Needs and Means for a Better Workhorse Trade Model

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Introduction

- The “workhorse models” of trade
  - Partial equilibrium (for trade policies)
  - Ricardian (for comparative advantage)
  - Heckscher-Ohlin(-Samuelson) (HO) (for source of comparative advantage and general equilibrium effects of trade)
  - Krugman/Helpman-Krugman (HK) (for intra-industry trade)
- Of these, the HO model has pride of place
  - Elegant but simple
  - Seemingly general, allowing extensions (e.g., HK) to improve realism when needed

Introduction

- Uses of the HO model
  - As the core model for teaching general-equilibrium trade
    - See Ethier text, Krugman-Obstfeld text, etc.
  - As the main tool for understanding certain issues
    - Trade of, and with, developing countries
    - “Trade and wages”

Introduction

- My reservations about the HO Model: some of its implications are
  - Extreme
  - Implausible
  - Inconvenient to take to data
- My hope for the HO Model: That it can be adapted, simply, to avoid these implications

Outline

- Some Uncomfortable Features of the H-O Model (The “Needs”)
- Assorted Potential Fixes (the “Means”)
- Elaboration of One of the Them: Increasing Trade Costs
  - How it meets the “needs”
  - Is it a good assumption?

Features of the HO Model

- What IS the HO Model?
  - Homogeneous goods and factors (any numbers > 1)
  - Perfectly competitive markets
  - Production functions
    - Constant returns to scale
    - Non-joint
  - Factors
    - Perfectly mobile across industries
    - Perfectly immobile across countries
  - Countries differ in factor endowments
  - Industries differ in factor intensities
  - Trade costs, if present, are constant (perhaps "iceberg")

The "Needs": Uncomfortable Features of the HO Model

- Factor Price Equalization
- Too much trade, in both goods and factors
- Indeterminacy of production and trade (with more goods than factors, if prices align)
- Tendency to specialize (with more goods than factors, if prices don't align)
- Hypersensitivity to prices and trade costs
- Few equilibrium trade flows

The "Needs": Uncomfortable Features of the HO Model

- Factor Price Equalization
  - This says: Under free and frictionless trade, countries with sufficiently similar factor endowments will have exactly the same factor prices
  - Implications:
    - Insensitivity to own factor endowments
    - One-to-one sensitivity to foreign factor prices
    - Nontraded goods prices determined entirely by world prices of traded goods and not at all by nontraded good supplies or demands

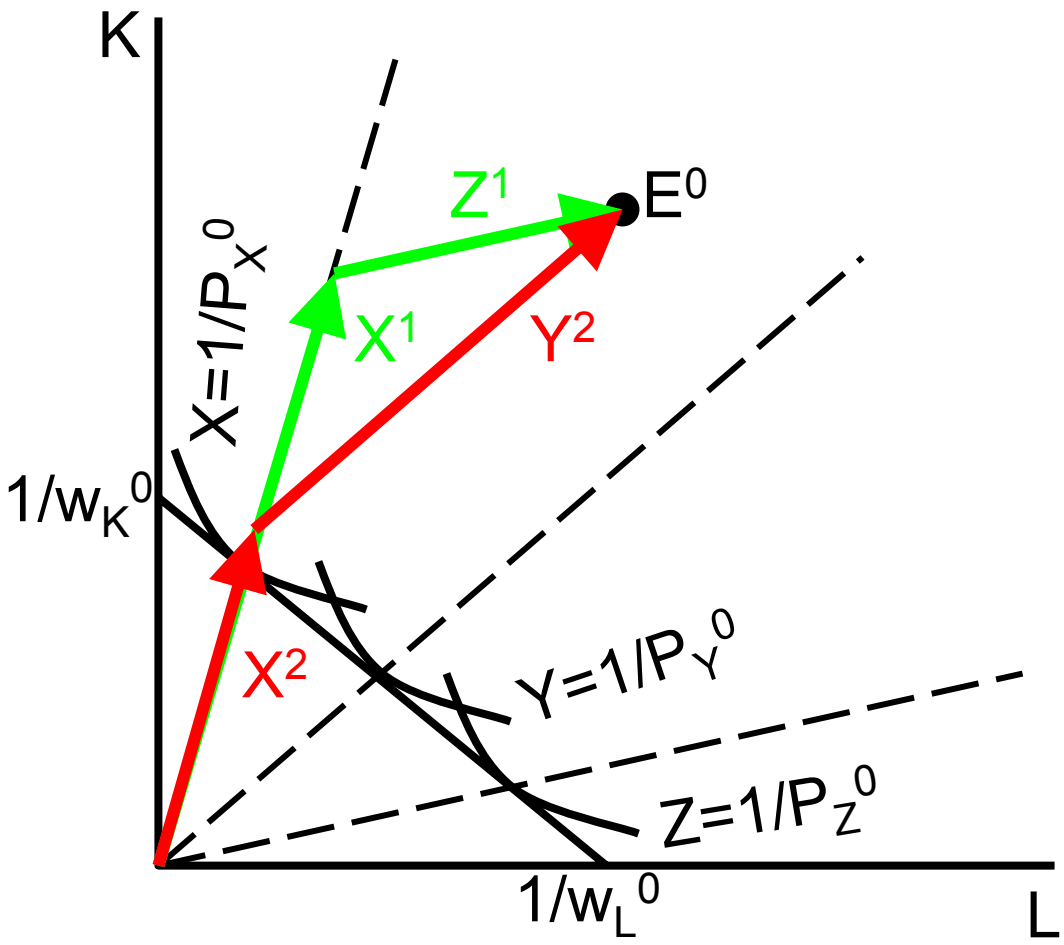
The “Needs”: Uncomfortable Features of the HO Model

