Tariff Incidence:

Evidence from U.S. Sugar Duties, 1890-1930

Douglas Irwin
Dartmouth College & NBER
Who bears the burden of import tariffs?

- Charles Bickerdike, EJ (1906)

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**THE THEORY OF INCIPENT TAXES**

The object of this article is to call attention to some interesting generalisations which can be established when we study the tendency of very small taxes as they begin to come into operation. It is more especially in connection with international trade and the vexed question of "taxing the foreigner" that the interest of the theory lies, but the method of approaching questions of incidence by considering first the tendency of incipient taxes has some use also in connection with purely domestic taxation. In connection with international trade, the question arises whether a country, by means of taxes, can get more favourable terms of exchange with foreigners in such a way as to leave a net advantage, after allowing for the disadvantages involved in turning production from its "natural" course, as it used to be expressed.

The two propositions which I venture to put forward are:

1. That in pure theory advantage is always possible in normal circumstances from either import or export taxation when the taxes are small enough, except in one peculiar and unlikely case.¹

2. That, in the case of incipient import taxes, the tendency to advantage is greater the more elastic the demand of the taxing country for the articles taxed.

This implies that a tax on finished articles, as a whole, would tend to give more advantage than a tax on raw materials, and that a tax on the importation of an article of which there was an untaxed home supply would give more advantage, initially, than would be the case if there were no home supply. That is to say, with taxes not exceeding some definite height, there seems to be a certain theoretical correctness in the methods followed by Protectionists. How far in any actual case such taxes could be increased to something of tangible importance and still

¹ Below, p. 822.
Tariff incidence: what do we know?

– Computational Evidence
  • CGE models imply large terms of trade effects
  • Costinot & Rodriguez-Clare (2013) – US, Ireland: 20%

– Elasticity Evidence
  • Broda, Limão, & Weinstein (AER 2008)
  • Correlation of tariffs and export supply elasticities
  • Belarus, Latvia, Lebanon, Lithuania, Ukraine?
  • Paraguay and Algeria have more market power than China and Russia? Optimal tariffs of 200-300%?
  • Olarreaga et al 2013 – optimal tariffs 4%

– Empirical Evidence
  • Winkelmann & Winkelmann (JIE 1998)
  • New Zealand is a small country
### Previous U.S. Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Goods</th>
<th>Data</th>
<th>Pass-through to consumer prices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sales Taxes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poterba (1996)</td>
<td>3 goods</td>
<td>Quarterly</td>
<td>≈ 100%</td>
</tr>
<tr>
<td>Besley &amp; Rosen (1999)</td>
<td>12 goods</td>
<td>Quarterly</td>
<td>&gt; 100%</td>
</tr>
<tr>
<td><strong>Tariff Changes</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Kreinin (1961)</td>
<td>1956 GATT Round</td>
<td>Annual</td>
<td>≈ 50%</td>
</tr>
<tr>
<td>Feenstra (1989)</td>
<td>2 goods</td>
<td>Monthly</td>
<td>60% for trucks 100% for motorcycles</td>
</tr>
</tbody>
</table>
Why pre-1930?

- Unilateral tariff changes (no bargaining)
- Large tariff changes (up & down)
- No exchange rate variation (gold standard)
Why sugar?

• U.S. plausibly a large country
  – 20-25% of world consumption
  – Cuba major supplier (20-30% of US sugar)
  – Cuba depends on US market (exports 95%+ to US)

• Unique price data
  – One place: New York City
  – Landed and wholesale price of 96° raw sugar
  – High frequency: weekly, daily
U.S. share of world sugar consumption
Fig. 4. The great bulk of the sugar moving in international trade moves north and west from Java, and north and east from Cuba, the two leading surplus-producing countries. Secondary sources of supply are Hawaii, the Philippine Islands, Porto Rico, Czechoslovakia, Formosa, Brazil, and Peru. The United States and Canada, the United Kingdom, and western Europe, India, China, and Japan are the chief sugar-importing countries.
### U. S. FOUR PORTS SUMMARY TO MAR. 2, 1893, in Tons

