BUSN 33946 & ECON 35101

International Macroeconomics and Trade

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Autumn 2020, Week 6

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Today: Does size matter?

- In neoclassical trade models, the pattern of specialization is size-invariant:
  - Ricardian: DFS (1977) $A(z)$ schedule independent of L/L^*
  - Heckscher-Ohlin: Factor intensity and abundance do not depend on size
  - Relative size determines the cutoff good z^* or the area of the FPE set, not the pattern of comparative advantage
- In new trade theory, size can influence the pattern of specialization because there are economies of scale
  - Intuition: Size is advantageous when there are economies of scale
  - Implications: strategic trade policy, multiple equilibria
  - Formalizing the idea proved challenging
- A "home-market effect", in which an economy with greater domestic demand is a (net) exporter of that good, distinguishes new trade theories from neoclassical models
- Empirical challenge is inferring "greater demand" from observed equilibrium

A short history of size in theory

- Linder (1961) posits that home demand is a source of comparative advantage such that rich countries will produce high-quality products
- '60s & '70s: Theorists struggle to link market size and specialization
- Krugman (1980) formalizes two-sector, two-country predictions for (1) exogenous demand differences and (2) country size differences
- Early 2000s: Empirical work correlates market size with sectoral composition
- 2010s: Income-driven demand composition in theory and empirics

I focus on internal economies of scale, for external economies see Helpman and Krugman (1985, p.36-38), Grossman and Rossi-Hansberg (2010, p.829-832), and Kucheryavyy, Lyn, and Rodriguez-Clare (2015)

Linder hypothesis

Linder (1961) posits that home demand governs supply capability (p.87–90)

> *[The] range of exportable products is determined by internal demand. It is a necessary, but not a sufficient condition, that a product be consumed (or invested) in the home country for this product to be a potential export product... In a world of imperfect knowledge, entrepreneurs will react to profit opportunities of which they are aware. These would tend to arise from domestic needs... An invention is, in itself, most likely to have been the outcome of an effort to solve some problem which has been acute in one's own environment... the production functions of goods demanded at home are the relatively most advantageous ones.*

Linder hypothesis for trade flows (p.91–94)

> *Internal demand determines which products may be imported... The range of potential exports is identical to, or included in, the range of potential imports... The more similar the demand structure of two countries, the more intensive, potentially, is the trade between these two countries... Similarity of average income levels could be used as an index of similarity of demand structures.*

A modeling challenge

Corden (1970, p.52):

> *Professor Grubel suggests that a country will tend to produce and export those products or 'styles' of products for which it has a relatively large domestic market. He explains this in terms of economies of scale. This is essentially the 'Linder hypothesis' which has obtained some empirical support, as well as being intuitively plausible. But it does raise an interesting theoretical question which has not, to my knowledge, been explored. In a simple static two-product two-country model with no transport costs, with economies of scale and with the demand patterns differing between the two countries it does not follow that a country will export that product to which its own demand pattern is biased... The question then is: What else must we put into the model? Is it transport costs, or is it rather something 'dynamic'?*

Two dynamic stories:

- Larger demand + economies of scale = lower autarky price
- Larger demand + learning by doing = inherited comparative advantage

Neither links contemporary demand conditions to trade flows

A modeling challenge

Corden (1970, p.54):

> *A third approach might be to introduce transport costs. Transporting goods from one country to another uses up resources, and from the point of view of maximising world income it will pay to minimise transport costs. Given that in the final equilibrium both countries will specialise, each country should then specialise on the good for which it has the relatively greater demand, since this will minimise transporting. This seems obvious. Provided we do not introduce other complications, trade along Linder lines will maximise potential world income. But it does not seem so easy to prove that trade will actually assume that pattern. Suppose that, for some reason, one starts with the trade flow in the opposite direction. One might explain this in terms of some dynamic considerations. Will there then be a natural tendency for the pattern of specialisation and hence the flow of trade to reverse itself? It does not seem obvious that this would be so. There is scope for further theoretical explorations here.*

Today: Increasing returns and home-market effects

- Print Krugman (JIE 1979): We will go through it in its entirety
- Print Krugman (AER 1980): We will go through it in its entirety
- Fajgelbaum, Grossman, and Helpman (2011) + Dingel (2017)
- Matsuyama (2019) "Engel's Law in the Global Economy"
- Costinot, Donaldson, Kyle, and Williams (2019) "The More We Die, The More We Sell? A Simple Test of the Home-Market Effect"

