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Tariffs and Consumer Prices

Insights from newly matched consumption-trade micro data

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Summary:

We evaluate the impact of various US tariff scenarios on consumer prices using novel micro-level data linking imports to consumer expenditures. Results indicate that an additional 10 percent tariff on Chinese imports, 25 percent tariffs on Canadian and Mexican imports, and 10 percent tariff on other countries could raise consumer prices on everyday retail purchases, such as food and beverage items and general merchandise, covering about a quarter of the total consumption basket, by 0.81 percent to 1.63 percent, assuming half to full pass-through. Notably, tariffs on Canada and Mexico contribute approximately 45 percent of the total price effect. Our results focus on direct effects of tariffs on a quarter of the total consumption basket, and the aggregate effect on the overall Consumer Price Index (CPI) further hinges on the price sensitivity of the excluded consumption categories, particularly transportation, services, energy, and housing.

Key findings:

1. Consumer Price Increases: An additional 10 percent tariff on Chinese imports, 25 percent tariffs on Canadian and Mexican imports, and 10 percent tariffs on other countries could raise consumer prices on everyday retail purchases such as food and beverage items and general merchandise, covering about a quarter of the total consumption basket, by 0.81 percent to 1.63 percent, assuming half to full pass-through. The aggregate effect on the overall Consumer Price Index (CPI) further hinges on the price sensitivity of the remainder of the consumption basket.
2. Reduced Dependence on China: The United States has decreased its reliance on Chinese imports since the last trade war, mitigating some negative price impacts from new tariffs.
3. Significant Impact from Canada and Mexico: Tariffs on Canada and Mexico account for half of the total projected price increases, reflecting the broader scope of current tariff scenarios.

Center Affiliation: Center for Quantitative Economic Research

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Key words: tariffs, consumer prices, trade

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1 Introduction

In the last decade, trade protectionism and industrial policy have seen a resurgence. The re-emergence of such policies is motivated by varying aims, including revitalizing domestic manufacturing, safeguarding employment, and geopolitical competition (Juhász, Lane and Rodrik, 2023). One of the primary mechanisms in which this has played out is through international trade policies and tariffs. The 2018-19 US-China trade war is a notable example, with the two countries engaging in a cycle of retaliatory tariffs. After five years of stability in the tariff rate between the United States and China, policymakers have recently discussed proposals for a new round of US tariff hikes—not only on China but also on other countries, including Canada and Mexico.

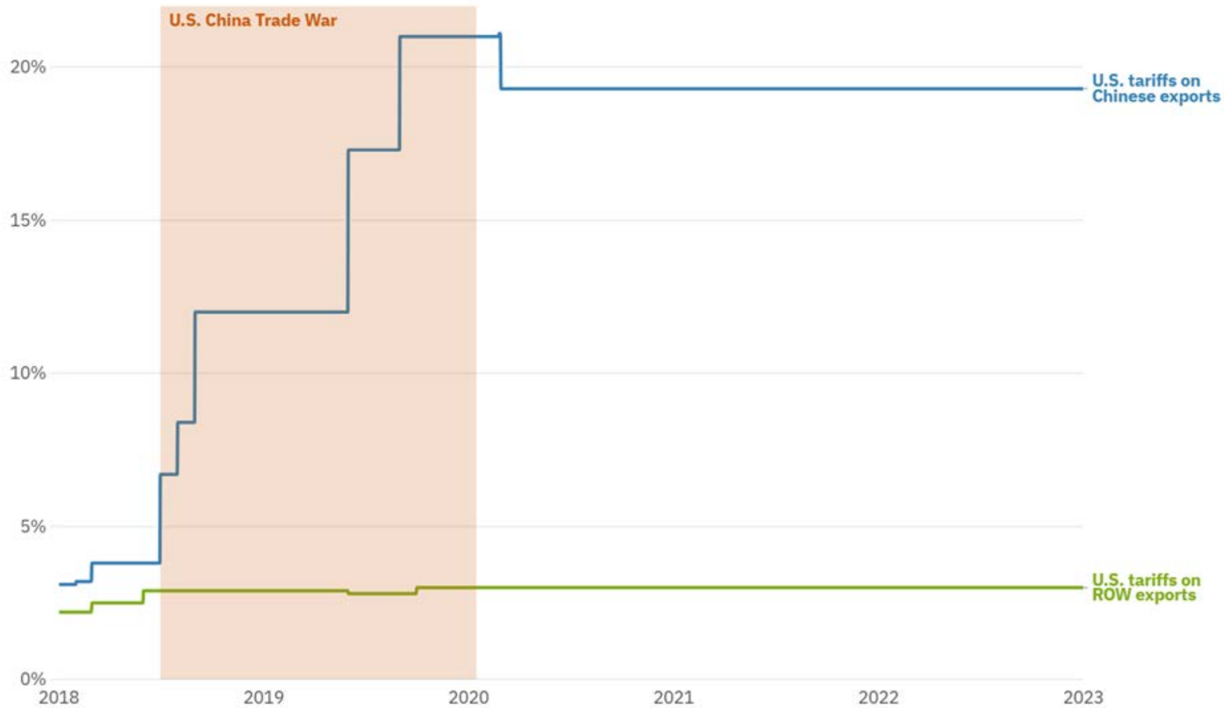
While higher tariffs create tariff revenue and favor domestic producers, the price consumers must pay to buy imported goods will increase because firms typically pass some portion of the tariff's cost onto consumers. Therefore, an important component for evaluating the aggregate impact of tariff policies on consumer well-being is the extent to which consumers will face higher prices as a result (Fajgelbaum and Khandelwal, 2022).

