Sticky Wages, Private Consumption and Fiscal Multipliers

Bill Dupor[1], Jingchao Li[2] and Rong Li[3]

[1]Federal Reserve Bank of Saint Louis [2]East China University of Science and Technology

[3]Renmin University

"Interaction of Fiscal and Monetary Policies" Conference
National Bank of Ukraine
May 31, 2018

The views expressed here do not reflect those of the Federal Reserve Bank of St. Louis or the Federal Reserve System.
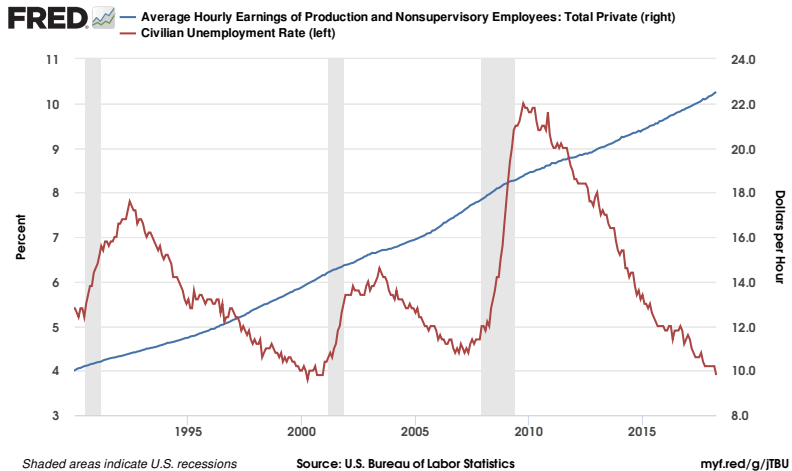
Existing research

There is a plethora of empirical work on multipliers

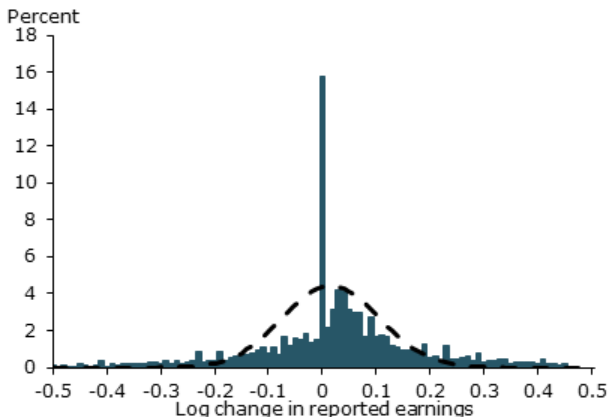There is a dearth of modern theoretical work on multipliers

Absence of wage adjustment leads labor supply to exceed labor demand

Good presentations start with a FRED graph!

FRED

Average Hourly Earnings of Production and Nonsupervisory Employees: Total Private (right)

Civilian Unemployment Rate (left)

Shaded areas indicate U.S. recessions   **Source: U.S. Bureau of Labor Statistics**   **myf.red/g/jTBU**

A role for downward nominal wage rigidity

Distribution of observed nominal wage changes

Sources: Current Population Survey (CPS) and authors calculations.

From Daly, Hobijn and Lucking (2012)

The High-Wage Doctrine

The doctrine holds that "workers can boost their chances of remaining employed by *increasing* the price of their services (Taylor and Selgin, 1999)."

Hoover Administration Press Release (1929): "The President was authorized by the employers who were present at this morning's conference to state ... that they will not initiate any movement for wage reductions, and it is their strong recommendation that this attitude should be pursued by the society as a whole ... the consuming power of the country will thereby be maintained."

Truman (1945): "The existence of substandard wage levels sharply curtails the national purchasing power and narrows the market for the products of our firms and factories."

The High-Wage Doctrine

Bernanke and Parkinson (1989): "Maybe Herbert Hoover and Henry Ford were right. Higher real wages may have paid for themselves in the broader sense that their positive effect on aggregate demand compensated for their tendency to raise costs."

The 2009 Recovery Act imposed Davis-Bacon "prevailing wage rate" requirements on the act's grant and contract recipients

Gali, Lopez-Salido and Valles (JEEA 2007) build a model where government purchases stimulate aggregate consumption by raising the real wage of rule-of-thumb consumers.

Effects of high-wage policies during downturns

Cole and Ohanian (JPE, 2004) find New Deal cartelization policies designed to limit competition and increase labor bargaining power extended and deepened the Depression via strong wage growth.

