

# ***Tax Models for Supporting Reforms***

## ***Tax focused CGE Model for Italy***



Dipartimento  
delle Finanze

**Silvia Carta and Marco Manzo**

*Unit VII*

*Directorate Tax Policy Analysis, Studies and Research*

**Workshop**  
**The Italian Tax CGE model for policy analysis**

**Rome, 25-26 November 2020 (online)**

# Overview

- Background and Objectives
- ITAXCGE-DF (Tax-focused CGE Model)
  - Nested structure of production function
  - SAM and National Accounts
  - Taxes and Subsidies
- Innovations, Strengths and Opportunities
  - Tax evasion and tax erosion / *compliance gap and policy gap*
  - CGE Models and heterogeneous agents
  - Dynamic scoring and micro-macro integrated models
  - Calibration
- Limitations, Weaknesses and Warnings
  - Modelling tax evasion behavior (optimization of tax evasion)
  - Theoretical framework: neo-Walrasian vs *less orthodox CGEs*
  - Multi-regional and environmental developments
- Focus on VAT and indirect taxation (from VATSIM to ITAXCGE)

# Thank You

- The SAM's construction is a result of teamwork.
- I'd like to thank Professor Ali Bayar and the ECOMOD consulting group as expert consultants.
- The Directorate for Studies and Researches on Tax Economics of the Italian Ministry of Economy and Finance for the support and the work carried out in developing the SAM matrix:
  - Ms. Barbara Bratta, Ms. Silvia Carta, Mr. Danilo Carullo, Ms. Cristina Cirillo, Ms. Fabiana De Cristofaro, Ms. Lucia Imperioli, Mr. Marco Manzo, Ms. Elena Miola, Mr. Carlo Orecchia;
  - Mr. Giorgio Mongelli, Mr. Gavino Mura and Ms. Maria Alessandra Tullio for SOGEI.

# Background and Objectives

- The Italian tax gap is one of the highest in the European Union. According to a study, commissioned by the European Commission, VAT gap in Italy in 2018 amounted to EUR 35.4 billion, the largest gap in EU-28 Member States.
- Despite the VAT Gap in Italy has followed a downward sloping trend during the period 2014-2018, reaching 24.5 percent of the VTTL in 2018 (from 29.9 in 2014), it remains the worst except for Lithuania, Greece and Romania.
- In order to implement effective tax policies for reducing the tax gap, it is crucial to develop evaluation tools able to describe and simulate all the featuring aspects of VAT and excise taxes, and their interactions with the other taxes.

# Background and Objectives

- The Department of Finance has already developed several models aimed at supporting tax policy analysis, but a model capable of covering the economy-wide effects of tax policies is still not available.
- This project aims at filling the gap by developing a multi-sector, multi-household, computable general equilibrium (CGE) model for Italy (called ITAXCGE-DF) specifically built for analyzing tax policy issues (dynamic macro and sectoral impacts, distributional effects) including the VAT and excise tax gaps.
- The model will enhance the analytical capabilities of the Department of Finance and shall become an important instrument for the policy evaluation of fiscal reforms.

# Background and Objectives

Tax	Microsimulation Models (Non-Behavioral) 1 <sup>st</sup> order effects		Economic Equilibrium (Behavioral) 2 <sup>nd</sup> order effects	
	Revenue Effects	Distributional Effects	Partial Equilibrium	General Equilibrium
PIT	✓ TAXBEN-DF (I)	✓ TAXBEN-DF (II)	Labor Supply (Income Elasticity of Labor Supply) EUROMOD and TAXBEN- DF (III)	Tax-Focused CGE Model ITAXCGE-DF
CIT	In progress (in collaboration with SOSE) CITSIM-DF		( <i>Devereux-Griffith-</i> Investment-Tax Adjusted User Cost of Capital)	
VAT and Excise duties	✓ VATSIM-DF (I)	✓ VATSIM-DF (II)	(QAIDS - <i>Deaton-</i> <i>Muellbauer-</i> in collaboration with SOSE- Price and Income elasticity of demand) VATSIM-DF (III)	

# Background and Objectives

This project also aims at:

