The Structure of Bilateral Commodity Trade:
The Role of Extensive Margins in Revealed Comparative Advantage

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Point:

(1) We develop extensive margins in HMR (2008) and revealed comparative advantage in Balassa (1965), and examine how the extensive margins interact with revealed comparative advantages at the product level.

(2) We develop data from 16,002 bilateral country pairs (127 countries for 126 trading partners) for 144 differentiated products in years 2005, 2006, 2007, and 2008.

(3) For more than 80% of the exporter-importer country pairs, we find the positive correlation between extensive margins and revealed comparative advantages across products. This finding suggests: (A) Unproductive firms in comparative advantage sectors can participate in exporting. (B) The leading firms in comparative advantage sectors are more productive than those in comparative disadvantage sectors.

(4) Moreover, our results indicate that the extensive margin is critical to understand the structure of commodity trade.

1. Theory

The approach we take is based on a model developed by Helpman, Melitz, and Rubinstein (2008) (hereafter HMR). For the theoretical discussion, we omit the time subscript t. Demand in each country l is obtained from a two-tier utility function of a representative consumer. The upper tier of this function is separable into sub-utilities defined for each product $i = 1, \dots, I$:

$U^l = U[u_1^l, ..., u_i^l, ..., u_I^l]$. The representative consumer uses a two-stage budgeting process. The first stage involves the allocation of expenditure across products. In the second stage, we derive the demand for each variety ω in product i from the utility maximization problem subject to the optimal expenditure (Y_i^l) obtained from the first stage.

The sub-utility index u_i^l is a standard CES utility function: $u_i^l = \left[\int_{\omega \in B_i^l} [q_i^l(\omega)]^{\alpha_i} d\omega \right]^{1/\alpha_i}$. Here, $q_i^l(\omega)$ is country l's consumption of variety ω in product i, B_i^l is the set of varieties in product i available for country l, and the product-specific parameter α_i determines the elasticity of substitution across varieties so that $\varepsilon_i = 1/(1-\alpha_i) > 1$. From the utility maximization problem of a representative consumer, we can find the demand function for each variety:

(1) $$q_i^l(\omega) = \frac{[p_i^l(\omega)]^{-\varepsilon_i} Y_i^l}{(P_i^l)^{1-\varepsilon_i}} \text{ where } P_i^l = \left[\int_{\omega \in B_i^l} [p_i^l(\omega)]^{1-\varepsilon_i} d\omega \right]^{1/(1-\varepsilon_i)}$$

A firm in country k produces one unit of output with a cost minimizing combination of inputs that costs c_i^k, which is country, industry, and time specific cost for unit production. $1/a_i^k$ is firm-specific productivity measure (i.e., a firm with a lower value of a_i^k is more productive and that with a higher value of a_i^k is less productive) whose product-specific cumulative distribution function $G_i(a_i^k)$ has a country-specific support $[\underline{a}_i^k, \overline{a}_i^k]$.

We assume that each variety ω is produced by a firm with productivity a_i^k. If this producer sells in its own market, it incurs no transportation cost. If this producer seeks to sell the same product in country l, it has to bear two additional costs: one is a fixed cost of serving country l (f_i^{kl}) and the other is an iceberg transport cost (τ^{kl}).

Since the market is characterized by monopolistic competition, a producer in country k with a productivity measure of a_i^k maximizes profits by charging the standard mark-up price: $p_i^k(a_i^k) = c_i^k a_i^k/\alpha_i$. If the producer in country k produces a variety in product i and exports to consumers in country l, the delivery price of the product is

(2) $$p_i^{kl}(a_i^k) = \frac{\tau_i^{kl} c_i^k a_i^k}{\alpha_i} \quad .$$

As a result, the associated operating profits from the sales to country *l* are

(3) $$\pi_i^{kl}(a_i^k) = (1-\alpha_i)\left(\frac{\tau_i^{kl} c_i^k a_i^k}{\alpha_i P_i^l}\right)^{1-\varepsilon_i} Y_i^l - f_i^{kl}$$

Since the profits are positive in the domestic market for surviving firms (Melitz, 2003), all N_i^k producers are profitable in home country *k*. However, sales to an export market such as country *l* are positive when a firm is productive enough to cover both fixed and variable costs for exporting. Therefore, we define the cut-off productivity level $\underline{a}_i^{kl}$ by setting $\pi_i^{kl}(\underline{a}_i^{kl}) = 0$:

(4) $$(1-\alpha_i)\left(\frac{\tau_i^{kl} c_i^k \underline{a}_i^{kl}}{\alpha_i P_i^l}\right)^{1-\varepsilon_i} Y_i^l = f_i^{kl} \quad .$$

The set B_i^l of varieties in product *i* available in country *l* is smaller than the total number of varieties produced in the world. In addition, $G_i(\underline{a}_i^{kl})$ could be zero since no firm from country *k* may find it profitable to export to country *l*.