Clemens and Wither (WP, 2016) find that increases in minimum wages between 2007 and 2009 reduced employment overall and for targeted populations.
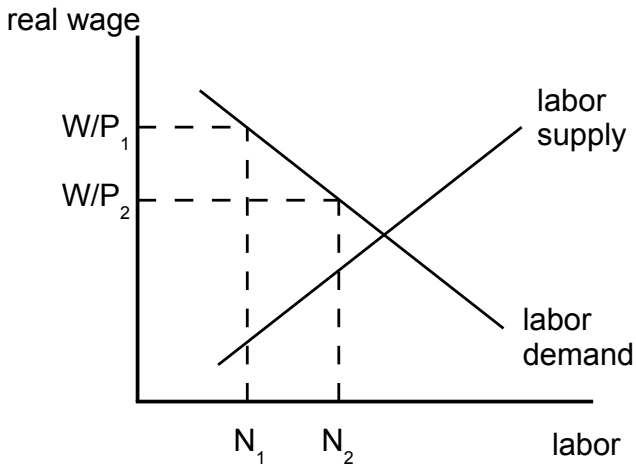
If recessions and unemployment signal a failure of wage adjustment, what does this imply for fiscal policy?

If recessions and unemployment signal a failure of wage adjustment, what does this imply for fiscal policy?

Interestingly, it gives a role for government spending.

What We Do

Develop a new mechanism, based on sticky nominal wages, that generates a positive consumption multiplier from government spending.

The mechanism:

1. If nominal wages are rigid and too high, labor supply exceeds labor demand.
2. Government-spending induced inflation reduces the real wage, which increases employment.
3. Increased employment raises income, which permits households to both pay their taxes and buy more consumption.

Most of our results are closed form and utilize a minimal departure from a simple NK model.

Existing mechanisms for positive consumption multipliers

Type of model	Mechanism	Problems	References
Utility function interactions	Gov. spending raises the marginal utility of consumption	1. Real world examples? 2. Assuming the result?	Linnenmann (2006) Bouakez & Rebei (2007)
Zero-lower bound	Gov. spending induced inflation lowers the ex ante real interest rate	1. Only works during ZLB episodes 2. Requires large response of consumption to policy rate	Christiano (2004) Eggertsson & Woodford (2006) Mertens & Ravn (2014)
Winner/loser	One group of agent (e.g. rule of thumb) have increased consumption, while another group suffers	1. Distributional conflict are not part of the casual discussion of the multiplier mechanism	Gali, et. al. (2007) Eggertsson & Krugman (2012)

The Model

The government

The flow government budget constraint is

$$H_t + M_t^s + \frac{B_t^s}{R_t} = M_{t-1}^s + B_{t-1}^s + Z_t$$

where $Z_t = P_t G_t + \tau \widetilde{W}_t \bar{N}_t^s$.

Let $\bar{N}^s$ be average economy-wide labor supply, R is the gross interest rate, M^s is the money supply and B is government debt.

Government spending, G, evolves according to

$$G_t = \rho G_{t-1} + (1 - \rho) \bar{G} + \varepsilon_t$$

We sometimes use the variable p, which is defined by $\rho = 1/(1 + p)$.

The government (continued)

Monetary policy is given by

$$R_t = (\lambda + 1) E_t (\pi_{t+1} - 1) + \beta^{-1}$$

where $\lambda > 0$, π is the inflation rate and β is the time discount factor.

Families

An economy is made up of a continuum of families, each indexed by v.

Each family:

- supplies $N^s(v)$ by sending family members to enter the employ of other families.
- produces by hiring labor, $N^d(v)$, from other families to produce $Y(v) = \left[N^d(v)\right]^\alpha$.
- sets the price of the good it sells subject to the following downward-sloping demand constraint:

$$Y(v) = d\left[\frac{P(v)}{P}\right] Y^d$$

- holds bonds, $B(v)$, and fiat currency, $M(v)$.
- resets its nominal price in each period with probability $1 - \theta$

Families (continued)

The family utility function is $U(v) =$

$$\sum_{t=0}^{\infty} \beta^t E_0 \left[\log \left[C_t(v) \right] + \zeta \log \left[\frac{M_t(v)}{P_t} \right] \right]$$

We will sometimes use the variable r, where $r = 1 - \beta$.

