Estimating of the economic impact of the agro-energy using administrative sources

Authors: Cusimano S., Fusco D., Truglia F.
Contact person: Cusimano S., cusimano@istat.it

Introduction:

- Renewable Energy Sources (solar thermal, photovoltaic, wind, etc.) are in a period of great development in the world, with an increasing weight in the energy production.
- The guidelines of the European Union provide an increasing total national energy consumption satisfied by renewable energy sources (Directive 2009/28 / EC).
- In the last years the production of electricity from renewable sources has grown strongly in the agricultural sector, offering important opportunities for the integration of the business income.

Objectives:

- Evaluate the economic impact of renewable energy on farms at territorial level considering the Standard Output (the average monetary value of the agricultural output at farm-gate price).

Data sources:

- VI General Agricultural Census
- Integrated Administration and Control System
- Managing Authority for Energy Services.

Methodology:

It was used the Monran index, a measure of spatial autocorrelation characterized by a correlation in a signal among nearby locations in space.

It was used the Global and Local indicators of spatial association (LISA), used to evaluate the clustering in those individual units by calculating Local Moran's I for each spatial unit and evaluating the statistical significance for each I_i.

The model was applied to the Piemonte Region for an experimental scope. The statistical units are the municipalities.

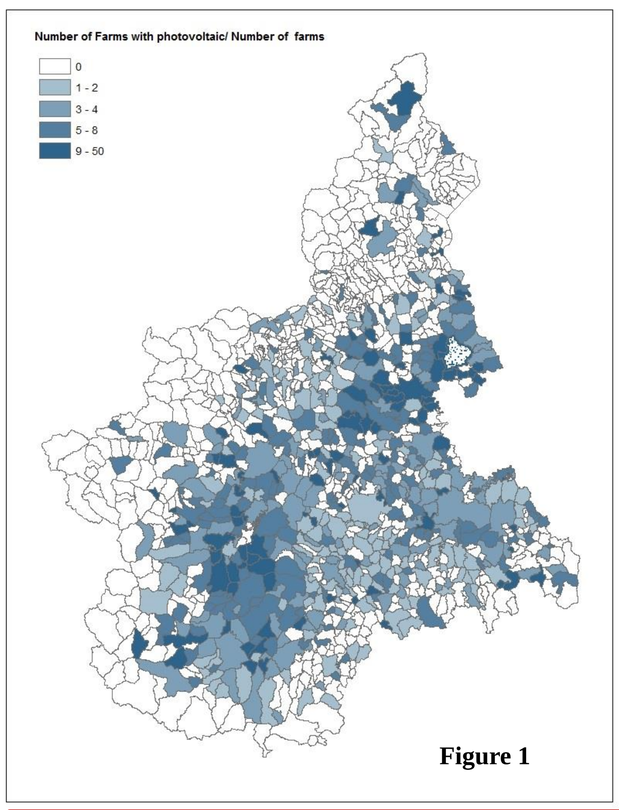

Figure 1

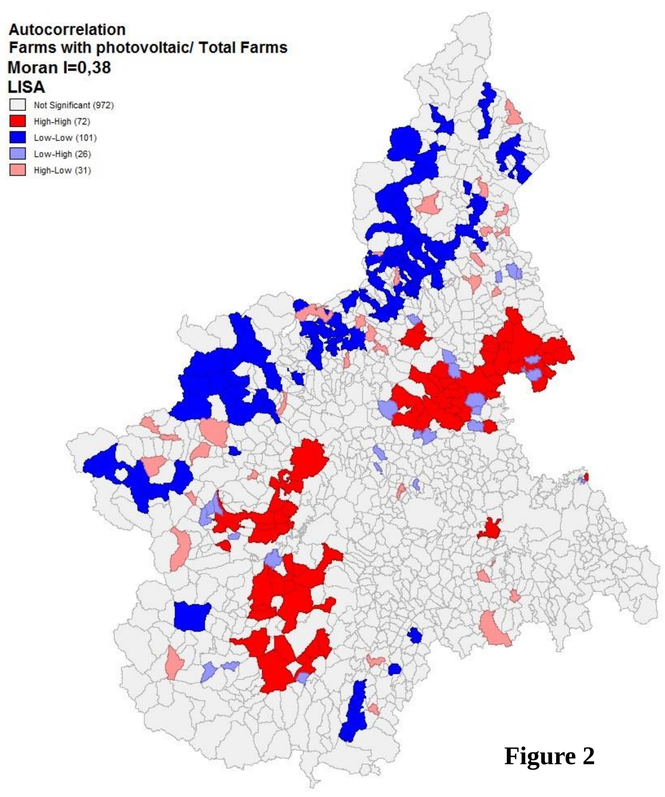

Figure 2

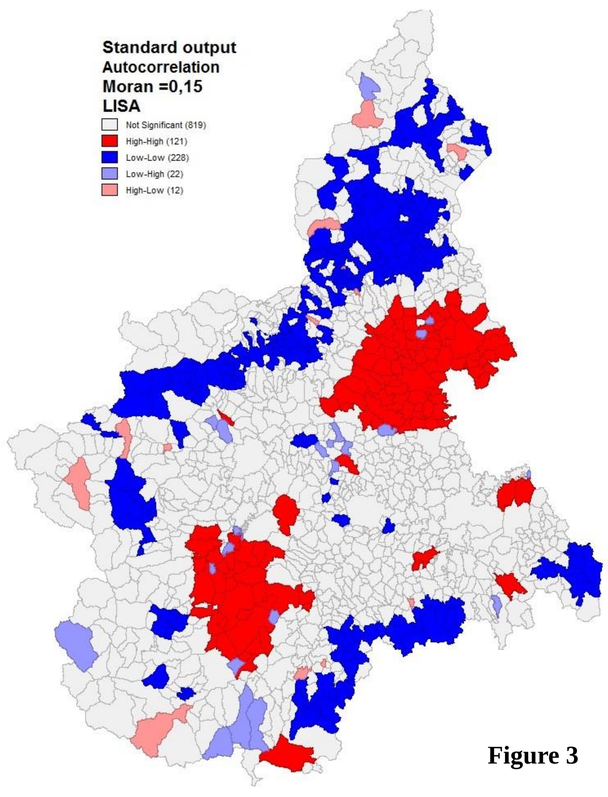

Figure 3

Results:

The index shows the contribution of each Province to the Global index. In the maps are highlighted four territorial cluster:

1.Nearby Municipalities with High values of indicators (HH) (Red)
2.Nearby Municipalities with Low values of indicators (LL) (Blue)
3.Municipalities with High values of indicators nearby Provinces with low values of indicators (HL) (Pink)
4.Municipalities with Low values of indicators nearby Provinces with low values of indicators (LH) (Pale blue)

(Figure 1) The number of farms with photovoltaic energy is 2,150 out of 67,148 total farms (3%). At Municipality level, 230 have the presence of photovoltaic out of 1,202 total Municipality (19%). For 75% of these 230 the maximum number of farms with photovoltaic energy is 8. At geographical level the Municipalities of the last quartile are concentrated in plain, mainly at east.

The spatial autocorrelation index is 0.38 for the percentage of farms with photovoltaic. There's a spatial aggregation of Municipality with similar values of this index. The spatial autocorrelation index is 0.15 for the Standard output, then the aggregation process is much lower compared to the incidence of the farms with photovoltaic, however, is statistically significant ($p < 0.05$).