<table>
<thead>
<tr>
<th></th>
<th>1892</th>
<th>1893</th>
<th>Increase</th>
</tr>
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<tbody>
<tr>
<td>Imports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New York</td>
<td>5001</td>
<td>3665</td>
<td></td>
</tr>
<tr>
<td>Boston</td>
<td>4054</td>
<td>2596</td>
<td></td>
</tr>
<tr>
<td>Philadelphia</td>
<td>1092</td>
<td>411</td>
<td></td>
</tr>
<tr>
<td>Baltimore</td>
<td>1084</td>
<td>161</td>
<td></td>
</tr>
<tr>
<td>Total Imports</td>
<td>10,741</td>
<td>6,648</td>
<td></td>
</tr>
<tr>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New York</td>
<td>3567</td>
<td>1976</td>
<td></td>
</tr>
<tr>
<td>Boston</td>
<td>2872</td>
<td>1695</td>
<td></td>
</tr>
<tr>
<td>Philadelphia</td>
<td>704</td>
<td>213</td>
<td></td>
</tr>
<tr>
<td>Baltimore</td>
<td>1359</td>
<td>221</td>
<td></td>
</tr>
<tr>
<td>Total Exports</td>
<td>7,256</td>
<td>4,134</td>
<td></td>
</tr>
<tr>
<td>Balance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New York</td>
<td>70</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Boston</td>
<td>1272</td>
<td>801</td>
<td></td>
</tr>
<tr>
<td>Philadelphia</td>
<td>704</td>
<td>213</td>
<td></td>
</tr>
<tr>
<td>Baltimore</td>
<td>1359</td>
<td>221</td>
<td></td>
</tr>
<tr>
<td>Total Balance</td>
<td>3025</td>
<td>1862</td>
<td></td>
</tr>
</tbody>
</table>

### Refined Sugar Quotations

**New York**
- Mar. 2: Final Week, Last Month, Last Year
  - Crushed: $0.05
  - Sacks: $0.05
  - Standard: $0.05
  - Extra Fine: $0.05
  - Wood: $0.05
  - Fijian: $0.05
  - Extra Fijian: $0.05
  - Hawaiian: $0.05
  - Hawaiian Extra: $0.05
  - Ceylon: $0.05
  - Ceylon Extra: $0.05
  - Madagascar: $0.05
  - Madagascar Extra: $0.05
  - P. I.: $0.05
  - P. I. Extra: $0.05
  - English: $0.05
  - English Extra: $0.05
  - Seconds: $0.05

**Philadelphia**
- Mar. 2: Final Week, Last Month, Last Year
  - Crushed: $0.05
  - Sacks: $0.05
  - Standard: $0.05
  - Extra Fine: $0.05
  - Wood: $0.05
  - Fijian: $0.05
  - Extra Fijian: $0.05
  - Hawaiian: $0.05
  - Hawaiian Extra: $0.05
  - Ceylon: $0.05
  - Ceylon Extra: $0.05
  - Madagascar: $0.05
  - Madagascar Extra: $0.05
  - P. I.: $0.05
  - P. I. Extra: $0.05
  - English: $0.05
  - English Extra: $0.05
  - Seconds: $0.05
Market structure

• Cuban supply
  – Perfectly competitive

• US demand
  – Sugar refiners in New York
  – Highly competitive oligopoly
    • Genesove & Mullin (Rand 1998)
New York sugar refining
Ad valorem tariff on raw sugar
THE OPENING OF THE CONGRESSIONAL SESSION.

TOMMY MORRISON:—Here I am again! What are you going to do with me?
Weekly sugar prices

cents per pound

1890 1895 1900 1905 1910

Cuba New York
Estimation approach

- **Weekly**
  \[ \Delta \log(p_i) = \alpha + \sum_{j=1}^{5} \beta_j \Delta \log(1 + \tau)_j + \epsilon \]
  - \( i = \) landed price, customs-cleared price
  - Plus month, year fixed effects

- **Monthly**
  - Control for wholesale prices, industrial production


Table 2: Tariff Incidence on Domestic and Import Prices

<table>
<thead>
<tr>
<th>Year of Tariff</th>
<th>Percent change in price due to tariff</th>
<th>Domestic Price (New York)</th>
<th>Import Price (Cuba)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1891</td>
<td>-50</td>
<td>0.94** (0.07)</td>
<td>-0.03 (0.08)</td>
</tr>
<tr>
<td>1894</td>
<td>+34</td>
<td>0.19* (0.11)</td>
<td>-0.80** (0.11)</td>
</tr>
<tr>
<td>1897</td>
<td>+26</td>
<td>0.39** (0.14)</td>
<td>-0.86** (0.15)</td>
</tr>
<tr>
<td>1903</td>
<td>-17</td>
<td>0.13 (0.21)</td>
<td>0.27 (0.23)</td>
</tr>
<tr>
<td>1914</td>
<td>-10</td>
<td>1.20** (0.36)</td>
<td>0.20 (0.38)</td>
</tr>
</tbody>
</table>

