

Understanding the Gains from Wage Flexibility in a Currency Union: The Fiscal Policy Connection

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1 Introduction

Gali and Monacelli (2016, *AER*, GM) find that:

1. The effectiveness of labor cost adjustments on employment is much smaller in a currency union.
2. An increase in wage flexibility often reduces welfare more likely so in an economy that is part of a currency union.

1 Introduction

Gali and Monacelli (2016, *AER*, GM) find that:

1. The effectiveness of labor cost adjustments on employment is much smaller in a currency union.
 2. An increase in wage flexibility often reduces welfare more likely so in an economy that is part of a currency union.
- I support GM's first finding even if the government budget constraint with endogenous fiscal policy is introduced into their baseline model.
 - I cannot necessarily support their second finding in that model.

- An increase in wage flexibility increases welfare in an economy that is a part of currency union as long as wage rigidity is enough high.
- There is enough room to discuss on how wage flexibility is beneficial in an economy that is a part of a currency union.

Considering Interaction between Monetary and Fiscal Policies

- Previous works (Gali, 2013, *JEEA*; Eggertsson, Ferrero and Raffo, 2014, *JME*; Bhattarai, Eggertsson and Schoenle, 2018, *JME*; Billi and Gali, 2020, *Oxford Bulletin of Economics and Statistics*) imply that wage flexibility does not necessarily contribute to improve welfare and reducing wage rigidity is harmful.
- However, those previous works do not consider interaction between monetary and fiscal policies.
- As Leeper and Leith (2016, *Handbook of Macroeconomics*) mention that it is always the joint behavior of monetary and fiscal policies that determine inflation (and stabilize debt), considering the interaction is not trivial.

What I Do

- Following Leeper and Leith (2016)'s suggestion, I introduce the government budget constraint with endogenous fiscal policy into the GM's baseline model to investigate their two findings.

In particular:

1. Deriving my base line model in which the steady state is distorted, different from the GM's baseline model.

2. Comparing a small open economy adopting flexible exchange rate (*inflation targeting*) with a small open economy that is a part of a *currency union*.
3. Replicating GM's two findings (GM's findings are still applicable in my baseline model).
4. Deriving the IGBC Model by introducing the government budget constraint with endogenous fiscal policy into my baseline model.
5. Showing the result on the welfare costs is OPPOSITE from the GM by calculating welfare costs in a small open economy that is a part of a currency union in the IGBC model.

Procyclicality of Bohn Rule

- The reason Why I have opposite result is resulting from procyclicality of Bohn rule adopted as an endogenous fiscal policy in the IGBC model.
- Bohn rule (Bohn, 1998, QJE) implies that the government secure enough fiscal revenue to prepare redemption of government debt.
- Suppose that an increase in the employment.
- The output increases which boost up tax revenue.
- As long as the tax revenue is enough to redeem the government debt, the tax rate decreases.
- Then, the output increases again.
- The tax rate negatively relates to the employment.
- This procyclicality hampers GM's second finding.

The Remainder of the Paper

- Section 2 derives my baseline model.
- Section 3 derives welfare criteria and equilibrium in the benchmark model.
- Section 4 shows the effectiveness of labor cost reduction and discusses wage flexibility and welfare.
- Section 5 derives the IGBC model.
- Section 6 shows welfare criteria and equilibrium in the IGBC model.
- Section 7 shows the effectiveness of labor cost reduction and discusses wage flexibility and welfare.
- Section 8 provides robustness exercise. (Skipped)
- Section 9 concludes the paper.

2 The Baseline Model: Introducing Distorted Steady State to GM's New Keynesian Small Open Economy Model

- Following GM, I assume:

1. A Representative Household Economy
2. Nominal Rigidities for Domestic Prices and Wages
3. Infinitesimal Small Open
4. Complete International Financial Markets
5. The Law of One Price

- Different from GM, I assume:

1. Distorted Steady State

The Reason Why Assume the Distorted Steady State

- Under the IGBC model, the government levies a tax on firm's sales and this distorts the steady state so that this is assumed to clarify how the introduction of the Bohn rule changes the two findings.

