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ABSTRACT

This paper examines the effects of tariffs along the supply chain using product-level data from a large U.S. wine importer in the context of the 2019-2021 U.S. tariffs on European wines. By combining confidential transaction prices with foreign suppliers and U.S. distributors as well as retail prices, we trace price impacts along the supply chain, from foreign producers to U.S. consumers. Although pass-through at the border was incomplete, our estimates indicate that U.S. consumers paid more than the government received in tariff revenue, because domestic markups amplified downstream price effects. The dollar margins per bottle for the importer contracted, but expanded for distributors/retailers. Price effects emerge gradually along the chain, taking roughly one year to materialize at the retail level. Additionally, we find evidence of tariff engineering by the wine industry to avoid duties, leading to composition-driven biases in unit values in standard trade statistics.

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I Introduction

The economic impacts of tariffs are perhaps the most consequential policy debate facing the United States and the global trade system. And yet, economists seeking to inform this debate face a paucity of empirical estimates to rely on, as there have been virtually no cases of an advanced country unilaterally raising broad tariffs on a scale seen by the United States over the last decade. While the previous iteration of tariff increases during 2018-2019 induced a surge of research—especially on the key question of tariff pass-through—there remain many open questions central to understanding the experience of the United States during the subsequent tariffs imposed in 2025.

Prominent among these open questions: How are the costs of tariffs shared between foreign producers, domestic importers, trade intermediaries, and the final consumer? A wide range of studies find tariff pass-through at the border is more or less complete and immediate (Amiti, Redding and Weinstein, 2019, 2020; Fajgelbaum, Goldberg, Kennedy and Khandelwal, 2019), implying domestic actors bear the brunt of these costs. Yet empirical evidence on tariff pass-through to consumers is both limited in scope and mixed in conclusions. Some evidence points to complete pass-through (Flaaen, Hortaçsu and Tintelnot, 2020) while others find it is very low (Cavallo, Gopinath, Neiman and Tang, 2021). This paper seeks to resolve this disconnect by tracing the tariff impact on prices of an imported product throughout its journey from the foreign producer—via the importer, wholesaler, and retailer—to the final consumer. We find that high pass-through at the border can be consistent with low percentage changes in retail prices, while the dollar cost of tariffs is still largely borne by consumers.

We study this question in the context of U.S. tariffs on European still wines implemented in 2019 as part of the long-running dispute on aircraft subsidies between the E.U. and the United States. Our unique perspective on the supply chain comes from confidential transaction data from a large wine importer that has been matched at the product-vintage level to other downstream stages of the distribution chain. The wine industry is particularly well-suited to the study of tariff pass-through across the distribution chain due to features of the regulatory environment—namely legal requirements on the separation of ownership across the tiers of distribution: producers/importers may not be distributors/wholesalers, and wholesalers may not be retailers. The result of this structure is clear arm's-length pricing at multiple stages of the distribution chain from the border to the end consumer.

Our main finding is that the presence of markups along a distribution chain makes it possible for the consumer to fully pay for the cost of the tariffs in dollar terms even when the foreign supplier partially absorbs the tariff by lowering its price. This highlights the difference between *percent* pass-through, which compares the percentage increase in consumer prices to the percentage point change in tariffs, and *dollar* pass-through, which compares the actual dollar increase in consumer prices to the actual dollar amount of tariffs paid. Absent markups or other distribution costs, these two definitions are identical. On the other hand, when markups are significant (or with multiple markups compounded across multiple stages) even small percent changes in an upstream price in the distribution chain can translate into significant dollar increases for consumers. Hence, low pass-through estimates in percent terms on consumer prices do not imply that the costs of the tariffs to consumers are small relative to tariff revenue.

In order to estimate the price effects of the tariffs, we exploit the fact that they were levied only on still wines with $\leq 14\%$ alcohol by volume (ABV). We compare price changes along the distribution chain for products that were tariffed to a control group of wines that were not tariffed (still wines with > 14% ABV and sparkling wines). To minimize any indirect tariff effects, we restrict this control group to products from wineries that did not sell any other tariffed products. We find that tariff pass-through at the border is incomplete, as foreign producers lower their price by 5.2 percent following the applied 25 percent tariff. This implies that around one-quarter of the tariff revenue is paid by foreign producers, while the remainder is paid within the United States. At the next stage of the chain, we find the U.S. importer *increases* the price charged to their distributors by an average of 5.4 percent. Tariff pass-through continues to be incomplete at this subsequent stage, and even with the lower price paid to producers, the importer absorbs some portion of the tariffs as lower markups. Finally, tracking these particular wines at the stage of final sales by retailers, we find that the consumer price increases by 6.9 percent following the tariffs. While such a percent increase implies incomplete pass-through given a 25 percent tariff, the multiple stages of markups implies the corresponding dollar value change in consumer prices could be higher than the actual tariffs paid. For example, for a wine that costs \$5 at the border prior to tariffs, our point estimate implies \$1.59 in higher consumer costs relative to \$1.19 in tariffs paid per bottle. Hence, at the level of the consumer, the dollar pass-through estimate exceeds 100 percent. Even taking into account the cumulative statistical uncertainty of pass-through estimates across multiple stages, consumer dollar cost per dollar of tariff revenue is larger than 68% with 90% probability.

