14.54 International Trade

Lecture 7: "Standard" Trade Model (II) — Changes in Terms of Trade
Today’s Plan

1. Changes in Terms of Trade: Small Open Economy
2. Terms of Trade and Welfare
3. Changes in Terms of Trade: World Economy
4. Trade Protection and the Terms of Trade

The small graphs on slides 5-9, 11, 12, 14, 25, 27-29, 31-34, 36, 39-41 were created by Marc Melitz. Used with permission.
1. Changes in Terms of Trade: Small Open Economy
Changes in Terms of Trade

- A country is open to trade at world trade price $p^T$
- So, this country can be affected by changes in the rest of the world
- In a competitive model, those changes are transmitted only through their effect on $p^T$ (and hence the country’s terms of trade)

- How do changes in the terms of trade, $p^T$, affect a country?
- For expository clarity, we will assume that this country exports $C$ so that an increase in $p^T$ represents a terms of trade increase
- We will start by looking at this impact in the short run, when production $Q$ does not respond
- ... and then look at the long run impact when $Q$ responds to the change in $p^T$
Recall the Open Economy Equilibrium
Changes in the Terms of Trade in the Short Run

- Production remains fixed at $Q^T$: What happens as $p^T$ changes?
  - Assume that changes in $p^T$ are not so extreme that this country no longer exports $C$

- An increase in $p^T$ shifts out the relevant portion of the budget constraint (and conversely for a decrease in $p^T$)
  - $p^T \uparrow$: positive income effect. $p^T \downarrow$: negative income effect
**Income and Substitution Effects of Price Changes**

- **Case 1:** $p^T \uparrow$

- Substitution effect: $D^1 \rightarrow \hat{D}$
  Income effect: $\hat{D} \rightarrow D^2$

- How do $D_C$ and $D_F$ respond to an increase in $p^T$?
  - $D_F$ must increase (reinforcing income and substitution effects)
  - Change in $D_C$ is ambiguous (opposite income and substitution effects)
Income and Substitution Effects of Price Changes

- **Case 2:** $p^T \downarrow$

- Substitution effect: $D^1 \rightarrow \hat{D}$  Income effect: $\hat{D} \rightarrow D^2$

- How do $D_C$ and $D_F$ respond to a decrease in $p^T$?
  - $D_F$ must decrease (reenforcing income and substitution effects)
  - Change in $D_C$ is ambiguous (opposite income and substitution effects)
What if a Country Exports F when Trade Price Decreases

- Substitution effect of demand must go in same direction but income effect is reversed
  - $D_C$ must increase (reinforcing income and substitution effects)
  - Change in $D_F$ is ambiguous (opposite income and substitution effects)
Income and Substitution Effects: Summary

- **Substitution effect:**
  - \( p^T \uparrow \) then \( D_C \downarrow \) and \( D_F \uparrow \) (and conversely when \( p^T \downarrow \))

- **Income effect:** Depends on good that is exported
  - If relative price of export good rises (terms of trade improvement)
    - Then \( D_C \) and \( D_F \) both increase (positive income effect)
  - If relative price of import good rises (terms of trade deterioration)
    - Then \( D_C \) and \( D_F \) both decrease (negative income effect)
Long Run Effects of Increase in Terms of Trade

- No change in substitution effect
- Positive income effect is reinforced by response in production
Long Run Effects of Decrease in Terms of Trade

- No change in substitution effect
- Negative income effect is lessened by response in production
- Note that overall welfare effect is still negative
  - Welfare effect of production response can never overturn direction of income effect (unless pattern of trade is reversed)
2. Terms of Trade and Welfare
Terms of Trade and Welfare

- A decrease in the terms of trade will induce a welfare loss until the autarky point is reached.

- Very large changes in $p^T$ can reverse the pattern of trade (and hence the direction of the income effect).

- Empirically, this type of change can only occur over a span of many years.
Empirically, how large are the welfare effects driven by changes in terms of trade?

How much have developed countries been hurt by increased trade with developing countries?