(Figure 2) The LISA index for the incidence of farms with photovoltaic shows three clusters of HH formed mainly by municipalities located in the last quartile and that form the area of greatest concentration of photovoltaic farms. The LL cluster is predominantly on alpine areas and includes the municipalities where the phenomenon is absent.

(Figure 3) The last map shows the clusters of standard output that have the same position from a geographical point of view. The results partially confirm previous figure.

Clusters Contingecy tables:
Standard Output, Number of farms, percentage

	Farms with photovoltaic/ Total Farms					
SO/Farms	**HH**	**HL**	**LH**	**LL**	**NS**	**Totale**
HH	8.043.710		65.462		1.406.286	9.515.458
HL				246.847	835.735	1.082.582
LH	1.297.498		30.241	42.429	700.025	2.070.192
LL		224.999		1.114.205	1.014.636	2.353.839
NS	8.350.908	783.030	651.543	2.923.581	35.038.791	47.747.853
Totale	17.692.116	1.008.029	747.245	4.327.062	38.995.473	62.769.925

	Farms with photovoltaic/ Total Farms					
SO/Farms	**HH**	**HL**	**LH**	**LL**	**NS**	**Totale**
HH	50		2		20	72
HL				13	18	31
LH	9		1	2	14	26
LL		4		62	35	101
NS	62	8	19	151	732	972
Totale	121	12	22	228	819	1.202

	Farms with photovoltaic/ Total Farms					
SO/Farms	**HH**	**HL**	**LH**	**LL**	**NS**	**Totale**
HH	12,81	0,00	0,10	0,00	2,24	15,16
HL	0,00	0,00	0,00	0,39	1,33	1,72
LH	2,07	0,00	0,05	0,07	1,12	3,30
LL	0,00	0,36	0,00	1,78	1,62	3,75
NS	13,30	1,25	1,04	4,66	55,82	76,07
Totale	28,19	1,61	1,19	6,89	62,12	100,00

Finally it was crossed the cluster of figures one and two to identify the territorial units belonging or not to the same cluster and its standard output. The results are showed in the tables. 50 Municipalities out of 230 with photovoltaic are in the cluster HH for both LISA indices. These Municipalities produce the 30% of Standard output of Municipalities with photovoltaic and 12% of total Standard output. The 13% of Standard output is produced by Municipalities of HH LISA index for the incidence of farms with photovoltaic cluster and NS LISA index for Standard output cluster.

Conclusion:

The beginning hypothesis are partially confirmed by the model applied. The economic impact of renewable energy on farms at territorial level, considering Standard output how economic measure, exists with a low intensity. In any case is important underline that the impact is high for the farms with photovoltaic.

However, this kind of result could improve with the data, available in the future, relative to the some areas of the southern and central regions, where we expect a probably greater impact of photovoltaics, especially for farms, due to the constant and intensive presence of the sun, greater than the northern region as the Piemonte