Tariffs, Manufacturing Employment, and Supply Chains

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US Manufacturing Jobs Have Plunged Since Trump's Tariffs

Manufacturers in the U.S. are cutting thousands of jobs even as President Trump pushes economic policies that he says will revitalize the industry.

- Manufacturing PMI slips to 48.2 from 48.7 in October
- New orders measure subdued amid concerns over near-term demand
- Manufacturers laying off workers, not filling open positions

US Factories Sputter Again As Tariffs Weigh On Demand

Manufacturing continued to shrink, with weaker orders, higher costs, and trickier trade policies.

Why Trump's Tariffs Are Holding Back US Factory Jobs

Trump still has tariffs on foreign-made machines needed to fuel a US factory revival

US manufacturing mired in weakness as tariff gloom spreads

President Donald Trump's tariffs, aimed at reshoring American jobs lost to overseas manufacturing, could end up lowering domestic head count instead, according to recent statements from corporate executives and economic forecasters.

Motivation

- Stated goal of Trump tariffs: "reindustrialize" U.S. economy
  - → Can it work?
  - → Best way to do it?
  - → How long will it take?
- Problem 1: Tariffs raise costs for downstream industries
  - → Steel tariffs during 1st Trump admin increased steel employment but…
  - → Destroyed ∼10x more jobs in other mfg sectors (Cox and Russ, 2020; Flaaen and Pierce 2024)
  - → Reduced export growth in other mfg sectors (Handley et al. 2020)
- Problem 2: Frictions slow adjustment & cause short-term pain
  - → Factors: Need to build new factories, get workers to switch occupations
  - → Supply chains: Transitory shocks in upstream sectors cause persistent disruptions in downstream sectors (Tsyvinski and Liu 2024)
- This paper: short vs. long-run effects of tariffs on mfg employment in general equilibrium

What I do

- Build multi-sector, multi-country dynamic GE model of US economy
  - → Starting point: Kehoe et al. (2018)
  - → Manufacturing split into 4 subsectors that differ by trade elasticity and upstreamness:
    - "Oil:" upstream, high elasticity
    - "Steel:" upstream, low elasticity
    - "Toys:" downstream, high elasticity
    - "Cars:" downstream, low elasticity
  - → Supply-chain adjustment frictions as in Tsyvinski and Liu (2024)
- Simulate effects of tariffs on sectoral employment dynamics
  - → Target specific sectors vs. across the board
  - → Baseline vs. frictionless model
  - → Target one country vs. entire world
  - → Passive trade partners vs. retaliation

What I find

- Tariffs can raise overall manufacturing employment
  - → Tariff on all mfg sectors: 1.75pct increase
  - → Best case: tariff on “toys” only, 3pct increase
  - → Worst case: tariff on “cars” only, 2pct decrease
- Net effect on overall mfg employment masks significant reallocation between mfg sectors
  - → Tariff on all mfg sectors: only “toys” grows, all other sectors shrink
  - → “Cars” tariff: employment in “cars” rises slightly, other 3 mfg sectors all shrink at least 2x more
- Employment may fall in short run before eventually rising
  - → Tariff on all mfg sectors: employment rises by 1.75pct in long run, but falls by 1.25pct in short run and remains depressed for 11 years
- If other countries retaliate, long-run gains disappear and short-run losses double

Related literature

- Trade war economics: Steinberg (2020), Carroll and Hur (2023), Flaeen and Pierce (2024), Alessandria et al. (2025ab), Bianchi and Coulibaly (2025), Cavallo et al. (2025), Cuba-Borda et al. (2025), Ignatenko et al. (2025), Itskhoki and Mukhin (2025), Pujolas and Rossback (2025)
  - → This paper: short-run vs. long-run effects on manufacturing employment
- Structural change in open economies: Uy et al. (2013), Kehoe et al. (2018), Sposi (2019), Lewis et al. (2022), Sposi et al. (2025)
  - → This paper: tariffs as driving force; reallocation between manufacturing sub-sectors
- Global value chains: Johnson and Noguera (2012), Antras et al. (2012), Caliendo and Parro (2014), Liu (2019), Liu and Tsyvinski (2024), Alessandria et al. 2023, Blanchard et al. (2024), Georgieva (2025)
  - → This paper: tariffs as a supply-chain disruption

Model

Overview

- Discrete time, perfect foresight
- I countries indexed by i, j (subscripts)
- S sectors indexed by s, r (superscripts)
- Agents:
  - → Households: work, consume, invest, buy bonds
  - → Producers: gross output $= f$(labor, capital, intermediates)
  - → Distributors: sector-specific Armington composite $= g$(domestic products, foreign products)
  - → Retailers: consumption + investment $= h$(sectoral composites)
  - → Governments: levy import tariffs

Producers

- Produce output using capital, labor, and intermediate inputs subject to labor adjustment costs

$$y_{i,t}^s = \left\{ \lambda_i^{s,v} \left[(k_{i,t}^s)^{\alpha_i^s} (\ell_{i,t}^s)^{1-\alpha_i^s} \right]^{\frac{\eta-1}{\eta}} + \left[\sum_{r=1}^{S} \lambda_i^{s,r} (m_{i,t}^{s,r})^{\frac{\xi-1}{\xi}} \right]^{\frac{\eta-1}{\eta}\frac{\xi}{\xi-1}} \right\}^{\frac{\eta}{\eta-1}} - \phi_\ell \left(\frac{\ell_{i,t}^s}{\ell_{i,t-1}^s} - 1 \right)^2 \ell_{i,t-1}^s$$

- Adjusting capital is also costly

$$k_{i,t+1}^s = (1-\delta) k_{i,t}^s + \delta^{1-\phi_k} (x_{i,t}^s)^{\phi_k} (k_{i,t}^s)^{1-\phi_k}$$

