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Do Differences in the Types of Commodities Exported Matter for Export Concentration?

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Motivation: Commodity-dependence (CD)

- A country is Commodity Dependent when its exports are concentrated on primary commodities.
- Commodity-Dependent Developing Countries (CDDCs) are especially vulnerable to negative shocks (e.g. Terms of Trade, capital inflows, technology shifts).
- Volatility can negatively impact development, including via Investment (incl. quality) and Tot. Factor Productivity.
- Another possible channel is through institutional quality.
- By 2017, 60%+ of goods exports are commodities in:
  - Almost two-thirds of developing countries.
  - 81% of Landlocked Developing Countries, and
  - 85% of Least Developed Countries .

Empirical Literature and Objectives of the Study

- The literature has looked into the determinants of export concentration, with a literature going back to Michaely (1958).
- Previous work related this study include Bebczuk and Berrettoni (2006), De Benedictis, Gallegati and Tamberi (2009), Cadot, Carrère, and Strauss-Kahn (2011a,b), Agosín, Alvarez and Bravo-Ortega (2012), Parteka and Tamberi, (2013) and Bahar and Santos (2018) and Cadot, Carrère, and Strauss-Kahn (2013).
- These studies consider and test a large number of potential determinants of export concentration.
- In this study, we test whether the composition of exports matter for export concentration, controlling for other important variables.
- Using a larger sample size dataset, which includes 173 countries, 92 of which are CDDCs, and a number of control variables identified as important in previous studies, we find that the composition of exports matter for export concentration.

Target Variable: Export Concentration

- We use three well-known different measurements, used by previous studies: Theil's T index, the normalized Hirschman-Herfinhdahl index and the bias-corrected Gini coefficient.
- Theil's T index is calculated as

$$TEI = \frac{1}{N}\sum_{k=1}^{N}\frac{x_k}{\mu}ln(\frac{x_k}{\mu}) \quad where \quad \mu = \frac{\sum_{k=1}^{N} x_k}{N}$$

with *N* being the number of export lines, x_k are exports of product *k*, and μ are mean exports.

- One challenge with export data used to calculate concentration is that in several developing countries, the number of export lines N "jumps" from year to year. This leads to high volatility in concentration measures like Theil's T index.
- Therefore, in this paper we measure Theil's T index assuming that the number of export lines is fixed at the maximum level, while individual exports of that line might be zero. This reduces the volatility of the measurement.

Covariates Used I

- Natural resource abundance: We measure it as exports of Agricultural, Energy and Mineral Commodities as a share of GDP. Previous studies have found that an aggregate of commodity exports as a share of total exports was correlated with concentration.
- The level of development of the county: We follow previous studies by including GDP per capita and its square.
- Institutional quality: We include a weighted average of different measures of institutional quality, with weights provided by the first component a Principal Component Analysis of all the indicators.
- Export prices: constructed using as weights the shares of exports of agricultural products, mining, energy and non-commodities, calculated for each country.
- Size of the urban population: Previous studies like Parteka and Tamberi (2013) used total population. We use urban population more relevant in a study with developing countries.

Covariates Used II

- Foreign direct investment: We include this variable, measured as a share of GDP, following previous studies. However, the latter seldom found it a significant determinant of concentration.
- Part of the issue may relate to data and model specification (lags)
- Trade costs: we follow the literature and use two different variables:
  - The economic distance between countries, measured as:

$$wdist_{it} = \sum \frac{GDP_{jt}}{GDP_{Wt}} log(D_{ij})$$

, where GDP_{jt} is the GDP of each partner country, GDP_W is World GDP, and D_{ij} is the physical distance between countries.

  - The Preferential Market Access variable from Cadot et al., (2011):

$$pta_{ijt} = \sum_{j=1}^{J} \frac{GDP_{jt}}{GDP_{Wt}} PBA_{ijt}$$

where GDP_{jt} and GDP_W are as above, and PBA_{ijt}, which takes value 1 if there is a preferential trade agreement between countries *i* and *j* in period *t*.

