Downward Wage Rigidity in a Liquidity Trap

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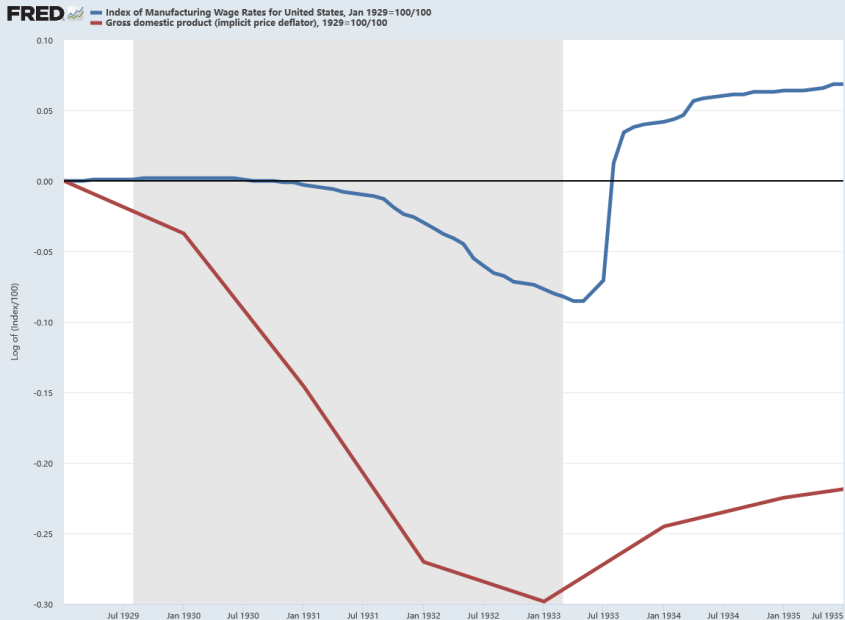American Economic Association 2022 Annual Meeting

Outline

Explore the relationship between downward wage rigidity and the severity of the recession.

Incorporate downward wage rigidity into a standard new Keynesian model and study its implications.

Find that downward wage rigidity exacerbates the severity of mild recessions but mitigates the severity of liquidity traps.
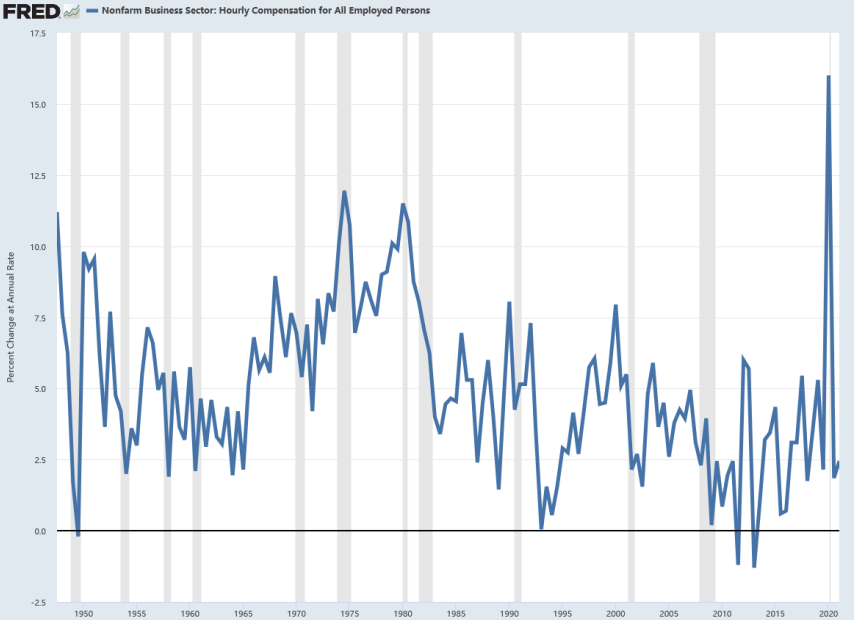
Empirical evidence on downward wage rigidity