Note: Weekly data from January 1, 1890-July 31, 1914. Number of observations is 1,278. Month and year fixed effects included.
Table 3: Dynamic Adjustment of Prices in Response to Tariff Shock

Import Price – Cuba

<table>
<thead>
<tr>
<th></th>
<th>t-2</th>
<th>t-1</th>
<th>t</th>
<th>t+1</th>
<th>t+2</th>
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</thead>
<tbody>
<tr>
<td>1891</td>
<td>0.05</td>
<td>-0.06</td>
<td>-0.03</td>
<td>-0.07</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.08)</td>
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<tr>
<td>1894</td>
<td>0.10</td>
<td>0.21*</td>
<td>-0.79*</td>
<td>-0.00</td>
<td>-0.00</td>
</tr>
<tr>
<td></td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.12)</td>
</tr>
<tr>
<td>1897</td>
<td>0.06</td>
<td>-0.03</td>
<td>-0.87*</td>
<td>-0.04</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
<td>(0.15)</td>
<td>(0.15)</td>
<td>(0.15)</td>
<td>(0.15)</td>
<td>(0.15)</td>
</tr>
<tr>
<td>1903</td>
<td>0.05</td>
<td>0.15</td>
<td>0.25</td>
<td>-1.06*</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>(0.23)</td>
<td>(0.15)</td>
<td>(0.23)</td>
<td>(0.23)</td>
<td>(0.23)</td>
</tr>
<tr>
<td>1914</td>
<td>0.41</td>
<td>0.25</td>
<td>0.22</td>
<td>0.37</td>
<td>-0.22</td>
</tr>
<tr>
<td></td>
<td>(0.38)</td>
<td>(0.38)</td>
<td>(0.38)</td>
<td>(0.38)</td>
<td>(0.38)</td>
</tr>
</tbody>
</table>

Domestic Price - New York

<table>
<thead>
<tr>
<th></th>
<th>t-2</th>
<th>t-1</th>
<th>t</th>
<th>t+1</th>
<th>t+2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1891</td>
<td>0.03</td>
<td>-0.04</td>
<td>0.94*</td>
<td>0.00</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>1894</td>
<td>0.22*</td>
<td>0.10</td>
<td>0.20*</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
</tr>
<tr>
<td>1897</td>
<td>-0.15</td>
<td>-0.02</td>
<td>0.38*</td>
<td>-0.03</td>
<td>-0.03</td>
</tr>
<tr>
<td></td>
<td>(0.14)</td>
<td>(0.14)</td>
<td>(0.14)</td>
<td>(0.14)</td>
<td>(0.14)</td>
</tr>
<tr>
<td>1903</td>
<td>-0.02</td>
<td>0.78*</td>
<td>0.13</td>
<td>-0.02</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>(0.21)</td>
<td>(0.21)</td>
<td>(0.21)</td>
<td>(0.21)</td>
<td>(0.21)</td>
</tr>
<tr>
<td>1914</td>
<td>0.21</td>
<td>0.13</td>
<td>1.21*</td>
<td>0.25</td>
<td>-0.14</td>
</tr>
<tr>
<td></td>
<td>(0.36)</td>
<td>(0.36)</td>
<td>(0.36)</td>
<td>(0.36)</td>
<td>(0.36)</td>
</tr>
</tbody>
</table>

Note: Number of observations: 1275. Time period: weekly, January 1890 – June 1914.
1891

- New York price
- Cuban price (c.i.f.)
FIRST DAY OF FREE SUGAR

IT MADE BUSINESS EXCEEDINGLY BRISK FOR THE TRADE.

Retailers were benefited in some localities—heavy dealings at the coffee exchange—new industries likely.

Yesterday was a busy day among wholesale grocers and jobbers, as the reduction in prices of sugars went into effect, and all were overwhelmed with orders. Both wholesalers and retailers have for some time past been carrying very light stocks.