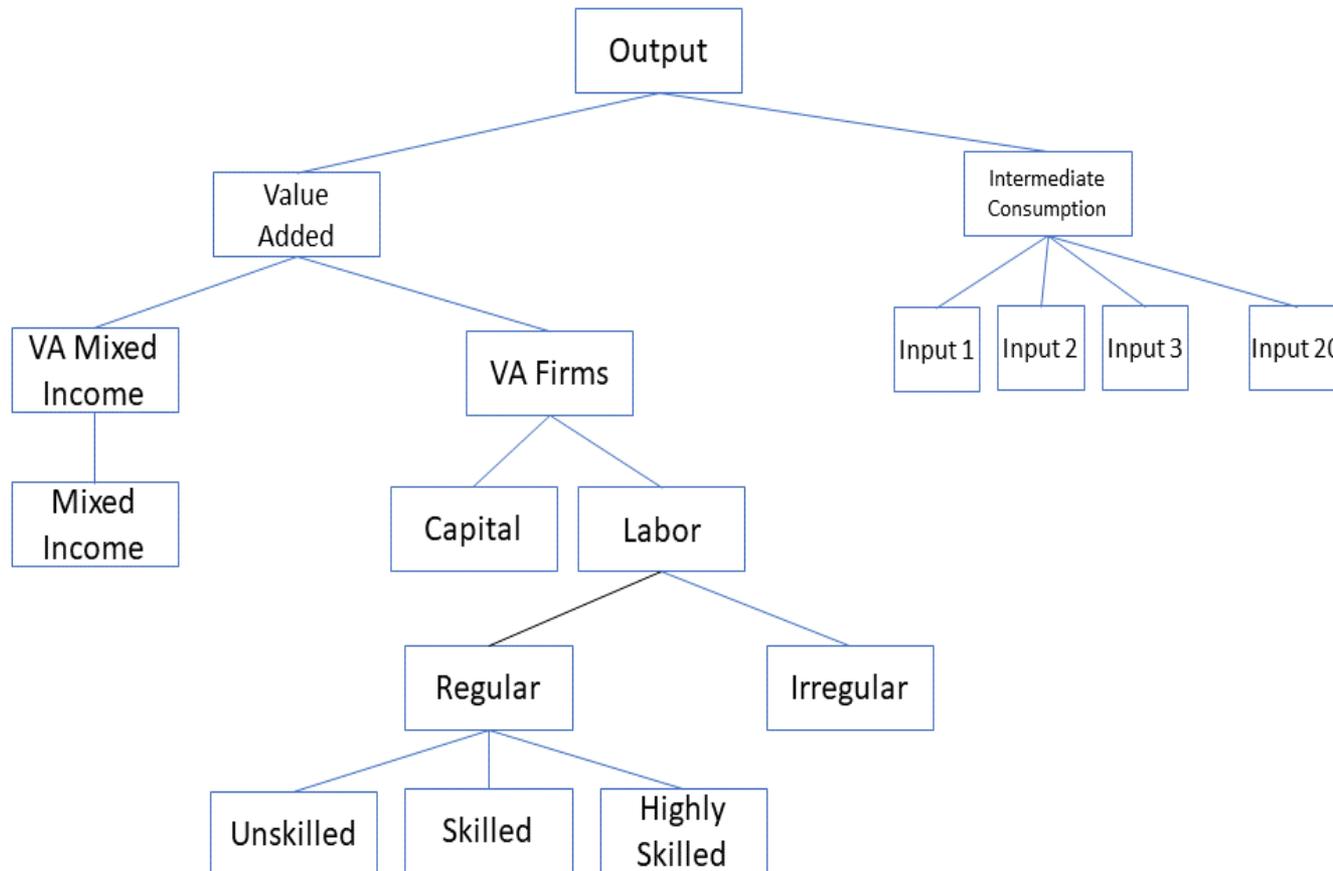
- Contributing to the general equilibrium tax literature
- Expanding and enriching the Italian literature in the field of CGE modelling along different dimensions of intervention:
  - improving in some parts the current state of the treatment of the tax component (i.e. tax evasion and tax erosion) in the SAM matrix, also in the awareness that, sometimes, this choice may imply greater weakness in other parts of the SAM matrix itself (wrt Gesualdo et al. 2019);
  - making the CGE model closely connected to the microsimulation models is important not only from the point of view of research, but above all on the institutional level of the best quantification of the revenue and redistributive effects able to take into account behavioral choices and feedback between economic agents.
- In general, this project intends to promote a fruitful collaboration between the various attempts at CGE modeling in Italy, stimulating a mutual interaction on the various strengths and weaknesses of each model (See Felici et al. 2020).