The family budget constraint is

$$M_t(v) + \frac{B_t(v)}{R_t} = B_{t-1}(v) + M_{t-1}(v) + P_t(v) \left[N_t^d(v) \right]^{\alpha} -$$
$$(1 - \tau)\, \widetilde{W}_t N_t^d(v) + \widetilde{W}_t N_t^s(v) - P_t C_t(v) - Z_t$$

where τ is a subsidy to families hiring workers.

Wage rigidity

The nominal wage, $\widetilde{W}_t = \xi W + (1 - \xi)P_t x$, is assumed to be a weighted average of a fixed nominal wage equal to W and a fixed real wage equal to x.

Let $\xi \in [0, 1]$.

Families post the two wages and stand willing to supply whatever labor is demanded at the fixed proportions of those two wages.

Three channels from government spending to consumption

A positive government spending shock has a:

- contractionary wealth effect
  - lump sum taxes push down consumption
- contractionary real interest rate effect
  - inflation drives up the real rate, which (typically) reduces consumption
- expansionary real wage effect
  - inflation drives down the real wage, which leads producers to increase employment

The Theorems

Log-linearized equilibrium conditions

Log-linearizing the inflation Euler equation results in

$$\hat{\pi}_t = \kappa \left[(1/\alpha - 1)\hat{y}_t - \xi\hat{p}_t\right] + \beta E_t (\hat{\pi}_{t+1})$$

Solving this equation forward gives

$$\hat{\pi}_t = \kappa \sum_{j=0}^{\infty} \beta^j E_t \left[(1/\alpha - 1)\hat{y}_{t+j} - \xi\hat{p}_{t+j}\right]$$

Recall ξ is the fraction of fixed nominal wages.

Log-linearized equilibrium conditions (continued)

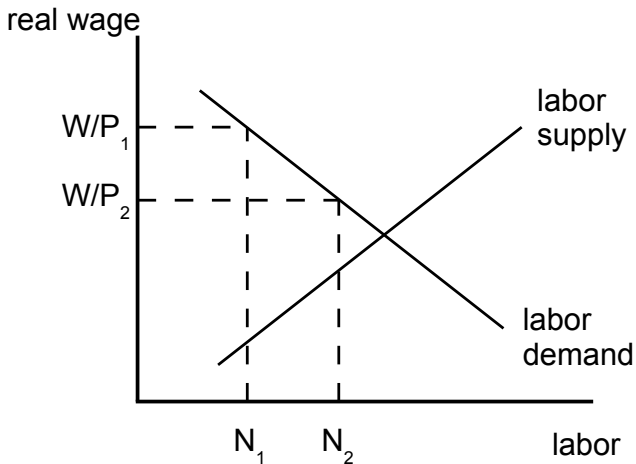The log-linearized resource constraint is

$$\hat{y}_t = s\hat{c}_t + (1 - s)\hat{g}_t$$

The log linearized consumption Euler equation is

$$E_t\left(\hat{c}_{t+1}\right) - \hat{c}_t = \lambda E_t\left(\hat{\pi}_{t+1}\right)$$

The law of motion for government spending is:

$$\hat{g}_{t+1} = \rho\hat{g}_t + \varepsilon_{t+1}$$

Local uniqueness

Recall s is the steady-state consumption share of output, ξ is the fraction of sticky nominal wages, and κ is the "Phillips curve parameter".

Theorem 1: If the interest rate feedback parameter λ satisfies

$$\frac{\alpha\xi}{s\left(1-\alpha\right)} < \lambda < \frac{\alpha\left(1-\beta+\kappa\xi\right)}{s\kappa\left(1-\alpha\right)}$$

then the equilibrium is locally unique.

If $\xi = 0$, the equation reflects the standard "Taylor principle."

If $\xi > 0$, then the central bank must lean against wind even more to achieve determinacy.

Closed form solutions for inflation and consumption

The equilibrium inflation rate is given by

$$\hat{\pi}_t = \gamma \hat{g}_t$$

where $\gamma > 0$ if $\rho < 1$.

Equilibrium consumption is given by

$$\hat{c}_t = \chi \hat{g}_t + \frac{\xi}{(1/\alpha - 1)s} \hat{p}_{t-1}$$

where $\chi > 0$ if $\xi > \frac{\rho(1-\beta)}{\kappa(1-\rho)}$

Lemmas 1 and 2

A positive government spending shock:

- increases the price level on impact if the government spending shock is not permanent.
- increases consumption on impact if the degree of nominal wage rigidity is sufficiently large, holding fixed other parameters.