- Choose $\{\ell_{i,t}^s, k_{i,t}^s, m_{i,t}^{s,1}, \ldots, m_{i,t}^{s,S}\}_{t=0}^{\infty}$ to maximize PDV of dividends

$$\sum_{t=0}^{\infty} \Lambda_{i,t} \left[p_{i,t}^s y_{i,t}^s - w_{i,t} \ell_{i,t}^s - p_{i,t}^x x_{i,t}^s - \sum_{r=1}^{S} p_{i,t}^{m,r} m_{i,t}^{s,r} \right]$$

Distributors

- Combine domestic and foreign products into use-specific (final or intermediate) Armington composites subject to cost of substituting between suppliers

$$q_{i,t}^{u,s} = \left[\sum_{j=1}^{I} \mu_{i,j}^{u,s} (z_{i,j,t}^{u,s})^{\frac{\zeta^s - 1}{\zeta^s}} \right]^{\frac{\zeta^s}{\zeta^s - 1}} - \sum_{j=1}^{I} \phi_u \left(\frac{z_{i,j,t}^{u,s}}{z_{i,j,t-1}^{u,s}} - 1 \right)^2 z_{i,j,t-1}^{u,s}, \; u \in \{m, f\}$$

  - → Long-run trade elasticities, ζ^s, vary by sector
  - → Adjustment frictions modeled as in Tsyvinski and Liu (2024)
  - → Lower short-run elasticities as in Krugman (1986)

- Choose $\{z_{i,1,t}^{u,s}, \ldots, z_{i,I,t}^{u,s}\}_{t=0}^{\infty}$ to maximize PDV of dividends

$$\sum_{t=0}^{\infty} \Lambda_{i,t} \left[p_{i,t}^{u,s} q_{i,t}^{u,s} - \sum_{j=1}^{I} (1 + \tau_{i,j,t}^{s}) z_{i,j,t}^{u,s} \right]$$

Retailers, households, and government

- Retailers: combine final-use sectoral composites into aggregate consumption and investment:

$$c_{i,t} = \left[\sum_{s=1}^{S} \varepsilon_i^{c,s} \left(z_{i,t}^{c,s}\right)^{\frac{\rho^c - 1}{\rho_c}}\right]^{\frac{\rho_c}{\rho^c - 1}}, \quad x_{i,t} = \left[\sum_{s=1}^{S} \varepsilon_i^{x,s} \left(z_{i,t}^{x,s}\right)^{\frac{\rho^x - 1}{\rho_x}}\right]^{\frac{\rho_x}{\rho^x - 1}}$$

- Households: work, consume, and save

$$\max_{\{c_{i,t},\ell_{i,t},b_{i,t+1}\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} u_i(c_{i,t}, \bar{\ell}_i - \ell_{i,t}) \quad \text{s.t.} \quad p_{i,t}^c c_{i,t} + Q_t b_{i,t+1} = w_{i,t}\ell_{i,t} + \bar{p}_t b_{i,t} + \Pi_{i,t} + T_{i,t}$$

- Government:
  - → Set tariffs $\tau_{i,j,t}^s$ on goods from country j's sector s
  - → Today: Rebate tariff revenue lump-sum to households
  - → Future: Reduce other distortionary taxes or subsidize investment as in Alessandria et al. (2025)

Equilibrium

- Sequence of prices and quantities that satisfy (i) household, retailer, distributor, and producer problems, and (ii) market clearing conditions
- Steady-state equilibrium: if tariffs are constant, equilibrium converges in long run to situation where all p's and q's are constant
- But no unique steady state! Continuum of steady states indexed by vector $b_{i,\infty}$ as in Kehoe et al. (2018) and Steinberg (2019, 2020)
  - $\rightarrow$ Long-run trade imbalances are endogenous
  - $\rightarrow$ Steady state determined by initial conditions and policy trajectory
  - $\rightarrow$ Adjustment costs $\phi^m, \phi^f, \phi^k, \phi^\ell$ don't enter steady-state versions of equilibrium conditions, but still affect which steady state you go to

Calibration

Overview

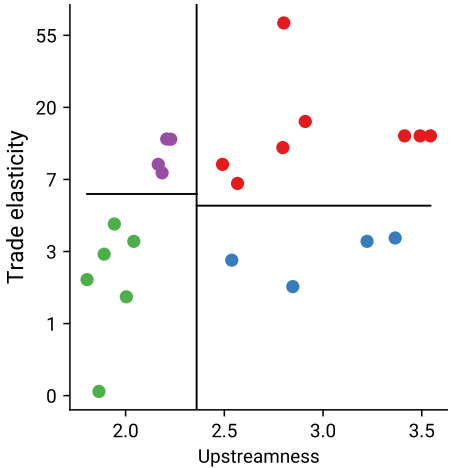
- Assign elasticities of substitution externally
  - → Between sectors in consumption and investment: Kehoe et al. (2018)
    - $\rho_c = 0.65$
    - $\rho_x = 1$
  - → Between value added and intermediates: Kehoe et al. (2018)
    - $\eta = 0.05$
    - $\xi = 0.03$
  - → Between different source countries ("trade elasticity"): Caliendo and Parro (2015)
    - ζ^s range from 2 to 18
- Calibrate expenditure shares so that input-output table constitutes pre-tariff steady state
  - → Next 4 slides
- Calibrate adjustment costs to short-run trade elasticity = 1
  - → Done during tariff experiment stage

Input-output data

- Source: 2020 OECD inter-country input-output table
- Aggregate countries into 3 regions: USA, China, rest of world
  - → Not crucial. Could use just USA and rest of world, but wanted to allow for trade diversion.
- Aggregate industries into 6 sectors
  - → Cluster goods industries (ISIC codes A-C) into 4 sectors by clustering on two characteristics
    - Trade elasticity from Caliendo and Parro (2015)
    - Upstreamness from Antras et al. (2012)
  - → Aggregate services industries (ISIC codes D, E, G-T) into one sector
  - → Keep construction (ISIC code F) separate. Completely non-traded, only used for investment.

