



# The economics of alternative fuel for shipping and the economic measures

*Meifeng Luo, Ph.D.*

*Associate Professor, Dept. of Logistics and Maritime Studies*

*Director, IMC-Frank Tsao Maritime Library and R&D Center*

# The prospects of alternative fuel for shipping

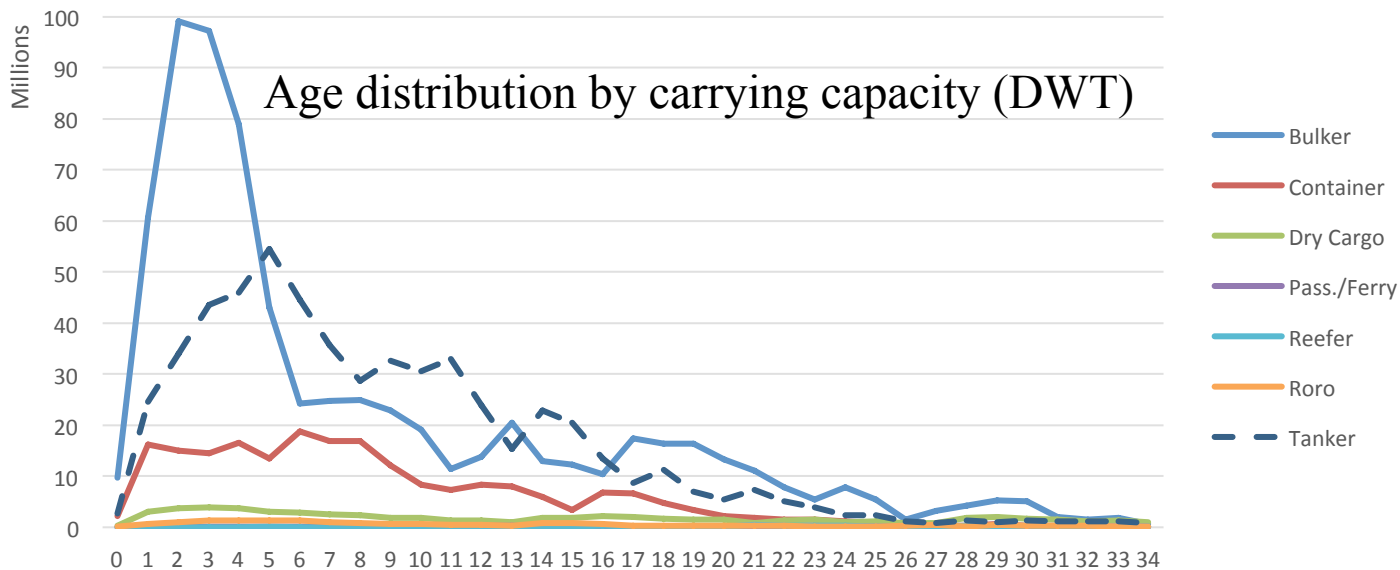
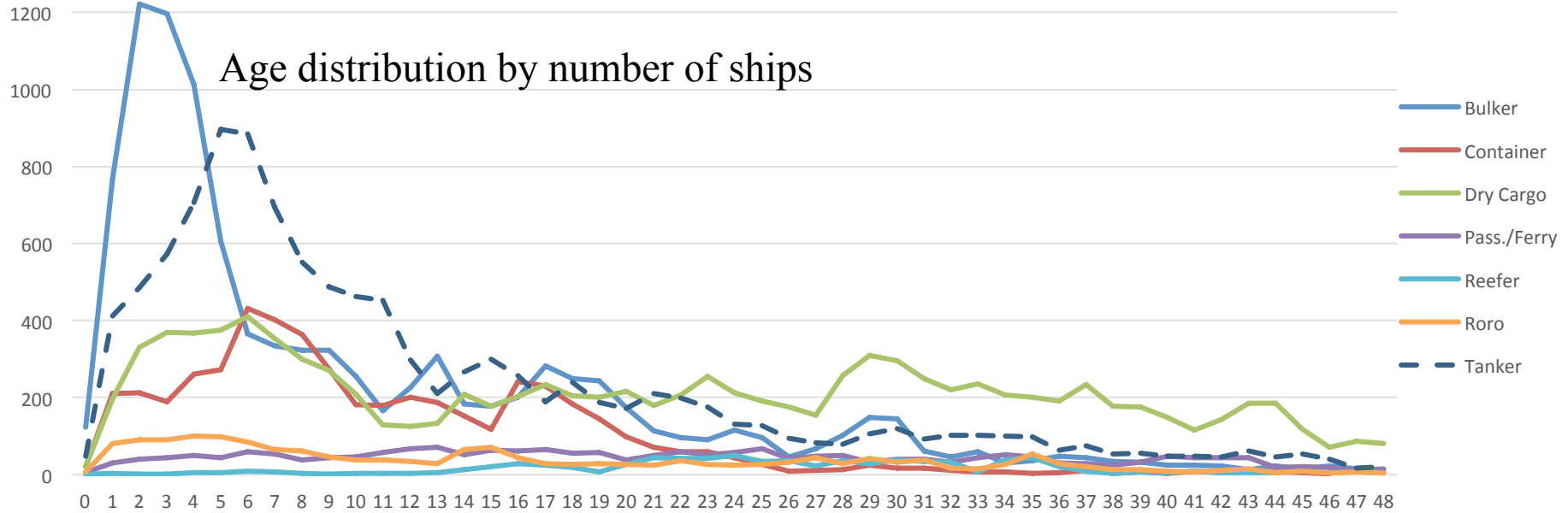
- LNG
  - Electricity
  - Biodiesel
  - Methanol
  - LPG
  - Ethanol
  - Dimethyl Ether (DME)
  - Biogas
  - Synthetic Fuels
  - Hydrogen
  - Nuclear
- What are the economic concerns?
    - ✓ From shipowners' perspective
      - ❖ Cost of installation and operation
      - ❖ Reliability
      - ❖ Popularity
      - ❖ Impact on the existing fleet
    - ✓ From social planners' point of view
      - ❖ Costs to bring the fuel
      - ❖ Competitive use of resources
      - ❖ Environmental attributes
      - ❖ Energy consumptions
      - ❖ Potential risks