Index of Manufacturing Wage Rates for United States, Jan 1929=100/100
Gross domestic product (implicit price deflator), 1929=100/100

Shaded areas indicate U.S. recessions.   Sources: NBER; BEA   fred.stlouisfed.org

Empirical evidence on downward wage rigidity

FRED — Nonfarm Business Sector: Hourly Compensation for All Employed Persons

Shaded areas indicate U.S. recessions. Source: U.S. Bureau of Labor Statistics fred.stlouisfed.org

Empirical evidence on downward wage rigidity

A brief summary:

- During the Great Depression, nominal wages barely changed initially and then fell much less than the price level.

- During the post war period, the growth rate of nominal wages has been almost always greater than zero in each recession.

Motivation

Rises in real wages due to downward wage rigidity affect the economy through two channels:

1. Lower labor demand:

   ▶ Exacerbate the decline in output and employment

   ▶ Example: Hoover's "wage-fixing" policies at the onset of the Great Depression were believed to be contractionary (Eichengreen and Sachs, 1985; Bernanke, 1995; Bernanke and Carey, 1996; Cole and Ohanian, 2001; Ohanian, 2009; Rose, 2010)

2. Raise firms' marginal costs and consumers' purchasing power:

   ▶ Raise inflation expectations

The effects of the second channel on the economy haven't been studied.

Model: strategy

Follow Schmitt-Grohé and Uribe (2017) and Shen and Yang (2018) in modeling downward wage rigidity

Incorporate downward wage rigidity into a standard new Keynesian model:

- ▶ The same IS curve
- ▶ The modified Phillips curve
- ▶ A law of motion for real wages
- ▶ The same monetary policy reaction function

Consider two types of recessions:

- ▶ A mild recession: the monetary authority can stabilize the economy
- ▶ A liquidity trap: the monetary authority is constrained by the zero lower bound on the nominal interest rate

All else equal, compare the severity of the recession with and without downward wage rigidity

Model: a standard new Keynesian model by Galí (2015)

$$y_t = E_t y_{t+1} - \frac{1}{\sigma} \left(i_t - E_t \pi_{t+1} - r_t^n \right)$$

$$\pi_t = \beta E_t \pi_{t+1} + \kappa y_t$$

$$i_t = \max \left(0, \rho + \phi_\pi \pi_t + \phi_y y_t \right)$$

where i_t denotes the nominal interest rate, r_t^n the natural rate of interest, y_t output, π_t inflation. σ, β, κ, ρ, ϕ_π, and ϕ_y are structural parameters. The last equation is the monetary policy function. It ensures that the nominal interest rate cannot fall below the zero lower bound. In this model, nominal wages are fully flexible and the labor market is cleared by equating labor demand and supply.
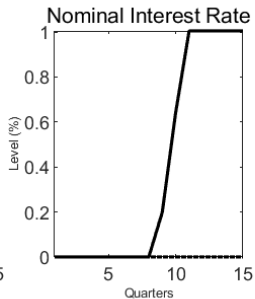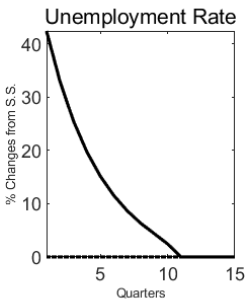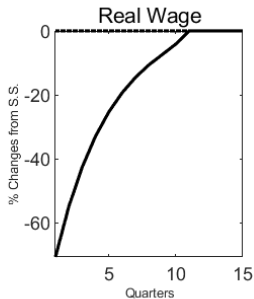
Model: a mild recession
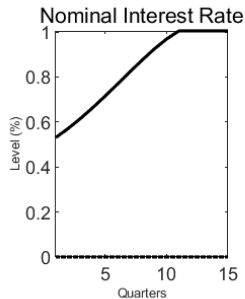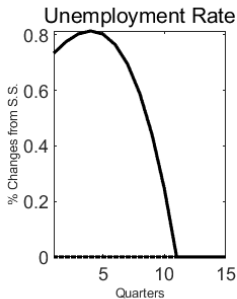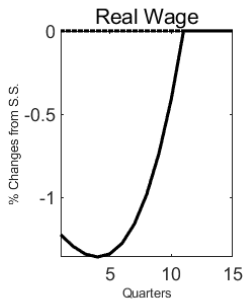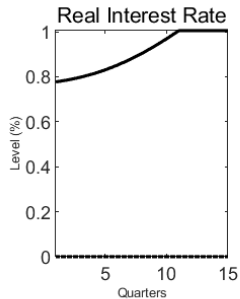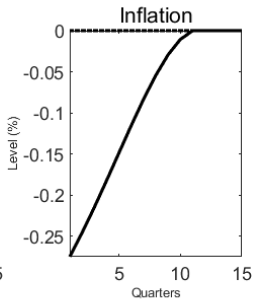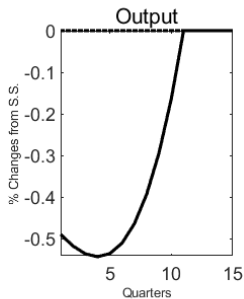
Model: a mild recession