This paper provides insights into the consumer price pressures we could expect from different plausible tariff scenarios. To do so, we provide a back-of-the-envelope calculation of the price effects of tariffs using a novel dataset that links US imports to consumer expenditures on everyday retail purchases such as food and beverage items and general merchandise, representing about a quarter of the total consumption basket. In a nutshell, price effects depend on the pass-through of tariffs to import prices and the transmission of higher import prices to consumer prices, which depends on the importance of imported varieties in the consumer basket. The matched imports-consumer expenditure data allow us to construct the approximate price effect on US consumers of different tariff scenarios while taking into account the micro-heterogeneity in consumer expenditures, firm product sourcing, and recent changes in the international trade landscape.

Our results indicate that an additional 10 percent tariff on Chinese imports, 25 percent tariffs on Canadian and Mexican imports,[1] and an additional 10 percent tariff on the rest of the world could raise consumer prices on everyday retail purchases, such as food and beverage items and general merchandise, by 0.81 percent to 1.63 percent, assuming half to full pass-through. Our results focus on about a quarter of the total consumption basket as data exclude expenditure categories, such as transportation, energy, housing, and most services. The aggregate effect on the overall Consumer Price Index (CPI) further hinges on the price sensitivity of the excluded consumption categories, the estimation of which goes beyond the scope of this paper. Additionally, indirect effects of tariffs through input-output linkages are not accounted for.

[1] Executive orders issued on February 1, 2025 already imposed these tariffs on China, Canada, and Mexico. However, Canada and Mexico negotiated a 30-day pause on the enactment of these tariffs.

Figure 1: U.S. China Tariff Rates Toward Each Other



Note: Trade-weighted average US tariff rate on Chinese exports and exports from the rest of the world.
Source: Bown (2021). See also Bown and Kolb (2021).

2 Retrospective of the 2018–19 Trade War

Departing from a nearly century-long trend of tariff reduction, in mid-2018, the United States instituted targeted tariffs on select Chinese-manufactured goods. In retaliation, China imposed new tariffs on a selection of US goods. Figure 1 illustrates the participation of the United States in the cycle of retaliatory tariffs that resulted in the average tariff rate on Chinese imports stabilizing at nearly 20 percent by January 2020.[2]

The studies evaluating the implications of the 2018–19 US-China trade war generally find negative welfare effects for US consumers. Fajgelbaum and Khandelwal (2022) review the literature consensus on the welfare effects. In standard trade models, consumer welfare implications of tariffs, to the first order, comprise three main components: costs of imports, gains from exports, and gains from revenues generated (Dixit and Norman, 1985). Focusing on the higher import costs, empirical studies of the 2018–19 trade war revealed that the tariff hikes were fully passed through to import prices (Amiti, Redding and Weinstein, 2019; Fajgelbaum et al., 2020; Cavallo et al., 2021*a*).[3] This complete pass-through on prices of imported goods, combined with the values of the import share of GDP and the fraction of US imports targeted by

[2] By the end of the Trade War, tariffs were applied to two-thirds of imports from China.

[3] The findings on the complete pass-through during the 2018–19 trade war contrast with earlier studies, which found incomplete pass-through from tariffs and exchange rate fluctuations (e.g. (Amiti, Redding and Weinstein, 2019)).

tariff increases, led the authors to estimate a welfare decrease due to increased import costs of approximately –0.58 percent of US GDP. Higher revenues from tariffs and export prices partly offset the adverse welfare effects from the importer cost channel, but the estimated aggregate welfare effect is still negative, at –0.10 percent of GDP. Other studies (Flaaen and Pierce, 2019; Waugh, 2021) also find that increased tariffs were negatively associated with domestic employment due to rising input costs and retaliatory tariffs.

3 Expected Price Changes of Tariff Scenarios

Motivated by recent discussions of possible tariff hikes, we use a first-order approach to estimate expected price effects from several tariff scenarios in 2025. After introducing the first-order approach, we outline data sources and discuss two significant changes in the economy since 2018: i) a declining dependence on Chinese imports since the first trade war, which—relative to the previous trade war—could mitigate the negative effect of new tariffs through the import cost channel, and ii) the recent period of high inflation, which might limit firms' ability to further raise consumer prices. Lastly, motivated by how these changes might mitigate the impact of future tariffs on consumer prices, we investigate the price effect of various potential tariff scenarios for 2025.