# Shipping market in the past 30 years



As the BDI indicates, the shipping market is going back to the sluggish period as appeared before 2003. The good time is over, but we are still in the memory of the good time between 2003 and 2008, and at the same time, suffering from the over-capacity which is left over from the past.

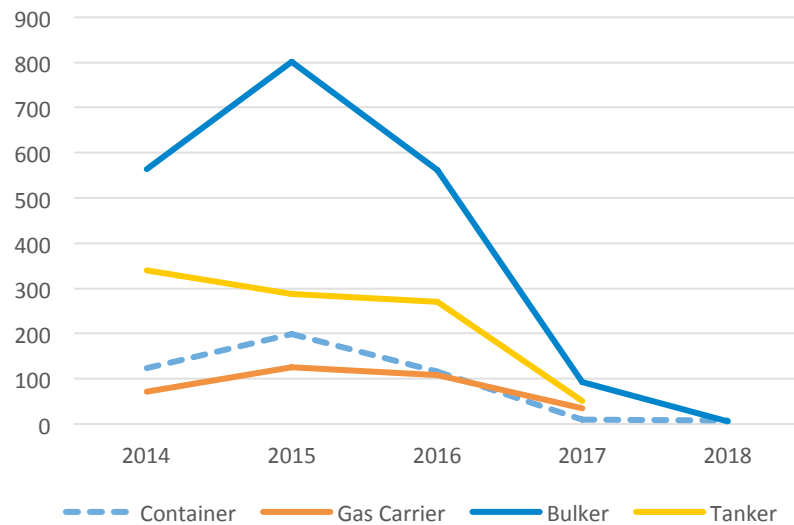
# Age distribution of world merchant fleet (March, 2014)