E. A. Clark, of the firm of Clark, Holly & Ketchum, said that they had reduced their prices of sugars to correspond with the general reduction. Granulated sugar had come down to 4 1/2 cents from 6 3/4 cents per pound, the price two weeks ago. Since that time wholesalers have been gradually reducing prices until 6 3/4 cents was reached a few days ago, so as to work off old stock. The prices of medium and yellow sugars range down to 3 1/2 cents per pound. The price of finest loaf sugar is 6 cents, and of the very fine powdered sugar used for high grade candies is 5 1/4 cents. The consumer, Mr. Clark believed, would get the full benefit of the reduction.
1894

New York price

Import price (Cuba, c.i.f.)

cents per pound

Aug

1894

Sep

2  9  16  23  30  6  13  20
1903

New York price

Import price (Cuba c.i.f.)
1914

New York price

Import price (Cuba, c.i.f.)

Jan | Feb | Mar | Apr
--- | --- | --- | ---
29  | 5   | 11  | 19
19  | 26  | 5   | 19
26  | 12  | 19  | 26
2   | 19  | 26  | 2
Daily prices (1914)

- New York price
- Import price (Cuba c.i.f.)
# Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Tariff Change</th>
<th>Incidence of Tariff Change</th>
<th>Domestic Prices</th>
<th>Import Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1890</td>
<td>↓</td>
<td>96%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>1894</td>
<td>↑</td>
<td>42%</td>
<td>59%</td>
<td></td>
</tr>
<tr>
<td>1897</td>
<td>↑</td>
<td>36%</td>
<td>64%</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>↓</td>
<td>83%</td>
<td>22%</td>
<td></td>
</tr>
<tr>
<td>1913</td>
<td>↓</td>
<td>100%</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>
Asymmetric response

• Common Finding
  – Exchange rates (Nakamura & Zerom REST 2010)
  – Gasoline (Borenstein, Cameron, Gilbert QJE 2007)
  – All prices (Peltzman JPE 2000)

• Possible explanations
  – Seasonality
  – Inventories
  – Pricing-to-market

• Sugar: not durable or storable but shiftable
PHILADELPHIA, July 24.—Of several vessels which were known to be steaming for this port laden with products dutiable under the new tariff act, and which were due here last night and to-day, the only one to arrive was the British steamship Hurworth, which sailed from Samarang, Java, May 22, heavily laden with sugar.

She passed in the Delaware Breakwater at 6 o'clock this morning. Four of the fastest steam tugboats in the service here were sent down the Delaware to give the steamer all the help possible, and at about 5 o'clock this afternoon she passed Marcus Hook, the beginning of the Philadelphia customs district.

Whether or not the Hurworth succeeded in saving the duties on her cargo will depend upon the decision of the Treasury Department as to the time the new Tariff bill shall be considered in force.
Monthly Imports

![Monthly Imports Chart]

- X-axis: Years (1890 to 1899)
- Y-axis: Monthly Imports in units

The chart illustrates the fluctuation of monthly imports from 1890 to 1899.
Asymmetric demand response
Check using monthly data

- Unit values (only import price)
- Higher level of aggregation

- Tariff reduction – consistent with no impact
- Tariff increase – unclear, less precision
Monthly import prices
(different series)
Pass-through to granulated sugar prices

- Only significant pass-through is in 1891
- Lower frequency price changes
- Absorbed through markup adjustment?
Interwar period

• Three tariff increases (1921, 1922, 1930)

• Philippines granted duty free access

• Trade diversion → terms of trade loss for Cuba

• Chang & Winters (AER 2002)
Ad valorem tariff on raw sugar
Weekly sugar prices

Cuba
New York
cents per pound

1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930

Cuba
New York
Table 2B: Tariff Incidence on Domestic and Import Prices

<table>
<thead>
<tr>
<th>Year of Tariff</th>
<th>Percent change in price due to tariff</th>
<th>Domestic Price (New York)</th>
<th>Import Price (Cuba)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1921</td>
<td>+12</td>
<td>-0.43 (0.27)</td>
<td>-1.99* (0.41)</td>
</tr>
<tr>
<td>1922</td>
<td>+4</td>
<td>0.96 (0.81)</td>
<td>0.14 (1.23)</td>
</tr>
<tr>
<td>1930</td>
<td>+16</td>
<td>0.04 (0.20)</td>
<td>-1.02* (0.31)</td>
</tr>
</tbody>
</table>

Note: Weekly data from January 1, 1921-December 31, 1930. Number of observations is 520. Month and year fixed effects included.
1921 tariff
increase of 0.6 cents per pound

New York
Cuba

Increase of 0.2 cents
1922 tariff

increase of 0.1648 cents per pound

From 4.61 cents to 4.77 cents

NY

Cuba
1930 tariff
increase of 0.2352 cents per pound
Effect on Sugar Market in 1930

