International Supply Chains

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INTERNATIONAL ECONOMICS I

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Motivation

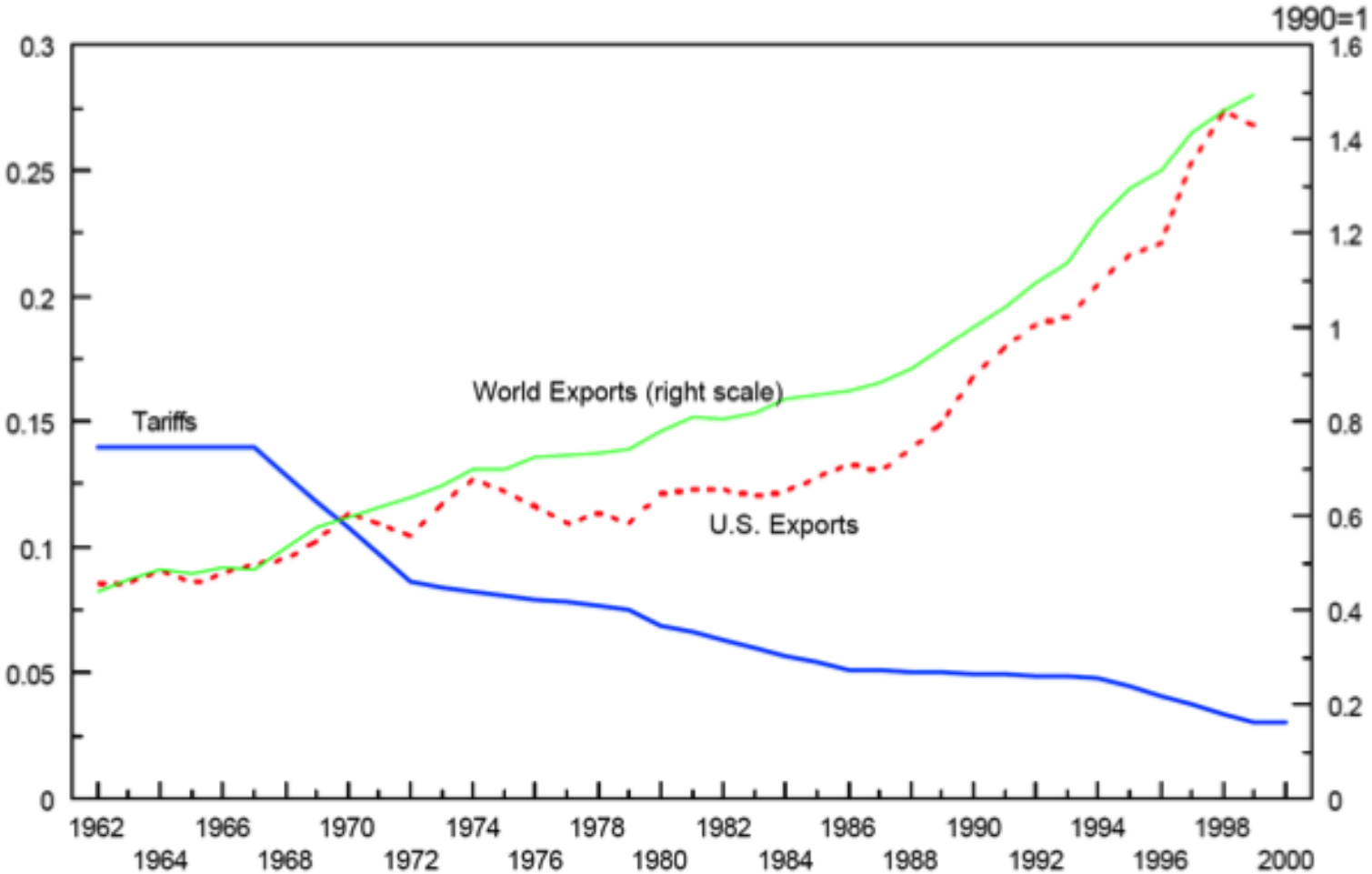
- Global supply chains refers to the type of international trade that occurs along firm's process of production
- As an specific example think about FDI where a foreign firm opens a domestic subsidiary to produce some intermediate good required in its own production
  - This type of FDI is known as vertical specialization as opposed to horizontal specialization (FDI of similar production units across borders)
- That output has to be be exported from the domestic economy to be used as a input in the foreign economy
- This type of international trade implies different economic linkages that are not necessarily directly captured by the models of international trade we studied: Ricardian, Heckscher-Ohlin, Krugman, or Melitz
- How to measure these global supply chains?
  - Are they quantitatively important?