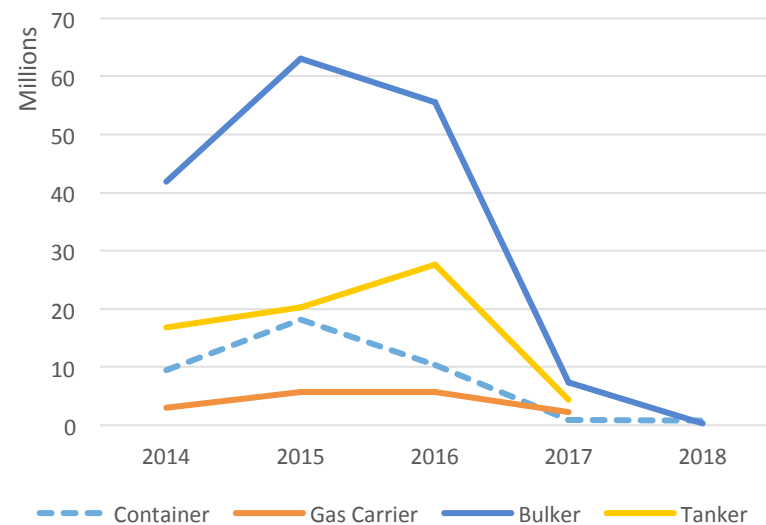
The major part of the shipping capacity is new (<10 years)

# The scheduled delivery of the ships on the order book

## Number of ships



## Total DWT





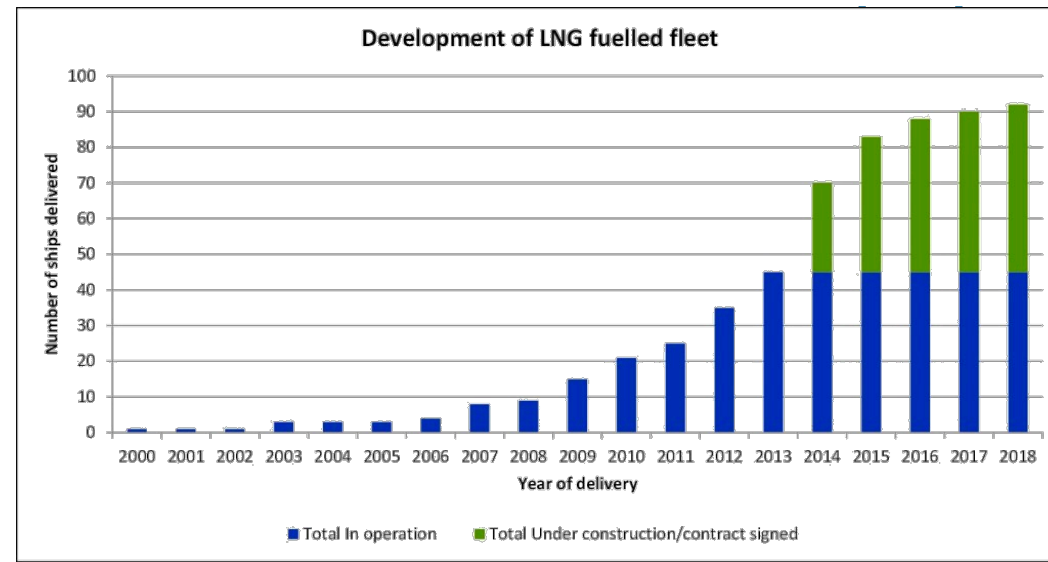
# LNG as a ship fuel

- Benefits:

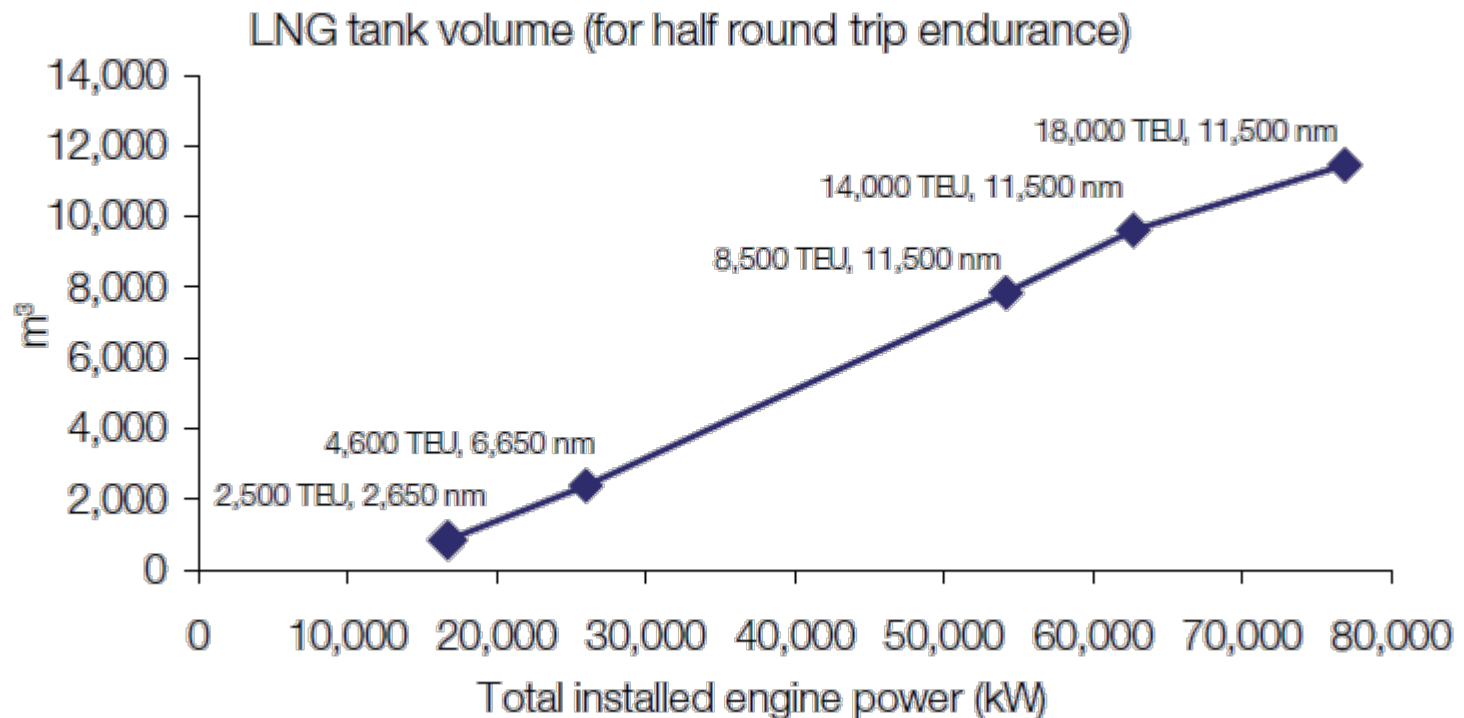
- Reduce  $SO_x$  by 90-95%, meet the requirement for ECA by 2015, and worldwide by 2020.
- 20-25% reduction in  $CO_2$  emission.
- For the same energy content,  $P_{LNG} < P_{HFO} < P_{MGO}$ .

- Concerns:

- Current ship age distribution and overcapacity
- Popularity of LNG fueled ships
- Bunkering infrastructure
- Installation cost
- Reduce payload capacity



# Capacity requirement for different containership sizes



A TEU is about 38.5 m<sup>3</sup>; 12000 m<sup>3</sup> is about 311 TEUs.

# Economic measures to promote LNG in shipping

- Incentives for early retirement of old ships.
  - Government subsidies on scrap the old ships, which will be materialized when the a new ship with LNG engine is built.
- Incentive for installing LNG engine
  - Tax incentive on manufacturing/importing such engine
- Incentive for bunkering services
  - Government subsidized bunkering facility before LNG shipping market is well developed.