<table>
<thead>
<tr>
<th></th>
<th>Imports</th>
<th>Average import price</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>(billions of pounds)</td>
<td>(per pound)</td>
</tr>
<tr>
<td></td>
<td>(import share in parenthesis)</td>
<td></td>
</tr>
<tr>
<td>Cuba</td>
<td>5.52 (77%)</td>
<td>1.8 cents</td>
</tr>
<tr>
<td>Philippines</td>
<td>1.56 (22%)</td>
<td>3.4 cents</td>
</tr>
<tr>
<td>Cuba</td>
<td>4.81 (74%)</td>
<td>1.2 cents</td>
</tr>
<tr>
<td>Philippines</td>
<td>1.73 (27%)</td>
<td>3.0 cents</td>
</tr>
<tr>
<td>Percentage Change</td>
<td>-12.8%</td>
<td>+10.5%</td>
</tr>
<tr>
<td></td>
<td>-33%</td>
<td>-11%</td>
</tr>
</tbody>
</table>
Price gap: Philippine-Cuban Sugar

Smoot-Hawley →
ASK AID IN SEEKING SUGAR TARIFF RISE

Domestic Producers' Committee Wants "Moral Support" of the Farm Board.

CHARGES CUBAN "DUMPING"

Body Composed Chiefly of Best Sugar Men Also Complains of Imports From Philippines.

Special to The New York Times.
WASHINGTON, Sept. 18.—Sugar beet and cane interests are trying to enlist the "moral support" of the Federal Farm Board in their efforts to get a higher duty on sugar. This was revealed today when the Farm Board made public recommendations of the sugar beet and sugar cane advisory committee, sent to it for consideration.

"While we appreciate that the Federal Farm Board is not empowered to deal with tariff matters," said the committee, "we feel that the sympathetic and moral support of the Federal Farm Board in our efforts to secure a higher tariff on sugar, either through the Tariff Commission or Congress, or the abolition of the present Cuban tariff preferential would add great weight to those efforts.

"We conceive also that valuable aid might be rendered by the economic staffs of the Federal Farm Board in the collection and collation of accurate data that may be used in the protection and furtherance of the industry."

The advisory committee set forth the following as problems of the solution of which it believed the Farm Board could aid:

"The tremendous impact of foreign competition, due to the dumping on our market of large quantities of Cuban sugar at ruinous prices, which is made possible by reason of the low cost of production in that Island, where tropical standards of living and wages exist.

"Wasteful practices existing in the domestic industry itself in the distribution and marketing, not alone of sugar produced in the continental United States and its insular possessions, but also that sugar which is refined in the seaboard refineries.
Conclusion

• Asymmetric incidence of tariff changes
  – Reductions: ≈ 100% pass-through
  – Increases: ≈ 40% percent pass through

• Asymmetric demand response
  – Forward shifting of imports with tariff increase
  – Little postponement with tariff decrease
The Smoot-Hawley Tariff of 1930
Cane sugar tariff

- Sugar imported from the Philippines & Cuba
- Philippines given duty free access
- Tariff on Cuban sugar hiked from 104% to 175%
Flow chart - raw sugar manufacture from sugar cane

Key to symbols:
- Process flow
- Gaseous, solid and liquid emissions
Why no price impact?

<table>
<thead>
<tr>
<th>Cuban Exports</th>
<th>1890</th>
<th>1891</th>
<th>Change</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>United States</td>
<td>513,355</td>
<td>707,237</td>
<td>+193,902</td>
<td>+38%</td>
</tr>
<tr>
<td>Other markets</td>
<td>122,904</td>
<td>100,505</td>
<td>-22,399</td>
<td>-18%</td>
</tr>
</tbody>
</table>
Figure 3. Sugar Production, Exports and Maximum Capacity of Active Mills

Sugar Exports and Maximum Capacity of Active Mills

Sources: production figures are from Moreno Fraginals (1978), vol. 3; exports are from Cuba Económica y Financiera, Anuario azucarero (1959); mill capacities are authors' elaboration using data from the Sec. de Agricultura, Comercio y Trabajo, Memoria de la zafra (1919-1929); continued by Memoria azucarera (1930-1939).
Bagwell-Staiger (2010)

• “the empirical relevance of terms-of-trade manipulation is much greater than has been widely believed . . . . most countries, even apparently ‘small’ countries, have significant ability to alter their terms of trade on many imported products with their tariff choices.”