CO2 Emissions, Environmental Provisions and Global Value Chains:

The Middle East and North Africa in a Global Context

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Motivation

- Air pollution coming from international freight transport could increase by 160 percent by 2050 **(OECD/ITF (International Transport Forum), 2017)**.

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Motivation

- Air pollution coming from international freight transport could increase by 160 percent by 2050 **(OECD/ITF (International Transport Forum), 2017)**.
- **Cherniwchan (2017)** proves that North American Free Trade Agreement (NAFTA), in its first five years, reduces emissions of pollutants by two-third in the United States (US) manufacturing sectors.
- CO2 emissions were shifted from developed countries to developing countries. This is explained by the fact that countries differently implement and enforce environmental laws **(Kanemoto et al. 2014)**.

Research question

What is the impact of **Global Value Chains (GVCs)** (in terms of forward and backward linkages) on **carbon emissions** in the presence of Regional Trade Agreements (RTAs) with **environmental provisions**?

RTAs with environmental laws

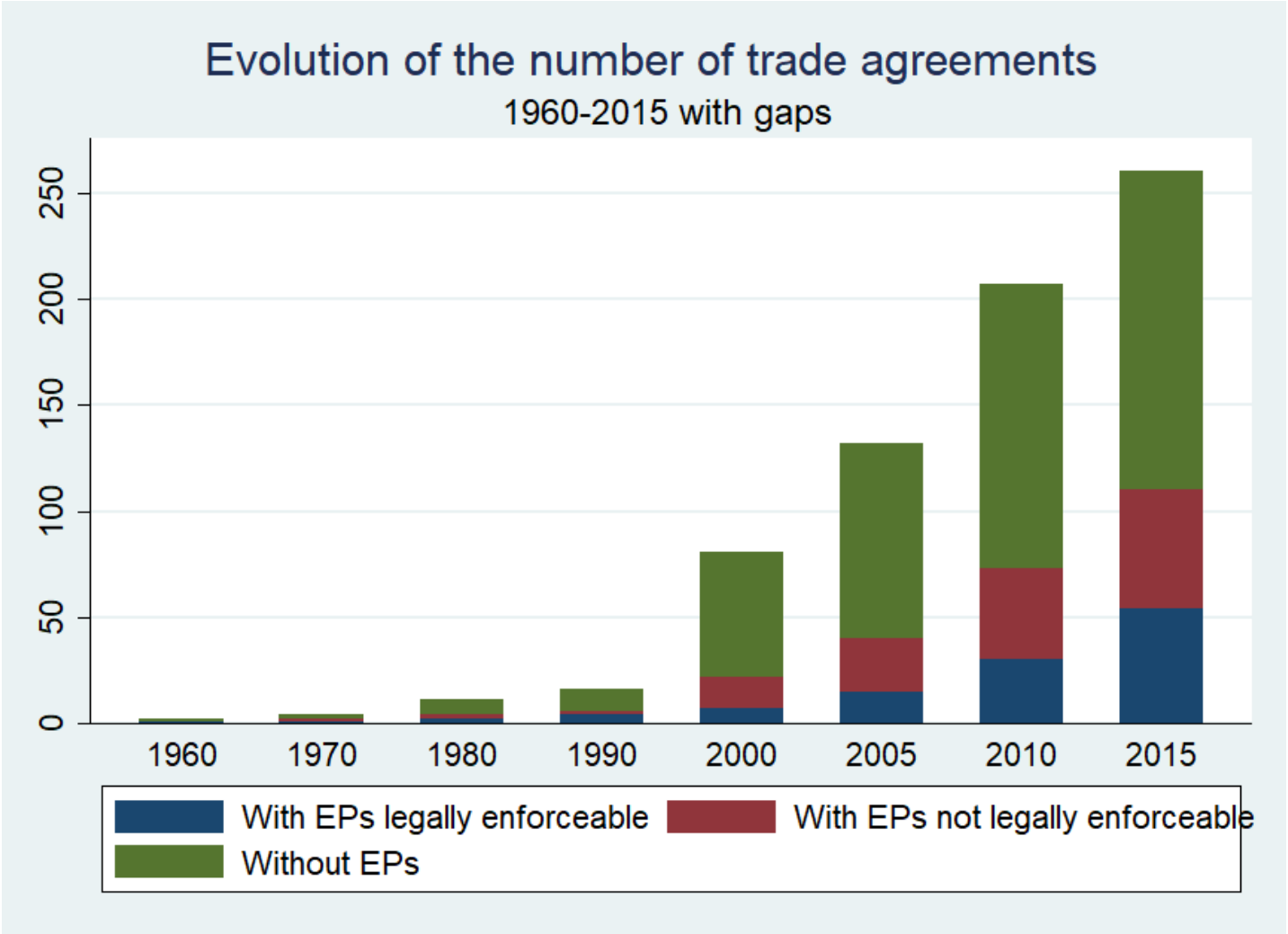


FIGURE – RTAs and Environnemental Provisions (EPs) (Authors calculations)

RTAs with environmental laws

- **Cherniwchan (2017) and Yao et al. (2019) :**The relationship between pollution and Trade agreements.
- **Zhou et al. (2017) ; Baghdadi et al. (2013) ; Martínez-Zarzoso, (2018) :** The impact of RTAs with and without environmental provisions on pollution.

GVC participation and pollution

- **WB (2019) :** International trade in intermediate products rises domestic CO2 emissions in developing countries.
- **Berger et al. (2016) :** GVCs are affected by policies related to investment, competition and environmental laws.
- **Ren et al. (2014)** indicate that china's trade openness and Foreign Direct Investment (FDI) increase air pollution.

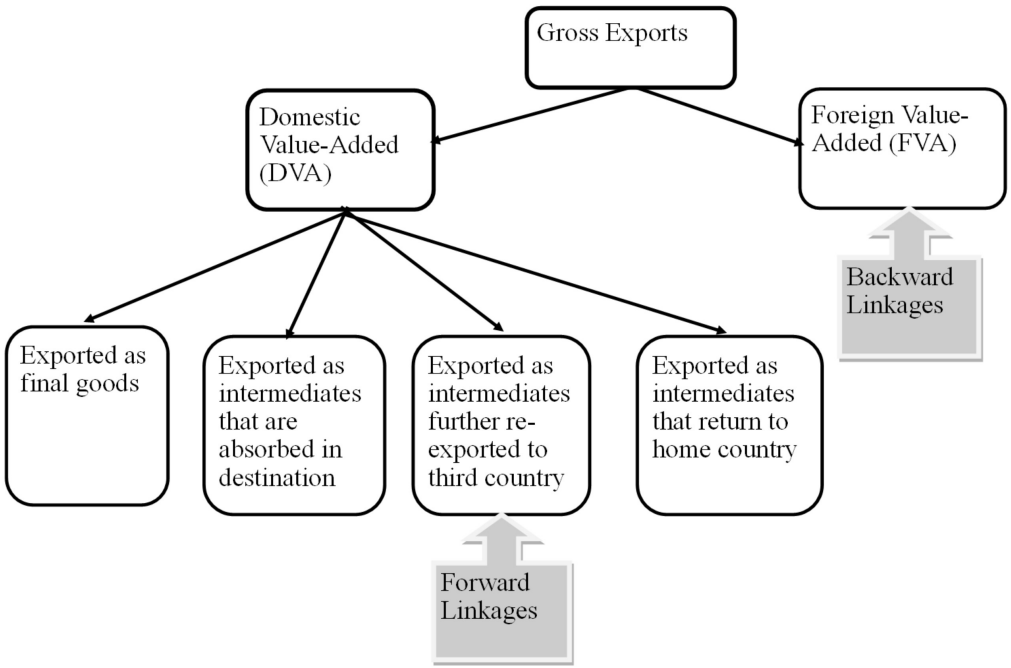
This paper

1. examines the empirical relations between trade and the environment in Middle East and North Africa (MENA) region during 1990-2015.

2. analyzes the impact of RTAs with and without environmental provisions on carbon emissions using the gravity model.