Krugman (JIE 1979)

$$U = \sum_{i=1}^{n} v(c_i) \quad v' > 0, v'' < 0 \tag{1}$$

$$\epsilon_i = \frac{-v'}{v'' c_i} \tag{2}$$

$$l_i = \alpha + \beta x_i \tag{3}$$

$$x_i = L c_i \tag{4}$$

$$L = \sum_i l_i = \sum_{i=1}^{n} \alpha + \beta x_i \tag{5}$$

$$p = p_i, x = x_i \ \forall i \tag{6}$$

$$v'(c_i) = \lambda p_i \ \forall i \tag{7}$$

$$p_i = \lambda^{-1} v' \left(x_i / L\right) \tag{8}$$

$$\pi_i = p_i x_i - (\alpha + \beta x_i) w \tag{9}$$

$$p_i = \frac{\epsilon}{\epsilon - 1} \beta w \tag{10}$$

$$0 = px - (\alpha + \beta x) w \tag{11}$$

$$p/w = \beta + \alpha/(Lc) \tag{12}$$

$$n = \frac{L}{\alpha + \beta x} \tag{13}$$

Krugman (AER 1980)

$$U = \sum_i c_i^\theta \tag{1}$$

$$l_i = \alpha + \beta x_i \tag{2}$$

$$x_i = L c_i \tag{3}$$

$$L = \sum_i (\alpha + \beta x_i) \tag{4}$$

$$\theta c_i^{\theta-1} = \lambda p_i \tag{5}$$

$$p_i = \theta \lambda^{-1} (x_i/L)^{\theta-1} \tag{6}$$

$$p_i = \theta^{-1} \beta w \tag{7}$$

$$\pi_i = p x_i - (\alpha + \beta x_i) w \tag{8}$$

$$x_i = \alpha\theta/\beta(1-\theta) \tag{9}$$

$$n = L(1-\theta)/\alpha \tag{10}$$

$$n = L(1-\theta)/\alpha,\ n^* = L^*(1-\theta)/\alpha \tag{11}$$

Krugman (1980), section III

- Two types of consumers consuming two classes of SDS varieties

$$U = \sum_{\omega} q(\omega)^{\frac{\sigma-1}{\sigma}}; \quad \tilde{U} = \sum_{\tilde{\omega}} \tilde{q}(\tilde{\omega})^{\frac{\sigma-1}{\sigma}}$$

- Home and foreign have same total population; different shares of types

$$L + \tilde{L} = L^* + \tilde{L}^* = \bar{L}; \quad L = \gamma \bar{L}; \quad L^* = (1-\gamma)\bar{L}$$

- Identical production functions and iceberg trade costs τ

$$l(\omega) = f + cx(\omega); \quad l(\tilde{\omega}) = f + cx(\tilde{\omega})$$
$$\Rightarrow p = \frac{\sigma}{\sigma-1}cw; \quad \pi = 0 \Rightarrow x = \frac{f}{c}(\sigma-1)$$

- Symmetry implies $w = \tilde{w} = w^* = \tilde{w}^*$ and thus $p = p^*$
- Only need to solve for $n, \tilde{n}, n^*, \tilde{n}^*$

Krugman (1980), section III

- Relative expenditure on foreign varieties when $p = p^*$ is $\tau^{1-\sigma}$
- Expenditure on domestic varieties as share of total is $\frac{n}{n+n^*\tau^{1-\sigma}}$
- Market clearing: industry income equals domestic plus foreign expenditure

$$npx = \frac{n}{n + n^*\tau^{1-\sigma}} wL + \frac{n\tau^{1-\sigma}}{n\tau^{1-\sigma} + n^*} w^*L^*$$
$$n^*p^*x^* = \frac{n^*\tau^{1-\sigma}}{n + n^*\tau^{1-\sigma}} wL + \frac{n^*}{n^* + n\tau^{1-\sigma}} w^*L^*$$