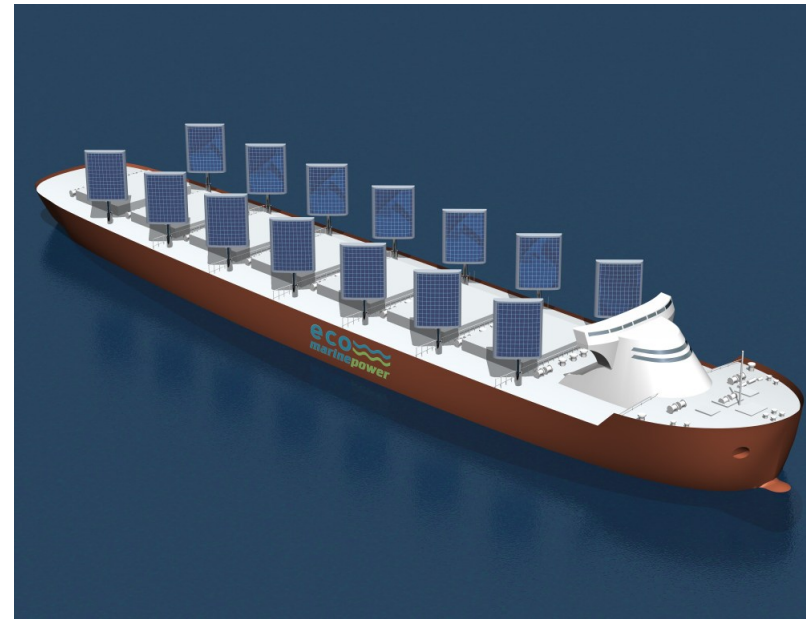
# Ship Electrification & renewables

- Use energy produced on shore
  - ✓ Cold ironing: when the ship is in port.
  - ✓ Pure batteries/hybrid system: for the sea journey
- Cost/benefit
  - ✓ High capital cost, but short payback period for fixed short route.
  - ✓ Reduce emission
- Harbor tugs, offshore service vessels, and ferries



# Economic concerns and prospects

- How was the shore power generated?
  - It should be clean, reliable and low-cost.
- Onboard power sources, such as wind and sun, have limited availability.
- For large scale application in world merchant fleet, the durability is a problem.



# Biofuel

Three primary sources:

Edible crops, non-edible crops (waste, or crops harvested on marginal land) and algae.

- Disadvantages:

- ✓ Land requirement;

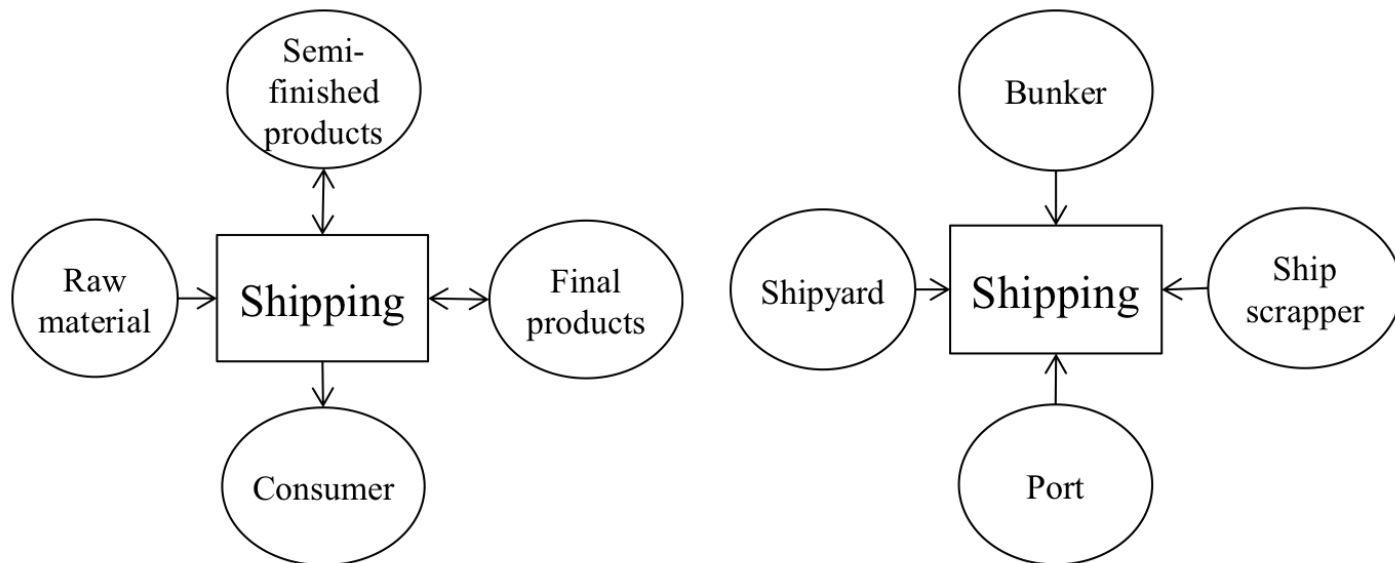
- ✓ Cost/energy/emission of bring it to the ship tank;



# Feasibility of economic and policy measures

- Global shipping is very competitive with very thin profit margin.
  - Shipowners will only start to change when the alternative is better than the existing one.
  - Shipping is the most globalized business in the world—fading away of the national identity;
  - National policy or incentive will have spillover effects—the input of one country will benefit all others.
    - The input in R&D, the generation of possible alternative fuels, the tax incentive of a country to build the engine, terminal and other facilities are for all the ships.
- International action is required to address these problems.

