International Policy Coordination in a Multisectoral Model of Trade and Health Policy

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Motivation

- Explosion of research on single-economy models of pandemic after the global outbreak of Covid-19 (Macro-SIR).
- Much has been learned for domestic policy: communication, education, labor, the limits of lockdowns, organazation of work, social psychology, monetary policy...
- Some international political and policy initiatives, but only little academic work on international aspects of pandemics
- Impression: After the great medical success brought about by the vaccines, the international community has quickly abandoned many systemic questions behind the Covid catastrophe.
- May 2024: WHO member states fail to agree on a global Pandemic Treaty.

Motivation (ctd.)

These developments are highly problematic because

- Pandemics are global in nature and require international coordination on domestic health policies.
- Any ensuing economic downturn is global in nature and requires international economic coordination.
- The spread of a pandemic affects international trade, which affects the international spread of the pandemic, which affects international trade, which ...

A sign of hope?
→ May 2025: WHO General Assembly adopts the global ' 'Pandemic Agreement".

Note: The agreement focuses almost exclusively on vaccines, ignores almost all economic considerations, is largely silent about international trade, cross-border policy coordination, protectionism.

Our Questions

- What is the role of international trade during a pandemic?
- How do the domestic economic costs of pandemics compare to the well-known gains from international trade?
- How do the economic costs of pandemics compare to their health costs in terms of lost or damaged lives ?
- Can the substitution of domestic production by foreign imports have not only economic advantages, but also provide health benefits?
- Should international health policy coordinate trade, and should it proceed differentially among sectors?
- How to set up international health policy coordination, and is this viable in the presence of national governments and national objectives?
- What externalities do insular health policies create?

Our Approach

- Starting point: There is no good quantitative data on international pandemics. The one pandemic that has been broadly documented (Covid-19) has been too complex to yield meaningful international time series:
  - multiple waves
  - mutations
  - uncertain transmission routes, etc.

- Our approach: Combine a (standard) model of international trade with a (standard) disease model from epidemiology, calibrate both parts according to normal-time macro data and medical micro data from Covid.

- Health policy is set by national governments to maximize domestic welfare. International cooperation is implemented by a benevolent international planner who maximizes the sum of national welfare functions

- Predictions by means of numerical solutions of the associated high-dimensional General Equilibrium problems.

The Framework

- Two countries, each producing two distinct goods from domestic labor: "manufactured goods" (m) and "services" (non-manufactured, n)
- Infinite-horizon Armington trade model, households value all 4 goods.
- Disease partitions populations in susceptible, infectious, removed people (SIR)
- Macro-SIR: Disease transmission is proportional to the product of susceptible and infected agents' economic activity
  - Disease has direct health costs (loss of lives) and economic costs (inefficient labor supply $\rightarrow$ loss of income)
  - Transmission through consumption and work
  - Consumption of services is more infectious than that of manufactured goods
  - Transmission occurs both within and across countries due to international trade
- National health policies are modeled as "containment taxes" that reduce economic activity to fight transmission
- Noncooperative national policy outcomes modelled as Nash equilibria of a dynamic two-person game.

Externalities I

- Classic static externality: Infected agents do not correctly internalize the health costs resulting from their economic activity
- Classic dynamic externality: Even susceptibles impose an externality on other susceptible agents because current economic activity increases chances of contagion in the future
- These externalities are addressed domestically by national governments.
  - National government policies modelled as strategies in an open-loop infinite-horizon non-cooperative game.
  - Government containment policies exhibit rich state-contingency based on infections of both countries.

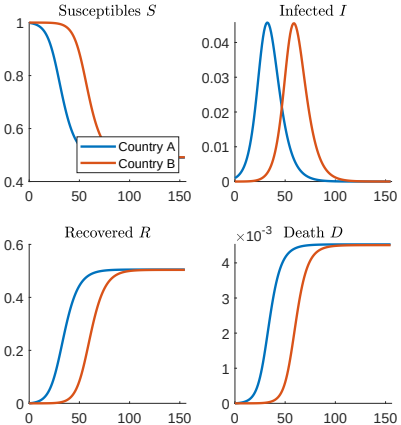
Externalities II

- Uncoordinated governments generate two externalities:
  - **Health externality**: Governments do not internalize the impact of domestic health policies on the spread of pandemic in the other country — Containment effort is too high or too low.
    - ⋆ too low: effect of domestic measures on foreign agents is ignored
    - ⋆ too high: combatting the domestic disease outbreak is costly, may be more efficiently done by adjusting imports and exports
    - ⋆ As a result, health outcomes are not socially efficient.
  - **Trade externality**: Each government wants to distort the terms of trade to its own advantage — import tariff is too high and inefficiently timed.
    - ⋆ The unilateral actions to stem the import of infections on the health front lead to a collective trade war as a Nash Equilibrium on the economic front
    - ⋆ As a result, consumption allocations are socially inefficient.
- **Key question:** How do health and trade externalities interact?

Main Intuition: Dynamic Reallocation of Infection and Consumption

- Diseases come in waves, and international disease transmission takes time.
- Hence, at each point in time there is one country that is harder afflicted and one that is relatively better off in terms of health.
  - Example: With Covid-19, there were at least 3 large waves in most countries, sometimes more.
  - Our model: Just one wave in each country, disease dies out with herd immunity.
  - Disease emerges in country A, while countey B does well; then it spreads to B and A is getting better
- Consumption insurance: Shift production to low-infection country $\rightarrow$ can produce more with lower infection probability
- Health insurance: Reduce infection risk from production in high-infection country.

A basic picture: No Government Policy – Classic SIR



- Two infection peaks about 25 weeks apart
- Reach "herd immunity" in each country around 60 weeks after outbreak

Main Results I

- As expected: Under central planning and under Nash domestic containment policies track the domestic infection cycle, peak close to the peak.
- Novel import tariff pattern under international coordination:
  - Uncoordinated: poor international risk-sharing
    - ⋆ High tariffs (trade war) overall
    - ⋆ Uninfected country raises tariffs to avoid infections
    - ⋆ Infected country responds with lower tariffs to shift production abroad
    - ⋆ Tariff structures changes terms of trade *against* the infected country
  - Coordinated: optimal international risk-sharing
    - ⋆ Lower tariffs overall
    - ⋆ Raise tariffs during high domestic infection, to subsidize the infected economy with higher income from trade
    - ⋆ Tariff structures changes terms of trade *in favor of* the infected country
- Tariffs on m (non-infectious) and on n (infectious) goods are used differentially
  - Nash-behavior slashes tariffs on n goods during high domestic infection, keeps tariff on m good almost unchanged.
  - Social planner raises tariffs on n goods slightly during high infection, raises tariffs strongly on m goods.

Main Results II

- Both uncoordinated governments and the coordinated planner reduce the amount of infection during the pandemic.
  - Comes at the expense of lower consumption and production in both countries, achieved by very different mechanisms
  - Nash: The dynamics of non-cooperative terms of trade amplify the pandemic-induced recession
  - Coordination: Eliminate the health externality across countries. Smooth the pandemic-induced recession intertemporally by exploiting the asynchronous nature of pandemic.
- Uncoordinated governments achieve a lower welfare gain for three reasons:
  - Trade war
  - Lack of international risk-sharing through timing of tariffs
  - No international relocation of production as a function of the pandemic state: High infection numbers make production less efficient $\rightarrow$ production should move to less infected country (marginally): made difficult by tariffs.
  - Shifting terms of trade of the service good against the infected country, while not manipulating those of the manufactured good effectively.

The Terms of Trade in a Picture