3RD BANCA D'ITALIA WORKSHOP ON MICROSIMULATION MODELLING
ADVANCING MICROSIMULATION MODELLING:
METHODS, APPLICATIONS, AND INNOVATIONS
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Lost Jobs, New Jobs and Optimal Tax-Transfers Reforms

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Motivation

- **New scenarios** induced by automation and globalisation:
  - lost jobs, new jobs, polarisation
  - increased **complexity** and uncertainty
  - **Stress** on welfare policies

- Directions for Tax–Transfer **reforms:**
  - More sophisticated **means-tested** and more selective **categorical** policies?
  - **Alternative view**: simple, unconditional, universal policies (e.g. UBI, NIT, FT)

Purpose

- Identify a simple and universal "optimal" tax-transfer rule, with "optimal" = Social Welfare maximising within a **flexible** class of tax-transfer rules

- Can a simple and universal tax-transfer rule

  - outperform (Social Welfare wise) the complex and categorical current rules?

  - more efficiently cope with new labour market scenarios?

Our approach

- **Computational Optimal Taxation** approach

- Combination of
  - **behavioural microsimulation**

  and
  - **numerical optimisation**

Our approach

- A **microeconometric model** **simulates** households' **choices** and households' **welfare** given
  - **alternative tax-transfer rules** and
  - **alternative labour market scenarios**
- **Money-metric utilities** of household choices are computed

- Households' utilities are aggregated into a **Social Welfare function**

- An **optimization** routine searches **Tax-Transfer rules** and **wage rates distributions** until Social Welfare is maximised under constraints:
  - **Fiscal neutrality**
  - **Labour market equilibrium** (Colombino 2013)

RURO = Random Utility Random Opportunities

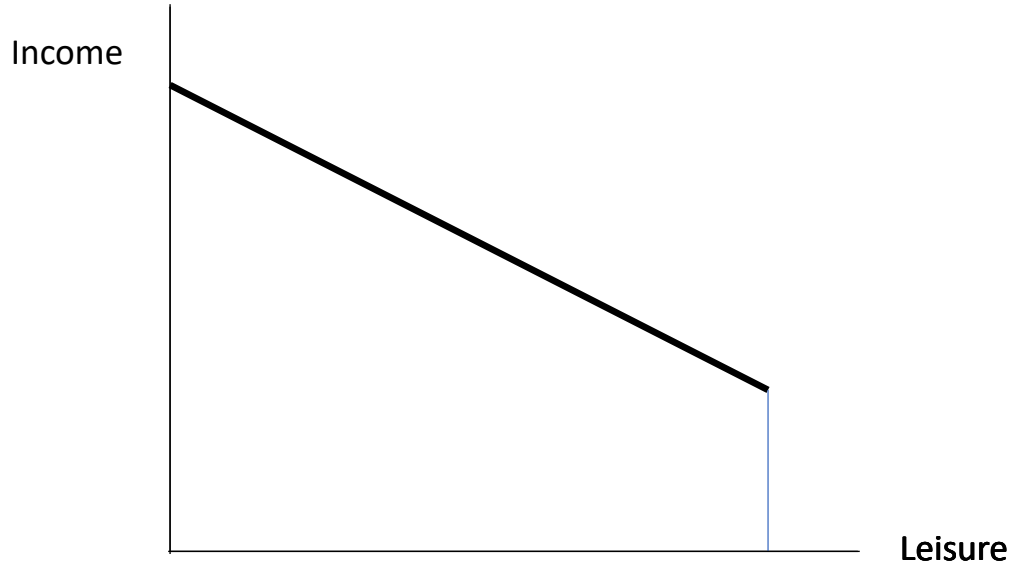
The RURO model (Aaberge & Colombino 2018) can be interpreted as

- a generalization of a standard labour supply model
- and more specifically of a Conditional Logit model…