How important is vertical specialization in the world trade?

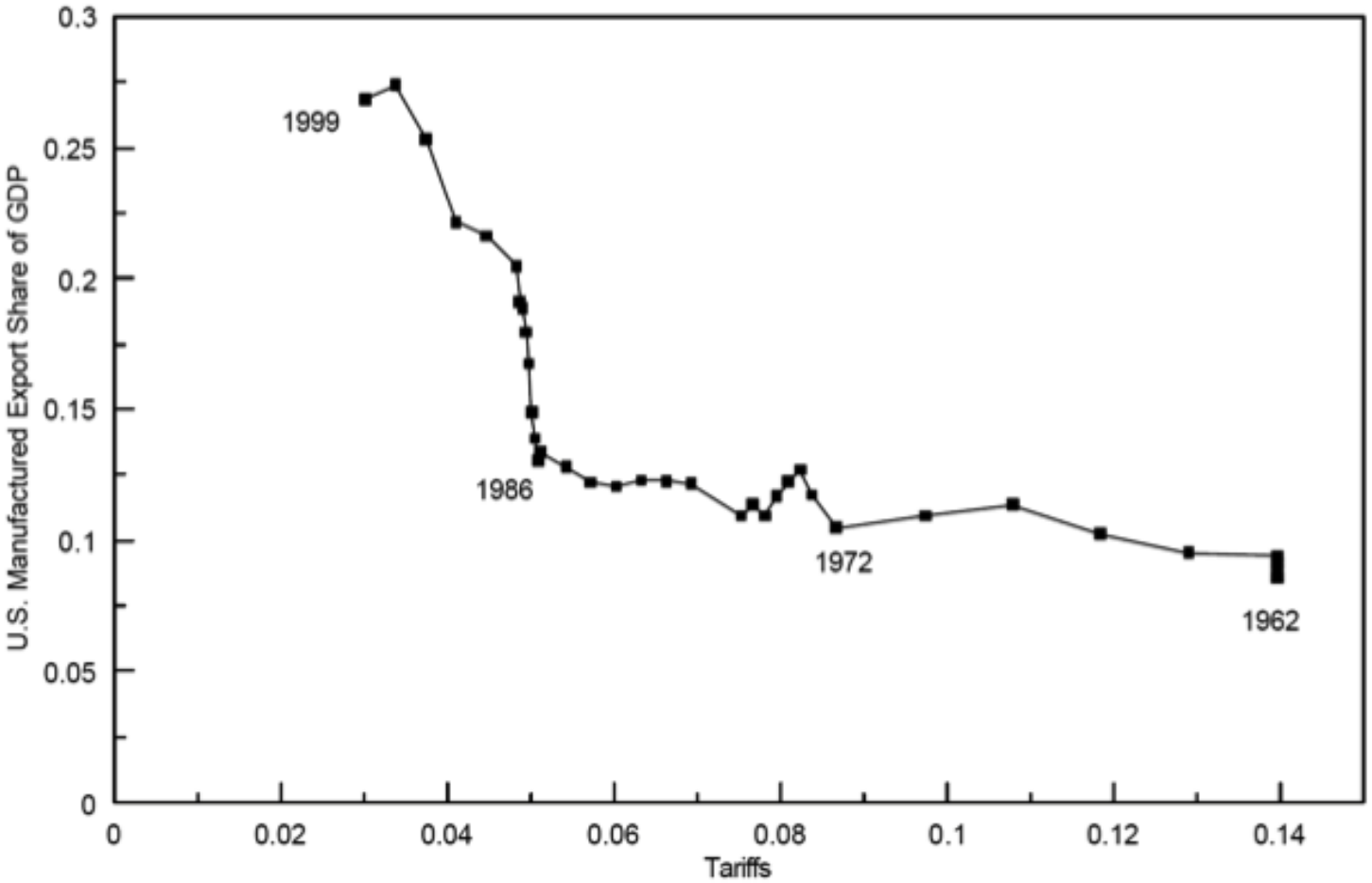
- We rely on findings of Yi (2003)
- Enormous expansion in world trade during the past half-century
- World merchandise export share of output has almost tripled
- World manufactured export share of output has almost quadrupled
- In the United States, trade growth has been even faster
  - Merchandise export share growth: 3.3% per year (since 1962)
  - Manufactured export share growth: 4.2% per year (since 1962)

