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ONLINE APPENDIX

Over Land and Over Sea: Domestic Trade Frictions in the Philippines

Eugenia Go
28 February 2020

A.1. DATA

1. Maritime Trade by Origin and Destination

The analysis is limited to a set of agricultural commodities corresponding to 101,159 monthly flows. About 5% of these exhibit highly improbable derived unit values suggesting encoding errors. More formally, provincial retail and farm gate prices are used as upper and lower bounds of unit values to check for outliers. In such cases, more weight is given to the volume record as advised by the Philippine Statistics Authority (PSA), and values were adjusted according to the average unit price of the exports from the port of the nearest available month before and after the outlier observation.

2. Interprovince Land Trade

Interprovince land trade flows were derived using Marketing Cost Structure Studies prepared by the Bureau of Agricultural Statistics for a number of products in selected years. These studies identify the main supply and destination provinces for certain commodities. The difference between production and consumption of a supply province is assumed to be the amount available for export to demand provinces.

The derivation of imports of a demand province is straightforward when an importing province only has one source province. In cases where a demand province sources from multiple suppliers, such as the case of the National Capital Region (NCR), the supplying provinces are weighted according to the sample proportions in the survey. For example, NCR sources onions from Ilocos Norte, Pangasinan, and Nueva Ecija. Following the sample proportion of traders in each supply province, it is assumed that 26% of NCR imports came from Ilocos Norte, 34% from Pangasinan, and 39% from Nueva Ecija.

The exports of supplying provinces are capped at the difference between production and consumption. In cases where supplying provinces are unable to fill the requirements in all demand provinces, importing provinces are prioritized by importance of markets as indicated by their sample proportion and by the availability of production information. These imputations were checked against coastwise trade data to avoid double counting. A summary of the geographic flow for each of the commodity in the study is described in Table A.1.

In cases where only two provinces sit on the same island (i.e., the eastern and western halves of Mindoro and Negros), land trade between the two neighboring provinces can also be derived.

Trade between east (e) and west (w) was derived as follows:

$$X_{ew} = Prod_e - \sum_{j \neq w}^n X_{ej} + \sum_{j \neq w}^n M_{ej} - C_e$$

where C is the consumption in the (e)ast; X_{ej} are the exports of the eastern province to provincial and international trading partners, and M_{ej} are its imports. Exports from the west to the east are similarly derived.

Table A.1: Supply and Demand Provinces for Land-Based Trade

Product	Supply Province	Demand Province
Calamansi	Nueva Ecija NCR	NCR Laguna, Rizal
Cassava	Apayao, Quirino Isabela Bukidnon South Cotabato Batangas, Quezon, Pampanga NCR	Isabela Cagayan Davao del Sur, Misamis Oriental, Sarangani Lanao del Sur NCR Bulacan, Cavite, Rizal, Tarlac
Corn	Bukidnon, Lanao del Sur South Cotabato North Cotabato Isabela Cagayan Ilocos Norte	Misamis Oriental Davao del Sur, Misamis Oriental Davao del Sur, Misamis Oriental Batangas, Bulacan, Ilocos Norte, NCR Batangas, Bulacan, Ilocos Norte, NCR Benguet, Bulacan, Pangasinan
Hog	Bulacan Davao del Norte, Sarangani, South Cotabato	Batangas, NCR, Nueva Ecija Davao del Sur
Mango	Bulacan, Pangasinan, Zambales NCR Ilocos Sur, La Union, Nueva Ecija, Tarlac North Cotabato, South Cotabato Sultan Kudarat	NCR Cavite, Laguna, Rizal Pangasinan Davao del Sur South Cotabato
Onion	Ilocos Norte Pangasinan Nueva Ecija	Cagayan, Isabela, Pangasinan Albay, Bataan, Batangas, Bulacan, Pampanga, Zambales Batangas, Cavite, Laguna, Quezon, Rizal
Potato	Benguet Benguet, Pangasinan Mountain Province Bukidnon	NCR, Pangasinan Nueva Ecija Benguet Misamis Oriental
Rice	Cagayan, Isabela, Nueva Ecija, Pangasinan, Tarlac Cagayan Nueva Ecija Bukidnon	NCR Benguet, La Union Bulacan, Pampanga, Rizal Misamis Oriental
Tomato	Pangasinan Bukidnon Misamis Oriental Nueva Vizcaya	NCR Misamis Oriental, Zamboanga City Zamboanga City Pangasinan

NCR = National Capital Region.