## ITAXCGE-DF (Tax-focused CGE Model)

- Four types of tax evasion are included in the model: irregular labor, mixed income evasion, VAT gap and excise gap.
- Factors of production are: composite labor, mixed income and capital. Composite labor is composed by regular and irregular labor. Regular labor includes three components: high skilled, medium skilled, low skilled labor.
- Mixed income is divided into: PIT base, forfeit regime tax base and mixed evaded income. Tax evasion is distributed along deciles of households (see Bazzoli et al. 2020).
- VAT gap is allocated among the various demand components: intermediate costs, consumption, investment, (non-market sector) by using VATSIM-DF microsimulation model.
- Excise gap is quantified through a top-down approach.

# ITAXCGE-DF (Tax-focused CGE Model)

## The Nested Structure of the Production Function



# ITAXCGE-DF (Tax-focused CGE Model)

- SAM and National Accounts 2016 (production process, generation of value, allocation of primary income, secondary distribution, net savings) based on:
  - NAM available from ISTAT (2014); SUTs last available (2016)
  - National accounts by institutional sector
  - Microsimulation models (deciles of households, tax and subsidies)
- 20 economic sectors; 10 households; 6 factors of production (irregular labor, regular high skilled labor, regular medium skilled labor, regular low skilled labor, mixed income, capita); 5 institutional sectors (firms, households, government, non-profit organizations, rest of world)
- EU and Non-EU countries (Import and Export, Domestic Production, Production for Export)

# ITAXCGE-DF (Tax-focused CGE Model)

## ➤ Taxes and SSCs:

- Direct taxes on households: PIT (Irpef), Additional (Regional and Municipal) PIT, forfeit tax, tax on rents, capital income tax, real estate tax (IMU)
- Direct taxes on corporations: CIT (Ires), Regional Business Tax (Irap), real estate tax (IMU)
- $SSC^{ee}$ ,  $SSC^{er}$ ,  $SSC^{me}$
- Indirect taxes on product: VAT, excise duties, tariffs on imports, other tax on products
- Other taxes on production
- Benefits: Pensions, «80 euro» bonus, Citizens' income, Family allowances, Unemployment benefits; interest payments on public debt, other lump-sum net subsidies

# Tax focused CGE model (Social Accounting Matrix)

	Sectors - Export EU-	Sectors - Export Non EU-	Commodities	Sectors	Factors of Production	Institutional Sectors	Taxes and SSCs	Subsidies	Inventories	Gross Capital Formation	Rest of World EU-	Rest of World Non EU-	Savings
Sectors - Export EU-											Export		
Sectors - Export Non EU-												Export	
Commodities			Margins	Intermediate Consumption		Consumption			Inventories	Gross Capital Formation			
Sectors	Export	Export	Production										
Factors of Production				Income									
Institutional Sectors					Net Income		Tax Revenue	Government Transfers					
Taxes and SSCs			Indirect taxes and Tariffs	CIT, Taxes on production, SSC <sup>er</sup>	SSC <sup>ee</sup> , SSC <sup>me</sup>	Tax Revenue							
Subsidies						Government Transfers							
Inventories													Inventories
Gross Capital Formation													Gross Capital Formation
Rest of World Non EU-			Import										
Rest of World EU-			Import										
Savings						Savings					Savings	Savings	

