Developing the regional Social Accounting Matrix:
Bilateral Regional Trade Flows in Italy – an Origin-Destination-Commodity GWR-SAR approach

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Inter-regional flows estimation - METHODOLOGY

➢ Step 1 – reconstruction of the final consumption of households (B2C) inter-regional flows starting from the fiscal data of VAT.

➢ Step 2 – estimation of inter-regional flows for intermediate consumptions (B2B) through a gravity-based model.

➢ Step 3 – further integration of administrative data: e.g. data from electronic invoice for reconstructing B2B trade flows in real time.

B2C Inter-regional flows estimation

The final consumption of households (B2C) has been reconstructed, starting from the fiscal data of VAT:

- Passage from tax domicile to plant location: construction of a bridge matrix on IRAP (BT) data

- Passage from sector to commodities: construction of the Bridge MatrixAC

- Reallocation of margins (electricity, trade, and transport) to the other commodities

- Construction VT demand-side by using a share approach

B2B Inter-regional flows estimation

Inter-regional trade is the **exchange of goods from a production unit in an origin region to another production unit of a destination region**. Lack of data: interregional trade flows data need to be estimated (usually through gravity-based models).

Gravity models are based on the assumption that trade relationships between two regions, r and s, in a sector j (y_j^{rs}) are influenced by the economic sizes of two places (X) and by their distance (d^{rs}):

$$y_j^{rs} = \frac{X_j^{r\cdot} \cdot X_j^{\cdot s}}{d^{rs}}$$

where:

y_j^{rs} are the trade flows of sector j from region r to region s;

$X_j^{r\cdot}$ are the total outflows of sector j from region r (supply);

$X_j^{\cdot s}$ are total inflows of sector j to region s (demand);

d^{rs} is the distance between regions r and s.

Liu et al. (2015) approach

$$Y = \rho_o W_o Y + \rho_d W_d Y + \rho_w W_w Y + \beta_0 L_n + \beta_1 X_1 + \beta_2 X_2 - \beta_3 X_3 + \varepsilon$$

where:

$W_o Y$ measures the spatial dependence on the origin of the trade;

$W_d Y$ measures the spatial dependence on the destination of the trade flow;

$W_w Y$ measures the interdependence between the origin and the destination of trade flow;

L_n is a N×1 matrix with all elements equal to 1;

X_1 is the total supply from supply regions;

X_2 is the total demand from demand regions;

X_3 is the distance between two regions.

Empirical strategy

In particular, in a first step final consumption of households is reconstructed (Y_{hh}), starting from fiscal data of VAT, then they are related to classical gravity model regressors in order to investigate with what intensity economic size and distance lead to creation or diversion of trade in Italy

$$Y_{hh} = \rho_o W_o Y_{hh} + \rho_d W_d Y_{hh} + \rho_w W_w Y_{hh} + \beta_0 L_n + \beta_1 X_1 + \beta_2 X_{2hh} - \beta_3 X_3 + \sum_{i=1}^{I-1} \beta_i D_i + \varepsilon$$

To take into account the spatial dependence, a GWR (Geographically Weighted Regression) is used.

Then, in a second step, the estimated b parameters are used to predict inter-regional flows for intermediate consumptions ($\hat{Y}_{ic}$):

$$\hat{Y}_{ic} = \hat{\rho}_o W_o Y_{hh} + \hat{\rho}_d W_d Y_{hh} + \hat{\rho}_w W_w Y_{hh} + \hat{\beta}_0 L_n + \hat{\beta}_1 X_1 + \hat{\beta}_2 X_{2ic} - \hat{\beta}_3 X_3 + \sum_{i=1}^{I-1} \hat{\beta}_i D_i$$

where X_{2ic} is the total demand of intermediate commodities from demand regions

Empirical strategy

Then, inter-regional flows for intermediate consumptions are corrected by the 'intra-commodities' (θ) and the 'intra-regions' (C) degree of interaction to take into account competitive and/or cooperative relationships of the different industries in each region:

$$Y'_{ic} = \frac{\hat{Y}_{ic}}{C^{\theta}}$$

Finally, intermediate consumption matrices are balanced by using a share approach.