The first-order approach to estimating price effects

We provide a methodology to construct the change in the price index from tariffs, taking into account both the consumer's micro-level expenditure weights across firms, and firms' heterogeneous import structure and exposure to specific countries. The methodology builds on first-order approximation to characterize the equivalent variation (EV) from price changes (Porto, 2006; Atkin, Faber and Gonzalez-Navarro, 2018; Borusyak and Jaravel, 2021; Allen et al., 2022). Here, we summarize only the resulting equation, and the appendix provides detailed derivations. The key equation captures how tariff changes ($d\ln(1+\tau_c)$) contribute to a change in the aggregate price index ($d\ln P$) through expenditure shares, sectoral openness, and import exposure. It is expressed as:

(1)

$$d\ln P \approx \varepsilon^p \sum_{\omega} \text{Expenditure Share}_{\omega} \times \text{Import Intensity}_{j(\omega)} \times \sum_{c} \text{Imports Affected}_{\omega,c} \times d\ln(1+\tau_c).$$

Here, ε^p represents the pass-through elasticity of the effective firm-level tariff change to prices. "Expenditure Share" measures the share of consumer expenditures on firm ω in the overall consumption basket; sectoral "Import Intensity" captures the share of imports of the firm's sector $j(\omega)$; and "Imports Affected" reflects the share of the firm's imports from a specific country c. This decomposition takes the firm-level import profile into account by constructing an exposure measure to country-specific tariff changes. Expenditure shares then aggregate these changes into price index changes. The decomposition, therefore, offers a tractable way to quantify the price index effects of tariff changes, taking into account both detailed consumer-level expenditure data and firm-level import data.

Data

We rely on aggregate import statistics as well as a new micro-level dataset combining firm imports and consumer expenditures. For aggregate import data, we use statistics from Census USA Trade Online. From the US census's USA Trade Online tool, which contains the universe of all trade into and out of the United States, we extract aggregate monthly measures of US import values by their country of origin and their associated NAICS-6 industry classification code. These variables allow us to construct country-sector import shares.

To obtain a finer measure of the exposure of consumer expenditures to the affected imports, we rely on the new dataset constructed in Baslandze and Fuchs (2025) that links two large-scale micro-level datasets. The first dataset is shipment-level bill of lading (BoL) data from S&P Panjiva that allows us to observe firm-level imports, and the second dataset is a large consumer expenditure panel from Numerator that allows us to evaluate consumer spending on products from different firms.

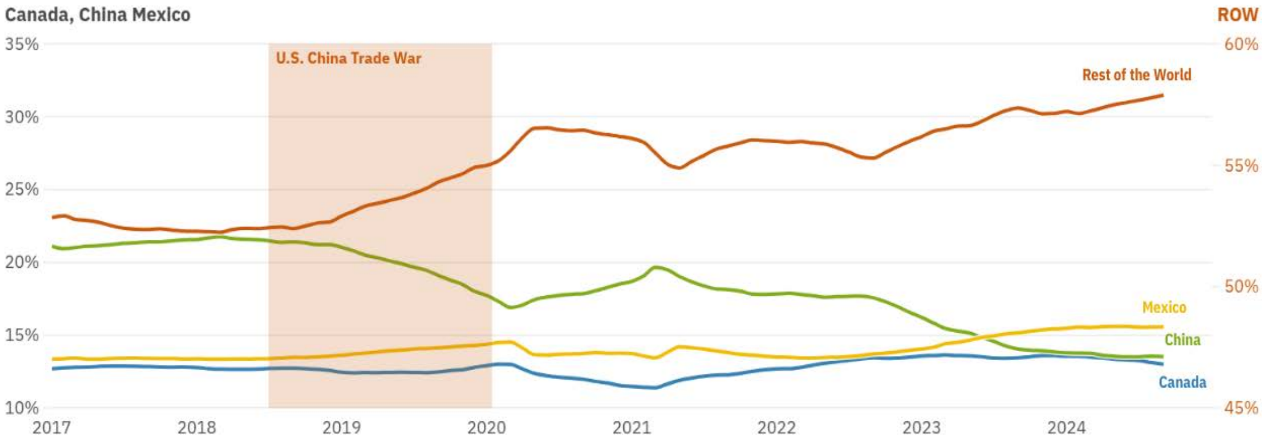
S&P Global collects BoLs, which are detailed legal documents between shippers and carriers required for the shipment of a good. They process these BoLs into a data product called Panjiva that contains detailed logistical information on individual shipments from 2007 to 2023. We focus on Panjiva's US imports dataset, which includes a shipment's arrival date, country of origin, exporting firm, and importing firm. The data contain more than a billion individual shipments from more than 150 different sourcing countries.[4]

Our consumer dataset is from Numerator, which maintains a panel of 150,000 households that are geographically and demographically representative of the United States.[5] The dataset contains information on what consumers purchase at brick-and-mortar and online retailers, including the transaction date, the name of the retailer, a description of the item extracted from physical receipts and digital transaction records, a global trade identification number (GTIN) or retail identification number (RIN) for the item when available, the brand of the item, the price paid for the item, and crucially, the name of the manufacturer that produced the

[4] As described in Flaaen et al. (2021), the bill of lading data cover all maritime shipments into the United States. However, some important drawbacks remain: First, import values are either imputed or often not available; second, firms can request redactions, and shipper IDs and shipment quantities can be missing in as many as 30 percent of the observations. That being said, the unrestricted access and the timeliness of availability make this the best firm-level dataset on maritime imports available.

[5] Out of 1 million users, Numerator selects a demographically and nationally representative sample of 150,000 users who self-identify as the primary shopper of the household and whose transactions are continuous and complete for a period of at least 12 months. Numerator then weights and balances households to ensure a match with census demographic data and to ensure that households' detailed purchases, when summed by retailer or by manufacturer, align with quarterly earnings reports of major retailers and consumer packaged goods manufacturers (Hacıoğlu Hoke, Feler and Chylak, 2024).

