

# Trade Union, Unemployment, Economic Growth and Income Inequality

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# Observations: Unions and Income Inequality

The model is built to be consistent with **three** major sets of empirical evidence

- 1 Unionization and Income distribution (Household income inequality/Factor income distribution)
- 2 Unemployment and growth effects of unionization
- 3 Relationship between unemployment and growth

# Observations: Unions and Income Inequality

- Earlier empirical studies: trade unions tend to reduce wage disparity and income inequality
  - (Negative) (during 1980s) Decline in the US union density can account for about 20% of the rise in wage inequality (Card 1996 and Freeman 1996)
  - Negative effect on pay inequality is also found in the UK (Machin 1997, Card et al. 2004 and Visser and Checchi 2009), Canada (Card et al. 2004), New Zealand (Wallerstein 1999) and other OECD countries (Kahn 2000)
- Recent evidence seems to refer to a positive effect
  - Collective bargaining can increase, rather than decrease, income inequality (Smeeding 2002, Gustavsson 2007, Atkinson 2008, and Bjorklund and Freeman 2008)
  - Positive effect on income inequality appears in both developed and developing countries (Bertola et al. 2002, Koeniger et al. 2007, and ILO 2008)

# Observations: Unions and Factor income distribution

- Karabarbounis and Neiman (2014): 42 out of 59 countries exhibited downward trends in their labor shares between 1975 and 2012
- Jayadev (2007) and the European Commission (2007): there is a positive correlation between union density and labor income share in OECD/EU countries
- The decline in unionization has depressed the labor income share

# Observations: Unemployment and Growth Effects

Evidence refers to an unfavorable effect of trade unionism on unemployment (Nickell (1997) for Europe and North America), but its impacts on firms' investment and hence the longer-term growth are not so significant

- (by using industry / firm level data) There is a positive productivity differential for unionized firms (Brown and Medoff 1978, Clark 1980, Nickell et al. 1989, and Gregg et al. 1993)
- (by using aggregate national data) The growth effect of unionization is mixed. Asterious and Monastiriotis (2001) find a positive growth effect in 18 OECD countries
- A theoretical attempt, such as Palokangas (1996), Ramos-Parreño and Sánchez-Losada (2002), Irmen and Wigger (2003), and Chang et al. (2007), is to highlight the positive effect of unionization on growth

# Observations: Unemployment – Growth Relationship

- Growth has been examined mostly based on a full-employment labor market, implying that unemployment is only a business cycle phenomenon that may disappear in the long run
- Bean (1994) and Daveri and Tabellini (2000): Growth often goes side by side with unemployment
- There is little evidence of a robust unemployment-growth relationship, either positive or negative, over a long time period from the 1950s to the 1980s (Bean and Pissarides 1993 and Aghion and Howitt 1994)
- Saint-Paul (1991), Aghion and Howitt (1992), Caballero (1993), and Gordon (1997) even refer to a positive unemployment-growth relationship

# Main Departure

- Most research has explored the issue of either equilibrium unemployment or economic growth separately. They are not able to capture the aforementioned empirical evidence in a unified model
- **In this paper we allow for the unemployment rate, the balanced-growth rate, and income inequality to be interdependent and endogenously determined in a unified macro model**
- Endogenous effective labor force: including extensive margin (the employment rate) and intensive margin (working hours)
- These features allow us to **reconcile the empirical evidence**

# Main Results

Unionization  $\left\{ \begin{array}{l} \left\{ \begin{array}{l} \text{unemployment } \uparrow \text{ (unemployment } \downarrow) \\ \text{working hours } \uparrow \end{array} \right\} \text{ effect labor force } \uparrow \rightarrow \text{ growth } \uparrow \\ \left\{ \begin{array}{l} \text{income inequality } \uparrow \downarrow \\ \text{labor income share } \uparrow \end{array} \right\} \end{array} \right.$

- Effective labor force ( $\tilde{E} = \tilde{h} \cdot \tilde{l}$ ) exhibits an “*intensive margin response*”: the number of employed workers  $\tilde{l}$  decreases, but each individual employed worker provides more working hours  $\tilde{h}$
- High unemployment and high growth can co-exist/ echoes the empirical finding of Gordon (1997)
- Deunionization lowers the labor income share, while has an ambiguous effect on households’ income inequality



