Labor Taxation and the Distribution of Income Shocks over the Cycle

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Key Contributions

- Introduce non-linear income taxes in Robin (2011) with endogenous vacancy creation.
- Develop a solution algorithm based on Reiter (2009).
- Evaluate the contribution of income taxes to the distribution of cyclical income shocks.

Cyclical Income Risk

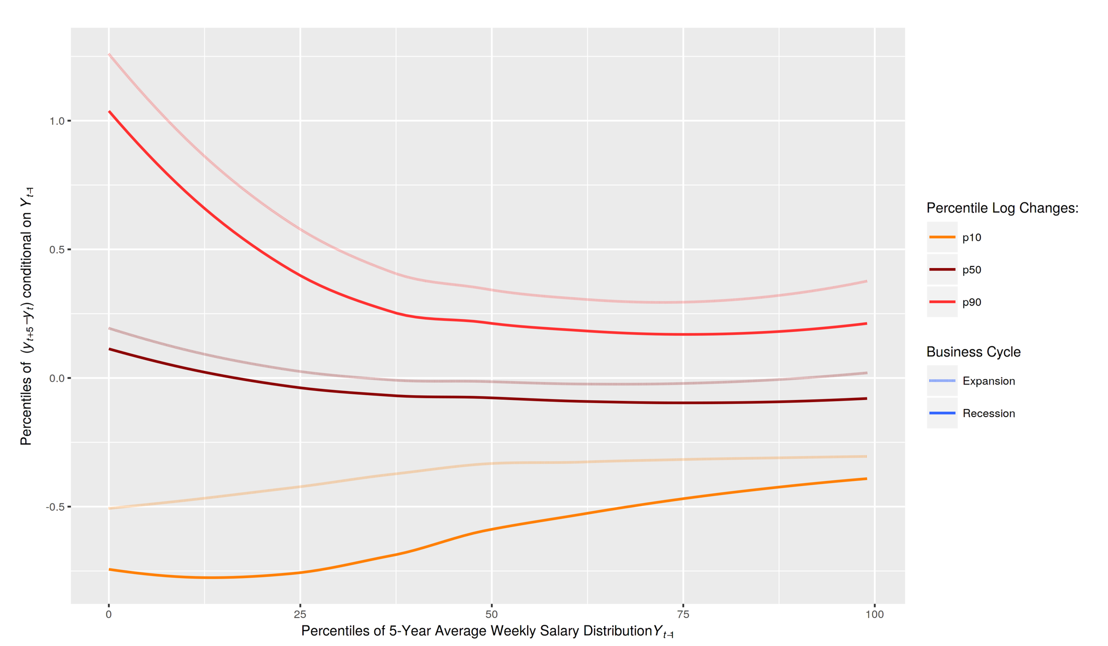

Figure 1: 5-year changes in log annual salary. Italy: 1977-2012. *source*: LoSai dataset, Estratti Conto.

Key facts on cyclical income risk:

- log-income changes are bigger and more cyclical for low-income workers.
- cyclical income risk driven mostly by extreme negative shocks (Guvenen et al. (2014)).
- Unemployment exits and entries play a key role.

Main Questions

1. **Can we reproduce the observed cyclical and distributional properties of labor income shocks?**
2. **How are these properties affected by alternative income tax schedules?**

Model

- **Continuum of workers with heterogeneous ability x and homogeneous firms.**
- **Aggregate productivity z_t evolves stochastically.**
- A firm-worker match produces output of value $p(x, z_t)$.
- **The government taxes labor income w according to a tax schedule** $\tau_w(w)$ and redistributes uniformly.
- Firms post vacancies V_t at cost $c(V_t)$.
- Per period number of meetings M_t is given by a matching function $M(L_t, V_t)$ with search effort

$$L_t = \int_0^1 u_{t+}(x)dx + s\int_0^1 h_{t+}(x)dx$$

- Unemployed (employed) workers meet a firm with probability λ_t ($s\lambda_t$), with

$$\lambda_t = \frac{M(L_t, V_t)}{L_t}$$

Let us define total and worker's private surplus from a match as $S_t(x, w)$ and $\Delta_t(x, w)$, respectively.

