

Soil loss, firm performance, and financing structure: An empirical investigation of Italian agricultural firms

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Introduction

Soil loss is the wearing of the upper side of the soil and can pose significant threats to ecosystem services, crop production, drinking water, and organic carbon stocks. Soil health can impact agricultural production by reducing the ability of the soil to produce by lowering the chemical properties of the soil lowering crop yields. It is estimated that globally, soil loss is an important factor affecting approximately 80% of cultivated soils, and negatively impacting the production levels in approximately 40% of cultivated areas worldwide.

Lower soil productivity has been linked with lower levels of crop productivity by agricultural firms making soil erosion a relevant factor for its long-term ramifications on crop harvests. Policymakers in the European Union are currently considering this issue had have policies into place geared at measuring and improving soil health, highlighting the relevance of the issue. Furthermore, in the EU Action Plan there is an initiative called: "Towards Zero Pollution for Air, Water and Soil".

Aim of the research

The objective of this article is to investigate the impact of unsustainable soil loss on firm financial performance, financing structure, and debt-related metrics.

Hypotheses

- 1) Unsustainable levels of soil loss are linked with lower levels of (i) profitability and (ii) higher operating income volatility.
 - By lowering the ability of the soil to produce crops.
 - Attempts to mitigate soil loss impacts by employing fertilizers can result into higher costs for agricultural firms.
- 2) Unsustainable levels of soil loss are linked with lower levels of (ii) formal financing (bank loans/total assets), (ii) informal financing (supplier credit/ total assets), and (iii) higher levels of equity financing (equity/ total assets).
 - The impacts of unsustainable levels of soil loss are visible in the income statements hence providers of finance will notice them.
 - Firms' with impacted financing availability make different investment decisions.
- 3) Unsustainable levels of soil loss are linked with higher levels of (i) cost of debt and (ii) lower interest coverage ratio levels.
 - Providers of loans will notice this feature in the income statement and will charge higher interest rates.

Firm level data

- Location: Italy
- Firm Financials: collected from the AIDA database.
- Firm Location Data (HQ): Collected from the AIDA database.
- The sample is restricted to larger firms as these represent globally 70% of cultivated crops and have higher finance availability.
- Only certain sectors of activity in terms of ATECO code are considered to identify the firms involved with agricultural production.

Soil loss data

- Collected from the Copernicus Climate Change Service (C3S) Climate Data Store
- Matrix (latitude, longitude) as an average value for the period 1980-2010.
- The European Commission's definition of over 5 tonners per hectare per year was employed to define Unsustainable soil loss (dummy variable).
- Not a raw rainfall vale, rather measured employing the RUSLE equation which considers soil related variables additionally to rainfall alone (inclination, management practices, crops, etc.).

Empirical results

Hyp.	Hypotheses	Results HT-Model	Coeff	Results ATT	Coeff	Results T-test (Mean 0 – Mean 1)	Coeff
H1.1.	Unsustainable levels of soil loss are associated with lower ROA for companies involved in agricultural production	Supported	-0.013***	Supported	-1.160***	Supported	0.013***
H1.2.	Unsustainable levels of soil loss are associated with lower ROE for companies involved in agricultural production	Supported	-0.021*	Supported	-2.649***	Supported	0.030***
H1.3.	Unsustainable levels of soil loss are associated with higher EBIT volatility for companies involved in agricultural production	Not supported	-21,090.77*	Not statistically sign	-9,292.32	Not statistically sign	-9,925.95
H2.1.	Unsustainable levels of soil loss are associated with lower levels of formal finance (bank long and short term) for companies involved in agricultural production	Supported	-0.020***	Supported	-0.827*	Supported	0.007*
H2.2.	Unsustainable levels of soil loss are associated with lower levels informal finance (suppliers' short term) for companies involved in agricultural production	Supported	-0.033***	Supported	-2.481***	Supported	0.030***
H2.3.	Unsustainable levels of soil loss are associated with higher levels equity financing for companies involved in agricultural production	Supported	0.048***	Supported	3.164***	Supported	-0.035***
H3.1.	Unsustainable levels of soil loss are associated with higher levels of costs of debt for companies involved in agricultural production	Not statistically sign	0.002	Not statistically sign	-0.071	Not statistically sign	0.001
H3.2.	Unsustainable levels of soil loss are associated with lower levels of interest coverage ratio for companies involved in agricultural production	Supported	-4.685*	Not statistically sign	-0.999	Not statistically sign	0.544

Notes. Statistical significance at 0.01, 0.05, and 0.10 are indicated respectively with ***, **, and *. The results presented in this table are related to the sample, with the variables related to the firm characteristics winsorized at the 0.99 level.

Concluding remarks

- Soil loss is a relevant and financially material climate/environmental risk for agricultural firms.
- Soil loss impacts financially (profitability – ROA and ROE) agricultural firms by (i) reducing their production ability and (ii) increasing firms' cost base (fertilizers).
- Firms located in unsustainable soil loss areas exhibit lower levels of external finance (formal and informal finance) and higher levels of equity finance. Those firms may be driven to make conservative investment choices and retain a higher portion of their earnings or obtain financing from family members.

Other considerations:

- The EU in its 2030 agenda outlines a reduction in use of chemical pesticides and fertilizers which can further increase the impacts of soil loss on crop yields/ agricultural firms financial health.