Source: Compiled by the author from various Marketing Cost Structure Studies (BAS 2002, 2003, 2007, 2008, 2011).

3. Transshipment

Products exported by the NCR have two potential sources: other provinces from mainland Luzon and international imports, IM . If $NCR_c \geq IM$, it is assumed that international imports are all consumed in the NCR and whatever is exported is originally sourced from other provinces that are part of the Luzon mainland. An implicit assumption is that there is no quality discrimination for destination markets. It turns out that $NCR_c \geq IM$ is true for all products except for corn, which exceed consumption in the NCR by at least 9,000 metric tons during the period of study. Presumably, this is because they are used as inputs to the feed milling industry, the majority and largest plants of which are in the NCR and the nearby Central Luzon provinces (Cruz 1996). This simplifies the problem since processed feeds move to another product classification. The reaccounting of source provinces is summarized in Table A.2.

Table A.2: Attribution of National Capital Region Exports

Product	MCSS	Provinces
Banana	no	Isabela (100%)
Cabbage	no	Benguet (100%)
Calamansi	yes	Nueva Ecija (100%)
Carrots	no	Benguet (100%)
Cassava	yes	Batangas (7%), Pampanga (9%), Quezon (84%)
Corn	yes	Cagayan (15%), Isabela (85%)
Mango	yes	Bulacan (2%), Pangasinan (94%), Zambales (4%)
Onion	yes	Ilocos Norte (33%), Nueva Ecija (52%), Pangasinan (15%)
Pineapple	no	Cavite (100%)
Pork	yes	Bulacan (100%)
Potato	yes	Benguet (100%)
Rice	yes	Cagayan (15%), Isabela (40%), Nueva Ecija (13%), Pangasinan (19%), Tarlac (13%)
Tomato	yes	Pangasinan (100%)

MCSS = Marketing Cost Structure Studies.

Source: Compiled by the author from various MCSS (BAS 2002, 2003, 2007, 2008, 2011).

4. Production Data

Adjustment factors for products are summarized in Table A.3. Production information on hogs and chicken are available in terms of quarterly inventories of animals. To come up with the production data, the quarter with the largest inventory is chosen for each year and is then converted to live weight equivalent using 80 kilograms (kg) for hogs and 1.45 kg for chickens. Finally, live weight is converted into carcass weight by a ratio of 0.70 and 0.77, respectively.

A modified method of imputation is necessary for products that have a large share that is processed because these are not picked up by the provincial consumption data. Corn, as the main feedstock ingredient in the Philippines, has over 50% of production destined for feeds and nonfood

use (PSA 2017). The hog and chicken consumption of provinces is accounted for by the feed conversion ratios for livestock and poultry documented in Sison (2014) and the ratio of backyard to commercial farm inventory from the PSA (2016). This is the same methodology that the Department of Agriculture employs in estimating annual demand for corn. A full-grown hog of 80 kg is assumed to have consumed 91.3 kg to 345 kg of feeds over its life cycle, while the numbers are 15.3 kg to 28.8 kg for chickens. The lower values refer to backyard animals, while higher values refer to animals in commercial farms.

Substantial shares of other products also go into processing: pineapple (45%), banana (25%), potato (25%), and tomato (15%). Nonetheless, knowledge of their processing locations allows us to impute consumption in areas where processing activities do not exist.

Table A.3: Production Adjustment Factors

Product	Adjustment factor
Banana	6% as feed and waste
Cabbage	8% as feed and waste
Calamansi	6% as feed and waste
Carrot	8% as feed and waste
Cassava	6% as feed and waste
Chicken	
Liveweight	Number dressed x 1.45 kg
Dress weight	total liveweight x 0.77
Corn	Kg of corn yields x 0.65
Mango	6% as feed and waste
Onion	8% as feed and waste; 7% as seed
Pineapple	6% as feed and waste
Pork	
Liveweight	Number slaughtered x 80 kg
Dress weight	total liveweight x 0.70
Potato	5% as feed and waste
Rice	Kg of Paddy x 0.65
Tomato	7% as feed and waste

kg = kilogram.