3 Welfare Criteria, Equilibrium, Monetary Regimes and Calibration on the Baseline Model

3.1 Welfare Criteria

My welfare criteria stems from second-order approximated utility function and linear terms which generates welfare reversal are appropriately eliminated and is given by:

$$\mathcal{L} \sim \frac{1}{2} \left[\Lambda_n \text{var}(\hat{n}_t) + \Lambda_p \text{var}(\pi_{H,t}) + \Lambda_w \text{var}(\pi_t^w) \right] \quad (15)$$

3.2 Equilibrium in the Baseline Model

The model is log-linearized and we have equilibrium dynamics as follows:

Aggregate Demand Block

$$y_t = (1 - v) c_t + \eta v (2 - v) z_t + v z_{1,t}^* \quad (16)$$

$$c_t = (1 - v) s_t + z_t - z_{2,t}^* \quad (17)$$

$$c_t = \mathbb{E}_t (c_{t+1}) - \left[r_t - \mathbb{E}_t (\pi_{t+1}) \right] + (1 - \rho_z) z_t + \delta \quad (18)$$

$$s_t = e_t - p_{H,t} \quad (19)$$

$$n_t = y_t - a_t \quad (20)$$

Aggregate Supply Block

$$\pi_{H,t} = \beta \mathbb{E}_t (\pi_{H,t+1}) + \lambda_p m_{c,t}, \quad (21)$$

$$m_{c,t} = \hat{\omega}_t + \hat{y}_t + \{v [1 - (\eta - 1) (2 - v)] + 1\} \hat{s}_t \\ + \frac{1}{1 - \tau} \tau_t + \nu_{p,t} - \frac{1}{1 - \tau} \tau, \quad (22)$$

$$\pi_{H,t} \equiv p_{H,t} - p_{H,t-1}, \quad (23)$$

$$\pi_t \equiv p_t - p_{t-1}, \quad (24)$$

$$p_t = p_{H,t} + v s_t, \quad (25)$$

$$\pi_t^w = \beta \mathbb{E}_t (\pi_{t+1}^w) - \lambda_w \mu_t^w, \quad (26)$$

$$\mu_t^w = \hat{\omega}_t - \varphi \hat{n}_t - \hat{c}_t, \quad (27)$$

$$\pi_t^w \equiv w_t - w_{t-1}, \quad (28)$$

$$\omega_t \equiv w_t - p_t, \quad (29)$$

3.3 Monetary Regimes

As same as the GM, I analyze two monetary regimes, *inflation targeting* and *currency union*.

- *inflation targeting*

$$\pi_t = 0, \quad (30)$$

- *currency union*

$$e_t = 0. \quad (31)$$

3.4 Calibration

Tab.1: Parameterization (Extracted)

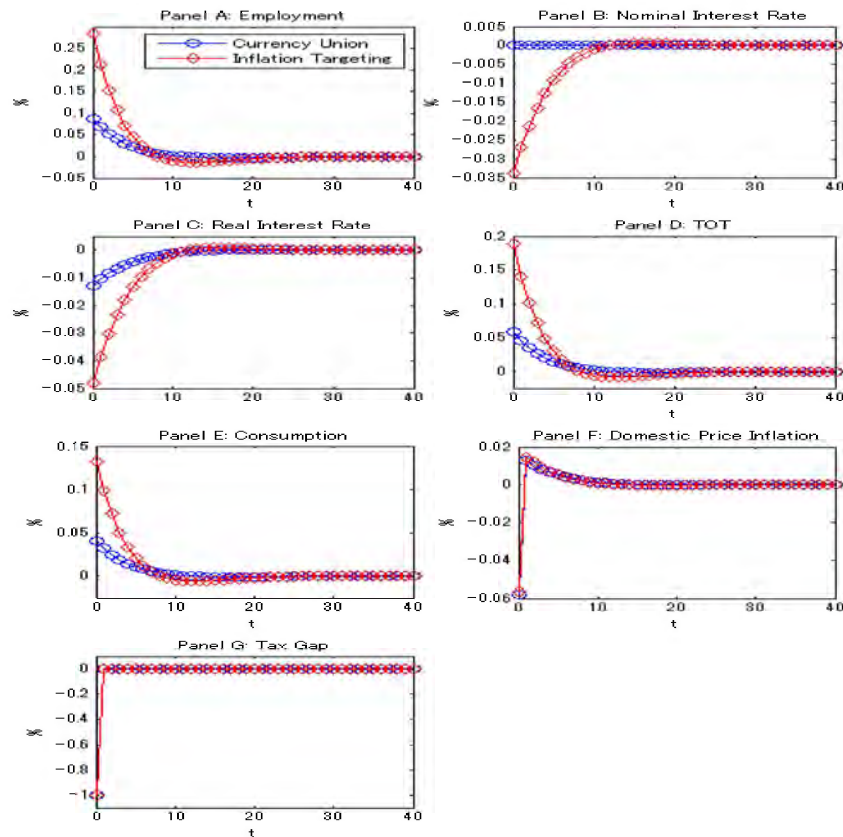
Model	Parameter	Description	Value	Source
Baseline Model	φ	Curvature of Labor Disutility	2.2	GM
	η	Trade Elasticity of Substitution	2	
	ϵ_w	Elas. of Substitution (Labor)	4.3	
	ϵ_p	Elas. of Substitution (Goods)	3.8	
	θ_p	Calvo Index of Price Rigidities	0.8	
	θ_w	Calvo Index of Wage Rigidities	0.8	
	v	Openness	0.3	
	β	Discount Factor	0.99	
	ρ_a	Persistence	0.9	
	ρ_z	of	0.9	
	ρ_1^*	Exogenous	0.9	
ρ_2^*	Process	0.9		