Clustering goods industries

Industry-level characteristics



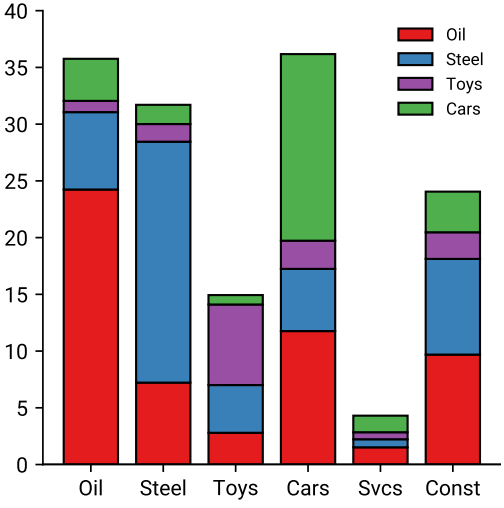
Sectoral aggregation

Sector	Industries	Upstreamness	Trade elasticity	Share of goods emp.
"Oil"	Agriculture, Mining (energy), Mining (non-energy), Mining support, Wood products, Paper products, Refined petroleum, Fabricated metals	3.0	17.6	28.4
"Steel"	Chemicals, Rubber + plastics, Minerals, Basic metals	3.0	2.8	18.1
"Toys"	Fishing, Textiles, Electronics, Electrical equipment	2.2	11.9	17.7
"Cars"	Food + beverages, Pharmateuticals, Machinery + equipment, Motor vehicles, Other trans. equip., Other mfg	1.9	2.2	35.7

Supply-chain linkages

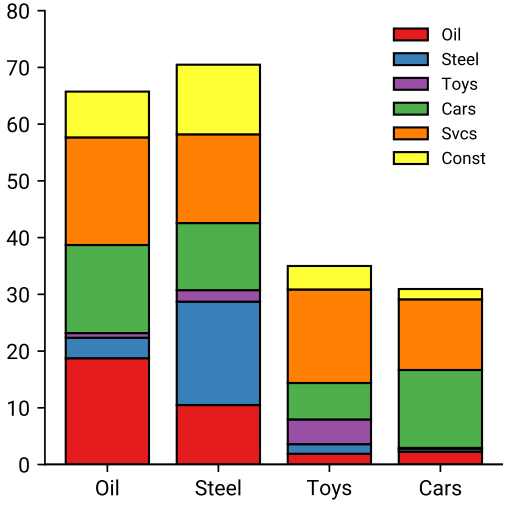
Downstream: intermediate purchases (% gross output)

'If it gets more expensive, how much does it affect me?"

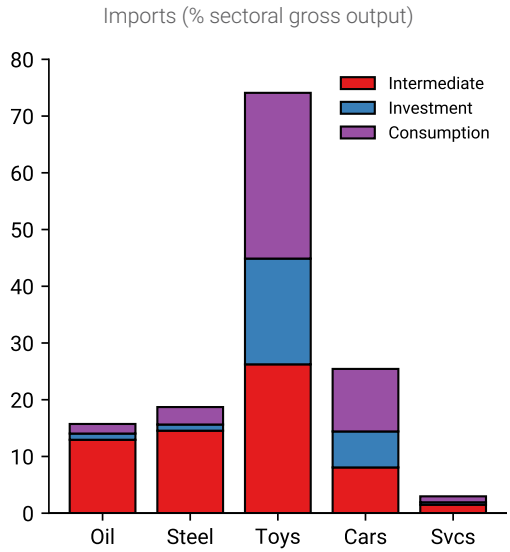


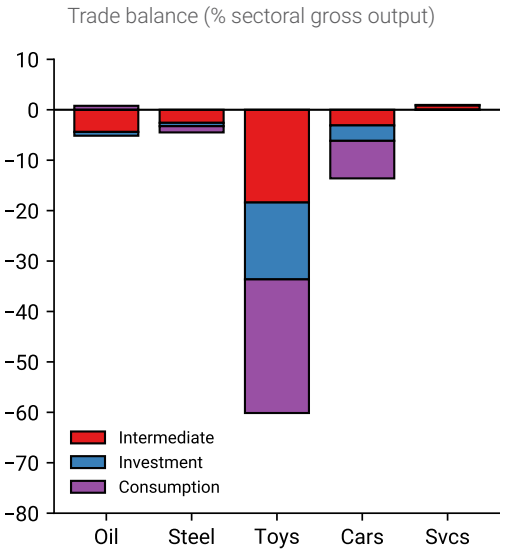
Upstream: intermediate sales (% gross output)

"If they stop buying, how much does it affect me?"