A brief summary:

- Assume that in period 0, the natural rate of interest (r_t^n) falls by 0.2%, and its impact lasts for 10 quarters.

- Output, inflation, and real wages fall. The unemployment rate rises.

- The monetary authority follows a Taylor rule, and so it lowers the nominal interest rate more than one-for-one in response to deflation.

- The policy's stabilizing effects are reflected in falls in the real interest rate, which alleviate falls in output, inflation, and real wages to some extent.
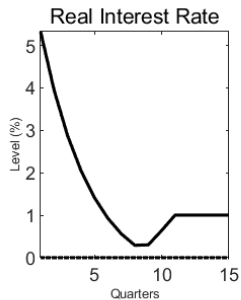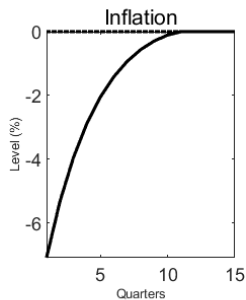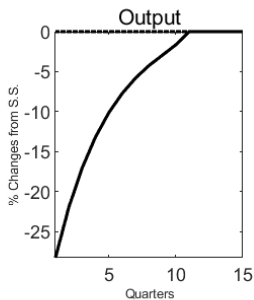
Model: a liquidity trap

Model: a liquidity trap

A brief summary:

▶ Assume that in period 0, the natural rate of interest (r_t^n) falls by 2%, and its impact lasts for 10 quarters.

▶ Output, inflation, and real wages collapse. The unemployment rate rises substantially.

▶ The nominal interest rate hits its zero lower bound immediately and remains there for many quarters.

▶ Without policy's stabilizing responses, the real interest rate rises, which further aggravates falls in output, inflation, and real wages.

Model: downward wage rigidity

Downward wage rigidity is modeled as:

$$W_t \geqslant \gamma(u_t) W_{t-1}$$

where W_t denotes nominal wages, u_t the unemployment rate, and $\gamma(u_t) = \gamma_0 (1 - u_t)^{\gamma_1}$ with $\gamma_0 \geq 0$ and $\gamma_1 \geq 0$. γ_1 governs the degree of downward wage rigidity. When $\gamma_1 = 0$, nominal wages are fixed and cannot go downward at all. When $\gamma_1 = \infty$, nominal wages are fully flexible. Whenever the economy falls into a recession, this constraint becomes binding and the labor market is cleared by equating this binding constraint and labor demand. Labor supply drops out of the dynamic system.