Do tariffs explain the explosion of trade?

FIGURE 1
Manufacturing Export Share of GDP and Manufacturing Tariff Rates



Large increase that is lagged with the change in tariffs



How to explain these trade patterns?

- Typical explanation: worldwide reductions in tariffs (and transportation costs);
- Two problems with standard story:
  - Tariffs (and transportation costs) have declined by only about 15 percentage points since the early 1960s
    - The workhorse trade (monopolistic competition, Ricardian) very high elasticities of substitution across goods (12 or higher)
  - Trade has grown more in the 1980s and 1990s than in the 1960s and 1970s, even though tariffs fell by more in the earlier period
    - Between 1962 and 1976, tariffs fell 6 percentage points. U.S. manufacturing trade (adjusted) grew by 36 percent
    - Between 1976 and 1997, tariffs fell 5 percentage points. U.S. manufacturing trade grew by 130 percent

Vertical specialization

- Think about a change in the nature of trade
- International trade increasingly involves interconnected vertical trading chains
  - U.S. produces and exports engine parts to Mexico
  - Mexico produces engines and exports all of it to the U.S.
  - U.S. produces automobiles with these engines, and some of the autos are exported.
- Specialization increasingly occurs in different stages of production
- Countries increasingly link sequentially to produce a good.
- Vertical specialization:
  - Many other names and terms: chain values, disintegration of production, fragmentation, outsourcing, intra-product specialization, multi-stage production, etc.