Data

- 3956 observations covering 173 countries, period 1995-2017.
- 38 developed countries, 40 LDCs and 95 other developing and transition countries. 87 countries in the dataset are CDDCs.
- Indices of export concentration were calculated using UNCTADStat data for goods exports (three digits of the SITC classification, third revision).
- Per capita GDP, urban population, FDI and export prices were sourced from data from UNCTADStat. Data from this source was used to calculate the different types of exports as a share of GDP.
- Institutional quality was constructed as a weighted average of six indicators from the Worldwide Governance Indicators of the WB.
- Economic distance used distance data from the CEPII GeoDist database and GDP data from UNCTADStat.
- Preferential Market Access was built using data from Jeffrey Bergstrand's webpage at the University of Notre Dame.

Summary Statistics and Correlations Table

Variable	1st Qu.	3rd Qu.	Max.	Mean	Median	Min.
Theil's T Index	1.523	2.981	5.005	2.341	2.2335	0.638
Theil's T Adj. Index	1.585	3.352	5.209	2.546	2.421	0.646
Logit HHI	-3.196	-1.206	2.000	-2.108	-2.214	-4.949
Logit Gini	1.512	3.341	6.705	2.513	2.385	0.395
Log GDP p.c.	3.087	4.143	5.054	3.632	3.610	2.205
Agricult. Expo/GDP	0.017	0.074	0.468	0.054	0.035	0.000
Energy Expo/GDP	0.002	0.050	0.778	0.063	0.009	0.000
Minerals Expo/GDP	0.003	0.029	0.470	0.032	0.009	0.000
Log Urban Population	3.137	4.087	5.912	3.558	3.605	1.160
Institut. Quality	-0.722	0.606	1.995	-0.060	-0.251	-2.072
Log Export Price Index	2.030	2.272	2.623	2.163	2.150	1.711
Economic Distance	3.823	3.967	4.143	3.904	3.911	3.746
Prefer. Market Access	0.445	0.727	0.893	0.580	0.621	0.000
FDI/GDP	1.072	5.376	499.6	4.821	2.586	-58.326

	theil	theil_adj	hhi_t	gini_t	lgdp_pc	pwt_hci	agri_gdp	min_gdp	nrg_gdp	lpop	lpop_urb	inst_pca	expo_p	w_dist	pta	fdi_gdp
theil	1.00	0.97	0.96	0.92	-0.33	-0.50	0.04	0.24	0.53	-0.20	-0.27	-0.48	0.26	0.33	0.26	0.01
theil_adj	0.97	1.00	0.98	0.98	-0.39	-0.55	0.06	0.19	0.46	-0.32	-0.39	-0.50	0.21	0.37	0.28	0.01
hhi_t	0.96	0.98	1.00	0.93	-0.35	-0.50	0.04	0.19	0.48	-0.28	-0.34	-0.47	0.21	0.34	0.26	0.02
gini_t	0.92	0.98	0.93	1.00	-0.42	-0.58	0.08	0.15	0.44	-0.35	-0.43	-0.52	0.20	0.38	0.30	0.01
lgdp_pc	-0.33	-0.39	-0.35	-0.42	1.00	0.78	-0.20	-0.10	0.22	-0.15	0.05	0.81	-0.05	-0.37	-0.51	0.09
pwt_hci	-0.50	-0.55	-0.50	-0.58	0.78	1.00	-0.11	0.02	0.00	-0.10	0.10	0.70	0.01	-0.43	-0.53	0.08
agri_gdp	0.04	0.06	0.04	0.08	-0.20	-0.11	1.00	0.08	-0.16	-0.20	-0.24	-0.07	-0.03	0.26	0.11	0.00
min_gdp	0.24	0.19	0.19	0.15	-0.10	0.02	0.08	1.00	-0.05	-0.04	-0.05	-0.04	0.34	0.14	0.15	0.02
nrg_gdp	0.53	0.46	0.48	0.44	0.22	0.00	-0.16	-0.05	1.00	-0.07	-0.01	-0.14	0.18	-0.01	-0.09	0.01
lpop	-0.20	-0.32	-0.28	-0.35	-0.15	-0.10	-0.20	-0.04	-0.07	1.00	0.97	-0.20	0.03	-0.07	-0.07	-0.17
lpop_urb	-0.27	-0.39	-0.34	-0.43	0.05	0.10	-0.24	-0.05	-0.01	0.97	1.00	-0.06	0.03	-0.16	-0.15	-0.14
inst_pca	-0.48	-0.50	-0.47	-0.52	0.81	0.70	-0.07	-0.04	-0.14	-0.20	-0.06	1.00	-0.15	-0.30	-0.43	0.11
expo_p	0.26	0.21	0.21	0.20	-0.05	0.01	-0.03	0.34	0.18	0.03	0.03	-0.15	1.00	0.12	0.11	0.03
w_dist	0.33	0.37	0.34	0.38	-0.37	-0.43	0.26	0.14	-0.01	-0.07	-0.16	-0.30	0.12	1.00	0.38	-0.06
pta	0.26	0.28	0.26	0.30	-0.51	-0.53	0.11	0.15	-0.09	-0.07	-0.15	-0.43	0.11	0.38	1.00	-0.04
fdi_gdp	0.01	0.01	0.02	0.01	0.09	0.08	0.00	0.02	0.01	-0.17	-0.14	0.11	0.03	-0.06	-0.04	1.00