- Too much trade, in both goods and factor content
  - Trefler’s (1995) “Missing Trade”

The “Needs”: Uncomfortable Features of the HO Model

- Indeterminacy of production and trade (with more goods than factors, if prices align)

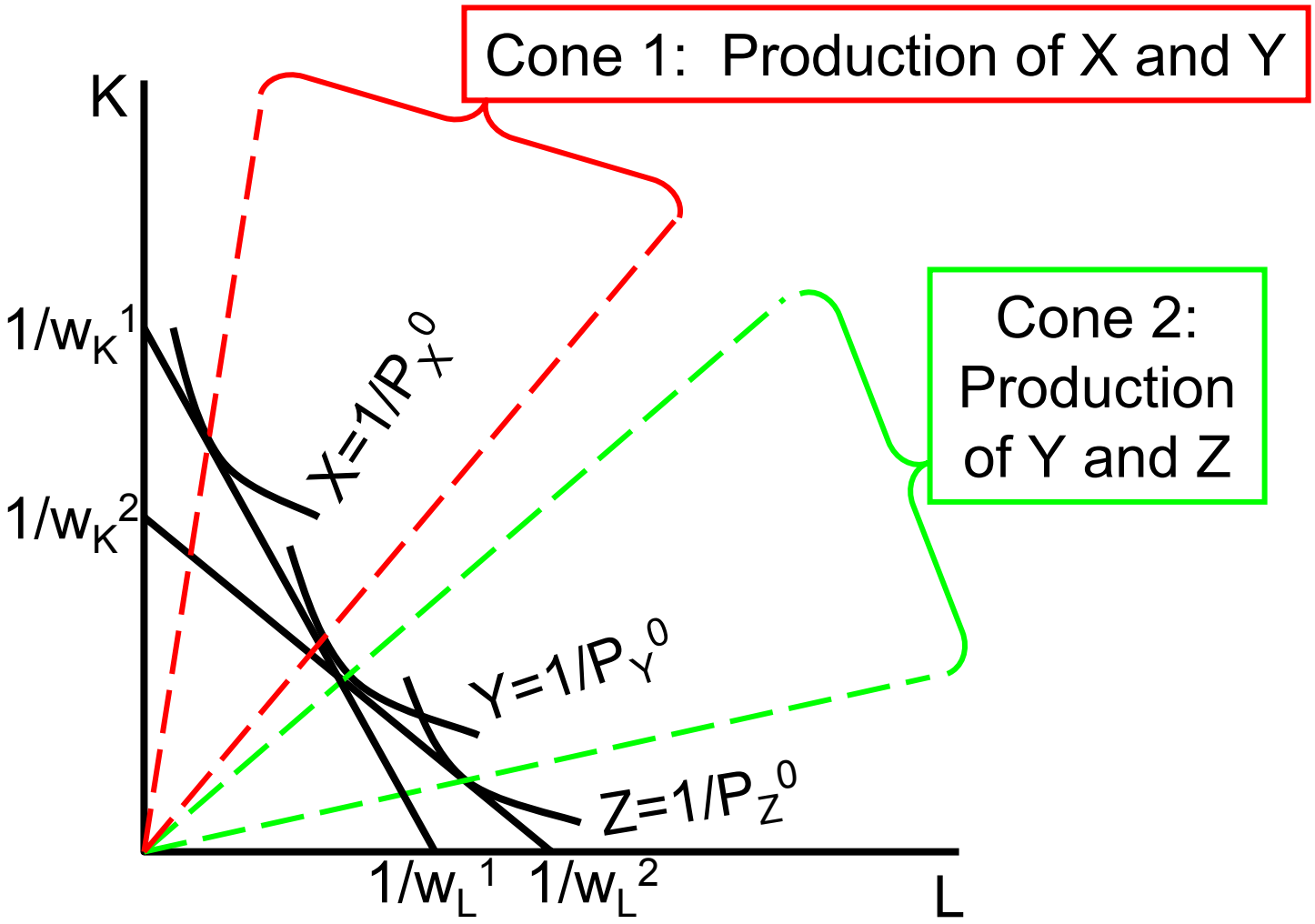
3-Good Lerner Diagram: Production Indeterminacy



