

CO2 Emissions, Environmental Provisions and Global Value Chains in MENA Countries

Insaf GUEDIDI^{1,2} Leila BAGHDADI¹

Date: June 24, 2021

24th Annual Conference on Global Economic Analysis
GTAP Conference

¹Higher School of Economic and Commercial Sciences of Tunis (ESSECT), University of Tunis

²Université Paris 1 Panthéon Sorbonne

Motivation

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

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

- CO2 emissions were shifted from developed countries to developing countries:
 - Countries differently implement and enforce environmental laws (**Kanemoto et al., 2014**).
 - China's trade openness increases carbon emissions (**Ren et al., 2014**).
 - The effect of trade on environment varies depending on the country and the pollutant(**Managi et al., 2009**).

Research question:

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

Literature

GVCs, environmental provisions and pollution

- Environmental effects of trade openness:
 - China's trade openness and Foreign Direct Investment (FDI) increase air pollution (**Ren et al., 2014**).
 - International trade in intermediate products rises domestic CO2 emissions in developing countries (**WB,2019**).
- The importance of trade agreements with environmental provisions:
 - GVCs are affected by policies related to investment, competition and environmental laws (**Berger et al., 2016**).
 - The relationship between pollution and Trade agreements(**Cherniwchan, 2017; Yao et al., 2019**).
 - The impact of RTAs with and without environmental provisions on pollution(**Zhou et al.,2017; Baghdadi et al.,2013; Martínez-Zarzoso,2018**).

GVCs, environmental provisions and pollution

- Environmental effects of trade openness:
 - China's trade openness and Foreign Direct Investment (FDI) increase air pollution (**Ren et al., 2014**).
 - International trade in intermediate products rises domestic CO2 emissions in developing countries (**WB,2019**).
- The importance of trade agreements with environmental provisions:
 - GVCs are affected by policies related to investment, competition and environmental laws (**Berger et al., 2016**).
 - The relationship between pollution and Trade agreements(**Cherniwchan, 2017; Yao et al., 2019**).
 - The impact of RTAs with and without environmental provisions on pollution(**Zhou et al.,2017; Baghdadi et al.,2013; Martínez-Zarzoso,2018**).

Channels through which GVCs harm or benefit the environment

1. Participation in GVCs benefits the country from competition and technique effects. Both effects make use of green technologies and eco-friendly products which benefit the environment and enhance its quality. However, growth or scale effect driven by early stage participation in GVCs increases per capita carbon emissions **(Wang et al., 2019)**.
2. As the product in global production networks crosses border many times before reaching its final destination, pollution coming from transport is higher in GVCs.
 - Air pollution coming from international freight transport could increase by 160 percent by 2050 **(OECD/ITF, 2017)**.
3. Migration of industries in countries with weak environmental protection is becoming a major concern in GVCs **(WDR, 2020)**.
 - Carbon leakage **(Ben-David et al., 2020)**.
 - 'Pollution Haven' hypothesis **(Cole, 2004)**.

Channels through which GVCs harm or benefit the environment

1. Participation in GVCs benefits the country from competition and technique effects. Both effects make use of green technologies and eco-friendly products which benefit the environment and enhance its quality. However, growth or scale effect driven by early stage participation in GVCs increases per capita carbon emissions **(Wang et al., 2019)**.
2. As the product in global production networks crosses border many times before reaching its final destination, pollution coming from transport is higher in GVCs.
 - Air pollution coming from international freight transport could increase by 160 percent by 2050 **(OECD/ITF, 2017)**.
3. Migration of industries in countries with weak environmental protection is becoming a major concern in GVCs **(WDR, 2020)**.
 - Carbon leakage **(Ben-David et al., 2020)**.
 - 'Pollution Haven' hypothesis **(Cole, 2004)**.

Channels through which GVCs harm or benefit the environment

1. Participation in GVCs benefits the country from competition and technique effects. Both effects make use of green technologies and eco-friendly products which benefit the environment and enhance its quality. However, growth or scale effect driven by early stage participation in GVCs increases per capita carbon emissions **(Wang et al., 2019)**.
2. As the product in global production networks crosses border many times before reaching its final destination, pollution coming from transport is higher in GVCs.
 - Air pollution coming from international freight transport could increase by 160 percent by 2050 **(OECD/ITF, 2017)**.
3. Migration of industries in countries with weak environmental protection is becoming a major concern in GVCs **(WDR, 2020)**.
 - Carbon leakage **(Ben-David et al., 2020)**.
 - 'Pollution Haven' hypothesis **(Cole, 2004)**.

