Accommodating Emerging Giants in the Global Economy

Zhuokai Huang
Harvard University

Benny Kleinman
Stanford University and NBER

Ernest Liu
Princeton University and NBER

Stephen J. Redding
Stanford University, NBER and CEPR

Motivation

- History provides examples of large changes in the relative economic size of nations that are often accompanied by heightened geopolitical tensions
  - Relative decline of Britain in the face of the emerging giants of Germany and United States
  - Relative decline of United States in the wake of Japanese growth after the Second World War and the emergence of China at the end of 20th century
- Is rapid growth in an emerging economy good or bad for income and welfare in other nations?
- What are the mechanisms through which these effects occur?
- How important is foreign productivity growth and trade integration for a country's income and welfare compared to its own productivity growth?

This Paper

- We use the class of quantitative trade models with a constant trade elasticity to provide empirical evidence on these questions
- We combine this class of models with data on bilateral trade, gross domestic product (GDP) and population from 1960-2020
- Recover unique productivities and bilateral trade costs for which the observed data are consistent with general equilibrium inthese model (up to normalization)
  - Globalization and deglobalization
  - Productivity catchup in emerging economies
- Examine the implications of the emergence of Japan and China for income and welfare in the United States and other nations
  - Rapid productivity growth in these countries led to a substantial relative decline in the United States as measured by its share of global income
  - This rapid productivity growth raised aggregate welfare in the United States
  - Effects of foreign productivity growth and trade integration modest relative to domestic productivity growth

Related Literature

- Impact of Japanese growth in the 1980s and Chinese growth today on U.S. living standards
  - Japan: Prestowitz (1988), Thurow (1992), Tyson (1992)
  - China: Autor et al. (2013), Pillsbury (2016), Allison (2018), Miller (2022)
- Theoretical literature on economic growth the terms of trade
  - Hicks (1953), Johnson (1955), Krugman (1994)
- Quantitative trade models with a constant trade elasticity
  - Armington (1969), Krugman (1980), Eaton and Kortum (2002), Melitz (2003), Dekle et al. (2007), Chaney (2008), Waugh (2010), Arkolakis et al. (2012), Costinot and Rodriguez-Clare (2014), di Giovanni et al. (2014), Simonovska & Waugh (2014), Caliendo and Parro (2015), Hsieh and Ossa (2016), Adão et al. (2017), Caliendo et al. (2019), Galle et al. (2023)
- Sufficient statistics in international trade
  - Arkolakis et al. (2012), Baqaee and Farhi (2024), Kleinman et al. (2023, 2024), Huo et al. 2025
- Geoeconomics (international political economy of trade policy)
  - Hirschman (1945), Tinbergen (1962), Grossman & Helpman (1995), Broner et al. (2023), Clayton et al. (2023, 2024), Liu & Yang (2023), Thoenig (2023), Becko & Connor (2024), Kleinman et al. (2024), Becko et al. (2025)

Outline

- Theoretical Framework
- Data and Parameterization
- Model Inversion
- Counterfactuals
- Conclusions

Theoretical Framework

- Consider the class of trade models with a constant elasticity gravity equation
- The world economy consists of many countries
- The representative consumer in each country consumes the differentiated goods produced by each country
- Each country's good is produced using a composite factor of production (equipped labor)
- Countries differ in terms of their endowments of equipped labor (ℓ_{nt}) and productivities (z_{nt})
- Allow for a wedge between expenditure and income (e_{nt}) to match observed trade deficits
- Iceberg variable trade costs such that $\tau_{nit} \geq 1$ units must be shipped from country i to country n for one unit to arrive: $\tau_{nit} > 1$ for $n \neq i$ and $\tau_{nnt} = 1$
- Use the equilibrium conditions of the model to recover (z_{nt}, τ_{nit}) from the observed data on gross domestic product (GDP), population, bilateral trade shares and expenditure/income (q_{nt}, ℓ_{nt}, s_{nit}, e_{nt})

Income and Welfare

- Income in country i is equal to the sum across all markets n of expenditure on its goods

$$w_{it}\ell_{it} = \sum_{n=1}^{N} \frac{\left(\tau_{nit} w_{it}/z_{it}\right)^{-\theta}}{\sum_{h=1}^{N}\left(\tau_{nht} w_{ht}/z_{ht}\right)^{-\theta}} e_{nt} w_{nt} \ell_{nt}$$

