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The Impact of Data Openness on Agricultural and Food Trade

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Motivation

- **Trade** is a driving force of economic development (Kim, 2011).
 - However, most of the less developed countries are less engaged in export markets except for the major exporting countries like China (UNCTAD, 2021).
 - Least Developed Countries (LDCs) occupy less than 1% share of global exports and facing high trade deficits due to high dependency on imports in 2020 (UNCTAD, 2021).
 - What factors make it challenge their ability to participate in export markets?
- An important driver of international trade is **access to market information** (Krautheim, 2012).
 - With the appearance of Information and Communications Technology (ICT), countries have taken advantages of internet to find information about new markets, advertise to buyers, reducing the entry cost into international markets (Freund and Weinhold, 2004; Lin, 2015; Meijers, 2014).
 - However, the number of internet users or ICT infrastructures may not directly imply a country's level of access to market information.

Motivation

- Trade and production rely on moving, connecting and using digital data across countries (OECD, 2019)
 - Data such as the statistical figures, regulations, tariffs etc. reduce transaction costs and trade costs by choosing the most efficient effect way of trade.
 - Producers and suppliers can decide what, when, how to produce and sell in the foreign market.
 - Data enables coordination of international production processes through Global Value Chain (GVC), helps small businesses reach global markets.
 - Organizations have been seeking efficiency and market access by freely moving data across national borders.
 - However, there are some obstacles to get those data.
 - i) Privately owned with high subscription costs for the most recent data.
 - ii) digital data is not accessible if firms are not prepared with digital technologies.
- => LDCs face high transaction costs in accessing cross-border data on market conditions (Allen, 2014).

What we do

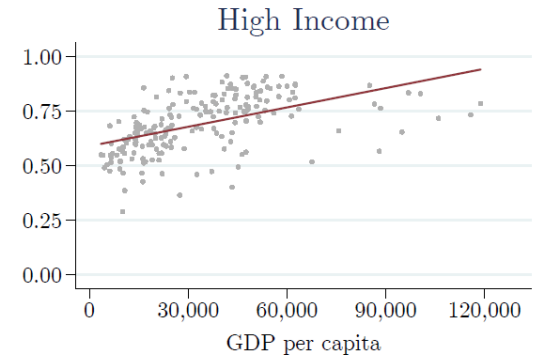
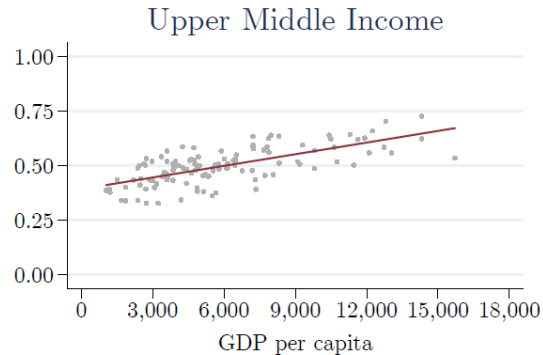
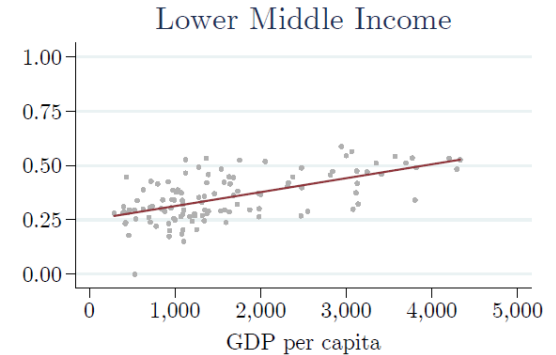
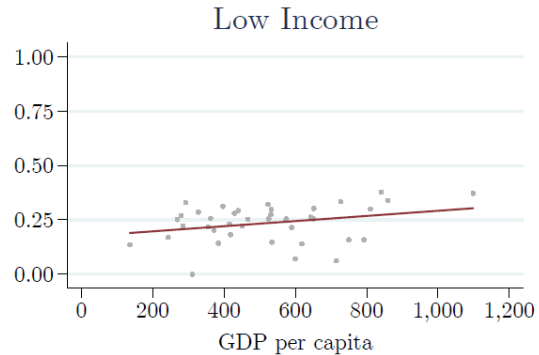
- We examine impact of digitalization on international trade from a developing country perspective.
 - Digitalization is measured by **UN E-Government index** (scaled 0 – 1), composed of
 - i) Online services: information about laws, policies, business licenses, patents etc. by Government.
 - ii) Telecommunications Infrastructure: internet users, mobile subscribers, broadband subscriptions.
 - iii) Human capacity: education level, adult literacy rate etc.
- Empirical analysis
 - Use panel data of bilateral trade from **2004 to 2014 for 118 countries** to estimate the digitalization effects on international trade.
 - Use **GTAP 10** for the bilateral trade data to take into account “**intra-national trade** data flows”. By including intra-national trade, non-discriminatory trade policies (export subsidies, MFN tariffs etc.) become bilateral in nature, making their identification and estimation possible (Heid, Larch and Yotov, 2021).