Next, let

(5) $$V_i^{kl} = \begin{cases} \int_{\underline{a}_i^k}^{\underline{a}_i^{kl}} (a_i^k)^{1-\varepsilon_i} dG_i(a_i^k) & for \quad \underline{a}_i^{kl} \geq \underline{a}_i^k \\ 0 & otherwise \end{cases}$$

The demand function (1) and the pricing equation (2) then imply that the demand in country *l* for product *i* from country *k* is given by:

(6) $$m_i^{kl} = \left(\frac{c_i^k \tau_i^{kl}}{\alpha_i P_i^l}\right)^{1-\varepsilon_i} Y_i^l N_i^k V_i^{kl} \quad \text{where} \quad (P_i^l)^{1-\varepsilon_i} = \sum_k \left(c_i^k \tau_i^{kl} / \alpha_i\right)^{1-\varepsilon_i} N_i^k V_i^{kl}$$

Note that the volume of bilateral imports (m_i^{kl}) equals zero when $\underline{a}_i^{kl} < \underline{a}_i^k$ because $V_i^{kl} = 0$.

We follow HMR and assume that firm productivity, $1/a_i^k$, is Pareto distributed. Thus in equation (5): $G_i(a_i^k) = [(a_i^k)^{\kappa_i} - (\underline{a}_i^k)^{\kappa_i}]/[(\overline{a}_i^k)^{\kappa_i} - (\underline{a}_i^k)^{\kappa_i}]$ where $\kappa_i > \varepsilon_i$ -1 and κ_i captures the shape of the distribution. The shape of the distribution is identical for each product across countries but, as we defined, the supports are different for countries for each year to capture technological progress from the productivity of the most productive firm in country k ($\underline{a}_i^k$). Then, we can further simplify V_i^{kl} as follows.

(7) $$V_i^{kl} = \frac{\kappa_i [\underline{a}_t^k]^{\kappa_i - \varepsilon_i + 1}}{(\kappa_i - \varepsilon_i + 1)[(\overline{a}_t^k)^{\kappa_i} - (\underline{a}_i^k)^{\kappa_i}]} W_i^{kl} \quad \text{where } W_i^{kl} = \max\left\{ (\underline{a}_i^{kl} / \underline{a}_i^k)^{\kappa_i - \varepsilon_i + 1} - 1, 0 \right\}.$$

The selection of firms into export markets is summarized in W_i^{kl}, which is determined by the cut-off value of $\underline{a}_i^{kl}$. This cut-off value is determined by the zero profit condition given by equation (4). Let us pick the most productive firm in country k in product i and define the latent variable Z_i^{kl} as

(8) $$Z_i^{kl} = \frac{(1-\alpha_i)(P_i^l \alpha_i / c_i^k \tau_i^{kl})^{\varepsilon_i - 1} Y_i^l (\underline{a}_i^k)^{1-\varepsilon_i}}{f_i^{kl}}.$$

This is the ratio of variable export profits for the most productive firm to the fixed export cost for exporting from k to l. Positive exports are observed if and only if $Z_i^{kl}>1$. In addition, W_i^{kl} is a monotonic function of Z_i^{kl}; $W_i^{kl} = (Z_i^{kl})^{(\kappa_i - \varepsilon_i + 1)/(\varepsilon_i - 1)} - 1$.

