Congressional Budget Office
Nonpartisan Analysis for the U.S. Congress

CBO's Conventional Tariff Analysis Model

May 2026

Introduction

Since early 2025, tariff policies have changed frequently in the United States, affecting revenues from tariffs as well as the economy.

To develop its budget and economic projections and inform Congress, the Congressional Budget Office regularly estimates the effects of changes in tariff policy.

CBO has developed several analytical frameworks to consistently estimate those effects.

One such framework is the Conventional Tariff Analysis Model (CTAM), which is used to estimate the effects of tariffs on revenues and imports from each U.S. trading partner.

A version of CTAM is publicly available on CBO's GitHub page.

Overview of CTAM

How CTAM Is Used

CTAM is used to estimate how changes in tariff rates affect imports and revenues from tariffs.

It is the main model that CBO uses to produce conventional estimates of the budgetary effects of changes in tariffs. (Conventional estimates consider the budgetary effects of a change while holding the size of the economy unchanged.) CBO regularly incorporates estimates from CTAM into other economic models the agency uses to analyze and forecast the economy.

- CBO uses additional models to estimate how changes in tariffs affect other economic outcomes, such as consumer prices, gross domestic product, or productivity.
- Estimates from CTAM and those other models are used to produce dynamic estimates of changes in tariffs—that is, estimates that account for the budgetary effects of changes in the size of the economy. They are also used to incorporate the effects of changes in tariffs into CBO's baseline projections.

For examples of CBO's analyses that use CTAM, see Congressional Budget Office, "CBO's Updated Projections of the Budgetary Effects of Tariffs as of November 15, 2025," *CBO Blog* (November 20, 2025), www.cbo.gov/publication/61877, and "An Update About CBO's Projections of the Budgetary Effects of Tariffs," *CBO Blog* (March 5, 2026), www.cbo.gov/publication/62210.

The CTAM Framework

CTAM is a nested constant elasticity of substitution (CES) model of imports, adapted from Fajgelbaum and others (2020).

- “Nested” refers to the model’s hierarchical structure, which simulates the order and scope of consumers’ decisions.

- CES models are a standard tool in the research literature on international trade.

- As in other Armington-style* models, consumers choose an optimal basket of goods that are differentiated by product type and by the country from which they are purchased.

- Consumers base their decisions on tariff-inclusive prices and a fixed consumption budget.

The effect on consumer behavior from changes in tariffs is modeled by comparing baseline trade patterns with patterns estimated under alternative tariff scenarios. CTAM is used to estimate the change in total imports of each product from each country under the alternative scenario.

* “Armington-style” refers to the seminal CES trade model presented in Armington (1969). In the description of CTAM that follows, “consumers” generally refers to households and firms.

CTAM’s Nested Structure

Three “Nests” of Substitution

CTAM consists of three levels, or nests, of substitution that characterize consumer behavior:

- Foreign-to-foreign substitutions,
- Within-industry substitutions, and
- Foreign-to-domestic substitutions.

Foreign-to-Foreign Substitutions

Foreign-to-foreign substitutions occur when consumers substitute one foreign source of a product for another foreign source within a narrowly defined product category.

- Products are grouped by their 10-digit HTS commodity codes.
- Consumers' sensitivity to a change in tariff rates is defined by a **microelasticity** of substitution. (That microelasticity is a numeric value that reflects how easily consumers can substitute a product from one country for a different variety of that product from a different country.)

HTS = Harmonized Tariff Schedule.

Within-Industry Substitutions

Within-industry substitutions occur when consumers substitute one product for another within the same industry.

- Industries are grouped by their four-digit NAICS industry codes.
- Consumers' sensitivity to a change in tariff rates is defined by an elasticity of substitution within a given industry.

NAICS = North American Industry Classification System.

Foreign-to-Domestic Substitutions

Foreign-to-domestic substitutions occur when consumers substitute a domestic good for a foreign good within the same industry.

- The foreign-to-domestic nest is aggregated at the level of four-digit NAICS industry codes.
- Consumers' sensitivity to a change in tariff rates is defined by a **macroelasticity** of substitution.

NAICS = North American Industry Classification System.

CTAM’s Nested Structure: Analyzing a Hypothetical Increase in a Tariff on Coffee Imported From Brazil

The **foreign-to-foreign** nest determines how consumers shift their purchases of coffee from Brazil (which becomes relatively more expensive with the tariff) to coffee from other foreign sources, such as Mexico or Colombia.