Key: Theil's T index (theil), Theil's T index adjusted (theil_adj), logit-transformed Hirschman-Herfindahl index (hhi_t), logit-tranformed Gini coefficient (gini_t), Log GDP per capita (lgdp_pc), Penn World Tables Human Capital Index (pwt_hci), Agricultural exports/GDP (agri_gdp), Mineral exports/GDP (min_gdp), Energy exports/GDP (nrg_gdp), Log population (lpop), Log urban population (lpop_urb), Institutional Quality (inst_pca), Export prices (expo_p), Economic distance (w_dist), Preferencial Trade Access (pta), Foreign Direct Investment/GDP (fdi_gdp).

Empirical Method

- We estimate dynamic panel data models using the Generalized Method of Moments estimator following Blundell and Bond (1998). Variables in levels and differences are used as instruments (i.e. “system” GMM).
- We use five lags of the dependent variable as instruments starting from the second lag to address instrument validity issues.
- The model estimated is $y_{it} = \beta_0 y_{it-1} + \beta_1 X_{it} + \mu_i + \gamma_t + \epsilon_{it}$, where y are the different measures of export concentration, X is the matrix of covariates, $\boldsymbol{\mu}$ and $\boldsymbol{\gamma}$ are the country and time fixed effects, respectively, and ϵ are the errors.
- The normalized HHI and Gini are logit-transformed to address their boundedness between 0 and 1 (Fox, 2016; Agosin, 2012).
- GDP per capita, institutional quality and FDI/GDP are included with one, one and two lags, respectively.
- Standard errors in are calculated using robust estimates of the coefficient covariance matrix, as proposed by Windmeijer (2005).