# Our Framework

- A unionized economy consisting of four types of agents: households, firms, a national trade union, and a government
- Households derive utility from consumption and leisure.
  - Income inequality could be caused by not only capital endowment, but also salary earning
  - Francis (2009) and Lemieux et al. (2009): wage inequality has greatly increased over the past two decades
- The firms produce goods by means of capital and labor service through a generalized **CES** technology. (endogenize labor income share)
- Union bargains over wage and employment with firms
  - Both employment and working time, called by “**effective**” labor force, are endogenous
- Government levies a lump-sum tax to finance its expenditure on unemployment benefits (balance its budget)

# Firms

- The constant elasticity of substitution (CES) production function

$$Y = A[\alpha_E(A_1E)^{-\beta} + \alpha_k(A_2k)^{-\beta}]^{-\frac{\alpha}{\beta}}, 0 < \alpha < 1, \beta \geq -1, \text{ and } \alpha_l + \alpha_k = 1,$$

- $E$ : Effective labor force ( $E = h \cdot l$ );  $k$ : Capital
- The elasticity of substitution between effective labor and capital:  $\epsilon = \frac{1}{1+\beta}$ . If  $\beta \rightarrow -1$ , effective labor and capital are perfect substitutes, i.e.,  $\epsilon \rightarrow \infty$ ; if  $\beta \rightarrow \infty$ , both are perfect complements, i.e.,  $\epsilon \rightarrow 0$ . If  $\beta \rightarrow 0$  and then  $\epsilon = 1$ , PF is reduced to a Cobb-Douglas functional form.
- $A_1(K)$  for effective labor and  $A_2(K)$  for capital (two productive externalities)
- Both are increasing in aggregate capital  $K$ ,  $A_1(K) = K^{\eta_1}$  and  $A_2(K) = K^{\eta_2}$  with  $\eta_1 = \frac{1}{\alpha} (> 0)$  and  $\eta_2 = \frac{1}{\alpha} - 1 (> 0)$ , which can generate sustain growth
- The representative firm seeks to maximize its profit  $\pi$ :

$$\pi = Y - whl - rk.$$

# Trade Union

- (Pemberton 1988): trade union's objective function is

$$U = [(wh - T) - b] \cdot l^v, \quad 0 < v < 1,$$

- $(wh - T) - b$  is the wage surplus
- Relative to wage surplus,  $v$  measures the weight of the union on employment  $l$
- A lower (higher)  $v$  implies that the union tends to be more wage-(employment)-oriented (see Mezzetti and Dinopoulos 1991)
- Case of a wage-oriented union where  $0 < v < 1$ , which is consistent with the empirical evidence (Clark and Oswald 1989; a survey of union leaders in Great Britain)

# Collective Bargaining

- Union and Employer federation bargain over wages and employment via the Nash bargaining solution

$$\max_{w,l} \Phi = [(wh - T - b)l^v]^\theta (Y - whl - rk)^{1-\theta},$$

subject to the firms' demand for capital

$$r = MPK = \frac{\alpha \alpha_k (K^{\eta_2} k)^{-\beta}}{k} A [\alpha_E (K^{\eta_1} hl)^{-\beta} + \alpha_k (K^{\eta_2} k)^{-\beta}]^{-\frac{\alpha}{\beta} - 1}.$$

- $\theta \in (0, 1)$  is the bargaining strength of the union
- firms have a right to determine their capital unilaterally

# Bargaining Consequence

- The optimal conditions for the wage and employment

$$wh - T - b = \frac{1}{v} \left\{ wh - \frac{\alpha \alpha_E (K^{\eta_1} hl)^{-\beta}}{l} A \left[ \alpha_E (K^{\eta_1} hl)^{-\beta} + \alpha_k (K^{\eta_2} k)^{-\beta} \right]^{-\frac{\alpha}{\beta} - 1} \right\},$$

$$w = \left[ \frac{\alpha \alpha_E (K^{\eta_1} hl)^{-\beta}}{\alpha_E (K^{\eta_1} hl)^{-\beta} + \alpha_k (K^{\eta_2} k)^{-\beta}} + \frac{\theta v (1 - \alpha)}{1 - \theta + \theta v} \right] \frac{A \left[ \alpha_E (K^{\eta_1} hl)^{-\beta} + \alpha_k (K^{\eta_2} k)^{-\beta} \right]^{-\frac{\alpha}{\beta}}}{hl},$$

- the contract curve in the  $(w, l)$  space: the locus of points at which the union's indifference curve and the firm's iso-profit curve are tangent
- the rent division curve: the bargained wage increases with the union's bargaining power  $\theta$

# Bargaining Consequence

- The firm's profit is

$$\pi = \frac{(1 - \theta)(1 - \alpha)}{1 - \theta + \theta v} A [\alpha_E (K^{\eta_1} h l)^{-\beta} + \alpha_k (K^{\eta_2} k)^{-\beta}]^{-\frac{\alpha}{\beta}},$$