# Innovations, Strengths and Opportunities

- ITAXCGE-DF is a tax focused CGE model able to incorporate the analysis of *compliance gap* and *policy gap* (tax evasion and tax erosion, undeclared tax base and base erosion).
- VAT Revenue (and excise duties) is expressed as a difference between theoretical VAT and VAT gap
- Tax Gap as a proxy of noncompliance gap and tax evasion:
  - VAT gap and excise gap (top-down and bottom-up approaches)
  - Mixed income evasion (top-down and bottom-up approaches)
  - Irregular labor income (NAs, source: Istat)
- Base erosion and tax expenditures:
  - PIT erosion for households (forfeit tax, tax on rents, substitutive tax on capital income, exemptions, etc..)
  - Tax expenditures for corporations (from gross operating surplus in SUT tables to obtain CIT base and IRAP tax base by sector, such as tax credit, hyper-depreciation, R&D credit, etc. ...)

# Innovations, Strengths and Opportunities

- ITAXCGE-DF is a multi-sectoral and multi-household CGE model: the model encompasses ten representative households along deciles of equivalent disposable income (distinguished from the tenth of the poorest families to the tenth of the richest families).
- Deciles of households' equivalent disposable income are micro-founded: all the variables (skilled labor income, capital income, PIT, VAT incidence on consumption, etc....) are determined in our tax microsimulation models (TAXBEN-DF for PIT and VATSIM-DF for VAT).
- ITAXCGE-DF deviates from the assumption of the representative agent towards a more-developed heterogeneous agents model (or first step to ABMs)

# Innovations, Strengths and Opportunities

- Dynamic scoring analysis of tax reforms, combining microsimulation *non-behavioral* models (PIT, CIT, VAT) with *behavioral* tax-focused CGE model. These two kinds of models are connected in two ways:
  - Output of microsimulation models are input in CGE models; output of CGE model becomes new input in microsimulation models (tax policy shocks in CGE derived from quantifying changes in implicit tax rates using MSMs)
  - By calibrating elasticities and deep parameters, by skill categories, in CGE model from values calculated and estimated using MSMs
- Finally, behavioral dimension is embedded into the microsimulation model (see “Dynamic Scoring of Tax Reforms in the EU”, JRC, 2016)

# Innovations, Strengths and Opportunities

## Dynamic scoring methodological steps



- We start from the microeconomic setup, using MSMs to calibrate selected parameters in CGE and to calculate the policy shocks to be introduced in that model;
- The policy shocks are obtained by simply running the MSMs for the baseline and reform scenarios – no behavioral reaction included – and obtaining the change on the implicit tax
- The second step consists in introducing the policy shocks in ITAXCGE-DF and running this model in order to obtain trajectories for some selected variables of interest (employment, income, wages, investment, ...)
- Finally, these trajectories are imputed back into MSMs

This methodological approach can somehow relate to some type of "bottom-up/top-down" approach, as described in Savard (2003)

# Innovations, Strengths and Opportunities

- Calibration of the deep parameters of the model is another important innovation of the project, as it is closely connected with the database used by the micro-simulation models available to the Finance Department.
- Elasticities of substitution between capital and labor (CES function) is estimated (contribution by Carullo 2020, ECM or FD models depending on economic sector, 2000-2016 SUT).
- Frisch elasticity by households by using TAXBEN-DF (III) (following the procedure as in Figari 2011).
- Price and income elasticities of demand (the same by household up to now) estimated by applying the Q-AIDS model on HBS 2005-2013 (DF-SOSE 2016).
- Income, tax and subsidies, tax gaps ... are micro-founded