Even with the shift to other foreign sources, the tariff increases the cost of coffee in relation to other beverages. The **within-industry** nest determines how consumers shift their purchases of beverages away from coffee and toward other products, such as tea or soda.

Even with the shift to other beverages, the tariff increases the cost of imported beverages. The **foreign-to-domestic** nest determines how consumers shift their purchases of beverages from imported foreign beverages toward domestically produced ones.

Taking all three types of shifts, or substitutions, into account, CTAM is used to produce an estimate of the value of imports of each category of beverage from each source country under the higher tariff on Brazilian coffee.

Mathematical Foundations of CTAM

CTAM's Mathematical Foundations

In CES models, consumers have a "love of variety" and select an amount of each product (x_{i}) to consume to maximize their utility (U) subject to a fixed budget.

$$U_{\mathrm{CES}}(x) = \left(\sum_{\mathrm{i}} a_{\mathrm{i}} * x_{\mathrm{i}}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

When relative prices change, consumers shift, or substitute, away from higher-priced products and toward lower-priced ones.

According to preferences in CES models, a given percentage change in the relative prices of products always results in the same rate of substitution between products. That implies that consumption responses are determined only by the relative price changes, not by the price level or consumption level of any individual product.

In the equation above, parameter a reflects consumer preferences for each product i.

Mathematical Foundations: **Foreign-to-Foreign Nest**

Within CTAM, imports are determined by a nested series of standard CES demand functions. Imports ($x_{s,i,o}$) of a product (i) within an industry (s) that are sourced from a country of origin (o) are determined by the price of the product ($p_{s,i,o}$), its tariff rate ($\tau_{s,i,o}$), its baseline import share ($\bar{\mathrm{h}}_{s,i,o}$), a price index for the product across origin countries ($\mathrm{P}_{s,i}$), and the foreign-to-foreign elasticity of substitution (σ_3).

$$x_{s,i,o} = \bar{\mathrm{h}}_{s,i,o}\left(\frac{\mathrm{P}_{s,i}}{(1+\tau_{s,i,o})p_{s,i,o}}\right)^{\sigma_3}$$

$$\mathrm{P}_{s,i} = \left(\sum_{\mathrm{o}} \bar{\mathrm{h}}_{s,i,o}\left[(1+\tau_{s,i,o})p_{s,i,o}\right]^{1-\sigma_3}\right)^{\frac{1}{1-\sigma_3}}$$

$$\bar{\mathrm{h}}_{s,i,o} = \frac{\bar{x}_{s,i,o}}{\bar{x}_{s,i}} = \frac{\bar{x}_{s,i,o}}{\sum_{\mathrm{o}} \bar{x}_{s,i,o}}$$

Baseline import values ($\bar{x}_{s,i,o}$) are used to calibrate the model to initial market conditions (before the change in the tariff rate) and consumer preferences.

In the equation above, baseline prices are normalized to 1, and new prices are solved for in terms of percentage changes.

Mathematical Foundations: **Within-Industry Nest**

Total imports ($x_{s,i}$) of each product (i) within an industry (s) are determined by the price index of the product ($\mathrm{P}_{s,i}$), the price index for the industry (P_s), the baseline import share of the product ($\bar{\mathrm{h}}_{\mathrm{s,i}}$), and the elasticity of substitution within the given industry (σ_2).

$$x_{s,i} = \bar{\mathrm{h}}_{\mathrm{s,i}} \left(\frac{\mathrm{P}_s}{\mathrm{P}_{s,i}} \right)^{\sigma_2}$$

$$\mathrm{P}_s = \left(\sum_{\mathrm{i}} \bar{\mathrm{h}}_{\mathrm{s,i}} \mathrm{P}_{s,i}{}^{1-\sigma_2} \right)^{\frac{1}{1-\sigma_2}}$$

$$\bar{\mathrm{h}}_{\mathrm{s,i}} = \frac{\bar{x}_{\mathrm{s,i}}}{\bar{x}_{\mathrm{s}}} = \frac{\bar{x}_{\mathrm{s,i}}}{\sum_{\mathrm{i}} \bar{x}_{\mathrm{s,i}}}$$

$$\sigma_2 = \frac{2}{3} \sigma_3$$

Mathematical Foundations: Foreign-to-Domestic Nest

Total imports (x_s) in each industry (s) are determined by the price index for the industry (P_s), the industry import share ($\bar{\mathrm{h}}_s$), and the macroelasticity of substitution (σ_1).

$$x_s = \bar{\mathrm{h}}_\mathrm{s} \mathrm{P}_s{}^{-\sigma_1}$$

$$\bar{\mathrm{h}}_\mathrm{s} = \frac{\bar{x}_\mathrm{s}}{\bar{x}} = \frac{\bar{x}_\mathrm{s}}{\sum_\mathrm{s} \bar{x}_\mathrm{s}}$$

$$\sigma_1 = \frac{1}{2}\sigma_3$$

Producing Multiyear Estimates With the Static CES Model

The nested CES model is a static model that produces estimates for a single period.

