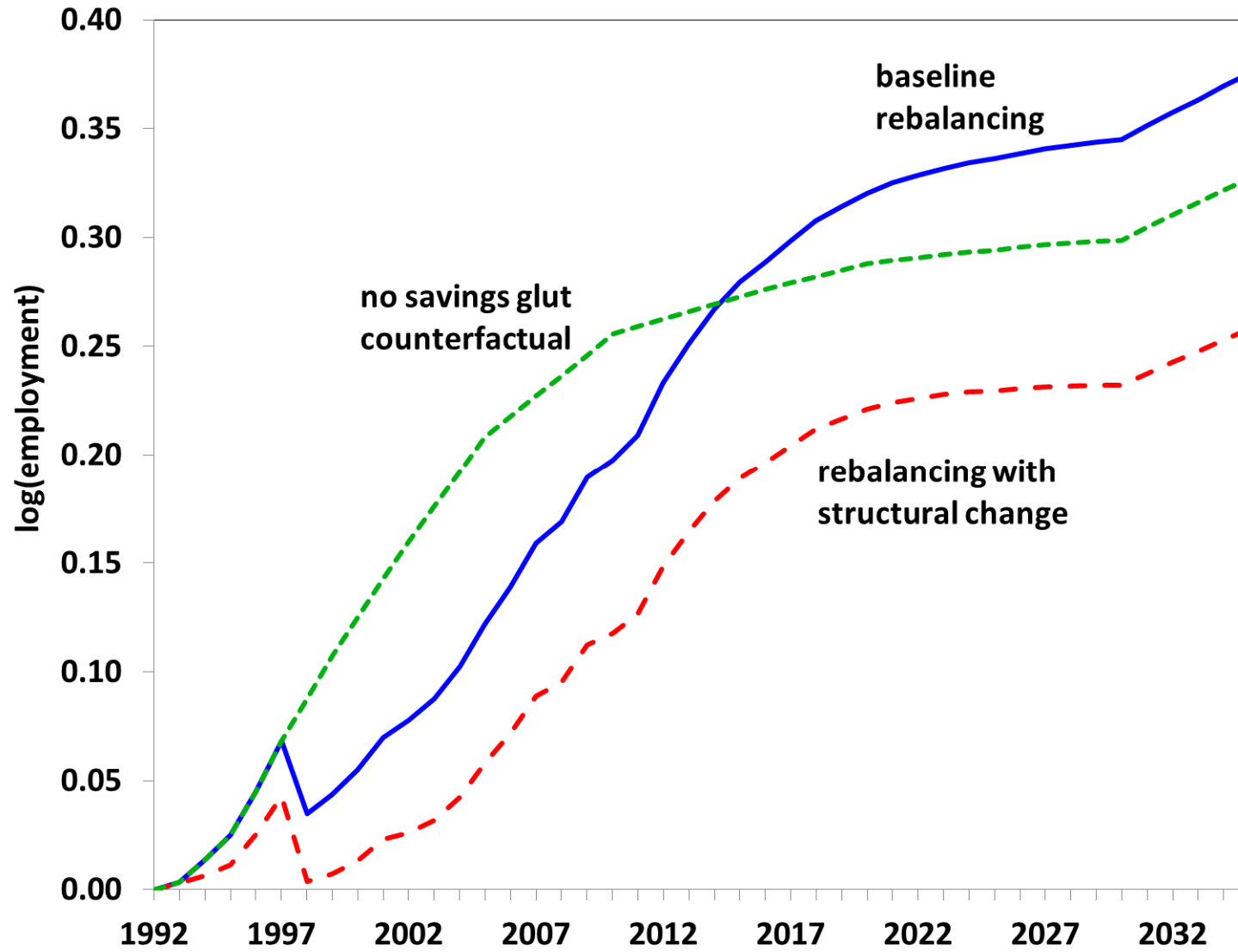
## Real exchange rate with structural change