Data

Data	Sources	Use
Export and Import values, production, population	GTAP10	Bilateral trade (export) from 2004 to 2014
E-Government Development Index	United Nations	Measure of digitalization from 2003 to 2020
Regional Trade Agreements	CEPII GeoDist	Trade cost variables
Gross Domestic Production	World Bank	Market size and income similarity

Digitalization by Income Group

- Low and Lower-middle income groups have lower level of digitalization, but there are still some countries with digitalization level below 0.5 in high and upper-middle income group.
- The digitalization index has a **positive relationship** with GDP per capita.



Methods

- Use the gravity model used in Baier, Yotov and Zylkin (2019).
- The average treatment effect of data openness of exporters and importers on international trade is estimated using OLS for the baseline analysis.

$$\ln(\text{Export}_{ijt}) = \beta_1 \text{EGOVT}_{it} + \beta_2 \text{EGOVT}_{jt} + \beta_4 \ln(\text{GDPPC}_{it}) + \beta_5 \ln(\text{GDPPC}_{jt}) + \beta_6 \ln(\text{POP}_{it}) + \beta_7 \ln(\text{POP}_{jt}) + \beta_8 \text{RTA}_{ijt} + \beta_9 \text{Linder}_{ijt} + \alpha_i + \delta_j + \theta_t + \gamma_{ij} + \varepsilon_{ijt} \quad (1)$$

- **Outcomes:** Total exports, Agricultural and non-agricultural exports (in logarithms)
- **Fixed effects:** exporter, importer, year and country-pair
 - These directional fixed effects account for the multilateral resistance terms (Feenstra, 2015).
- **Linder term** = $\{\log(\text{GDP per capita of exporter}) - \log(\text{GDP per capita of importer})\}^2$
 - The Linder term is larger the more dissimilar are the two countries' incomes, so the prediction of the Linder hypothesis is that the coefficients are negative (Hallak, 2010).

Methods (Cont'd)

- Use **quantile variables for digitalization index** (normalized score).
 - 4 groups: 1 ($D \leq 0.25$), 2 ($0.25 < D \leq 0.5$), 3 ($0.5 < D \leq 0.75$), 4 ($0.75 < D \leq 1$)
 - Investigate which digitalization level has a more positive effect on international trade.
- Construct a **similarity variable of the digitalization** level between exporters and importers.
 - Similarity of digitalization: $(E\text{-government level of exporter} - E\text{-government level of importer})^2$
 - How does international trade change as the gap of digitalization level increases?
 - How different are the results when exporters have higher digitalization levels?
- Consider **income differences** of exporters and importers.
 - How does the effect of digitalization on international trade changes when exporters are developing countries?