To produce a multiyear sequence of estimates for the 11-year projection period, the model is run 11 times.

For each of the 11 iterations, the following modifications are then made:

- Elasticities of substitution are adjusted to allow for higher levels of substitution over time, and
- Baseline import values are altered to reflect the projected change in growth of nominal imports (in relation to growth before the change in tariffs).

Combining the 11 iterations produces a sequence of estimates that reflects the time path of tariff responses over 11 years.

Elasticities of Substitution in CTAM

Elasticities of Substitution: **Key Parameters in CTAM**

Elasticities of substitution determine how much consumers respond to a change in tariffs.

- Higher elasticity values imply stronger responses to tariffs, which result in higher rates of substitution toward countries with lower relative tariff rates and away from countries with higher relative tariff rates. Higher substitution implies a smaller effect on revenues from changes in tariffs.
- Lower elasticity values imply weaker responses to tariffs, which result in lower rates of substitution and larger effects on revenues from tariffs.
- Elasticities reflect considerations such as the availability of alternative sources, consumers' sensitivity to prices, contractual obligations, and the degree of differentiation among products.

In addition to varying across the three nests of substitution, CTAM elasticities vary over time and across industries.

Elasticities of Substitution: **Nests**

CTAM uses a different elasticity of substitution within each nest, thus following the approach of Fajgelbaum and others (2020):

- **Foreign-to-foreign.** The microelasticity is equal to 5 on the basis of Head and Mayer's (2014) study of elasticity values in the research literature.*

- **Within-industry.** The within-industry elasticities are equal to $2/3 \times$ microelasticity (or 3.3), as in Fajgelbaum and others (2020).

- **Foreign-to-domestic.** The macroelasticity is equal to $1/2 \times$ microelasticity (or 2.5), as in Fajgelbaum and others (2020).

The relative values reflect that the same product from a different country tends to be a closer substitute than a different product from the same industry. Also, substituting different products within an industry—drawing on any global source—is easier than shifting to domestically sourced goods.