Let $f_i^{kl} = \exp(\varphi_i^l + \varphi_i^k + \lambda_i \varphi_i^{kl} - e_i^{kl})$ where e_i^{kl} is random variable, φ_i^l is a fixed trade barrier for product i imposed by the importing country on all exporters, φ_i^k is a measure of fixed export costs common across all export destinations, φ_i^{kl} is an observed measure of any additional country pair specific fixed trade costs. Using this specification together with $(\varepsilon_i - 1)\ln(\tau_i^{kl}) = \gamma_i d^{kl} - u_i^{kl}$ where d^{kl} is the log of distance between countries k and l and u_i^{kl} is a random error, the latent variable $z_i^{kl} = \ln(Z_t^{kl})$ can be expressed as

(9) $$z_i^{kl} = \beta_i + \beta_i^k + \beta_i^l - \gamma_i d^{kl} - \lambda_i \varphi^{kl} + \eta_i^{kl}$$

where $\eta_i^{kl}=u_i^{kl}+e_i^{kl}$ is random error; β_i^k is an exporter fixed effect that captures $(1-\varepsilon_i)\ln(c_i^k)$, $(1-\varepsilon_i)\ln(\underline{a}_i^k)$, and φ_i^k; β_t^l is an importer fixed effect that captures $(\varepsilon_i-1)\ln(P_i^l)\ln(Y_i^l)$, and φ_i^l; and the remaining variables in equation (8) are constant for product i (β_i).

Now, define the indicator variable T_i^{kl} to be 1 when country k exports product i to country l and 0 when it does not. Let ρ_i^{kl} be the probability that product i of country k exports to country l conditional on the observed variables. We can specify the following Probit equation:

(10)
$$\begin{aligned}\rho_i^{kl} &= \Pr(T_i^{kl}=1 \mid \beta_i, \beta_i^k, \beta_i^l, d^{kl}, \varphi^{kl}) \\ &= \Phi(\beta_i + \beta_i^k + \beta_i^l - \gamma_i d^{kl} - \lambda_i \varphi^{kl} + \eta_i^{kl})\end{aligned}$$

where Φ is the cdf of the unit-normal distribution. Let $\hat{\rho}_i^{kl}$ be the predicted probability of exports of product i from country k to l, and let $\hat{z}_i^{kl} = \Phi^{-1}(\hat{\rho}_i^{kl})$ be the predicted value of the latent variable. Then, an estimate for W_i^{kl} is obtained from

(11)
$$W_i^{kl} = \max\left\{(Z_i^{kl})^{(\kappa_i-\varepsilon_i+1)/(\varepsilon_i-1)} - 1, 0\right\}.$$

2. Estimation

2.1. Product-Level Characteristics of Non-Zero Observations

To estimate equation (10) for each product for each year, we employ data on bilateral trade across 127 countries (16,002 country pairs) for 144 3-digit differentiated products.[1] We prepare the following bilateral measures for the estimation of equation (10): log of distance between two countries (d^{kl}), common language ($Language^{kl}$), and common border ($Border^{kl}$).[2] The time-specific bilateral variables for trade cost ($Cost^{kl}{}_t$), business start-up costs ($Startup^{kt}{}_l$), and legal strength ($Legal^{kl}{}_t$) are developed from the World Bank Development Indicators.

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[1] We use trade measured at the 3-digit level due to the enormous number of zero trade observations at further levels of disaggregation. Country list is available in the Appendix.

[2] Distance and the dummy variables for common border and language are from the CEPII website (Head et al., 2011).

Figure 1 reports the number of non-zero observations in our sample from 127 countries and 144 products. If 127 countries import all 144 products from 126 countries, there would be 2,304,288 potential observations for each year. For example, in year 2005, we have only 680,003 non-zero observations, indicating that these non-zero observations comprise 30% of all the potential observations. Figure 2 depicts the scatter plot of the share of non-zero observations for a country as an exporter against that for the same country as an importer. We develop the horizontal value (i.e., shares as exporters) by dividing the number of importer-commodity pairs for a country as an exporter by the total number of non-zero exporter-importer-commodity observations, while we develop the vertical value (i.e., shares as importers) by dividing the number of exporter-commodity pairs for the same country as an importer by the same number. If a country trades all products with all the partner countries, the observations would locate in the 45-degree line. However, as in Figure 2, there is no evidence for the one-to-one relationship between these two shares. In fact, there is a clear non-linear relationship that the limited number of countries exports more products to more destination countries. Table 1 confirms the same tendency. The standard deviation of the importer-commodity pairs for exporters is much greater than that of the exporter-commodity pairs for importers.