Figure 2: U.S. Import Share (2017 - 2024)



Note: ROW: All countries from which the U.S. imports excluding China, Canada, and Mexico. Import shares are measured as the 12 month moving average of the total value of imports from a country divided by the total value of all imports in a given month.
Source: U.S. Census Bureau (USA Trade Online), authors own calculations.

item.[6]

By using the firm-level match of Numerator and Panjiva from Baslandze and Fuchs (2025), we can gauge consumer expenditure shares on firms exposed to Chinese and other countries' imports and the extent of this import exposure. Since Panjiva data excludes land trade, we use census data for our calculations for Canada and Mexico, as detailed in the following sections.

Lower Dependence on Chinese Imports

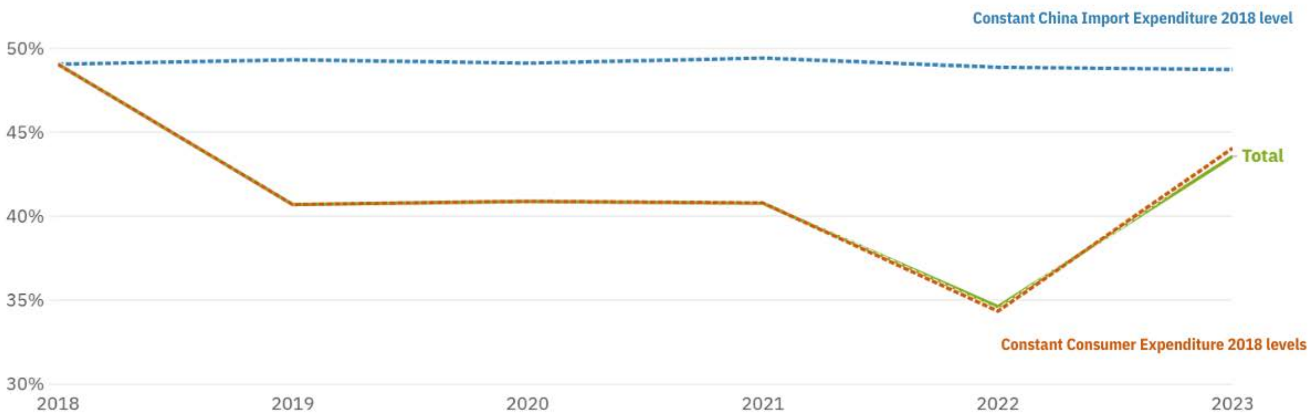
US reliance on Chinese imports has decreased markedly since 2018. China's share of all US imports declined from more than 20 percent in 2018 to less than 15 percent after 2022, as shown in figure 2. The declining import share from China coincided with increasing import shares from Mexico and other trading partners, suggesting active supply chain restructuring by US firms.

The exposure of US consumer expenditures to Chinese imports has declined since the beginning of the trade war. We look at the share of all consumer expenditure at firms that import from China using consumer purchases data from Numerator and shipment data from Panjiva.

[6] Numerator collects data from households in several ways. Using a mobile phone app called "Receipt Hog," consumers can (1) snap and upload a picture of their paper receipts, (2) allow Numerator to scrape their emails for digital receipts, and (3) link loyalty and membership accounts (such as Amazon, UberEats, Walmart, and Home Depot accounts), which Numerator then scrapes for transaction information. Panelists are rewarded with coins redeemable for Amazon or Visa gift cards or for cash through PayPal. On average, Numerator rewards panelists approximately $10 per month for providing their purchase information and completing surveys (Hacıoğlu Hoke, Feler and Chylak, 2024). The Numerator data have also been described and benchmarked relative to similar datasets in previous papers (He and Su, 2023; Hristakeva, Liaukonyte and Feler, 2024).

Figure 3: Consumer Expenditures on Firms Importing from China Decomposition

consumer expenditure shares



Note: The solid green line depicts the share of consumer spending that goes to firms with positive annual imports from China. The dashed blue line shows consumer expenditure shares if the firms' Chinese import exposure is held constant at 2018 levels. The dashed orange line shows consumer expenditure shares if consumer spending on firms are held at their 2018 levels. Sample of persistent firms available in all years of data (2018-2023).
Source: Data from Numerator and Panjiva, authors own calculations.

Figure 3 shows the share of consumer spending that goes to firms importing from China. The total effect (solid green line) shows a decline in the consumer expenditure share from 49 percent in 2018 to 44 percent in 2023, showing that the US consumer expenditures on firms that imported from China decreased by approximately 11 percent.

We show that this decline in US consumers' exposure to Chinese imports is due to US firms reducing reliance on Chinese imports, not because consumers substitute away from products exposed to Chinese imports. To see this, we first isolate changing consumer preferences by holding firms' Chinese import exposure constant at 2018 levels. In figure 3, this is represented by the dotted blue line. We can infer the effect of changing consumer expenditure patterns by comparing this blue line with the total effect. The value remains constant, meaning consumers' changing preferences account for very little of the total effect. Similarly, we can identify the impact of firms' sourcing decisions by holding consumer expenditure shares constant at 2018 levels while allowing firm import patterns to vary (represented by the dotted orange line in figure 3) and comparing that to the total line. Notice that this line tracks the total effect very closely, implying that nearly all of the 11 percent decline in US consumer expenditure shares comes from US firms reducing their direct exposure to Chinese imports.

