PBO microsimulation models

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Workshop on microsimulation

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Outline

- PBO tasks
- PBO tools
- Data issues
- PBO approach building representative population
- Household tax – benefit model main features and future developments
- Corporate tax model main features and future developments

PBO assignments

- PBO main tasks:
  - Assessing fiscal rule compliance (macroeconomic forecast validation and budget projection evaluation)
  - Ex ante evaluation of legislative measures
  - Analysis of long term sustainability of public finances
  - Enhancing transparency and reliability of public accounts at the service of the Parliament and the general public

- Assess official estimates of the impact on revenues and expenditures
  - First order impact
    - static impact - no behavioural reactions (to assess static government estimates)
  - Second order effects
    - behavioural reactions that may affect revenues and expenditures in the short run

Evaluation of legislative measures
Not only scoring…

- Clear picture of the overall impact of the reforms may improve the quality of decisions
  - Distributive analysis (can reveal the effective nature of a tax reform)
  - Analysis of the incentives (measure the impact of tax reform on firm's investment decisions)
  - Indirect effects (tax incidence effects)
  - General equilibrium impact (interactions between markets in the economy)

Microsimulation at PBO

- PBO is developing a range of sectorial microsimulation models in order to meet its tasks in reform evaluation
- The range of models
  - **Household tax–benefit**
  - **Corporate tax**
  - **Short run pension expenditure**
  - **Long run pension expenditure**
  - **Short run interest expenditure**

Twofold requirements

- **Precision** → need for a very good representation of actual tax liabilities and benefit received
  - i.e. fiscal variables, net of tax evasion and erosion
- **Comprehensiveness** → need for a wider set of information, beyond actual tax bases
  - «real» economic conditions gross of tax evasion and erosion, to determine real distributive effects
  - Need for several context variables to model complex phenomena, as incentives, behavioural reactions and so on
- Key issue: selection of datasources to build a represenative population

Survey data issues

- If a microsimulation model is used to reproduce effective tax liabilities (costing analysis), relying only on survey data causes several drawbacks:
  - Measurement errors (of fiscal aggregates)
    - Evasion
  - Sampling distortions (concerning fiscal distributions)
    - Sampling design does not control for dimensions that are relevant for tax calculations (non response bias)
  - Incomplete information
    - Erosion
    - Indeductible costs
    - Individual choices
    - Income definitions
    - Other issues (cadastral values, imputed incomes)

Administrative registers issues

- On the contrary, if a microsimulation model is only based on administrative registers data, it will be highly reliable reproducing actual tax yield but:
  - registers are conditioned by actual legislation (exclusion of potential taxpayers or incomes)
    - Problems in simulating law changes: missing information on «new tax bases» that potentially may be involved in new tax regimes
  - Difficulties to get actual distributive effect, because of evasion and implicit erosion
  - Limited set of information

PBO strategy: integration of sources

- In order to overcome these problems and to fulfill both goals of precision in estimation of actual tax liabilities and comprehensiveness of analysis:
  - We perform an **integration** of survey data with administrative registers on the same population

- In Italy administrative registers are generally not available to the public, data availability to PBO is guaranteed by law (affiliation to National Statistical System – SISTAN, under general rule of confidentiality)
  - Direct linkages via administrative id allowed for:
    - surveys provided by ISTAT
    - administrative registers provided directly by public bodies managing the archives (Ministry of Economy, National Social Security Institution - INPS)
    - corporations balance sheets dataset (provided by National Chambres of Commerce Association)