- General equilibrium reduces to a system of N equations in the N wages in each country (w_{nt})
  - Wages in each country are gross substitutes
  - Exists a unique wage vector that solves this system of equations (Alvarez and Lucas 2007 and Allen et al. 2020)
- Country welfare can be expressed in the following indirect form

$$\mathcal{U}_{nt} = \frac{w_{nt}}{\mathcal{P}_{nt}} = \frac{w_{nt}}{\left[\sum_{h=1}^{N}\left(\tau_{nht} w_{ht}/z_{ht}\right)^{-\theta}\right]^{-\frac{1}{\theta}}} = z_{nt}\left(\frac{1}{s_{nnt}}\right)^{\frac{1}{\theta}}$$

- where we have used $\tau_{nnt} = 1$

Mechanisms

- Totally differentiating the income accounting relationship allowing productivity (z_n) to change
  - Holding constant bilateral trade costs (τ_{ni}), population (ℓ_n), and the expenditure-income ratio (e_n)

$$\underbrace{\mathrm{d}\ln \mathbf{w}}_{\text{income effect}} = \underbrace{\mathbf{T}\,\mathrm{d}\ln \mathbf{w}}_{\substack{\text{market-size}\\ \text{effect}}} + \underbrace{\theta \mathbf{M}\left(\mathrm{d}\ln \mathbf{w} - \mathrm{d}\ln \boldsymbol{z}\right)}_{\substack{\text{cross-substitution}\\ \text{effect}}},$$

$$\underbrace{\mathrm{d}\ln \mathbf{u}}_{\text{welfare effect}} = \underbrace{\mathrm{d}\ln \mathbf{w}}_{\substack{\text{income}\\ \text{effect}}} - \underbrace{\mathbf{S}\,\mathrm{d}\ln \mathbf{w}}_{\substack{\text{cost-of-living}\\ \text{effect}}},$$

- $\mathbf{S} \equiv [s_{ni}]$ is the $N \times N$ matrix with the ni-th element equal to importer n's share of expenditure on exporter i
- $\mathbf{T} \equiv [t_{in}]$ is the $N \times N$ matrix with the in-th element equal to exporter i's share of income from importer n, with $t_{in} = \frac{s_{ni} e_n w_n \ell_n}{w_i \ell_i}$
- We define $\boldsymbol{M} \equiv \boldsymbol{TS} - \boldsymbol{I}$

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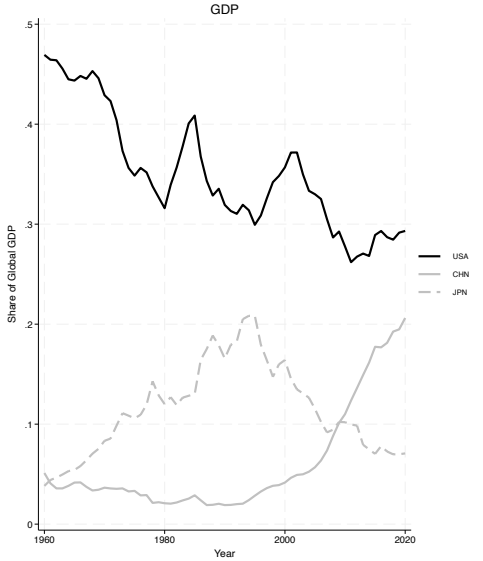
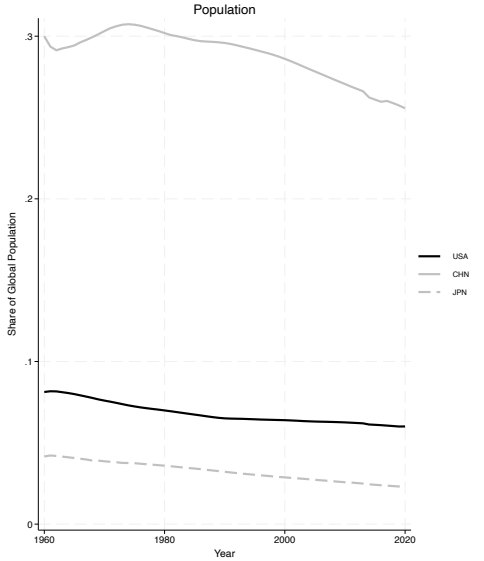
Data and Parameterization