A simple calibration

- Discount factor, $\beta = 0.99$
- Output elasticity of labor, $\alpha = 0.66$
- Steady-state ratio of private consumption to output, $s = 0.8$
- Probability of no price change, $\theta = 0.75$
- Fraction of nominally rigid wage bill, $\xi = 0.211$

Response of economy to a gov. spending shock, varying ρ and λ
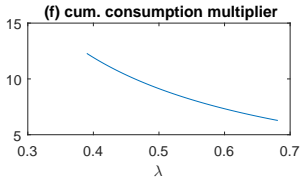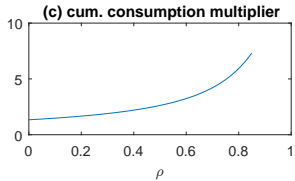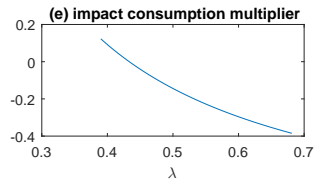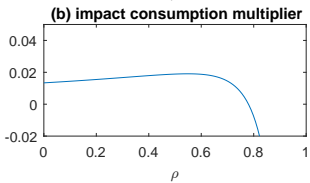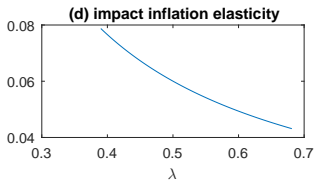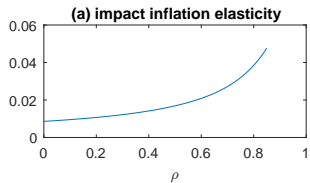
An Extension: Gradual Nominal Wage Adjustment

Making the real effect of g shocks transitory

Replace permanently fixed wage with Calvo wage setting

$$\hat{\pi}_{w,t} = \kappa_w \left[(\mu_n/\alpha)\,\hat{y}_t + \hat{c}_t - \hat{w}_t \right] + \beta E_t \left(\hat{\pi}_{w,t+1} \right)$$
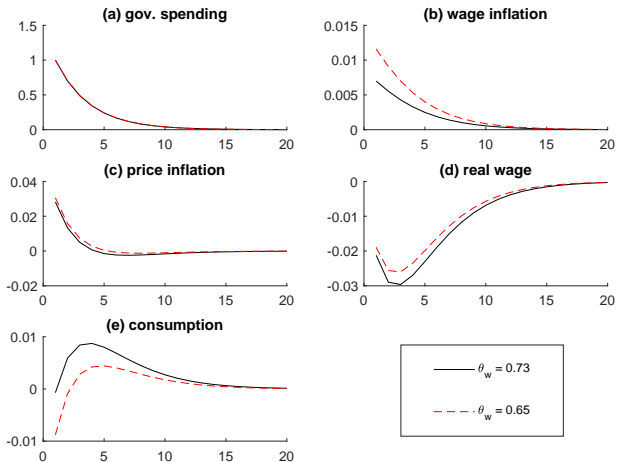
Let $\pi_{w,t} = \frac{W_t}{W_{t-1}}$ denote the wage inflation rate.

Then the change in the real wage is the difference between wage inflation and price inflation

$$\hat{w}_t = \hat{w}_{t-1} + \hat{\pi}_{w,t} - \hat{\pi}_t$$

Cannot solve the model analytically.

Figure 4: Response of economy to a government spending shock, varying the degree of wage rigidity

Notes: $\theta_w = 0.73$ reflects the benchmark case; $\theta_w = 0.65$ reflects less sticky nominal wages.

Figure 5: Response of economy to a government spending shock, varying the responsiveness of the interest rate rule
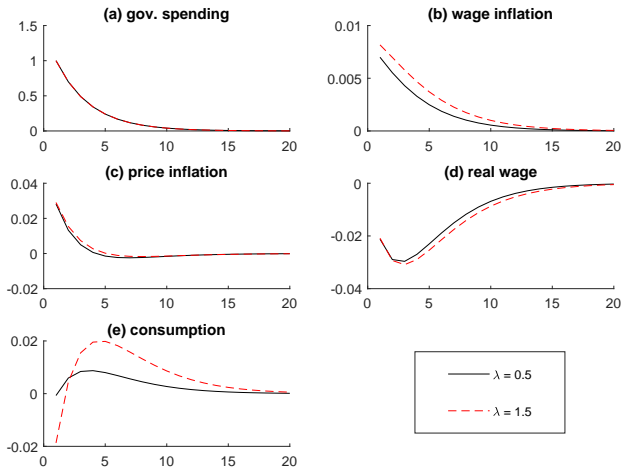
Notes: $\lambda = 0.5$ reflects the benchmark case; $\lambda = 1.5$ reflects relatively active policy.