The “Needs”: Uncomfortable Features of the HO Model

- Tendency to specialize (with more goods than factors, if prices don’t align)
  - Countries have unequal factor prices and therefore produce and trade at most 1 (or F−1) goods in common

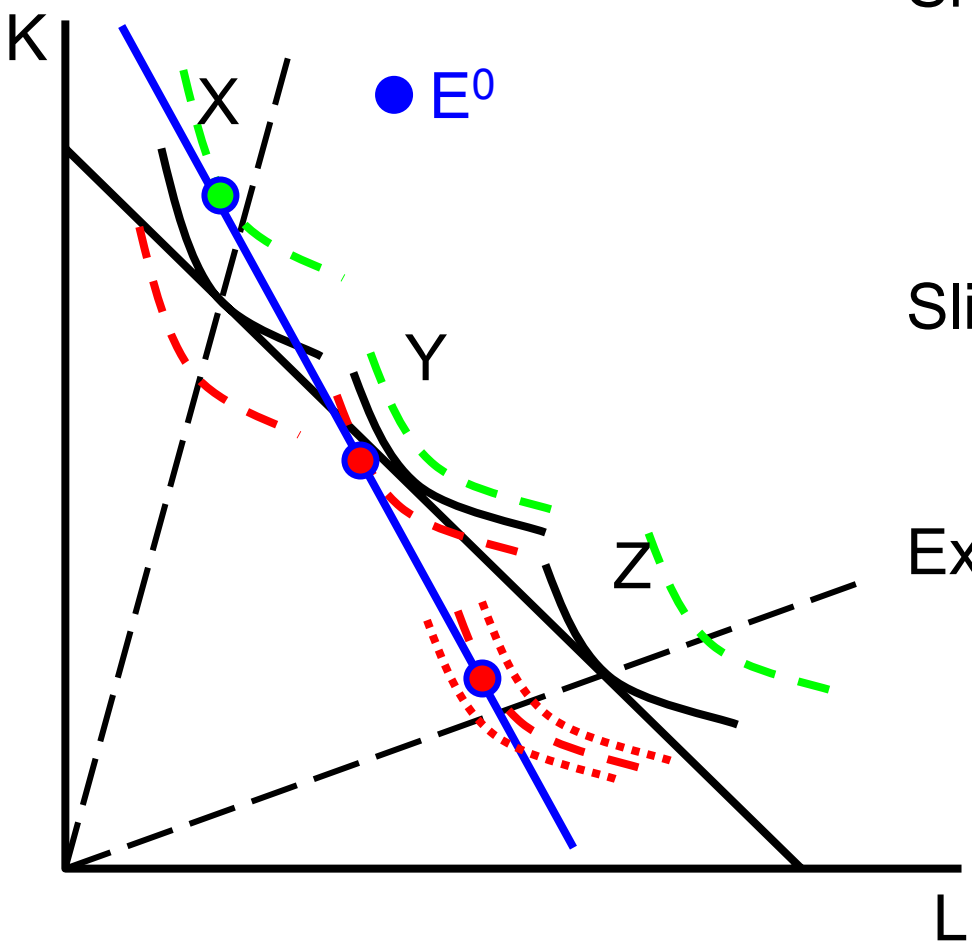
3-Good Lerner Diagram: Two-Cone Model



The “Needs”: Uncomfortable Features of the HO Model

- Implications of these more-goods-than-factors properties:
  - Hypersensitivity to prices and trade costs of production and (what countries) trade
    - Hypersensitivity to tariff changes