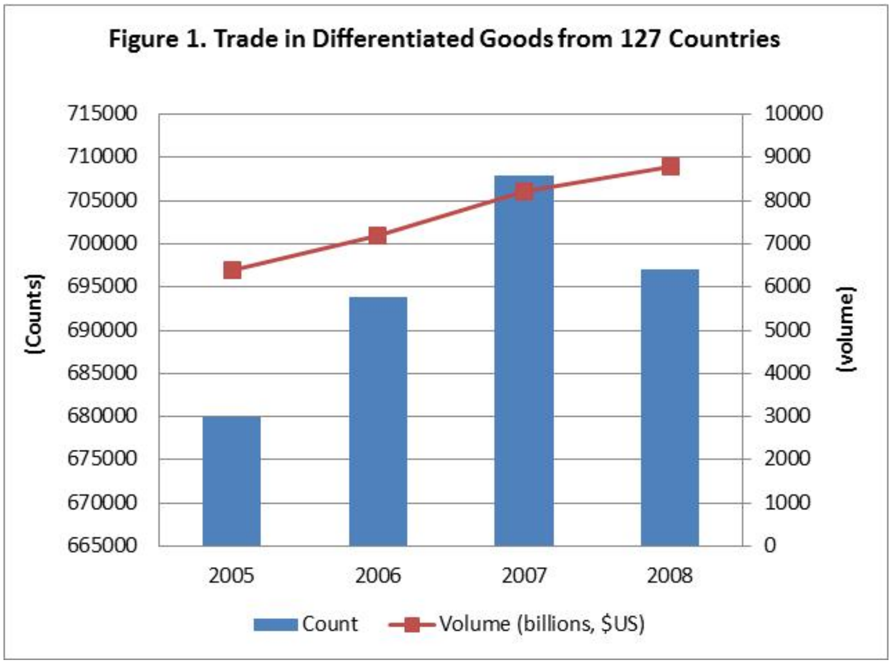


Figure 1. Trade in Differentiated Goods from 127 Countries
715000
710000
705000
700000
695000
690000
685000
680000
675000
670000
665000
(Counts)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
(volume)
2005
2006
2007
2008
Count
Volume (billions, $US)

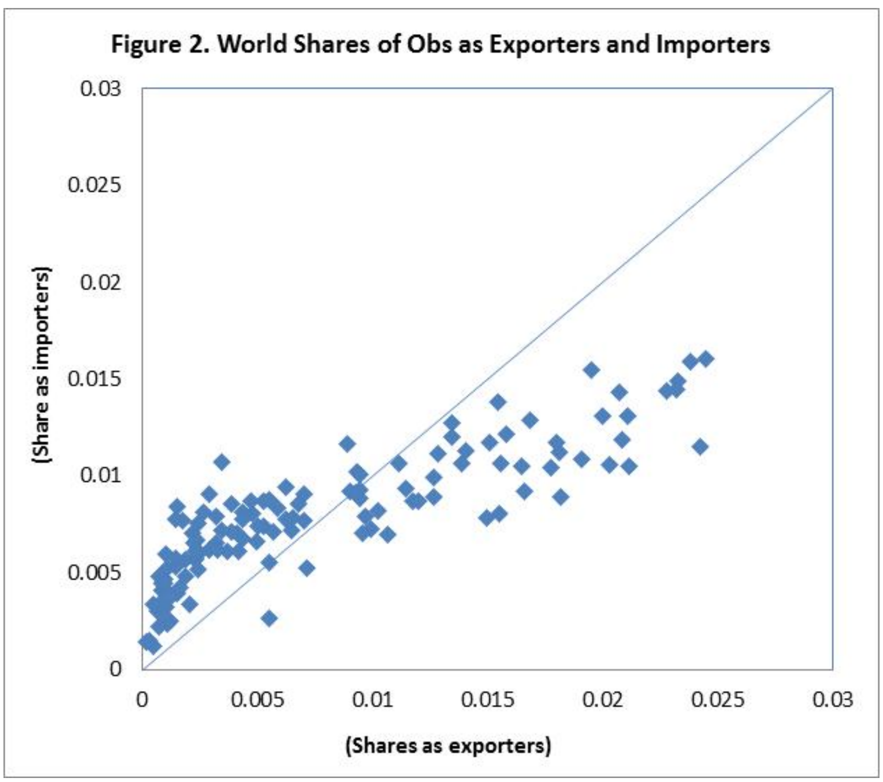


Figure 2. World Shares of Obs as Exporters and Importers
0.03
0.025
0.02
0.015
0.01
0.005
0
(Share as importers)
0
0.005
0.01
0.015
0.02
0.025
0.03
(Shares as exporters)