- Data on bilateral trade, gross domestic product and population from 1960-2020 from CEPII Gravity Database (Conte et al. 2022)
  - Bilateral trade data from the Direction of Trade Statistics (DOTS)
  - GDP and population data from the World Development Indicators (WDI)
  - Construct the expenditure-income ratio using our trade and GDP data
- Drop small countries with < 1 million population
- Focus on a balanced panel of 75 countries for which GDP and population data are available in each year and positive total imports and total exports are observed in each year
- Measure global GDP and population as the sum of countries in our sample
- Use a central value for the trade elasticity of $\theta = 4$

Shares of Global Totals





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Model Inversion

- We observe GDPs (q_{it}), population (ℓ_{it}), bilateral trade with foreign countries (x_{nit} for $n \neq i$), and compute the ratio of expenditure to income (e_{it})
- Normalize the total world population equal to one in each year
- Choose world GDP as our numeraire:

$$\sum_{n=1}^{N} q_{nt} = 1$$

- Recover wages (w_{it}) from observed GDP (q_{it}) and population (ℓ_{it}):

$$w_{it} = q_{it}/\ell_{it}$$

- Assume population (ℓ_{it}) and the expenditure-income ratio (e_{it}) are exogenous
- Treat GDP (and hence wages) and bilateral trade as endogenous
- Invert the equilibrium conditions of the model to recover unique values for domestic trade (x_{nnt}), productivity (z_{it}) and bilateral trade costs (τ_{nit}) from the observed data (up to normalizations)

Bilateral Trade Frictions

- Estimate bilateral trade frictions from the gravity equation using PPML estimator following Santos Silva and Tenreyro (2006) and Head and Mayer (2014)

$$s_{nit} = \exp\left(\eta_{it} + \mu_{nt}\right) + u_{nit}$$

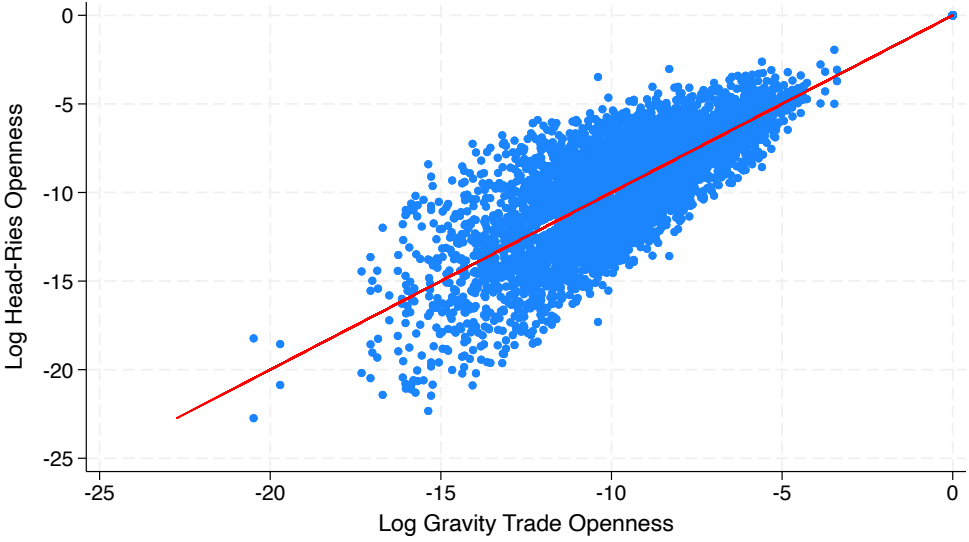
- $\eta_{it} = \log\left(z_{it}^{\theta}\right)$ is an exporter-year fixed effect
- $\mu_{nt} = \log\left(P_{nt}^{\theta}\right)$ is an importer-year fixed effect
- u_{nit} is a regression error that includes bilateral trade frictions $(\tau_{nit}^{-\theta})$
- Compute inverse measure of bilateral trade frictions

$$\tau_{nit}^{-\theta} = \frac{s_{nit}}{\exp\left(\eta_{it} + \mu_{nt}\right)}$$

- Compute gravity openness measure (GRO_{nit}) for importer n and exporter i in each year t as