RURO labour supply microeconometric model

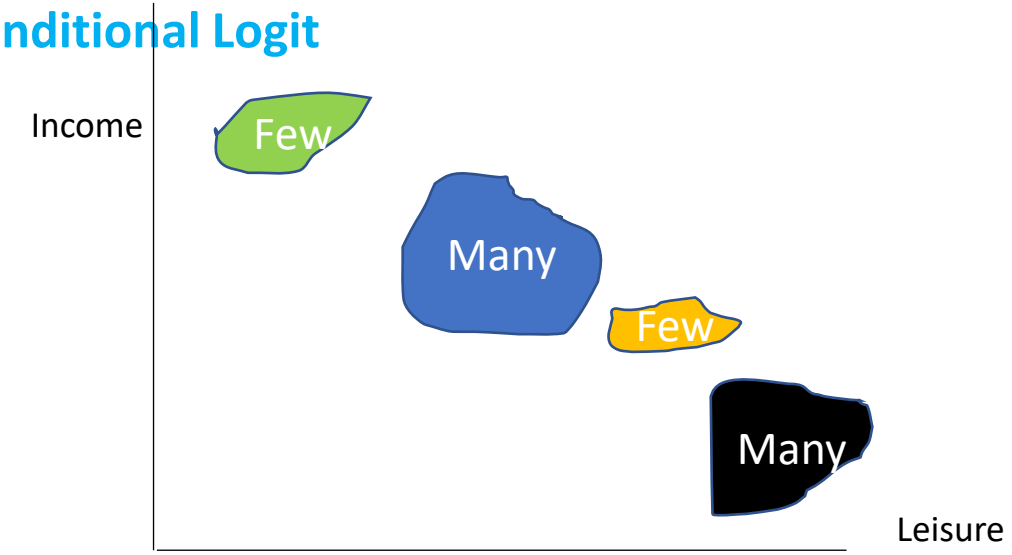
Traditional model

All the alternatives are equally available



RURO model

Different availability of jobs for different individuals. **It permits to represent different labour demand scenarios. A generalization of Conditional Logit**



Conditional Logit Model

$$U_j = V_j + \varepsilon = \text{ utility of a job of type j}$$

$$\text{Prob}(U_k = \max_j (U_1, \ldots U_j, \ldots, U_M) = \frac{\exp\{V_k\}}{\sum_{j=1,\ldots,M} \exp\{V_j\}}$$

RURO labour supply microeconometric model

$U_j = V_j + \varepsilon =$ utility of a job of type j

$g_j =$ p.d.f. (or relative density) of jobs of type j

$$\text{Prob}(U_k = \max_j (U_1, \ldots U_j, \ldots, U_M) = \frac{\exp\{V_k\} g_k}{\sum_{j=1,\ldots,M} \exp\{V_j\} g_j}$$

The terms $g_1, \ldots, g_M$ make it possible to

– represent alternative labour market scenarios

– account for market equilibrium (Colombno 2013)

RURO labour supply microeconometric model

Each individual can choose among 7 types of activities (“jobs”):

- Non-market activities (“leisure”)
- Part-time wage employment
- Full-time wage employment
- Over-time wage employment
- Part-time self-employment
- Full-time self-employment
- Over-time self-employment

RURO labour supply microeconometric model

- We estimate **12 separate models**:
  - 3 types of households
    - Couples
    - Female singles
    - Male singles
  - 4 countries
    - France
    - Germany
    - Italy
    - Luxembourg
- Head-of-household aged 18 – 55

- Data used for estimation and simulation are built from EUROMOD datasets (EU-Silc2015)

The class of candidate optimal Tax-Transfer rules

We look for an optimal TTR within a **polynomial class**:

$$C_i = \tau_0 \sqrt{H_i} + \tau_1 X_i + \tau_2 X_i^2 + \tau_3 X_i^3 + \tau_4 X_i^4$$

- C = total household net disposable annual income
- X = total household taxable annual income
- H = household size
- τ_0 = transfer

The polynomial rule completely replaces the current one

The class of candidate optimal Tax-Transfer rules

$$C_i = \tau_0 \sqrt{H_i} + \tau_1 X_i + \tau_2 X_i^2 + \tau_3 X_i^3 + \tau_4 X_i^4$$

- If $\tau_0 > 0$: UBI or, equivalently, NIT
- If $\tau_2 = \tau_3 = \tau_4 = 0$, then we have a UBI (or NIT) + FT rule

$$C_i = \tau_0 \sqrt{H_i} + \tau_1 X_i$$

- with MTR = 1- τ_1

Scenarios

We consider **three alternative labour demand scenarios**:

- Status quo (the observed one)
- Jobless: -20% available market jobs for medium-skill individuals, for any level of the wage rate (i.e. a horizontal shift of the demand curve)
- Polarised: -20% available market jobs for medium-skill individuals, + 10% available market jobs for high-skill and for low-skill individuals, for any level of the wage rate (i.e. a horizontal shift of the demand curve)
  - **High-skill**: above the 75° %tile of the wage distribution
  - **Low-skill**: below the 25° %tile of the wage distribution
  - **Medium-skill**: between the 25° and the 75° %tiles of the wage distribution.

Available jobs

The number of available jobs - of a given type - for individuals of a given skill level, is determined by a constant-elasticity demand "curve":

$$J = A\omega^{-\eta}$$

Social Welfare

We adopt the following Social Welfare index (Kolm 1976):