Table 1. Summary Statistics of Count Data

	Exporters x Products				Importers x Products			
	2005	2006	2007	2008	2005	2006	2007	2008
Mean	5354	5464	5575	5488	5354	5464	5575	5488
Median	3583	3717	3894	3643	5299	5395	5425	5485
Std Dev	4772	4803	4833	4831	2263	2285	2301	2242
Min	106	110	147	135	827	54	882	882
(country)	(COM)	(COM)	(COM)	(COM)	(CAF)	(CAF)	(COM)	(COM)
Max	16663	16717	16915	16871	10908	11000	11082	10692
(country)	(USA)	(USA)	(CHN)	(CHN)	(USA)	(USA)	(USA)	(USA)

Note: CHN is China, COM is Comoros, and CAF is Central African Republic.

2.2. Probit Estimations

We report the estimation results of equation (10) for each of the 144 differentiated commodities for each year in Table 2. Here, we successfully estimated 554 cases.[3] Although we have 16,002 observations for each product, we have to drop the observations if a country exports to all 126 trading partners, imports from all 126 countries, or does not export or import the product at all. Given the large number of estimates we have for each product, we do not report all the results. Instead, in the table we provide summary statistics for the estimated coefficients, the proportion of coefficients that have the expected sign, and the proportion of those that are significant at the 5% level.

The probability of successful exports from country *k* to *l* (ρ_i^{kl}) is negatively related to the log of distance between them. 100 percent of industry-level estimates have negative signs and are statistically significant. As expected, estimated coefficients on common language and borders are positive. Interestingly, some business-related variables provide strong support for

[3] We have 144 products for 4 years. Although we would have 576 equations (144 x 4), we failed to estimate 22 equations, ending up with 554 product-level estimations.

the model. The probabilities of positive trade among the country pairs are higher with relatively low costs of trade and business start-up.

Table 2. Probit Estimates for 144 Differentiate Products

	Expected signs	Sign match (%)	Sign match & 5% significance	Mean	St. Dev	Max	Min
Year: 2005, 2006, 2007 and 2008							
Coefficients							
log($distance^{kl}$)	-	100.0	100.0	-0.895	0.131	-1.227	-0.431
$Border^{kl}$	+	99.3	86.6	0.460	0.167	-0.063	1.019
$Language^{kl}$	+	100.0	100.0	0.464	0.098	0.175	0.967
$Cost^{kl}$	-	91.2	48.2	-0.685	0.489	-2.135	0.963
$Startup^{kl}$	-	93.7	60.5	-0.792	0.494	-2.261	0.528
$Legal^{kl}$	+	60.5	8.1	0.013	0.074	-0.219	0.205
Observations				15086	1225	8194	16002
# of coefficients				252	10	187	259
% of non-zero observations				0.310	0.087	0.124	0.513
st errors of regression				0.275	0.018	0.218	0.308
McFadden r-squared				0.590	0.025	0.490	0.645

Remember that $\hat{\rho}_i^{kl}$ is the predicted probability of exports of product *i* from country *k* to *l*, using the estimates from (10). Let $\hat{z}_i^{kl} = \Phi^{-1}(\hat{\rho}_i^{kl})$ be the predicted value of the latent variable. Then, an estimate for W_i^{kl} is obtained from $W_i^{kl} = (Z_i^{kl})^{(\kappa_i - \varepsilon_i + 1)/(\varepsilon_i - 1)} - 1$ for non-zero observations. Assuming that κ^i and ε^i are constant over time, we can use equation (7) to show the relationship between our estimates of the latent variable and the cut-off point of productivity for each product:

(12) $$\hat{z}_i^{kl} = (\varepsilon_i - 1)\ln(\underline{\hat{a}}_i^{kl} / \underline{\hat{a}}_i^{k}).$$

We call $\hat{z}_i^{kl}$ as log of extensive margin.

2.3. Revealed Comparative Advantages

The traditional idea of the revealed comparative advantage by Balassa (1965) is a useful measure to understand the structure of the commodity trade. Since the data on commodity trade is by far the best available source of global data, this measure is employed not only by trade economists but also by development-related agencies and policy makers.