Model: downward wage rigidity

In steady state, $u_t = 0$ and there is a lower bound on the growth rate of nominal wages:
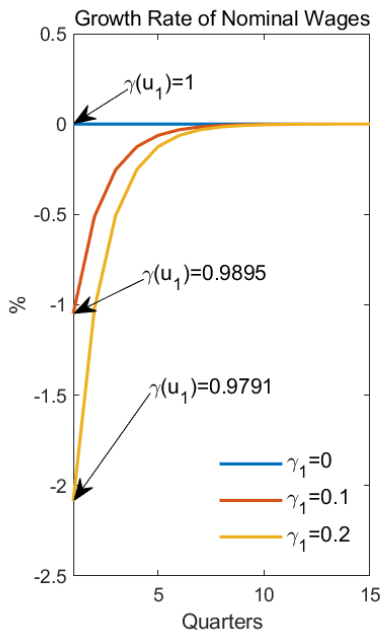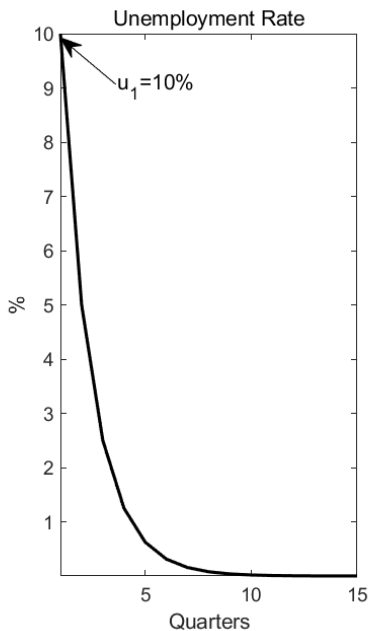
$$\frac{W_t - W_{t-1}}{W_{t-1}} > \gamma_0 - 1$$

without loss of generality, set $\gamma_0 = 1$.

Assume:
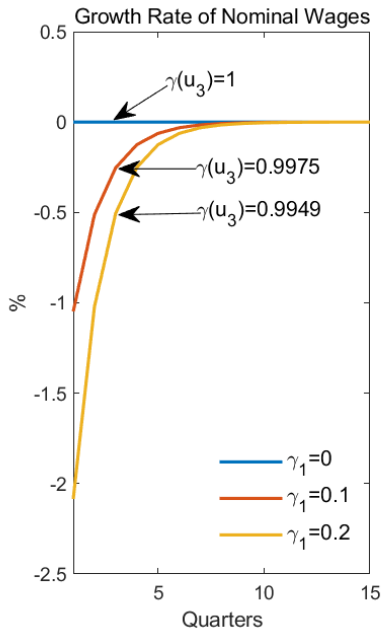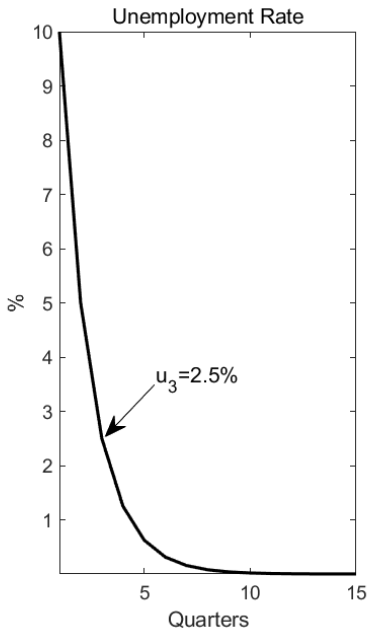
$$u_t = \rho_u u_{t-1} + \varepsilon_t^u$$

where $|\rho_u| < 1$ and $\varepsilon_t^u \sim i.i.d. \left(0, \sigma^2\right)$. Set $\rho_u = 0.5$ and $\sigma^2 = 0.1$.

