

The effects of Tax Incentives on Green goods in Kenya

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Motivation

- Greening the economy is a key priority for the GOK
- GOK has paved the way through tax incentives across time
- Daunting challenges in the use of polluting fuels and access to electricity
- Over 80% of the SSA population depends on polluting fuels and cookstoves for cooking with firewood and charcoal

Motivation

- As of 2021 only 50.6% of Sub-Saharan Africa (SSA) has access to electricity despite the potential in renewable energy sources such as solar and wind
- VAT has been removed and reinstated across various categories, making an impact study possible

What do we do?

- We use the exemptions to classify Kenyan green goods
- The international Green Transition Navigator (GTN) is mainly for OECD countries
- Import data and the VAT Act of 2013 and other Financial Acts help us define what is “green”
- The VAT Act is clear on clean stove product codes (we take these as given)
- Rosenow et al. (2024) suggest some electric motors and separators are critical sub-components of renewable energy technologies (HS Chapter 85)

Research Question and Hypothesis

- Do green imports increase after the policy was implemented?
- Within a firm or agent establishment, do green imports increase?
- What is the uptake locally?
- This stage of the paper addresses the first two questions

Initial Hypothesis

Domestic firms shift from local suppliers to imported green goods because they are cheaper.

Trends and Policy Exemptions Context

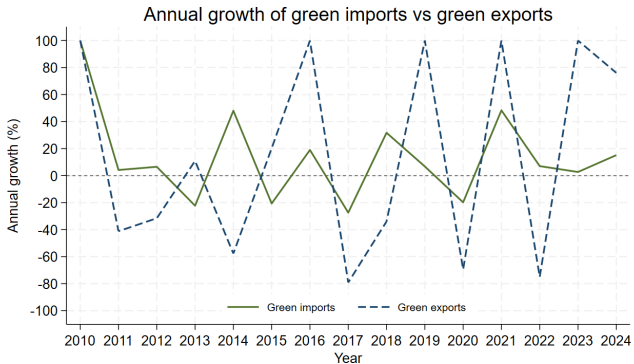


Figure 1: Enter Caption

Trends and Policy Exemptions Context

- Includes clean stoves (2016, 10%), solar/wind (2013, 10%). 0% revoked in May 2020 for solar/wind and July 2020 for clean stoves.
- LPG was erratic: 0% in 2010–2013, reduced to 8% in 2022, and 0% in 2023–2024.
- Lithium batteries exempted in 2023.
- Increases with a lag.
- Green imports and exports seem to follow the same trend.
- Very few exporters of the total green goods (around 770 firms).

Data

- We have 5 datasets from the Kenya Revenue Authority
- Customs data (exports and imports) provide quantities, values, VAT rates, unique firms, and unique agents
- Corporate Income Tax data has total inventory, assets, capital allowance, etc
- PAYE is about the employees of a firm.
- The registration data are about age of the firm, sector, location, etc
- VAT purchases and sales data (summary sheets). Domestic transactions between buyers and sellers were filed with KRA.
- All of these data files have a unique identifier

How do we know a green good/firm/agent? (preempting our identification strategy)

- HS Chapter 73 clean stoves are spelled out in the VAT Act of 2013:
- 73211100, 73211200, 73211900, 73218100, 73218200, 73218300
- The control group is within the same Chapter 73
- Import data show implementation in Oct 2016 and revocation in July 2020
- We drop product codes that ever had a VAT rate of zero during the study period to form a clean control

How do we know a green good/firm/agent? (preempting our identification strategy)

- Rosenow et al. (2024) allude to Chapter 85.
- We ended up with over 40 codes that ever had a zero in our study period.
- We select treated imports with VAT rate 0% in Oct 2013 and 14% in May 2020.
- To form a clean control, we choose controls from HS Chapter 85 and drop codes that were ever zero.