Baseline Results

Dependent variable in Log	Total export	Agriculture	Non-Agriculture
Explanatory variable	(1)	(2)	(3)
Digitalization, exporter (1: low – 4: high)	0.019* (0.012)	-0.056*** (0.018)	0.038*** (0.012)
Digitalization, importer	-0.054*** (0.011)	-0.092*** (0.018)	-0.059*** (0.012)
Log of GDP per capita, exporter	0.567*** (0.020)	0.807*** (0.031)	0.548*** (0.021)
Log of GDP per capita, importer	0.423*** (0.023)	0.402*** (0.033)	0.436*** (0.024)
Log of Population, exporter	0.722*** (0.056)	1.206*** (0.078)	0.616*** (0.059)
Log of Population, importer	0.581*** (0.064)	-0.151 (0.092)	0.674*** (0.065)
RTA	0.078*** (0.019)	0.061 (0.039)	0.074*** (0.020)
Linder	0.008** (0.004)	0.024*** (0.006)	0.007* (0.004)
Fixed Effects			
Exporter	Yes	Yes	Yes
Importer	Yes	Yes	Yes
Year	Yes	Yes	Yes
Country-pair	Yes	Yes	Yes
Observation	55,696	55,696	55,696
R-squared	0.974	0.950	0.974

Note: Standard errors in parentheses, * p<0.10, ** p<0.05 and *** p<0.01, respectively.

- “Impact of digitalization on international trade”
 - Digitalization level is scaled from 1 to 4.
 - Total exports:
 - Digitalization variables indicate that exporter’s digitalization level is **positively** associated with Total export of a country.
 - Sectoral exports:
 - exporter’s digitalization level is **negatively** correlated with agricultural exports while **positively** related with non-agricultural exports.
- ⇒ These results indicate that increase in exporter’s digitalization level matters in international trade.
- ⇒ Agricultural products are exported by developing countries and they might have low level of digitalization.

