Economics 245 — Fall 2013

International Trade

Extra Problem Set

(Substitute for Problem Set 2 or 3)

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Motivation. Balassa (1965) proposed to measure revealed comparative advantage with

$$RCA_{is}^{\text{Bal}} = \frac{EX_{is}/EX_s}{EX_i/EX}, \tag{1}$$

where EX_{is} denotes exports from source country s's industry i to the rest of the world, EX_s denotes country s's total exports, EX_i denotes industry i's total exports from any source country in the world to the rest of the world, and EX denotes global exports. This is a measure of *revealed* comparative advantage because it ignores the conceptual origin of the industry's relative advantage.

The Balassa (1965) measure suffers the drawback that it potentially confounds geographic and demand factors with exporter-side origins of comparative advantage. The conceptual note *Trade Theory and a Foundation of Revealed Comparative Advantage Measures* by Hanson, Lind and Muendler (2013), posted on the course web page, shows how gravity equation estimation can be used to isolate a key term Y_{is}/Ξ_{is}, which measures exporter capability and is not confounded by geography and foreign demand. The variable Y_{is} denotes an industry's gross production value, and Ξ_{is} is a measure of market potential that can vary in interpretation depending on the underlying theory. An according geography-free revealed comparative advantage measure can be defined as

$$RCA_{is}^{*} = \frac{(Y_{is}/\Xi_{is})/(\sum_{t=1}^{S} Y_{it}/\Xi_{it})}{\sum_{j=1}^{J} \mu_j \left[(Y_{js}/\Xi_{js})/(\sum_{t=1}^{S} Y_{jt}/\Xi_{jt})\right]}, \tag{2}$$

where μ_j is the global share of industry j in total worldwide trade.

The implementation of this measure requires estimation of the gravity equation with fixed effects OLS for a full set of source country fixed effects, all but one destination country fixed effects, and bilateral gravity variables under industry specific coefficients (interacting the bilateral gravity variables with a full set of industry dummies). The source country fixed effects provide the estimates of Y_{is}/Ξ_{is}. Interpretation of the key term, however, depends on underlying theory. Table 1 provides a synopsis of origins of comparative advantage, and the according key term, across models.

One important extension of classic trade theory is missing from Table 1: the generalization of the Heckscher-Ohlin model to many industries by Dornbusch, Fischer and Samuelson (1980). An

Table 1: THEORETICAL FOUNDATIONS OF REVEALED COMPARATIVE ADVANTAGE

Theory model	Theory component: Gravity equation	Key term Y_{is}/Ξ_{is}	Market potential Ξ_{is}
Tinbergen (1962) gravity	$X_{isd} = \kappa_i \frac{Y_{is} X_{id}}{d_{sd}}$		
Armington (1969)	$X_{isd} = \frac{Y_{is} X_{id}}{(d_{sd})^{\varepsilon_i - 1}} \frac{(P_{id})^{\varepsilon_i - 1}}{\Xi_{is}}$	$\beta_{is}(p_{iss})^{-(\varepsilon_i - 1)}$	$\sum_d \frac{(d_{sd})^{-(\varepsilon_i - 1)}}{(P_{id})^{-(\varepsilon_i - 1)}} X_{id}$
Classic trade (Deardorff 1998)			
Incomplete spec., identical preferences	$X_{isd} = Y_{is} X_{id} \frac{1}{\Xi_i}$	$\gamma_{is} = Y_{is}/Y_i^W$	$Y_i^W = \sum_{d=1}^{S} X_{id}$
Incomplete spec., non-homothetic prefs.	$X_{isd} = Y_{is} X_{id} \frac{1}{\Xi_i}$	$\gamma_{is} = Y_{is}/\Xi_i$	$\sum_d \beta_{id} X_d$
Trade frictions, complete specialization	same as Armington (1969)		
Eaton and Kortum (2002)	$X_{isd} = \frac{Y_{is} X_{id}}{(d_{sd})^{\theta_i}} \frac{(\bar{P}_{id})^{\theta_i}\, \Gamma(1-(\sigma-1)/\theta_i)^{\frac{1}{\sigma-1}}}{\Xi_{is}}$	$T_{is}(w_s)^{-\theta_i}$	$\sum_d \frac{(d_{sd})^{-\theta_i}}{\Phi_{id}} X_{id}$
Krugman (1980)	$X_{isd} = \frac{Y_{is} X_{id}}{d_{sd}^{\varepsilon_i - 1}} \frac{(P_{id})^{\varepsilon_i - 1}}{\Xi_{is}}$	$\frac{L_s/F}{\sum_i \varepsilon_i} \left(\frac{\varepsilon_i}{\varepsilon_i - 1} \frac{w_s}{\phi_{is}} \right)^{-(\varepsilon_i - 1)}$	$\sum_d \frac{(d_{sd})^{-(\varepsilon_i - 1)}}{(P_{id})^{-(\varepsilon_i - 1)}} X_{id}$
Arkolakis and Muendler (2010)	$X_{isd} = Y_{is} X_{id} \frac{1}{\Xi_{is}} \times \frac{f_{sd}(1)^{-(\tilde{\theta}_i - 1)} \sum_{G=1}^{\infty} G^{-\delta(\tilde{\theta}_i - 1) - \alpha\theta_i}}{(d_{sd})^{\theta_i}}$	$V_{is}(w_s)^{-\theta_i}$	$\sum_d (d_{sd})^{-\theta_i} \times f_{sd}(1)^{-\tilde{\theta}_i} \bar{F}_{isd} X_{id}$