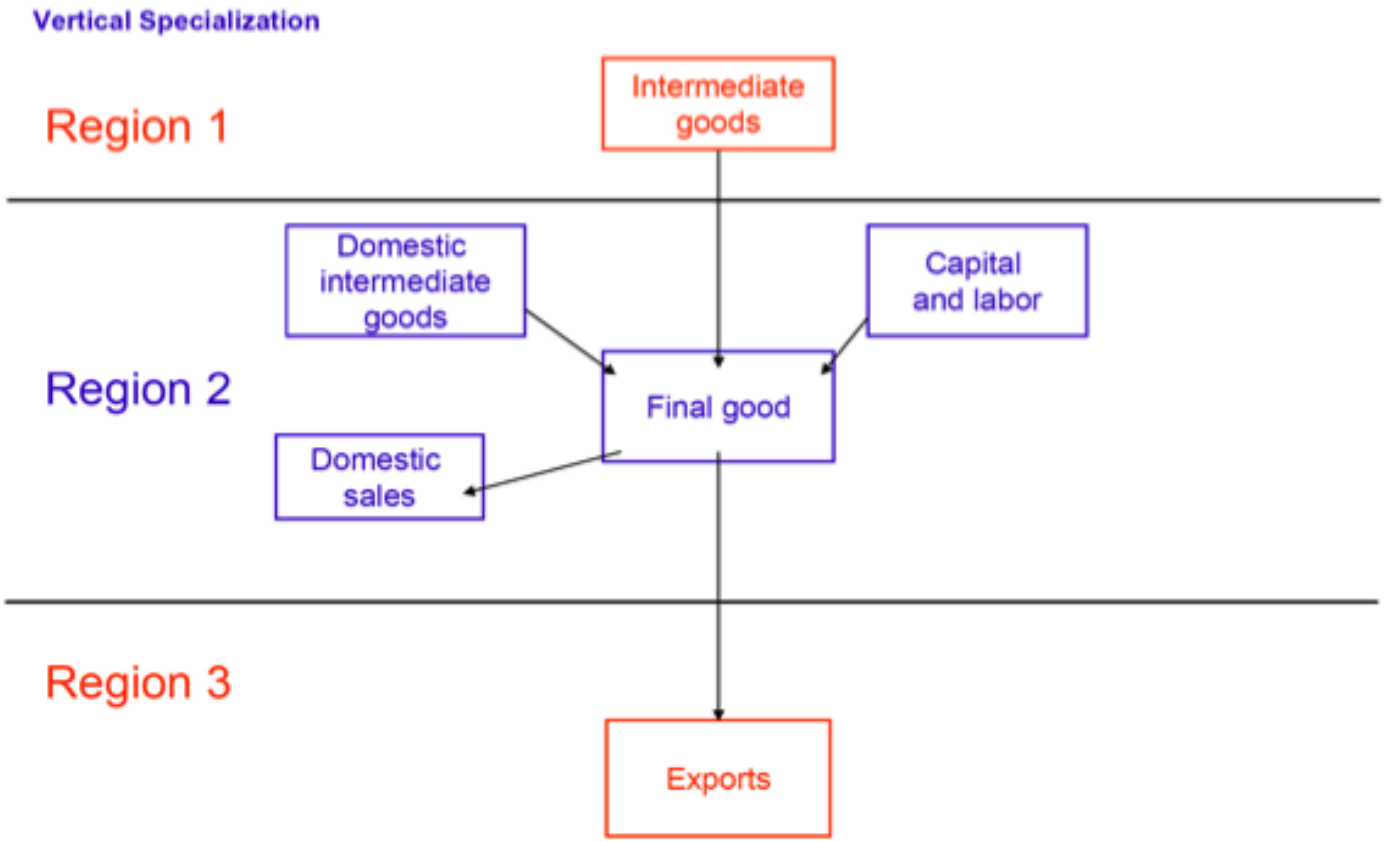
Mechanisms of vertical specialization

- World-wide tariffs (and transportation costs) decline
- The cost of producing goods whose production processes involve multiple stages in multiple countries falls by more than the cost of producing "regular goods", because the vertically specialized goods are tariffed multiple times while in process
- Vertical specialization trade increases by more than "regular" trade because
  - Magnified decline in costs for vertically specialized trade (internal margin)
  - Some "regular: goods now become vertically specialized (external margin)
- Total trade increases
  - because both regular trade and vertical specialization trade increase by more than standard models predict
- Moreover, the effect is non-linear, because, if tariffs are high enough, so that there is no vertical specialization, then tariff reductions have only the standard effects on trade. Once vertical specialization kicks in, then the magnification effect kicks in

Structure of production under vertical specialization

1. A good is produced in two or more sequential stages
2. Two or more countries provide value-added during the production of the good.
3. At least one country must use imported inputs in its stage of the production process, and some of the resulting output must be exported
4. Part 3 is key: Vertical Specialization is related to but not the same as intermediate goods trade, which is consistent with 1 and 2, but not necessarily with 3

Representation of structure of production



How to measure vertical specialization?

- For country k and good i:

$$VS_{ki} = \left(\frac{imported\ intermediates_{ki}}{gross\ output_{ki}} \right) \cdot exports_{ki}$$