4 The Effectiveness of Labor Cost Reduction, Wage Flexibility, Exchange Rate Policy and Welfare in the Baseline Model

4.1 Effectiveness of Labor Cost Reduction

- Fig.1 shows the responses to one percent decrease in the tax.
- My findings are corresponding to GM's finding.

Fig. 1: Dynamic Responses to One Percent Decrease in the Tax Rate in the Distorted S. S. Model

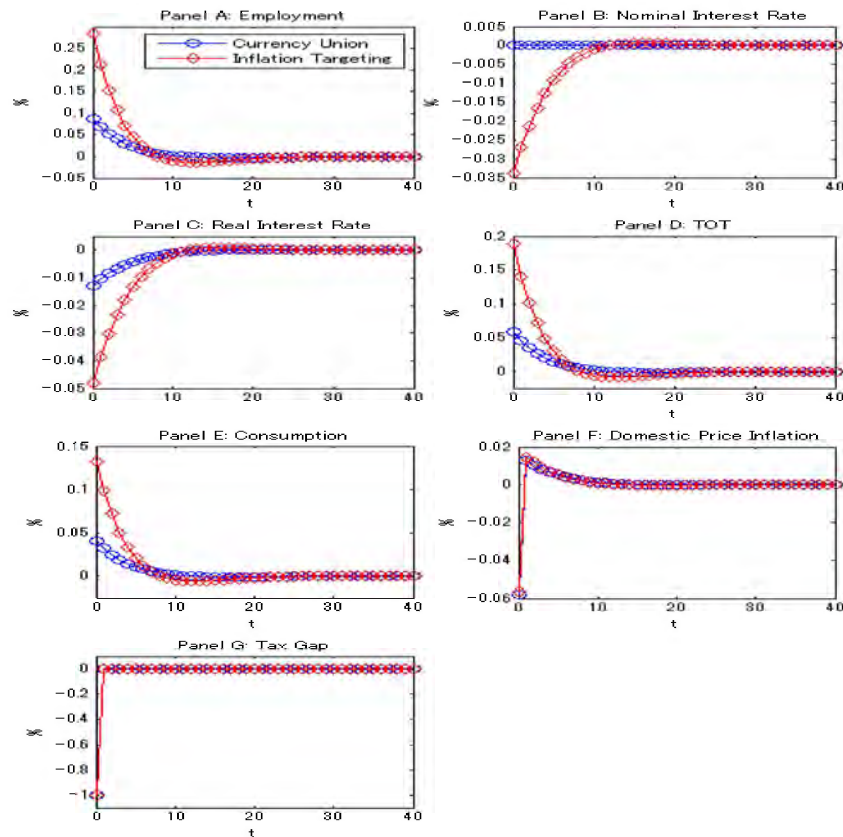


4 The Effectiveness of Labor Cost Reduction, Wage Flexibility, Exchange Rate Policy and Welfare in the Baseline Model

4.1 Effectiveness of Labor Cost Reduction

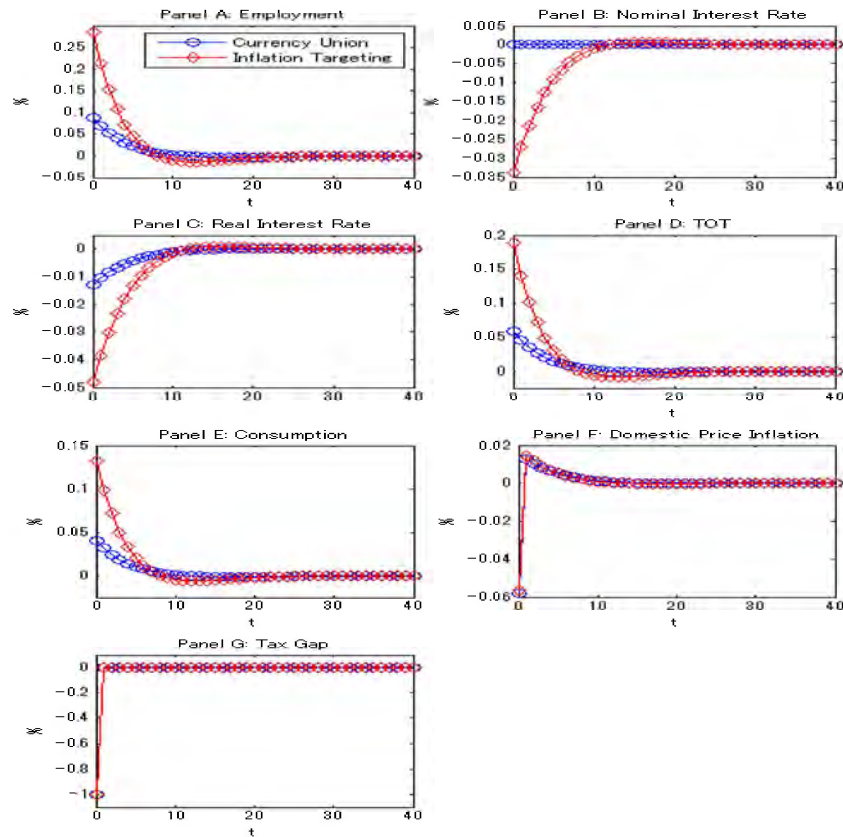
- The effectiveness of tax cut is much smaller under a *currency union*.