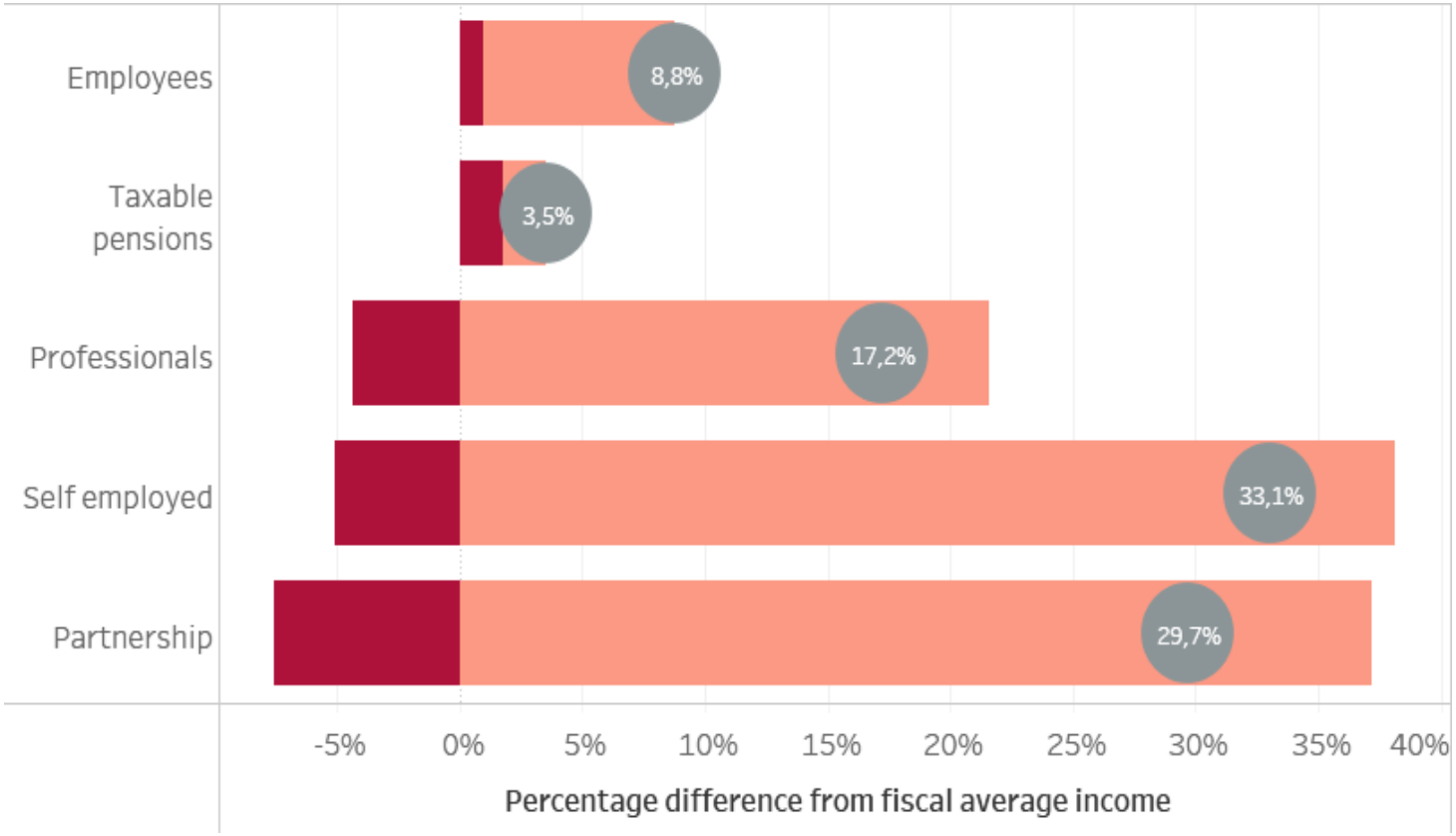
Our approach

- Our approach therefore differs from the traditional estimation techniques of fiscal incomes from survey data
  - Use of registers data to get actual tax bases (get rid of measurement error of fiscal variables)
    - However in some cases answers to survey are helpful to estimate missing administrative information
  - Correction of sample distortion (with respect to fiscal distributions) with post stratification techniques to reproduce actual figures
    - Calibration of survey weights, controlling their variability (R-package: *ReGenesees* Zardetto - 2013)
  - Estimation of «actual» economic conditions by survey self–reported net incomes, gross of evasion and erosion, useful to identify «real» distributive effects (hypotesis of no under reporting in answers to the survey)

- Integration of administrative data overcomes misrepresentation of «fiscal world»
  - Ability to identify (and to correct separately) measurement errors and sample distortion that affect survey answers with respect to declared tax bases

- A form of integration of administrative data with survey data is already performed by Istat (and other SNAs) in the Silc income estimations
- The purpose however differs from our:
  - "*The aim […] is to improve data quality on income components […] by means of imputation of item non-responses and reduction of measurement errors [of actual incomes]*". (Consolini P. Donatiello G. - 2015).
- In other words the aim is to use administrative sources to get a better representation of "actual" incomes, rather than a precise measurement of fiscal aggregates:
  - "*when the net administrative incomes are higher than the survey incomes, the net and gross incomes completely arise from administrative data. On the opposite, […] the net incomes are those taken from the survey*"
- Since it is not possible to go back to administrative values from publicly distributed data set, we perform by ourself a new integration procedure