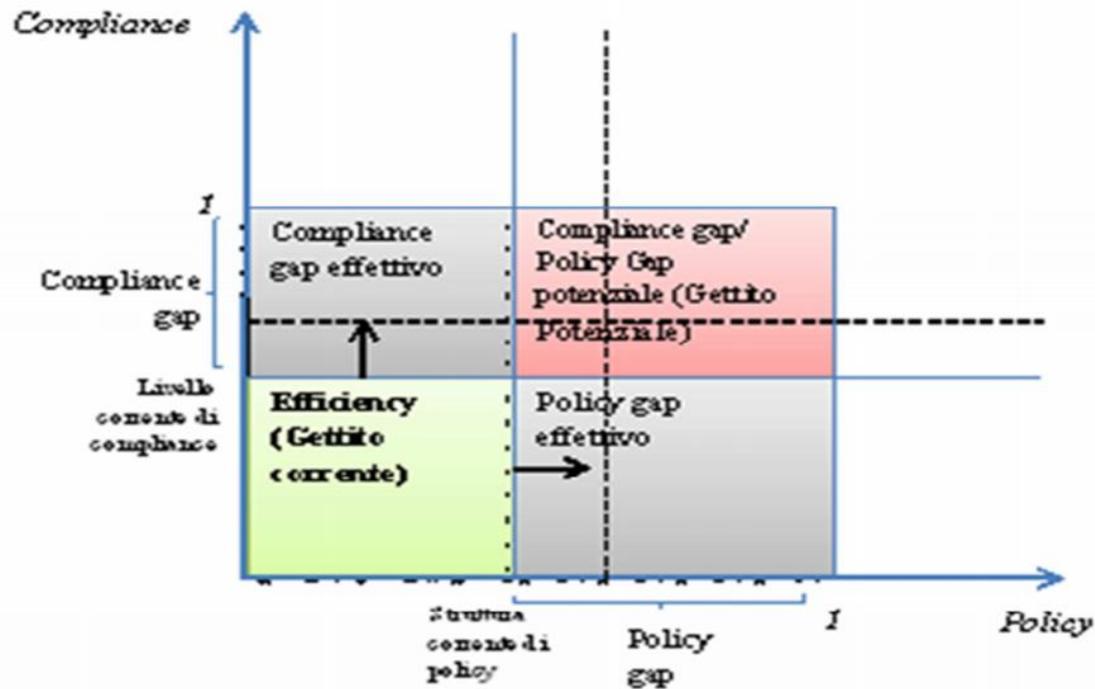
# Limitations, Weaknesses and Warnings

- Dynamic behavior of tax evasion (see Alm and Sennoga 2010)
  - Incorporate formal and informal sectors, the individual's decision to evade and allow for varying degrees of mobility via competition and/or entry across sectors in the economy.
- Theoretical framework: neo-Walrasian *vs less-orthodox CGEs* (see Felici et al. 2020)
  - Further developments: monopolistic competition (markups and market power), wage setting and involuntary unemployment, investment (from savings-driven to investment choice), forward-looking expectations (announcement effect of tax policy)
- Multi-regional and environmental SAM
  - SRSP4 is aimed at this scope

# VAT and Indirect Taxation

- In Italy, the *overall tax gap*, the sum of *policy and compliance gap*, is higher than for other EU members, by undermining total tax revenues and the sustainability of public finances
- The reduction of the *overall tax gap* is one of the priorities of the country in order to make the Italian tax system fairer, more efficient and supportive of economic growth, in line with the CSRs for Italy)
  - ✓ The relevance of the *policy gap* derives from the high number of tax deductions and expenditures in different sectors.
  - ✓ Many economic and social factors explain the high *compliance gap* in Italy.
  - ✓ In 2016, the Italian Government created two specific Committees for measuring and monitoring the *policy* and the *compliance gap*.
  - ✓ However, it has been difficult to collect information on and monitor the excise sector. In this sector, the *compliance gap* was not measured and the assessment of the *policy gap* was not satisfactory.
- The need of ameliorating the knowledge of the *overall tax gap* in the excise sector spreads in other relevant policy areas that have an impact at a national and an European level

# VAT and Indirect Taxation



- With no evasion: compliance is equal to 1 (y-axis); with no tax expenditures: policy gap is equal to 1 (x-axis);
- A rise of *compliance* and/or a reduction of tax expenditures determine: i) variations in current levels of *policy gap* and *compliance gap* (grey area); ii) a progressive increase of the total potential tax revenue (red area) with an increase of the level of taxes.

# VAT and Indirect Taxation

**Tax gap**: Difference (gap) between taxes effectively/actually paid and taxes that taxpayers would have to pay in the case of total compliance given the existing administrative and fiscal rules (e.g., tax laws). It is commonly, at national and international level, used as a *proxy* for tax evasion (also by the national independent Commission for tax gap estimates in Italy, “Giovannini Commission”).

