Dynamics and Monetary Policy in a Fair Wage Model of the Business Cycle

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Research Questions

Dynamic general equilibrium models of the business cycle

- study source of shocks + propagation
- role of real and nominal rigidities
- optimal policy

wage reflects the MRS between leisure and consumption + only source of rigidity is nominal $\longrightarrow$ improve labor market representation

We want to compare

- fair-wage model (efficiency wage)
- monopolistic competition on labor market (Smets - Wouters)

Which features are preferred by data ? - Gain by relying on efficiency wage?

Background

Idea of the fair wage:

Gift exchange model of Akerlof (1982): firms increase workers effort by improving morale with a fair wage (gift-exchange)

Strong empirical support in applied economics (Bewley, 1998) and experimental psychology:

firms dislike pay cuts because they hurt morale

RBC models with fair-wage: Danthine and Donaldson (1990), Collard and de la Croix (2000)

Introducing nominal dimension: Danthine and Kurman (2004)

What we do

Fair wage model in which effort pro-cyclical

Two steps

1. Theoretical properties in a RBC model for which we get closed-form solutions
2. Comparison with the benchmark New-Keynesian RBC model: Econometric estimates and numerical analysis

A simple model

Introduce fair wage into a simple model à la Bénassy (2004):

- no physical capital
- log utility function
- price staggering à la Calvo
- shock affecting money supply

Effort

Disutility of effort:

$$[e_t(j) - e_t^\star(j)]^2$$

Fair effort:

$$e_t^\star(j) = \frac{\phi_1}{\psi} \left(w_t(j)^\psi - \phi_2 \left(\frac{1}{1 - N_t} \right)^\psi - \phi_3 w_t^\psi - (\phi_0 - \phi_2 - \phi_3) \right)$$

Lemma

For $\phi_0 = 1$ and $\psi \to 0$, effort is given by:

$$e_t^\star(j) = \phi_1 \left(\ln w_t(j) - \phi_2 \ln \frac{1}{1 - N_t} - \phi_3 \ln w_t \right).$$

Households and firms

Households: money-in-the-utility function.

Final output produced with a combination of intermediate inputs y_i by competitive firms using efficient labor.

Elasticity of substitution between intermediate goods: $1/(1-\theta)$ with $\theta \in (0,1)$
θ: index of product market competition ("competitiveness")

Intermediate firms: set wage, employment and prices.
Each time a fraction $1-\xi_p$ of firms sets a new price $p_t^\star(i)$.

Intermediate Good Firms

Production:

$$y_t(i) = A\left(e_t(i)n_t(i)\right)^{\alpha}. \tag{1}$$

Intermediate firm minimize costs

$$w_t(i)n_t(i)$$

subject to technology (1) and effort function.

Proposition (Pro-cyclicity of effort)

Optimal effort set by firms is given by:

$$e_t(i) = \phi_1 w_t(i)^{\psi}.$$

It is constant if $\psi = 0$. Otherwise, there is a positive relation in equilibrium between effort and wages.

Aggregate wage

$$w_t = w_t(i) = \left[\frac{\phi_2}{1-\psi-\phi_3} \left(\frac{1}{1-N_t} \right)^{\psi} + \frac{\phi_0 - \phi_2 - \phi_3}{1-\psi-\phi_3} \right]^{1/\psi}.$$

Proposition (Real Wage Rigidity)

Under $1-\psi-\phi_3 > 0$, *at given employment rate, real wage rigidity decreases with the relative sensitivity of effort to employment* ϕ_2. *It decreases with the relative importance of the externality* ϕ_3.

If $1-\psi-\phi_3 < 0$ and $\phi_0 - \phi_3 < 0$, very strong externalities, wages decreases with employment rate.

Inflation Stickiness

After loglinearization around the steady state, inflation follows:

$$\hat{P}_t - \hat{P}_{t-1} = \rho(\hat{P}_{t-1} - \hat{P}_{t-2}) + (1-\rho)(\hat{M}_t - \hat{M}_{t-1})$$

Proposition

Inflation stickiness ρ increases with the Calvo probability ξ_p and with the degree of real wage rigidity. It also increases with ψ, the degree of substitution between wage and employment in the effort function.

