The Long-Term Impact of Steel Tariffs on U.S. Manufacturing

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June 7, 2021
Motivation

- Globally integrated supply chains complicate traditional cost-benefit analysis of tariff policy.

- Measures designed to temporarily insulate upstream industries can have cascading effects.
  - Employment and production Bown et al. (2020), Flaaen and Pierce (2019).
  - Prices and welfare Amiti et al. (2019), Cavallo et al. (2019), Fajgelbaum et al. (2020).
  - Downstream export growth Handley et al. (2020).

- Little to no evidence on whether these unintended consequences are temporary, like the tariffs, or persistent.
This Paper: Three Contributions

   - Construct this using publicly available exclusion requests filed in response to Trump’s tariffs.

2. **New empirical evidence of long-term effects:** temporary tariffs upstream have persistent impacts on downstream industries due to permanent restructuring of global trade flows.

3. Simple framework shows **persistence of downstream impacts substantially impacts welfare implications** of tariff policy.
Outline

Policy Setting: Background on the Bush Steel Tariffs

New Steel-Specific Input-Output Table

Estimation and Results

Welfare Implications
Background: The Bush Steel Tariffs

- Announced March 5, 2002; went into effect March 20, 2002.
- Covered 171 steel products (HS8).
- Ranged from 8 to 30 percent on top of existing rates.
- Eliminated early in December 2003.

Figure: Trade-Weighted Average Tariff Rate on Protected Steel Products
Advantages of this Setting

▶ Steel is a broadly used input—particularly prone to broad downstream effects.

▶ Shock!
  ▶ Temporary increase from near-zero.
  ▶ Somewhat politically unexpected.

▶ Rates varied across steel products → downstream industries face different input taxes.

▶ Long-Term data available.
Difficulty in Estimating Downstream Effects

▶ Goal is to compare **relative outcomes of downstream industries** leveraging variation in input tariffs.

▶ **Data Constraint:** linking downstream industries to specific steel inputs/tariffs.

▶ **Tariffs highly specific:** *Flat-rolled products of iron or nonalloy steel, of a width of 600 mm or more, hot-rolled, not clad, plated or coated, not in coils, not further worked than hot-rolled, with patterns in relief of a thickness of 4.75mm or more.*

▶ **Input-Output table is very broad:** *Iron and Steel Mills and Ferroalloy Manufacturing.*
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Steel-Specific Input-Output Table (SS-IO)

- Use publicly available exclusion requests from Regulations.gov filed in response to Trump’s Section 232 steel tariffs.

- Firms filed OMB Form 064-0139 for each individual 10-digit steel product they wanted excluded from tariffs.

- Report information on use of the steel product, justification for exclusion, etc.

- By definition, exclusion requesting firm is a downstream user of a very specific upstream steel product.
Steel-Specific Input-Output Table (SS-IO)

- Cover 170 of the 171 protected steel products, linked to 1,200 downstream products (HS6).
- Linked downstream industries represented $176 billion in exports in 2001 (roughly a quarter of U.S. exports).
- Exclusion requests used only to link inputs to industries.

Time-Consistency Assumption
SS-IO Proof of Concept

- Benefits over obvious alternative data sources (i.e., Census):
  - Publicly available.
  - Methodology works for other upstream inputs (e.g., aluminum).
  - Unique information.

- Efficacy of input-output linkages:
  - Upstream import unit values predict linked downstream industry material costs.
  - Intensity of use highly correlated with similar measures from BEA.
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Welfare Implications
Estimation: Dynamic Specification

\[ x_{d,t} - x_{d,2001} = \alpha_t + \beta_t (\tau_{d,2003} - \tau_{d,2001}) + \Xi_t' X_d + \Sigma_{t,d} \]

- Where \( \tau_d \) is a weighted average of tariffs on \( d \)'s associated upstream inputs.

- **Outcome Variables:** trade flows (U.S. and global) and domestic outcomes.

- **Samples:**
  - All downstream industries.
  - Intense users of steel (above median steel cost-share).

- **Endogeneity Concerns?**
  - No pre-trends in main results.
  - Endogeneity will work *against* my results.
Results: Global Market Share

Response to 1 p.p. Increase in Statutory Rate

- Tariff Period
- 95% Confidence Interval
- Response

Quintiles
Quartiles

All Downstream
Above Median Intensity
Results: Exports and Export Prices

(a) Export Values

(b) Export Prices

Quintiles

Quartiles
Results: Global Market Share Shifts to Other Top Producers

\[ x_{dj,t} - x_{dj,2001} = \alpha_t + \beta_t (\tau_{d,2003} - \tau_{d,2001}) + \Xi'_t X_d + \Sigma_{t,d} \]

Additional positive effects for France and Belgium.

Top exporters in 2001 (pre-tariff): USA (1), Germany (2), Japan (3), France (4), China (8), Belgium (9).
Results: Domestic Outcomes More Transitory

Data: NBER CES Mfg Industry Database & QCEW (subset of downstream NAICS industries).