Model: downward wage rigidity

Model: downward wage rigidity

Model: downward wage rigidity

A brief summary:

- ▶ Assume that the economy falls into a recession, the unemployment rate rises and the constraint $W_t \geqslant \gamma(u_t)W_{t-1}$ becomes binding, which implies:

$$\frac{W_t - W_{t-1}}{W_{t-1}} = (1 - u_t)^{\gamma_1} - 1$$

- ▶ According to this equation, the numerical results are:

u_t	γ_1	$\gamma(u_t) = (1 - u_t)^{\gamma_1}$		W_t
	0	1		no changes
10%	0.1	0.9895	$\Downarrow$	fall by more than 1%
	0.2	0.9791		fall by more than 2%
	0	1		no changes
2.5%	0.1	0.9975>0.9895	$\Downarrow$	fall by more than 0.2%
	0.2	0.9949>0.9791		fall by more than 0.5%

Model: downward wage rigidity

Discuss the relationship between the degree of downward wage rigidity ($\gamma(u_t)$), the unemployment rate (u_t), and γ_1:

- ▶ Given the unemployment rate, γ_1 is inversely related to the degree of downward wage rigidity. The larger the value of γ_1, the lower the degree of downward wage rigidity.

- ▶ Given γ_1, the unemployment rate is inversely related to the degree of downward wage rigidity. The higher the unemployment rate, the lower the degree of downward wage rigidity.

- ▶ In the general equilibrium model considered below,
    - ▶ Benchmark scenario: $\gamma_1 = 0$
    - ▶ Sensitivity analysis: $\gamma_1 = 0.1$ and $\gamma_1 = 0.2$

Model: a revised new Keynesian model

$$y_t = E_t y_{t+1} - \frac{1}{\sigma} \left(i_t - E_t \pi_{t+1} - r_t^n \right)$$
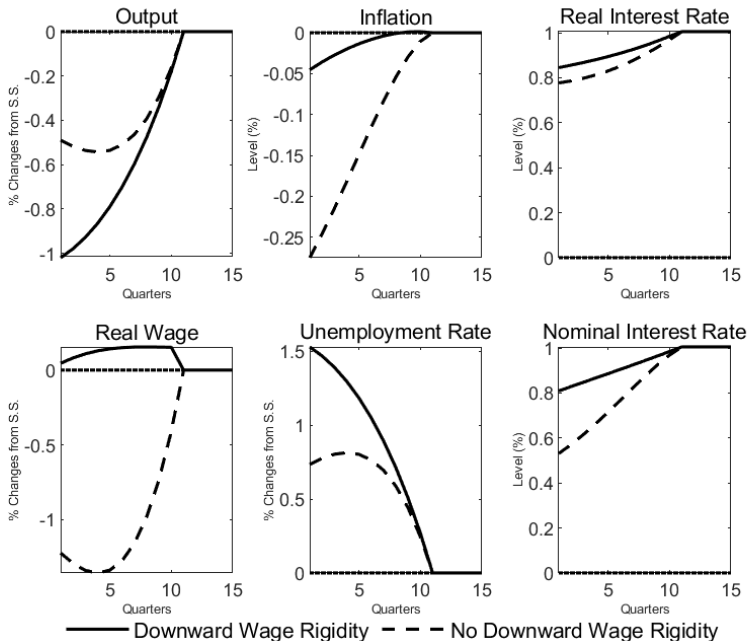
$$\pi_t = \beta_1 E_t \pi_{t+1} + \kappa_1 y_t + \frac{\lambda}{1+\lambda} \omega_{t-1}$$

$$\omega_t = \frac{\gamma_1}{1-\alpha} y_t + \omega_{t-1} - \pi_t$$

$$i_t = \max \left(0, \rho + \phi_\pi \pi_t + \phi_y y_t \right)$$

where $\beta_1 = \frac{\beta}{1+\lambda}$ and $\kappa_1 = \frac{\lambda(\gamma_1+\alpha)}{(1+\lambda)(1-\alpha)}$. γ_0 is dropped during log-linearization.