Using both aggregate trade and consumer data, we find a declining import dependence on China that will likely mitigate the price effects from tariffs imposed on Chinese imports. However, simultaneously, imports from other countries, namely Mexico, have increased, and these countries might become targets of tariffs in potential scenarios, leading to greater price effects.

Figure 4: Recent Inflation and Import Intensity by Sectors

Note: We calculate Total Inflation as the increase in the Producer Price Index at the NAICS-3 level from 2020-2023 to capture the price change over the pandemic period. We calculate the Import Intensity of sectoral expenditures as the share of import value to gross output plus net exports by sector. The size of the markers on the plot is determined by the size of the sector's gross outputs in 2023.
Source: Producer Price Index from the Bureau of Labor Statistics; import values from the USA Trade Online (U.S. Census Bureau); sectoral output from the Bureau of Economic Advisors.

Tariff Exposure and Recent Inflation

The price effects of tariffs crucially depend on the pass-through elasticity of prices from the increased costs faced by firms. As previously discussed, empirical studies of the US-China trade war find approximately complete pass-through, suggesting that firms passed the entire cost from tariffs to consumers. However, given that the economy is currently emerging from a period of exceptionally high inflation, one may wonder if the firms are limited in their ability to further hike prices. Indeed, consumer resistance might constrain price increases, as in Eyster, Madarász and Michaillat (2021). To explore this possibility, we examine if those sectors that are more exposed to potential tariff hikes in 2025—those with the highest reliance on imports—have recently gone through a high inflationary period.

Figure 4 examines the relationship between sectoral import intensity and recent price increases using producer price index data. We measure import intensity at the NAICS-3 level by dividing the value of imports by the sum of gross output and net exports in that sector for 2023. We match these sector-level import intensity measures to the price level change throughout the inflationary episode from 2020 through 2024 as measured by the Producer Price Index.[7] We find a weak negative relationship between the cumulative price growth recently experienced by a sector and the sector's current import intensity. The industries with the highest import intensity did not experience the greatest price growth. Since these industries were not the primary drivers of inflation, the recent inflation experienced by consumers is unlikely to limit firms in these sectors from passing future tariff costs onto them. We consider complete and

[7] Due to the PPI's classification at the NAICS-3 industry classification level, we prefer it over the CPI in this context.

incomplete price pass-through in our assessment of potential tariff scenarios for 2025, detailed in the following section.

Evaluation of Potential Tariff Scenarios

In light of these recent changes in the international trade environment, we investigate the price effect of various potential tariff scenarios for 2025. The most significant difference between the 2018–19 US tariffs and the scenarios we evaluate for 2025 is their broader scope. While previous tariffs primarily targeted Chinese imports, we now include tariffs on Canada and Mexico– the largest US trading partners, as well as on the rest of the world.

To evaluate how much we can expect prices to increase under these scenarios, we employ our first-order approximation in equation (1) and use aggregate trade statistics combined with detailed data on consumer expenditures and firm-level imports from Numerator and Panjiva. We investigate additional 10 percent tariffs on Chinese imports, 25 percent tariffs on imports from Canada and Mexico, and additional 10 percent tariffs on the rest of the world. Since the future pass-through rate is an important, but still uncertain, parameter in our calculations, we opted to offer two different outcomes by calculating the price effects under complete and incomplete pass-through. First, we consider a *complete pass-through* ($\varepsilon^p = 1$), which would resemble a scenario that would repeat the pass-through behavior of firms during the previous US-China trade war. The second scenario provides a more conservative estimate of price effects, assuming *incomplete pass-through* equal to half of the complete pass-through ($\varepsilon^p = 0.5$). The incomplete pass-through is closer to the average estimates from the literature before the US-China trade war.[8] The firm-level expenditure shares in equation (1) are calculated using Numerator consumer expenditure data. We identify the import intensity and imports affected in the case of Chinese and the rest-of-the-world tariffs using Panjiva data, but since these data do not provide good coverage of Canadian and Mexican imports, we rely on statistics from the census to obtain more aggregated import shares (see more details in the appendix).

Table 1 presents our estimates of the price effects of Chinese, Canadian-Mexican, the rest-of-the-world, and the combined tariffs under different scenarios: complete and incomplete pass-through.[9] We present results for two product groupings: all retail products and the retail less food and services in our sample. All retail products refer to the complete Numerator expenditure basket covering everyday retail purchases, such as food and general merchandise, and cover approximately 25 percent of the CPI basket (which excludes items like energy, housing, most of the services, and transportation). The second grouping covers all products in the first grouping, excluding food and any service categories. Our results focus on about a quarter of the total consumption basket, and the aggregate effect on the overall CPI further hinges on the price sensitivity of the excluded consumption categories, particularly

[8] Fajgelbaum and Khandelwal (2022) summarize the tariff pass-through estimates from prior works.

[9] We assume that the United States' current tariff rate toward Canada and Mexico is 0 percent, 3 percent toward the rest-of-the-world (Figure 1), and 12.8 percent toward China. We calculate the latter value from Figure 1, where the tariff rate is 19.3 percent on two-thirds of imports from China (12.8% = 19.3% · 2/3).