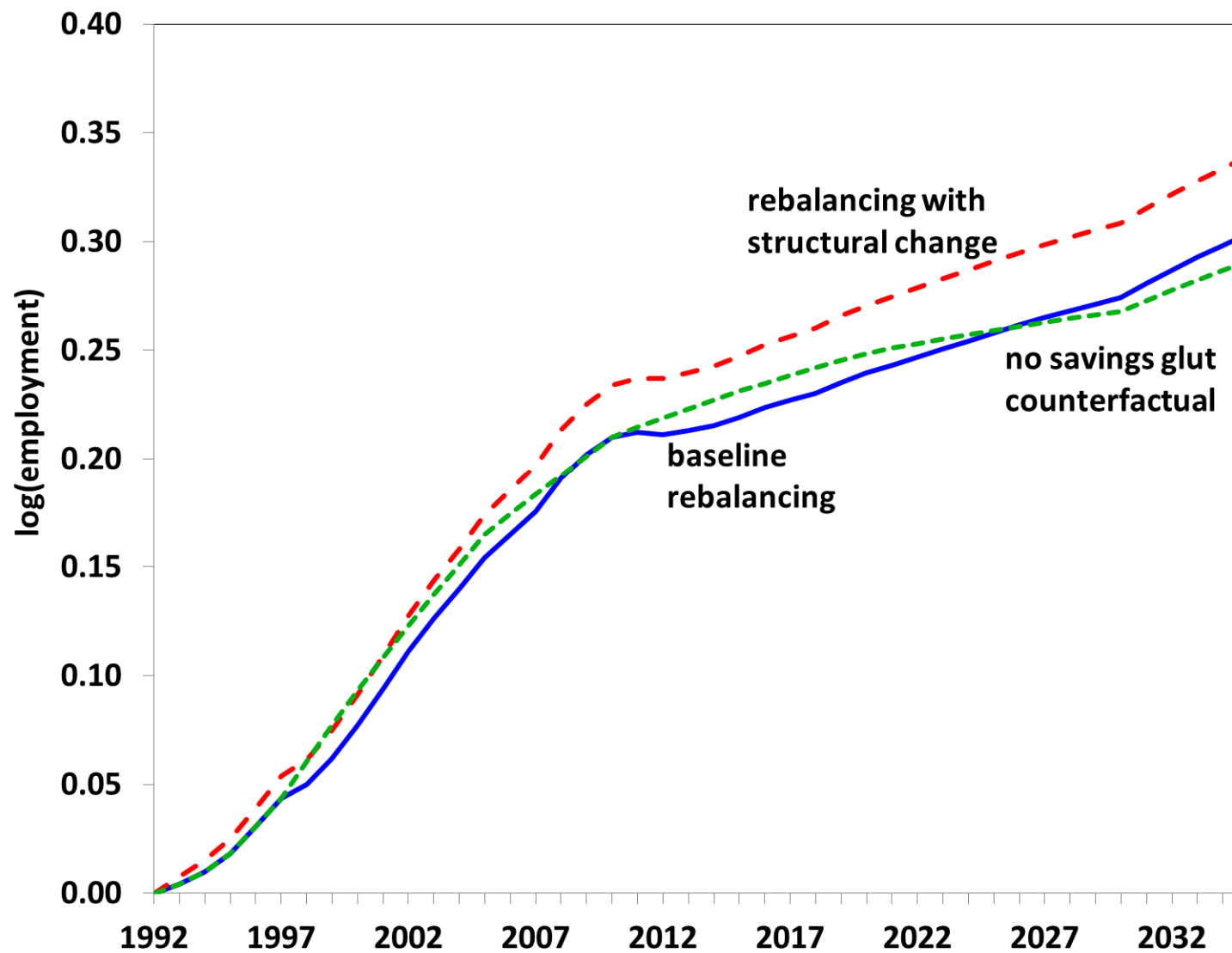
## Total employment with structural change