Conclusion

The "high wage" view of recessions has implications for fiscal policy.

Policies that put downward pressure on the real wage will increase labor demand, total income and then total demand for goods

Sticky wages are themselves sufficient to generate positive consumption multipliers from government spending.

Inflationary government spending drives down the real wage.

Two key empirical challenges to this theory

- Many papers find negative consumption multipliers
- Does the real wage fall following G shocks

Extra Slides

But hasn't someone done it before?

No one has shown that sticky wages themselves are sufficient for positive consumption multipliers.

A few papers have used sticky wages as an amplification mechanism, but have relied on other ingredients as well

- Rendahl (2016)
- Schmit-Grohe and Uribe (2016)
- Bordo, et al. (2000)

Wage rigidity (continued)
More details:

- Our model of wage rigidity is deliberately simple.

- In the background, we envision a more general model in which employers post vacancies and meet with searching individuals and then engage in bargaining over match surpluses.

- As shocks hit the economy, neither member of the worker-employer matched pair may have incentive to separate so long as there is value in the existing match.

- A constant wage may be a norm (as long as that wage is in the bargaining set) as an alternative to other bargaining protocols.

- Models that provide foundations for wage rigidity along these lines include Hall (2005).

Closed form solutions for inflation and consumption

Theorem 2: The equilibrium inflation rate is given by $\hat{\pi}_t = \gamma \hat{g}_t$ where

$$\gamma = \frac{\kappa \left(1/\alpha - 1\right)\left(1 - s\right)\left(1 - \rho\right)}{1 + \beta\rho^2 + [s\kappa(1/\alpha - 1)\lambda - (1 + \kappa\xi + \beta)]\rho}$$

Equilibrium consumption is given by $\hat{c}_t = \chi \hat{g}_t + \frac{\xi}{(1/\alpha - 1)s}\hat{p}_{t-1}$ where

$$\chi = \frac{(1 + \kappa\xi - \rho\beta)\gamma - \kappa\left(1/\alpha - 1\right)\left(1 - s\right)}{s\kappa\left(1/\alpha - 1\right)} = \frac{\left(1 - s\right)\left(1 - \rho\right)/s}{1 - \rho + \frac{s\kappa(1/\alpha - 1)\lambda\rho - \kappa\xi}{1 - \beta\rho + \kappa\xi}} - \frac{1 - s}{s}$$

Two special cases

1. IID spending shocks, $\rho = 0$.

   - The impulse responses π and c simplify

   $$\{\hat{\pi}_{t+j}\}_{j=0}^{\infty} = \{\kappa \left(1/\alpha - 1\right)\left(1 - s\right), 0, 0, 0, \ldots\}$$

   $$\{\hat{c}_{t+j}\}_{j=0}^{\infty} = \left\{\frac{\left(1 - s\right)\kappa\xi}{s}, \frac{\left(1 - s\right)\kappa\xi}{s}, \ldots\right\}$$

   - Immediate and permanent increase in c
   - Since c growth is zero between t and $t + 1$, as well as between future periods, the real interest rate must remain at its steady state.
   - Prices are forward looking, wages are backward looking

2. Permanent spending shocks, $\rho = 1$.

   - g shocks have no effect on either π or y.
   - Suppose g increases and families forecast no effect on the p sequence.
   - Then, there is no change in π, real wage, or real interest rate.
   - Only effect on families is higher lump-sum taxes.

Intuition for intermediate case

When $0 < \rho < 1$

Upon the impact of higher government spending,

- real interest rate jumps up and then converges back to steady state
- real income jumps up and increases towards a new steady state as a result of higher employment from the lower real wage
- inflation jumps on impact and then returns to steady state

Temporarily high inflation raises the long-run price level, which drives down the real wage (and thus labor input).

Summary of comparative static lemmas

An increase in:	Consumption on impact	Price level on impact
The persistence of government spending	For small ρ, the responsiveness is increasing For large ρ, the responsiveness is decreasing [Lemma 5]	For small ρ, the responsiveness is increasing For large ρ, the responsiveness is decreasing [Lemma 4]
The aggressiveness of monetary policy	Decreasing responsiveness [Lemma 3]	Decreasing responsiveness [Lemma 3]