Results: a mild recession

Output — % Changes from S.S. (Quarters); Inflation — Level (%) (Quarters); Real Interest Rate — Level (%) (Quarters); Real Wage — % Changes from S.S. (Quarters); Unemployment Rate — % Changes from S.S. (Quarters); Nominal Interest Rate — Level (%) (Quarters)
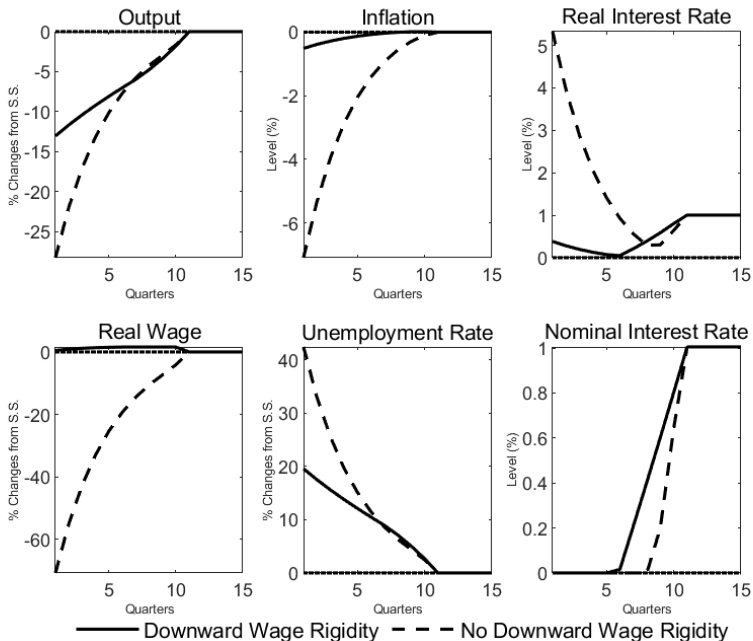
—— Downward Wage Rigidity — — — No Downward Wage Rigidity

Results: a mild recession

A brief summary:

▶ Assume that in period 0, the natural rate of interest (r_t^n) falls by 0.2%, and its impact lasts for 10 quarters.

▶ Downward wage rigidity raises real wages, which:

  ▶ Lowers labor demand, exacerbating the decline in output and employment - a contractionary effect

  ▶ Raises inflation expectations, weakening monetary policy's response - a contractionary effect

▶ Compared with the economy without downward wage rigidity, the recession worsens.
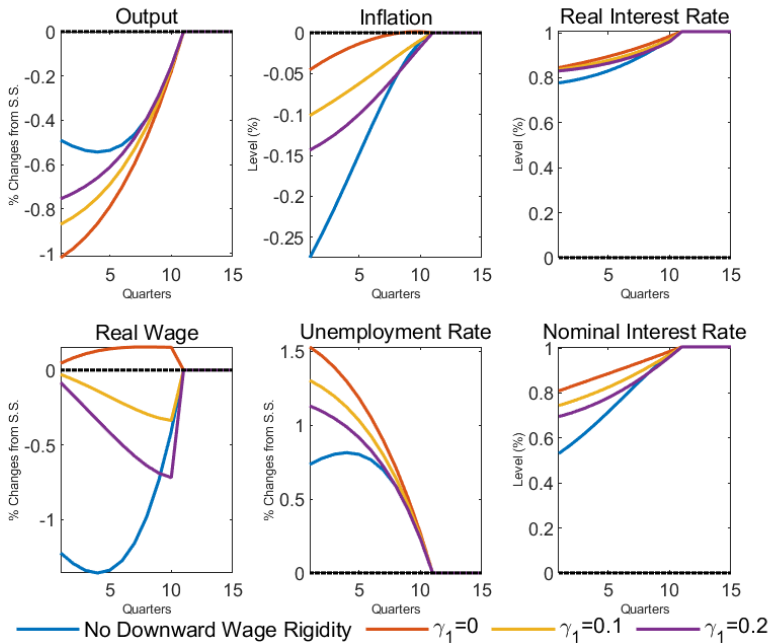
Results: a liquidity trap

Results: a liquidity trap

A brief summary:

- Assume that in period 0, the natural rate of interest (r_t^n) falls by 2%, and its impact lasts for 10 quarters.

