How does the EU's ETS Phase III impact on green innovation in MENA border countries?

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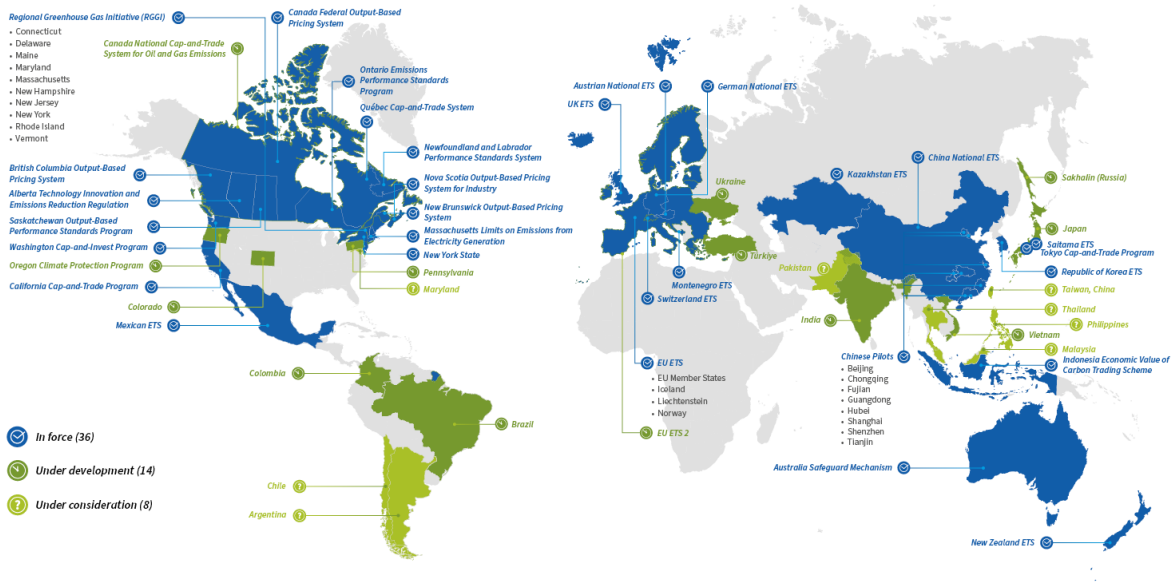
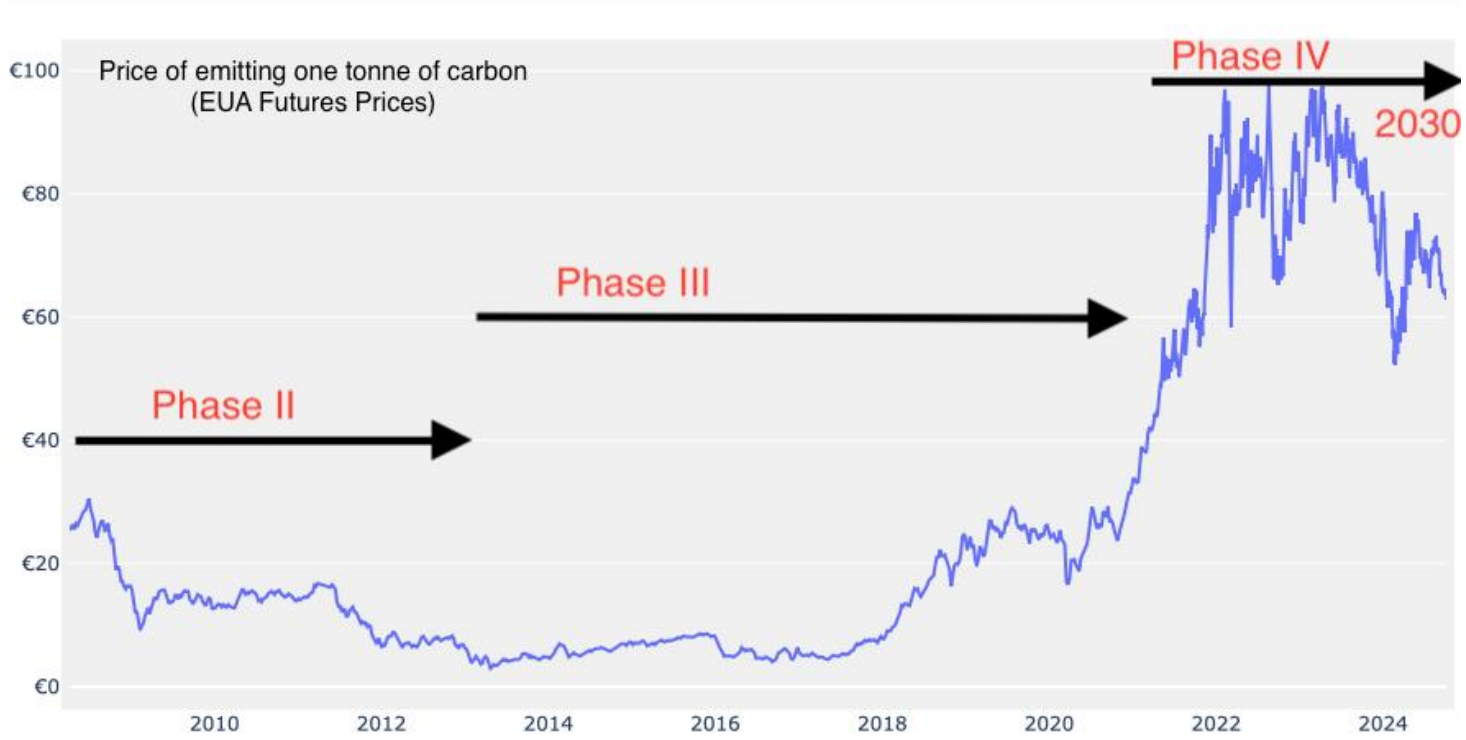