Discrepancies between reported and fiscal incomes (It-Silc 2014)



- Percentage difference from average reported and average actual fiscal income
- Sample bias effect
- Measurement error (average discrepancy reported / fiscal individual incomes)

- Actual average income
  - $\bar{y}=\sum y_i \cdot f_i$
- Survey average income
  - $\hat{y} = \sum(y_i + \varepsilon_i) \cdot w_i$
    - ε_i: measurement error
    - w_i: sample weights
- Avg. discrepancy (%)
  - $\frac{(\hat{y}-\bar{y})}{\bar{y}} = \frac{\sum y_i(f_i-w_i)}{\bar{y}} + \frac{\sum \varepsilon_i \cdot w_i}{\bar{y}}$
    - $\frac{\sum y_i(f_i-w_i)}{\bar{y}}$: sample bias
    - $\frac{\sum \varepsilon_i \cdot w_i}{\bar{y}}$: Average measurement error

Units with corresponding type of incomes in survey and registers

Household tax–benefit model

Available data sources

- Surveys
  - It-Silc
    - Detailed information on economic condition
    - Linkable to income tax returns and Social Security Contributions (SSC)
  - Household expenditures
    - Detailed consumption behaviour
    - Linkable to income tax returns and SSC (not to It-Silc)

- Administrative registers
  - Income tax returns #1
    - Linkable sample (up to now only to It-silc)
    - Taxable PIT incomes (gross)
    - Some exclusions
  - Income tax returns #2
    - Non linkable very large sample (4/365 share of the whole population).
  - Social security contributions & pensions
    - Linkable
    - Highly detailed
    - Help filling gaps in income tax returns
    - History of past incomes (very useful in a life cycle perspective), some incompleteness
  - Means tested benefits (Isee)
    - Non linkable (up to now)
    - Useful taking into account unmodellable take up. Difficult to simulate new measures

PBO set of microsimulation modules

- Several modules of the model, based on combinations of datasources, with different tasks
  - DTB – Direct taxation and benefits
    - It-Silc (S) + income tax returns (A) + social contributions and pensions (A)
  - DITB – Direct and indirect taxation and benefits
    - Family expenditures (S) + income tax returns (A) + social contibutions and pensions (A)
  - MIB – Minimum income and other mean tested benefits
    - ISEE dataset (A – not linked)
  - PIT – Large sample of tax returns (A - not linked), for robustness analysis