Three-Good Lerner Diagram: Hypersensitivity



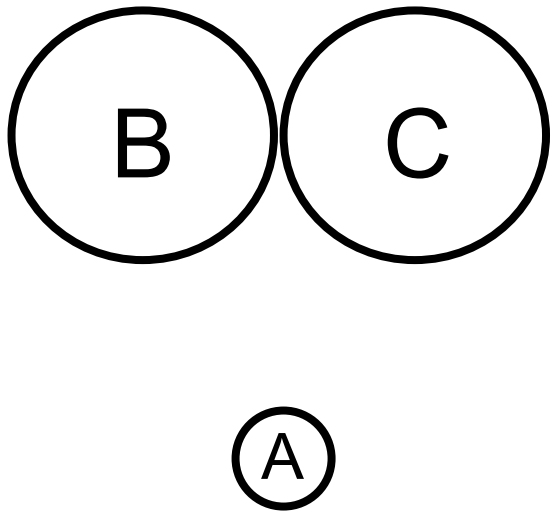
- Small country facing FPE in rest of world with trade costs initially permitting import of 2 goods, Y and Z
- Slight change in trade cost of any good can force output of either Y or Z to zero
- Examples:
  - Rise in t_Z forces import of Z to zero
  - Fall in t_Z forces import of Y to zero

The “Needs”: Uncomfortable Features of the HO Model

- Hypersensitivity to prices and trade costs of (with whom countries) trade
  - Hypersensitivity to preferential trading arrangements

Geographic Hypersensitivity to Trade Costs

- Example:
  - 3 Countries, 2 goods
  - Country A is small compared to both B and C
  - B and C have zero trade costs between them
  - A has trade costs with both B and C,
  - but these may be different