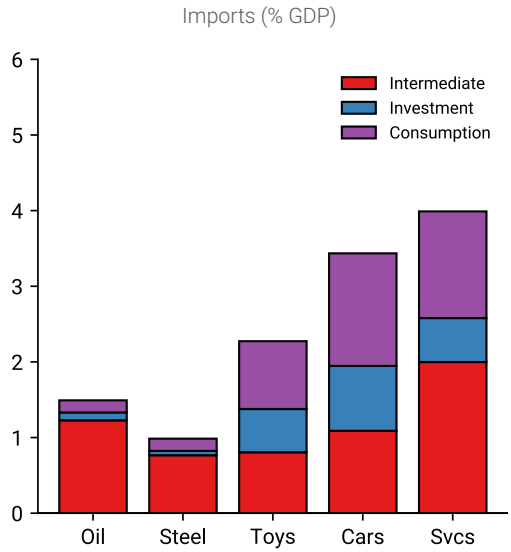


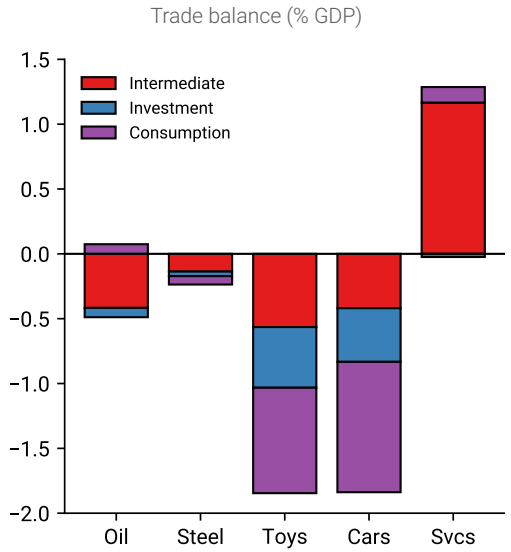
Sectoral exposure to trade





Macroeconomic importance of trade



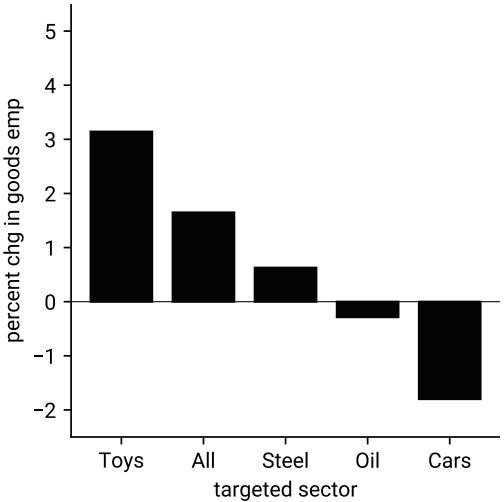


Experiments

Overview

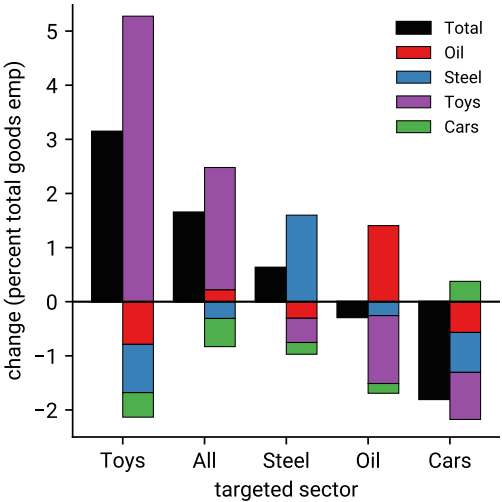
- Start from steady state with free trade
- 25% tariffs unexpected and permanent
  - → On each good separately
  - → On all goods together
- Object of interest: goods-sector employment dynamics

Which tariffs would be most effective at reindustrialization?



- Best: high-elasticity, downstream goods (“toys”)
- Worst: low-elasticity, downstream goods (“cars”)
- Broadest: Across-the-board (ATB) tariff on all goods. Still generates smaller employment gain than tariff on toys only.

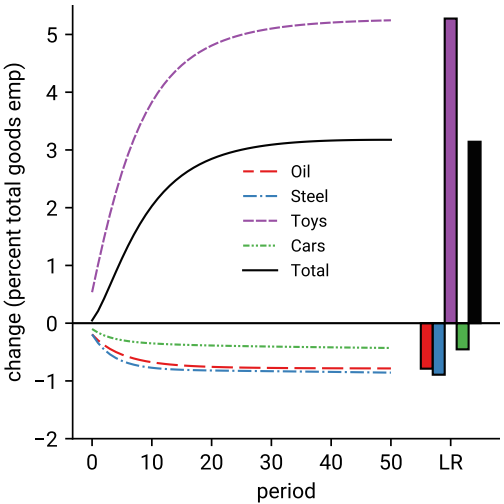
Reindustrialization or reallocation?



- Employment gains concentrated in one sector. All other sectors lose workers.
- ATB tariff hurts low-elasticity sectors. Barely helps “oil.” Less growth in “toys” than under targeted tariff.
- Tariff on “cars” hurts all other sectors more than it helps protected sector

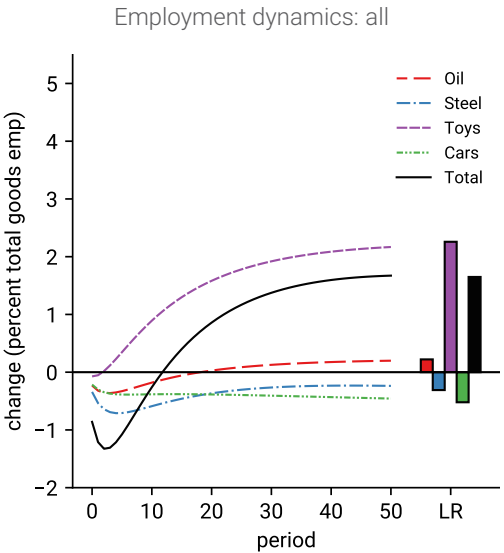
Short run vs. long run

Employment dynamics: “toys” only



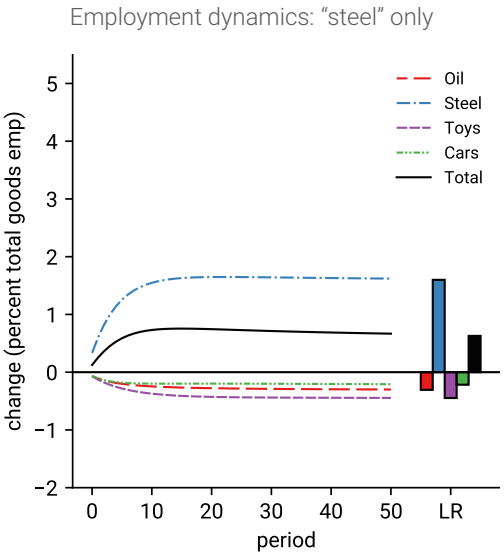
- “Toys:” Gradual net growth & reallocation

Short run vs. long run



- "Toys:" Gradual net growth & reallocation
- All: Overall employment falls in SR. "Toys" grows gradually, other sectors overshoot.