Overview

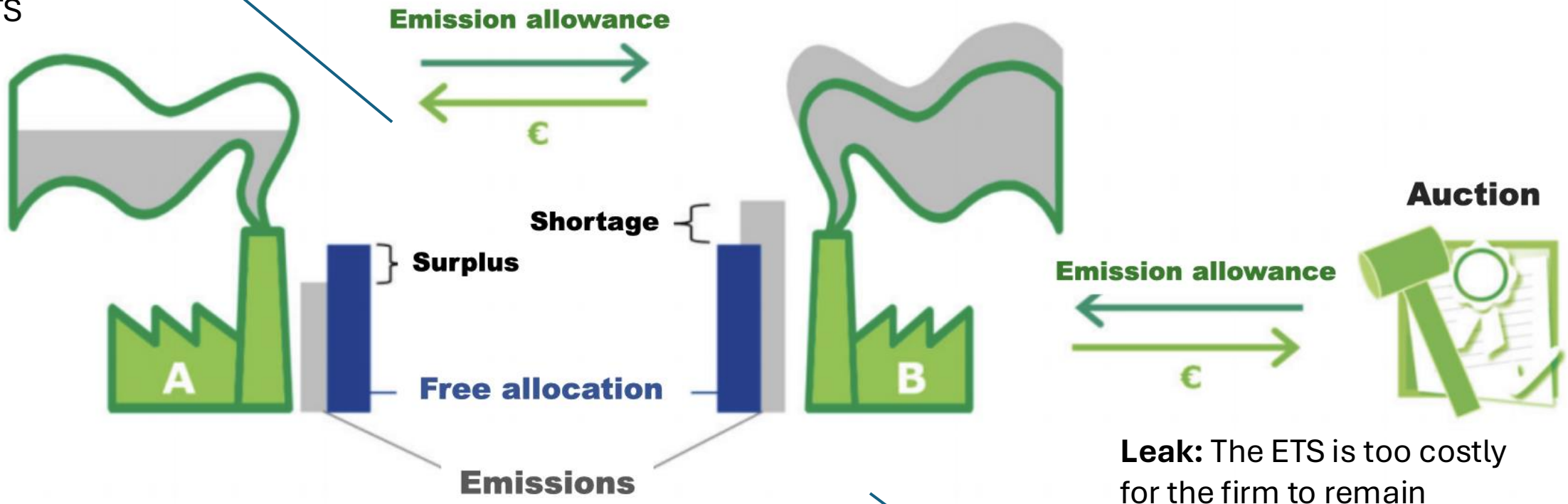
- Short intro to the EU's Emissions Trading System
- Background to this paper: The SEM model was calibrated in another paper that focuses exclusively on Turkey (using Italy as control)
- About the datasets (World Bank Enterprise Surveys) – second-hand data
- Summary of previous results for Turkey/Italy
- SEM model results (calibrating a model for Turkey)
- Advantages and disadvantages of SEM modelling
- Concluding remarks and next steps..