To investigate the structure of commodity trade across products and the role of extensive margins, we prepare the well-known index for revealed comparative advantage proposed by Balassa (1965)

$$RCA_{it}^{k} = \left(\sum_{l} m_{it}^{kl} \Big/ \sum_{i}\sum_{l} m_{it}^{kl}\right) \Big/ \left(\sum_{k}\sum_{l} m_{it}^{kl} \Big/ \sum_{k}\sum_{i}\sum_{l} m_{it}^{kl}\right). \tag{13}$$

If RCA^{k}_{it} is greater than unity, the commodity i in country k in year t is revealed to have a comparative advantage. It is important to notice that the RCA index represents the structure of commodity trade relative to the world average. For example, the RCA index for k=USA and i=Aircraft in year t=2005 is around 4. This simply means that the export share of Aircrafts is greater than that of world trade, implicitly suggesting the structure of the USA exports. Moreover, it has been long criticized that there is no theoretical foundation for the RCA index. The recent literature such as Constinot et al. (2011) develops the RCA index by using the Eaton and Kortum (2002) model.

Table 3 reports the RCA values and country names for the highest RCA value for each of years 2005 and 2008 for each of the selected commodities. For example, Ivory Coast (Côte d'Ivoire) had the highest RCA value of “Chocolate and Cocoa” and the Switzerland had the highest RCA value of “Watches & Clocks”.

Table 3. RCA Index for Selected Products (SITC. Rev 3. 3-digit)

	2005		2008	
	RCA	Country	RCA	Country
FISH,DRIED,SALTED,SMOKED	741.4	Maldives	738.0	Maldives
CHOCOLATE,OTH.COCOA PREP	72.1	Côte d'Ivoire	21.2	Côte d'Ivoire
MEDICAMENTS	9.3	Ireland	9.7	Ireland
EXPLOSIVES & PYROTECHNICS	41.5	Zambia	21.8	Zambia
LEATHER	217.0	Nigeria	190.9	Ethiopia
PEARLS & PRECIOUS STONES	72.6	Botswana	73.1	Botswana
SILVER & PLATINUM	48.0	South Africa	63.9	South Africa
TELEVISION RECEIVERS	15.2	Slovakia	8.2	Mexico
SOUND RECORDER	5.1	Indonesia	4.4	Indonesia
TELECOMM EQUIPMENT	4.9	Finland	6.9	Finland
TRANSISTORS	11.0	Philippines	9.4	Philippines
PASS.MOTOR VEHCLS.	2.7	Slovakia	2.7	Canada
TRUNK & SUIT-CASES	5.0	Viet Nam	6.3	Viet Nam
CLOTHNG (MENS)	35.8	Bangladesh	33.0	Nicaragua
FOOTWEAR	20.1	Viet Nam	36.8	Albania
OPTICAL INSTRUMENTS	11.6	Rep. of Korea	11.1	Rep. of Korea
WATCHES & CLOCKS	27.1	Switzerland	27.2	Switzerland
BABY CARRIAGE,TOYS, & GAMES	4.2	China	4.6	China

Table 4 reports the list of the commodities and the number of their trading partners for the top and bottom ten RCA value products for some selected countries. According to Table 4, regardless of the comparative advantage or disadvantage goods, the United States export products to almost all trading partners. This tendency holds not only for productive small-size country such as Austria but also large newly developed country such as China. For the least developing countries such as Bangladesh, they do not have any export markets for their comparative disadvantage products.

Table 4. Top 10 and Bottom 10 Products in RCA (Selected Countries, 2005)