- Downward wage rigidity raises real wages, which:
  - Lowers labor demand, exacerbating the decline in output and employment - a contractionary effect
  - Raises inflation expectations, lowering the real interest rate at the zero lower bound - an expansionary effect

- Compared with the economy without downward wage rigidity, the second effect more than offsets the first so that the liquidity trap improves.
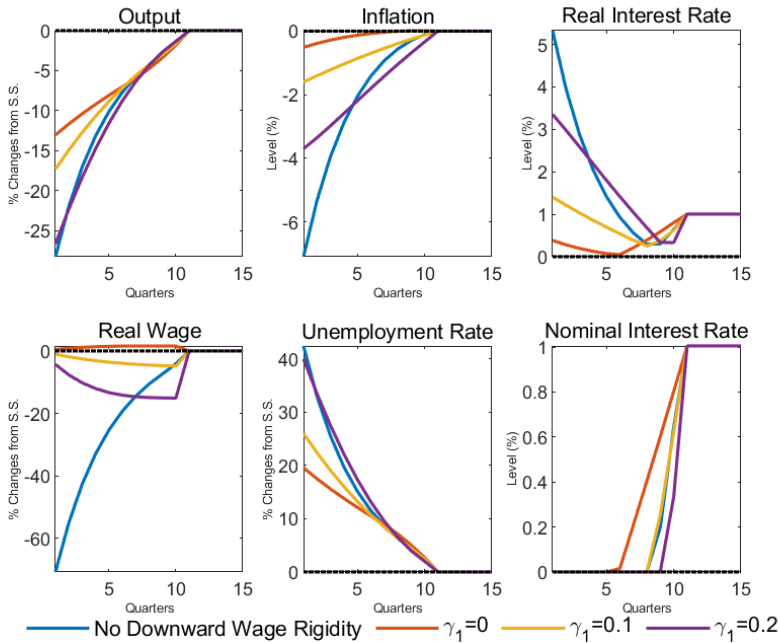
Robustness tests: a mild recession

Robustness tests: a mild recession

A brief summary:

- ▶ Assume that in period 0, the natural rate of interest (r_t^n) falls by 0.2%, and its impact lasts for 10 quarters.

- ▶ The larger the value of γ_1, the lower the degree of downward wage rigidity, and the less the worsening of the recession.

- ▶ The benchmark result is robust.

Robustness tests: a liquidity trap

Robustness tests: a liquidity trap

A brief summary:

- Assume that in period 0, the natural rate of interest (r_t^n) falls by 2%, and its impact lasts for 10 quarters.

- The larger the value of γ_1, the lower the degree of downward wage rigidity, and the less the improvement of the liquidity trap.

- The benchmark result is robust.

Main contributions

Summarizing:

- ▶ Reveal that the rise in real wages caused by downward wage rigidity can affect the severity of recession through two different channels.

- ▶ Incorporate downward wage rigidity into a standard new Keynesian model. Examine the effects of these two channels on the economy in a mild recession and a liquidity trap, respectively.

Main contributions

Summarizing:

- ▶ In a mild recession, the monetary authority can stabilize the economy by adjusting nominal interest rates. In this case, the effects of both channels are contractionary. Downward wage rigidity exacerbates the severity of the recession.

- ▶ In a liquidity trap, the nominal interest rate is at its zero lower bound and thus cannot be lowered further to stabilize the economy. In this case, the two channels have opposite effects on the economy and their net effect is expansionary. Downward wage rigidity mitigates the severity of the recession.

Main contributions

Summarizing:

- ▶ It is a paradox: downward wage rigidity worsens recessions – unless the recession is bad enough to push the economy into a liquidity trap.