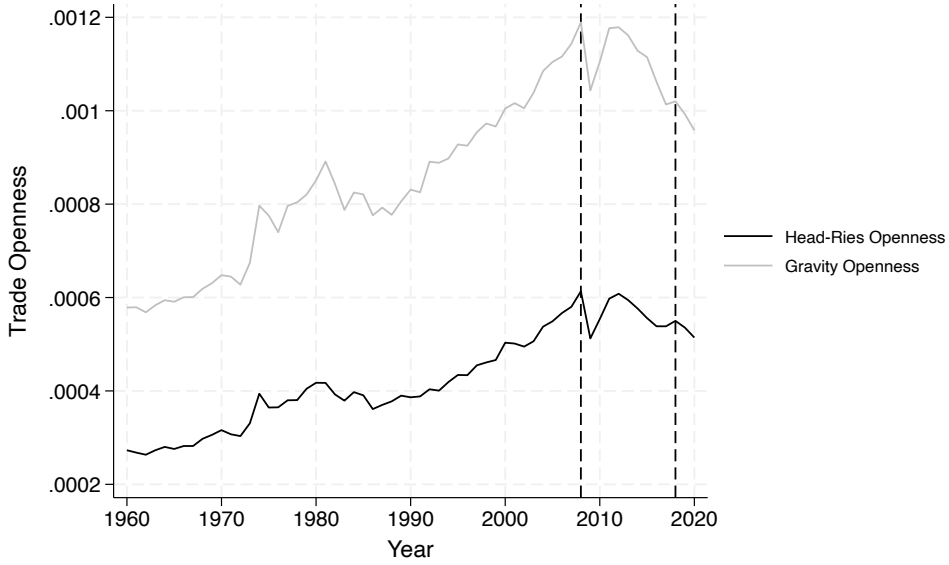
$$GRO_{nit} = \left(\frac{\tau_{nit}}{\tau_{nnt}}\right)^{-\theta} = \tau_{nit}^{-\theta} = \frac{s_{nit}/\exp\left(\eta_{it}\right)}{s_{nnt}/\exp\left(\eta_{nt}\right)}$$

Head-Ries Versus Gravity

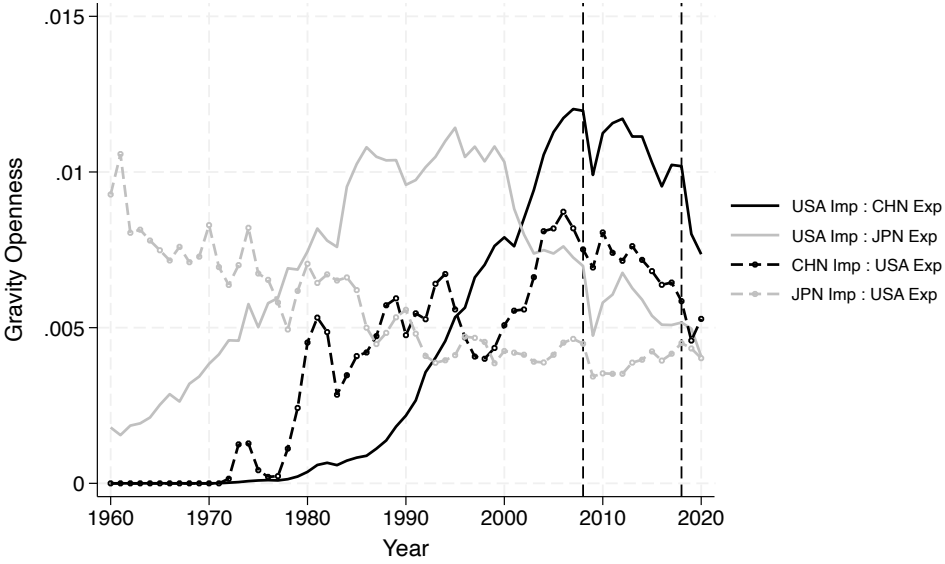


Note: Slope coefficient: 1.0000; standard error: 0.0112; R-squared: 0.6325.