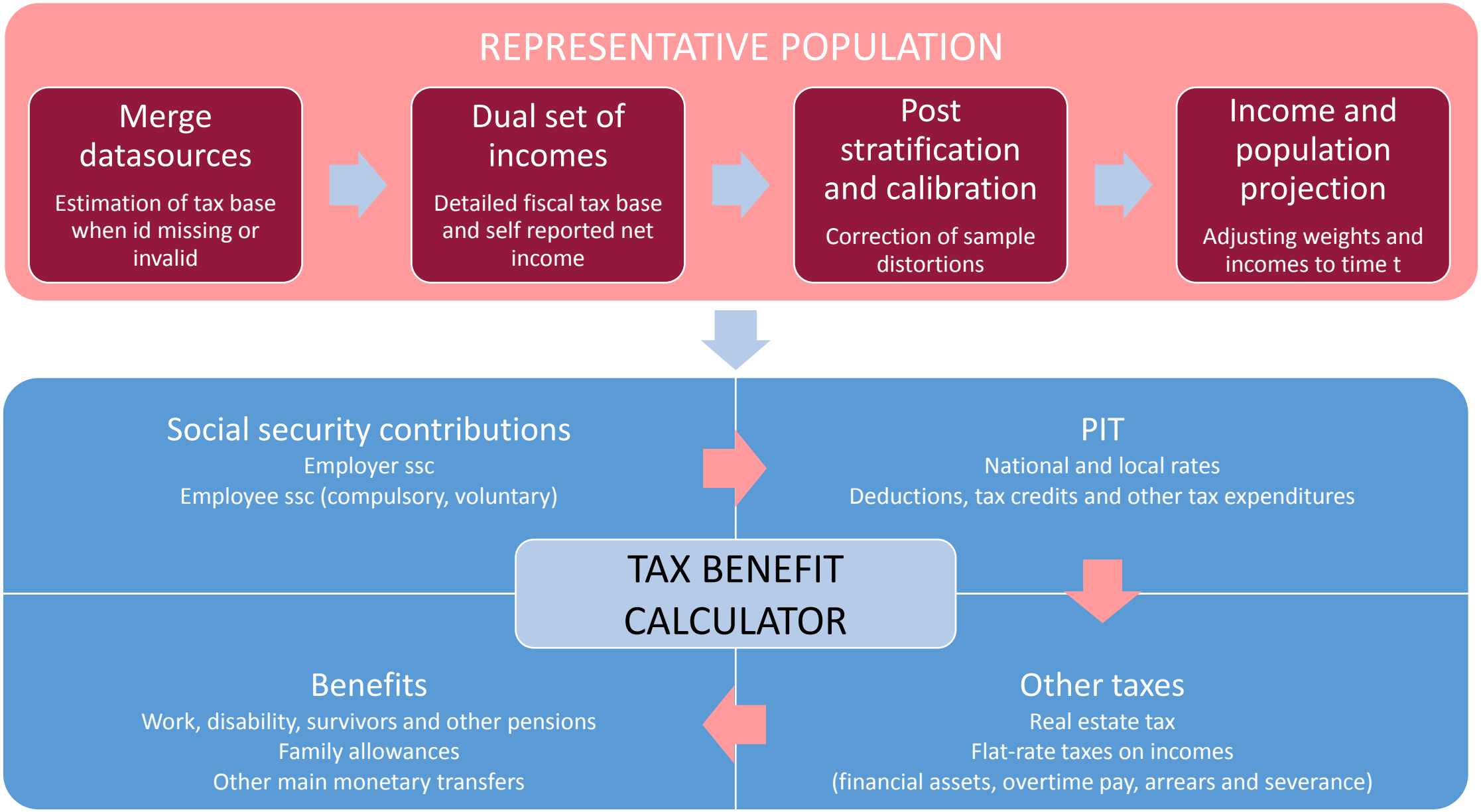
Breakdown of income by type and data source

Personal income tax	Real estate incomes	Self occupied house	Real estate extempted
			Real estate non extempted
		Rents	
		Cadastral value of non occupied houses	Non extempted
			Extempted
		Lands	
	Dependent and fiscally assimilated	Dependent worker and unemployed	Employed income
			Employed income below notax area
			Atypical worker
			Unemployment benefits
			Fringe benefit
		Assimilated to dependent	Alimonies (spouse)
			Other
		Taxable pensions	Old age
			Survivors
			Disability
	Self employed and fiscally assimilated	Professional	
		Self employer	
		Partnerships	
		Agricoltural incomes	Typ A (forfait)
			Typ B
		Others	
	Other incomes	Specific incomes	
		Capital	
Separate taxation		Flat tax on rents	Ordinary 21%
			Rebated 10%
		Arrears	
		Overtime pay	
		Low income self employed	
		Financial asset	
Non taxable		Family allowances	
		Mean tested minimum pension	
		Disability/war pensions	
		Disability integration	
		Indennitary pensions	
		Pension integration	
		Scolarships	
		Means tested transfers	
		Allowance to 3rd child	
		Maternity allowance (local)	
		Housing allowances	
		Non taxable fringe benefit	
		Income taxable abroad	
		Cross border workers non tax inc.	
		Non taxable copyright income	
		Alimonies (child)	
		Intra household transfers	

SOURCES

- *Survey*
- *PIT register*
- *Pensions register*
- *PIT register decomposed with survey*
- *PIT register decomposed with pensions register*