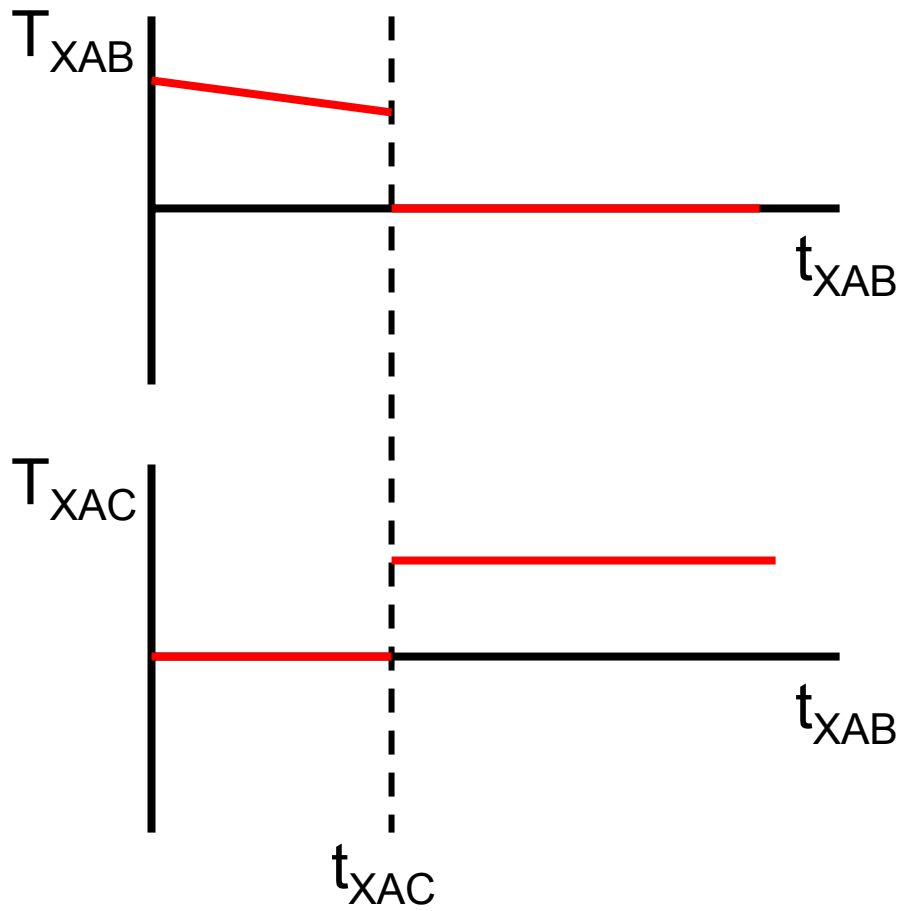


Geographic Hypersensitivity to Trade Costs

- Assume:
  - B and C identical, thus same autarky prices
  - A is capital abundant compared to B and C, so A has comparative advantage in X
- Then:
  - A will trade based on 2×2 HO model, exporting X and importing Y
  - With whom A trades depends on trade costs
- Let
  - T_{IJK} be net export of good I from country J to country K, and
  - t_{IJK} be iceberg transport cost for that trade flow

Geographic Hypersensitivity to Trade Costs

- A's trade flows with B and C both change discontinuously at $t_{XAB}=t_{XAC}$



The “Needs”: Uncomfortable Features of the HO Model

- Few equilibrium trade flows
  - No intra-industry trade

Specialization

- With multiple countries, HO Model with trade costs predicts relatively few bilateral trade flows
- This cannot be seen in the 2×2×2 model, where so few are possible
- As number of countries C grows, number of possible bilateral trade flows grows with square of C. Maximum number of equilibrium trade flows in HO model (except with zero probability) grows only with C.

Specialization

- In Deardorff (2005) I derive that

$$\frac{R_{HO}}{R_{MAX}} \leq \frac{G(C-1)+FC-1}{GC(C-1)}$$

- Where
  - R is the number of active good-origin-destination trade "routes"
    - R_{MAX} = number possible
    - R_{HO} = max number (except with zero probability) under HO
  - G = Number of goods
  - C = Number of countries
  - F = Number of factors

Specialization

- Reason:
  - Each country will import each good only from the lowest-cost source
    - One country, or
    - Group of countries whose prices and trade costs align exactly for the importer.
    - If trade costs are random, on average the size of such a group is limited by the number of factors.

The “Means”

- Ways to Make HO Behave?
  - Specific factors
  - Armington Preferences
  - Lumpy Countries
  - Monopolistic Competition
  - Heterogeneous Firms
  - Aggregation
  - Increasing Trade Costs

The “Means”

- Not a new question
- CGE modelers have had to deal with it
  - Models based too closely on HO don’t fit the data
  - Most obviously (for me, via Bob Stern): Estimates of price elasticities of imports are much smaller than they would be in HO models taken literally
    - due to “hypersensitivity”
  - We’ve used several of the fixes mentioned here

Specific Factors

- Also called the Ricardo-Viner Model, this was how Samuelson (1971) and Jones (1971) got the HO Model to behave
- Each sector has its own "specific factor"

  = Factor that is either
  - useless in, or
  - immobile to and from,

  all other sectors

Specific Factors

- Implications
  - Supplies likely remain positive at all prices
  - Supplies increase smoothly with price
  - There is no indeterminacy
  - Trade does not equalize factor prices (Hence, “Ohlin was right”)

Specific Factors

- Problems
  - Makes perfect sense for short run, but not for long run
  - Doesn't solve problem of hypersensitivity of bilateral trade to trade costs
  - With specific factor in each industry, model no longer "explains" trade, except tautologically: countries export products of their abundant specific factors

Armington Preferences

- Due to Armington (1969), who used it in a macroeconomic, not HO, context
- Products are differentiated by country of origin
- Examples?
  - French wine
  - Italian shoes
  - Swiss watches

Armington Preferences

- Implications
  - Trade need not equalize prices of same "good" from different countries
  - Trade elasticities are much reduced
    - hence all hypersensitivity is eliminated

Armington Preferences

- Problems
  - Trade now depends on preference parameters as well as factor endowments
    - France exports wine because people like French wine, etc.
    - (This is fine in CGE models, which don't seek to explain trade, but use trade data to inform trade policy)
  - Preferences give every country market power in trade

Lumpy Countries

- Due to Courant and Deardorff (1992)
- Countries have multiple regions, across which there is not FPE

Lumpy Countries

- Implications
  - May alter pattern of trade from HO prediction
  - Internal regions may specialize
  - Regional limits on trade? Hence lower elasticities?
  - Specialization at regional level without specialization nationally? Hence less specialization?
  - Continuum of regions?