- Fear: as developing countries industrialize, world supply of manufactured goods exported by developed countries increases and drives down the relative price of those goods

Question 1: Empirically, how big are changes in the terms of trade?
Table 5-1 from *International Economics* removed due to copyright restrictions.
Changes in the Terms of Trade for Primary Products

Figure 2-12 from *International Macroeconomics* removed due to copyright restrictions.
Take Chile (in 2013)

Refined copper and copper alloys

Gold content

$79.4B USD

Unrefined copper

Grape

Fresh fruit

Chemical woodpulp, soda or sulfate, not dissolving grade

Apples

Maize (corn) seed

Fluorine, chlorine, bromine and iodine

Fish fillet or meat

Fish...

Wine of fresh grapes

Cars

Gold

Changes in Terms of Trade

Changes in the World Price of Coffee

Graph from *International Trade* removed due to copyright restrictions.
Who Are the Big Coffee Exporters?

Quantitative Effect of Terms of Trade Changes on Welfare

- Question 1: Empirically, how big are changes in the terms of trade?
- Question 2: Quantitatively, how to changes in terms of trade translate into changes in welfare?

Mathematical postscript to textbook shows how to derive changes in welfare (measured in terms of ‘real’ income) as a function of changes in the terms of trade:

\[ \Delta \text{Welfare} \ (\$) = \text{Value of Trade} \ (\$) \times %\Delta p^T \]

\[ \Leftrightarrow \ \Delta \frac{\text{Welfare}}{\text{GDP}} = \frac{\text{Trade}}{\text{GDP}} \times %\Delta p^T \]

Note: Value of trade is value of balanced exports or imports (not the sum)
Quantitative Effect of Terms of Trade Changes on Welfare (cont.)

- Recall:
  \[ \Delta \frac{\text{Welfare}}{\text{GDP}} = \frac{\text{Trade}}{\text{GDP}} \times \%\Delta p^T \]

  Note: Value of trade is value of balanced exports or imports (not the sum)

- **Developed countries:**
  - Trade is 20% of GDP (on average, lower for U.S.) and changes in terms of trade are less than 1% per year
  - \(\rightarrow\) Welfare effect of TOT: 20% \(\times\) 1\% = .2\% GDP (max)

- **Developing countries** (big exporters of primary products)
  - Trade can be 20-50\% of GDP and changes in terms of trade can be 10-25\% per year
  - \(\rightarrow\) Welfare effect of TOT: 2\%-12.5\% of GDP
  - Nonetheless, recall that TOT shocks can never reduce welfare below autarky levels
How Do Exports and Imports Respond to Changes in Trade Price?

- Assume that a country exports $C$ and $p^T$ increases (TOT increase)
- Demand: $D_F \uparrow$ and $D_C \downarrow$ or $\uparrow$ (if income effect dominates)
- Production: $Q_C \uparrow$ and $Q_F \downarrow$ (movement along PPF)

Implications for trade:
- $D_F \uparrow$ and $Q_F \downarrow$ so $IM_F = DF - QF \uparrow$
- $D_C \downarrow \uparrow$ and $Q_C \uparrow$
  - Change in $EX_C = Q_C - D_C$ is ambiguous, tough $EX_C \uparrow$ is the typical case

Summary:
- Import demand curves are always downward sloping
- Export supply curves are typically upward sloping but can be backward bending when the income effect from a price change is very large (dominates both the substitution effect in consumption and the production response)
3. Changes in Terms of Trade: World Economy
What Drives Changes in World Prices?

- Changes within a country can only affect world prices when that country is a large exporter or importer of a good (relative to the rest of the world).
- If a country is relatively small, then changes in that country will not affect world prices.
  - **Small open economy**: affected by changes in $p^T$ but no feedback effect to $p^T$.
- In general, equilibrium $p^T$ is affected by changes in $RD^W$ or $RS^W$. 

