Economic and environmental effects in the presence of resource scarcity and substitution between renewable and nonrenewable resources

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Presentation structure

- Motivation
- The model
- Theoretical results
- Empirical simulation
- Sensitivity analysis
- Conclusions

Motivation

- Compatibility between economic growth and a cleaner environment
- Need for Government intervention?
- General equilibrium model:
  - resources substitution;
  - resource exhaustion;
  - pollution.

The model

Sectors

Final-goods sector	• Homogeneous • Firms use (polluting) non-renewable resources and/or (non-polluting) renewable resources to produce
Resources sectors: • Renewable Resources (RR) • Non-Renewable Resources (NRR)	• Monopolistic firm • Scarcity and pollution - NRR • Base Case: extraction costs constant • Endogenous Technical Change Case (ETC Case): the firm invest in knowledge to reduce extraction costs
Government	• One policy instrument: tax on emissions

Theoretical Results

Base Case	• Resource consumption increases with output and decreases with price (and the tax level for NRR) • Resource prices increase with costs (and the tax for NRR) • Resource consumption grows at the same rate as output • Permanent trade-off between economic growth and a cleaner environment
ETC Case	• Costs decrease as knowledge accumulates • Resource consumption increases with output and with knowledge **(**but decreases with the tax level for the NRR) • Resources prices decrease as knowledge accumulates (and increase with the tax level for NRR) • Resource consumption does not necessarily grow at the same rate as output • Possible compatibility between economic growth and a cleaner environment – need for Government intervention

Empirical Simulation

Data	• USA • Electricity sector • 2009
Scenarios	• Based on different RR shares and different tax levels
Results	• Higher RR share and lower tax on emissions decrease steady-state output • Variable levels (output, resource consumption and knowledge stocks) very sensitive to changes in the RR share and tax level; emission and output growth rates stable • The USA electricity structure remains dominated by fossil fuels (output and non-renewable resources consumption grow at very close rates)

Sensitivity analysis

Base Case		
$\partial(RR/NRR)/\partial\tau>0$	$\partial g\downarrow Y/\partial\tau>0$	$\partial g\downarrow E/\partial\tau>0$
$\partial(RR/NRR)/\partial\varepsilon<0$	$\partial g\downarrow Y/\partial\varepsilon<0$	$\partial g\downarrow E/\partial\varepsilon<0$

Endogenous Tecnical Change Case		
$\partial(RR/NRR)/\partial\tau>0$	$\partial g\downarrow Y/\partial\tau>0$	$\partial g\downarrow E/\partial\tau>0$
$\partial(RR/NRR)/\partial\varepsilon<0$	$\partial g\downarrow Y/\partial\varepsilon<0$	$\partial g\downarrow E/\partial\varepsilon<0$ if $1.9<\varepsilon<3.3$

Conclusions

- Importance of Endogenous Technical Change for the compatibility between economic growth and a cleaner environment (R&D)
- Importance of substitution of NRR for RR
- Importance of Government intervention
- Empirical dominance of NRR
- Further research


Thank you for your attention!