Wages are set following Robin (2011). Only two possible new wages per period and type:

$$\phi_t^0(x) : \Delta_t(x, \phi_t^0(x)) = 0$$

$$\phi_t^1(x) : \Delta_t(x, \phi_t^1(x)) = S_t(x, \phi_t^1(x))$$

Contrary to Robin (2011) and Lise Robin (2017) the surplus:

- depends on its allocation between workers and firms (i.e. on w) = partially transferable utility.
- depends on the offer arrival rate λ_t

λ_t, on the other hand, depends on L_t and

$$V_t = (c')^{-1}\Big(\frac{M(L_t, V_t)}{V_t} J_t\Big)$$

and therefore indirectly on the history-dependent distribution of matches $h_t(x) = \ell(x) - u_t(x)$.

Resolution Method

The model can be written as:

$$\begin{cases} \big(\underbrace{\triangle(x, w; \Gamma)}_{\text{Worker surplus}}, \underbrace{S(x, w; \Gamma)}_{\text{Joint surplus}}\big) = \Phi_1(\triangle(x, w, \Gamma), S(x, w; \Gamma)) \\ \underbrace{h(.)}_{\text{Distribution of Employment}} = \Phi_2(h(.)|\triangle(x, w; \Gamma), S(x, w; \Gamma)) \end{cases}$$

where the aggregate state variable Γ contains z, $h(.)$ and the tax schedule $\tau_w(.)$

1. Provide a finite representation of the model

Replace infinite dimensional (S, $\triangle$, h) objects by discrete values on grids: $F(\mathbf{X_t}, \mathbf{X_{t-1}}, \eta_\mathbf{t}, \varepsilon_\mathbf{t})$
$\mathbf{X_t}$ contains values on grids $(S_{ij}, \triangle_{ij}, h_k)_t$, $\eta_\mathbf{t}$ are expectational errors and $\varepsilon_\mathbf{t}$ are shocks.

2. Solve for a steady-state of the discrete model

- Solve for S and $\triangle$ holding fixed h
- Solve for h holding fixed S and $\triangle$

3. Linearize F around its non-stochastic steady-state and use a rational expectation solver

$$F_1(\mathbf{X_t} - \mathbf{X_{ss}}) + F_2(\mathbf{X_{t-1}} - \mathbf{X_{ss}}) + F_3\eta_\mathbf{t} + F_4\varepsilon_\mathbf{t} = \mathbf{0}$$

$F_1 = \frac{\partial F}{\partial \mathbf{X_t}}|\mathbf{X_{ss}}$, $F_2 = \frac{\partial F}{\partial \mathbf{X_{t-1}}}|\mathbf{X_{ss}}$, $F_3 = \frac{\partial F}{\partial \eta_\mathbf{t}}|\mathbf{X_{ss}}$, $F_4 = \frac{\partial F}{\partial \varepsilon_\mathbf{t}}|\mathbf{X_{ss}}$

The outcome is a linear model:

$$\mathbf{X_{t+1}} = A_\tau \mathbf{X_t} + B_\tau \varepsilon_\mathbf{t+1}$$

Surplus Function

$$S_t(x, w) = p(x, z_t) - \tau_w(w)w - b(x) + \frac{1-\delta}{1+r}\mathbb{E}_t\Big[\mathbb{1}\{S_{t+1}(x, w) < 0\}R_{t+1}^w(x) + \mathbb{1}\{S_{t+1}(x, w) \geq 0\}[s\lambda_{t+1}S_{t+1}(x, \phi_{t+1}^1(x)) + (1 - s\lambda_{t+1})A_{t+1}(x, w)]\Big]$$

$$R_t^w(x) = \begin{cases} S_t(x, \phi_t^1(x)) & \text{if } S_t(x, \phi_t^0(x)) \geq 0 \\ 0 & \text{if } S_t(x, \phi_t^0(x)) < 0 \end{cases}$$

$$A_t^w(x) = \begin{cases} S_t(x, w) & \text{if } 0 \geq \Delta_t(x, w) \geq S_t(x, w) \\ S_t(x, \phi_t^1(x)) & \text{if } \Delta_t(x, w) > S_t(x, w) \\ S_t(x, \phi_t^0(x)) & \text{if } \Delta_t(x, w) < 0 \end{cases}$$