Short run vs. long run



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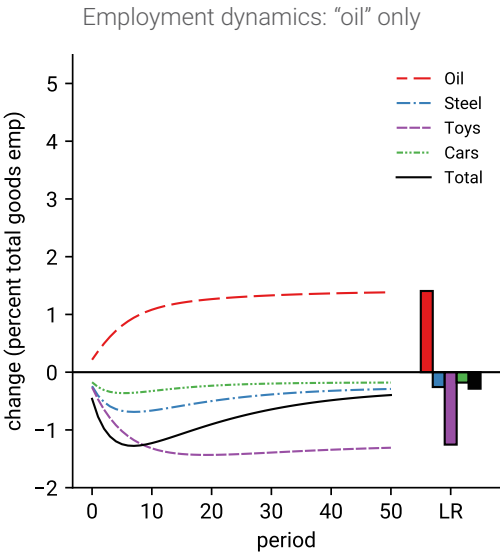
- “Steel:” Gradual growth & reallocation. Faster than “toys” tariff, but smaller effects.

Short run vs. long run



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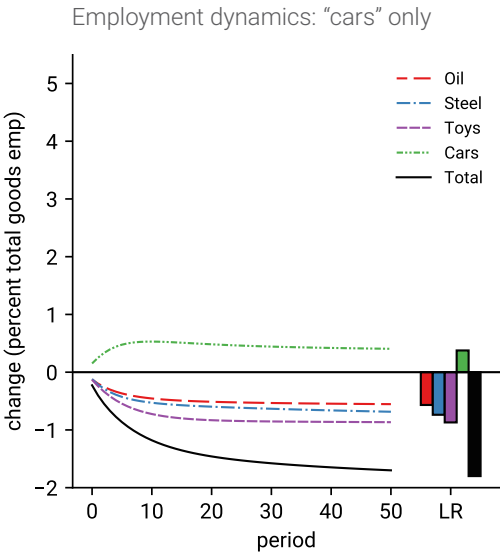
Short run vs. long run



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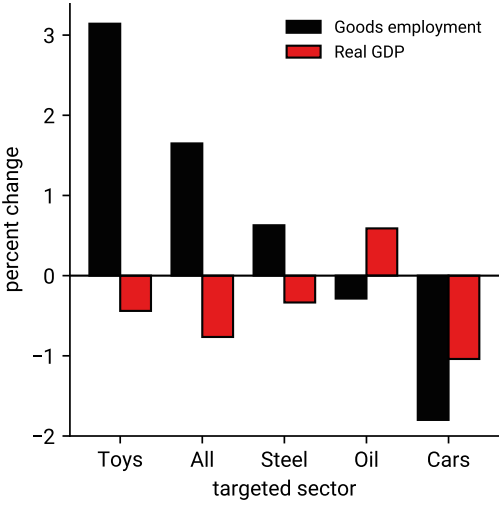
- “Oil:” Pronounced overshooting in overall employment, steel & cars
- “Cars:” Gradual net contraction & reallocation

Other considerations

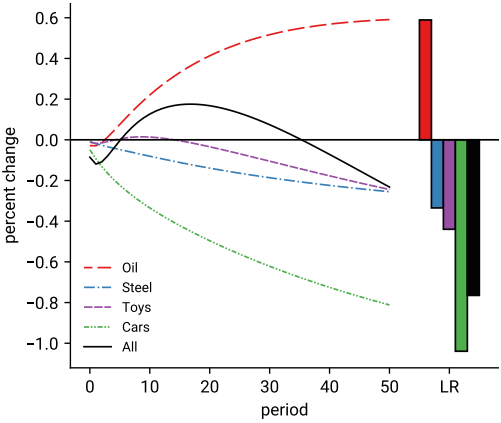
- What about macroeconomic consequences?
- Target all countries or just China?
- What if other countries retaliate?
- What if there were no adjustment frictions?
- For simplicity, focus on across-the-board tariffs on all goods sectors