- With $p = p^*$, $w = w^*$, $x = x^*$, solve for $\frac{n}{n^*}$

$$n > 0, n^* > 0 \Rightarrow \frac{n}{n^*} = \frac{L/L^* - \tau^{1-\sigma}}{1 - \tau^{1-\sigma} L/L^*}, \quad \frac{L}{L^*} \in [\tau^{1-\sigma}, \tau^{\sigma-1}]$$
$$\frac{L}{L^*} < \tau^{1-\sigma} \Rightarrow n = 0; \quad \frac{L}{L^*} > \tau^{\sigma-1} \Rightarrow n^* = 0$$

- $\frac{n}{n^*}$ is increasing in $\frac{L}{L^*}$: greater relative demand calls forth domestic supply

Krugman (1980), section III

- In autarky, entry is proportionate to demand:

$$npx = wL; \quad \tilde{n}\tilde{p}\tilde{x} = \tilde{w}\tilde{L}$$

$$w = \tilde{w}, p = \tilde{p}, x = \tilde{x} \Rightarrow n/\tilde{n} = L/\tilde{L}$$

- With trade, entry more than proportionate to demand (Krugman 1980, Fig 2)

$$\frac{n}{n^*} = \frac{L/L^* - \tau^{1-\sigma}}{1 - \tau^{1-\sigma} L/L^*}$$

$$\frac{\partial n/n^*}{\partial L/L^*} = \frac{1 - \left(\tau^{1-\sigma}\right)^2}{\left(1 - \tau^{1-\sigma}\frac{L}{L^*}\right)^2} \geq 1 \text{ if } \frac{L}{L^*} \geq \tau^{1-\sigma}$$

- The market with relatively greater demand for a product type is a net exporter of that type

$$\text{home net exports of first type} = \frac{n\tau^{1-\sigma}}{n\tau^{1-\sigma} + n^*} w^* L^* - \frac{n^*\tau^{1-\sigma}}{n + n^*\tau^{1-\sigma}} wL$$
$$= \frac{\tau^{1-\sigma} w L^*}{\tau^{1-\sigma} n + n^*} \left[n - n^*\right]$$

- This is the home-market effect

An extension

- That model assumes exogenous differences in preferences
- In a final "extension", Krugman posits what has become the popular case

Another, perhaps more interesting, generalization would be to abandon the assumed symmetry between the industries. Again, we would like to be able to make sense of some arguments made by practical men. For example, is it true that large countries will have an advantage in the production and export of goods whose production is characterized by sizeable economies of scale? This is an explanation which is sometimes given for the United States' position as an exporter of aircraft.

A general analysis of the effects of asymmetry between industries would run to too great a length. We can learn something, however, by considering another special case. Suppose that the *alpha* production is the same as in our last analysis, but that the production of *beta* goods is characterized by *constant* returns to scale and perfect competition. For simplicity, also assume that *beta* goods can be transported costlessly.

It is immediately apparent that in this case the possibility of trade in *beta* products will ensure that wage rates are equal. But this in turn means that we can apply the analysis of Part B, above, to the *alpha* industry. Whichever country has the larger market for the products of that industry will be a net exporter of *alpha* products and a net importer of *beta* products. In particular: if two countries have the same composition of demand, the larger country will be a net exporter of the products whose production involves economies of scale.

The analysis in this section has obviously been suggestive rather than conclusive. It relies heavily on very special assumptions and on the analysis of special cases. Nonetheless, the analysis does seem to confirm the idea that, in the presence of increasing returns, countries will tend to export the goods for which they have large domestic markets. And the implications for the pattern of trade are similar to those suggested by Steffan Linder, Grubel (1970), and others.

The more widely used case

- Helpman-Krugman (1985, 10.4) formalize "another special case"
- Cobb-Douglas upper tier with SDS share α and homogeneous share $1-\alpha$
- Homogeneous good is CRS, freely traded, produced in both $\Rightarrow w = w^*$
- Market clearing, again exploiting $p = p^*$ and now using α

$$npx = \frac{n}{n + n^*\tau^{1-\sigma}}\alpha w L + \frac{n\tau^{1-\sigma}}{n\tau^{1-\sigma} + n^*}\alpha w^* L^*$$

$$n^*p^*x^* = \frac{n^*\tau^{1-\sigma}}{n + n^*\tau^{1-\sigma}}\alpha w L + \frac{n^*}{n^* + n\tau^{1-\sigma}}\alpha w^* L^*$$