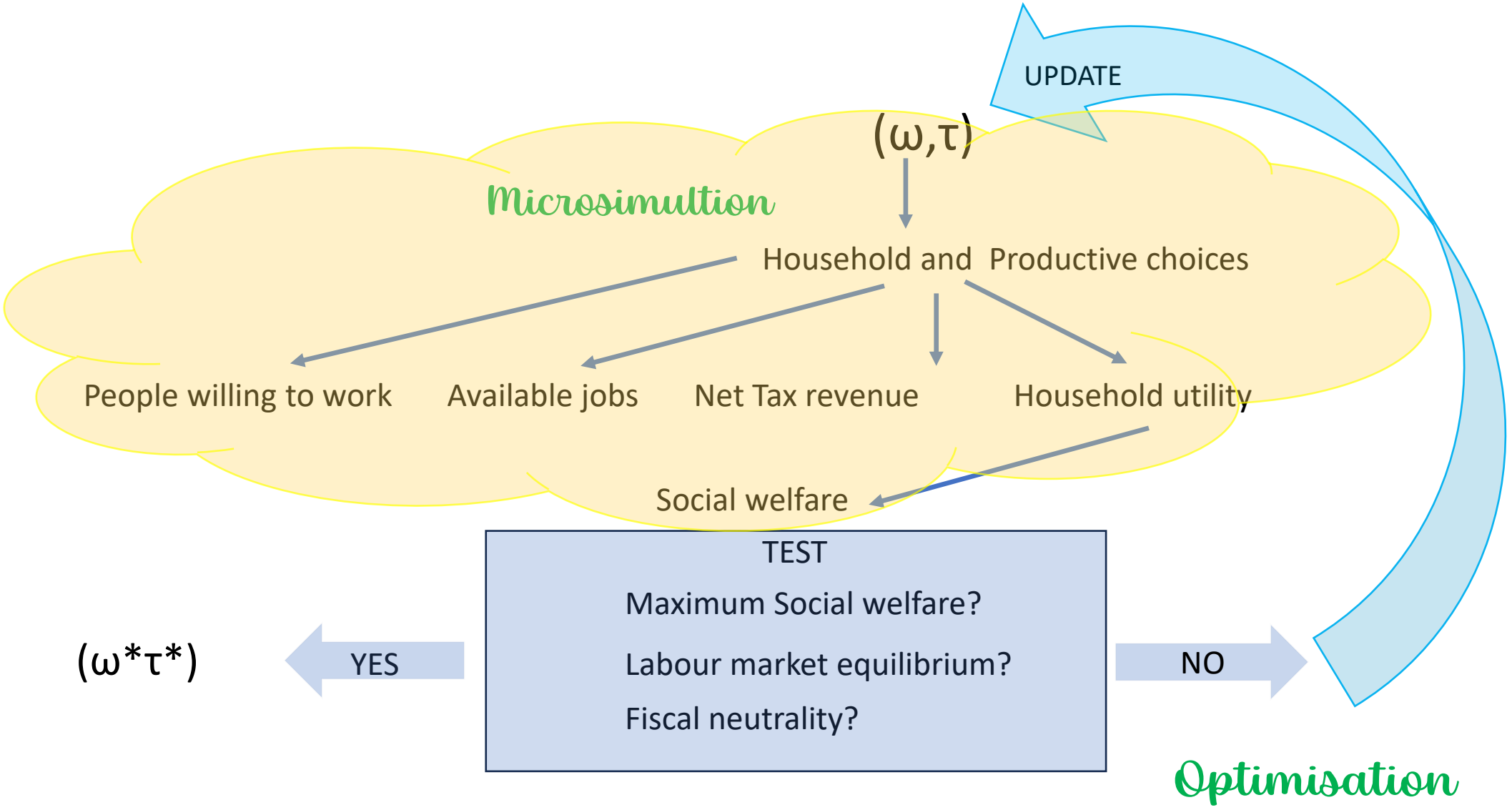
$$W = \bar{y} - \frac{1}{k}\ln\left[\sum_{i}\frac{\exp\left\{-k\left(y_i - \bar{y}\right)\right\}}{N}\right] \rightarrow \begin{cases} \bar{y} \text{ as } k \text{ approaches } 0 \\ \min_i\left(y_i\right) \text{ as } k \text{ goes to } \infty \end{cases}$$

y_i = household i's money-metric utility (King 1983)

N = number of households

k = index of social aversion to inequality (= 0.075 in this paper)

Identifying optimal Tax-Transfer Rules τ* and equilibrium wages ω* for a given scenario



Results

- Optimal polynomial TTRs are **superior** (more efficient, although slightly disequalizing) to the current ones

- Optimal TTRs include a **UBI** (or, equvalently, a **NIT**)

- Optimal marginal tax rates are **flatter** than the current ones in France, Germany and Italy, close to flat at least up to 100000 euros:

$$C_i = \tau_0 \sqrt{H_i} + \tau_1 X_i$$

- **Exception**: Luxembourg, where optimal TTR is very close to the current (not flat) one

- Higher aversion to inequality (Kolm's k) leads to the same shape with higher UBI and FT (Colombino & Islam (2022)