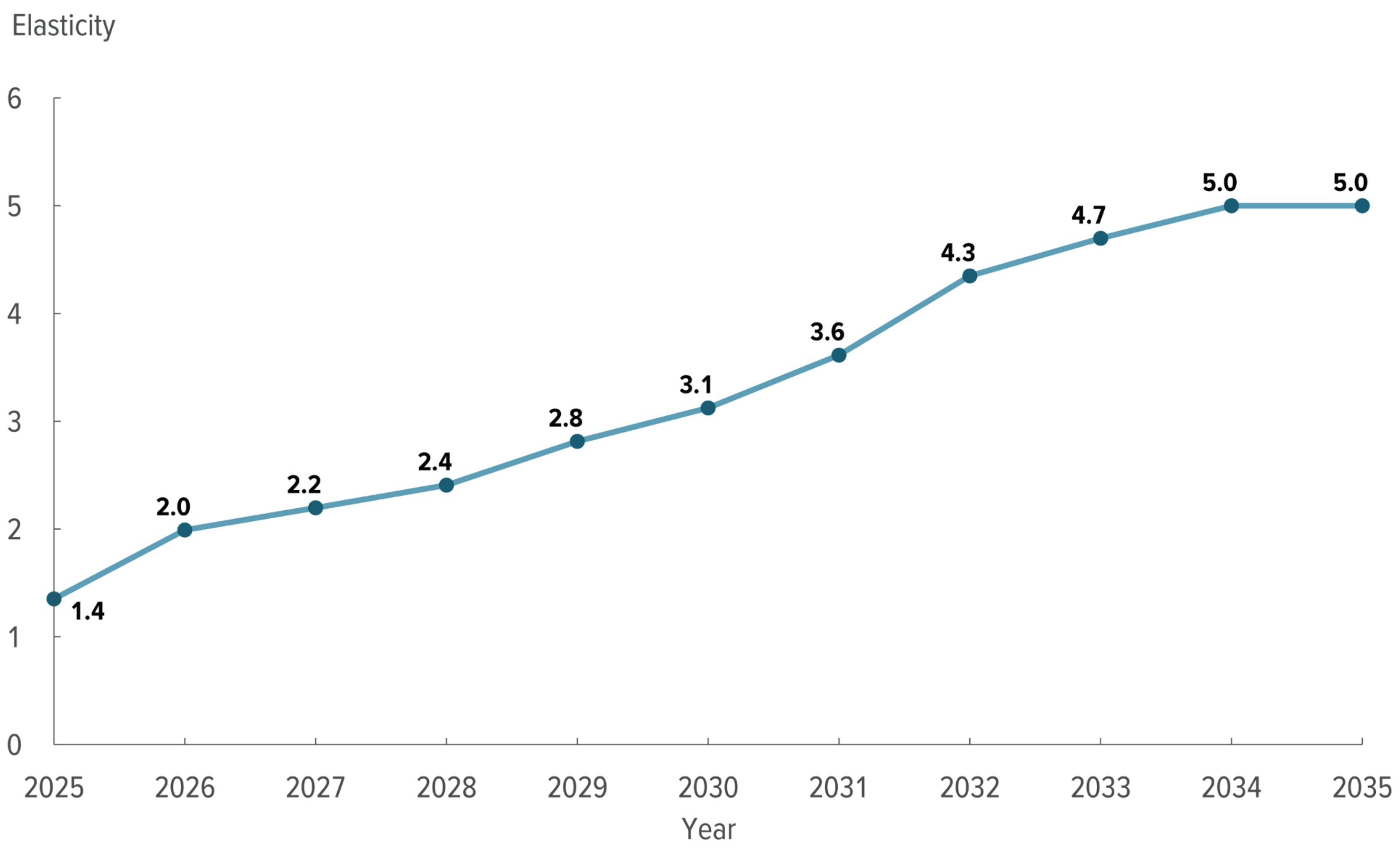
* As discussed in later slides, 5 represents the average long-term elasticity across industries.

Elasticities of Substitution: **Time**

In CTAM, elasticities evolve over time on the basis of estimates in Boehm, Levchenko, and Pandalai-Nayar (2023).

- In the short run, elasticities are small, reflecting challenges associated with quickly implementing decisions about the sourcing of products.
- In the long run, consumers are more flexible, and elasticities are larger than they are in the short run.

Elasticity of Foreign-to-Foreign Substitutions Over Time



The long-run (10 years and beyond) foreign-to-foreign elasticity among import sources is equal to 5 on the basis of Head and Mayer (2014).

The short-run foreign-to-foreign elasticity is scaled down to 1.4 in the first year on the basis of the time path shown in Boehm, Levchenko, and Pandalai-Nayar (2023). Elasticities for the other nests are scaled in the same way.

Elasticities of Substitution: **Industries**

In CTAM, some industries are more responsive to tariffs than others.

The relative differences in elasticities are based on industry-specific estimates from four studies (Ahmad and Riker 2020, Caliendo and Parro 2015, Hertel and others 2007, and Broda and Weinstein 2006).

