"Agricultural primary commodity export and environmental degradation: what consequences for populations health?"

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Motivations

- Emergence of an important literature on environmental concerns and its link to economic development
- High share of agricultural primary commodities in African countries exports, and link between health and agriculture
- Emphasis of health within the MDGs

Objective

Investigate the consequences of agricultural primary commodity export on health via environmental degradation.

Outline

- Trade and environment
- Some stylized facts
- Econometric models and data
- Main Results
- Conclusion and policy implications

How does international trade affect environmental quality

- Effect through economic growth: scale, technique and composition effects
- Pollution haven hypothesis: weak environmental regulations in poor countries
- Tariff escalation: reallocation of economic activities of exporting countries toward primary production

How does Agricultural exports affect environmental quality?

- Are Commodities exported substitutes of local consumption goods in terms of production, or additional productions.
- Comparison of the environmental impacts of the production of export commodities and local consumption goods
- Comparison of the environmental impacts of primary production and processing

Exports characteristics of different World Bank geographical regions

▸ Details

Primary agricultural commodity export and environmental quality

▸ Details

Three different econometric models

- Environmental effect of primary agricultural commodity export ▸ Details
- Health effect of agricultural pollution ▸ Details
- Simultaneous estimation of the two effects ▸ Details

Data and variables

- 119 countries, covering the period 1991-2009 subdivided into 4 periods of 5 years
- 3 main environmental indicators: agricultural methane and nitrous oxide emissions per capita, and Biological Oxygen Demand (BOD) per capita
- Agricultural primary commodity indicator from COMTRADE, and we follow the Standard International Trade Classification
- 3 health indicators: (IMR and U5MR) from UNICEF dataset and life expectancy from WDI.

Econometric results

- Environmental effect of primary agricultural commodity export results ▸ Details
- Health effect of agricultural pollution results ▸ Details
- Simultaneous estimation of the two effects ▸ Details

Robustness checks

- Disaggregation of primary agricultural product into subgroups Details
- Deforestation as environmental indicator Details
- Inclusion of openness variable Details

Conclusion

- The export of agricultural primary products increases agricultural methane and nitrous oxide emissions as well as water pollution (biological oxygen demand).
- These results appear to be robust to different subcomponents of primary agricultural export, to the inclusion of openness variable, and to other environmental variables considered.
- This environmental degradation from trade worsens populations health outcomes (infant and child mortality rates and life expectancy at birth).

Policy Implications

- Our results give additional tools to policy makers, since they may improve health outcomes through the modification of the composition of exports.
- Avoid climate change consequences by minimizing the share of primary agricultural commodity in exports.
- But how?
- Transform raw products before exporting them.
- Tariff escalation issue needs to be addressed to encourage the export of processed commodities.
- Produce more local consumption products instead of forcing the production of some agricultural products for export

Thank you for your attention !

