



Dipartimento
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Developing the regional Social Accounting Matrix: Regionalization of Fiscal Data in SAM Construction

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PROJECT: REGIONAL CGE MODEL

- **Project:** "Assistance for the assessment of environmental tax reforms (20IT41)", by the World Bank for the Italian Ministry of Economy and Finance (MoEF) and funded by the European Commission
- **Goal:** simulate economic shocks and effects in the Italian regional system; to give insights to reform and modernize the tax system and to improve the regional economic outcomes
- **Tool:** A new regional Computable General Equilibrium (CGE) model based on the regional Social Account Matrix (SAM) as input data



REGIONAL SAM FOR ITALY

- A regional SAM provides disaggregated information on a set of regions.
- In the literature, regional models for Italy are generally built on macro-regions (NUTS-I).
- However, it could be more appropriate to disaggregate Italian regions at NUTS-II level considering the diversity of Italian regions
- This approach would require building a complete SAM for all regions including bilateral trade flows, government, regional capital stocks etc. Once such SAM is created, the model equations can be expanded using a regional index and adding equations for interregional links.



Social Account Matrix (SAM): key concepts

- SAM is a comprehensive, economy-wide data framework, typically representing the economy of a nation
- SAM is a square matrix in which each account is represented by a row and a column
- Each cell shows the payment from the account of its column to the account of its row
Row = incomes and column = expenditures
- Principle of double-entry: for each account in the SAM, total revenue (row total) equals total expenditure (column total)



SAM-BASED CGE MODELS

- SAM provides behavioral parameters governing consumer demands, production technology, the relationship between imports and domestic production, fiscal burden etc. For this reason, SAM-based CGE models are widely recognized as powerful impact analysis instruments, capable of emphasizing the peculiarities of the economic system
- SAM-based CGE models have been widely used by governments and research centers to simulate ex-ante the potential impact of different policy measures
- Once the SAM is built, the CGE model is applied to our data. The model we refer is IRENCGE-DF presented before



DATA SOURCES

- Domestic wages and salaries: ISTAT
- Consumption of general government: ISTAT
- Final consumption expenditure of households: ISTAT
- Employment in persons: ISTAT
- Domestic compensation of employees: ISTAT
- Gross value added: ISTAT
- Gross fixed capital formation: ISTAT
- Imports/exports: ISTAT-ICE
- Tax data: DF
- Interregional flows: Estimation from DF administrative data
- National SAM: DF (Project "Improving the evaluation of VAT and excise tax policies in Italy")



BUILDING THE REGIONAL SAM: FRAMEWORK

- 20 Nace Rev.2 **sectors** (activities);
- 12 COICOP -> national bridge matrix -> 20 **commodities**;
- 10 COFOG -> national bridge matrix -> 20 **commodities**;
- 20 NUTS-II **regions**;
- 2 **factors**: capital (1) and labor (20);
- 4 **agents**: Households (20), Enterprises (20), Central Government (1), Local Governments (20);
- 10 **tax categories**: SSC, IMU, PIT (national, regional and municipal), taxes on production, IRAP, IRES, taxes on commodities, VAT, excises, taxes on imports;
- **Rest of the world.**

REGIONAL SAM: overview

	Activity (ar)	Commodity (ar)	Labor (r)	Capital (1)	Household (r)	Enterprise (r)	Government (1)	Local Governments (r)	IMU (1)	SSC-er (1)	PIT (1)	RegPIT (1)	MunPIT (1)	PRD (1)	IRAP (1)	IRES (1)	COMM(1)	VAT (1)	EXCISES (1)	IMPORT TAX (1)	Stock (1)	Investment (1)	Debt Interest (1)	RoW (1)	Total
Activity (ar)		OUTPUT																							
Commodity (ar)	IO	MARGINS			HH CONSUMP		GOV CONSUMP	LOCAL GOV CONSUMP													STOCK	INVESTMENT		EXPORT	
Labor (r)	LABOR VA																								
Capital (1)	CAPITAL VA																								
Household (r)			LABOR INC	CAPITAL INC		ENT2HH	GOV2HH																	INTER2HH	
Enterprise (r)				CAPITAL INC																				INTER2ENT	
Government (1)				DEPRECIATION						SSC	PIT			PRD		IRES	COMM	VAT	EXCISES	IMPORT TAX				INTER2GOV	
Local Governments (r)									IMU			RegPIT	MunPIT		IRAP										
IMU (1)	IMU																								
SSC-er (1)	SSC																								
PIT (1)					PIT																				
RegPIT (1)					RegPIT																				
MunPIT (1)					MunPIT																				
PRD (1)	PRD																								
IRAP (1)	IRAP																								
IRES (1)	IRES																								
COMM(1)		COMM																							
VAT (1)		VAT																							
EXCISES (1)		EXCISES																							
IMPORT TAX (1)		IMPORT TAX																							
Stock (1)																					STOCK				
Savings (1)					HH SAVINGS	ENT SAVINGS	GOV SAVINGS																	ROW SAVINGS	
Debt Interest (1)					HH2DEBT	ENT2DEBT	GOV2DEBT																	ROW2DEBT	
RoW (1)		IMPORT																						INTER2ROW	
Total																									

Final size = 697x697

Balancing the SAM

Note that in almost each step of the regional SAM building procedure the cross-entropy algorithm is applied as balancing method with a Highest Posterior Density (HPD) estimation function.

Balancing the SAM as a constrained optimization problem: a set of identities must be fulfilled by the final balanced data set, such as:

- closed market balances
- macro-economic accounting identities
- various exhaustion conditions
- non-negativity (e.g., to exclude negative consumption)

Set of equalities and inequalities: the constraints represent additional information (Bayesian approach)

Penalty function to correct the raw data based on the constraints: it minimizes the difference between the original and final data set.

Entropy criterion: to provide a distance measure between the a-priori and posteriori distribution.

Imbalances

After the balancing procedure, we assume the **imbalances are due to the estimation of interregional trade for intermediate use plus changes in stocks.**

1. Imbalances in interregional trade: solved through an optimization problem (Non linear programming). We want to minimize the difference between new and old supply/demand under the constraint $\text{Supply} = \text{Demand}$. We obtain the optimal level of trade, and the excess is attributed to margins;

2. The rest of imbalances on commodities becomes:

- Stocks if the demand for investment is greater than zero;
- Households' savings if the demand for investment is equal to zero.

At the end of this procedure, we apply again the cross-entropy algorithm to balance the final SAM.

SUMMARY AND FUTURE STEPS

We built an Italian regional SAM to observe the effect of fiscal-economic shocks at regional level through a Computable General Equilibrium (CGE) model

Next research steps:

- Further integration of administrative data: e.g., data from electronic invoice for reconstructing B2B trade flows in real time;
- Inclusion of information on regional tax gap;

THANK YOU



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