Table 1: Effects of Tariffs on Retail Prices

	Complete Pass-through				Incomplete Pass-through			
	CHN ↑ 10%	*MEX & CAN* ↑ 25%	RoW ↑ 10	*Combined Effect*	*CHN* ↑ 10%	*MEX & CAN* ↑ 25%	RoW ↑ 10	*Combined Effect*
All Retail Products	0.13%	0.74%	0.76%	1.63%	0.07%	0.37%	0.38%	0.81%
Retail Products (less food and services)	0.37%	0.85%	1.35%	2.57%	0.19%	0.42%	0.67%	1.28%

Note: All Retail Products - refers to all items in the Numerator consumer data. These products cover everyday retail purchases, such as food, beverage, and general merchandise, comprising approximately one-quarter of the total consumption basket (data exclude expenditures on energy, housing, transportation, and most services). Retail Products (less food and services) - refers to the above sample of products, further excluding food and any service expenditures.
Source: Data from Numerator, Panjiva, and U.S. Census Bureau, authors own calculations

transportation, services, energy, and housing.

Under complete pass-through, our estimates show that retail prices for the portion of the consumer basket covered in our data would increase by 1.63 percent for all products and 2.57 percent for products excluding food and services in our sample (as defined above) when all tariff policies are implemented. The impact is roughly halved under incomplete pass-through, with price increases of 0.81 percent and 1.28 percent, respectively. Notably, the tariffs on Mexico and Canada drive approximately 45 percent of the total price effect, while additional Chinese tariffs contribute an additional 8 percent, with the rest of the world adding 47 percent of the total effect. This distribution reflects both the larger magnitude of the increase in Mexico/Canada tariffs (25 percent versus 10 percent) and the US economy's reduced dependence on Chinese imports.

In terms of the timing of the price effects, recent studies indicate that tariff effects are both immediate and persistent. For instance, Cavallo et al. (2021*a*) show that nearly the full tariff rate is passed through to import prices within just one month of enactment, reflecting a rapid market response. This quick adjustment is further corroborated by Amiti, Redding and Weinstein (2020), who demonstrate that these initial price increases endure well beyond the immediate aftermath of the tariff shock. Collectively, these findings imply that future tariffs are likely to be transmitted swiftly to retail prices and have lasting impacts.

4 Conclusion

The 2018–19 US-China trade war resulted in sustained increases in consumer prices due to the imposition of tariffs on Chinese goods and subsequent retaliatory tariffs on US exports. Since then, significant changes have reshaped the trade landscape: the United States has reduced its dependence on Chinese imports, global inflation has risen, and discussions around tariffs have expanded to include Canada, Mexico, and other countries. These developments render previous estimates of tariff impacts on prices outdated.

In response, this study uses a novel micro-level data match of detailed import records with consumer purchases, alongside a first-order approximation of the impact of tariffs on consumer prices, to reassess the potential effects of tariff scenarios. Our results indicate that an additional 10 percent tariff on Chinese imports, 25 percent tariffs on Canadian and Mexican imports, and an additional 10 percent tariff on the rest of the world could raise consumer prices on everyday retail purchases, such as food and beverage items and general merchandise, covering about a quarter of the total consumption basket, by 0.81 percent to 1.63 percent. Notably, tariffs on Canada and Mexico are projected to contribute approximately 45 percent of the total price effect, underscoring the significant impact of these broader tariff measures. Our results focus on approximately a quarter of the total consumption basket, and the aggregate effect on overall CPI further hinges on the price sensitivity of the excluded consumption categories, particularly transportation, services, energy, and housing. While effects on the remainder of the consumption basket (including housing and automobiles) are likely, that analysis is beyond the scope of our paper.

Despite these insights, uncertainties remain regarding the pass-through elasticity of future tariffs—whether firms will fully or partially transfer tariff costs to consumers. While tariffs themselves may not spur long-lasting inflation, empirical studies suggest they trigger an immediate, one-time upward shift in price levels that persists. For example, Cavallo et al. (2021*b*) find nearly full pass-through to import prices within a month, and Amiti, Redding and Weinstein (2020) show these price increases endure. Moreover, for two key reasons, our estimates in this paper should be viewed as a lower bound. First, tariffs can affect prices indirectly through input-output linkages, amplifying their impact beyond the direct pass-through captured in our analysis. Second, for Canada and Mexico, we rely on aggregate import shares and do not account for firm-level heterogeneity in expenditure shares and import dependence. If firm-level expenditure shares positively correlate with import dependence, our aggregate estimates for Canada and Mexico likely underestimate the true price effects. We also note that our analysis is limited to about a quarter of the CPI basket covered by our data and excludes expenditures on most services, energy, housing, and transportation; as a result, the effect on these categories remains unclear. A final caveat is that this study focuses exclusively on price impacts without addressing potential repercussions on employment, wages, economic growth, or overall welfare. Consequently, while our findings provide valuable projections on consumer prices, they do not offer a comprehensive evaluation of the broader economic implications of tariff implementations.