Direct taxation and benefit model - Workflow



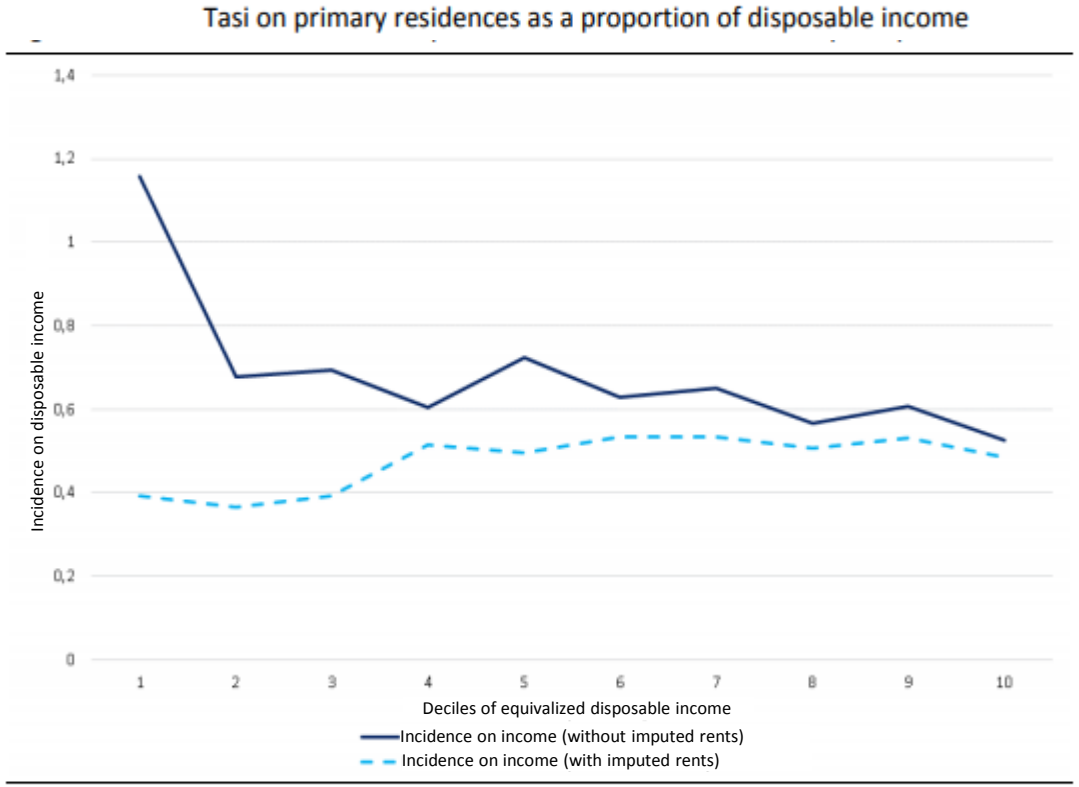
Developments of the model: behavioural reactions

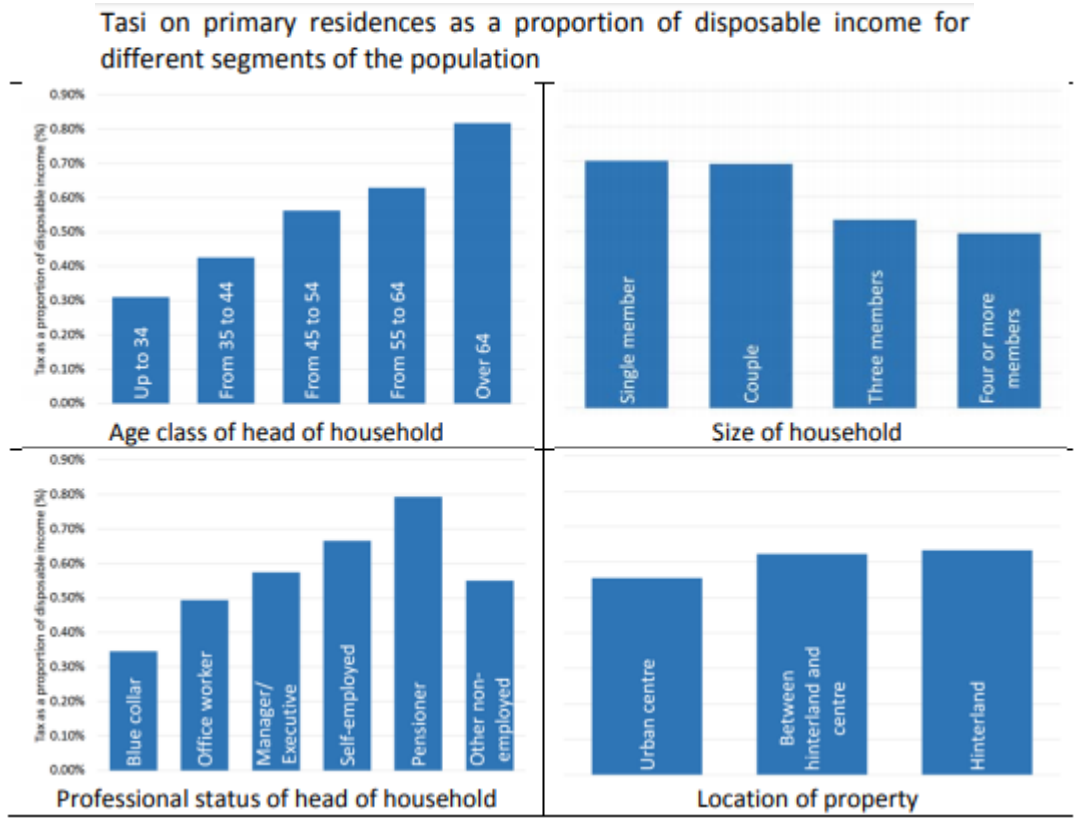
- Short run behavioral reactions (costing purposes)
  - Modelling consumption reactions to price (indirect taxation) shocks and income shocks (direct tax + indirect tax + ssc effects on disposable income)
    - Estimation of demand system (substitution elasticities between groups of goods / services)
    - Estimation of MPCs to evaluate consumpion reactions to shocks on income.
    - Integration with PBO macroeconomic model (memo.it) in order to estimate short term effects on economic system
- Other behavioral reactions (long run impact on economic system)
  - Joint project with JRC, providing assistance to develop an instrument for assessing the impact of reforms on labour supply
  - Integration with general equilibrium model (PBO version of Quest) to estimate long run effects