- $\pi$  is decreasing in  $\theta$ ; in the extreme case where the union's bargaining power is absolute ( $\theta \rightarrow 1$ ), the firm's profit reduces to zero

# Households

- Households are indexed by  $i$  and are identical in all respects except for their initial capital endowment  $K_{i0}$ 
  - García-Peñalosa and Turnovsky (2006): define the share of individual  $i$ ,  $K_i$ , in the aggregate stock of capital,  $K$ , as  $k_i$  ( $k_i = K_i/K$ )
  - The relative capital  $k_i$  follows a distribution function  $D(k_i)$ , with mean  $\sum_i k_i = 1$  and the variance is  $\sigma_k^2$
- Each individual  $i$  is endowed with a unit of time that can be allocated either to labor  $h_i$  or leisure  $\ell_i$  (given that the employment rate  $l$  is determined by the bargaining consequence)

# Households

- Household optimization

$$\max_{C_i, h_i, K_i} \int_0^{\infty} \frac{[C_i(1 - E_i)^\eta]^\varphi}{\varphi} e^{-\rho t} dt, \quad E_i = h_i l$$

subject to its budget constraint

$$s.t. \quad \dot{K}_i = rK_i + wh_i l + b(1 - l) + \pi_i - C_i - T.$$

- “Big family” assumption: in facing a pooled resource, the “large” household has a unified preference capturing the enjoyment of all its members
- Given the employment rate  $l$ ,  $lwh_i + (1 - l)b$  is the average labor income



# Household's Optimization

- The necessary conditions for the household optimization problem

$$C_i^{\varphi-1}(1-h_i l)^{\eta\varphi} - \lambda_i = 0,$$

$$l[-\eta C_i^{\varphi}(1-h_i l)^{\eta\varphi-1} + \lambda_i w] = 0,$$

$$\dot{\lambda}_i / \lambda_i = \rho - r,$$

the transversality condition of  $K_i$ :

$$\lim_{t \rightarrow \infty} \lambda_i K_i e^{-\rho t} = 0.$$

- Labor supply:  $w = \eta C_i / (1 - h_i l)$ , showing that working hours  $h_i$  increase with the bargained wage  $w$

# Government

- The government budget constraint can be expressed as

$$b(1 - l) = T.$$

To avoid unemployment benefits being degenerated, we specify  $b = sY$ , where  $s$  is the unemployment benefits-GDP ratio

# Balance-Growth-Path Equilibrium

- From households' optimal conditions, we have:

$$(\varphi - 1) \frac{\dot{C}_i}{C_i} - \eta \varphi \frac{(1 - E_i)}{1 - E_i} = \frac{\dot{\lambda}_i}{\lambda_i} = \rho - r.$$

$$\varphi \frac{\dot{C}_i}{C_i} + (\eta \varphi - 1) \frac{(1 - E_i)}{1 - E_i} = \frac{\dot{w}}{w} + \frac{\dot{\lambda}_i}{\lambda_i}.$$

- Each agent faces the same rate for the shadow value of capital and the wage offer, irrespective of his/her capital endowment  $K_{i0}$
- All individuals choose the same growth rate for consumption  $C$  and leisure  $1 - E$

$$\frac{\dot{C}_i}{C_i} = \frac{\dot{C}_j}{C_j} = \frac{\dot{C}}{C} \quad \text{and} \quad \frac{(1 - E_i)}{1 - E_i} = \frac{(1 - E_j)}{1 - E_j} = \frac{(1 - E)}{1 - E}; \quad \forall i, j.$$

# Balance-Growth-Path Equilibrium

- Let  $x \equiv \frac{C}{K}$ . We have the instantaneous relationship of the employment rate and the average working hours

$$l = l(x; \theta) \quad \text{and} \quad h = h(x; \theta)$$

$(+)$     $(-)$                        $(-)$     $(+)$

- Under the symmetric equilibrium, we can obtain

$$\gamma_K = \frac{\dot{K}}{K} = \frac{Y}{K} - \frac{C}{K} \quad \text{and} \quad \gamma_C = \frac{\dot{C}}{C} = \frac{1}{(\varphi - 1)} \frac{\dot{\lambda}}{\lambda} = \frac{1}{(\varphi - 1)} (\rho - r)$$