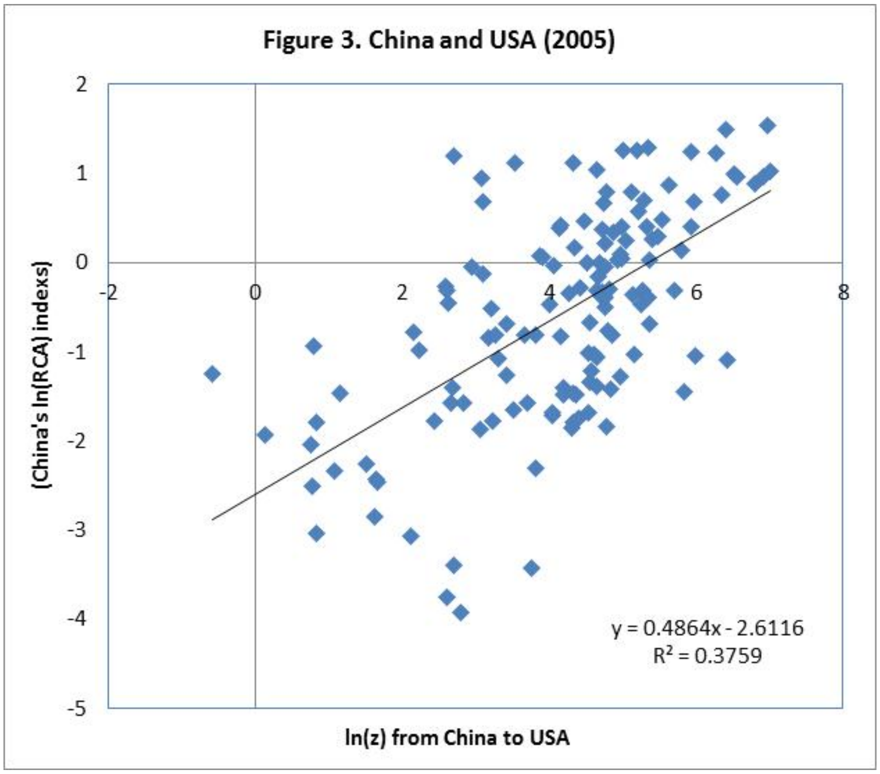
4.1. Developed countries

	Exporter: USA			Exporter: Austria		
Top 10	RCA	Markets	Products	RCA	Markets	Products
1	4.23	111	ENGINES,MOTORS NON-ELECT	13.23	98	NON-ALCOHOL.BEVERAGE,NES
2	3.81	122	AIRCRAFT,ASSOCTD.EQUIPNT	11.27	53	RAILWAY TRACK IRON,STEEL
3	2.54	121	PREPRD ADDITIVES,LIQUIDS	6.74	100	GLASSWARE
4	2.35	124	MEASURE,CONTROL INSTRMNT	6.36	60	RAILWAY VEHICLES.EQUIPNT
5	2.34	124	MEDICAL INSTRUMENTS NES	3.80	75	WOOD, SIMPLY WORKED
6	2.25	124	ELECTRO-MEDCL,XRAY EQUIP	3.35	70	PAPER,PULP MILL MACHINES
7	2.17	92	EXPLOSIVES,PYROTECHNICS	3.23	85	WOOD MANUFACTURES, NES
8	2.14	106	WORKS OF ART,ANTIQUE ETC	3.20	74	MONOFILAMENT OF PLASTICS
9	2.01	125	MEDICINES,ETC.EXC.GRP542	3.11	80	METALWORKING MACHNRY NES
10	1.89	98	TOBACCO, MANUFACTURED	3.09	100	MUSICAL INSTRUMENTS,ETC.
	Exporter: USA			Exporter: Austria		
Bottom 10	RCA	Markets	Products	RCA	Markets	Products
1	0.07	122	FOOTWEAR	0.01	14	FISH,DRIED,SALTED,SMOKED
2	0.08	119	MENS,BOYS CLOTHNG,X-KNIT	0.04	51	PEARLS,PRECIOUS STONES
3	0.08	113	POTTERY	0.05	14	CINE.FILM EXPOSD.DEVELPD
4	0.09	117	WOMEN,GIRL CLOTHNG,XKNIT	0.06	38	SHIP,BOAT,FLOAT.STRUCTRS
5	0.12	119	TRUNK,SUIT-CASES,BAG,ETC	0.06	59	RADIO-BROADCAST RECEIVER
6	0.12	116	WATCHES AND CLOCKS	0.10	20	FURSKINS,TANNED,DRESSED
7	0.13	123	OTHR.TEXTILE APPAREL,NES	0.12	87	TRUNK,SUIT-CASES,BAG,ETC
8	0.13	110	WOMEN,GIRLS CLOTHNG.KNIT	0.12	39	SILVER,PLATINUM,ETC.
9	0.14	122	SOUND RECORDER,PHONOGRPH	0.13	64	TELEVISION RECEIVERS ETC
10	0.15	122	CLOTHNG,NONTXTL;HEADGEAR	0.13	95	PARTS,FOR OFFICE MACHINS