Source: Philippine Statistics Authority. 2017. "Technical Notes on National Agricultural Statistics." CountrySTAT Philippines: <http://openstat.psa.gov.ph/Featured/CountrySTAT-Philippines> (accessed 18 September 2016).

5. Intraprovince Trade

The derivation of intraprovince trade rests on being able to map a concordance of products across datasets on consumption and production, prices, and trade. The concordance developed in this paper is presented in Table A.4.

Table A.4: Data Concordance at the Provincial Level

PSCC	PSCC Commodity Description	Price (monthly)			Production (annual)	Per Capita Consumption (annual)
		Farmgate	Wholesale	Retail		
01221	Meat of swine, fresh or chilled	hogs for slaughter	hogs for slaughter	meat with bones, lean	number of heads (inventory)	pork
01222	Meat of swine, frozen			meat, front leg		
01231	Poultry, fresh	chicken native/improved	chicken native/improved	chicken fully dressed	number of birds (inventory)	chicken
01232	Poultry, frozen					
01234	Poultry cuts and other offal, fresh or chilled					
01235	Poultry cuts and offal, frozen					
04210	Rice in the husk (paddy or rough rice)	paddy fancy, paddy other variety	paddy fancy, paddy other variety	rice special, rice premium, well milled rice, regular milled rice	paddy	rice
04231	Rice, semi-milled or wholly milled, (excluding broken rice)					
04410	Maize seed, unmilled	corn grain white, corn grain yellow	corn grain white, corn grain yellow	corn grits (white and yellow)	yellow corn, white corn	corn
04490	Other maize (not including sweet corn), unmilled					
05410	Potatoes, fresh or chilled (not including sweet potatoes)	potatoes white	potatoes white	potatoes white	potatoes white	potatoes white
05440	Tomatoes, fresh or chilled	tomato	tomato	tomato	tomato	tomato
05451	Onions & shallots, fresh/ chilled	native (shallot), red creole, white (granex)	native (shallot), red creole, white (granex)	onion red creole, onion white (granex)	onion	onion
05453	Cabbage and similar edible brassicas, fresh or chilled	cabbage	cabbage	cabbage	cabbage	cabbage
05455	Carrots, turnips, salad beetroot, salsify, celeriac, radishes and similar edible roots, fresh or chilled	carrots	carrots	carrots	carrots	
05481	Manioc (cassava), fresh or dried, whether or not sliced or in the form of pellets	cassava dried chips, cassava fresh tubers	cassava dried chips, cassava fresh tubers		cassava	cassava
05729	Citrus fruit, nes, fresh/dried	calamansi	calamansi	calamansi	calamansi	calamansi
05730	Bananas (including plantains), fresh or dried	banana latundan, banana saba	banana latundan, banana saba	lakatan, latundan, saba	banana lakatan, banana saba	banana (all varieties)
05795	Pineapples, fresh or dried	pineapple hawaiian	pineapple hawaiian	pineapple hawaiian	pineapple	pineapple
05797	Avocados, guavas, mangoes, mangosteens, fresh or dried	carabao, indian, piko	mango carabao, mango indian, mango piko	mango carabao	mango carabao	mango ripe

nes = not elsewhere specified, PSCC = Philippine Standard Commodity Classification.

Source: Author.

Table A.5: Gravity Covariates for Varying Border Effects

Variable	(1) Product	(2) Year	(3) Province	(4) Province year
Log distance	-0.375*** (0.0922)	-0.408*** (0.0820)	-0.462*** (0.0768)	-0.747*** (0.0791)
Language	0.268 (0.192)	0.198 (0.185)	-0.171 (0.243)	-0.665** (0.277)
Land	4.301*** (0.213)	4.373*** (0.189)	4.019*** (0.218)	3.853*** (0.231)
Observations	40,650	40,650	40,650	40,650

Notes: Robust standard errors in parentheses, clustered at province pairs. Regressions include origin-time, destination-time, product-time fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Source: Author's calculations.