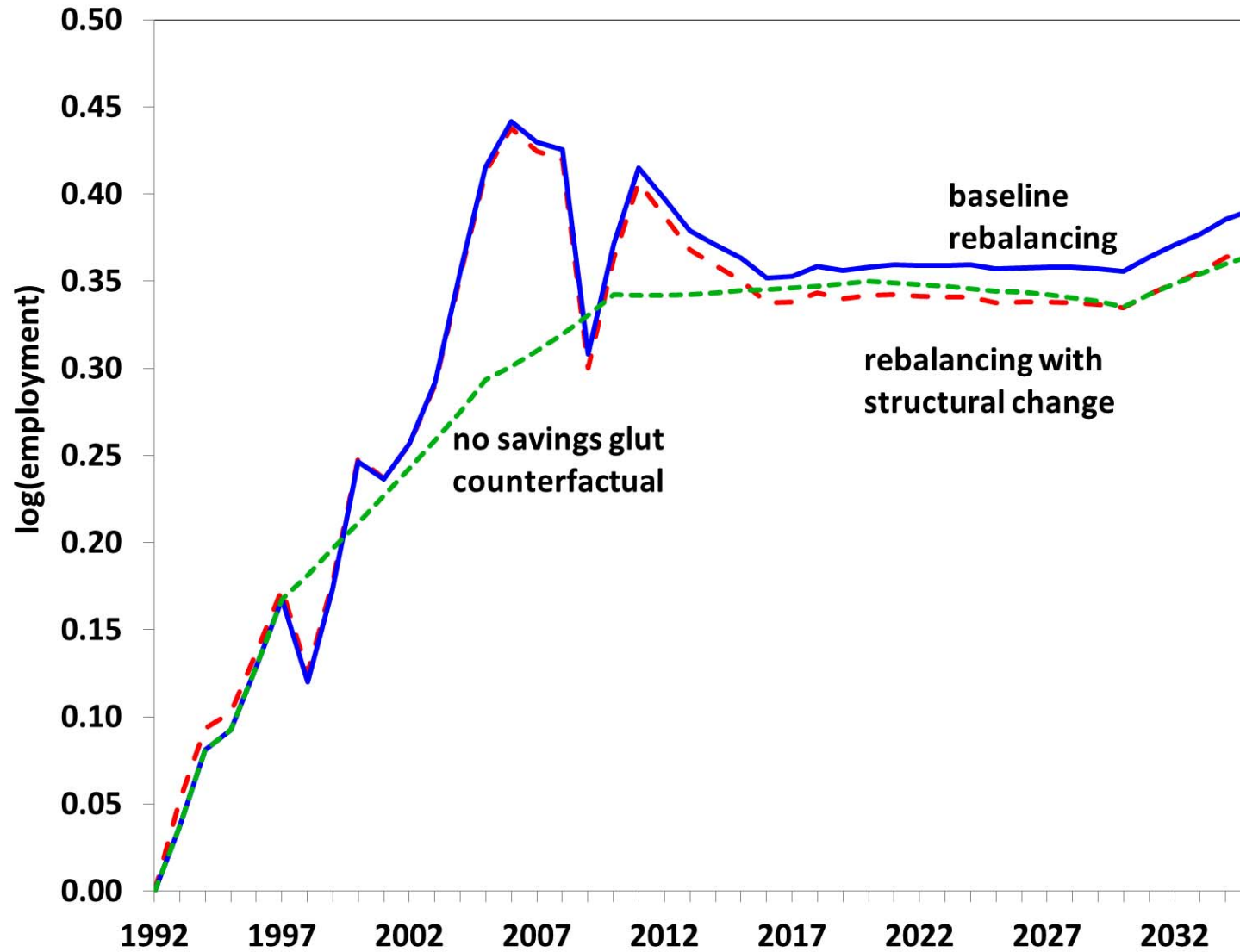
## Goods employment with structural change