Figure 1: Exports characteristics of different World Bank geographical regions

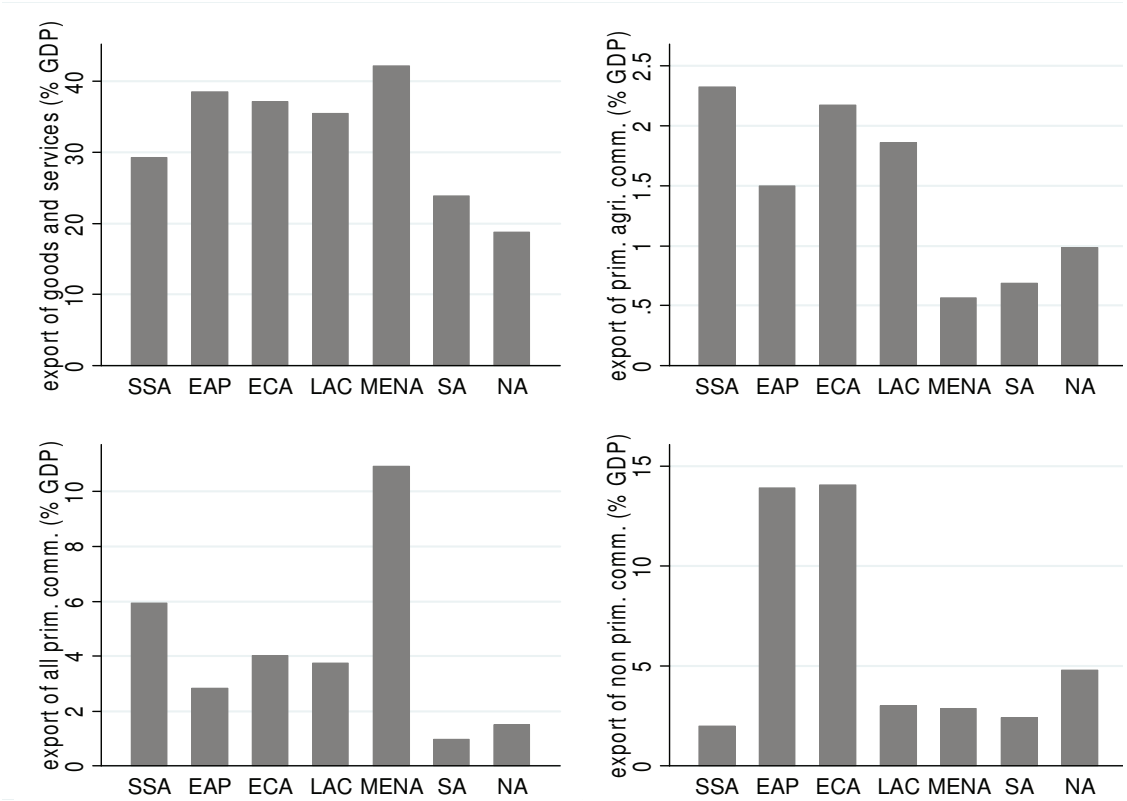

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Figure 2: Primary agricultural commodity export and environmental quality