This paper

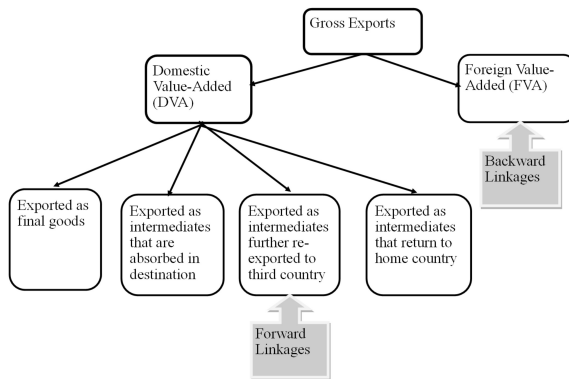
1. examines the empirical relations between trade and the environment in Middle East and North Africa (MENA) region during 1990-2015.
2. explores the impact of forward and backward linkages on pollution taking into consideration participation by sector in GVCs.
3. analyzes the effects of RTAs with environmental provisions and integration in GVCs on carbon emissions using the gravity model.

Methodology

$$GVCParticipationIndex = ForwardGVCIndex + BackwardGVCIndex \quad (1)$$

$$ForwardGVCParticipationIndex = \frac{Indirectvalueadded(DVX)}{Grossexports} \times 100 \quad (2)$$

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



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

Figure 1: Decomposition of Gross exports into value-added exports

Variable	Description	Source
Ln CO2	Log of embodied flow_Gg CO2	Eora Global Supply Chain Database
Ln gdp	Log of GDP (current US\$)	WDID: World Development Indicators, World Bank
Distance	Log of weighted distance	CEPII
Contiguity	1=Contiguity	
Language	1=Common official or primary language	
Colony	1=Pair ever in colonial relation	
RTA_noenvlaws	=1 if regional trade agreement (no environmental provisions)	Dataset on the content of preferential trade agreements (PTAs) (Hofmann et al., 2017)
RTA_envlaws	=1 if there is at least one RTA with environmental provision mentioned in the agreement	
Government Effectiveness	Percentile Rank	Worldwide Governance Indicators (WGI) World Bank
Forward/Backward by sector	Forward and backward participation index in High-Tech Manufacturing, Low-Tech Manufacturing and Primary sectors	UNCTAD-Eora Global Value Chain Database

- 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 estimated equation is as follows:

$$\begin{aligned}
\ln \text{CO2}_{odt} = & \phi_{od} + \vartheta_t + X_{odt} + \alpha_9 \text{Government Effectiveness}_{ot} + \\
& \alpha_{10} \text{Government Effectiveness}_{dt} + \alpha_{11} (\text{RTA noenvlaws}_{odt} \times \\
& \text{Government Effectiveness}_{ot}) + \alpha_{12} (\text{RTA noenvlaws}_{odt} \times \\
& \text{Government Effectiveness}_{dt}) + \alpha_{13} (\text{RTA envlaws}_{odt} \times \\
& \text{Government Effectiveness}_{ot}) + \alpha_{14} (\text{RTA envlaws}_{odt} \times \\
& \text{Government Effectiveness}_{dt}) + \alpha_{15} \text{GVC HTM}_{ot} + \\
& \alpha_{16} \text{GVC LTM}_{ot} + \alpha_{17} \text{GVC P}_{ot} + \alpha_{18} (\text{RTA noenvlaws}_{odt} \times \\
& \text{GVC HTM}_{ot}) + \alpha_{19} (\text{RTA noenvlaws}_{odt} \times \text{GVC LTM}_{ot}) + \\
& \alpha_{20} (\text{RTA noenvlaws}_{odt} \times \text{GVC P}_{ot}) + \alpha_{21} (\text{RTA envlaws}_{odt} \times \\
& \text{GVC HTM}_{ot}) + \alpha_{22} (\text{RTA envlaws}_{odt} \times \text{GVC LTM}_{ot}) + \\
& \alpha_{23} (\text{RTA envlaws}_{odt} \times \text{GVC P}_{ot}) + \varepsilon_{odt}
\end{aligned}
\tag{4}$$