Data and variables

	Mean	St. Dev.	Min	Max
Final consumption of households (Y)	113	1,022	0	39,361
Total supply (X1)	6,622	11,156	0	126,434
Total demand of households (X2hh)	2,573	6,294	3.5	75,018
Intermediate consumption (X2ic)	3,572	10,310	0	147,548
Road distance (X3)	644	427	0	2,210

- Data are net of import and export
- X3 is the road distance in kilometres calculated as minimum path between regional centroids from the OpenStreetMap's maps
- W is the spatial weight matrix deriving from ISTAT shapefiles (neighbourhood is identified by considering a radius of 250 kilometres)

Estimation results

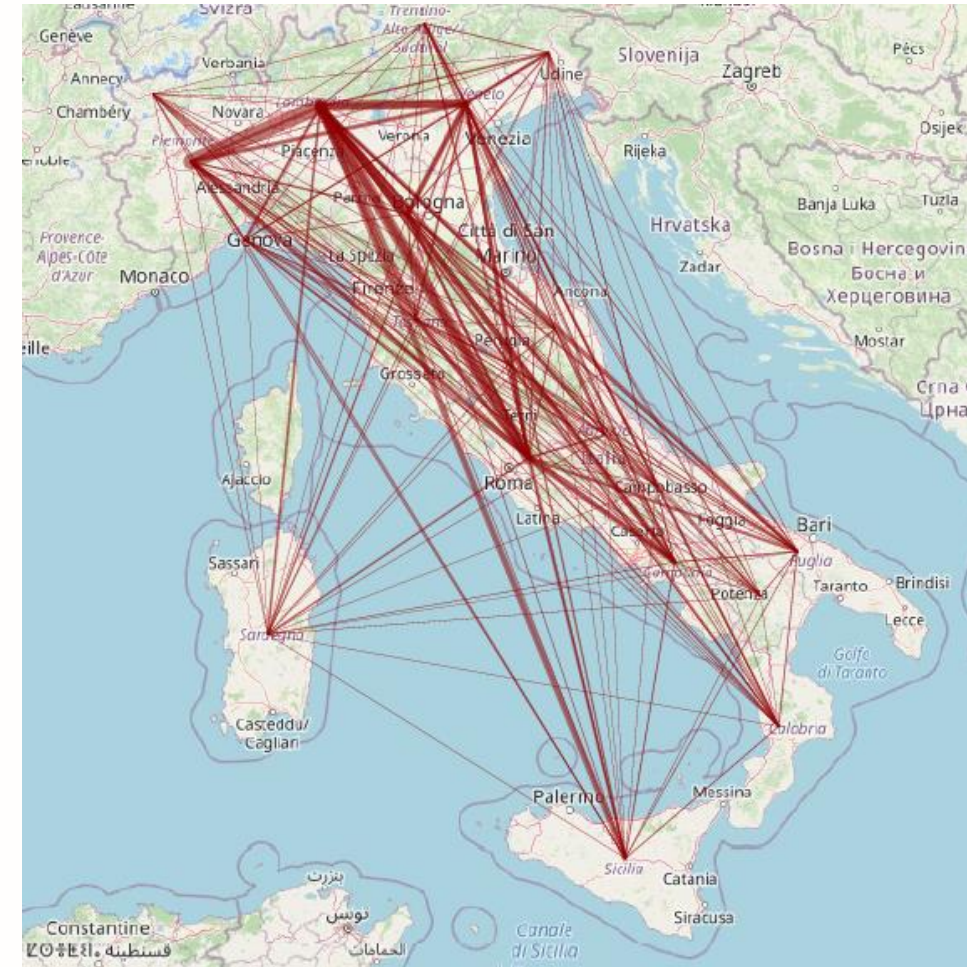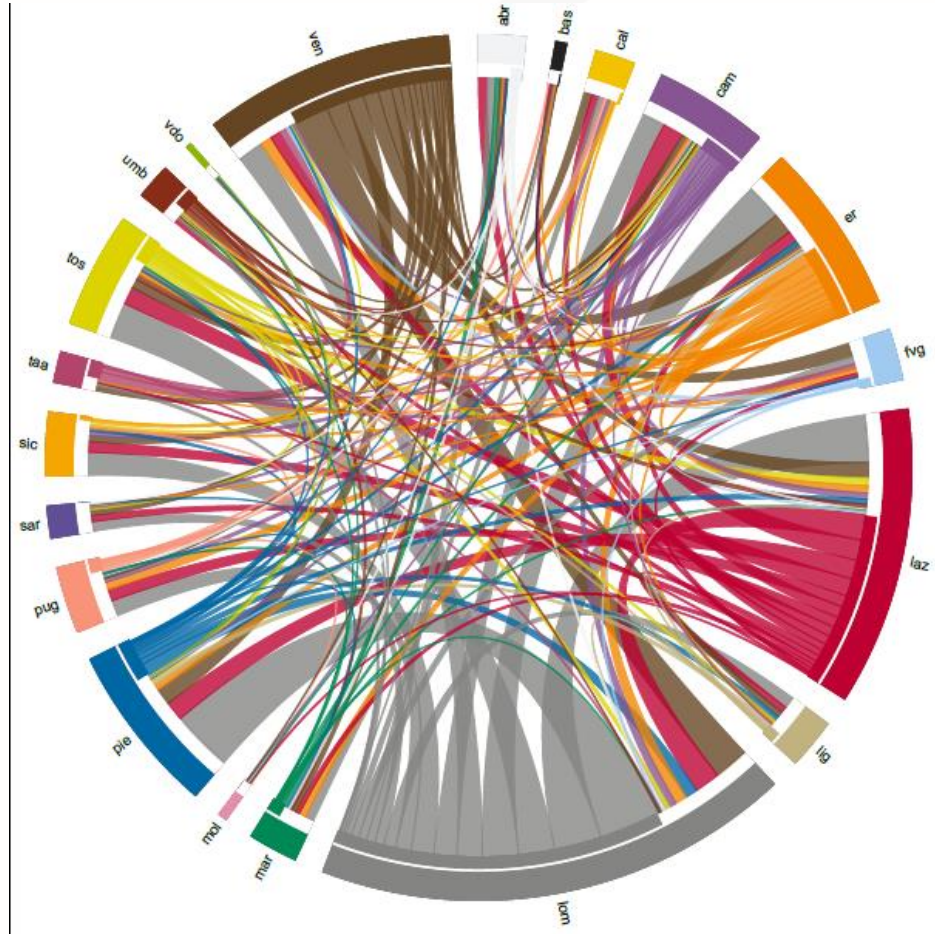| Dependent variable: Final consumption of households	OLS			GWR		
	(1)	(2)	(3)	p25	p50	p75
Total supply (X1)	0.434***	0.433***	0.572***	0.538	0.608	0.653
Total demand of households (X2hh)	0.425***	0.437***	0.350***	0.316	0.369	0.417
Road distance (X3)	-0.763***	-0.764***	-0.763***	-0.772	-0.758	-0.746
Spatial dependence on the origin (WoY)	-	-0.040***	-0.010	-0.012	-0.010	-0.009
Spatial dependence on the destination (WdY)	-	-0.017**	0.013	0.000	0.012	0.019
Spatial interdependence (WwY)	-	0.036***	0.007	0.005	0.007	0.010
Dummy commodities	NO	NO	YES	YES		
AIC	23,498	23,470	22,260	21,400		
R²	0.684	0.685	0.731	0.758		

Lagrange multiplier test confirms that, while we are able to reduce/eliminate the spatial dependence in Y, at the same time, this correction is not enough to deal with the spatial dependence in the error, so a GWR is required.

Check with institutional data: Road Freight Transport (RFT) by Istat for the year 2016

Spearman correlation

Commodity	HH flows	IC flows	Total flows
Products of agriculture, forestry and fishing	0.686	0.729	0.720
Manufactured products	0.714	0.854	0.848
Mining and quarrying	0.738	0.688	0.737

Intermediate consumption, estimated flows: Manufactured products

Thank you