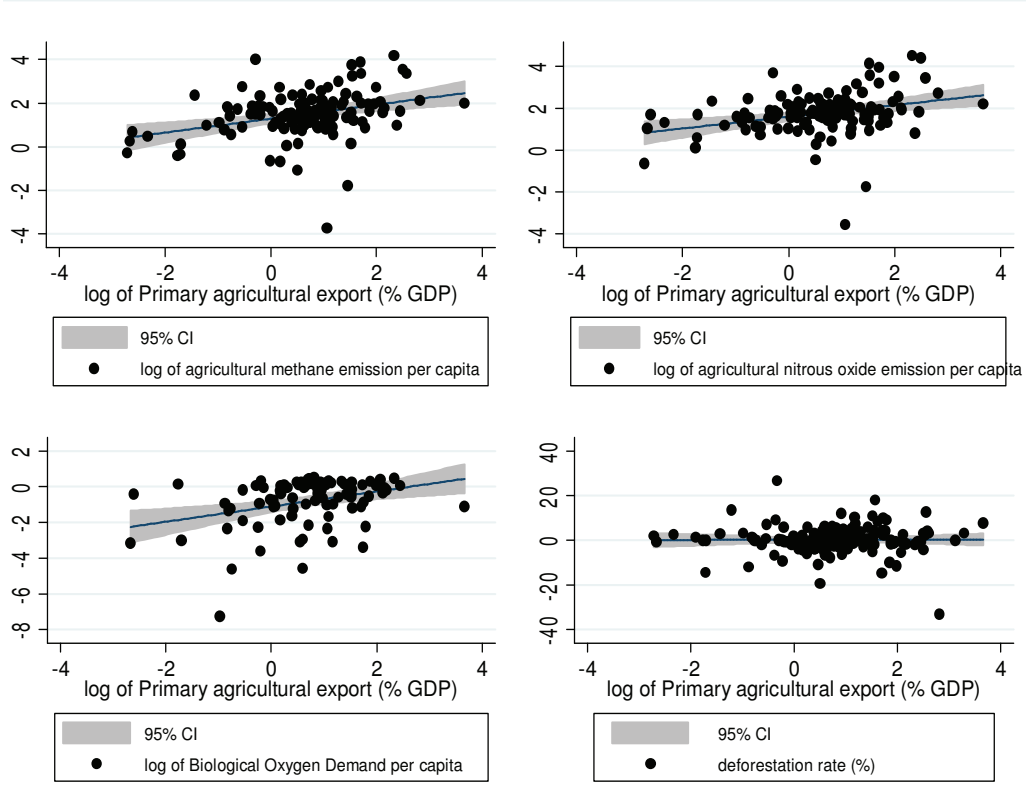

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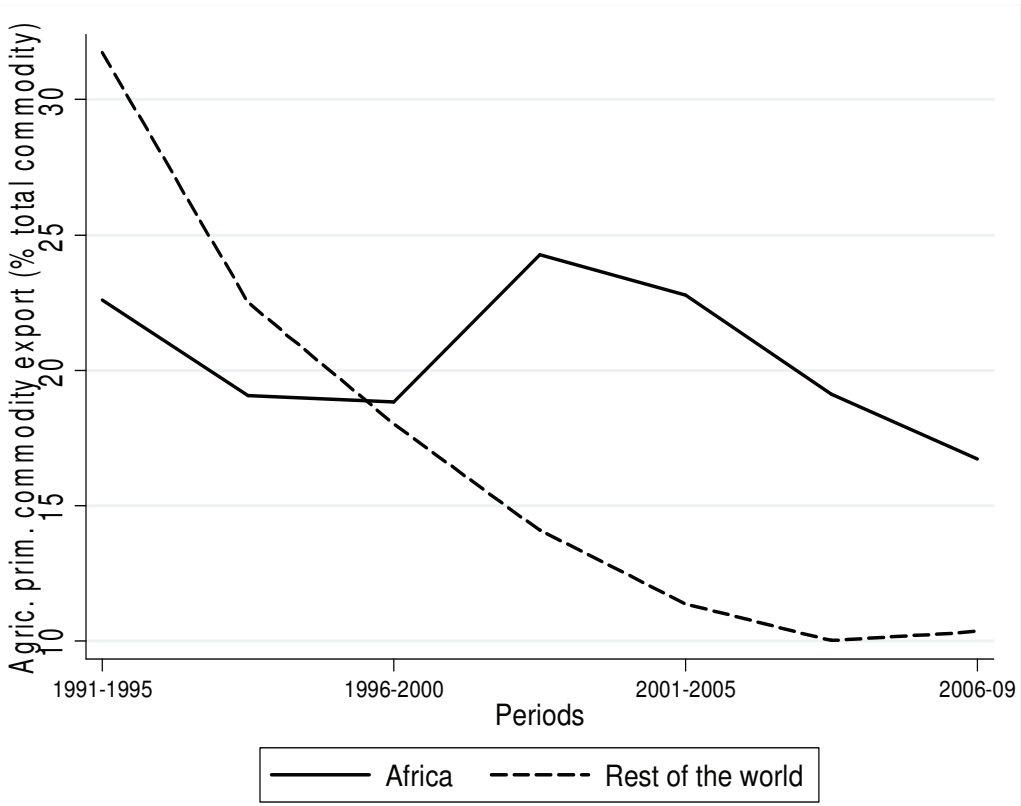
Figure 3: Evolution of primary agricultural export in Africa and the rest of the world



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Environmental effect of primary agricultural commodity export

$$environment_{it} = \alpha agrprimcom_{it} + X_{it}^{'}\beta + \varepsilon_{it} \quad (1)$$

Where $environment_{it}$ represents the environmental degradation of country i in period t.

$agrprimcom$ is the indicator of agricultural primary commodity export,

X the matrix of control variables commonly used in the literature, and

ε_{it} is the error term. α, our coefficient of interest, is expected to be positive ($\alpha > 0$).

2 instruments for $environment_{it}$:

- The agricultural land per total land area

- The Agricultural machinery, tractors per 100 square kilometer of arable land

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Health effect of agricultural pollution

$$Health_{it} = \eta_i + \gamma environment_{it} + \theta_k Z_{kit} + \psi_t + \omega_{it} \quad (2)$$

Where *Health* represents health status measure and

Z_{it} is the matrix of the control variables.

η_i and ψ_t represent respectively the country and time fixed effects, and

ω_{it} is the error term.

We expect our coefficient of interest, γ, to be more than zero ($\gamma > 0$).