Where,

$$X_{odt} = \alpha_1 \ln gdp_{ot} + \alpha_2 \ln gdp_{dt} + \alpha_3 \ln Distance_{od} + \alpha_4 \ln Contiguity_{od} + \alpha_5 \ln Language_{od} + \alpha_6 \ln Colony_{od} + \alpha_7 \ln RTA_{odt} + \alpha_8 \ln RTAenvlaws_{odt}$$

(5)

Estimation

Table 1: RTAs, environmental provisions and Carbon emissions

VARIABLES	(1) OLS	(2) OLS	(3) FE	(4) FE
RTA_envlaws	0.425*** (0.0659)		0.0754 (0.0569)	
RTA_noenvlaws		-1.413*** (0.0985)		0.121** (0.0593)
Government Effectiveness_o	-0.00435*** (0.000247)	-0.00578*** (0.000241)	-0.00157*** (0.000346)	-0.00160*** (0.000345)
Government Effectiveness_d	0.0121*** (0.000239)	0.0109*** (0.000225)	0.00120*** (0.000375)	0.00127*** (0.000376)
RTA_envlaws × Government Effectiveness_o	-0.0102*** (0.000842)		5.03e-05 (0.000542)	
RTA_envlaws × Government Effectiveness_d	0.000615 (0.000845)		-0.00114 (0.000703)	
RTA_noenvlaws × Government Effectiveness_o		0.00989*** (0.00111)		-0.000313 (0.000663)
RTA_noenvlaws × Government Effectiveness_d		0.0125*** (0.00118)		-0.00223*** (0.000610)
Observations	52,818	52,818	52,818	52,818
Country pair FE	NO	NO	YES	YES
Year FE	NO	NO	YES	YES

Table 2: CO2 emissions and forward GVC participation (HTM)

	(1)	(2)	(3)	(4)
VARIABLES	OLS	OLS	FE	FE
Forward_HTM_o	-0.0162*** (0.000609)	-0.0177*** (0.000626)	0.000512 (0.00179)	-0.000741 (0.00180)
RTA_noenvlaws	-0.0704 (0.0555)		-0.0530 (0.0404)	
RTA_envlaws		-0.529*** (0.0370)		-0.0583** (0.0291)
RTA_noenvlaws × Forward_HTM_o	0.0132*** (0.00415)		-0.00109 (0.00231)	
RTA_envlaws × Forward_HTM_o		0.0133*** (0.00241)		0.00876*** (0.00162)
Observations	80,814	80,814	80,814	80,814
Country pair FE	NO	NO	YES	YES
Year FE	NO	NO	YES	YES

Table 3: CO2 emissions and forward GVC participation (LTM)

	(1)	(2)	(3)	(4)
VARIABLES	OLS	OLS	FE	FE
Forward_LTM_o	0.00428*** (0.000342)	0.00513*** (0.000361)	0.00362** (0.00172)	0.00445** (0.00176)
RTA_noenvlaws	-0.0704 (0.0555)		-0.0530 (0.0404)	
RTA_envlaws		-0.529*** (0.0370)		-0.0583** (0.0291)
RTA_noenvlaws × Forward_LTM_o	-0.0291*** (0.00226)		-0.00125 (0.00145)	
RTA_envlaws × Forward_LTM_o		-0.0103*** (0.000941)		-0.00269*** (0.000740)
Observations	80,814	80,814	80,814	80,814
Country pair FE	NO	NO	YES	YES
Year FE	NO	NO	YES	YES

Table 4: CO2 emissions and forward GVC participation (P)

	(1)	(2)	(3)	(4)
VARIABLES	OLS	OLS	FE	FE
Forward_P_o	0.0174*** (0.000548)	0.0163*** (0.000560)	-0.00310*** (0.000779)	-0.00309*** (0.000771)
RTA_noenvlaws	-0.0704 (0.0555)		-0.0530 (0.0404)	
RTA_envlaws		-0.529*** (0.0370)		-0.0583** (0.0291)
RTA_noenvlaws × Forward_P_o	0.00618* (0.00374)		0.00322* (0.00188)	
RTA_envlaws × Forward_P_o		0.0142*** (0.00219)		-0.00229 (0.00142)
Observations	80,814	80,814	80,814	80,814
Country pair FE	NO	NO	YES	YES
Year FE	NO	NO	YES	YES

Table 5: CO2 emissions and backward GVC participation (HTM)