Thus, we can reduce the dynamic system to the differential equation in terms of  $x$

$$\frac{\dot{x}}{x} = \frac{\dot{C}}{C} - \frac{\dot{K}}{K} = \left[ \frac{\alpha \alpha_k}{(1 - \varphi) [\alpha_E (hl)^{-\beta + \alpha_k}] - 1} \right] A [\alpha_E (hl)^{-\beta + \alpha_k}]^{-\frac{\alpha}{\beta}} + x - \frac{\rho}{(1 - \varphi)}$$

# Balance-Growth-Path Equilibrium

- Linearizing the above equation

$$\dot{x} = D(x - \tilde{x}),$$

where  $D = x \left\{ 1 + \alpha \alpha_E A (hl)^{-\beta-1} [\alpha_E (hl)^{-\beta} + \alpha_k]^{-\frac{\alpha}{\beta}-1} \left[ \frac{\alpha_k (\alpha + \beta)}{(1-\varphi) [\alpha_E (hl)^{-\beta} + \alpha_k]} - 1 \right] \left( l \frac{\partial h}{\partial x} + h \frac{\partial l}{\partial x} \right) \right\}$

- To ensure that the steady-state equilibrium is locally determinate, we assume that  $D > 0$

# Income Distribution

- With regard to income distribution, we derive

$$\sigma_y = \Omega \sigma_k = \frac{(1 + \eta) - \frac{w}{\bar{Y}}}{(1 + \eta)} \cdot \sigma_k$$

- $\sigma_y / \sigma_k$  measures income/wealth inequality
- $\frac{w}{\bar{Y}} = \frac{1}{hl} \cdot \left[ \frac{\alpha \alpha_E (hl)^{-\beta}}{\alpha_E (hl)^{-\beta} + \alpha_k} + \frac{\theta v (1 - \alpha)}{1 - \theta + \theta v} \right] > 0$  the union's power  $\theta$  affects the wage-output ratio and in turn income inequality
- Two important implications
  - (1)  $\Omega < 1$  implies that along the BGP equilibrium income inequality is lower than wealth inequality, which is consistent with the empirical evidence

# Income Distribution

$$\sigma_y = \Omega \sigma_k = \frac{(1 + \eta) - \frac{w}{Y}}{(1 + \eta)} \cdot \sigma_k$$

- (2)  $\sigma_y$  is increasing in the initial distribution of capital  $\sigma_k$ , but decreasing in the wage-to-output ratio  $w/Y$  (via  $\Omega$ ), implying that income inequality could be caused by not only capital endowment, but also salary earning
- Why does income inequality decrease with the wage-output ratio  $w/Y$ ?
  - A higher wage-output ratio implies a higher return on labor and a lower return on capital.
  - Given that labor is more equally distributed than capital, the income gap between any two individuals falls and, consequently, income inequality  $\sigma_y$  decreases with  $w/Y$

# Intensive Margin Response of Labor Force

- *If unionism becomes more intensive, the number of employed workers  $\tilde{l}$  decreases, but each individual employed worker provides more working hours  $\tilde{h}$* 
  - A higher  $\theta$  induces the union to raise the bargained wage  $w$
  - In face of a higher wage rate, on the one hand, the employment rate  $\tilde{l}$  decreases (increases  $\tilde{u}$ ) and on the other hand, employed workers are inclined to increase their labor supply  $\tilde{h}$



# Effects on Economic Growth

- *A higher bargaining power of the union  $\theta$  increases the economic growth rate  $\tilde{\gamma}$ , while it has an ambiguous effect on income inequality  $\tilde{\sigma}_y$* 
  - Since the working-time effect dominates, the effective labor force ( $E = hl$ ) increases. The balanced-growth rate  $\tilde{\gamma}$  increases as well
  - Asterious and Monastiriotis (2001) find a positive growth effect in 18 OECD countries

# Effects on Income Inequality

- There are two conflicting effects on income inequality  $\tilde{\sigma}_y$ :
  - (i) The direct unionization effect: higher bargaining power  $\theta$  allows the union to raise the wage-output ratio
  - (ii) The induced labor force effect: unionization has a positive effect on the effective labor force, which lowers the return on labor and raises the return on capital (MPL diminishing)
- This ambiguity provides a reconciliation for the mixed empirical findings

# Unemployment and Growth

- *In response to a higher degree of unionization, high unemployment and high growth can coexist*
  - Due to the intensive margin response of the effective labor force, our model provides a plausible explanation to the positive correlation between unemployment and growth
  - Saint-Paul (1991), Aghion and Howitt (1992), Caballero (1993), and Gordon (1997) refer to an empirical possibility of a positive unemployment-growth relationship

# Labor Share

In face of de-unionization (a lower  $\theta$ ), the labor income share declines  
( $LS = \frac{wlh}{Y}$ )