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Simultaneous estimation of the two effects (Equation 1 and 2)

$$\begin{cases} environment_{it} = \alpha agrprimcom_{it} + X'_{it}\beta + \varepsilon_{it} \\ Health_{it} = \gamma environment_{it} + \theta_k Z_{kit} + \omega_{it} \end{cases} \quad (3)$$

Three Stages Least Square method (3SLS).

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Table 1: 2SLS results of the environmental effect of agricultural export

	Dependent variables					
	Whole sample			Africa sample		
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variables	Methane	Nitrous	BOD	Methane	Nitrous	BOD
Log Agri. Prim. Comm. export	1.165***	1.290***	0.004*	0.231**	0.287***	0.0004
	(4.61)	(5.00)	(1.90)	(2.57)	(3.60)	(0.46)
Time dummies	yes	yes	yes	yes	yes	yes
Observations	350	350	201	69	69	32
Fisher statistic of first stage	7.43	7.43	3.70	9.88	9.88	1.67
Hansen OID p-value	0.21	0.08	0.24	0.56	0.43	0.83

Notes: The dependent variables are in natural logarithmic form. Robust absolute t statistics in parentheses, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

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Table 2: Health impact of environmental degradation

	Dependent variables: Health status								
	Log Infant mortality rate			Log Under 5 mortality rate			Log (80-life expectancy)		
Indep. variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Methane (-1)	0.273***			0.263***			0.145**		
	(3.51)			(3.17)			(2.52)		
Log Nitrous (-1)		0.252***			0.245***			0.130***	
		(4.14)			(3.51)			(3.27)	
BOD (-1)			62.51**			58.01*			4.128
			(2.25)			(1.92)			(0.24)
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	252	252	101	252	252	101	252	252	101
Countries	108	108	66	108	108	66	108	108	66
R^2	0.71	0.70	0.70	0.72	0.71	0.69	0.66	0.65	0.70

Note: Robust absolute t statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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Table 3: Three stages least square estimation of environmental and health (und. 5 Mort. Rate) equations

	Dependent variable : Health status and environment					
	(1)	(2)	(3)	(4)	(5)	(6)
Indep. variables	Log Methane	Log Under 5 Mort. rate	Log Nitrous	Log Under 5 Mort. rate	BOD	Log Under 5 Mort. rate
Log Agri. Prim. Comm.	0.51***		0.45***		0.048*	
	(3.69)		(3.949)		(1.837)	
Log Methane		0.18***				
		(3.052)				
Log Nitrous				0.19***		
				(3.70)		
BOD						3.75***
						(2.69)
Time dummies	yes	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes
Observations	204	204	204	204	114	114
R^2	0.21	0.83	0.41	0.85	0.21	0.83

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Table 4: 2SLS results of the methane effect of agricultural export disaggregated

	Dependent variable: log Methane per capita			
Indep. variables	(1)	(2)	(3)	(4)
Log Foods and Animals	0.872***			
	(6.16)			
Log beverages		0.726***		
		(3.87)		
Log Crude Materials			1.947**	
			(2.57)	
Log Animals and veg. Oil				1.595*
				(1.95)
Time dummies	yes	yes	yes	yes
Observations	356	354	356	350
Fisher statistic of first stage	13.06	7.68	2.44	1.54
Hansen OID p-value	0.26	0.41	0.55	0.34

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Table 5: Agricultural export and deforestation in Africa

	Dependent variable: Deforestation rate
Log Agri. Prim. Comm. export	0.084**
	(2.44)
Time dummies	yes
observations	110
Fisher statistic of first stage	2.95
Hansen OID p-value	0.15

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Table 6: 2SLS results of the environmental effect of agricultural export (including openness)

	Dependent variables		
	(2)	(3)	(4)
Indep. variables	Log Methane	Log Nitrous	BOD
Log Agri. Prim. Comm. export	1.091***	1.253***	0.003
	(4.85)	(5.25)	(1.27)
Log openness	-1.031***	-0.978***	0.001
	(6.24)	(6.14)	(0.49)
Time dummies	yes	yes	yes
observations	349	349	201
fisher	7.88	7.88	3.31
Hansen OID p-value	0.56	0.23	0.23

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