The parameters of the optimal Tax-Transfer rule

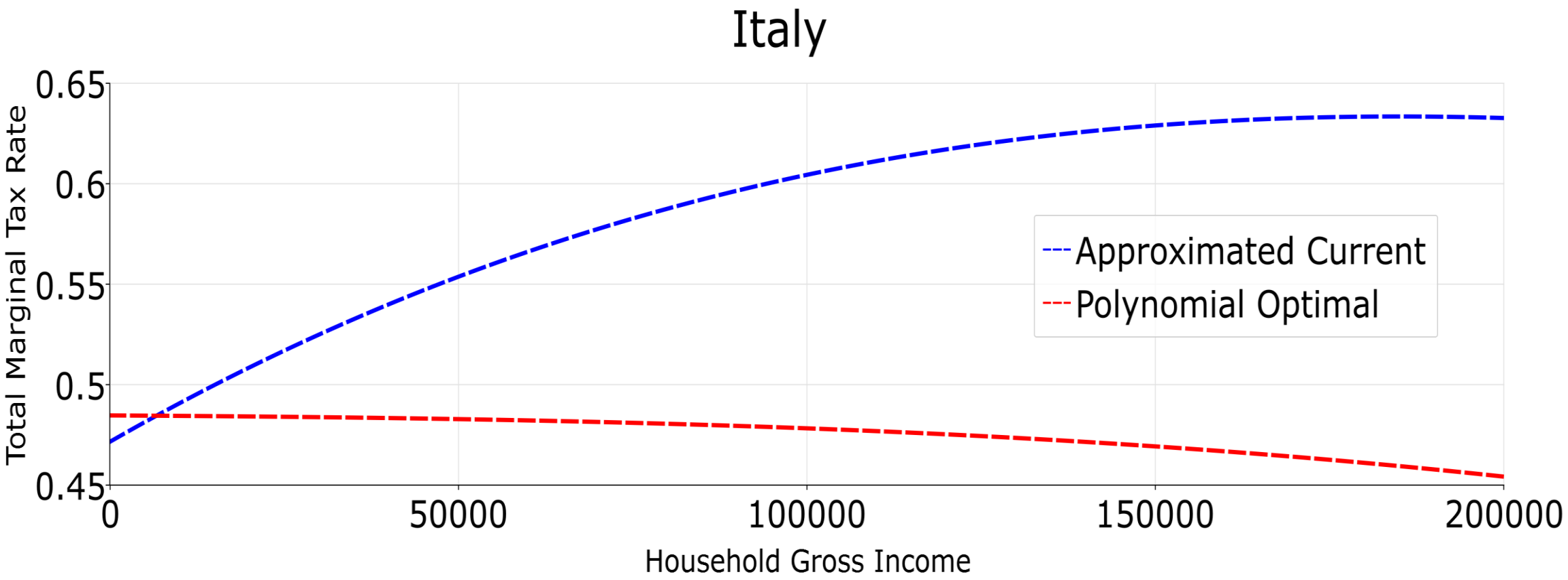
- The next slide shows, for each country, the parameters of the optimal polynomial Tax-Transfer rule under the Status quo scenario.

- It also shows analogous parameters (in italics) that represent a polynomial approximation to the current Tax-Transfer rule.

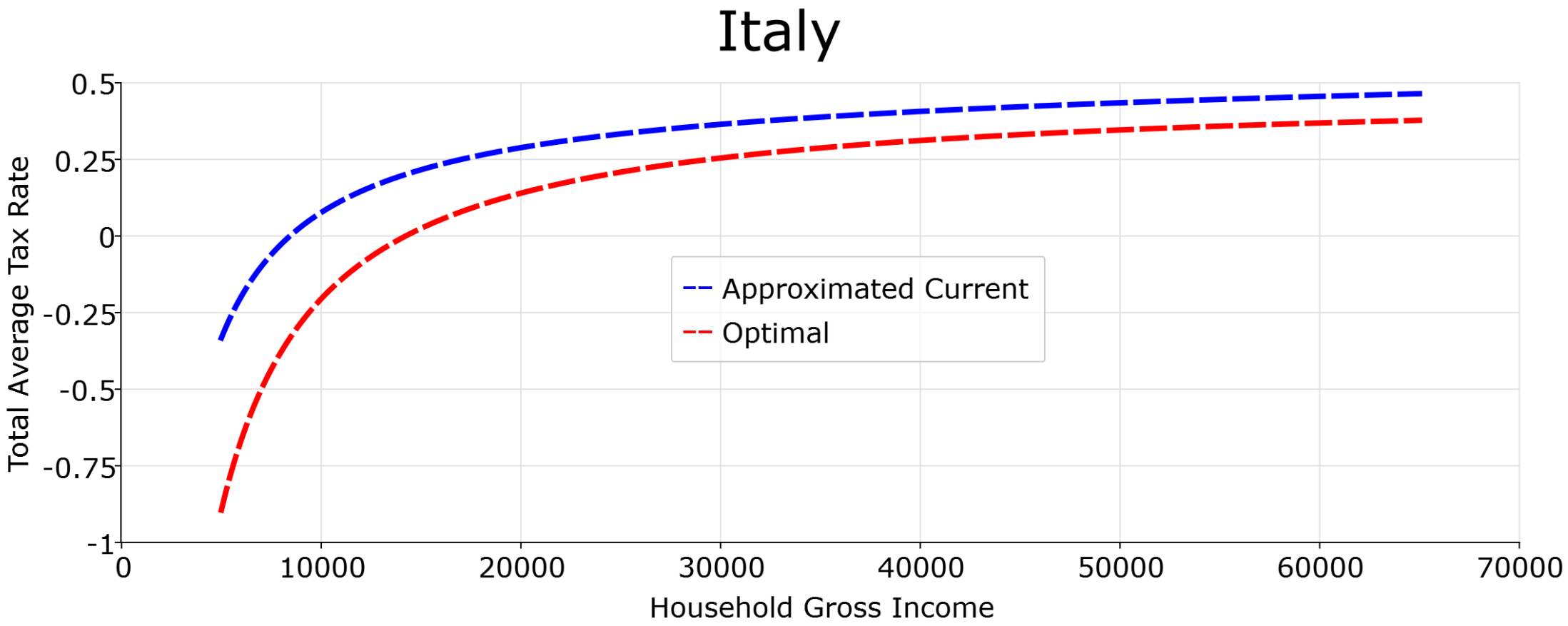
Optimal TTR vs. (approx.) Current TTR under Status quo scenario