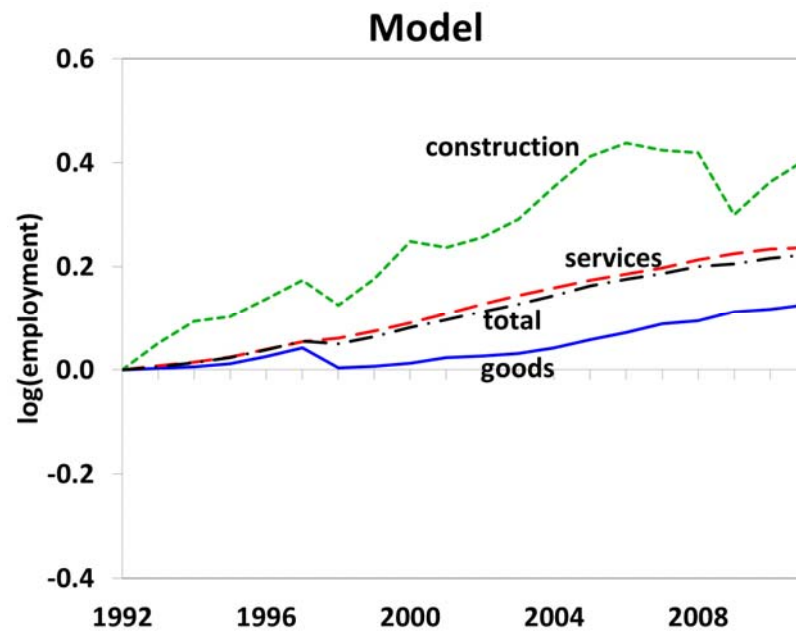
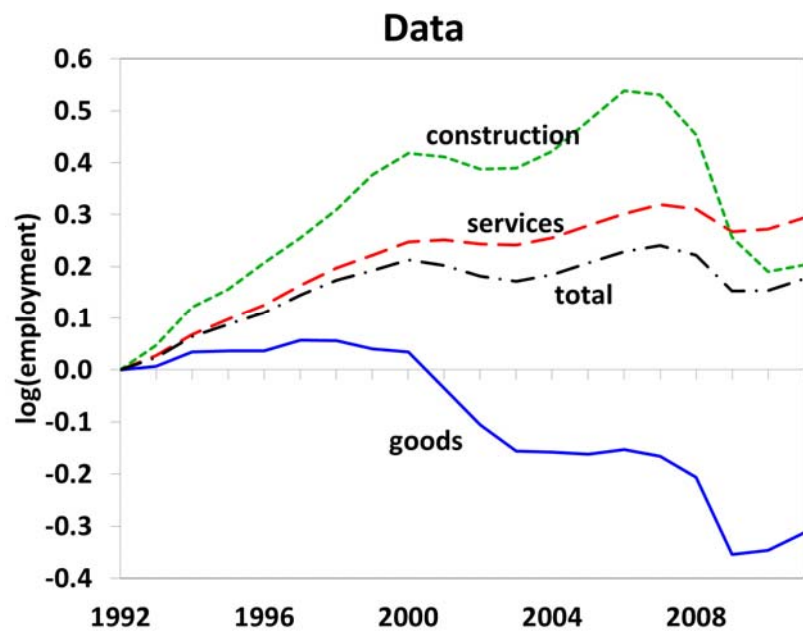
## Services employment with structural change