(a) Employment

(b) Value of Shipments
Outline

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Welfare Implications
Welfare Implications

- Conventional cost-benefit analysis of tariff policy focuses on impacts within protected industry.
  - Calculate upstream impacts of 2002-2003 steel tariffs following methodology from Amiti et al. (2019).

- Incorporating contemporaneous and persistent downstream impacts substantially changes welfare implications.

- Illustrate this using a simple partial equilibrium framework for thinking about dynamic welfare implications.
Welfare Implications: Downstream (Static)

1. Steel tariffs $\rightarrow$ inward shift of downstream U.S. supply curve.

   $\blacktriangleright$ **Empirics:** exports, employment, shipments ↓; export prices ↑.

\[
\Delta\text{Welfare} = \Delta PS = (A + B) - (B + C) = D
\]
Welfare Implications: Downstream (Dynamic)

1. Tariffs lifted $\rightarrow$ U.S. Supply reverts to pre-tariff location.
   - **Empirics:** Low persistence in domestic impacts.
2. Foreign buyers that shifted to other sources do not return.
   - **Intuition:** Fixed cost of switching (Baldwin and Krugman (1989)).
   - **Empirics:** Persistent decline in U.S. export share, U.S. export prices.

\[ \Delta \text{Welfare} = \Delta PS = B \]
Estimation Procedure

Welfare changes downstream represented by trapezoids $D$ and $B$:

$$\Delta W_t = \frac{x_0 + x_t}{2} \times (p_{x,t} - p_{x,0})$$

Dynamic regression coefficients give us $\frac{\partial \text{prices}_t}{\partial \tau}$ and $\frac{\partial \text{exports}_t}{\partial \tau}$, e.g.,

$$p_{d,t} - p_{d,2001} = \alpha_t + \beta_t^{\text{prices}} \ln\left(\frac{(1 + \tau_{d,2003})}{(1 + \tau_{d,2001})}\right) + \Xi'_t X_d + \Sigma_{d,t}$$

Rewrite $\Delta W_t$ as:

$$\frac{\partial W_t}{\partial \tau} \approx \frac{1}{2} \sum_d (p_{d,t} x_{d,t}) \times (\Delta \tau_d)^2 \times \beta_t^{\text{price}} \begin{bmatrix} \beta_t^{\text{exports}} & - \beta_t^{\text{price}} \end{bmatrix}$$
Welfare Estimates (All)

Use $\beta$’s from full sample regressions.

Table: Overall Welfare Losses ($B$)

<table>
<thead>
<tr>
<th>Year</th>
<th>(1) Upstream</th>
<th>(2) Static</th>
<th>(3) Dynamic</th>
<th>(4) Net, % Exports</th>
<th>(5) Net, % GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0 [ 0.00,0.00]</td>
<td>0 [ 0.00,0.00]</td>
</tr>
<tr>
<td>2002</td>
<td>0.33</td>
<td>0.02</td>
<td>0.02</td>
<td>0.19 [ 0.07,0.31]</td>
<td>0 [ 0.00,0.01]</td>
</tr>
<tr>
<td>2003</td>
<td>0.26</td>
<td>0.32</td>
<td>0.32</td>
<td>0.31 [ 0.00,0.62]</td>
<td>0.01 [ 0.00,0.01]</td>
</tr>
<tr>
<td>2004</td>
<td>0</td>
<td>0</td>
<td>1.61</td>
<td>0.75 [-0.33,1.82]</td>
<td>0.01 [-0.01,0.03]</td>
</tr>
<tr>
<td>2005</td>
<td>0</td>
<td>0</td>
<td>0.74</td>
<td>0.3 [-1.57,2.18]</td>
<td>0.01 [-0.03,0.04]</td>
</tr>
<tr>
<td>2006</td>
<td>0</td>
<td>0</td>
<td>0.84</td>
<td>0.3 [-0.46,1.06]</td>
<td>0.01 [-0.01,0.02]</td>
</tr>
<tr>
<td>2007</td>
<td>0</td>
<td>0</td>
<td>0.97</td>
<td>0.3 [-0.40,1.00]</td>
<td>0.01 [-0.01,0.02]</td>
</tr>
<tr>
<td>2008</td>
<td>0</td>
<td>0</td>
<td>1.19</td>
<td>0.32 [-0.88,1.52]</td>
<td>0.01 [-0.02,0.04]</td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
<td>0</td>
<td>0.24</td>
<td>0.09 [-0.25,0.42]</td>
<td>0 [ 0.00,0.01]</td>
</tr>
</tbody>
</table>

Note. 90 percent confidence intervals calculated using asymptotic standard errors.
Conclusion

▶ New **Steel-Specific IO table** provides detailed linkages between steel inputs and downstream industries.

▶ Provided **new evidence of the long-term downstream impacts** of temporary upstream tariffs.

▶ Temporary upstream steel tariffs cause **persistent negative impacts** to downstream industries.
  ▶ Particularly for intense users of steel.
  ▶ Particularly on the export margin.

▶ Incorporating the dynamic downstream impacts of tariffs substantially alters welfare implications of upstream tariffs.
References I


References II


References IV