Figure 1. (Source: Sandbag CPV - https://sandbag.be/carbon-price-viewer/ and own additions.)



ETS: How does it work in theory and practise?

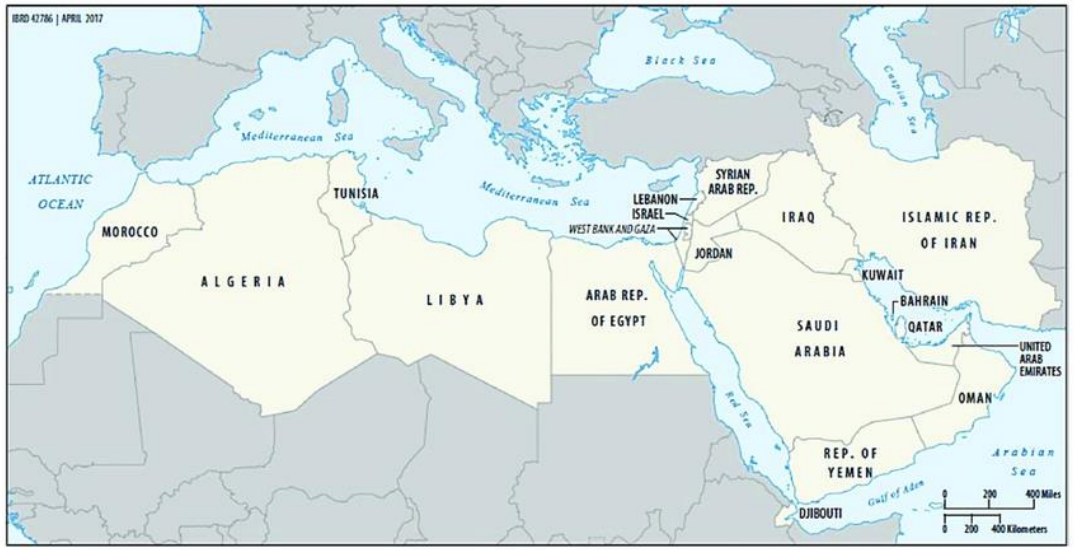
Leap: Firm introduces innovation (energy efficiency improvement) whereby it is no longer s.t. the ETS



Source: ECA adapted from the European Commission's EU ETS Handbook, 2015.

Leak: The ETS is too costly for the firm to remain competitive. The firm reconfigures its international activities causing carbon leakage.

Research questions



- What is the impact of the EU's ETS on 3rd countries?
  - Does it lead to carbon leakage? (defined as a negative trade policy spillover)
  - Can there be a positive effect or positive trade policy spillover?
  - What is the impact on balance for different MENA countries?
  - Does the free allocations in industries at risk have an independent impact?

About the Enterprise Survey (ES) data

- Repeated surveys for a wealth of countries, across all world regions, across all income groupings.
- Only surveys with the Green Module+ can be used for the research purposes (implemented for a limited period and mostly in Europe, Central Asia and the Middle East – co-project between the World Bank ES group and the European Bank for Reconstruction and Development).
- Rich data for developing latent constructs desired – i.e. capturing institutions (formal such as taxes and public standards, informal such as pressure from customers) that impact on green behaviour in organisations or firms.
- The internal validity of the datasets is very high – i.e. Cronbach Alpha around 0.8 for the Turkey dataset.
- Also valid for making inferences at population level – comes with survey weights (sampling is stratified on firm size and industry, not energy intensity).
- Main weakness is that most observations are cross-sectional.
- Some causality assumptions are not fulfilled – time series order and reverse causality.