Example of application: the abolition of service tax

- PBO Budgetary Policy Report for 2016: evaluation of the Goverment proposal to abolish municipal service tax on primary residences
  - 2016 Budget Law: reform aiming to stimulate household consumption, the real estate market and the construction industry
- PBO microsimulation analysis performed with an early version of the model
  - Costing analisys (did not show discrepancies with official estimates - 3,5 bil. euro)
  - Distributive analysis
  - Impact on aggregate consumption

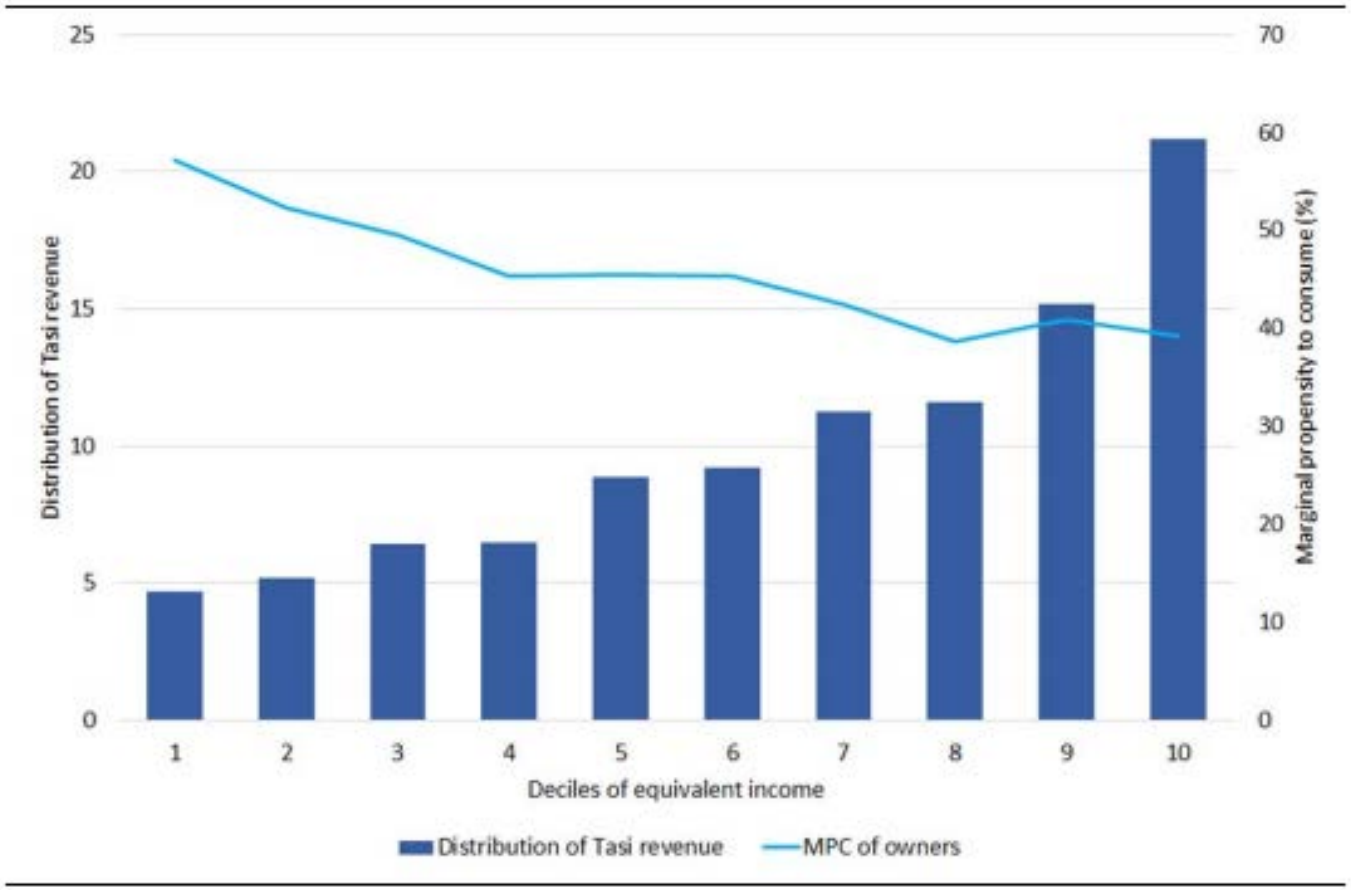
Abolition of service tax: distributive impact