## Construction employment with structural change



## Sector-level employment growth





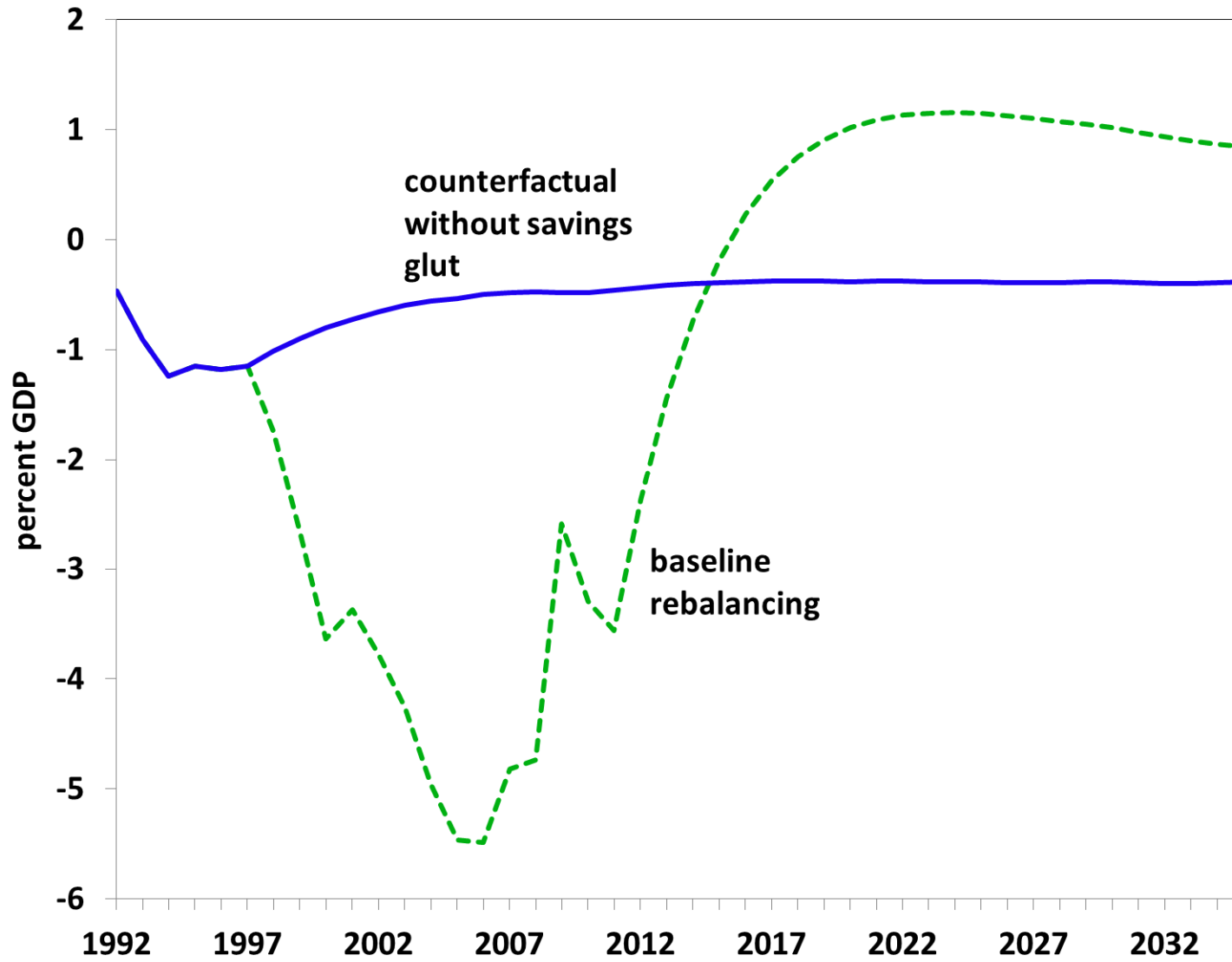
## **Summary and conclusion**

Savings glut explains key facts about U.S. economy since 1992.

Exit scenario has small long-run implications.

Savings glut has large long-run implications.