For 3rd countries the most correct is to code all manufacturing industries as ETS industries. For 1st and 2nd countries this would be incorrect. Because ETS eligibility is not based on industry classification but on energy intensity benchmarks.

How to account for ETS and free allocations?

NB! The EU's System of Free Allocations (here explained for Phase 3 because it is this phase that is covered by the data used in the present research)

Defining significant risk of carbon leakage (for the current list 2015-2020)

In phase 3, a sector or sub-sector is considered to be at significant risk of carbon leakage if:

- direct and indirect costs induced by the implementation of the directive would increase production cost, calculated as a proportion of the gross value added, by at least 5%; **and**
- the sector's trade intensity with non-EU countries (imports and exports) is above 10%.

A sector or sub-sector is also deemed to be exposed if:

- the sum of direct and indirect additional costs is at least 30%; **or**
- the non-EU trade intensity is above 30%.

The cost estimate referred to above takes into account that sectors not on the carbon leakage list are also eligible for some free allocation.

Source - https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/free-allocation/carbon-leakage_en

Descriptive statistics: overview of variables

Table 1: Descriptive statistics

Statistic	N	Mean	St. Dev.	Min	Max
AdoptanyEE: Firm adopted energy efficiency enhancing technology	1,208	0.2	0.4	0	1
Capitalcity: Dummy for firms located in Istanbul	1,208	0.1	0.3	0	1
Customers: Exert environmental standards	1,208	0.1	0.3	0	1
EINT: Energy intensity=Electricity and Fuel Bills over Sales	1,208	0.04	0.1	0.000	0.7
ETS: A dummy for ETS regulated industries	1,208	0.7	0.5	0	1
ETSFreeAll: A dummy for ETS industries with free allocations	1,208	0.2	0.4	0	1
Exporter: Dummy for export active firms	1,208	0.2	0.4	0	1
Female: Dummy for female manager	1,208	0.1	0.4	0	1
Foreign: Dummy for foreign owned subsidiary	1,208	0.02	0.1	0	1
Large: Dummy for firms larger than 249 employees	1,208	0.2	0.4	0	1
Management: Firm has designated manager for environmental and climate policy	1,208	0.02	0.2	0	1
Monitoring: Firm actively monitors its own energy consumption	1,208	0.5	0.5	0	1
Standards: The firm is subject to an energy performance standard	1,208	0.1	0.3	0	1
Strategy: Environment and climate is mentioned in the strategic objectives	1,208	0.1	0.2	0	1
Targeting 1: Firm has targets for own energy consumption	1,208	0.1	0.3	0	1
Targeting 2: Firm has target for own CO2 emissions	1,208	0.03	0.2	0	1
Taxes: The firm is subjet to an energy tax	1,208	0.2	0.4	0	1

Source: Enterprise Survey Data, Turkey 2019, The World Bank and EBRD

Sampled MENA countries from ES datasets

COUNTRY	TOTAL CASES	OBS.*	ETS REG. IND.	ETS IND. AT RISK**
Turkey	1663	1284	857	255
Tunisia	615	384	230	30
Morocco	1096	161	71	10
Lebanon	532	442	226	42
Egypt	3075	2772	1815	338
Italy	760	509	310	104

Note: *Selected from total cases after deletion of non-missing values, **Industries classified at risk of carbon lekage according to the European Commission's classification

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# measurement model

INFORMAL =~ Strategy + Management + Customers
FORMAL =~ Taxes + Standards + Capital_city
SELFMAN =~ Monitoring + Targeting1 + Targeting2



# regressions

SELFMAN ~ FORMAL
INFORMAL ~ SELFMAN

Adopt_any_EE ~ INFORMAL + Large + Foreign + Exporter + Female
EINT ~ Adopt_any_EE  + ETS + ETS_Free_All

# residual correlations

Large ~~ Foreign + Exporter
Exporter ~~ Foreign
Monitoring ~~ Adopt_any_EE
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Model fit statistics (Turkey)

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  Number of observations                          1284

Model Test User Model:

  Test statistic                               1169.188
  Degrees of freedom                            110
  P-value (Chi-square)                           0.000

