

The Robot Economy and optimal tax-transfer reforms

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Processes like globalisation, automation and digitalisation might imply important changes on the volume and structure of labour demand.

Possible effects are:

- fewer jobs;
- more temporary jobs;
- more intermittent careers;
- increased inequality and polarization of incomes;
- more geographical, sectoral and temporal mobility of resource allocation;
- more low- and high-skill jobs at the expense of average-skill ones.

The traditional welfare policies might need a redesign in view of the changes prospected above.

- Sachs and Kotlikoff (2012); Acemoglu and Restrepo (2017); Autor and Dorn (2013); West (2018); Rodrik (2016); Spence (2011).

An important policy issue is whether and how the tax-transfer rules should be reformed to cope with those changes.

Research questions:

- a. Can a universalistic TTR and what shape of it outperform the current categorical and targeted TTRs?
- b. Can a universalistic TTR and what shape of it be a better response (compared to the current TTR) to the Robot Economy? process.

We perform the long-run equilibrium with the current TTR and with the polynomial optimal TTR for France, Germany, Italy and Luxembourg under three different scenarios:

- the Current Economy.
- the Jobless Economy and
- the Polarized Economy .

Our Methods:

- Household choices are simulated with a RURO model of labour supply;
- The RURO model can account for alternative labour demand scenarios, a Jobless Economy and a Polarized Economy scenario;
- We consider the class of TTRs where total household disposable income is a 4th degree transformation of total household taxable income;
- Within the above class, we identify the optimal (Social Welfare maximizing) TTR under alternative labour demand scenarios;

Our Methods:

- In order to identify the optimal TTRs, we adopt a computational approach, embedding the microsimulation of the household choices into a numerical optimization procedure;
- All the simulations are performed while taking into account the public budget constraint (fiscal neutrality) and the labour market equilibrium constraint (allowed by the features of the RURO model).

RURO Model and Equilibrium Condition

The probability that individual i is willing to hold a job of type j turns out to be (e.g., Aaberge et al. 1995, 1999):

$$\bullet P_i(j; w_i, \tau) = \frac{\exp(V_i(j; w_i, \tau) + \sum_{t=0}^T \delta_t D_t)}{\sum_{x=0}^M \exp(V_i(j; w_i, \tau) + \sum_{t=0}^T \delta_t D_t)}, \quad \dots \quad (1)$$

with

- $\delta_0 = \ln(J/A_0)$, $\delta_t = \ln(\frac{J}{A_0} \frac{J_t}{J})$, where
- J = total number of market jobs, and
 J_t = total number of jobs of type t , and A_0 , A_t are constants.
- U = quadratic form in leisure and income parameters depending on socio-demographic characteristics: $V(h, y) + \epsilon$
- Opportunity set: 7 (49) alternatives $[h, y]$ for singles (couples)

Polynomial tax-transfer rules Model

We look for optimal TTRs within the class of rules defined as a polynomial functions of taxable income:

- $C = \tau_0 \sqrt{N_i} + \tau_1 y_i + \tau_2 y_i^2 + \tau_3 y_i^3 + \tau_4 y_i^4 \quad \dots \quad (2)$

where C = total household disposable income; y_i = household total taxable income; and N_i = household size. τ_0 = basic transfer(income), $1 - \tau_1$ = tax rate, and so on.

Comparable Money-metric Utility (CMU)

We calculate the expected maximum utility attained by household i under TTR τ_i (McFadden 1978):

$$\bullet E(\max(U_i(j, w_i, \tau_i, \epsilon_{ij}))) = \ln(\sum \exp(V_i(x, w_i, \tau_i))) \quad \dots \quad (3)$$

Analogously, the expected maximum utility attained by the reference household R under the reference TTR τ_R

$$\bullet E(\max(U_i(j, w_i, \tau_R, \epsilon_{ij}))) = \ln(\sum^X \exp(V_i(x, w_i, \tau_R))) \quad \dots \quad (4)$$

The reference household is the couple household at the median value of the distribution of $E(\max(U_i(j, w_i, \tau_R, \epsilon_{ij})))$.

The CMU of household i under TTR τ , $\mu_i(\tau)$, is defined as the gross income that a reference household under a reference TTR τ_R would need in order to attain an expected maximum utility equal to $E(\max(U_i(j, w_i, \tau, \epsilon_{ij})))$.

Social Welfare (Kolm)

- The Kolm (1976) Social Welfare index

$$W = \bar{\mu} - \left(\frac{1}{k}\right) \ln \left[\sum_i \frac{\exp\{-k(\mu_i - \bar{\mu})\}}{N} \right] \quad \dots \quad (5)$$

where

μ_i = utility of household i

$\bar{\mu} = \left(\frac{1}{N}\right) \sum_i \mu = \text{efficiency}$

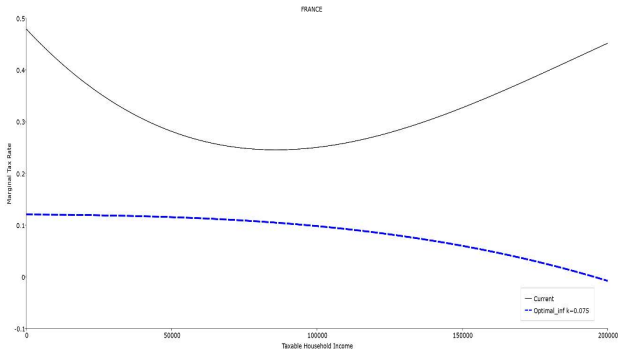
$\left(\frac{1}{k}\right) \ln \left[\sum_i \frac{\exp\{-k(\mu_i - \bar{\mu})\}}{N} \right] = \text{inequality}$

k = inequality Aversion parameter

Identifying optimal rules:

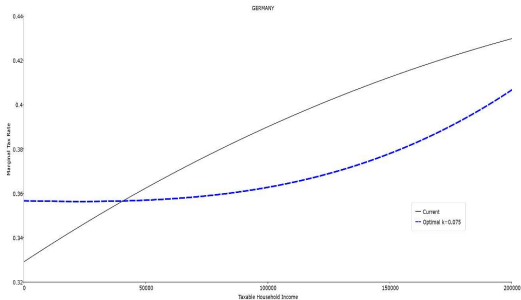
- 1. Start with initial guesses τ^0 and ν^0
- 2. Compute comparable money metric measures $\mu_1(\tau^0, \nu^0), \dots, \mu_H(\tau^0, \nu^0)$ and the social welfare function $W(\mu_1(\tau^0, \nu^0), \dots, \mu_H(\tau^0, \nu^0))$
- 3. Compute the total expected net tax revenue $T(\tau^0, \nu^0)$
- 4. Compute the total number of jobs Je^{ν^0} and the total number of individuals willing to work $M(\tau^0, \nu^0)$
- 5. Iterate (1) - (4) by updating $(\tau^0, \nu^0), (\tau^1, \nu^1), \dots$, until $W(\mu_1(\tau^*, \nu^*), \dots, \mu_H(\tau^*, \nu^*))$ is maximized and $T(\tau^*, \nu^*) \geq R$ and $M(\tau^*, \nu^*) \geq Je^{\nu^*}$ are both satisfied, where R is the net tax revenue required by public budget constraint.

The effects of the parameters $\tau^1, \tau^2, \dots, \tau^4$ on the shape of the TTRs - France



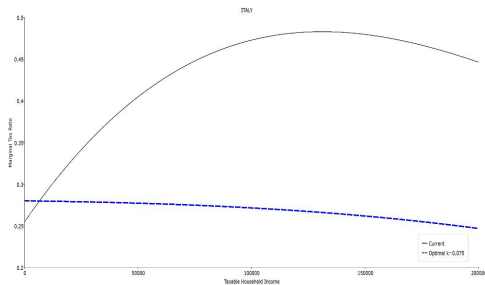
Note: The almost flat MTR hold whatever the value of the inequality aversion parameter. The current 4th degree polynomial MTR measures the change in total household taxes when total household income increases one euro.

The effects of the parameters $\tau^1, \tau^2, \dots, \tau^4$ on the shape of the TTRs - Germany



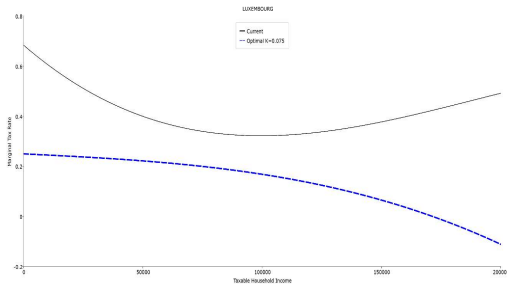
Note: Germany envisages an expensive current income support policies and yet a slowly increasing MTR on low income.

The effects of the parameters $\tau^1, \tau^2, \dots, \tau^4$ on the shape of the TTRs - Italy



Note: In Italy, the current MTRs are first steeply increasing up to taxable income 100000 and then decreasing.

The effects of the parameters $\tau^1, \tau^2, \dots, \tau^4$ on the shape of the TTRs - Luxembourg



Note: The current systems in Luxembourg appear to envisage relatively generous income support policies at lower or zero income followed by very high implicit marginal benefit reduction rates. The optimal rules suggest less expensive income support and a longer phase-out.

Table: Current and optimal TTRs

		The Current Economy		The Jobless Economy		The Polarised Economy	
		Current TTR	Optimal TTR	Current TTR	Optimal TTR	Current TTR	Optimal TTR
France	UBI	603	269	603	252	603	297
	FT	0.52	0.85	0.52	0.82	0.52	0.92
Germany	UBI	607	643	607	586	607	585
	FT	0.67	0.64	0.67	0.62	0.67	0.62
Italy	UBI	217	312	217	241	217	269
	FT	0.75	0.63	0.75	0.61	0.75	0.71
Luxembourg	UBI	1470	1533	1470	1466	1470	1464
	FT	0.32	0.30	0.32	28	0.32	0.30

Note: $\tau_2 = 0, \tau_3 = 0, \tau_4 = 0$.