3. contributes to understanding to which extent integration in GVCs (forward and backward participation) and signing more RTAs with provisions related to the environment could affect pollution in the MENA region.

Methodology



Sources: Koopman and others (2011), Rahman and Zhao (2013), Aslam and others (2017).

FIGURE – Decomposition of Gross exports into value-added exports

Methodology

$$GVCparticipationindex = ForwardGVCparticipationindex + BackwardGVCparticipationindex \quad (1)$$

$$ForwardGVCparticipationindex = \frac{Indirctvalueadded(DVX)}{Grossexports} \times 100 \quad (2)$$

$$BackwardGVCparticipationindex = \frac{ForeignValueAdded(FVA))}{Grossexports} \times 100 \quad (3)$$

Data

Variable	Description	Obs	Mean	Min	Max	Source
CO2	Embodied Flow Gg CO2	9163	203.322	0	16285.13	Eora Global Supply Chain Database
numberRTAenv_notle	Number of RTAs with not enforceable environmental laws	9163	.631	0	8	Mario Larch's Regional Trade Agreements Database
numberRTAenv_le	Number of RTAs with legally enforceable environmental laws	9163	.291	0	8	
numberRTA_no	Number of RTAs without environmental laws	9163	.615	0	1	
Forward_o	Forward participation index of origin county	9163	6290000	0	4.63e+07	UNCTAD-Eora Global Value Chain Database
Backward_o	Backward participation index of origin county	9163	2980000	0	2.78e+07	
Forward_d	Forward participation index of destination country	9163	3.53e+07	0	6.34e+08	
Backward_d	Backward participation index of destination country	9163	3.99e+07	0	8.75e+08	

Model specification

- Period : 1990 - 2015.
- Gravity model :
  - CO2 emissions **(Yao et al., 2019 ; Baghdadi et al., 2013).**
  - Water exports **(Duarte et al., 2019).**
- Region : 19 MENA countries originating pollution.
- The PPML estimated equation is as follows :

$$
\begin{aligned}
&CO2_{odt} = \\
&exp\,[\,\mu_o + \phi_d + \delta_t + \alpha_1 ln\ gdp_{ot} + \alpha_2 ln\ gdp_{dt} + \alpha_3 ln\ distance_{od} + \alpha_4 contiguity_{od} + \\
&\alpha_5 language_{od} + \alpha_6 colony_{od} + \alpha_7 numberRTAenvle + \alpha_8 numberRTAenvnotle_{odt} + \\
&\alpha_9 numberRTAno_{odt} + \alpha_{10} Forward_{ot} + \alpha_{11} Backward_{ot} + \alpha_{12} Forward_{dt} + \alpha_{13} Backward_{dt} + \\
&\alpha_{14}(numberRTAenv_{odt} \times Forward_{ot}) + \alpha_{15}(numberRTAenv_{odt} \times Backward_{ot}) + \\
&\alpha_{16}(numberRTAenv_{odt} \times Forward_{dt}) + \alpha_{17}(numberRTAenv_{odt} \times Backward_{dt})] \times \epsilon_{odt} \quad (4)
\end{aligned}
$$

Estimation

TABLE – RTAs, environnemental provisions and Carbon emissions (PPML estimation)

VARIABLES	(1) CO2	(2) CO2	(3) CO2	(4) CO2
numberRTAenv_le		-0.179**		
		(0.0854)		
numberRTAenv_notle			0.177	
			(0.243)	
numberRTA_no				0.0328
				(0.188)
Observations	8,404	8,404	8,404	8,404
exporter FE	YES	YES	YES	YES
importer FE	YES	YES	YES	YES
year FE	YES	YES	YES	YES

Estimation

TABLE – CO2 emissions and forward GVC participation (PPML estimation)

VARIABLES	(1) CO2	(2) CO2	(3) CO2	(4) CO2	(5) CO2
Forward_o	0.000181				
	(0.00809)				
Forward_d	0.0102				
	(0.0176)				
numberRTAenv_le × Forward_o		-0.00636**			
		(0.00299)			
numberRTAenv_le × Forward_d			-0.00665**		
			(0.00284)		
numberRTAenv_notle × Forward_o				0.0179***	
				(0.00552)	
numberRTAenv_notle ×Forward_d					0.0121*
					(0.00730)
Observations	7,202	7,781	7,766	7,781	7,766
exporter FE	YES	YES	YES	YES	YES
importer FE	YES	YES	YES	YES	YES
year FE	YES	YES	YES	YES	YES