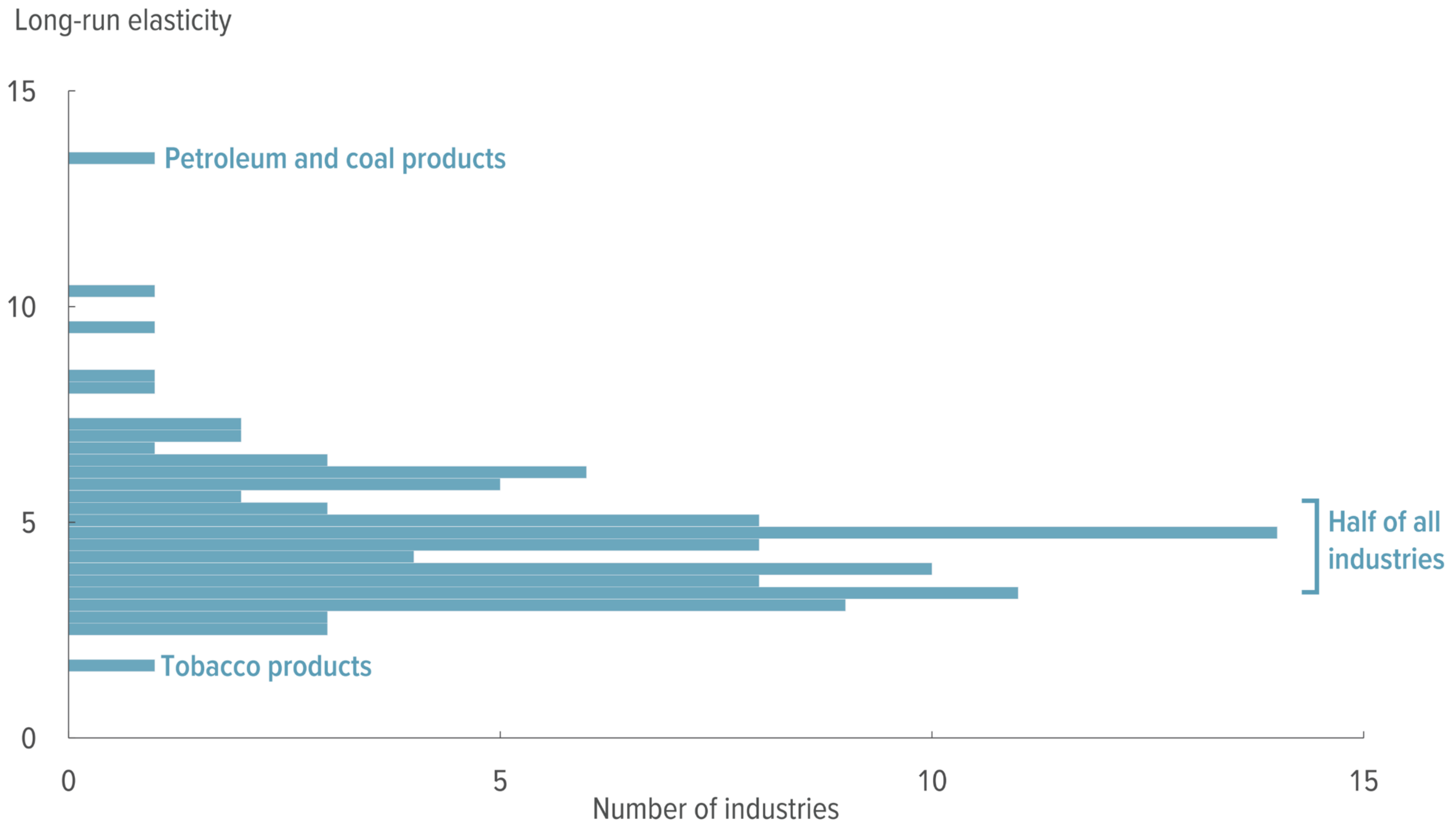
The variation in the estimates from each study is used to produce a distribution of values across 108 industries.

The industry estimates are considered long-run foreign-to-foreign elasticities, and the constructed distribution is recentered around a mean of 5 to align the estimates with the results of Head and Mayer’s (2014) study.

The foreign-to-foreign elasticity for each industry is scaled down from the long run to the short run on the basis of the time path in Boehm, Levchenko, and Pandalai-Nayar (2023).