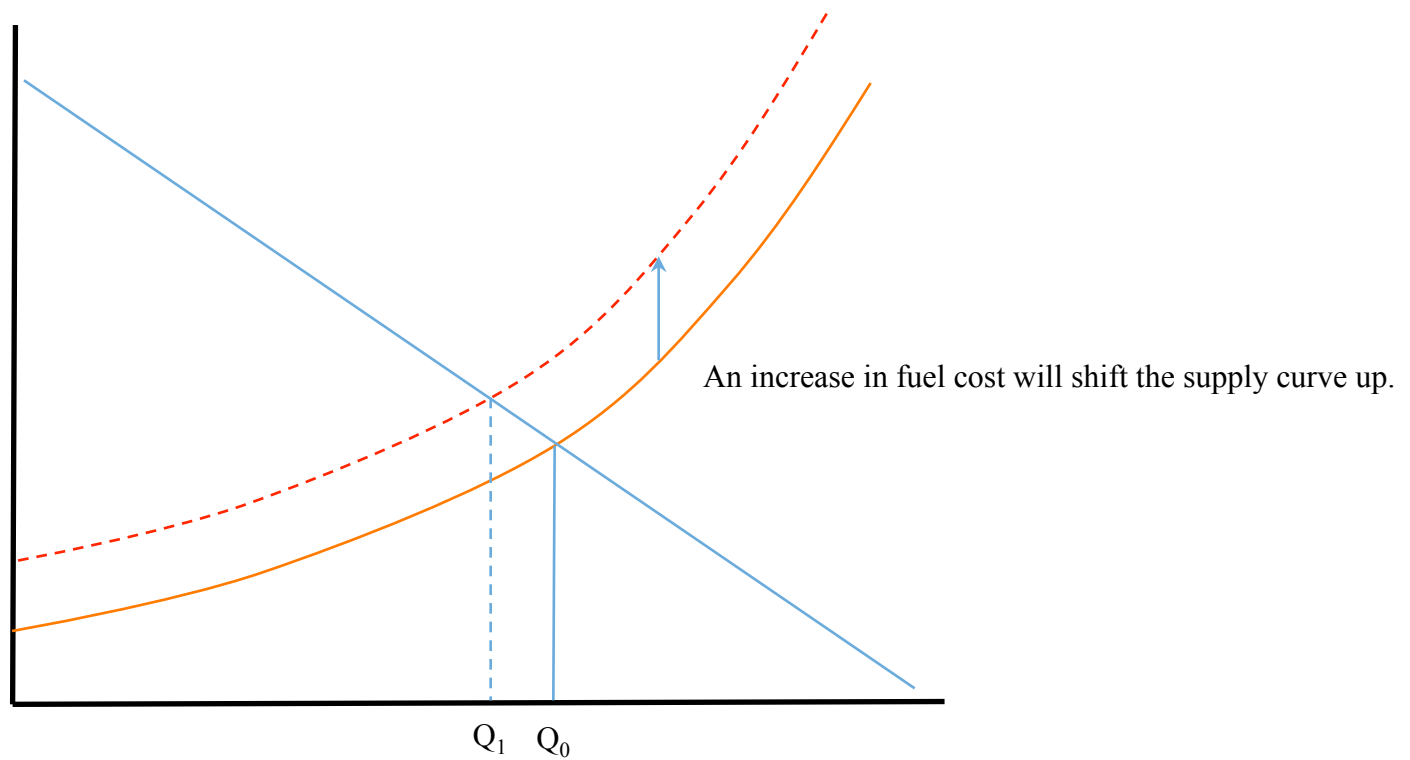
# If alternative fuel leads to an increase in fuel cost