- Possible solutions, denoting $\rho \equiv \tau^{1-\sigma}$

$$n = 0 \qquad n^* = \frac{\alpha}{x}(L + L^*)$$

$$n = \frac{\alpha}{x}(L + L^*) \qquad n^* = 0$$

$$n = \frac{\alpha}{(1-\rho)x}(L - \rho L^*) \qquad n^* = \frac{\alpha}{(1-\rho)x}(L^* - \rho L)$$

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$$npx = \frac{n}{n + n^*\tau^{1-\sigma}}\alpha w L + \frac{n\tau^{1-\sigma}}{n\tau^{1-\sigma} + n^*}\alpha w^* L^*$$
$$n^*p^*x^* = \frac{n^*\tau^{1-\sigma}}{n + n^*\tau^{1-\sigma}}\alpha w L + \frac{n^*}{n^* + n\tau^{1-\sigma}}\alpha w^* L^*$$

- Possible solutions, denoting $\rho \equiv \tau^{1-\sigma}$

$$n = 0 \qquad\qquad n^* = \frac{\alpha}{x}(L + L^*)$$
$$n = \frac{\alpha}{x}(L + L^*) \qquad\qquad n^* = 0$$
$$n = \frac{\alpha}{(1-\rho)x}(L - \rho L^*) \qquad\qquad n^* = \frac{\alpha}{(1-\rho)x}(L^* - \rho L)$$

The more widely used case

- Define $s_n = \frac{n}{n+n^*}$ and $s_L = \frac{L}{L+L^*}$

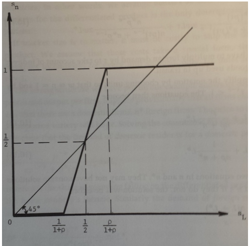


Figure 10.4

- HK (1985): "In effect a large domestic market serves as a base for exports – a proposition that has always seemed plausible to practical people but is hard to capture in formal models. We have been able to work only with a highly specialized example; it is probable, however, that 'home market effects' of the kind we have illustrated here are actually quite pervasive."
- Davis (1998): "This result depends on the relative size of trade costs in differentiated and homogeneous industries. In a focal case in which the industries have identical trade costs, the home market effect disappears."

Empirics

- Feenstra, Markusen, Rose (2001): In gravity regressions, differentiated goods have higher elasticity of exports wrt exporter GDP than importer GDP; reverse for homogeneous goods
- Hanson and Xiang (2004): Differences-in-differences test. Do higher-GDP countries export relatively more of high-transport-cost, low-elasticity-substitution goods? Yes
- Davis and Weinstein (2003): Infer “idiosyncratic elements of demand”. Does domestic production rise less than one-for-one or more than one-for-one with demand? More
- These papers infer demand differences from GDP levels or expenditure patterns, which are equilibrium objects that may also reflect supply-side differences
- FMR speak to net exports, while DW and HX are less clear

Back to Linder

Linder (1961) differs from Krugman (1980) in two important ways:

1. Linder predicts that demand generates exports, Krugman predicts demand generate net exports
2. The Helpman-Krugman formulation emphasizes country size, Linder focused on incomes: "The level of average income... has... a dominating influence on the structure of demand... when we compare demand structures, it is necessary to define goods by specifying quality." (p.94–95)

The home-market effect, weak and strong

Helpful typology from Costinot, Donaldson, Kyle, and Williams (2019):

- Weak home-market effect: Demand generates exports.
  Linder (1961): "The range of exportable products is determined by internal demand."
- Strong home-market effect: Greater demand generates *net* exports.
  Krugman (1980): "If two countries have the same composition of demand, the larger country will be a net exporter of the products whose production involves economies of scale."
- A weak home-market effect requires economies of scale; the strong HME requires sufficiently strong economies of scale
- Krugman's choice of functional form yielded the strong home-market effect for all parameter values – only CDKW formalize the weak HME

The role of income: Non-homothetic preferences in trade

- Harrigan (2001): "The assumption of identical homothetic preferences is implausible, and uninteresting in the sense that there is no real theory behind it."
- Linder posited that income composition affects demand composition, which is what every household budget study finds (Deaton and Muellbauer 1980)
- Non-homothetic preferences make income levels relevant for consumer expenditure allocations
- This heterogeneous demand might predict trade flows through intersectoral or intrasectoral (quality) specialization
- High-income economies might have comparative advantage in income-elastic goods due to a coincidental correlation or a causal home-market effect