	France		Germany		Italy		Luxembourg	
	Approx. Current TTR	Optimal TTR	Approx. Current TTR	Optimal TTR	Approx. Current TTR	Optimal TTR	Approx. Current TTR	Optimal TTR
τ_0	*603*	466	607	728	*217*	370	*1470*	1495
τ_1	*0.52*	0.92	*0.67*	0.72	*0.75*	0.77	*0.32*	0.38
τ_2	*3.01*	0.03	*-0.36*	0.05	*-1.98*	0.02	*4.12*	4.13
τ_3	*-1.51*	0.01	*0.03*	-0.06	*0.69*	0.02	*-1.87*	-1.86
τ_4	*0.20*	0.05	*-0.00*	0.01	*-0.07*	0.03	*0.25*	0.26

Total Marginal Tax Rate (including social security contributions)

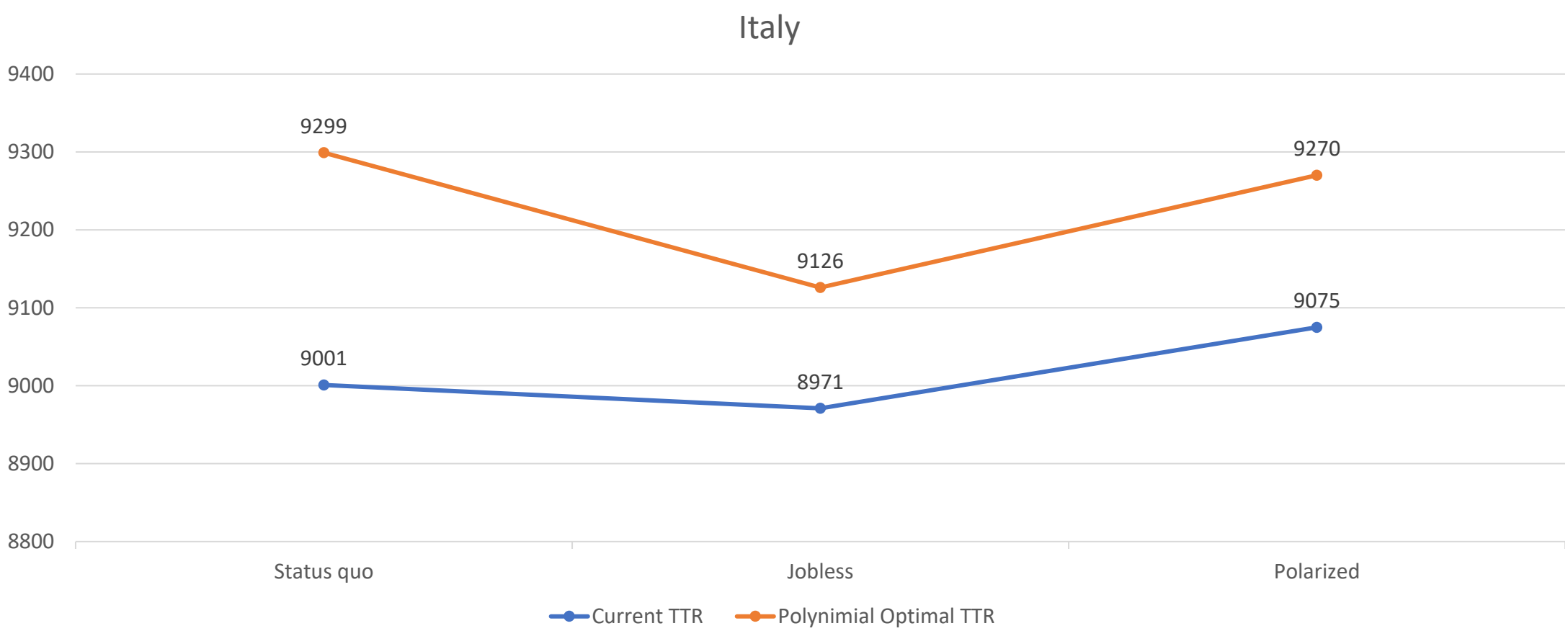


Total Average Tax Rate (including social security contributions)