Estimation

TABLE – CO2 emissions and backward GVC participation (PPML estimation)

VARIABLES	(1) CO2	(2) CO2	(3) CO2	(4) CO2	(5) CO2
Backward_o	11.68**				
	(5.258)				
Backward_d	1.195***				
	(0.274)				
numberRTAenv_le × Backward_o		-0.00429**			
		(0.00176)			
numberRTAenv_le × Backward_d			-0.00236		
			(0.00248)		
numberRTAenv_notle × Backward_o				-0.0175**	
				(0.00795)	
numberRTAenv_notle × Backward_d					0.00943
					(0.00613)
Observations	7,202	7,781	7,766	7,781	7,766
exporter FE	YES	YES	YES	YES	YES
importer FE	YES	YES	YES	YES	YES
year FE	YES	YES	YES	YES	YES

Main results

- Enforceability of RTAs which contains environmental provisions decreases pollution.
  - **Zhou et al. (2017)** show that RTAs without environmental provisions harm air quality.
  - Low income countries suffer from pollution even after signing more FTAs due to lenient environmental standards **(Yao et al., 2019)**.

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- Upstream tasks in GVCs does not contribute to environmental deterioration in MENA.

Main results

- Enforceability of RTAs which contains environmental provisions decreases pollution.
  - **Zhou et al. (2017)** show that RTAs without environmental provisions harm air quality.
  - Low income countries suffer from pollution even after signing more FTAs due to lenient environmental standards **(Yao et al., 2019)**.
- Upstream tasks in GVCs does not contribute to environmental deterioration in MENA.
- Exporting foreign value added (downstream activities) increases CO2 emissions in MENA.
  - Multinational firms headquartered in developing countries perform their polluting activities in countries with relatively weak environmental laws. Moreover, Developing countries execute tasks in in high-polluting industries **(Ben-David et al., 2018)**.

Conclusion

- RTAs with legally enforceable environmental provisions reduce carbon emissions.
- Participation of MENA countries in backward GVCs rises environmental degradation.
- This study helps identify to which extent negotiating environmental policies in the MENA region is important for a green sustainability.

Thank you !

Do you have any questions ?

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Appendix

VARIABLES	(1) CO2	(2) CO2	(3) CO2	(4) CO2
Ln distance	-1.089***	-1.102***	-1.080***	-1.091***
	(0.0782)	(0.0767)	(0.0804)	(0.0785)
Ln gdp_o	0.0479	0.0853	0.0345	0.0503
	(0.0739)	(0.0809)	(0.0698)	(0.0722)
Ln gdp_d	0.821***	0.853***	0.850***	0.814***
	(0.0951)	(0.0971)	(0.0899)	(0.0929)
contiguity	0.114	0.142	0.108	0.113
	(0.168)	(0.166)	(0.170)	(0.168)
language	0.619***	0.569***	0.623***	0.607***
	(0.157)	(0.147)	(0.154)	(0.152)
colony	0.261	0.292*	0.257	0.269
	(0.174)	(0.163)	(0.171)	(0.168)
numberRTAenv_le		-0.179**		
		(0.0854)		
numberRTAenv_notle			0.177	
			(0.243)	
numberRTA_no				0.0328
				(0.188)
Constant	-12.24***	-13.80***	-12.81***	-12.12***
	(1.986)	(2.279)	(2.106)	(2.006)
Observations	8,404	8,404	8,404	8,404
exporter	YES	YES	YES	YES
importer	YES	YES	YES	YES
year FE	YES	YES	YES	YES