Table 1: Treatment and control groups

	HS Codes	Firms		Agents	
Clean stove (Ch. 73)	73211100, 73211200, 73211900	Pure	274	Pure	35
	73218100, 73218200, 73218300	Mixed	1714	Mixed	172
		Total	1988	Total	207
		Control	11714	Control	1135
Solar/wind (HS Ch. 85)	85014000, 85016100, 85016400	Pure	377	Pure	36
	85024000, 85042100, 85042300	Mixed	3005	Mixed	220
	85043300, 85151900, 85152100	Total	3381	Total	256
	85152900, 85153100, 85153900	Control	15566	Control	2007

Identification strategy: Standard DiD

Baseline difference-in-differences (DiD):

$$Y_{ipt} = \beta(\text{Green}_p \times \text{Post}_t) + \alpha_i + \tau_t + \varepsilon_{ipt}. \quad (1)$$

Notation:

- Y_{ipt} : import value of firm i for product p in month t .
- Green_p : equals 1 if product p (HS code) is eligible/affected by the tax incentive, 0 otherwise.
- Post_t : equals 1 for months after policy implementation, 0 otherwise.
- α_i : firm fixed effects.
- τ_t : month fixed effects.
- ε_{ipt} : error term.

Inference: standard errors are clustered at the firm and product levels.

Identification strategy: Event study

Dynamic effects (event study):

$$Y_{ipt} = \sum_{k \neq -1} \beta_k \left(\text{Green}_p \times \mathbb{1}[t - T_0 = k] \right) + \alpha_i + \tau_t + \varepsilon_{ipt}. \quad (2)$$

Event-time notation:

- T_0 : policy start month (e.g., Oct 2016).
- $k = t - T_0$: event time (months relative to policy); $k < 0$ are leads, $k \geq 0$ are lags.
- $\mathbb{1}[t - T_0 = k]$: indicator equal to 1 if month t is exactly k months from the policy month.
- Omitted category $k = -1$: the month just before treatment (baseline), so all β_k are relative to this pre-policy period.

Interpretation:

- β_k for $k < 0$: pre-trends (should be statistically close to 0 under parallel trends).
- β_k for $k \geq 0$: dynamic treatment effects over time.

Results and discussion

Clean stoves

- We use PPML to estimate the percentage change in import values for treated products in the post-treatment period.
- Green imports increase across products

Table 2: Average Product-Level Treatment Effect Across Firms

	(1)
<i>D</i>	0.416*** (0.110)
treat = 0	0.000 (.)
treat = 1	-0.442 (0.314)
post	-0.448*** (0.127)
Constant	11.910*** (0.028)
Observations	190,644
Pseudo R^2	0.670
Log pseudolikelihood	-2.926×10^9
Wald χ^2	26.814
Prob > χ^2	0.000

Interpretation: $D = 0.416$ implies $\sim 52\%$ higher post-policy import values for green vs non-green products.

Standard errors in parentheses. Firm-year FE: Yes; HS4 FE: Yes. SEs clustered by firm (taxid) and product (hs4). *Significance:* * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