## Main aspects:

- Focus on the difference (delta) between the ideal/potential tax revenues (with no evasion) and the effective/actual tax revenues
- Need of making a distinction between the *policy gap* (e.g., the reduction of tax revenues due to tax credits) and the *compliance gap* (that can be due to both evasion and elusion activities)
- Need of making a distinction between the *assessment gap* (tax gap net of omitted payments) and *collection gap* (tax gap due to omitted payments)

# VAT and Indirect Taxation (from VATSIM ...)

- The key objectives of the VAT modeling are to project VAT revenue, to estimate compliance level and tax expenditures in VAT, and, more broadly, to analyze the revenue impact of proposed changes in VAT policy and/or administration.
- The model relies primarily on the SUT approach to derive the detailed final consumption of goods and services by household, government, and business (intermediate inputs and capital purchases). Further adjustments have to be made to account for the impact of exemption, zero-rating, and threshold.
- Sources: National accounts, VAT returns (individual firms, incorporated and unincorporated firms), B2G e-invoicing.

# VAT and Indirect Taxation (from VATSIM...)

- The expected VAT revenue by commodity at full compliance (theoretical or potential VAT) can be calculated by multiplying the tax base with the taxable proportion and tax rates.
- In a general form, the theoretical VAT revenues are estimated by distinguishing three macro-components:
  - Before-VAT final expenditures of commodities and household investment (the so-called "pure" VAT)
  - Intermediate consumption and investments of market and non-market sector (the so-called "impure" VAT)
  - Difference between inputs and output by below-threshold small bus
- Breaking down of VAT by tax rates, economic sector and CPA products (making the NAs and SUT by CPA and economic sector consistent with tax declarations by economic sector and tax rates, by using a bridge transition matrix)

# VAT and Indirect Taxation (from VATSIM...)

- To analyze the tax revenue effects of tax policies regarding VAT and excises taxes (changes in tax rates);
  - ✓ Households final consumption from NA;
  - ✓ Input-output matrix for non-deductible B2B transactions;
  - ✓ Electronic Invoicing for non-market sector;
  - ✓ Investment from NA;
  - ✓ Consumptions of oil sector estimated through surveys by MISE and compared with administrative data from gas stations.
- To estimate VAT (and excise) evasion for the different products/goods and services;
  - ✓ Non-observed economy for each economic sector from ISTAT
  - ✓ Difference between theoretical and effective consumption
- To update time series for *c-efficiency*, *policy gap* and *compliance gap* from 2014 to 2018
  - ✓ Difference between benchmark and theoretical or effective tax revenue

# VAT and Indirect Taxation (and excises gap estimate...)

- We decided to adopt, in order to estimate of excise tax gap, a two-steps strategy:
  - First-step (short-run): estimating excise tax gap for gasoline and diesel by combining two sources of data on (produced and distributed) quantities;
  - Second-step (medium-to-long run): starting collecting data like those used in other EU countries for checking the robustness of the methodology of first-step.
- We used data on quantities at two different points (upstream and downstream) of the fuel distribution chain:
  - Actual tax base: **Quantity of fuel registered (in exit) from fiscal deposits** "*Immerso in Consumo*" (source: Ministry of Economic Development);
  - Potential tax base: **Quantity of fuel registered (in exit) from distributors** "*Erogato*" (source: Italian Custom Agency).
- Series available from 2012 onwards.

# VAT and Indirect Taxation (... to ITAXCGE)

- Design and setting up the baseline CGE modelling framework focused on VAT and excise sector:
- Construction of the Social Accounting Matrix
  - VAT and excises are decomposed into two components: theoretical VAT and tax gap
  - It is possible to separate shocks related to tax rates and shock related to improvement in tax compliance
- Policy scenarios for impact assessment and impulse-response analyses;
- Implementing the model on the EcoMod Platform software (a user-friendly analytics software) so that the CGE model can be used in an easy and timely manner in order to allow the user to manage the model, run simulations, and extract the results in table and graph formats without any knowledge of specific software.