Fig. 1: Dynamic Responses to One Percent Decrease in the Tax Rate in the Distorted S. S. Model



- The reduction in the real interest rate and worsening in the TOT in a *currency union* is much smaller than it in an *inflation targeting*, because the nominal interest rate does not change in a *currency union*.
- Thus, an increase in the employment is much smaller in a *currency union* than it in an *inflation targeting*.
- The GM's first finding is applicable even in my baseline model.

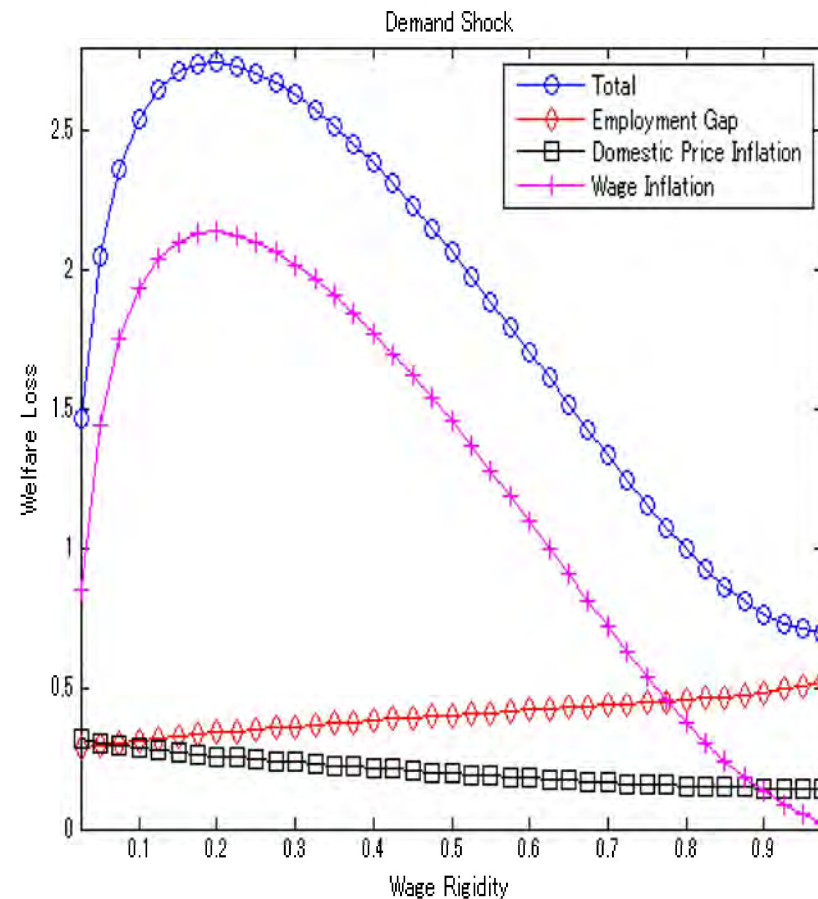
Fig. 1: Dynamic Responses to One Percent Decrease in the Tax Rate in the Distorted S. S. Model



