Crucial Materials?

how Export Restrictions Upstream boost Manufacturing Exports Downstream

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What my paper is about

Raw Material Rich Country:

Export Restriction Upstream $\Rightarrow$ Competitive Advantage Downstream in Manufacturing Sectors

- Raw material rich countries give manufacturing sectors downstream a competitive advantage by imposing export restrictions upstream
- $\Rightarrow$ **theoretical model and empirical evidence**
- Estimating a *Fixed Effect Model*, I provide evidence that **export restrictions on industrial raw materials upstream help promote manufacturing exports downstream**.

How I relate to the Literature: a short selection

international trade literature

Krugman (1984): import protection as export promotion:

- here export restrictions upstream both as import protection and export promotion for the domestic market
- here access to cheap key materials instead of economies of scale

industrial organization literature: Raising Rivals' Cost

- Salop and Scheffman (1983): inducing supplier group boycotts or lobbying for more government regulations can be instruments to raise production costs for competitors
- led to models of vertical integration and foreclosure started by Salinger (1988) and Ordover, Saloner and Salop (1988)
- Here I show that export restrictions upstream can be used as an instrument to raise rival's costs in downstream markets.

A simple model: setup

Raw Material

- raw material R necessary input for good x
- R is traded at world market price r
- country B is rich in raw material R: no export restrictions on R

Countries & Technologies

- homogeneous good x produced by A firms and B firms
- firms compete in perfect competition in C
- different technology in A than in B: $mc_B > mc_A$
- no fixed costs, no transportation costs

A simple model continued

one A firm is faces the following demand in C (reverse for D_B):

$$D_A(p_c^n, p_c^m) = \begin{cases} \frac{1}{N}\ D(p_c^n) & \text{if } p_c = p_c^n < p_c^m \\ \frac{1}{N+M}\ D(p_c^n) & \text{if } p_c^n = p_c^m \\ 0 & \text{if } p_c^n > p_c^m \end{cases} \quad \text{(i)}$$

- perfect competition $\Rightarrow p_c = p_c^n < p_c^m$
- each of the N firms in A max $\pi_n = (p_c - mc_A)D_A(p_c^n, p_c^m) = 0$
- each (of the M) B firms max $\pi_m = (p_c - mc_B)D_B(p_c^n, p_c^m) < 0$
- $\Rightarrow$ B firms do not serve C
- $\Rightarrow$ B firms convince gov'nmt to impose export tax τ per unit of raw material R

A simple model: Impact of τ?

Country B Important Supplier of Raw Material R on World Market

$\Rightarrow$ Introduction of Export Tax can raise World Market Price r [a]

- now 2 different prices for raw material R:
  - firms worldwide can purchase it at r^W
  - firms in B can get it at $r^B < r^W$
  - Please note that $r^B < r$.
- $\Rightarrow mc_A^{new} > mc_A$; $mc_B^{new} < mc_B$

[a] Upward sloping Supply Curve & Downward sloping Demand Curve

A simple model: distinction of cases

The export tax was chosen

(i) too small, i.e. $p_c = mc_A$;
$mc_B > mc_A$ still holds (difference between the two had been shrinking);

(ii) high enough such that $mc_B = mc_A$;

(iii) such that $mc_B < mc_A$ (extreme case)

A simple model: case (i)

- B firm(s) still do not enter
- demand downward sloping & $mc_A^{new} > mc_A \rightarrow$ higher price
- thus each of the A firms now faces less demand in C:

$$D_A^{new}(p_c^n, p_c^m) = \frac{1}{N} D^{new}(p_c^n) < D_A(p_c^n, p_c^m) = \frac{1}{N} D(p_c^n). \qquad \text{(iv)}$$

Proposition

Both mean and total exports of A firms decrease with the introduction of export tax τ as $q_A = \frac{1}{N} D^{new}(p_c^n = mc_A^{new}) = \frac{1}{N} D^{new}(mc_A + r^W(\tau) - r)$

A simple model continued: case (ii)

- B firms enter & take over part of the demand from A firms
- each single firm serving C now faces the following demand:

$$D_A^{new}(p_c^n, p_c^m) = D_B^{new}(p_c^n, p_c^m) = \frac{1}{N+M} D^{new}(p_c^n) \qquad \text{(v)}$$

- downward sloping demand & $mc_A < mc_A^{new} = mc_B^{new}$
  $\rightarrow$ higher price
- thus $D^{new}(p_c^n) < D(p_c^n)$ still holds as it has been in case (i).

Proposition

If the export tax is high enough to equalize marginal costs, both mean and total exports of A firms decrease with τ *as* $\frac{1}{N+M} D^{new}(p_c^n) < \frac{1}{N} D(p_c^n)$ *and* **mean and total exports of B firms increase with it**.