Notes: Revealed comparative advantage (2) is defined as

$$RCA^*_{is} = \frac{(Y_{is}/\Xi_{is})/(\sum_{t=1}^{S} Y_{it}/\Xi_{it})}{\sum_{j=1}^{J} \mu_j \left[(Y_{js}/\Xi_{js})/(\sum_{t=1}^{S} Y_{jt}/\Xi_{jt}) \right]},$$

where Y_{is} denotes an industry's gross production value, Ξ_{is} is a measure of market potential, and μ_j is the global share of industry j in total worldwide trade. An industry i's bilateral trade flow from source country s to destination d is X_{isd}; $X_{id} = \sum_s X_{isd}$ is demand-side market size and L_s supply-side market size (labor supply); the constant κ_i absorbs units of measurement; d_{sd} is a measure of bilateral distance; ε_i is a demand elasticity of substitution between firm-products and σ between industries; ϕ_{is} is industry wide labor productivity; p_{iss} is the factory gate price; w_s is the wage rate; P_{id} is an ideal price index for CES and $\bar{P}_{id}$ its expectation; β_{is} is an Armington preference weight; β_{id} is a non-homothetic demand share of an industry in total expenditure; γ_{is} measures source s's contribution to good i's world pool of supply (classic comparative advantage if $\gamma_{is} > 1/S$); θ_i is a Fréchet or Pareto shape parameter and $\tilde{\theta}_i = \theta_i/(\sigma-1)$; T_{is} is a Fréchet scale parameter; $\Gamma(\cdot)$ is the Gamma function; Φ_{id} is a Weibull shape parameter ($\Phi_{id} = \sum_{s=1}^{S} T_{is}(w_s d_{sd})^{-\theta_i}$); F is a firm's fixed entry cost, $f_{sd}(1)$ a firm's fixed entry cost for its first product and $\bar{F}_{isd}$ the average product entry cost by firm; δ is the elasticity of firm-product fixed entry costs with respect to exporter scope G and α is the elasticity of the efficiency loss with respect to the product number away from core competency; V_{is} is the measure of potential entrants.

important insight from Dornbusch et al. (1980, Section IV) is the characterization of equilibrium with free trade when factor prices do not equalize under sufficiently diverse factor endowments.

The Dornbusch et al. (1980) model promises a realistic explanation for comparative advantage patterns around the world, as empirical test results by Davis and Weinstein (2001) suggest. When quantified in the spirit of revealed comparative advantage measurement, the model also promises to provide a potential alternative interpretation of results compared to those by Costinot, Donaldson and Komunjer (2012), who view gravity estimation as fundamentally related to Ricardian trade forces.

Open-ended Questions.

- Use results from Dornbusch et al. (1980, Section IV) for two factors of production to derive the key exporter capability term Y_{is}/Ξ_{is}, similar to the Deardorff (1998) derivations reported in Table 1 and in the conceptual note *Trade Theory and a Foundation of Revealed Comparative Advantage Measures* by Hanson et al. (2013).

- State the key exporter capability term Y_{is}/Ξ_{is} for the case of factor price equalization and the case of failing factor price equalization.

- Introduce transport costs for the case of failing factor price equalization. Derive the relative export value of a country's industry as a share of destination market size by industry

  $$\frac{X_{isd}}{X_{id}} \equiv \frac{p_{isd}q_{isd}}{X_{id}}.$$

  Show how the key exporter capability term Y_{is}/Ξ_{is} differs from X_{isd}/X_{id} in the presence of transport costs.

- Propose an estimation strategy to compare the quantitative relevance of Heckscher-Ohlin trade forces to Ricardian trade forces.

References

Arkolakis, Costas and Marc-Andreas Muendler, "The Extensive Margin of Exporting Products: A Firm-level Analysis," *NBER Working Paper*, December 2010, *16641.*

Armington, Paul S., "A Theory of Demand for Products Distinguished by Place of Production," *International Monetary Fund Staff Papers*, March 1969, *16* (1), 159–178.

Balassa, Bela, "Trade Liberalization and Revealed Comparative Advantage," *Manchester School of Economic and Social Studies*, May 1965, *33*, 99–123.

Costinot, Arnaud, Dave Donaldson, and Ivana Komunjer, "What Goods Do Countries Trade? A Quantitative Exploration of Ricardo's Ideas," *Review of Economic Studies*, April 2012, *79* (2), 581608.

Davis, Donald R. and David E. Weinstein, "An Account of Global Factor Trade," *American Economic Review*, December 2001, *91* (5), 1423–53.

Deardorff, Alan V., "Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?," in Jeffrey A. Frankel, ed., *The Regionalization of the World Economy*, Chicago: University of Chicago Press, January 1998, chapter 1, pp. 7–32.

Dornbusch, Rudiger, Stanley Fischer, and Paul A. Samuelson, "Heckscher-Ohlin Trade Theory with a Continuum of Goods," *Quarterly Journal of Economics*, September 1980, *95* (2), 203–24.

Eaton, Jonathan and Samuel Kortum, "Technology, Geography, and Trade," *Econometrica*, September 2002, *70* (5), 1741–79.

Hanson, Gordon, Nelson Lind, and Marc-Andreas Muendler, "The Empirical Dynamics of Comparative Advantage," October 2013. UC San Diego, unpublished manuscript.

Krugman, Paul R., "Scale Economies, Product Differentiation, and the Pattern of Trade," *American Economic Review*, December 1980, *70* (5), 950–59.

Tinbergen, Jan, *Shaping the world economy: Suggestions for an international economic policy*, New York: The Twentieth Century Fund, 1962.