- A lower  $\theta$  leads to a decrease in the equilibrium wage rate
- While the employment rate increases, the effective labor  $E$  decreases (working hours  $h$  are more responsive)
- Jayadev (2007) and the European Commission (2007) show that union density is positively correlated with the labor income share in a sample of OECD/EU countries
- Over the past two decades, the industrial countries experienced, on the one hand, the declines in unionization and, on the other hand, the slides in the labor income share

# Calibrations

- The effects of the elasticity of factor substitution is too complicated to be analytically examined. We perform a numerical study
- In line with Lingens (2003), we set  $\alpha_E = 0.6$  and  $\alpha_k = 0.4$  and choose  $\beta = 0.429$  such that the elasticity of substitution between effective labor and capital  $\epsilon = 0.7$ .
  - This is consistent with the estimates of Klump et al. (2007) who show that the elasticity of factor substitution is 0.699 for the US during 1953-2002 and 0.669 for the European area during 1970-2003
- Following García-Peñlosa and Turnovsky (2006), we choose  $\sigma_y = 32.88\%$  (referring to the Gini coefficient in practice) and  $\Omega = 0.17$  in the steady state, implying that the standard deviation of wealth is larger than that of income

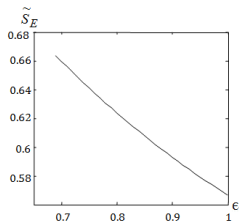
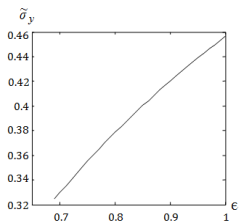
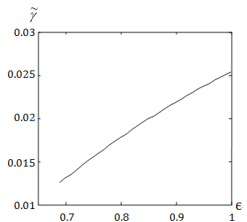
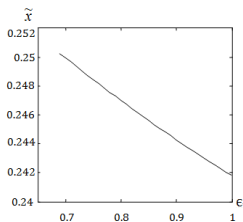
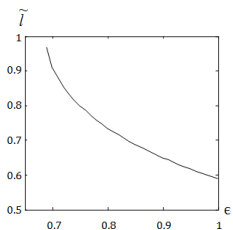
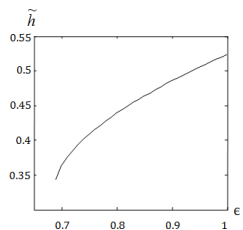
# Calibrations

Parameters		Variables	
$\varphi$	-1.1	$\tilde{x} = \tilde{C}/\tilde{K}$	0.25
$\theta$	0.5	$\tilde{h}$	0.36
$\rho$	0.04	$\tilde{l}$	0.92
$\beta$	0.429	$\epsilon$	0.7
$s$	0.58	$\tilde{u}$	0.08
$\alpha_E$	0.6	$\tilde{r}$	1.3%
$\alpha_k$	0.4	$\tilde{\Omega}$	0.17
$\alpha$	0.874	$\tilde{S}_E$	0.66
$A$	0.495		
$\nu$	0.501		
$\eta$	1.40		

## Result 1: Effects of the Factor Substitution

- In the face of a higher  $\epsilon$ , the firm is inclined to use more capital to substitute for labor, because
  - the firm has the right to determine the capital level unilaterally
  - whereas the employment level has to be negotiated with the trade union
- This raises the return rate on capital and lowers the return rate on labor
  - Since labor is more equally distributed than capital, income inequality increases
  - Since labor is greatly substituted by capital, the labor income share  $S_E$  declines
- Since the economy accumulates more capital, the steady-state  $x = C/K$  decreases and the balanced-growth rate  $\gamma$  increases
- Since labor is substituted by capital more easily, the optimizing firms tend to decrease the number of workers (the employment rate  $l$ ), but use these employed workers more intensively (increase the working time  $h$ )

# Result 1: Effects of the Factor Substitution





## Result 2: Unionization and Factor Substitution

How does factor substitution affect the unionization effect?

- In face of a higher elasticity of substitution, labor are more easily substituted by capital
- The influence of unionization becomes weaker
- The steady-state effects of unionization on growth, income inequality, employment and working hours all become weaker
- The labor share effect becomes more pronounced

# Conclusions

- 1 In this paper we allow for the unemployment rate, the balanced-growth rate, and income inequality to be interdependent and endogenously determined in a unified macro model, so thoroughly examining the consequences of unionization.
- 2 In a unified model our results can be consistent with three major sets of empirical evidence
- 3 A simple numerical example confirms these results to be empirically convincing