Coincidental correlation: Caron, Fally, Markusen (2014)

- Caron, Fally, Markusen (2014): Intersectoral specialization, correlation between income elasticity and skill intensity
- CRIE preferences: $U = \sum_k \alpha_{1,k} Q_k^{\frac{\sigma_k - 1}{\sigma_k}} \Rightarrow x_{nk} = \lambda_n^{-\sigma_k} \alpha_{2,k} P_{nk}^{1-\sigma_k}$
- EK-CDK-CP multi-sector production with intermediates (no HME)
- Sectoral gravity:

$$\frac{X_{nik}}{X_{nk}} = \frac{S_{ik} d_{nik}^{-\theta_k}}{\Phi_{nk}}; \quad \Phi_{nk} = \sum_i S_{ik} d_{nik}^{-\theta_k}$$

- Gravity with zero trade costs and no intermediates shows interaction of supply and demand characteristics

$$\frac{X_{ni}}{X_n} = \sum_k \underbrace{\left(\frac{S_{ik}}{\sum_j S_{jk}} \right)}_{\text{supply shifters}} \underbrace{\left(\frac{\alpha_{4,k} \lambda_n^{-\sigma_k}}{\sum_{k'} \alpha_{4,k'} \lambda_n^{-\sigma_{k'}}} \right)}_{\text{demand shifters}}$$

Caron, Fally, Markusen (2014)

- Sectoral gravity to obtain structural proxy for Φ_{nk}

$$\ln X_{nik} = \underbrace{\ln S_{ik}}_{ik \text{ FE}} - \theta_k \underbrace{\ln d_{nik}}_{\text{proxies}} + \underbrace{\ln \left(\frac{X_{nk}}{\Phi_{nk}} \right)}_{nk \text{ FE}}$$

$$\Rightarrow \hat{\Phi}_{nk} = \sum_i \exp \left(\widehat{\ln S_{ik}} - \hat{\theta}_k \ln d_{nik} \right)$$

- Price indices closely related to inward MR, $P_{nk} = \alpha_{3,k} \Phi_{nk}^{-1/\theta_k}$
- Sectoral expenditures to identify $\{\sigma_k, \lambda_n, \alpha_{5,k}, \theta_k\}$ via constrained NLS

$$\ln x_{nk} = -\sigma_k \ln \lambda_n + \ln \alpha_{5,k} + \frac{\sigma_k - 1}{\theta_k} \ln \hat{\Phi}_{nk} + \epsilon_{nk}$$

$$\sum_k \exp \left[-\sigma_k \ln \lambda_n + \ln \alpha_{5,k} + \frac{\sigma_k - 1}{\theta_k} \ln \hat{\Phi}_{nk} \right] = e_n$$

- Correlation between a good's income elasticity of demand and its skilled-labor intensity in production is about 50%
- CFM explain missing factor content, income-openness relationship

Causal HME in theory: Matsuyama (2019)

- Matsuyama (2019): Intersectoral specialization, causal home-market effect
- Continuum of SDS sectors – lower tier looks like Krugman (1980)
- Direct implicitly additive CES utility with sector-specific income elasticity parameters (see Hanoch 1975 or Matsuyama's Canon lecture)
- Ranking sectors by income elasticities, the economy with higher standard of living is a net exporter in higher-ranked sectors
- Comparative statics for productivity improvements and trade costs

Brief discussion of implicit additive separability

- Recall utility functions $U(x)$ and indirect utility $V(p, y)$
- Explicitly additively separable function $U : \mathbb{R}_+^J \rightarrow \mathbb{R}$ is $U(x) = \sum_j u_j(x_j)$
- Bergson ([Burk] 1936): If U is quasi-concave, increasing, and explicitly additively separable, then it is homothetic if and only if $u_j(x_j) = \alpha_j \frac{x_j^\rho}{\rho} + \beta_j \ \forall j$
- Pigou's Law (1910) (Deaton 1974): If the (direct) utility function is additively separable, then the income elasticity of a good is (approximately) proportionate to the price elasticity of that good
- An implicitly additively separable utility function is $\sum_{j=1}^J f_j\left(x_j; U\right) = 1$

Questions about the Matsuyama paper?