- Distributive analysis shows that the impact of the measure is progressive if we do not consider imputed rent, almost proportional if we do consider it
- The relative impact on income is higher for elderly, and lower for large households. Higher for self-employed than for employees

Abolition of service tax: effects on consumption



- Micro-estimation of MPCs allows to calculate the consumption boost in 44 percent of the revenue loss. The distribution of absolute level of total benefits was in fact in favor of high deciles, that exhibit lower MPC

Corporate tax model

Model features

- A static multi period model
  - Detailed tax simulations
  - Business Tax (IRAP)
  - Corporation tax (IRES)
  - Social contributions (under construction)

Available data sources

- Financial Accounting Data

Censuary data at company level (1 mln excluding financial sector)

  - Demographic characteristics
  - Balance-sheets
  - Ownership structure

- Istat Statistical Archive
  - Statistical register of Italian active enterprises
  - Business structural surveys

- Aggregate Tax Statistics
  - Corporation tax returns (profit tax and business tax)
  - Consolidated tax returns

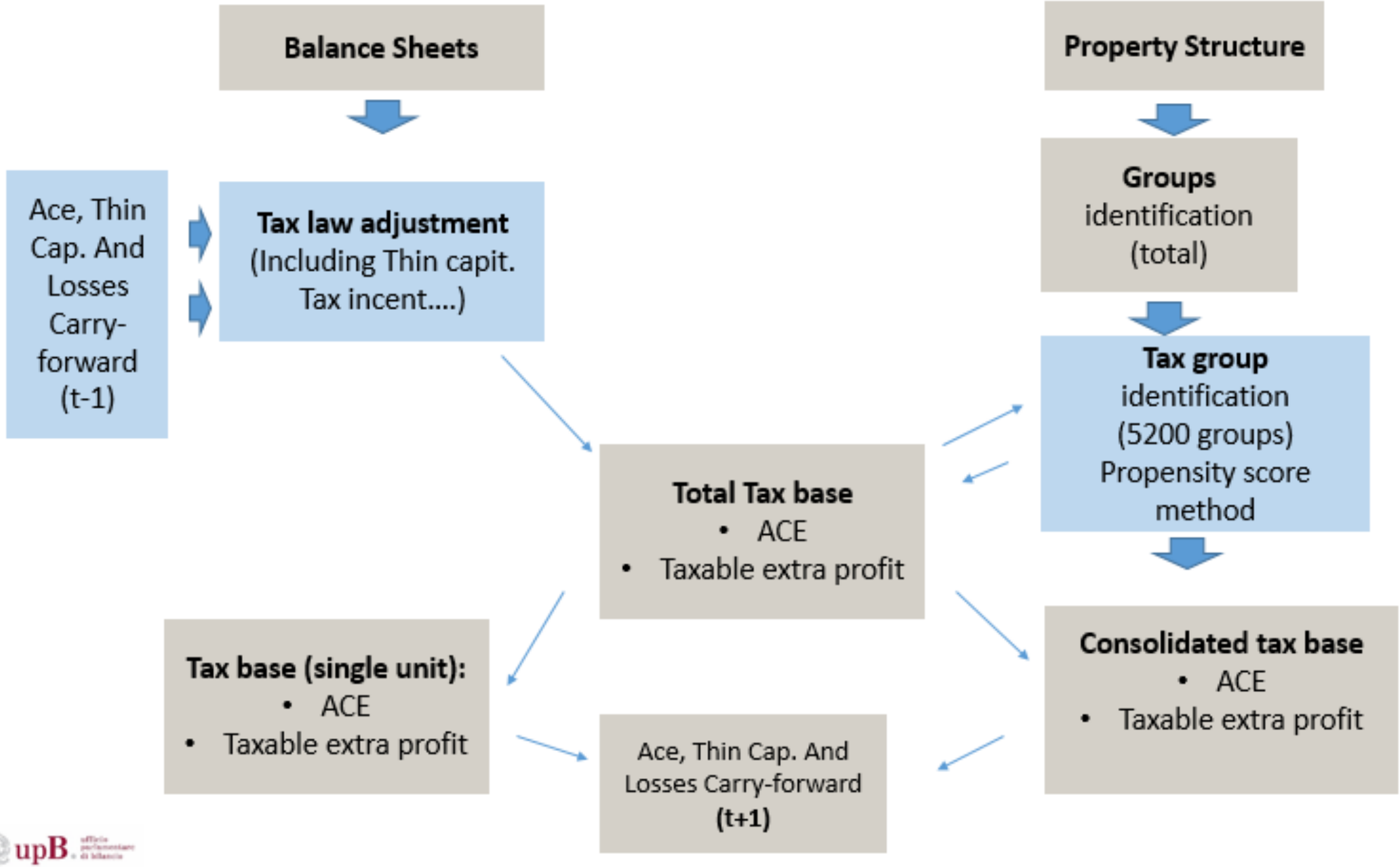
- Administrative register (in progress)
  - Single corporation tax returns (profit tax and business tax)
  - Consolidated tax returns