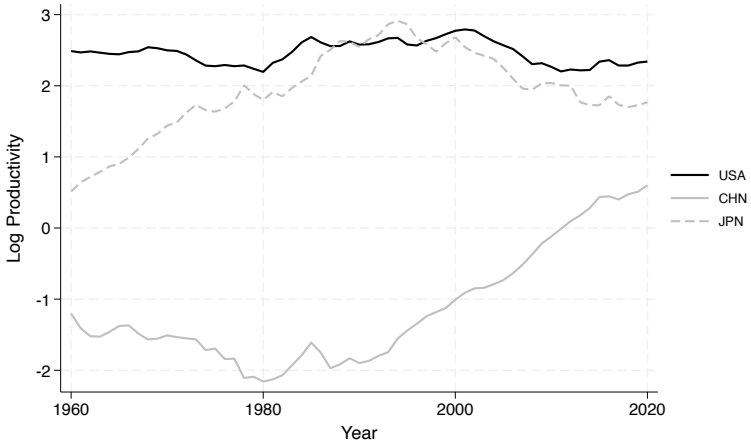
Global Trade Openness



Gravity Openness (USA-CHN-JPN)



Country Productivities



- Recover country productivities from the equality between country income and expenditure on the goods produced by that country

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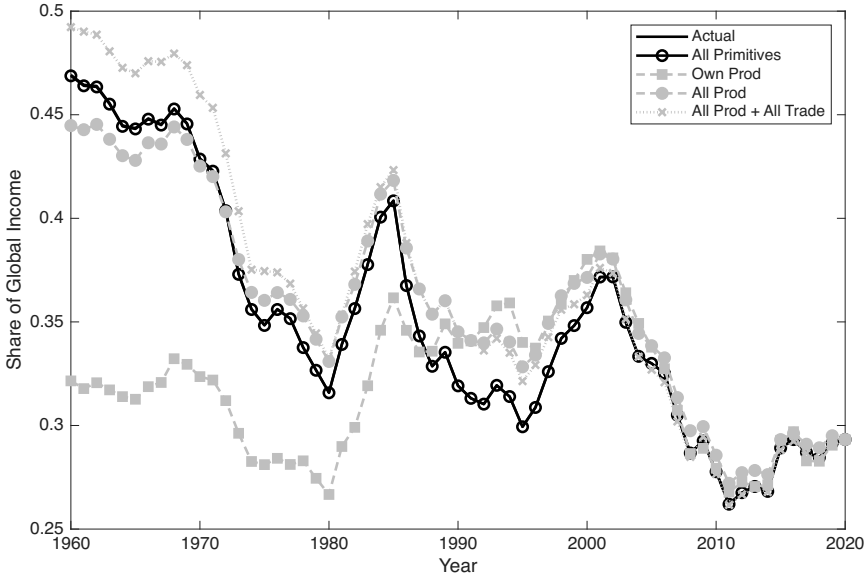
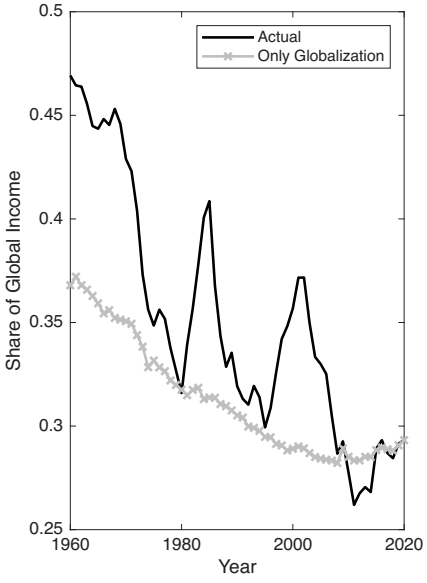
Counterfactuals

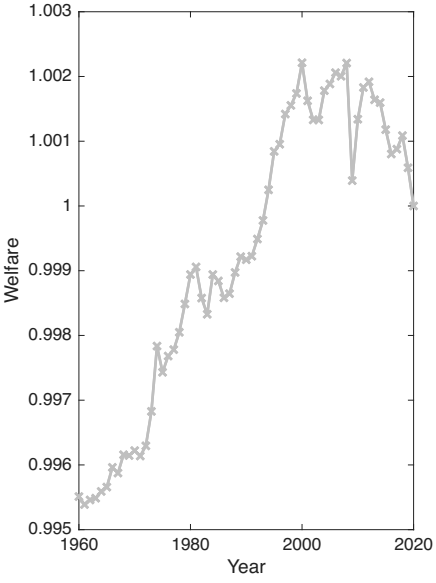
- Given assumed bilateral trade costs ($\widetilde{\tau}_{nit}^{-\theta}$) and productivities ($\widetilde{z}_{it}$), population shares ($\widetilde{\ell}_{it}$) and expenditure-income ratios ($\widetilde{e}_{nt}$), solve for counterfactual wages ($\widetilde{w}_{nt}$) from the equality between income and expenditure
- If we use the model-inverted values of all four variables for each year ($\tau_{nit}^{-\theta}$, z_{it}, ℓ_{it}, e_{nt}), the model's counterfactual predictions exactly reproduce the observed evolution of wages over time (w_{nt})
- If we allow some of these variables to change over time, but hold others constant at their end of sample values, the model's counterfactual predictions need not equal the observed data
- Comparing the model's counterfactual predictions to the observed data reveals the importance of different mechanisms