Quality specialization

- High-income countries export products at higher prices
- High-income countries import products at higher prices
- Is it correlated comparative advantage or a causal home-market effect?
- Dingel (2017) extends Fajgelbaum, Grossman, Helpman (2011) to empirically pursue this question

CDKW: The More We Die, The More We Sell?

Costinot, Donaldson, Kyle, Williams (2019):

- Theory: Define "home-market effect" outside Krugman-like settings
- Empirics: Use demographic differences as source of exogenous variation in demand for pharmaceutical drugs

This is the must-read paper on home-market effects

See my blog post on "Market-size effects, across places and over time"

CDKW: Theoretical environment

- Demand: Consumption in j of varieties from i targeting disease n is
$$d_{ij}^n = d(p_{ij}^n/P_j^n)\theta_j^n D(P_j^n/P_j)D_j$$
- Supply: Perfect competition and iceberg trade costs yields supply curve
$$s_i^n = \eta_i^n s(p_i^n)$$
- Equilibrium:
$$s_i^n = \sum_j \tau_{ij}^n d_{ij}^n$$

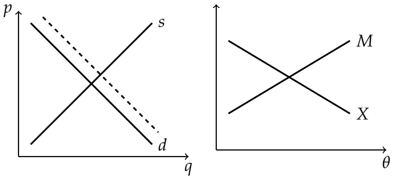
CDKW: Estimating equation

- Reduced-form regression for exports from i to j:

$$\ln X_{ij}^n = \beta_X \theta_i^n + \beta_M \theta_j^n + \delta_{ij} + \delta^n + \epsilon_{ij}^n$$

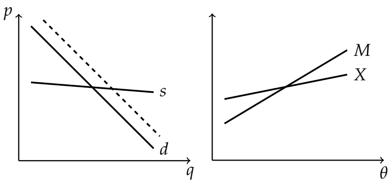
- First-order approximation (log-linearization) around a symmetric equilibrium
- Can be derived in perfect competition (with external economies), monopolistic competition (a la Krugman), Bertrand oligopoly, and monopoly settings
- Empirical strategy is to proxy for θ_i^n using i's age$\times$gender-predicted disease burden
- $\beta_X > 0$ demonstrates a "weak home-market effect"
- $\beta_X > \beta_M > 0$ demonstrates a "strong home-market effect"

CDKW in pictures



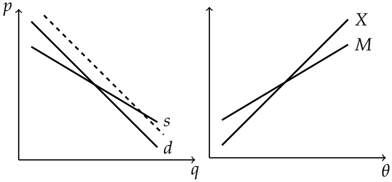
(a) Price and quantity. **(b)** Exports and imports.

Figure 1: Neoclassical Benchmark.



(a) Price and quantity. **(b)** Exports and imports.

Figure 2: Weak home-market effect.



(a) Price and quantity. **(b)** Exports and imports.

Figure 3: Strong home-market effect.

CDKW: Data

- Drug-level pharmaceutical sales for 56 countries; aggregated to countries based on drug's producer's headquarters
- Predicted disease burden from combining WHO's age-gender disease burden in disability-adjusted life years with countries' population demographics
- Theory vs data: Iceberg trade costs vs pricing to market?
- Theory vs data: Multinational production?

CDKW: Is the world symmetric?

$$\ln X_{ij}^n = \beta_X \theta_i^n + \beta_M \theta_j^n + \delta_{ij} + \delta^n + \epsilon_{ij}^n$$

- A symmetric equilibrium with $\theta_i = 1 \; \forall i$ and $\tau_{ij} = \tau > 1 \; \forall i, j : i \neq j$
- Symmetry allows omission of multilateral resistance terms
- How do we define HME away from the symmetric equilibrium?