## Trade balance counterfactual: savings glut vs. no savings glut



## Two puzzles

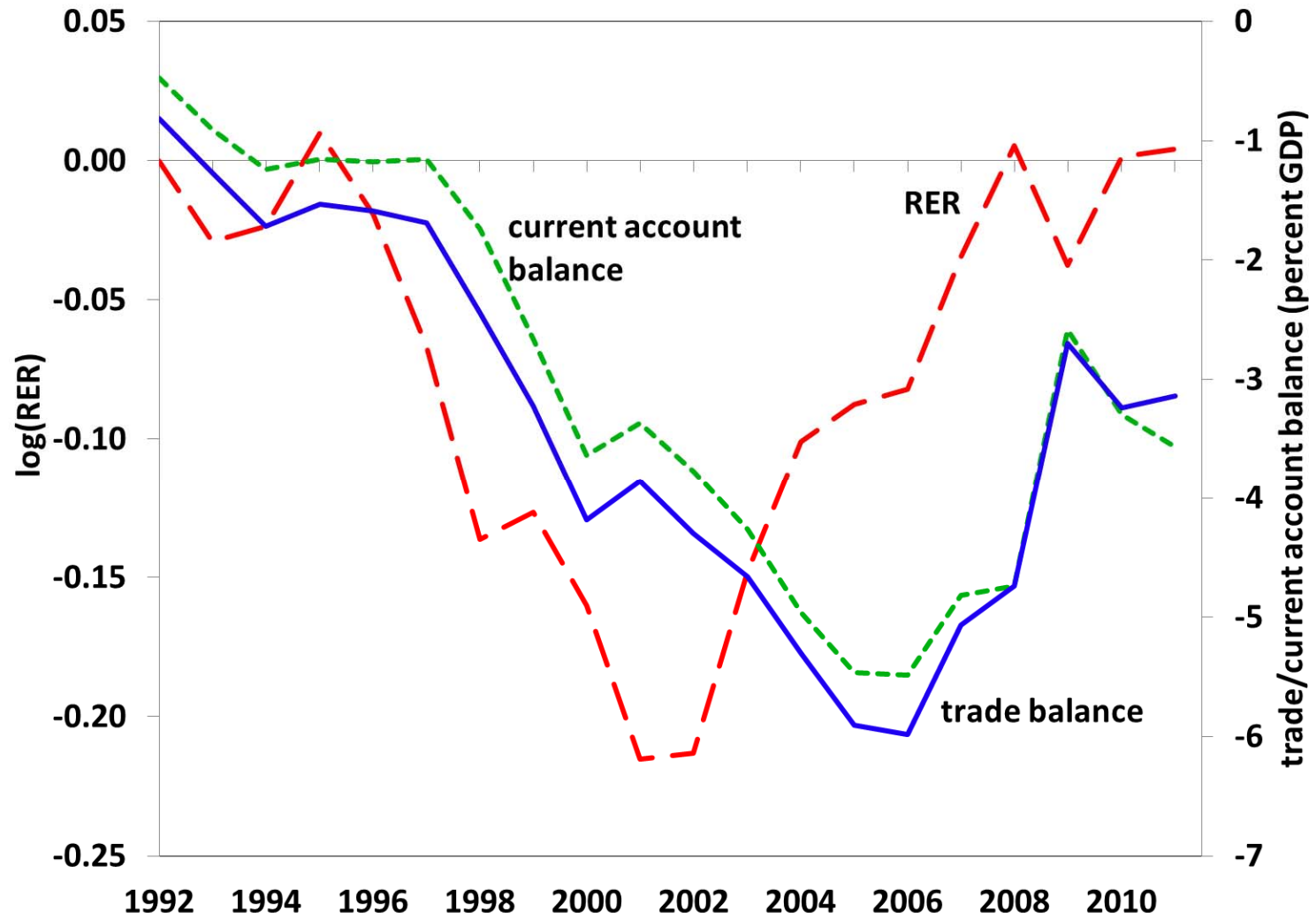
RER and trade balance:

In the data, the RER starts to depreciate in 2003 while the trade deficit starts to fall in 2007. In model they move together.

Interest rates and RER:

The model generates only a very small drop in the U.S. interest rate compared to that in the data. It does generate an appreciation in the RER comparable to that in the data.

# Real exchange rate, trade balance, and current account balance



# Real interest rates on US bonds