4.2 Wage Flexibility and Welfare in a Currency Union

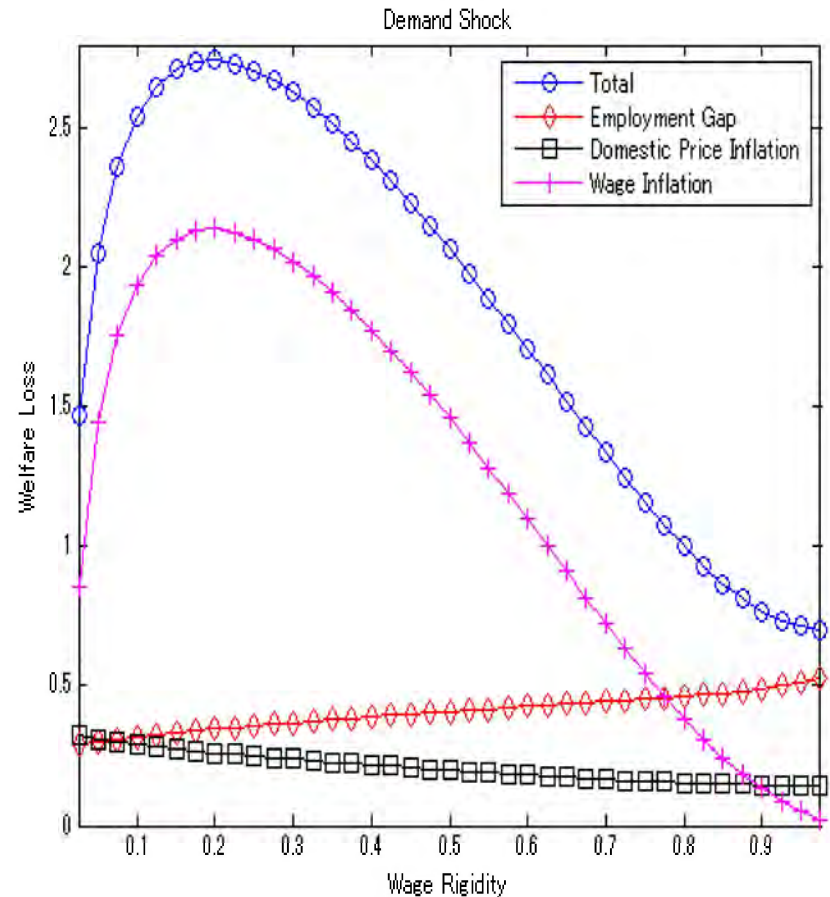
- Fig.4 shows the welfare losses associated with demand shocks together with the three components of the welfare loss function, similar to the GM.
- The wage inflation component of welfare losses simply the kind of non-monotonically displayed by the overall loss, so its contribution is particularly important.

Fig. 4: Wage Rigidities in a Currency Union: Welfare Components



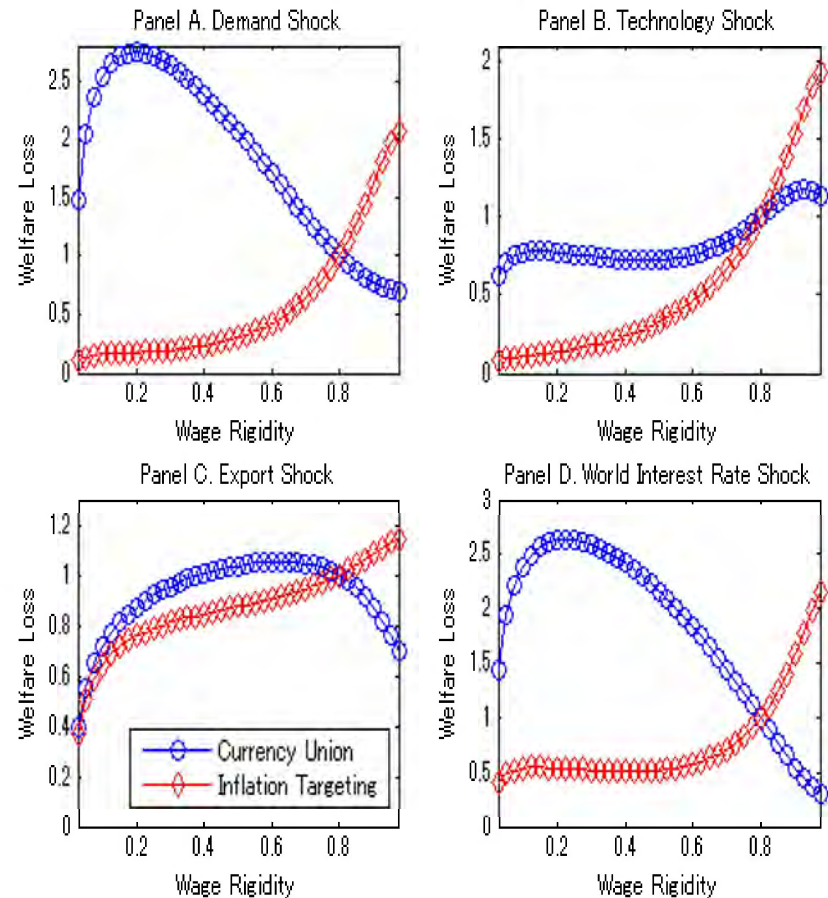
- While the wage rigidities decreases starting from close to unity, the variance of the wage inflation increases.
- On the one hand, the weight associated with the wage inflation volatility in the loss function Λ_w rapidly decreases as wages become more flexible.
- Thus, the welfare losses associated with the wage rigidities decreases when the wage rigidities is below a certain level.