	(1)	(2)	(3)	(4)
VARIABLES	OLS	OLS	FE	FE
Backward_HTM_o	0.0132*** (0.000941)	0.00620*** (0.000963)	0.0150*** (0.00130)	0.0148*** (0.00132)
RTA_noenvlaws	-0.264*** (0.0522)		0.0930** (0.0408)	
RTA_envlaws		-0.527*** (0.0334)		-0.00844 (0.0239)
RTA_noenvlaws × Backward_HTM_o	-0.0865*** (0.00509)		0.00564** (0.00282)	
RTA_envlaws × Backward_HTM_o		0.0883*** (0.00457)		0.00856*** (0.00214)
Observations	80,814	80,814	80,814	80,814
Country pair FE	NO	NO	YES	YES
Year FE	NO	NO	YES	YES

Table 6: CO2 emissions and backward GVC participation (LTM)

	(1)	(2)	(3)	(4)
VARIABLES	OLS	OLS	FE	FE
Backward_LTM_o	-0.0304*** (0.000766)	-0.0261*** (0.000783)	-0.0171*** (0.00136)	-0.0169*** (0.00137)
RTA_noenvlaws	-0.264*** (0.0522)		0.0930** (0.0408)	
RTA_envlaws		-0.527*** (0.0334)		-0.00844 (0.0239)
RTA_noenvlaws × Backward_LTM_o	0.0778*** (0.00431)		-0.00508** (0.00234)	
RTA_envlaws × Backward_LTM_o		-0.0475*** (0.00319)		-0.00468*** (0.00156)
Observations	80,814	80,814	80,814	80,814
Country pair FE	NO	NO	YES	YES
Year FE	NO	NO	YES	YES

Table 7: CO2 emissions and backward GVC participation (P)

	(1)	(2)	(3)	(4)
VARIABLES	OLS	OLS	FE	FE
Backward_P_o	0.0209*** (0.000659)	0.0238*** (0.000673)	0.00892*** (0.000550)	0.00885*** (0.000546)
RTA_noenvlaws	-0.264*** (0.0522)		0.0930** (0.0408)	
RTA_envlaws		-0.527*** (0.0334)		-0.00844 (0.0239)
RTA_noenvlaws × Backward_P_o	0.0296*** (0.00433)		-0.00894*** (0.00170)	
RTA_envlaws × Backward_P_o		-0.0370*** (0.00330)		-0.00656*** (0.00181)
Observations	80,814	80,814	80,814	80,814
Country pair FE	NO	NO	YES	YES
Year FE	NO	NO	YES	YES

Main results

- RTAs increase carbon emissions and RTAs with environmental provisions could reduce carbon emissions in MENA region in upstream Low-Tech Manufacturing (LTM) sectors and in downstream LTM and Primary sectors.
 - **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**).

- Sectoral aspect and type of integration (forward or backward) matters for MENA countries when we evaluate the impact of GVC participation on environmental quality.
 - Multinational firms headquartered in developing countries perform their polluting activities in countries with relatively weak environmental laws. Moreover, Developing countries execute tasks in high-polluting industries (**Ben-David et al., 2018**).
- Good governance of institutions in the MENA region decreases carbon footprint.
 - EPs in MENA does not directly contribute to environmental quality even when institutional quality is ensured.
 - This supports the findings of **Law (2016)**. They show that high levels of institutional quality make trade openness beneficial to the environment in Sub-Sahara Africa (SSA).

- Sectoral aspect and type of integration (forward or backward) matters for MENA countries when we evaluate the impact of GVC participation on environmental quality.
 - Multinational firms headquartered in developing countries perform their polluting activities in countries with relatively weak environmental laws. Moreover, Developing countries execute tasks in high-polluting industries (**Ben-David et al., 2018**).
- Good governance of institutions in the MENA region decreases carbon footprint.
 - EPs in MENA does not directly contribute to environmental quality even when institutional quality is ensured.
 - This supports the findings of **Law (2016)**. They show that high levels of institutional quality make trade openness beneficial to the environment in Sub-Sahara Africa (SSA).

Conclusion

Conclusion

- The environment suffers deterioration when MENA countries engage to upstream Low-Tech Manufacturing (LTM) sectors and downstream High-Tech Manufacturing (HTM) and Primary sectors.
- This study helps identify to which extent negotiating environmental policies in the MENA region is important for a green sustainability.
- The impact of pollution is global.
 - Consumer/emitter perspective.
 - Call for serious coordination in terms of respecting and implementing environmental laws in investments and business activities.

Thank you!

Do you have any questions?

Contact

E-mail: insaf.guedidi@gmail.com

LinkedIn: Insaf Guedidi