Goods employment vs. aggregate GDP

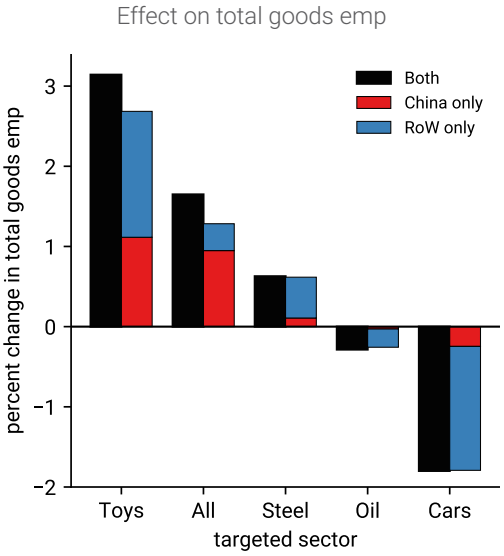
Long-run effects



GDP dynamics

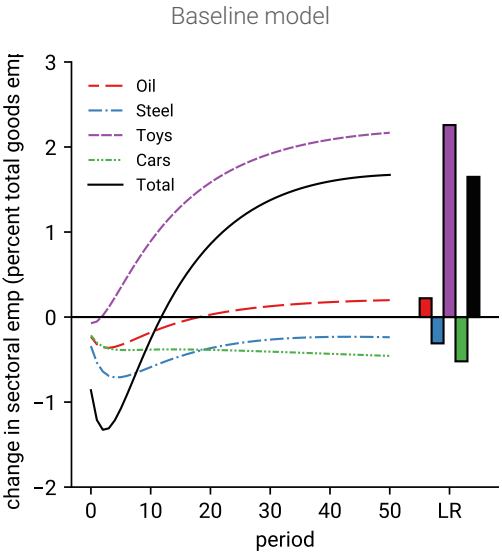


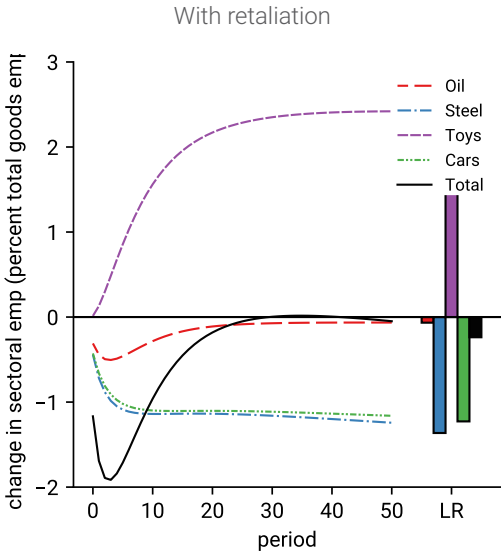
Target all countries or just China?



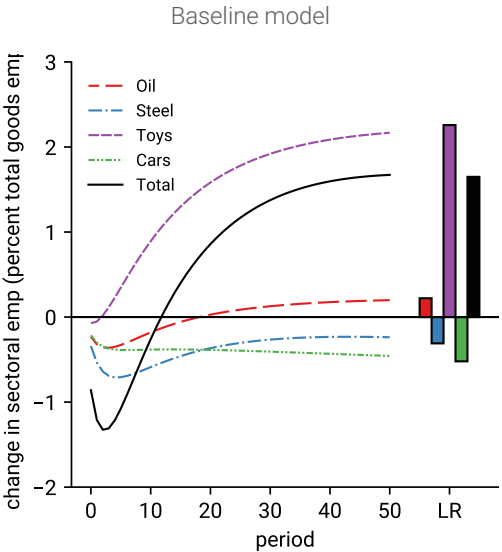
- Targeting only one country diverts trade to the other, reducing domestic production boost
- Especially in high-elasticity sectors where substituting between import sources is easy
  → Most diversion in “toys”, least in “cars” & “steel”
- Less diversion when one country is a minor supplier
  → “Oil” has a high elasticity, but little potential for diversion because US buys barely any from China

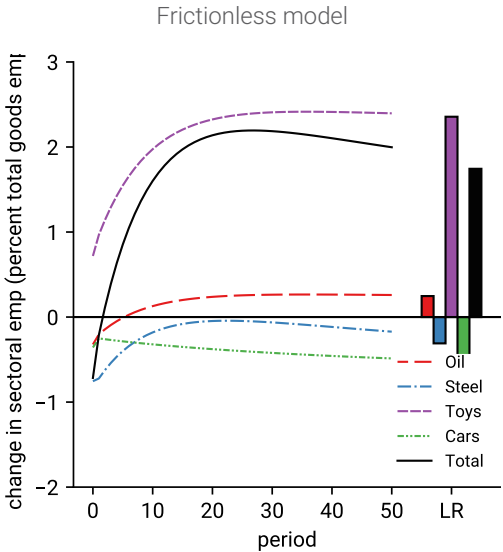
Effects of retaliation





Effects of adjustment frictions





Conclusion

Summary

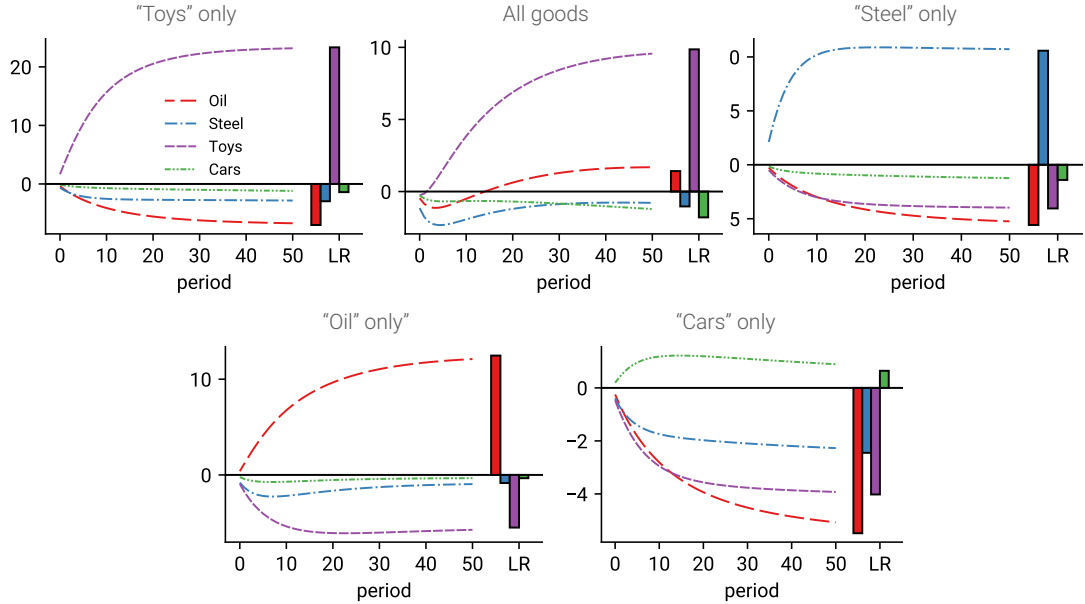
- Can tariffs increase mfg employment? Yes, but with some caveats.
- Long-run gain may require short-term pain
  - → Employment can fall for 10+ years before rising
  - → Supply-chain adjustment frictions play crucial role. W/o frictions, employment rises immediately.
- More reallocation across mfg industries than overall reindustrialization
  - → Broad tariffs only boost employment in consumer goods (“toys”). All other mfg industries shrink.
  - → Targeted tariffs can raise employment in industries with nat-sec concerns (cars, heavy machinery, etc.), but may shrink overall mfg sector
- Gains only possible if targeted countries don’t retaliate
  - → With retaliation, no gain in long run and more pain in short run