Fig. 4: Wage Rigidities in a Currency Union: Welfare Components



- Fig.5 compares the welfare effect of changes in wage flexibility in the *currency union* to an *inflation targeting*.
- Under the *inflation targeting*, an increase in the wage flexibility is always welfare improving, while an increase in wage flexibility often reduces welfare under the *currency union*.
- The GM's second finding is even applicable in the baseline model.

Fig. 5: Wage Rigidities and Welfare: Currency Union vs Inflation Targeting



5 The IGBC Model: Introducing Government Budget Constraint into the Baseline Model

I introduce government facing its budget constraint into my baseline model.

5.2 Government

Iterated Government Budget Constraint (IGBC)

$$1 = \frac{\sum_{k=0}^{\infty} \beta^k \mathbb{E}_t \left(C_{t+k}^{-1} Z_{t+k} S P_{t+k} \right)}{C_t^{-1} Z_t B_{t-1} \left(\frac{P_t}{P_{t-1}} \right)^{-1}}, \quad (40)$$

which can be derived by iterating (real) government budget constraint forward and imposing the appropriate transversality condition for the government debt $\lim_{k \rightarrow \infty} \beta^k \mathbb{E}_t \left(\frac{B_{t+k}^n}{P_{t+k+1}} \right) = 0$.

6 Welfare Criteria, Equilibrium, Monetary and Fiscal Policy and Calibration on the IGBC Model

6.2 Equilibrium in the IGBC Model

Aggregate Demand Block (Modified and Derived Anew Only)

$$y_t = (1 - v) c_t + \eta \sigma_C v (2 - v) s_t + v \sigma_C z_{1,t}^* + \sigma_G g_t, \quad (43)$$

$$c_t = \mathbb{E}_t (c_{t+1}) - [r_t - \mathbb{E}_t (\pi_{t+1})] - b_t + \frac{1}{\beta} (r_{t-1} - \pi_t) + \frac{1}{\beta} b_{t-1} - \frac{1 - \beta}{\beta} s_{pt} + (1 - \rho_z) z_t + \frac{1 - \beta}{\beta} \delta, \quad (44)$$

$$s_{pt} = -v s_t + \frac{\beta}{(1 - \beta) \sigma_B} (\tau_t + \tau y_t - \sigma_G g_t - \hat{\zeta}_t + \tau), \quad (45)$$

$$b_t = \frac{1}{\beta} (r_{t-1} - \pi_t) + \frac{1}{\beta} b_{t-1} - \frac{1 - \beta}{\beta} s_{pt} - \frac{1}{\beta} \delta_t, \quad (46)$$

6.3 Monetary and Fiscal Regimes

- Based on Bohn (1998, *QJE*), Mahdavi (2014, *SEJ*) estimates a key coefficient of Bohn rule in states government data in the US where is regarded as a currency union.
- Logarithmic equality of the fiscal feedback rule in Mahdavi (2014) is as follows:

$$sp_t = \phi_b b_{t-1} + (\phi_b - 1),$$

with $\phi_b \equiv \frac{\phi_B \beta}{1 - \beta}$.

- Previous equality is adopted as a fiscal policy rule.

6.4 Calibration

Tab.1: Parameterization (Extracted)