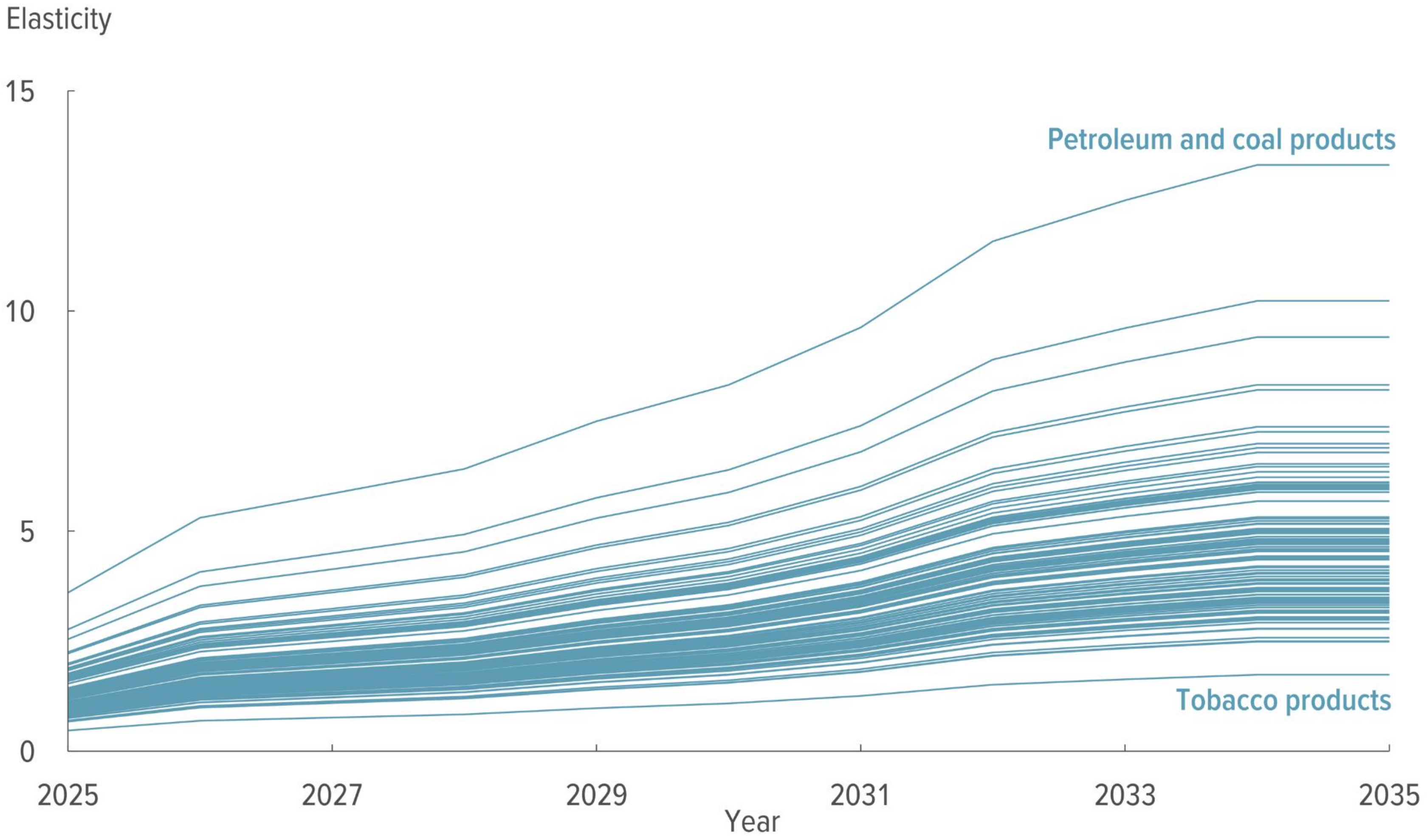
CTAM’s elasticities are based on elasticities from the research literature that were typically estimated using statutory tariff rates and observed trade values. Elasticities in CTAM, like those estimated in the literature, reflect trade values that exclude tariffs. Additionally, the elasticities—from the research literature and in CTAM—account for substitution toward other goods and countries as well as changes in consumption that result from changes in tariff rates.

Distribution of Long-Run Foreign-to-Foreign Elasticities Across Industries



For half of the 108 industries analyzed in CTAM, foreign-to-foreign elasticities fall within the range of 3.5 to 5.3 in the long run (2035, in this case).