U.S. Relative Income

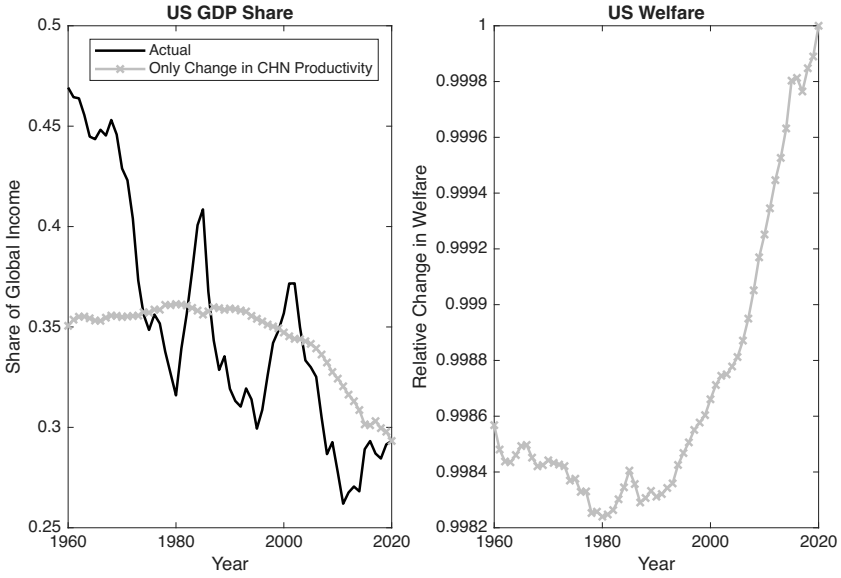


Globalization and U.S. Income/Welfare

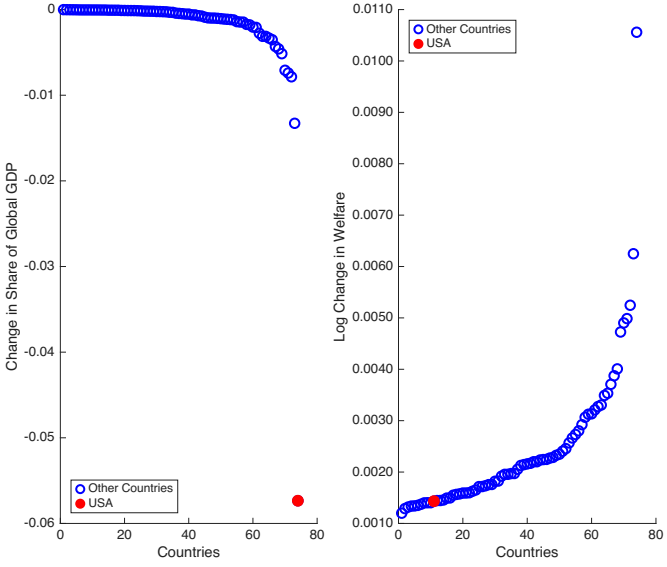




China and U.S. Income/Welfare



China and Other Countries



Conclusions

- History provides examples of large changes in the relative economic size of nations that often bring heightened geopolitical tension
- How are aggregate income and welfare in advanced countries affected by globalization and productivity growth in emerging economies?
- We use the class of constant elasticity trade models and data on bilateral trade, national income and population from 1960-2020 to provide quantitative evidence on these questions
  - Globalization, hyper globalization and deglobalization
  - Globalization reduced the share of the United States in global GDP, but raised aggregate welfare in the United States
  - Rapid productivity growth in Japan and China led to a substantial relative decline in the United States as measured by its share of global income
  - This rapid productivity growth raised aggregate welfare in the United States
  - Effects of foreign productivity growth and trade integration modest relative to domestic productivity growth
- Changes in countries relative incomes are potentially quite misleading for their welfare
- While domestic productivity is not everything, it plays a large role for domestic living standards

Thank You