Model Test Baseline Model:

  Test statistic                               6136.552
  Degrees of freedom                            133
  P-value                                        0.000

User Model versus Baseline Model:

  Comparative Fit Index (CFI)                    0.824
  Tucker-Lewis Index (TLI)                       0.787

Loglikelihood and Information Criteria:

  Loglikelihood user model (H0)                848.497
  Loglikelihood unrestricted model (H1)       1433.091

  Akaike (AIC)                               -1622.993
  Bayesian (BIC)                             -1432.157
  Sample-size adjusted Bayesian (SABIC)      -1549.688

Root Mean Square Error of Approximation:

  RMSEA                                          0.087
  90 Percent confidence interval - lower         0.082
  90 Percent confidence interval - upper         0.091
  P-value H_0: RMSEA <= 0.050                    0.000
  P-value H_0: RMSEA >= 0.080                    0.992
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Latent Variables:

	Estimate	Std.Err	z-value	P(>|z|)	Std.lv	Std.all
INFORMAL =~						
Strategy	1.000				0.189	0.761
Management	0.436	0.027	16.201	0.000	0.082	0.486
Customers	1.174	0.045	25.938	0.000	0.222	0.784
FORMAL =~						
Taxes	1.000				0.282	0.682
Standards	0.945	0.038	25.164	0.000	0.267	0.814
Capital_city	0.771	0.031	24.594	0.000	0.218	0.790
SELFMAN =~						
Monitoring	1.000				0.123	0.248
Targeting1	2.232	0.266	8.377	0.000	0.275	0.788
Targeting2	0.885	0.109	8.135	0.000	0.109	0.620

Factor loadings

Regression results and variance explained

Regressions:

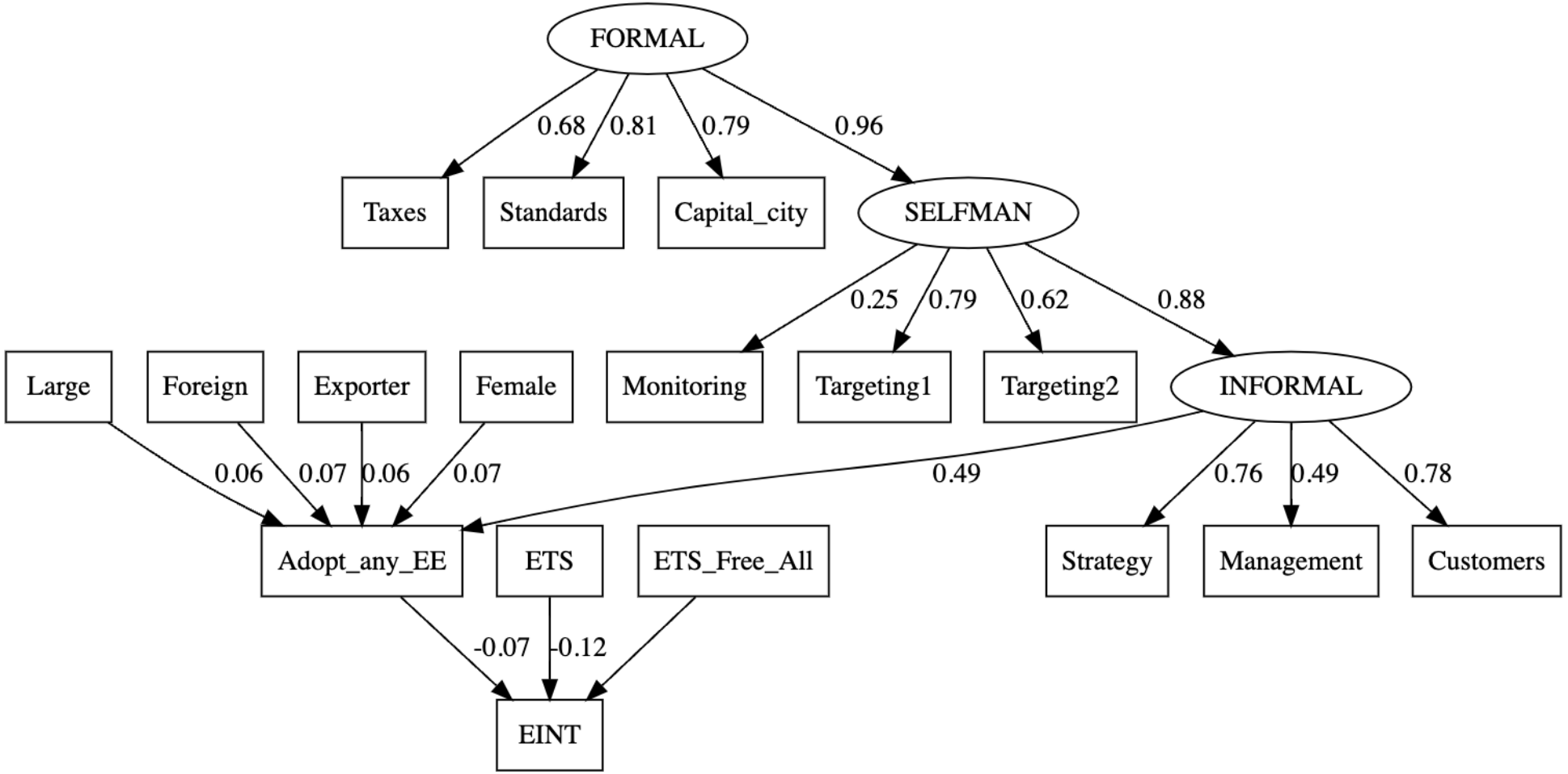
	Estimate	Std.Err	z-value	P(>|z|)	Std.lv	Std.all
SELFMAN ~						
FORMAL	0.417	0.051	8.189	0.000	0.956	0.956
INFORMAL ~						
SELFMAN	1.345	0.163	8.244	0.000	0.876	0.876
Adopt_any_EE ~						
INFORMAL	1.055	0.064	16.390	0.000	0.200	0.485
Large	0.057	0.024	2.333	0.020	0.057	0.058
Foreign	0.203	0.069	2.921	0.003	0.203	0.071
Exporter	0.067	0.026	2.570	0.010	0.067	0.065
Female	0.078	0.028	2.843	0.004	0.078	0.068
EINT ~						
Adopt_any_EE	-0.011	0.004	-2.551	0.011	-0.011	-0.071
ETS	-0.015	0.004	-3.905	0.000	-0.015	-0.115
ETS_Free_All	0.001	0.005	0.239	0.811	0.001	0.007

R-Square:

	Estimate
Strategy	0.579
Management	0.237
Customers	0.614
Taxes	0.465
Standards	0.663
Capital_city	0.625
Monitoring	0.061
Targeting1	0.621
Targeting2	0.385
Adopt_any_EE	0.258
EINT	0.018
INFORMAL	0.768
SELFMAN	0.914