Similarity of Digitalization

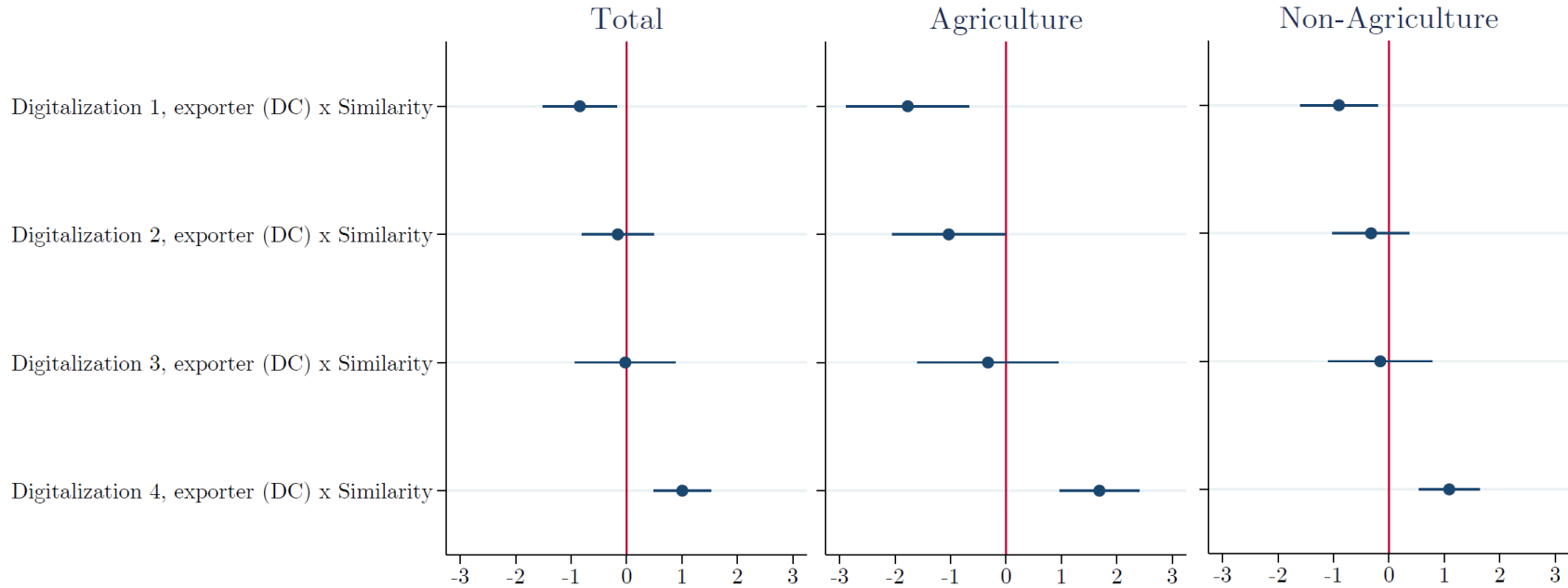
Dependent variable in Log	Total export		Agriculture		Non-Agriculture	
Explanatory variable	(1)		(2)		(3)	
Similarity of digitalization	0.733***		1.005***		0.766***	
	(0.187)		(0.285)		(0.188)	
Digitalization 1, exporter x Similarity of digitalization		0.296		0.317		0.386*
		(0.224)		(0.426)		(0.224)
Digitalization 2, exporter x Similarity of digitalization		0.760***		0.873***		0.693***
		(0.166)		(0.338)		(0.165)
Digitalization 3, exporter x Similarity of digitalization		0.866***		1.741***		0.752**
		(0.302)		(0.497)		(0.314)
Digitalization 4, exporter x Similarity of digitalization		0.459*		0.724		0.385
		(0.276)		(0.473)		(0.268)
RTA	0.027	0.029	0.029	0.030	0.026	0.027
	(0.020)	(0.019)	(0.044)	(0.039)	(0.020)	(0.019)
Linder	-0.008**	-0.007*	0.012**	0.014**	-0.012***	-0.011***
	(0.004)	(0.004)	(0.006)	(0.006)	(0.004)	(0.004)
Fixed Effects						
Exporter-year	Yes	Yes	Yes	Yes	Yes	Yes
Importer-year	Yes	Yes	Yes	Yes	Yes	Yes
Symmetric Country-pair	Yes		Yes		Yes	
Asymmetric Country-pair		Yes		Yes		Yes
Observation	55,696	55,696	55,696	55,696	55,696	55,696
R-squared	0.952	0.974	0.911	0.950	0.952	0.974

Note: Standard errors in parentheses, * p<0.10, ** p<0.05 and *** p<0.01, respectively.

- “The similarity effect of digitization” between exporters and importers.
- If the similarity index increases, the more dissimilar are the two countries’ digitalization level (Scaled from 0 to 1).
- As the digitalization gap between an exporter and an importer increases, **all types of exports increase.**
- When exporters have a higher level of digitalization, with increasing digitalization gap, all types of exports increase.

⇒ What if the exporters are **developing countries?**

Similarity of Digitalization, Developing Countries



- As exporter's digitalization level increases and digitalization gap increases, both types of exports increase.
- When exporter's digitalization level is low and digitalization gap increases, exports decrease on average.

Conclusions

- Our results provide evidence that there is a **positive digitalization effects on exports**, both in agricultural and non-agricultural sectors, when the digitalization gap between exporter and importer increases.
 - We find that the exporter's digitalization level matters for their participation in export markets, rather than the importer's digitalization level.
 - This result implies that a digital environment where market information can be obtained within the exporting country is important.
- For developing countries as exporters, when their digitalization level is low, their exports are likely to be smaller on average.
 - This result is different from the digitalization effects on international trade for developed countries.
 - Developing countries with low levels of digitalization may need support to upgrade their digitalization level so that they can more easily access export markets (WTO, 2018).

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