The state of the art

- Financial Accounting Data + aggregated tax return data
  - Distributive analysis of tax revenue changes (full range of relevant differences between firms)
  - Problems: Tax codes contain complex and detailed rules for the determination of the tax base and tax due: necessary information details are not included in available firms data sets

- Integration with Micro Tax Return Data (Administrative register)
  - Improves precision and allows more comprehensive analysis overcoming the previous problems
  - Improves the assessment of budgetary impact

Corporate tax model workflow



- Estimation of the impact on corporate tax revenue:
  - Corporate tax rate cut (2016 Stability Act) by 3.5 points (from 27.5% to 24%)

- Changes in the ACE mechanism (2017 Budget Bill)
  - reduction of the notional rate return
  - restriction of tax base relief

Impact of tax changes by sector

Percentages

	Corporate Tax rate cut (from 27.5% to 24%)	ACE tax parameters changes	Total tax saving	Composition of net tax saving
Agriculture	-12.7	3.0	-9.8	0.3
Industry	-12.7	1.7	-11.0	40.6
Services (1)	-12.7	2.2	-10.6	59.1
of which: holding companies (2)	-12.7	3.9	-8.9	10.2
Total	**-12.7**	**2.0**	**-10.8**	**100.0**

(1) Excluding banks and insurance companies. – (2) ATECO sectors 64.2 and 70.1

- Change in the corporate income tax rate lowers the tax liability by 12.7% for all types of firms
- Changes to the ACE parameters increase the corporate tax liability unevenly across firms
- The overall impact is a 10.8% tax saving, with more capitalised enterprises benefiting proportionally less than the others

Impact of tax changes by dimension

Percentages

Firms by class of value of production	Corporate Tax rate cut (from 27.5% to 24%	ACE tax parameters changes	Total tax saving	Composition of net tax saving
Small (< €100,000)	-12.8	1.3	-11.5	3.2
Medium (between €100,000 and €2.5 million)	-12.7	1.8	-11.0	21.0
Large (> €2.5 million)	-12.7	1.7	-11.0	75.8
Total (1)	**-12.7**	**1.8**	**-11.0**	**100.0**

(1) Excluding banks and insurance companies. – (2) ATECO sectors 64.2 and 70.1

- By firm size, excluding holding companies, the overall net tax saving is broadly uniform, varying between 11% and 11.5%
- The relatively largest savings are achieved by smaller firms which are typically less capitalised

Developments of the model: behavioural reactions

- Multiperiod extension
- Investment and financing decisions
- Possible assistance from European Commission Structural Reform Support Programme

Thanks for your attention !

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