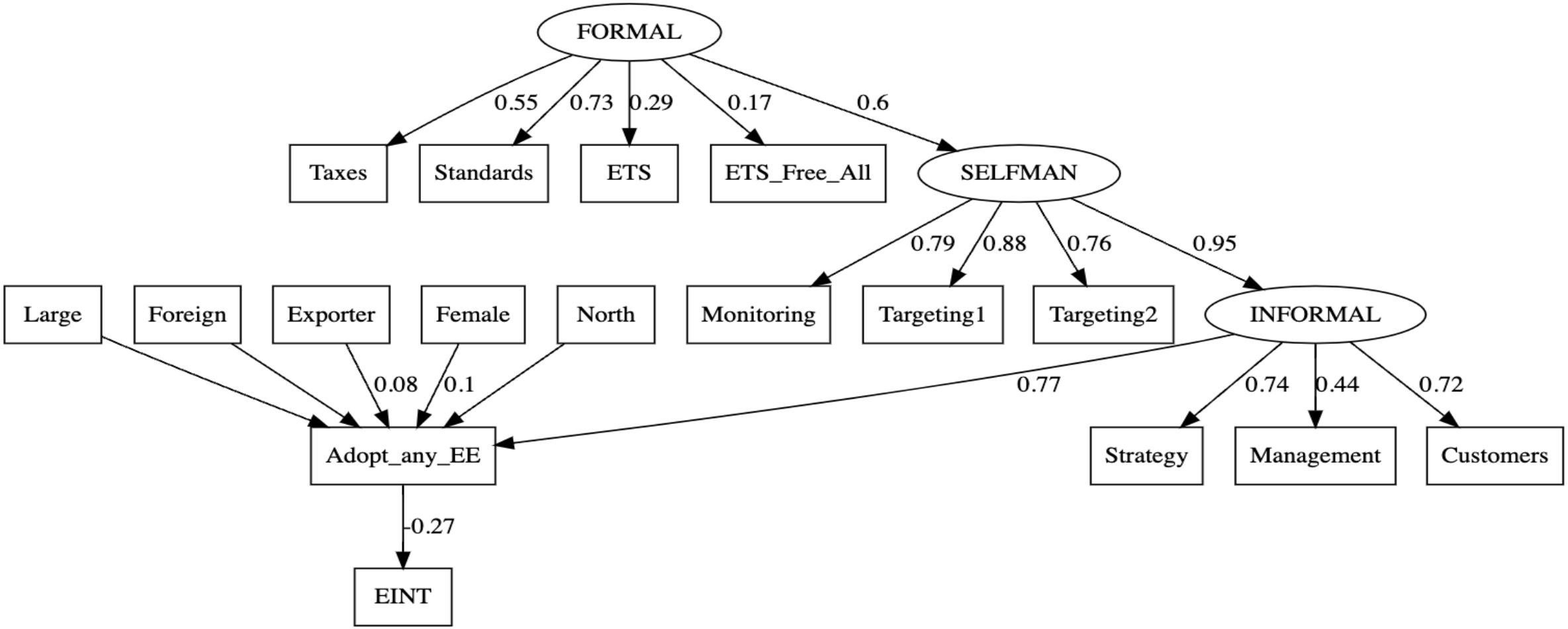
Path diagram: Turkey – standardised coefficients shown (p<0.05)

ML results (DWLS does generate better fit statistics but is computationally less efficient)



Path diagram: Italy – standardised coefficients shown (p<0.05)

ML results (DWLS does generate better fit statistics but is computationally less efficient)



Replicating the final model for Turkey for the other MENA country samples

COUNTRY	ETS LOCAL FIT	OBS.	X2	DF	X2/DF*	CFI**	TLI**	RMSEA***
Turkey	-0.12 (<0.01)	1284	1169	110	10.63	0.82	0.79	0.09
Tunisia	0.09 (<0.10)	384	459	107	4.29	0.59	0.51	0.09
Morocco	-0.25 (<0.01)	161	255	95	2.68	0.80	0.75	0.10
Lebanon	-	442	449	107	4.20	0.63	0.55	0.09
Egypt	0.09 (<0.01)	2772	2673	107	24.98	0.65	0.57	0.09

Note: *Cut off/critical value <5, **Cut off/critical value>0.90, ***Cut off/critical value<0.05

Conclusions: main results

- The research demonstrates that the ‘average’ 3rd country effect may be heterogenuous
- The impact of the ETS is shown to be larger than the general impact of introducing incremental innovations (energy conserving) in MENA countries
- The large countries (large samples) demonstrate this well – for Turkey there is an average positive trade policy spillover, oppositely for Egypt there is an average negative trade policy spillover of carbon leakage
- For the small countries (small samples) and especially Lebanon and Tunisia the results are less valid and therefore inconclusive
- Morocco shows a similar result to Turkey (positive trade policy spillover)

Discussion, perspectives, next steps..

- The results demonstrate well that the impact of the ETS overall is heterogeneous at the country and firm-level.
- Free allocation variables are never significant in any of the models, however, removing them and replacing them with the CBAM may still have large implications for MENA firms and especially for Egypt. Egypt is unexpectedly is more at risk of carbon leakage compared to Turkey.
- Next steps: include control for energy intensity at the SITC 4-digit level in the last step of the SEM model (outcomes), results can also be triangulated with import data such as import of machinery from the European Union and current trade specialisation patterns with the EU.

Thank you for your attention!