Empirical Results

	1-HHI	2-Gini	3-Theil's T	4-Adj.Theil's T
Logit Norm.HHI (1 lag)	0.751***			
	(0.04)			
Logit Gini Coeff. (1 lag)		0.695***		
		(0.04)		
Theil's T (1 lag)			0.716***	
			(0.03)	
Adj.Theil's T (1 lag)				0.739***
				(0.03)
Energy Expo/GDP share	1.188***	1.163***	1.064***	0.946***
	(0.23)	*(0.20)*	*(0.17)*	*(0.15)*
Minerals Expo/GDP share	0.765**	0.509*	0.759***	0.575**
	(0.35)	*(0.29)*	*(0.25)*	*(0.25)*
Agricult. Expo/GDP share	-0.36	-0.40	-0.17	-0.27
	(0.31)	*(0.28)*	*(0.22)*	*(0.23)*
Log GDP per capita (1 lag)	-0.598**	-0.834***	-0.558***	-0.683***
	(0.28)	*(0.28)*	*(0.20)*	*(0.22)*
Square Log GDP per capita (1 lag)	0.075*	0.105***	0.072**	0.089***
	(0.04)	*(0.04)*	*(0.03)*	*(0.03)*
Institut. Quality (1 lag)	-0.113***	-0.138***	-0.096***	-0.107***
	(0.04)	*(0.04)*	*(0.03)*	*(0.03)*
Log Urban Population	-0.134***	-0.179***	-0.089***	-0.132***
	(0.03)	*(0.03)*	*(0.02)*	*(0.02)*
Export Prices	0.565***	0.569***	0.516***	0.482***
	(0.18)	*(0.15)*	*(0.14)*	*(0.13)*
Econ. Distance	0.518***	0.566***	0.408***	0.497***
	(0.18)	*(0.19)*	*(0.15)*	*(0.15)*
Preferential Market Access	-0.04	-0.03	0.01	-0.03
	(0.09)	*(0.08)*	*(0.07)*	*(0.07)*
FDI/GDP (1 lag)	0.00	0.00	0.00	0.00
	(0.00)	*0.00*	*0.00*	*0.00*
n	173	173	173	173
T	23	23	23	23
Num. obs.	3956	3956	3956	3956
Sargan Test: chisq	142.6	151.3	151.9	146.0
Sargan Test: p-value	0.15	0.06	0.06	0.11
Autocorrelation test (1): p value	0.00	0.00	0.00	0.00
Autocorrelation test (1): p value	0.56	0.82	0.12	0.27
Wald Test Coefficients: chisq	6244	6503	5943	8904
Wald Test Coefficients: p-value	0.00	0.00	0.00	0.00
Wald Test Time Dummies: chisq	100.9	98.0	121.0	108.9
Wald Test Time Dummies: p-value	0.00	0.00	0.00	0.00

***p < 0.01; **p < 0.05; *p < 0.1

Results - Summary

- Energy and Mineral exports as a share of GDP are positively correlated with export concentration. The coefficient of Energy is larger than for Minerals, so the challenge of CD is especially difficult for exporters of the former.
- However, the share of agricultural exports is not significantly diff. from 0.
- All other coeff. that are statistically significant have the expected signs:
  - GDP per capita is negatively correlated with export concentration, while its square is positively correlated, as found by Cadot et al. (2011).
  - Institutional quality is negatively correlated with export concentration.
  - The size of the urban population is also negatively correlated.
  - Export prices are positively correlated.
  - Economic distance is also positively correlated.
  - Preferential market access (as measured) and foreign direct investment as a share of GDP were not significantly different from 0.
- The theoretical literature has discussed different channels through which the composition of exports can affect concentration, not modeled here.
- Our results reinforce the idea that the effects of Energy and (to a lesser extent) mineral-export dependence on concentration are separate from the effects of weak institutions.

Final Points

- The conclusions of the paper are useful from policy perspective in that they indicate that CDDCs concentrated on exporting energy and, to a lesser extent, minerals, are particularly affected.
- Many energy exporting countries have more than two thirds of their exports concentrated in one single product (UNCTAD, 2019).
- This is particularly important in the context of the energy transition that is expected to take place.
- Subjects for further research:
  - Better integration of empirical work with conceptual models that shine more light on the channels through which productive and export patterns contribute to export concentration.
  - Refining datasets with higher dissagregation, but maintaining the representativity of CDDCs in the sample
  - Particularly challenging is including adequately into empirical models covariates such as capital stocks (including human capital) foreign direct investment, transport costs and trade barriers, among others.