Parting thoughts

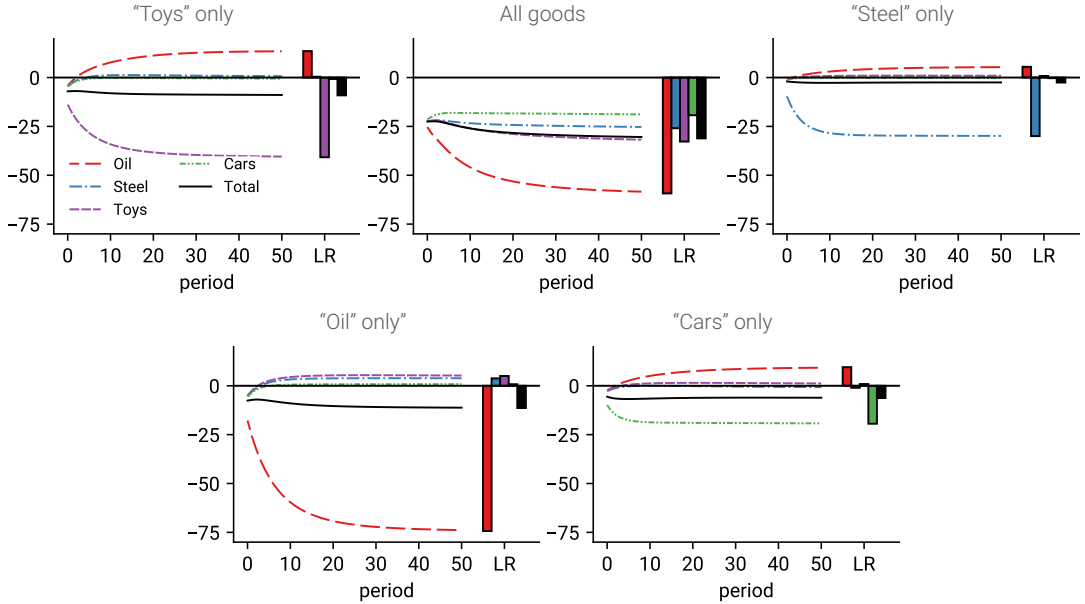
- Positive analysis only. Don't draw normative conclusions.
- Manufacturing employment ! = welfare
  - → Welfare impact depends on what revenues are used for
  - → Consumption can rise in LR with lump-sum tariffs even though output falls
  - → But transition also matters! Next paper: optimal tariffs w/ vs. w/o supply-chain frictions.
- Hard to model and quantify nat-sec concerns
  - → Maybe gov't is willing to boost "cars" even if rest of mfg sector shrinks
- $TFP = F(\text{tariffs})$?
  - → Protectionism often justified by scale/learning externality. But Baumol effect would attenuate effect on employment in equilibrium (Kehoe et al. 2018).
  - → But trade may also raise productivity (Atkeson-Burstein 2010). Could go other way!

Appendix

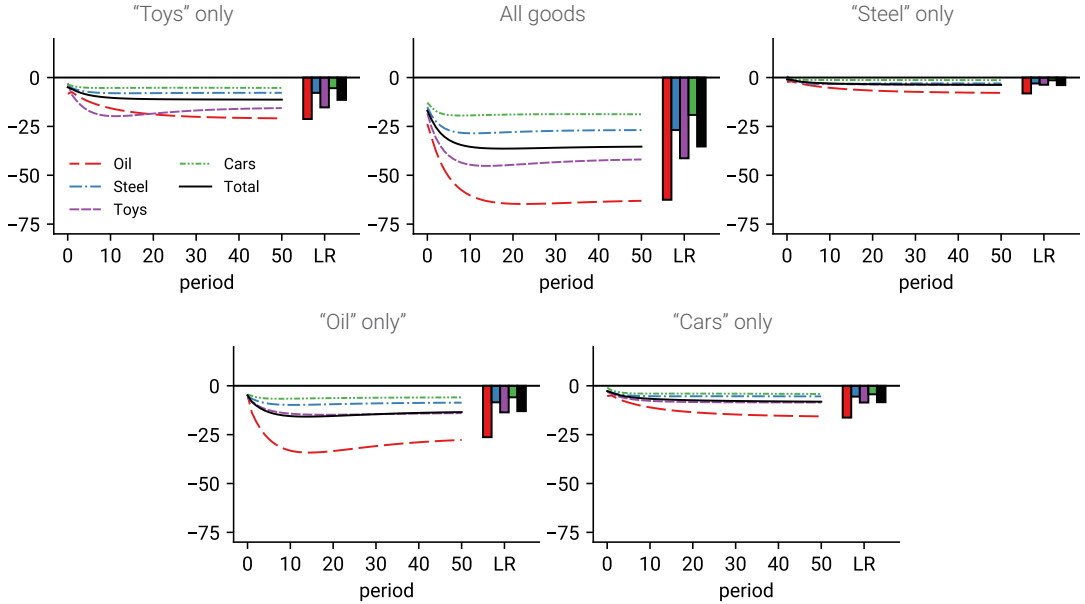
Gross output (pct changes)