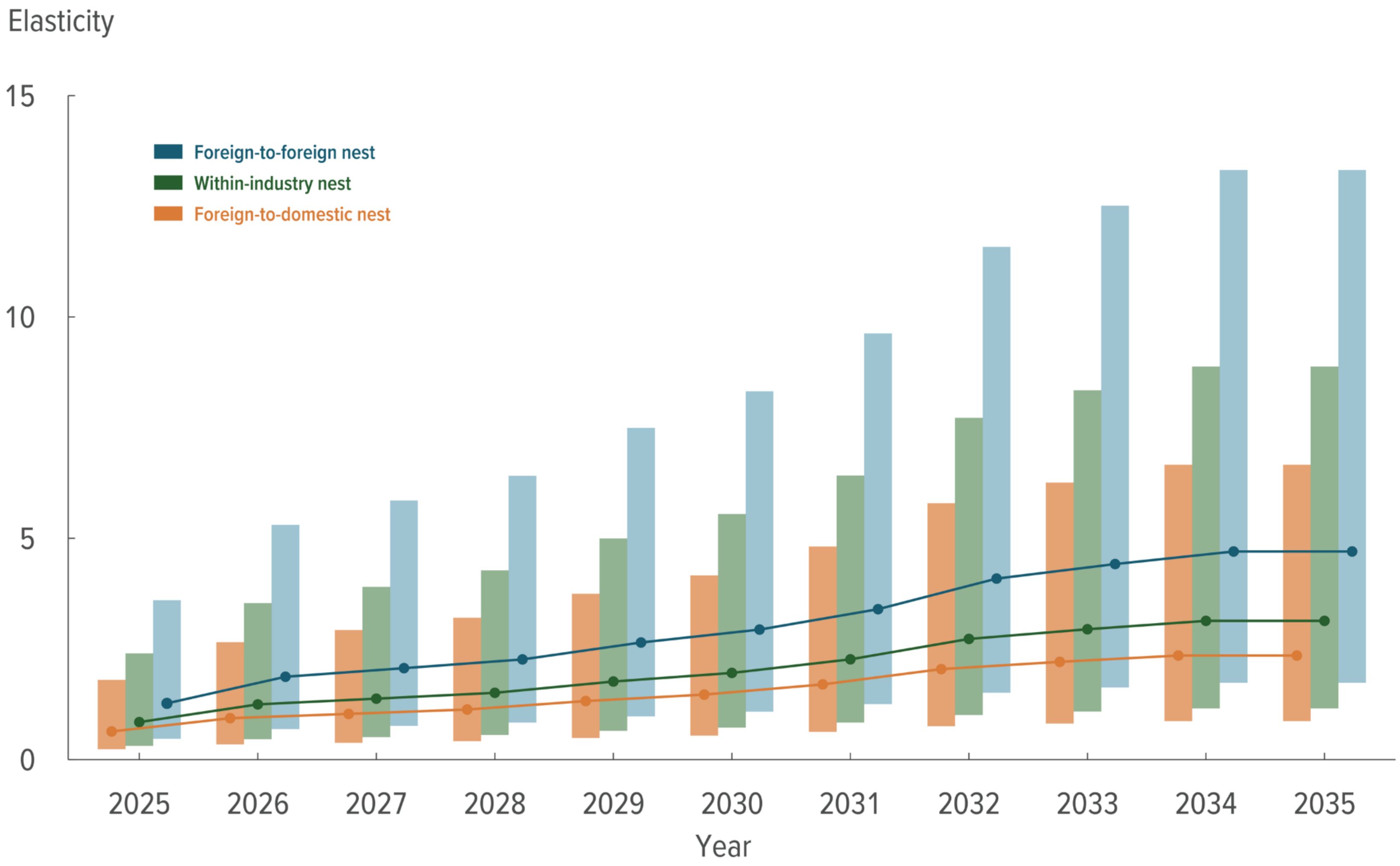
Time Paths of Foreign-to-Foreign Elasticities for Various Industries



Foreign-to-foreign elasticities are scaled down from the long run (2035) to the short run (2025).

For tobacco products, elasticities range from 0.5 in the short run to 1.7 in the long run; for petroleum and coal products, they range from 3.6 to 13.3.

Elasticities of Substitution: Nests, Time, and Industries



CTAM uses a distribution of elasticities across industries that differs for each nest and time period.

The segmented lines in the figure show the mean elasticity for each nest over time. The colored bars show the range of values across industries for each nest and time period.

Data Inputs and Specifications in CTAM

Data Inputs

CTAM relies on several data inputs:

- **Historical trade flows.** Monthly import data for the baseline year (at the 10-digit HTS product level) from the Census Bureau are used to establish a baseline for nominal imports and trade shares.

- **Projected import growth.** Annual nominal growth rates for imports are sourced from CBO's economic projections and used to extrapolate baseline values in CTAM over the 11-year projection period.

- **Baseline tariff rates.** To derive a baseline tariff rate, census data for "calculated duties" are divided by "imports for consumption" in the baseline year.

Specifications for New Tariff Policies

In CTAM, new tariff policies are specified by assigning an additional or alternative tariff rate to each product from each source country. In some cases, special features must be accounted for:

- **Preferential treatment.** Certain products may enter the United States duty-free under preferential agreements such as those covered by the United States–Mexico–Canada Agreement (USMCA) or the Dominican Republic–Central America Free Trade Agreement. Other agreements may create more complex interactions, such as the European Union agreement's specification of maximum tariff rates, which takes pre-existing tariff rates into account.

- **Input content**. Some tariffs are applied only to the value of certain inputs to the product, such as the value of the steel, aluminum, or copper embedded in the product.

- **Value originating in the United States.** Some tariffs apply only to the nondomestic content of an imported good, such as USMCA-compliant automobiles.