Effort co-moves with wages, and compensates the influence of the wage on the marginal cost; inflation is more persistent.

Long-run Unemployment

$$\underbrace{(A\theta\alpha)^{\frac{1}{1-\alpha\psi}}\phi_1^{\frac{\alpha}{1-\alpha\psi}}N^{\frac{-(1-\alpha)}{1-\alpha\psi}}}_{PS} = \underbrace{\left[\frac{\phi_0-\phi_2-\phi_3}{1-\psi-\phi_3}+\frac{\phi_2\left(\frac{1}{1-N}\right)^{\psi}}{1-\psi-\phi_3}\right]^{\frac{1}{\psi}}}_{WS}$$

Proposition

Under $1-\psi-\phi_3>0$, *there is a unique steady state employment rate* N. *It is a positive function of competitiveness* θ *and productivity* A. *It is a negative function of effort sensitivity to employment* ϕ_2. *If* $\phi_0 \geq 1-\psi$, *it is a negative function of the strength of the wage externality* ϕ_3.

A large New-Keynesian model

Benchmark: Smets and Wouters (2003)
Efficiency wage: replace labor supply by fair wage

- physical capital
- nominal wage stickiness à la Calvo
- monetary policy rule à la Taylor.
- + additional propagation mechanisms such as habit formation and adjustment costs on investment in physical capital.

Estimation

Bayesian full information approach

Seven macroeconomic time series for the Euro area used for estimation: growth rate in real GDP, consumption, investment, real wages, inflation rate in the GDP deflator, short term interest rate and employment.

1974:1-2005:4

Number of shocks = number of observable variables

Shocks

- Productivity shocks : AR(1) process;
- Investment-specific technology shocks : ARMA(1,1) process;
- Public expenditure shocks : AR(1) process;
- Risk premium shocks affecting consumption and investment : AR(1) process;
- Mark-up shocks in wages (benchmark) or shocks in effort decision (efficiency wage model) : ARMA(1,1) process;
- Mark-up shocks in domestic prices : ARMA(1,1) process;
- Monetary policy shocks (AR(1) process).

Selected results - global assessment

Log-data density:
benchmark: -440.425
fair-wage: -432.321

Data likes fair wage better

Selected results - effort function

$$e_t^\star(j) \approx w_t(j)^\psi - \phi_2 \left(\frac{1}{1 - N_t} \right)^\psi - \phi_3 w_t^\psi$$

ψ	0.358	(0.077)
ϕ_2'	0.182	(0.084)
ϕ_3	0.795	(0.089)

$\phi_2' = \phi_2 \cdot (1/\left((1-N)w\right))^\psi * (N/1-N)$

ψ significantly positive

large externality (imposing $\phi_3 = 1$ not rejected)

$1 - \psi - \phi_3 < 0$

Selected results -productivity shock

Intermediate producers produce $q_t(j)$ through the following technology:

$$q_t^j = \varepsilon_t^a \left(e_t(j) n_t(j)\right)^{1-\alpha} k_t(j)^{\alpha}$$

benchmark		fair-wage	
std ε_t^a		std ε_t^a	
0.778	(0.099)	0.613	(0.080)

Mispecification of total factor productivity in models without effort.

Selected results - price shock

Price mark-up shock $\sim$ shocks to parameter θ

supposed to follow ARMA(1,1) process

	benchmark		fair-wage	
AR	0.963	(0.033)	0.767	(0.065)
MA	0.863	(0.038)	0.597	(0.116)

Sign that the persistence of inflation is better captured by the rest of the model, i.e., the modeling of wage.