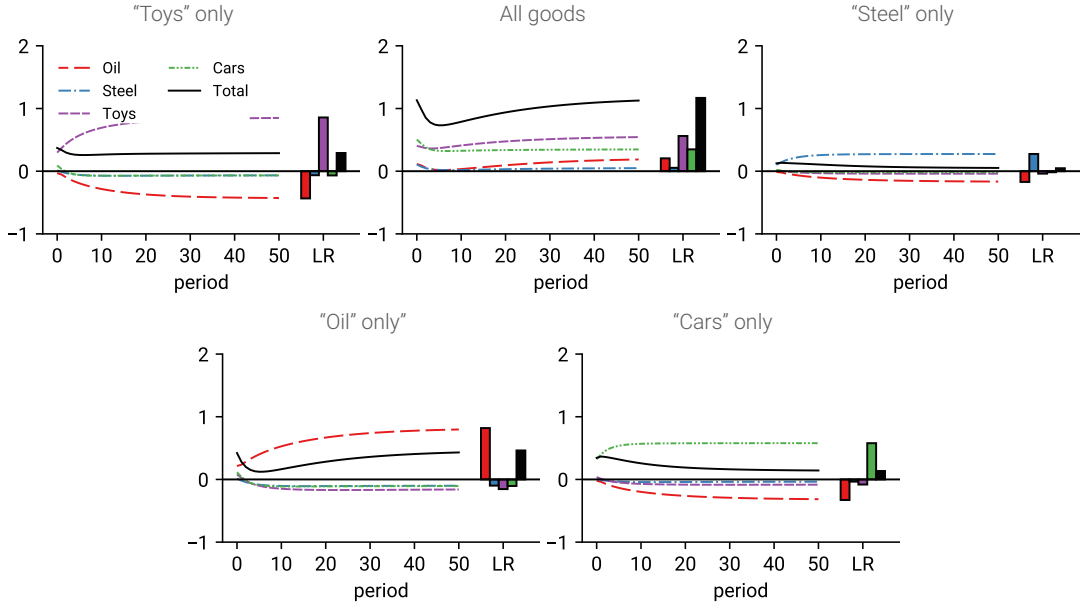
Imports (pct changes)



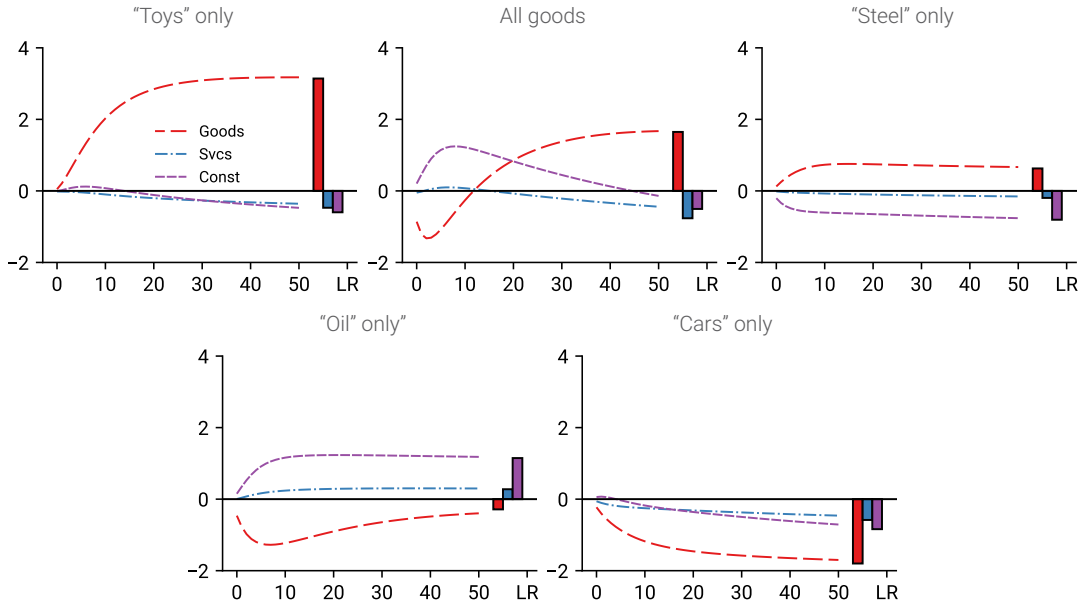
Exports (pct changes)



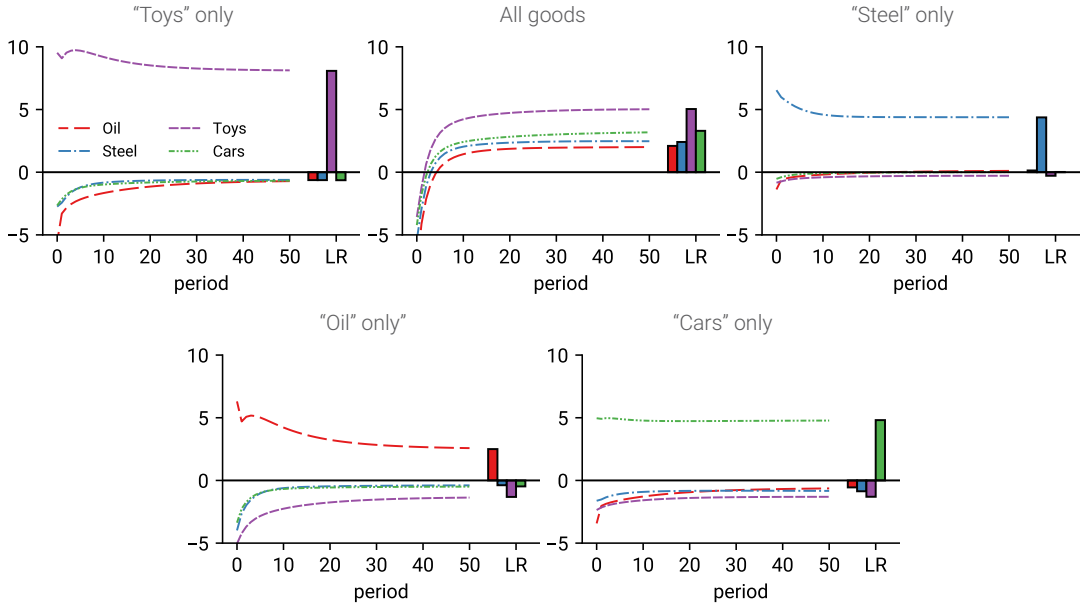
Net exports/GDP (pp changes)



Sector-level employment (pct changes)



Intermediate goods prices (pct changes)



Final goods prices (pct changes)