Using CTAM to Analyze a Change in Tariff Policy

General Steps in Using CTAM

To analyze a change in tariff policy using CTAM:

1. Users specify a profile of alternative tariff rates.

2. CTAM is used to estimate import values under the alternative rates.

3. Using the updated import values, CTAM calculates:
   - The increase or decrease in revenues from the new tariff policy and
   - The change in revenues—attributable to a change in the amount of imports—that would have been collected under previous tariff policies.

4. CTAM's calculation of the net change in revenues is then adjusted to account for certain factors.

Adjustments to Estimates of Revenues

CBO also accounts for several factors when estimating the budgetary effects of changes in tariff policy:

- **Timing of revenues.** When applicable, estimated revenues are adjusted within a fiscal year to account for partial-year changes in tariffs.

- **Delays.** CBO adjusts its estimates of revenues to account for delays in the implementation or collection of customs duties. For example:

  - Goods already in the process of being shipped are often not subject to new tariffs.

  - Under the Periodic Monthly Statement program administered by Customs and Border Protection, payments are often made up to 45 days after products have cleared customs.

Adjustments for Conventional Estimates

CBO’s estimates of policy changes sometimes reflect the assumption that the overall size of the economy remains unchanged. Cost estimates for legislation that incorporate that assumption are referred to as “conventional” estimates.

For changes in tariffs estimated with CTAM, that assumption is implemented by allowing the total value of imported goods to change while holding the total value of all net imports unchanged. For example, a reduction in imported goods may be offset by some combination of an increase in imported services and a reduction in exports.

CBO’s estimates also reflect that a change in tariff revenues is a change in indirect business taxes. Indirect business taxes affect the tax base for taxes on income and payroll taxes paid by individuals and businesses. In conventional estimates, CBO accounts for that effect by applying an “offset” that reflects the impact on those other revenue sources. (For more information, see CBO 2022.)

Recent Estimates of Effects From Changes in Tariffs Using CTAM

CBO has regularly informed Congress about how changes in tariffs would affect the federal budget and the economy.

In CBO's projections, higher tariffs since 2025 result in higher revenues and lower federal deficits. The magnitudes of those effects have changed as tariff policies have changed:

- In November 2025, CBO estimated that increases in tariffs since January 2025 would reduce total deficits by $3 trillion over the 2025–2035 period in relation to the agency's January 2025 baseline projections.
- In March 2026, CBO estimated that the termination of tariffs implemented under the International Emergency Economic Powers Act would increase total deficits by $2 trillion over the 2026–2036 period in relation to the agency's February 2026 baseline projections.

In addition, CBO expects higher tariffs to temporarily raise the rate of inflation, reduce real (inflation-adjusted) investment, lower real gross domestic product, and reduce employment.

See Congressional Budget Office, "CBO's Updated Projections of the Budgetary Effects of Tariffs as of November 15, 2025," *CBO Blog* (November 20, 2025), www.cbo.gov/publication/61877, and "An Update About CBO's Projections of the Budgetary Effects of Tariffs," *CBO Blog* (March 5, 2026), www.cbo.gov/publication/62210.

Sources of Uncertainty

CBO's modeling of recent tariff policies is subject to uncertainty:

- **Historical precedence.** The United States has not implemented changes in tariffs of this size in many decades, so there is little empirical evidence to guide estimates of their long-term effects. Moreover, consumers and businesses could be more responsive or less responsive to changes in tariffs of this size, which would cause trade and revenues to diverge from projected values.

- **Policy administration.** If there are changes to the ways that tariff policies are administered, such as the introduction or termination of exemptions, trade flows and the amount of customs duties collected could differ substantially from CBO's estimates.

CBO will continue to assess how businesses and consumers respond to changes in tariffs and will incorporate that information in future analyses.

References and Attributions

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About This Document

This document was prepared to enhance the transparency of the work of the Congressional Budget Office and to encourage external review of that work. In keeping with CBO's mandate to provide objective, impartial analysis, the document makes no recommendations.

The document is the result of work by Nicholas Abushacra (formerly of CBO), Kenneth Austin Castellanos, Daniel Fried, Peter Herman, Jack Lynch, Natalia Reyes, Emma Uebelhor, Tyler Van Patten, and Griffin Young.

Devrim Demirel, Joseph Kile, John McClelland, Molly Saunders-Scott, and Joshua Shakin provided comments. Jeffrey Kling reviewed the document, Scott Craver edited it, and Jorge Salazar created the graphics.

CBO seeks feedback to make its work as useful as possible. Please send comments to communications@cbo.gov.