Appendix

VARIABLES	CO2	CO2	CO2	CO2	CO2
Ln distance	-1.088***	-1.097***	-1.109***	-1.004***	-1.078***
	(0.0793)	(0.0771)	(0.0775)	(0.0887)	(0.0812)
Ln gdp_o	0.0320	0.0935	0.0875	-0.0166	0.0186
	(0.0676)	(0.0888)	(0.0826)	(0.0767)	(0.0735)
Ln gdp_d	0.797***	0.862***	0.873***	0.987***	0.886***
	(0.0970)	(0.100)	(0.0985)	(0.0951)	(0.0945)
contiguity	0.0376	0.124	0.109	0.102	0.0600
	(0.179)	(0.172)	(0.167)	(0.182)	(0.172)
language	0.623***	0.558***	0.560***	0.555***	0.622***
	(0.155)	(0.145)	(0.145)	(0.146)	(0.150)
colony	0.260	0.299*	0.298*	0.310**	0.252
	(0.172)	(0.162)	(0.160)	(0.150)	(0.160)
Forward_o	0.000181				
	(0.00809)				
Forward_d	0.0102				
	(0.0176)				
numberRTAenv_le × Forward_o		-0.00636**			
		(0.00299)			
numberRTAenv_le × Forward_d			-0.00665**		
			(0.00284)		
numberRTAenv_notle × Forward_o				0.0179***	
				(0.00552)	
numberRTAenv_notle ×Forward_d					0.0121*
					(0.00730)
Constant	-10.35***	-13.76***	-13.52***	-15.27***	-12.79***
	(2.181)	(2.493)	(2.445)	(2.346)	(2.290)
Observations	7,202	7,781	7,766	7,781	7,766
exporter	YES	YES	YES	YES	YES
importer	YES	YES	YES	YES	YES
year FE	YES	YES	YES	YES	YES

Appendix

VARIABLES	CO2	CO2	CO2	CO2	CO2
Ln distance	-287.3***	-1.087***	-1.098***	-1.088***	-1.084***
	(85.69)	(0.0780)	(0.0783)	(0.0780)	(0.0812)
Ln gdp_o	83.74***	0.0438	0.0465	0.0108	0.0184
	(30.44)	(0.0759)	(0.0758)	(0.0777)	(0.0721)
Ln gdp_d	42.11*	0.840***	0.828***	0.785***	0.888***
	(24.92)	(0.0975)	(0.0958)	(0.0957)	(0.0895)
contiguity	-166.4	0.0993	0.0770	0.0760	0.0585
	(170.0)	(0.173)	(0.170)	(0.179)	(0.173)
language	246.8	0.602***	0.615***	0.504***	0.626***
	(215.8)	(0.152)	(0.152)	(0.151)	(0.152)
colony	1,035	0.274	0.264	0.366**	0.256
	(711.9)	(0.170)	(0.170)	(0.158)	(0.169)
Backward_o	11.68**				
	(5.258)				
Backward_d	1.195***				
	(0.274)				
numberRTAenv_le × Backward_o		-0.00429**			
		(0.00176)			
numberRTAenv_le × Backward_d			-0.00236		
			(0.00248)		
numberRTAenv_notle × Backward_o				-0.0175**	
				(0.00795)	
numberRTAenv_notle × Backward_d					0.00943
					(0.00613)
Constant	-1,051	-12.11***	-11.54***	-9.540***	-12.48***
	(1,232)	(2.046)	(2.074)	(2.160)	(2.178)
Observations	7,202	7,781	7,766	7,781	7,766
Number of id	547				
exporter	YES	YES	YES	YES	YES
importer	YES	YES	YES	YES	YES
year FE	YES	YES	YES	YES	YES

Appendix

Gravity Variables	Description	Obs	Mean	Min	Max	Source
Contiguity	1=Contiguity	9163	.081	0	1	CEPII
Language	1=Common official or primary language	9163	.531	0	1	
Colony	1=Pair ever in colonial relation	9163	.02	0	1	
Distance	weighted distance (pop-wt, km)	9163	2719.724	131.758	17465.98	
Gdp_o	Origin GDP (current US$)	8667	8.99e+10	4.92e+08	7.54e+11	WDID: World Development Indicators, World Bank
Gdp_d	Destination GDP (current US$)	8894	4.10e+11	4.92e+08	1.80e+13	