Universal Basic Income(UBI)= τ_0 , FLAT TAX (FT)= $1 - \tau_1$.

k=Inequality Aversion Parameter.

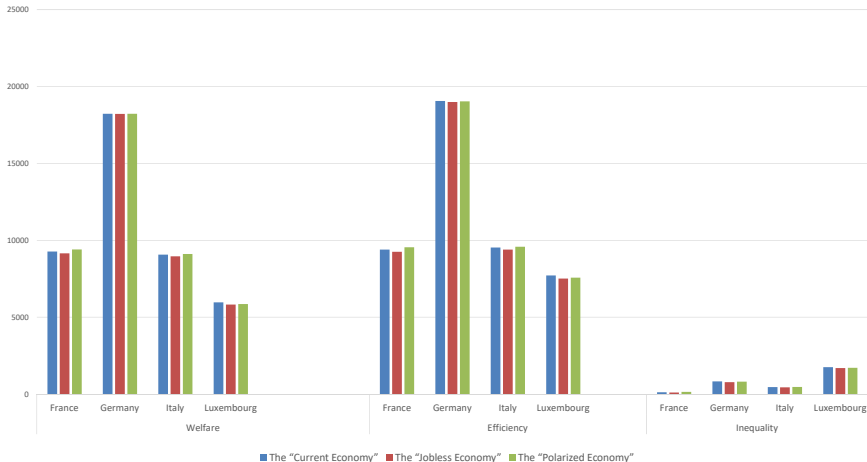
Table: Participation% and Weekly hours

		The Current Economy		The Jobless Economy		The Polarised Economy	
		Current TTR	Optimal TTR	Current TTR	Optimal TTR	Current TTR	Optimal TTR
France	Participation%	92.04	93.70	92.38	92.26	93.55	93.00
	Weekly hours	35.98	36.96	35.99	36.15	36.56	36.96
Germany	Participation%	84.02	86.72	84.13	85.35	84.68	84.80
	Weekly hours	31.96	32.90	31.83	32.07	32.15	32.10
Italy	Participation%	79.58	82.24	80.74	81.11	81.29	80.55
	Weekly hours	28.68	29.54	29.05	29.16	29.27	29.03
Luxembourg	Participation%	87.95	89.16	88.14	87.78	85.00	87.92
	Weekly hours	34.20	34.61	34.26	34.07	33.23	34.17

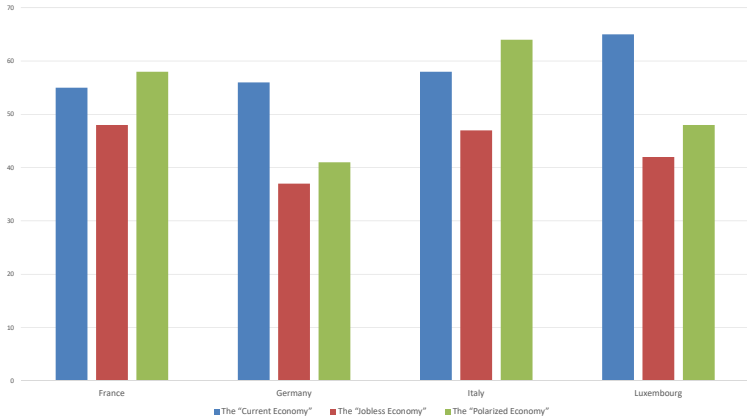
Table: Disposable income and Poverty gap%

		The Current Economy		The Jobless Economy		The Polarised Economy	
		Current TTR	Optimal TTR	Current TTR	Optimal TTR	Current TTR	Optimal TTR
France	Disposable income	3612	3809	3452	3470	3650	4097
	Poverty gap%	3.76	5.13	3.99	6.41	3.25	4.77
Germany	Disposable income	3435	3445	3298	3140	3404	3320
	Poverty gap%	6.24	5.28	6.76	6.35	6.35	6.21
Italy	Disposable income	1852	1934	1780	1697	1982	1997
	Poverty gap%	18.91	11.07	18.95	15.32	17.30	12.32
Luxembourg	Disposable income	4734	4796	4587	4418	5963	4560
	Poverty gap%	4.42	0.99	4.70	0.00	3.38	0.00

Welfare, Efficiency, and Inequality



Winners



Conclusion – Back to NIT + FT?

- An extremely simple TTR based on total household income and featuring a UBI (or, equivalently, a universal NIT) outperforms complicated, categorical and strongly progressive TTRs such as the current ones.
- While in Luxembourg the optimal polynomial TTR is close to the current one, in France, Italy and Germany the optimal polynomial TTR features close-to-flat MTRs

Conclusion – Back to NIT + FT?

- The shape of the polynomial optimal TTRs suggests that a combination of UBI (or NIT) plus a (almost) FT is more effective than the current TTR in promoting the level of economic activity and in sustaining the level of household income above the poverty line.
- Under both the Jobless Economy and the Polarized Economy scenarios, the results are similar to those obtained under the current scenario: the re-optimised polynomial TTRs which take into account the new scenarios are definitely superior to the current TTRs in France, Germany and Italy and candidate themselves as reforms that can better cope with the challenges raised by automation and globalization.

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