![Diagram](image)
Changes in World Relative Demand

- Driven by changes in consumer tastes or by changes in income per capita (if preferences are not homothetic)
- If changes are driven by increases in income per capita, then this will tend to benefit the terms of trade for developed countries (and hurt the terms of trade for the poorest countries)
- Empirically, the evidence for such terms of trade changes are limited
- Especially relative to the large effects of changes in world relative supply
  - These changes are quantitatively much larger than shifts in demand
Example 1: Imperfect competition

OPEC cartel increases world price of oil by reducing world supply
New countries ‘open up’ to international trade

Recall that this country must be large relative to the rest of the world
Changes in World Relative Supply: Country Growth

- Assume that foreign is growing
- First assume that growth is unbiased so $RS^*$ is unaffected by growth:

Unbiased growth will decrease foreign’s terms of trade and increase home’s terms of trade
Changes in World Relative Supply: Country Growth (Cont.)

- What if growth is biased?
  - If growth is biased towards the export good, then terms of trade effects are reinforced.
  - If growth is biased towards the import good, then the bias of growth works against the terms of trade effect.
    - The bias could be so extreme that the terms of trade of the growing country improve.
Welfare Effects of Growth on Growing Country

- Two effects:
  - Positive direct effect of growth (shift out of PPF)
  - Secondary effect through changes in terms of trade (if country is large)

- If a country is closed to trade, then only positive direct effect is present:

  ![Graph showing PPF shift]

  - This effect is irrespective of any bias of growth
Similarly, a growing small open economy will also only experience the positive direct effect from growth.

Note that the budget set for the aggregate consumer must shift out.

Again, this effect is irrespective of any bias of growth.
Welfare Effects of Growth on Growing Country: Large Open Economy

- Growth will now affect terms of trade:

- If growth induces large decrease in terms of trade, it is then possible (but not likely) that the negative welfare effect from the terms of trade decrease dominates the positive direct effect from growth
  - This is called immiserizing growth
Immiserizing Growth

- This is an extreme case, but is nevertheless possible for very large exporters of primary goods.
- When is immiserizing growth more likely to occur?
  - When growth is biased towards the export good.
  - When relative demand is very inelastic (very little substitution between export good and other goods).
  - Then changes in export supply can have large effects on relative prices.
Back to Coffee

Courtesy of Macmillan Higher Education. Used with permission.
4. Trade Protection and the Terms of Trade
Import Restrictions and Subsidies

- An import restriction (import tariff or other barrier) or export subsidy induces different prices inside the country relative to the world trade prices.
  - Both the import tariff and the export subsidy will raise the internal price of a good:
    - An import tariff on $C$ (for a $C$ importer) or an export subsidy on $C$ (for a $C$ exporter) raises $p_C/p_F$ inside the country relative to $p^T$.
    - Note the difference between an export subsidy and a production subsidy (which would lower the relative price of a good).

- If a country is small relative to the world, then this trade restriction will not induce any changes in $RD^W$ or $RS^W$ and hence in $p^T$.
  - So only internal relative prices change.
Consider a small importer of $F$ considering an import tariff on $F$
... which would lower $p_C/p_F$ inside the country but would not affect $p^T$
... and shift demand from $F$ to $C$ and supply from $C$ to $F$ inside the country

Such a restriction must generate welfare losses
Similarly, an export subsidy will also generate welfare losses
Import Barrier in a Large Economy

- Now consider a large importer of $F$ considering an import tariff on $F$
- This will lower $p_C / p_F$ inside the country and also will affect $p^T$
- The lower internal $p_C / p_F$ will shift demand from $F$ to $C$ and supply from $C$ to $F$ inside the country
- Since this country is large, this will also affect $RD^W$ and $RS^W$

This generates a terms of trade improvement for the country
The inefficiency from the distortion of the internal relative price still induces a negative welfare effect.

But this effect must now be weighed against the positive terms of trade effect.

For a ‘small’ tariff, the positive welfare effect from the terms of trade will dominate and welfare will rise but the effect is reversed for a ‘large’ tariff.
Welfare is maximized for a large economy by setting a small import tariff.

However, this welfare gain comes at the expense of all the other countries in the world.

... and reduces world welfare.

Retaliation by other large countries would then make all countries worse off.
Export Subsidies

For a large economy, export subsidies are even more detrimental to welfare than for the small economy

- Because the export subsidy generates a decrease in the large country’s terms of trade
- An export subsidy on C by a large C exporter will shift in $RD^W$ and shift out $RS^W$