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Appendix

First-Order Approach to Evaluating the Price Effects of Tariffs

We construct a first-order approximation of the equivalent variation (EV) associated with a small change in prices, constructing a sufficient statistic approach to measuring inflation by exploiting standard results in consumer theory (Porto, 2006; Atkin, Faber and Gonzalez-Navarro, 2018; Borusyak and Jaravel, 2021; Allen et al., 2022). In this appendix, we outline the approach, characterizing it first for a representative consumer consuming a generic set of varieties, then adapting the problem to our empirical setting where consumption occurs across firms that bundle both domestic and foreign varieties from different countries. We propose a decomposition that allows us to implement the sufficient statistic approach with the available firm-level expenditure and import data. Finally, we compare and contrast our approach with the decomposition of the welfare effects of tariffs in Fajgelbaum et al. (2020).

First-Order Approach. To derive our approach, we follow Borusyak and Jaravel (2021). For a differentiable indirect utility function $\mathcal{V}(p, Y)$, where p represents a vector of prices, Y denotes income or expenditure, and superscript 0 refers to the initial levels of respective variables, the EV for a representative consumer is defined implicitly by the equation

$$\mathcal{V}(p^0, Y^0 + EV) - \mathcal{V}(p^0, Y^0) = \mathcal{V}(p^0 + dp, Y^0 + dY) - \mathcal{V}(p^0, Y^0),$$

which compares the change in utility caused by a price shock dp and an income adjustment dY to the compensating variation in income required to hold utility constant. For small shocks, this expression can be rearranged to isolate the EV as

$$EV = dY - \left(-\frac{\partial\mathcal{V}/\partial p}{\partial\mathcal{V}/\partial Y}\right) dp = dY - \sum_{\omega} q_\omega dp_\omega,$$

where q_ω represents the consumption share of good ω. Normalizing by initial expenditure Y, the proportional welfare change is derived as

$$d\ln\mathcal{W} \equiv \frac{EV}{Y} = \frac{dY}{Y} - \sum_{\omega} s_\omega \frac{dp_\omega}{p_\omega} = d\ln Y - \sum_{\omega} s_\omega d\ln p_\omega,$$

where s_ω denotes the expenditure share of good ω. This formulation highlights two components of welfare change: the direct impact of income changes and the effect of price adjustments on expenditures. The change in the price index for a generic set of goods can be expressed as:

$$d\ln P = \sum_{\omega} s_\omega d\ln p_\omega. \tag{2}$$

This equation summarizes how price changes for different varieties combine to affect the aggregate price index, weighted by expenditure shares. This first-order approximation provides a general measure of welfare changes tied to price movements without yet specifying particular sources, such as import prices or trade costs, which we will discuss next.

Deriving an Empirical Approximation. In the empirical implementation, we introduce imported varieties by assuming that a firm produces a good ω that is a bundle combining domestic and foreign varieties from different countries. Consumers purchase varieties from these firms, and the prices reflect the firms' domestic and international sourcing costs. The marginal cost for firm bundling inputs from various countries depends on input costs and trade costs—including tariffs.

Using cost minimization, changes in trade costs and input prices drive changes in marginal costs. The change in the price of a firm's variety can be decomposed into contributions from domestic and foreign inputs. Let the domestic country be denoted as d and the set of foreign countries the firm is sourcing from as C^f_ω. Then, the change in the price of a firm's bundle is given by:

$$d\ln p_\omega = \varepsilon^p_{mc}\left(\varepsilon^p_d \beta^\omega_d d\ln(1+\tau_d) + \varepsilon^p_c \sum_{c\in C^f_\omega} \beta^\omega_c d\ln(1+\tau_c),\right)$$

where ε^p_c denotes the pass-through of country-specific tariff changes into bundle-specific marginal cost and where ε^p_d denotes the pass-through of domestic trade cost changes into bundle-specific marginal cost. And where ε^p_{mc} represents the pass-through of bundle-specific marginal cost into prices, taking into account adjustments in the markup of the firm. Finally, β^ω_d represents the share of domestic inputs, and β^ω_f represents the share of foreign inputs from country c. Assuming domestic trade costs remain constant and assuming that the pass-through elasticity for imported varieties is constant across countries, i.e. $\varepsilon^p = \varepsilon^p_{mc} \cdot \varepsilon^p_c$ the expression simplifies to:

$$\begin{aligned} d\ln p_\omega &= \varepsilon^p \sum_{c\in C^f_\omega} \frac{M^c_\omega}{\text{Inputs}} d\ln(1+\tau_c) \\ &= \varepsilon^p \underbrace{\frac{\sum_c M^c_\omega}{\text{Inputs}_\omega}}_{\equiv \beta^\omega_M} \sum_{c\in C^f_\omega} \underbrace{\frac{M^c_\omega}{\sum_c M^c_\omega}}_{\equiv \beta^\omega_{c,m}} d\ln(1+\tau_c) \end{aligned}$$

where, in the last row, we have decomposed the share of foreign inputs from the country c into the overall import share of firm ω across all countries, β^ω_M, and the country-specific import share out of overall imports, $\beta^\omega_{c,m}$. Since firm-level openness is often unobserved, we use sectoral averages to approximate firm-level behavior, which results in:

$$\begin{aligned} d\ln p_\omega &= \varepsilon^p \frac{\sum_c M^c_\omega}{\text{Inputs}_\omega} \times \frac{\bar{Y}_{j(\omega)}}{\bar{M}_{j(\omega)}} \times \frac{\bar{M}_{j(\omega)}}{\bar{Y}_{j(\omega)}} \sum_{c\in C^f_\omega} \frac{M^c_\omega}{\sum_c M^c_\omega} d\ln(1+\tau_c) \\ &\approx \varepsilon^p \underbrace{\frac{\bar{M}_{j(\omega)}}{\bar{Y}_{j(\omega)}}}_{\equiv \bar{\beta}^{j(\omega)}_M} \sum_{c\in C^f_\omega} \underbrace{\frac{M^c_\omega}{\sum_c M^c_\omega}}_{\equiv \beta^\omega_{c,m}} d\ln(1+\tau_c), \end{aligned}$$

with Y denoting outputs, M denoting imports, and $j(\omega)$ indicating the sector j of firm ω. This approximation holds under the assumption that $\frac{\sum_c M^c_\omega}{Inputs_\omega} \times \frac{\bar{Y}_{j(\omega)}}{\bar{M}_{j(\omega)}} \approx 1$, meaning that deviations from the average import intensity are small. Substituting into equation (2) to aggregate the changes across all firms, we obtain:

$$d\ln P \approx \varepsilon^p \sum_\omega \underbrace{s_\omega}_{\text{expenditure share}} \times \underbrace{\bar{\beta}^{j(\omega)}_M}_{\text{sector import intensity}} \times \sum_{c\in C^f_\omega} \underbrace{\beta^\omega_{c,m}}_{\text{imports affected}} \times \underbrace{d\ln(1+\tau_c)}_{\text{tariff change}}. \tag{3}$$

This expression links trade cost changes, via tariffs, to changes in the price index by aggregating across firms and different sourcing countries. The result provides a tractable way to quantify price index changes due to tariff shocks while accounting for heterogeneity in firm-level import dependence.

Implementation. The empirical implementation proceeds in two steps. Since Panjiva data have good coverage of Chinese imports but do not cover most Canadian and Mexican imports (recall that Panjiva covers maritime imports only), our calculations for Chinese and Canadian/Mexican scenarios differ in the first step. To estimate the effect of the change in Chinese tariffs, first, at the sectoral level, import intensity ($\bar{\beta}_M^{j(\omega)}$) times the expenditure (s_ω)-weighted average share of Chinese imports ($\beta^{\omega}_{CN,m}$) is calculated. Sectoral import intensity is derived from USA Trade Online Census data and calculated as sectoral imports divided by sectoral output minus net imports. The firm-level expenditure shares are calculated based on expenditures in Numerator, and the imports affected by Chinese tariffs are based on Panjiva imports. Thus, we calculate the first expression for each sector *j* as:

$$W_j^{CN} = \frac{M_j}{Y_j^{BEA} + M_j - X_j} \sum_{\omega} \frac{y_{\omega j}^{Num}}{Y_j^{Num}} \frac{M_\omega^{CN}}{M_\omega},$$

where, as before, *Y* is output, *M* is imports, and *X* is export.

For Mexico and Canada, the lack of rail and road shipments in our dataset implies that we cannot credibly calculate import shares and hence rely on aggregate statistics from the census. We calculate:

$$W_j^{MEX/CAN} = \frac{M_j}{Y_j^{BEA} + M_j - X_j} \frac{M_j^{CAN/MEX}}{M_j}.$$

For the rest of the world (RoW), we proceed similarly, and calculate:

$$W_j^{RoW} = \frac{M_j}{Y_j^{BEA} + M_j - X_j} \frac{M_j^{RoW}}{M_j}.$$

In the second step, these country *c*-specific sectoral values are aggregated to the economy-wide level by weighting sectoral contributions by their expenditure shares:

$$d \ln P^c \approx \varepsilon^p \sum_j \frac{Y_j^{Num}}{Y^{Num}} W_j^c \times d \ln(1 + \tau_c)$$

Our empirical calculations are based on the year 2023. We aggregate the BEA detailed commodity code-level import intensity measures from the Supply-Use tables to the broad sectors for our products and obtain the following average import-intensities: Goods (0.222), Foods (0.088), Apparel (0.753), Computers & Electronics (0.462), Motor Vehicles (0.269), and Services (0.061).[10]

Comparison with literature. The welfare effects of trade policy changes, such as tariffs, can also be captured using a first-order approximation from Dixit and Norman (1985) as previously used by Fajgelbaum et al. (2020). The aggregate EV measures the monetary compensation required to offset a policy change expressed as

$$\Delta EV = -\mathbf{m}'\Delta[\mathbf{p}_m^*(1 + \tau)] + \mathbf{x}'\Delta\mathbf{p}_x^* + \Delta R,$$

where **m** and **x** represent imported and exported quantities, $\mathbf{p}_m^*$ and $\mathbf{p}_x^*$ are world prices, τ is the ad valorem tariff, and ΔR is the lump-sum transfer or tariff revenue. This decomposition explicitly links trade policy, price adjustments, and welfare outcomes, capturing the effects of both import and export price changes and redistributive policies. Our calculations more narrowly correspond to the first term, which captures the Equivalent Variation from import price changes.

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[10] Services in Numerator data mainly consist of spending on restaurants, movies, and TV.