Selected results - inflation persistence

Reminder: Calvo price parameter ξ_p:

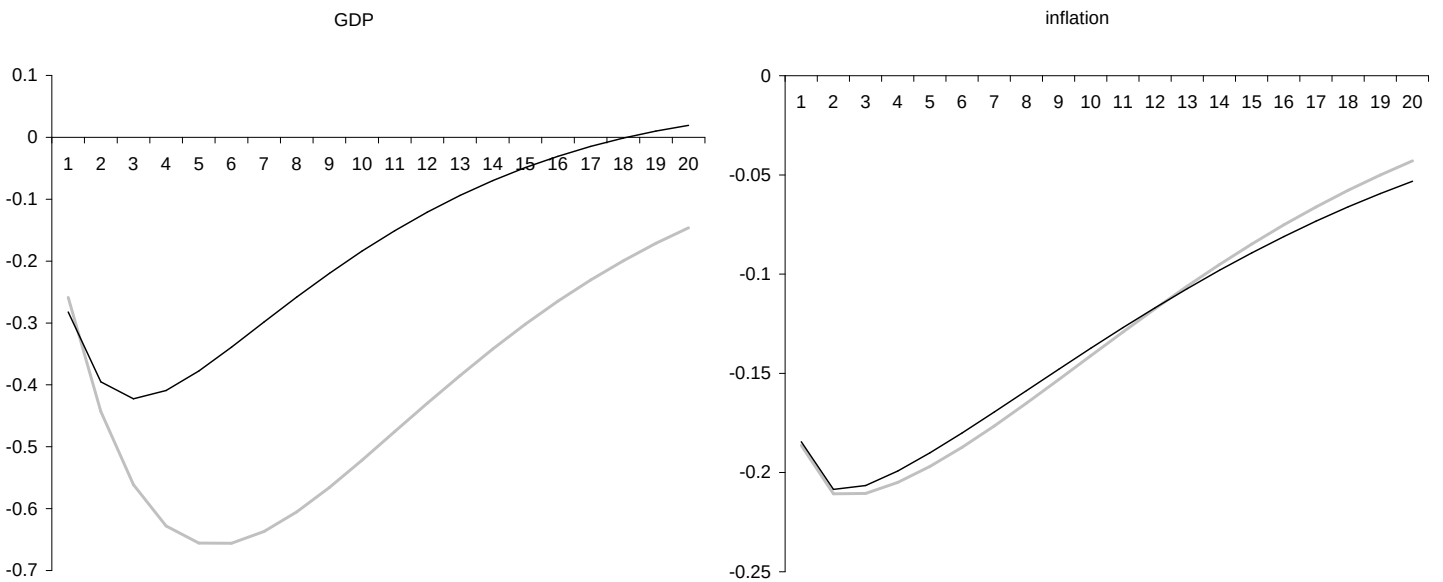
$$\hat{P}_t = (1 - \xi_p)\hat{p}_t^\star + \xi_p \hat{P}_{t-1}$$

	benchmark		fair-wage	
ξ_p	0.902	(0.020)	0.892	(0.016)

Not much reduced. If it was, productivity shocks which have a direct effect on prices would have a too strong effect.

Inflation persistence facing a monetary shock

Output response is less persistent with fair wage
but inflation is as persistent
Hence, "rigidity" is stronger with fair wages



Note: Grey line: benchmark model. Black line: Fair wage model

Extended models

- Past wage in effort function (Collard and de la Croix, 2000):

$$e_t^\star(j) = ... - \phi_4 w_{t-1}^{\psi}$$

$\longrightarrow \phi_4$ non signif. and Log data density worsens.
Not helpful on top of nominal wage stickiness

- Productivity in effort function - internal rent sharing (Danthine and Kurmann, 2006)

$$e_t^\star(j) = ... - \phi_5 \left(\frac{q_t(j)}{n_t(j)} \right)^{\psi}$$

$\longrightarrow \phi_5 = 0.125$ (0.06). Log data density improves

Policy conclusions

Two externalities having opposite effects

- Employment externatity (ϕ_2): firms do not take into account the negative spillover effects of their employment decision on the general effort level in the economy.
- Wage externality (ϕ_3): firms do not take into account the negative spillover effect of their wage decision on the overall effort level.

decentralized equilibrium $\neq$ social optimum

Net outcome depend on relative size of ϕ_2 vs ϕ_3.