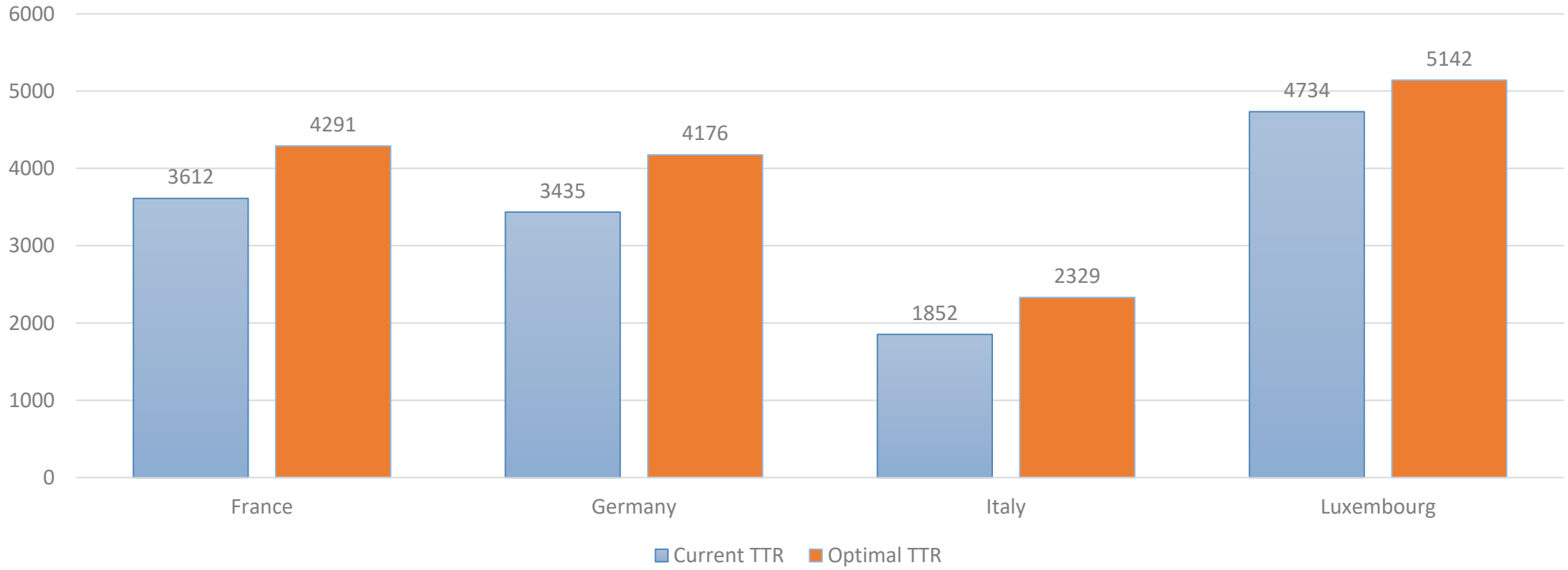


Status quo scenario: *Optimal* Polynomial *TTR vs. Current TTR: Changes in Welfare, Efficiency and Equality (monthly euro-equivalent per household)*