The Empirical Model

3-fold panel: country (c) - good (g) - year/time (t)

- Dummy introduction/extension export restriction for material *i* in country *c* and time period *t*
- Dummy material *i* used in good *g*

$$y_{cgt} = \alpha_{cg} + \alpha_{ct} + \alpha_{gt} + \sum_{i=1}^{I} \beta_i \; (U_{ig} * ExportRest_{ict} * D_{ict}^{o30}) + \epsilon_{cgt} \quad (1)$$

- Dummy *c* produces at least 30% of world production of *i* in *t*

The Empirical Model: Data used

- **OECD Inventory on Export Restrictions**
- **USGS End-Use Data**
- **UN Comtrade Export Value Data and Export Quantity Data**

$$y_{cgt} = \alpha_{cg} + \alpha_{ct} + \alpha_{gt} + \sum_{i=1}^{I} \beta_i \, (U_{ig} * ExportRest_{ict} * D_{ict}^{o30}) + \epsilon_{cgt} \quad (2)$$

- **World Mining Data** published by the Austrian Federal Ministry of Science, Research and Economy (BMWFW)

The Empirical Model: Equations for testing

Estimating a FE model for the following equations:

1. Any market power in raw materials production

$$y_{cgt} = \alpha_{cg} + \alpha_{ct} + \alpha_{gt} + \beta\ D_{cgt}^{any} + \gamma\ D_{cgt}^{any,L1} + \varphi\ D_{cgt}^{any,L2} + \epsilon_{cgt}$$

2. ... at least 30% of world production

$$y_{cgt} = \alpha_{cg} + \alpha_{ct} + \alpha_{gt} + \beta\ D_{cgt}^{any\_o30} + \gamma\ D_{cgt}^{any\_o30,L1} + \varphi\ D_{cgt}^{any\_o30,L2} + \epsilon_{cgt}$$

3. ... at least 40% of world production

$$y_{cgt} = \alpha_{cg} + \alpha_{ct} + \alpha_{gt} + \beta\ D_{cgt}^{any\_o40} + \gamma\ D_{cgt}^{any\_o40,L1} + \varphi\ D_{cgt}^{any\_o40,L2} + \epsilon_{cgt}$$

Estimations log Export Value, robust FE

Market Power Upstream	(1) Any	(2) $\geq$ 30 %	(3) $\geq$ 40 %
AnyIntroduction/Extension	**0.086*** **		
	(0.030)		
lagAnyIntroduction/Extension	**0.072** **		
	(0.036)		
lag 2 AnyIntro/Extension	0.013		
	(0.038)		
AnyIntro/Ext_o30		**0.113*** **	
		(0.037)	
lag AnyIntro/Ext_o30		**0.201*** **	
		(0.045)	
lag 2 AnyIntro/Ext_o30		**0.117*** **	
		(0.040)	
AnyIntro/Ext_o40			**0.115*** **
			(0.039)
lag AnyIntro/Ext_o40			**0.210*** **
			(0.046)
lag 2 AnyIntro/Ext_o40			**0.116*** **
			(0.042)
_cons	17.587***	17.740***	17.741***
	(0.010)	(0.002)	(0.002)
r2	0.002	0.002	0.002
N	9660.000	7802.000	7802.000

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

Estimations log Export Quantities, robust FE

Market Power Upstream	(1) $\geq$ 20 %	(2) $\geq$ 30 %	(3) $\geq$ 40 %
AnyIntro/Ext_o20	**0.108***		
	(0.057)		
lag AnyIntro/Ext_o20	**0.080***		
	(0.046)		
lag2 AnyIntro/Ext_o20	**0.168*****		
	(0.037)		
AnyIntro/Ext_o30		**0.160***	
		(0.086)	
lag AnyIntro/Ext_o30		**0.094***	
		(0.051)	
lag2 AnyIntro/Ext_o30		**0.175*****	
		(0.043)	
AnyIntro/Ext_o40			**0.175***
			(0.090)
lag AnyIntro/Ext_o40			**0.102***
			(0.052)
lag2 AnyIntro/Ext_o40			**0.181*****
			(0.044)
_cons	15.946***	15.947***	15.946***
	0.003	0.004	0.004
r2	0.001	0.001	0.001
N	7801.000	7801.000	7801.000

Significance levels: $+p < 0.15, *p < 0.10, **p < 0.05, ***p < 0.01$

Conclusions

Raw Material Rich Country Big Enough to Influence WMP:

New Type of Industry Protection:
Export Restriction Upstream $\Rightarrow$ Competitive Advantage Downstream in Manufacturing Sectors

empirical evidence:

- a clear and highly significant positive effect of the introduction (or extension) of an export restriction upstream on the export value in the manufacturing sectors downstream.
- effect higher & lasts longer when taking into account the market power in the raw material market upstream
- similar effect for exported quantities

Additional Slides

Robustness Checks

how we make sure not to suffer from endogeneity problems:

- omitted variable? $\Rightarrow$ used **fixed effects** as panel data available
- measurement error? $\Rightarrow$ used **highly reliable datasources**; a miss-measured regressor can at worst result in an underestimate of the true parameter.
- sample selection bias? $\Rightarrow$ our **dataset** is not only quite big but more importantly **contains all major producing countries of the raw materials** included
- reversed causality? Instrument approach as robustness check: I am currently working on it - not included yet
- functional form miss-specification? A linear relationship can be seen as a **Taylor approximation** of an unknown function and we are mainly interested in the sign of the effect.

Extensions I am currently working on

- differentiated products
- imperfect competition
- several periods game: what is the response of A firms?
- do we have different effects for Low Income, Medium Income and High Income Countries?

List of Countries Included

Africa and Middle-East (17 countries):
Angola, Botswana, Burundi, Congo (Republic Of) (Bra), Egypt, Ghana, Jordan , Kenya, Madagascar, Mozambique, Nigeria, Oman, Rwanda, South Africa, Tunisia, Zambia, Zimbabwe.

Americas (10 countries):
Argentina, Bolivia, Brazil, Canada, Chile, Colombia, Jamaica, Mexico, Morocco, Peru.

Asia (8 countries):
China, India, Indonesia, Japan, Malaysia,Russian Federation, Turkey, Viet Nam.

Europe (7 countries):
Belarus, Belgium, Kazakhstan, Norway, Portugal, Spain, Ukraine.

Oceania (1 country):
Australia.