(Preliminary) Counter-Factual

We calibrate the model using Italian administrative data for the period 1977-2012. We use our model to asses two alternative income tax regimes:

- Italian income tax regime in 2010.

Table 1: Tax Schedule

Rate	23%	27%	38%	41%	43%
Thr.	15k	28k	55k	75k	-

- Revenue equivalent flat tax (24% flat rate).

Table 2: Counter-Factual - Aggregate

	1-Year Log Income Change			
	Level			
	P10	P50	P90	Std
Step	-0.349	0.002	0.345	0.327
Flat	-0.449	0	0.434	0.42
	(Time Series) St. Deviation			
Step	0.489	0.244	0.469	0.264
Flat	0.649	0.337	0.609	0.307

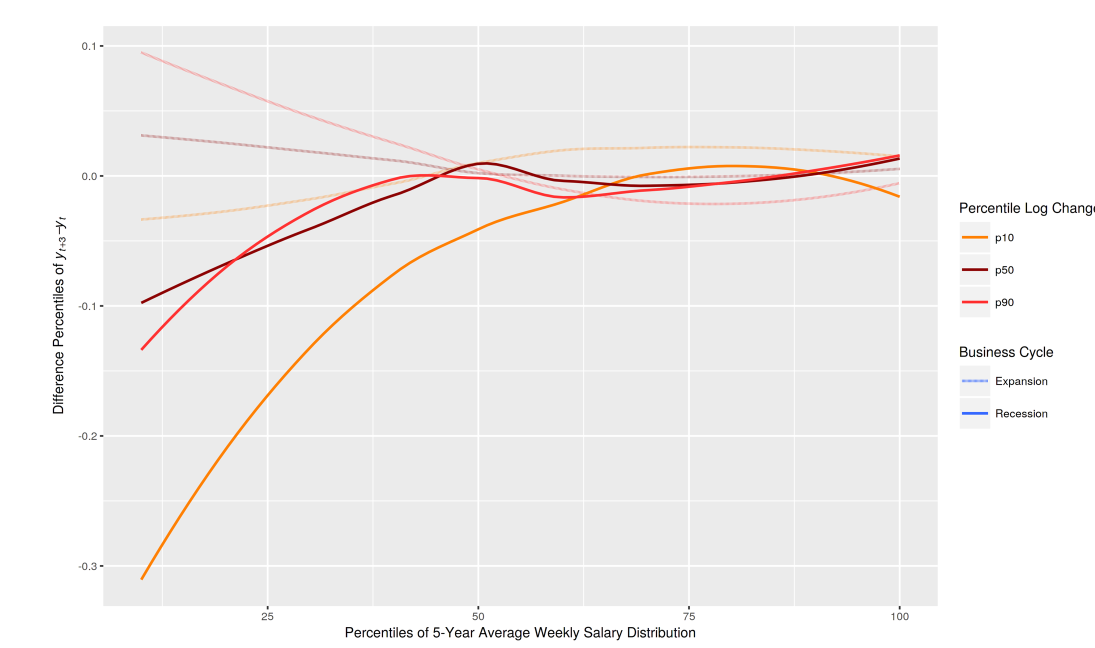

Figure 2: 3-year changes in log annual salary (simulated data)

Conclusion

- An income tax introduces an additional level of complexity in a model à la Lise, Robin (2017).
- Reiter (2009) allows to efficiently solve and estimate the model (estimation is ongoing).
- Preliminary results show that, on aggregate, a revenue equivalent **flat tax**:
  - **increases the aggregate volatility and dispersion** of income changes.
  - the effect is driven by low income workers.