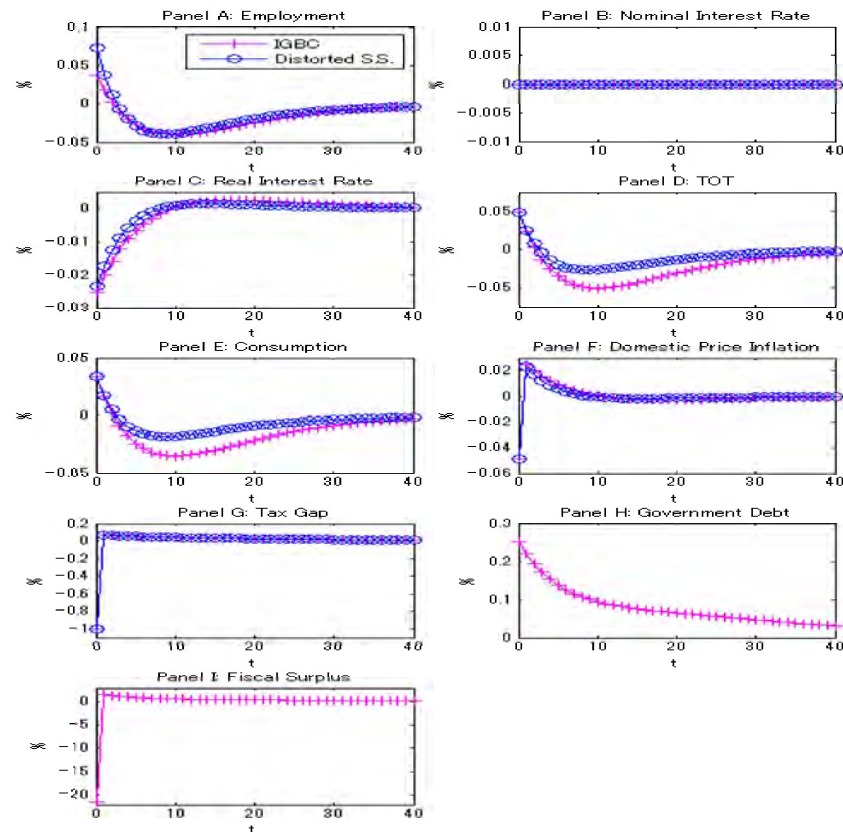
Model	Parameter	Description	Value	Source
IGBC Model	τ	Steady State Tax Rate	0.3	Ferreo (2009, <i>JIE</i>)
	σ_B	S.S. Share of Gov. Debt to GDP	4.543	Average in GIPS
	σ_G	S.S. Share of Gov. Exp. to GDP	0.477	2008– –2019
	ϕ_b	Bohn Rule Coefficient	6.5	Mahdavi (2014, <i>SEJ</i>)
	ρ_g	Persistence of Exogenous Process	0.9	(Unless Specified Otherwise)

7 The Effectiveness of Labor Cost Reduction, Wage Flexibility, Exchange Rate Policy and Welfare in the IGBC Model

7.1 Effectiveness of Labor Cost Reduction

- Fig.6 shows the responses to one percent decrease in the tax.
- The effectiveness is much smaller in a *currency union*.
- The GM's first finding is still available even in the IGBC model.

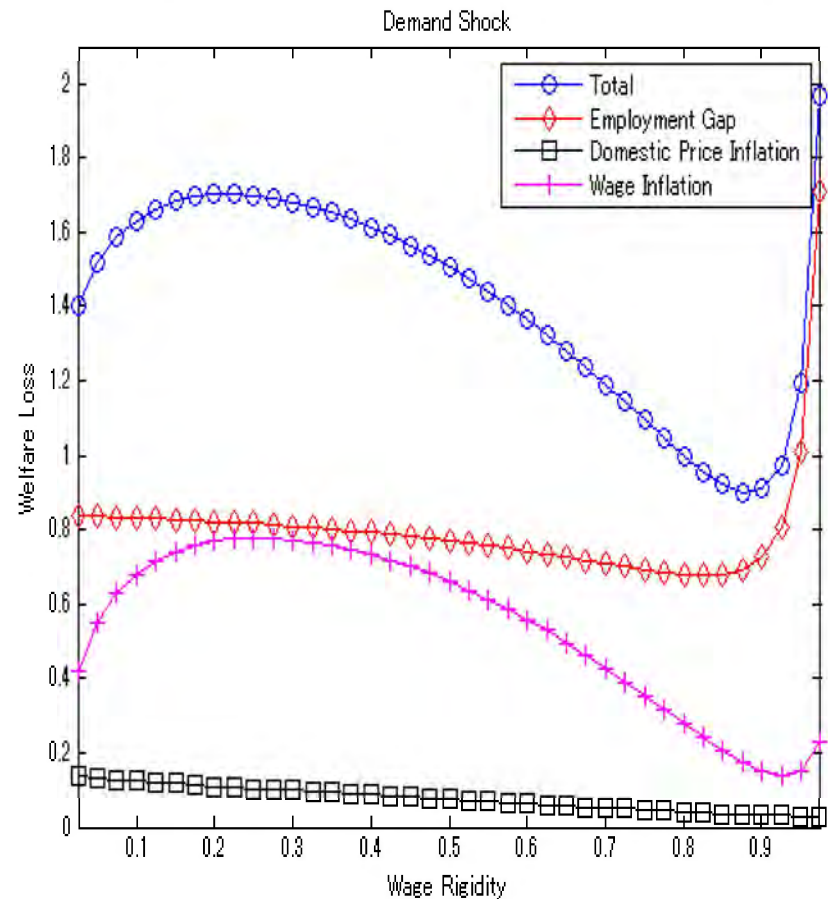
Fig. 6: Dynamic Responses to One Percent Decrease in the Tax Rate in the IGBC Model