Lumpy Countries

- Problems?
  - Don’t know yet
  - Hardly any of this has been worked out

Monopolistic Competition

- Helpman and Krugman (1985) put this in HO trade models, building on Spence-Dixit-Stiglitz preferences. Romalis (2004) generalized for empirical work
- Goods are differentiated by firm, while firm-level increasing returns limit product variety

Monopolistic Competition

- Implications
  - Most obviously, model explains intra-industry trade
  - Implications for specialization and factor prices are the same as the standard HO Model, so it does not help much with some of that
  - Product-differentiated bilateral exports remain positive from any country that produces, avoiding hypersensitivity to trade costs

Monopolistic Competition

- Problems
  - Plausible for (some) manufactures and services, but not for agricultural products, minerals, or some other inputs
  - Doesn't change extremes of specialization

Heterogeneous Firms

- Melitz (2003) put this into trade theory, following Hopenhayn (1992). Bernard, Redding, and Schott (2005) put it in the HO model
- Individual firms each have a randomly chosen productivity parameter, as well as differentiated products

Heterogeneous Firms

- Implications
  - Industry gets small, but doesn't disappear, when factor prices move against it, since most productive firms survive
  - Thus avoids extremes of specialization
  - Supply responds to prices through entry or survival of less productive firms

Heterogeneous Firms

- Problems
  - Requires firm-level product differentiation as well
  - Thus most appropriate only for manufactures
  - Not (yet?) particularly easy to use

Aggregation

- Davis and Weinstein (2001) suggest this in motivating part of their empirical work
- Observed industries are actually aggregates of unobservable industries with heterogeneous factor intensities

Aggregation

- Implications
  - Observed industries represent different mixes in different countries, leading to cross-country correlation between factor endowments and factor intensities, even with FPE (Davis and Weinstein)
  - In a multi-cone model, even though countries specialize in actual industries, observed industries operate at positive output due to products that unobservably belong to another cone
  - In response to price changes, instead of a whole observed industry responding hypersensitively, only unobserved components do and observed industry responds gradually.

Aggregation

- Problems
  - This has not been worked out as a formal model (I think)

Increasing Trade Costs

- I suggested in Deardorff (1984) that HO would be better behaved if trade costs varied appropriately
- Assume that trade costs for a particular good along a particular route (pair of countries) rise with the volume of trade

Increasing Trade Costs

- Implications
  - This makes bilateral export supply curves upward sloping even when supplies of goods are infinitely elastic
  - Indeterminacy of trade is eliminated
  - Volume of trade may then vary smoothly with size of autarky price differences

Increasing Trade Costs

- Problems
  - Hard to imagine that this assumption could be valid
    - If anything, transport seems more likely to have decreasing costs, not increasing
- For now, I'll ignore this problem and
  - Explore further the implications
  - Come back at the end to possible reasons for rising trade costs

Increasing Trade Costs

- Assume:
  - HO model with rising, iceberg, trade costs
  - That is
    - A fraction t of goods that are exported is used up in transit
    - t increases with quantity exported, X: e.g.,

      $$M = X(1-t) = X(1-cX)$$

    - (Could also include another component that is positive for X=0, perhaps rising in distance.)

Implications of Increasing Trade Costs

- Small Country
  - Suppose it faces a single set of given prices, p^W, for goods delivered or purchased abroad
    - (Not now plausible in a world of many countries. Prices will be different.)
  - Compare to autarky prices, p^A.
    - Trade pattern: as in HO, following factor-based comparative advantage
    - Domestic prices, p^D, move toward p^W but do not reach them, as t rises to offset $|p^W - p^D|$

Implications of Increasing Trade Costs

- Small Country Results
  - Trade pattern same as HO
  - But quantity of trade is less than HO
  - Goods prices drawn toward world prices, but not to equality
  - Factor prices drawn toward world factor prices, but also not to equality

Implications of Increasing Trade Costs

- Small Country Results
  - Factor price insensitivity
    - No longer completely insensitive: Change in factor endowment changes both production/trade and factor price.
    - Corollary of one-to-one sensitivity to foreign factor prices also dampened

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - Factor Price Equalization
- ITC
  - No FPE, only a tendency toward it

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - Factor Price Insensitivity to own factor endowments
- ITC
  - Factor prices do respond to changing factor endowments

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - One-to-one sensitivity to foreign factor prices
- ITC
  - Dependence on foreign factor prices is reduced

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - Nontraded goods prices determined entirely by world prices of traded goods and not at all by nontraded good supplies or demands
- ITC
  - Nontraded good supplies/demands affect factor prices and thus nontraded good prices