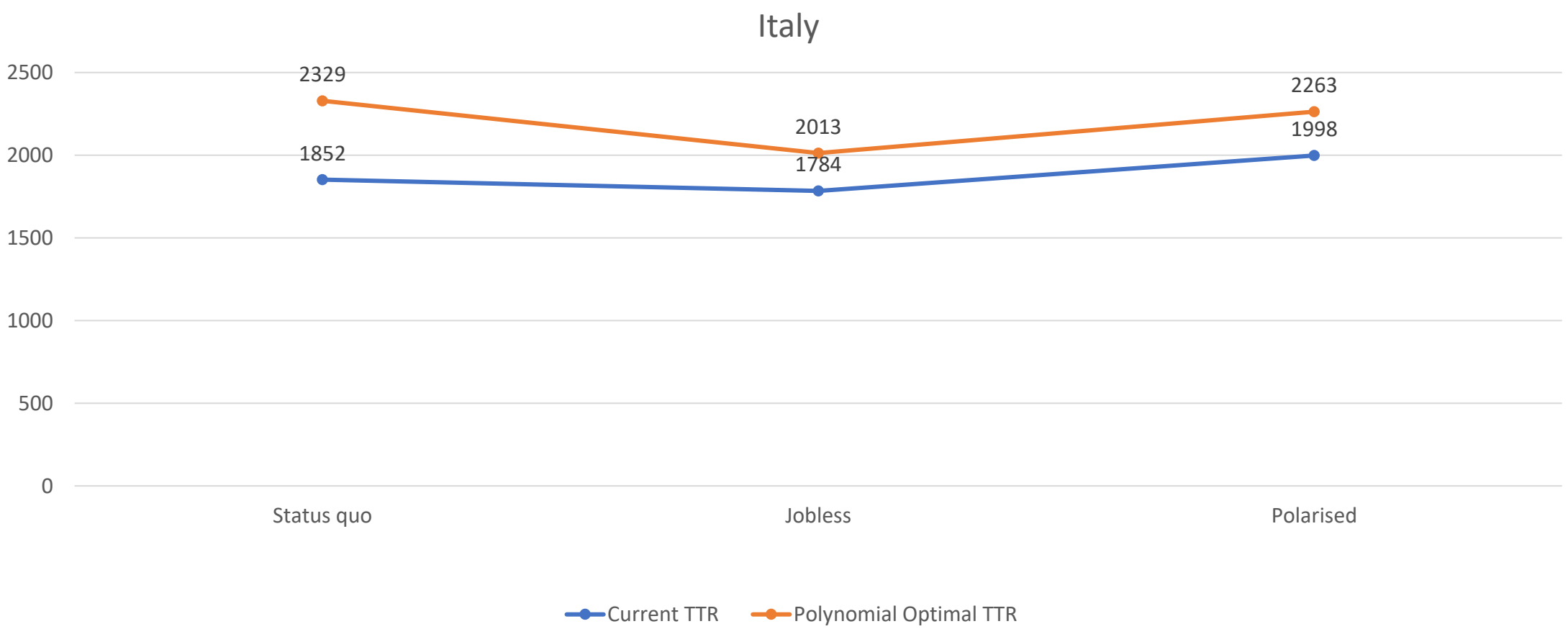
Social welfare across the scenarios (Monthly euro-equivalent)



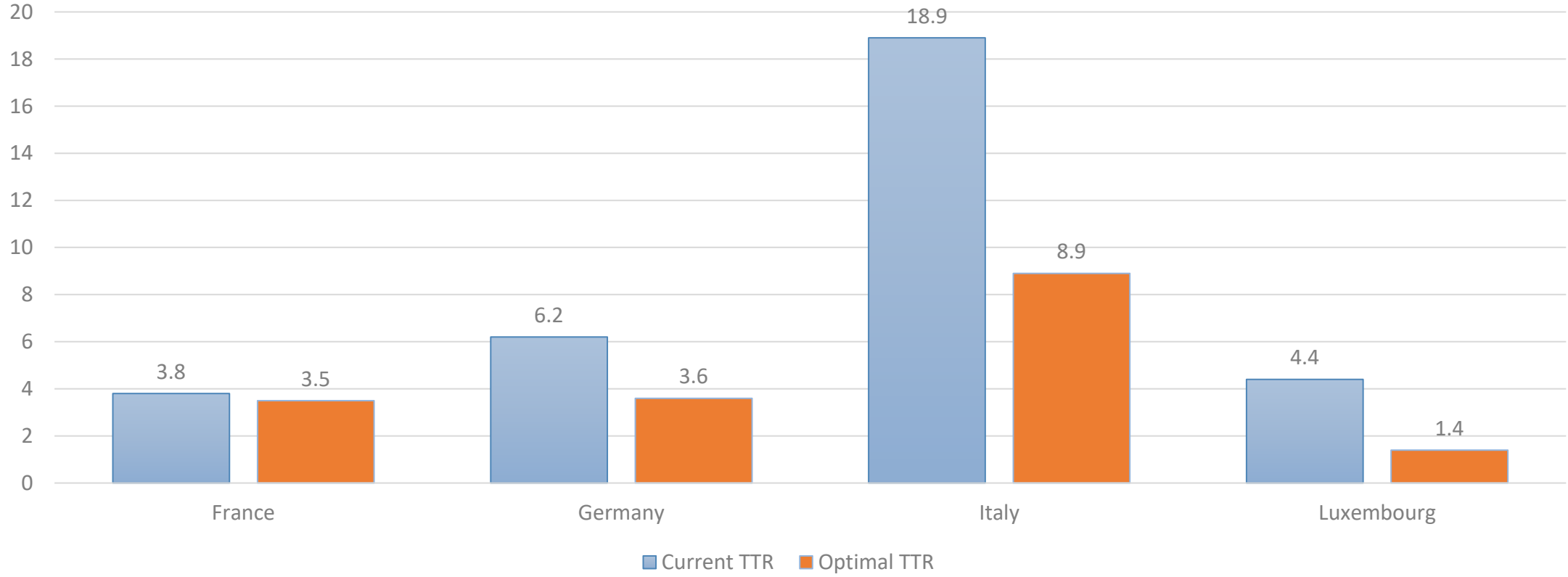
Households disposable income (monthly)
Status quo scenario: *Optimal TTR vs. Current TTR*