7.2 Wage Flexibility and Welfare in a Currency Union

- Fig.8 shows the welfare losses associated with demand shock together with the three components of the welfare loss function, similar to Fig.4.
- When the wage rigidity θ_w reaches 0.85, the welfare loss rooted from the employment gap exceeds it at $\theta_w = 0.8$ and that loss is increasing together with an increase in the wage rigidity.

Fig. 8: Wage Rigidities in a Currency Union in the IGBC Model: Welfare Components

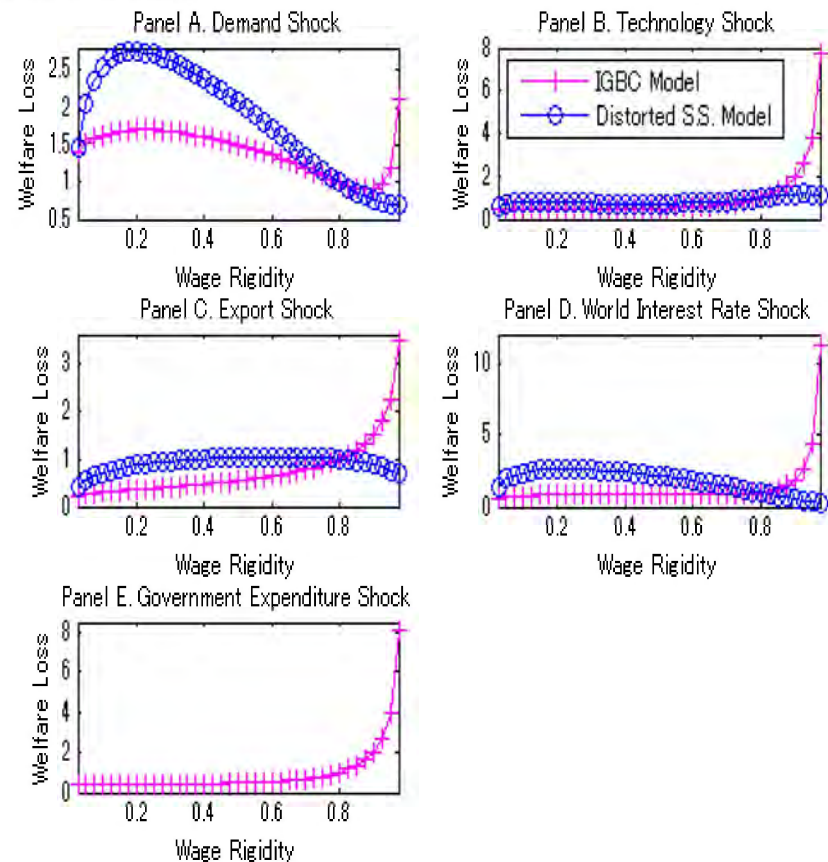


The Reason Why Non-monotonic Relationship between the Welfare and the Wage Rigidity Disppapers

- Bohn rule implies that the government secure enough fiscal revenue to prepare redemption of government debt.
- When the employment increases, the output increases which boost up tax revenue.
- As long as the tax revenue is enough to redeem the government debt, the tax rate decreases.
- Thus, on the fiscal policy rule, the tax rate negatively relates to the employment through the output.
- When the employment is satisfactory, the tax rate decreases due to much fiscal revenue and this decrease on the tax rate increases consumption.
- This procyclicality makes the NKPC flatter and generates welfare losses.

- Fig.10 compares the welfare effect of changes in wage flexibility in the IGBC model with it in the distorted steady state model.
- Under the IGBC model, an increase in the wage flexibility is almost welfare improving.
- The GM's second finding is that an increase in wage flexibility often reduces welfare, more likely so in an economy that is part of a *currency union* is not applicable.

Fig. 10: Wage Rigidities and Welfare in a Currency Union: The IGBC Model vs Distorted S. S. Model



9 Conclusion

- I investigated the GM's two findings by using a small open economy model.
- As long as there is the government budget constraint with endogenous fiscal policy in an economy that is a part of a currency union, the GM's second finding is not necessarily available.
- Wage flexibility may contribute to reduce welfare cost.
- There is enough room to discuss how wage flexibility contribute to reduce welfare loss in various settings.