Table 1: Top 10 countries in terms of sales

Country	Share of world sales (%) (1)	Share of world expenditures (%) (2)	Number of firms headquartered (3)
USA	36.67	42.10	361
Switzerland	13.14	0.61	35
Japan	11.62	12.67	53
United Kingdom	10.69	2.67	79
Germany	6.75	4.67	89
France	6.52	4.34	59
India	2.28	1.61	292
China (Mainland)	2.18	3.74	524
Canada	1.40	2.57	48
Italy	1.35	3.36	63

CDKW: Main result

Table 3: Test of the Home-Market Effect (baseline)

	log(bilateral sales)		
	(1)	(2)	(3)
log(PDB, destination)	0.526		0.563
	(0.098)		(0.109)
log(PDB, origin)		0.932	0.918
		(0.174)	(0.122)
p-value for $H_0 : \tilde{\beta}_X \leq 0$		0.000***	0.000***
p-value for $H_0 : \tilde{\beta}_X \leq \tilde{\beta}_M$			0.027**
Origin × disease FE	✓		
Destination × disease FE		✓	
Disease FE			✓
Adjusted R^2	0.629	0.562	0.539
Observations	18,857	19,008	19,255

Notes: OLS estimates of equation (16). Predicted disease burden (PDB_i^n) is constructed from an interaction between the global (leaving out country i) disease burden by demographic group in disease n, and the size of each demographic group in country i. All regressions omit the bilateral sales observation for home sales (i.e. where $i = j$) and control for origin-times-destination fixed-effects. The number of observations differs across columns due to omission of observations that are completely accounted for by the included fixed-effects. Standard errors in parentheses are two-way clustered at origin and destination country levels. p-values are based on F-test of the stated H_0. *** p<0.01, ** p<0.05.

CDKW: Robustness checks

Attempt to relax symmetry assumption, address spatially correlated demand

Table 6: Test of the Home-Market Effect (sensitivity analysis III)

	log(bilateral sales)			
	(1)	(2)	(3)	(4)
log (PDB, destination)	0.563	0.567	0.623	0.559
	(0.109)	(0.114)	(0.089)	(0.108)
log (PDB, origin)	0.918	0.933	0.820	0.917
	(0.122)	(0.145)	(0.167)	(0.126)
p-value for $H_0 : \tilde{\beta}_X \leq 0$	0.000***	0.000***	0.000***	0.000***
p-value for $H_0 : \tilde{\beta}_X \leq \tilde{\beta}_M$	0.027**	0.046**	0.172	0.027**
Sample of only ij obs. with $dist_{ij} \geq$	–	1,000 km	2,000 km	–
Control for $\sum_{k \neq i} \ln PDB_k^n \cdot dist_{ik}^{-1}$				✓
Control for $\sum_{k \neq j} \ln PDB_k^n \cdot dist_{kj}^{-1}$				✓
Adjusted R^2	0.539	0.538	0.549	0.539
Observations	19,255	16,676	13,459	19,255

Notes: OLS estimates of equation (16). All specifications control for origin-destination fixed-effects and disease fixed-effects. See Table 3 for details on construction of variables, sample restrictions, and calculation of standard errors (reported in parentheses) and p-values. *** p<0.01,** p<0.05.

CDKW: PPML and extensive margin

Table 8: Test of the Home-Market Effect (extensive margin)

	log(bilateral sales)		𝟙(bilateral sales>0)	
	(1)	(2)	(3)	(4)
log (PDB, destination)	0.563	0.383	0.008	0.009
	(0.109)	(0.149)	(0.004)	(0.004)
log (PDB, origin)	0.918	1.272	0.055	0.063
	(0.122)	(0.515)	(0.013)	(0.013)
p-value for $H_0 : \tilde{\beta}_X \leq 0$	0.000***	0.007***	0.000***	0.000***
p-value for $H_0 : \tilde{\beta}_X \leq \tilde{\beta}_M$	0.027**	0.065*	0.000***	0.000***
PPML estimator		✓		
Disease FE × origin GDP/capita				✓
Disease FE × destination GDP/capita				✓
Adjusted R^2	0.539	0.407	0.487	0.500
Observations	19,255	178,640	178,640	178,640

Notes: Column (1) reports OLS estimates, column (2) Poisson Psuedo-Maximum Likelihood (PPML) estimates, and columns (3) and (4) linear probability model estimates, based on equation (16). Pseudo-R^2 reported in column (2). All specifications control for origin-destination fixed-effects and disease fixed-effects. See Table 3 for details on construction of variables, sample restrictions, and calculations of standard errors (reported in parentheses) and p-values. *** p<0.01,** p<0.05.

Home-market effects

- Home-market effects are a hallmark of new trade theory relative to neoclassical theories
- Empirical evidence is still in its infancy
- Home-market effects appear important to understanding both (1) quality specialization within US manufacturing and (2) global pharmaceutical sales

Next week

Heterogeneous firms