4.2. Developing countries

	Exporter: Bangladesh			Exporter: Mexico		
Top 10	RCA	Markets	Products	RCA	Markets	Products
1	31.48	87	MENS,BOYS CLOTHNG,X-KNIT	8.18	61	TELEVISION RECEIVERS ETC
2	25.50	93	OTHR.TEXTILE APPAREL,NES	5.46	67	METERS,COUNTERS,NES
3	23.66	77	MENS,BOYS CLOTHING,KNIT	4.92	95	ELECTR DISTRIBT.EQPT NES
4	14.67	81	WOMEN,GIRL CLOTHNG,XKNIT	3.54	58	RADIO-BROADCAST RECEIVER
5	11.44	72	WOMEN,GIRLS CLOTHNG.KNIT	3.53	49	GOODS,SPCL TRANSPORT VEH
6	8.99	44	LEATHER	2.95	90	MEDICAL INSTRUMENTS NES
7	8.36	88	TEXTILE ARTICLES NES	2.17	95	ALCOHOLIC BEVERAGES
8	4.87	79	CLOTHNG,NONTXTL;HEADGEAR	2.01	92	FURNITURE,CUSHIONS,ETC.
9	3.34	53	POTTERY	2.00	87	ROTATING ELECTRIC PLANT
10	2.98	66	TEXTILE YARN	2.00	72	LIGHTNG FIXTURES ETC.NES
	Exporter: Bangladesh			Exporter: Mexico		
Bottom 10	RCA	Markets	Products	RCA	Markets	Products
1	0.00	1	SILVER,PLATINUM,ETC.	0.01	43	METAL REMOVAL WORK TOOLS
2	0.00	1	EXPLOSIVES,PYROTECHNICS	0.01	4	FURSKINS,TANNED,DRESSED
3	0.00	9	PIGMENTS, PAINTS, ETC.	0.02	57	PRINTNG,BOOKBINDNG MACHS
4	0.00	4	ELECTRO-MEDCL,XRAY EQUIP	0.02	37	PAPER,PULP MILL MACHINES
5	0.00	3	METERS,COUNTERS,NES	0.02	43	AIRCRAFT,ASSOCTD.EQUIPNT
6	0.00	9	SOUND RECORDER,PHONOGRPH	0.02	36	TOBACCO, MANUFACTURED
7	0.00	4	OTH.POWR.GENRTNG.MACHNRY	0.03	11	RAILWAY TRACK IRON,STEEL
8	0.00	3	RADIO-BROADCAST RECEIVER	0.03	32	MACH-TOOLS,METAL-WORKING
9	0.00	12	DOM.ELEC,NON-ELEC.EQUIPT	0.03	27	MONOFILAMENT OF PLASTICS
10	0.00	21	PARTS,TRACTORS,MOTOR VEH	0.04	25	PEARLS,PRECIOUS STONES

Figure 3 plots the log of extensive margin to that of the revealed comparative advantage for China's access to the United State. Here, the RCA measures are the exporter's (Chinese) indices for 144 commodities, while the extensive margin from equation (11) is $\hat{z}_i^{kl}$ where k=China and l=USA for each commodity. In this figure, the positive number in the log of the revealed comparative advantage implies that industry i is a comparative advantage sector. Interestingly, there is clear positive and statistically significant relationship between these two variables. It is worth emphasizing that while we estimate extensive margins from product-level data we develop the RCA indices from export shares in each country relative to world exports.



This tendency is not limited to South countries' access to North markets. For example, even the access of Japan to Brazilian market, we can find the similar positive relationship between these two variables.

Finally, we estimate the following equation to investigate the association between the extensive margin and the comparative advantage for each exporter-importer pairs for each year *t*. *** Eventually, I would like to use RCA as dependent variables…

(14) $$\hat{z}_{it}^{kl} = c_t^{kl} + a_t^{kl} \ln(RCA_{it}^{k})$$

Regardless of the development stages of the countries, the estimated values of $a^{kl}{}_t$ are positive and statistically significant at the 5% confidence level. Figure 4 reports the portion of *t*-values for 7,225 country-pairs.