(a) Shipping serves commodity flow (b) Services support shipping

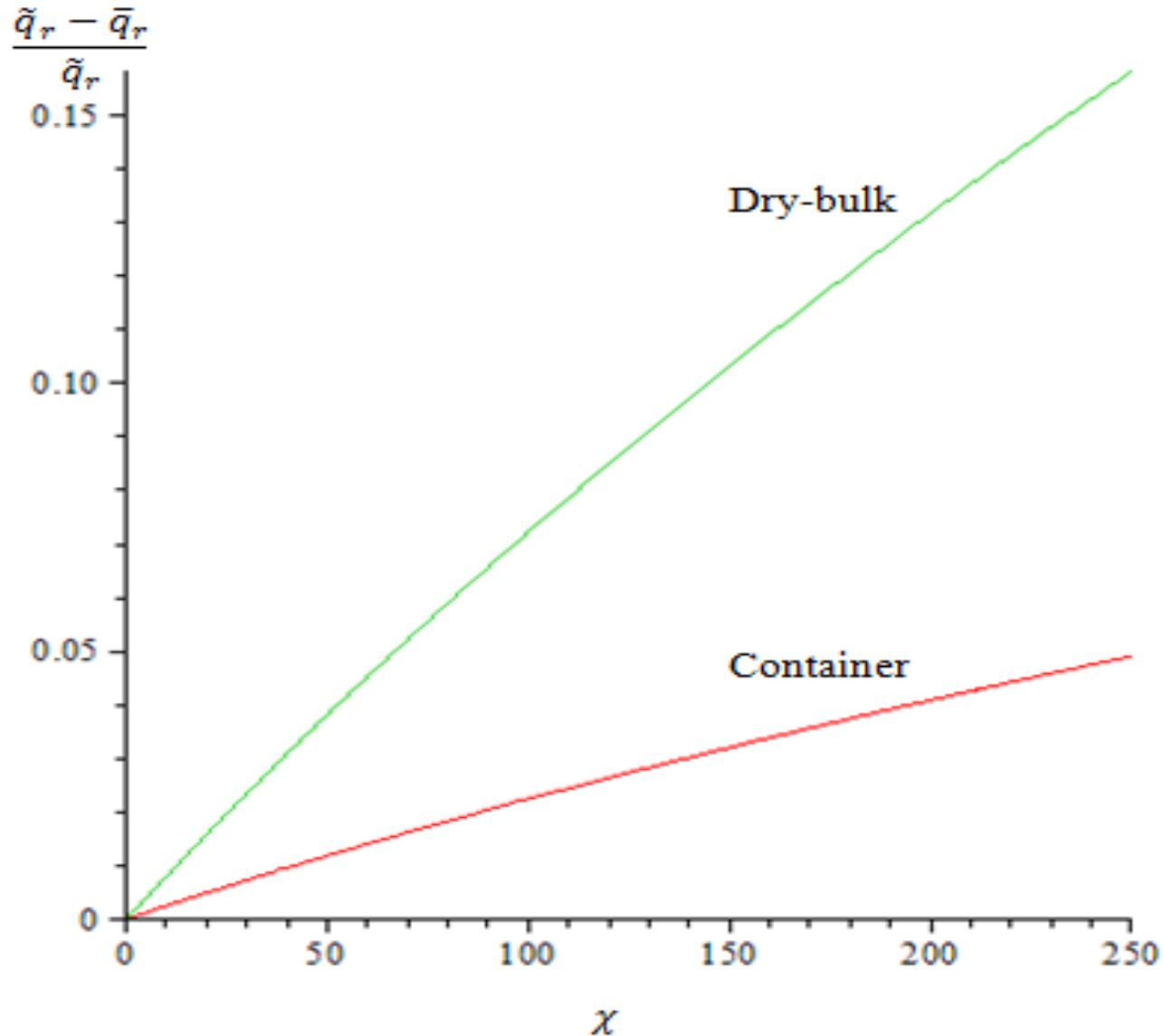
Any impacts on global shipping will have a ripple effect on the commodity flow, as well as its service sectors.

# Impacts on seaborne trade





# Impacts on different shipping sectors



# Summary

- If the alternative fuel can only be put on newbuildings, the existing market over-capacity can delay the adoption.
- If the adoption of alternative fuel have high initial cost, it is hard to implement at the low market condition without public subsidy.
- Offshore vessels and domestic shipping are better sectors under national incentive, while international shipping require international policies.
- If the alternative fuel increases the shipping cost, it will reduce international trade; and it may also have different impacts on different shipping sectors.