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - Too much trade, in both goods and factors
- ITC
  - Trade is reduced, arbitrarily close to zero

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - Indeterminacy of production and trade (with more goods than factors, if prices align)
- ITC
  - Indeterminacy eliminated, since production and trade can't change without changing prices

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - Tendency to specialize (with more goods than factors, if prices don't align)
- ITC
  - Specialization is unlikely, as it implies high trade and thus high trade costs
  - (two countries with different factor prices can produce many goods in common and trade, since variable trade costs makes up the difference in costs)

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - Hypersensitivity to prices and trade costs of production and (what countries) trade
- ITC
  - Changes in prices and/or trade costs are dampened by trade cost adjustment

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - Hypersensitivity to tariff changes
- ITC
  - Tariff cut expands imports which expands trade cost to offset the tariff cut

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - Hypersensitivity to prices and trade costs of (with whom countries) trade
- ITC
  - Hypersensitivity of trade partners reduced if each has trade cost dependent on bilateral trade flow

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - Hypersensitivity to preferential trading arrangements
- ITC
  - Preferential tariffs induce offsetting changes in trade costs, dampening the response of trade

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - Few equilibrium trade flows
- ITC
  - More trade flows are likely, since countries can import from and export to multiple partners, as trade costs offset price differences.

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

- HO Need
  - No intra-industry trade
- ITC
  - Does not yield intra-industry trade (unless perhaps trade cost is negative for low trade!).

Do Increasing Trade Costs (ITC) Meet the HO "Needs"?

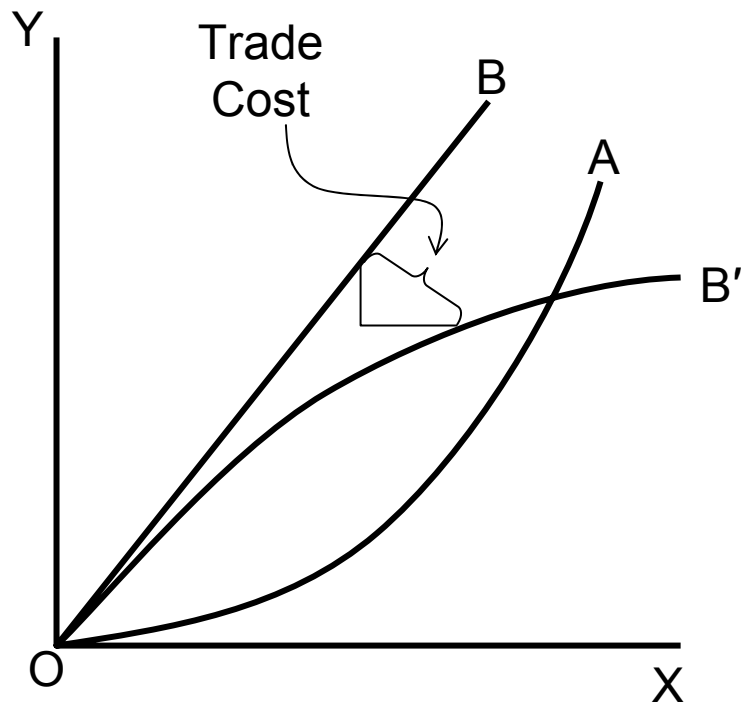
- Do Increasing Trade Costs provide a model that is simple enough to be a "workhorse"?
  - Perhaps not, in general
  - I suggest, therefore, an extreme version:
    - Let trade costs rise for such small amounts of trade that effects on factor prices are negligible.
    - Call it <u>The Negligible Trade Model</u>

Features of the Negligible Trade Model

- Factor Prices are approximately those of autarky
- Trade depends, via variable trade costs, on relative autarky prices
- Small effects of trade on factor prices and other variables can be obtained by differentiation from initial autarky equilibrium
- Trade flows depend fairly simply on factor endowments

Implication of Increasing Trade Costs

- Implies that even a small country faces diminishing terms of trade.
- Thus even small country's optimal tariff > 0!
- Reason: rising trade cost is an externality.



Possible Reasons for Increasing Trade Costs

- Congestion
- Trade-specific factors and/or capacity constraints (Coleman 2005)
- Cost of market penetration (geographic or other)

Conclusion

- Increasing trade costs are worth looking into
  - Use trade flow equation to estimate relationship of trade costs to trade
  - If successful, explore more fully the various reasons for increasing trade costs

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