Table A.6: Gravity Covariates for Roll-On Roll-Off Terminal System-Induced Changes in Border Effects

	(1) Product	(2) Year	(3) Province
Log distance	-0.296*** (0.0929)	-0.699*** (0.0884)	-0.498*** (0.0862)
Language	0.466*** (0.177)	-0.238 (0.266)	0.243 (0.254)
Land	4.658*** (0.229)	4.053*** (0.197)	4.213*** (0.254)
Observations	36,600	36,600	36,600

Notes: Robust standard errors in parentheses, clustered at province pairs. Regressions include origin-time, destination-time, product-time fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Source: Author's calculations.

Table A.7: Estimated Province Border Effects

Province	Border Effect	Province	Border
Agusan del Norte	3.922***	Misamis Occidental	4.929***
Albay	2.177***	Misamis Oriental	0.376
Basilan	3.679***	Negros Occidental	2.310***
Bataan	5.513***	Negros Oriental	3.090***
Batangas	4.793***	Northern Samar	6.144***
Benguet	3.636***	Nueva Ecija	5.811***
Bohol	4.513***	Occidental Mindoro	3.869***
Bulacan	3.843***	Oriental Mindoro	0.0676
Cagayan	7.135***	Palawan	4.470***
Camarines Sur	5.218***	Pampanga	5.127***
Camiguin	8.193***	Pangasinan	1.740***
Catanduanes	6.598***	Quezon	7.873***
Cavite	4.098***	Romblon	10.02***
Cebu	-0.137	Samar	7.134***
Davao del Sur	2.822***	Sarangani	0.145
Davao Oriental	9.241***	Siquijor	6.281***
Ilocos Norte	0.188	Sorsogon	8.205***
Ilocos Sur	9.495***	South Cotabato	3.541***
Iloilo	3.053***	Southern Leyte	5.107***
La Union	5.282***	Sulu	4.034***
Laguna	4.253***	Surigao del Norte	3.124***
Lanao del Norte	6.113***	Surigao del Sur	4.650***
Lanao del Sur	2.983**	Tarlac	5.350***
Leyte	5.554***	Tawi-Tawi	5.229***
Maguindanao	8.544***	Zambales	5.995***
Marinduque	-2.091	Zamboanga del Norte	6.659***
Masbate	6.297***	Zamboanga del Sur	2.985*

Notes: Robust standard errors in parentheses, clustered at province pairs. Regressions include origin-time, destination-time, product-time fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Author's calculations.

**Table A.8: Roll-On Roll-Off Terminal System-Induced Changes
in Province Border Effect**

Province	<i>Smprov</i>	RRTS x <i>Smprov</i>
Agusan del Norte	3.742***	0.102
Albay	2.653***	2.465***
Basilan	1.423*	3.590***
Batangas	6.170***	-1.427***
Bohol	4.555***	0.511*
Camiguin	6.461***	2.889**
Cebu	0.250	-0.158
Iloilo	2.485***	0.588*
Lanao de l Norte	6.022***	0.440
Leyte	4.535***	1.102**
Marinduque	-0.584	-1.717*
Masbate	5.269***	0.747
Misamis Occidental	3.392***	2.077***
Misamis Oriental	0.922	-0.129
Negros Occidental	2.706***	-0.327
Negros Oriental	3.734***	-0.315
Occidental Mindoro	4.336***	-0.504***
Oriental Mindoro	1.859	-0.677***
Palawan	4.443***	0.813**
Quezon	7.198***	1.008
Romblon	9.680***	0.492
Samar	6.239***	2.832***
Siquijor	6.803***	-0.00864
Sorsogon	6.285***	3.242***
Southern Leyte	5.168***	0.249
Sulu	3.116***	1.673***
Surigao del Norte	2.867***	0.0946
Tawi-Tawi	3.832***	3.168**
Zamboanga del Norte	6.719***	0.306
Zamboanga del Sur	1.839*	0.935***

RRTS = Roll-On Roll-Off Terminal System.

Notes: Robust standard errors in parentheses, clustered at province pairs. Regressions include origin-time, destination-time, product-time fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's calculations.

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