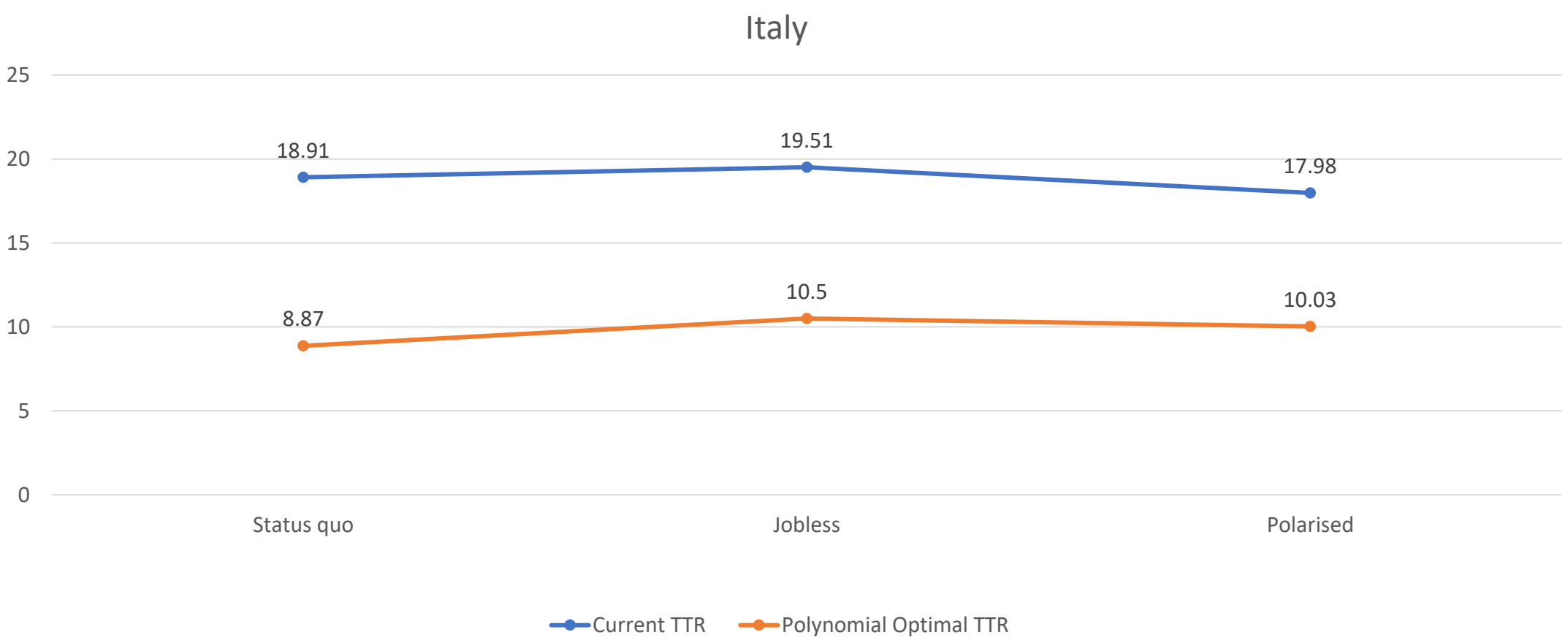
Household income across the scenarios



Poverty Gap %
Status quo scenario: *Optimal TTR vs. Current TTR*



Poverty Gap% across the scenarios



Conclusions

- A **simple** (5 parameters) and **universal** Tax-Transfer rule can:
  - Outperfom the **complex** (dozens or hundreds of parameters) current TTRs
  - **Help coping** with the new scenarios
- The optimal recipe is close to **UBI** (or **NIT**) + (almost) **FT** (in FR, DE and IT)

What's behind the optimal «recipe»

- **Efficiency**: Larger "cake" (gross income) and lower average tax rate
  - The universal TTR rule guarantees a larger taxable income
  - Equilibrium leads to a greater employment share of high-skill (high wage rate) workers
  - Flat optimal TTR helps labour supply
  - Lower average tax rate sufficient to satisfy the public budget constraint

- **Efficiency & Equality**: The UBI or NIT transfers bring more income gains to the lowest income deciles, where the marginal utility of income is higher.

- **Literature** supporting similar conclusions:
  - Micro: Islam & Colombino (2018), Magnani & Piccoli (2020), Colombino & Islam (2022)
  - Macro: Ferriere et al (2023), Guner et al (2021), Lopez-Daneri (2016)

Referemces

- Aaberge & Colombino (2018) Structural Labour Supply Models and Microsimulation, International Journal of Microsimulation, 11(1), Spring 2018.
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Thank You!