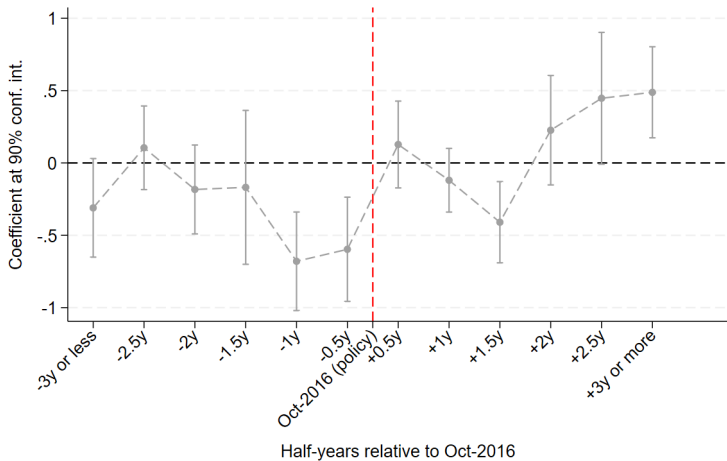


Figure 2: Average product-level treatment effect across firms

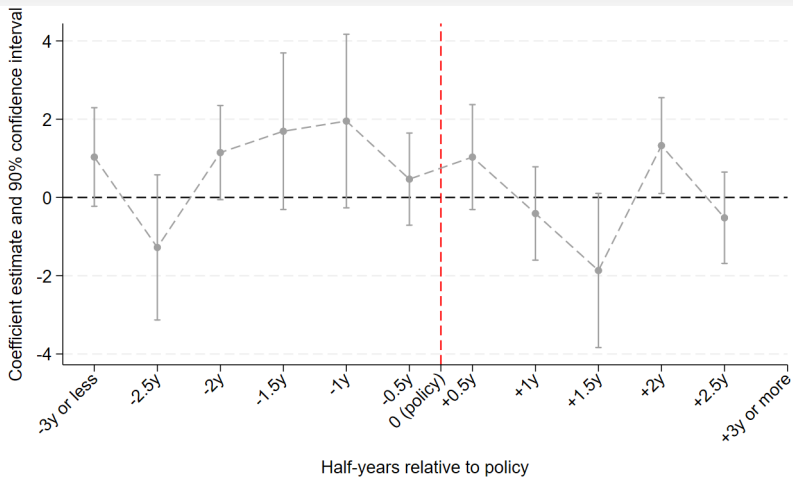


Figure 3: Within a mixed agent firm, do we see more green imports ?

Mixed Firm Reallocation Towards Clean Stoves

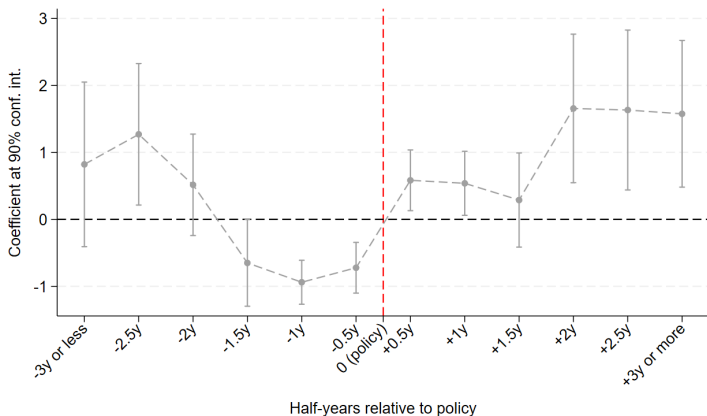


Figure 4: Mixed firm reallocation towards clean stoves

Note: Pre-trends may reflect firms anticipating the passage of the bill and its subsequent implementation.

Results and Discussion: Solar/Wind Technologies

	Coefficient	(Robust SE)
D (Post \times Green)	-0.138	(0.243)
Green (=1)	1.201***	(0.204)
Post	0.270	(0.194)
Constant	11.425***	(0.123)
Observations	389,299	
Pseudo R^2	0.588	
Wald χ^2	72.86	
Clusters (HS4)	45	
Clusters (Firm/TaxID)	8,532	
Firm-year FE	Yes	
HS4 FE	Yes	

Note: The DiD coefficient on D (post \times green) is not statistically significant for solar/wind technologies controlling for firm-year and HS4 fixed effects. Standard errors are robust and clustered by firm (taxid) and product (HS4).

Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Average product level treatment effect across firms

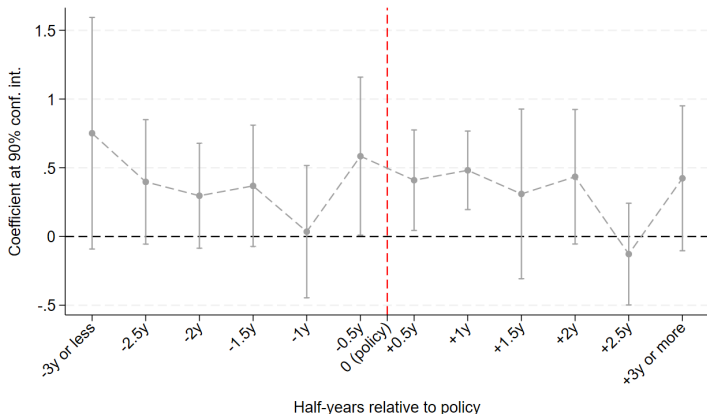
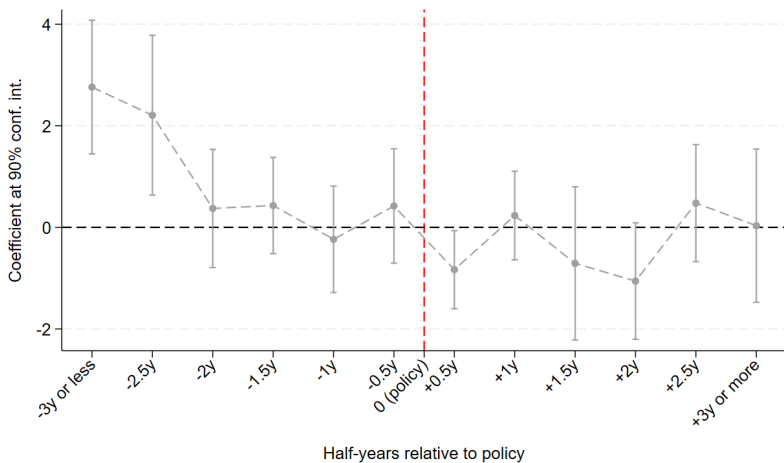


Figure 5: Average product level treatment effect across firms

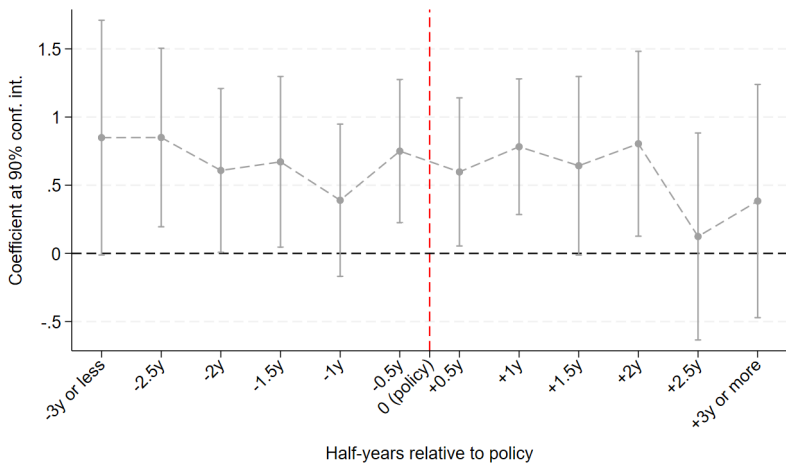
Note: Pre-trends. Marginal significant at 10%

Within a mixed agent firm, is there a shift towards solar/wind?



Note: Solar/wind may be capital intensive for clearing and forwarding agents. Significant decline

Within a mixed real firm, is there a shift towards solar/wind?



Note: Significant positive pre-trends. What could explain this? Is the nature of solar/wind different from clean stoves?

Conclusion

- **Clean stoves:** Evidence is consistent with possible anticipatory effects among firms ahead of policy implementation.
- **Solar/wind:** Positive pre-trends. Importing here is unique for agents; market participation may be constrained by capital intensity and operational barriers.
- **Next steps (VAT data):** We are waiting to obtain VAT purchase and sales Summary records to recover invoice dates and distinguish final consumption from intermediate inputs.

Thank you for your attention!

Questions and comments welcome.