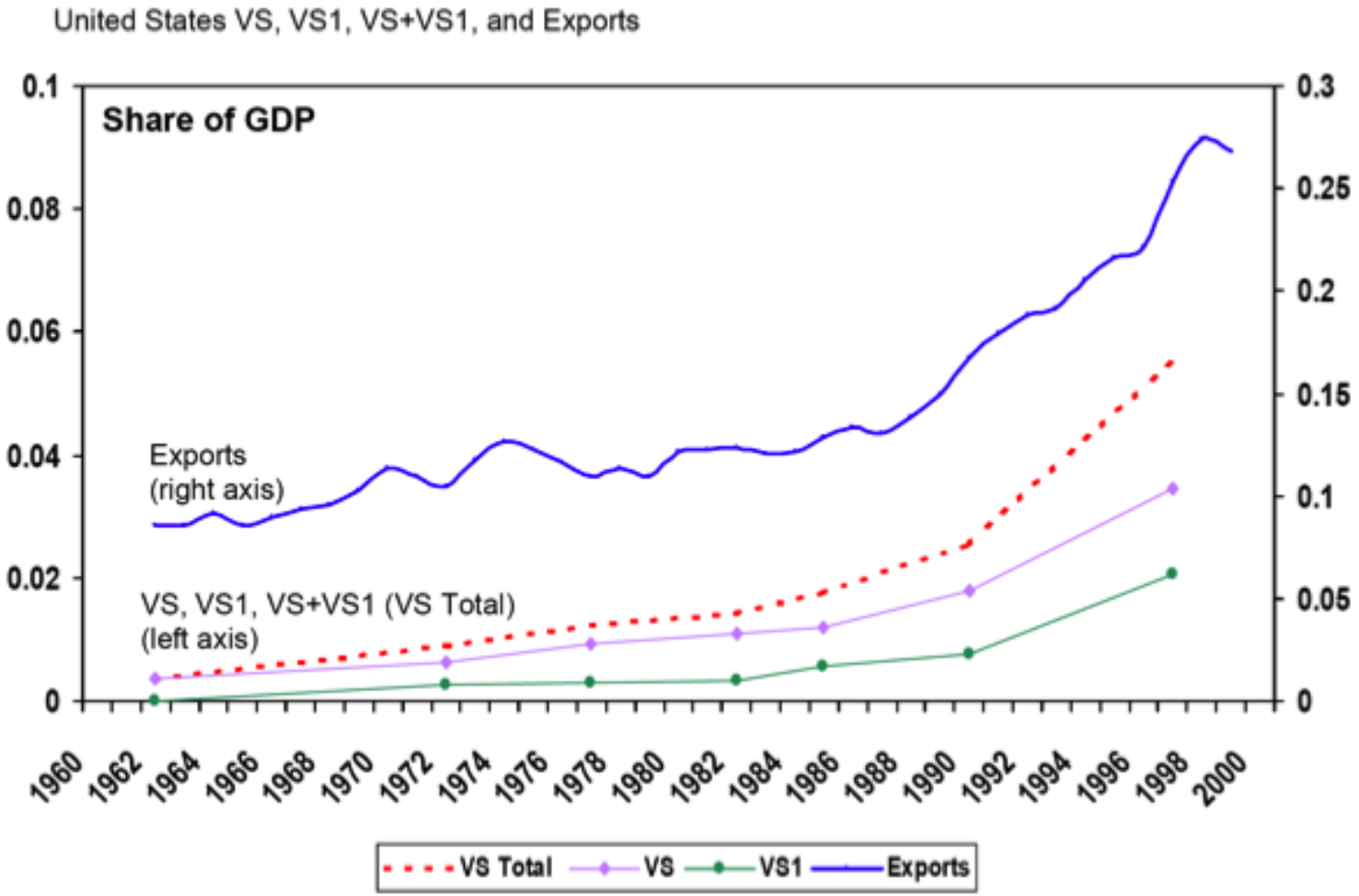
- VS is the imported input content of country k exports of good i
- Country level VS:

$$\frac{VS_k}{X_k} = \frac{\sum_i VS_{ki}}{\sum_i X_{ki}}$$

- Note that exports can also be used as intermediates in other countries:

$$VS1_{kij} = \left(\frac{exports_{ij}}{gross\ output_{ij}} \right) \cdot exported\ intermeditates_{kij}$$

Trends in vertical specialization



Trends in vertical specialization

- Growth Decomposition: What fraction of the change in the U.S. merchandise export share of GDP can be accounted for by vertical specialization?

	VS (%exports)	Export (%GDP)	Export (% merch GDP)
1962	.042	3.67%	7.46%
1997	.219	8.52%	23.38%
change		4.85	15.92

- Vertical specialization now represents a big part of trade

Theoretical framework of vertical specialization

- Ricardian model (dynamic)
- 2 countries, 2 factors (homogenous capital and labor)
- Continuum of goods indexed on unit interval
- Infinite horizon
- Capital accumulation, but no international capital flows (portfolio autarky)
- Exogenous growth