Monetary Policy:

- Cost of wage and price inflation
- Cost of externalities

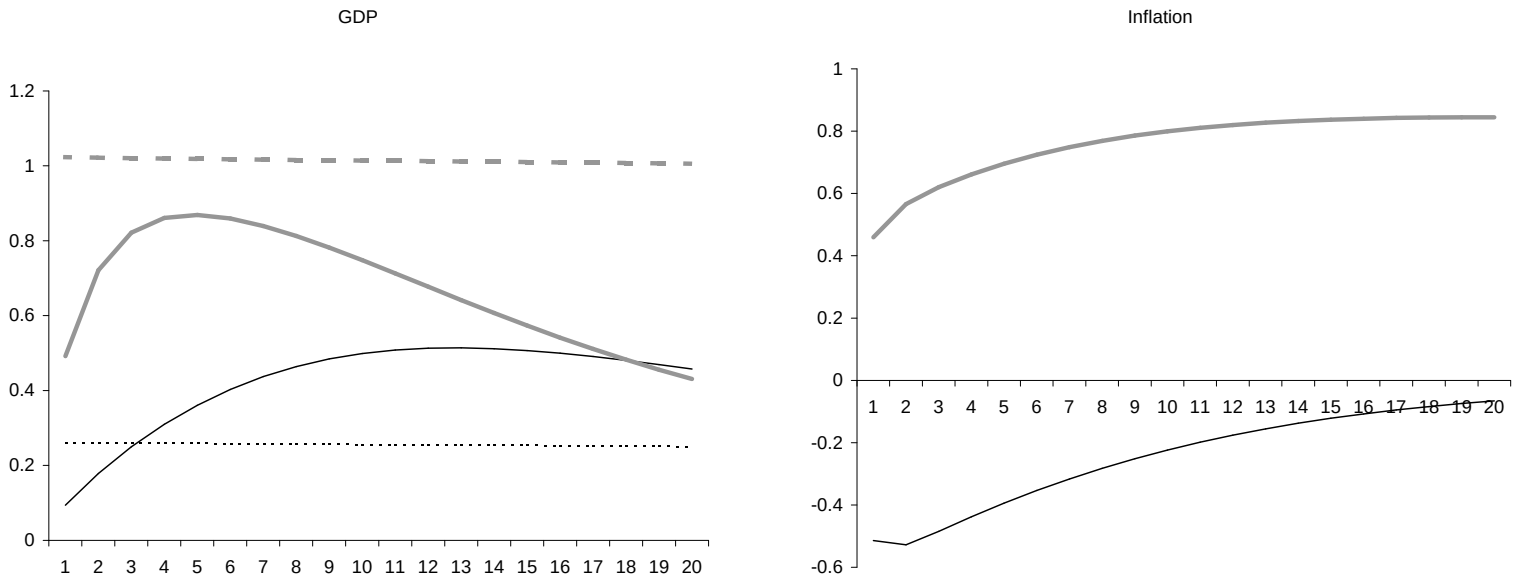
Cannot do anything in the long-run

In the short-run should stabilize the the wedge between the dynamic response in the first best efficient problem and the response under the decentralized setting (efficient output gap)

Facing a productivity shock, efficient output increases more than equilibrium output

Monetary policy should be more accommodating in this case

Monetary policy targeting natural versus efficient output gap



Conclusion

Fair wage model interesting

- Generalized effort function $\longrightarrow$ Variable effort
- Sensitivity of the marginal cost to output and employment variations is decreased
- Need for lower persistence in mark-up shocks but does not affect required price inertia (Calvo parameter)

New trade-off between inflation stabilization and output and employment gap stabilization

Agenda

Weakness of the approach: ad-hoc effort function

To be done:

- better microfoundations
- consistency between micro and macro estimates of fair wage considerations