The broader picture of pass-through that we capture in this paper offers an accounting of tariff incidence both across and *within* borders. While much of the focus has been on whether foreign or domestic actors pay for increased tariff revenue, we study the incidence of tariffs between domestic intermediaries and consumers. These details provide useful information on the dynamics of firm profits, disposable personal income, and inflation following tariff changes. We find that among the domestic intermediaries, the dollar margins per bottle for the importer contracted, but expanded for distributors/retailers. We show how these patterns can arise in a simple model with multiple distribution stages and participation constraints.

Our event-study estimates of pass-through along multiple stages also provide a unique perspective in the timing of price changes following a tariff. In the case of these wine tariffs, it took around three months for the wine importer's prices to change, and consumer prices do not fully respond until nearly a year after tariffs were applied, with significant positive price impacts lasting well beyond when the tariffs expired. This finding provides useful perspective for policymakers wanting to understand the lag structure of inflation effects of tariffs. The precise timing of these effects will relate to the number of distribution or production stages in the supply chain, as well as inventory management practices.

While the finding of incomplete tariff pass-through at the border is in contrast to prevailing findings in recent literature, it is more consistent with theoretical predictions of monopsony power of a large market such as the United States. Further, we show the benefits of having true price observations at the detailed product and transaction-level: pass-through estimates in our setting using publicly available unit values of HS-8-level product definitions give a misleading picture due to changes in product composition induced by the tariffs.

We exploit additional detailed product-level alcohol label data for all wines sold in the U.S. to document how changes in product composition reflect an intriguing case of tariff engineering.

Because the initial tariffs only applied to wines defined by a threshold level of alcohol content ($\leq$ 14% ABV), we document a systematic shift in new product offerings toward higher alcohol content exempt from these tariffs, as well as engineering of existing wines to modify the listed alcohol content for exemption from these tariffs.

The findings of this paper offer important lessons for policymakers more generally, especially as they interpret pass-through estimates for tariffs imposed in 2025. Markups imposed across multiple distribution stages are a common feature of all goods transactions in the United States, and are especially relevant for imports. Bernard, Jensen, Redding and Schott (2010) and Ganapati (2024) document the important role played by the U.S. wholesalers and retailers in trade. Feenstra (1998) cites the famous example of the imported Barbie doll with an export value of \$2 that retailed for \$10 in the U.S. at the time. This paper argues that estimates of the consumer price impact of tariffs—in percent terms—must take into account prevailing markups along the distribution chain to adequately scale the impact to consumer prices relative to assessed tariff revenues. Such gross markups are quite significant, on average. Based on estimates from the Bureau of Economic Analysis, the average weighted gross markup across all personal consumption expenditure goods is a little over 100 percent between producer and purchaser prices.[1] If this gross markup rate in the domestic distribution sector prevails and foreigners absorb little of the tariffs, consumer prices could rise—in dollar terms—by substantially more than the tariffs paid. Although wine may appear to be a narrow product class, these mechanisms we highlight are general features of international trade settings, and thus our insights extend beyond this specific industry.

Our paper contributes principally to two areas of research. First, it adds to a growing literature on the consequences of tariffs, with a particular emphasis on their incidence.[2] Earlier examples include Feenstra (1989), who examines tariff pass-through to car prices, and Irwin (2019), who analyzes pass-through to sugar prices. More recently, Amiti, Redding and Weinstein (2019); Fajgelbaum et al. (2019); Alviarez, Fioretti, Kikkawa and Morlacco (2023) studied the pass-through effects of the 2018-2019 U.S.-China tariffs at the border, while Flaaen, Hortaçsu and Tintelnot (2020); Cavallo et al. (2021) examined them at the retail level. Our work contributes by connecting these two margins and documenting how price pass-through is transmitted along the supply chain from the port of entry to final consumers for the same products. We provide direct evidence of how trade policy propagates through import intermediaries to retailers—a key but previously underexplored channel in understanding the incidence of tariffs. In particular, we document that even though the foreign exporters absorbed part of the tariffs by lowering prices, consumers ultimately paid more than the direct dollar cost of the tariff, a pattern that conventional models of trade with no supply chains cannot rationalize.

Second, we contribute to the empirical explorations of pass-through. As in Nakamura and Zerom (2010); Goldberg and Hellerstein (2012); Bergquist and Dinerstein (2020); Alvarez-Blaser,

[1] This estimate is derived from the 2017 personal consumption expenditure (PCE) bridge tables, calculated across goods categories pertaining to NIPA lines 7 through 141 corresponding to commodity codes in agriculture, mining, and manufacturing. We exclude PCE categories that are scrap or used goods. By this metric, the gross markup for wineries of 143 percent reported by the BEA is not that dissimilar to the equivalent estimate in this paper of 161 percent (excluding the importer stage), nor is it dramatically higher than the weighted average.

[2] Beyond the price effects, an active literature has examined the labor market effects of tariffs including Dix-Carneiro and Kovak (2017), Kovak and Morrow (2024), Cox (2025), Flaaen and Pierce (2024), Lake and Liu (2025). Handley, Kamal and Monarch (2025) examined the effects of import tariffs on exports. An early look at the retail price effects of the 2025 tariffs is provided by Cavallo, Llamas and Vazquez (2025).

Cavallo, MacKay and Mengano (2025), we also study pass-through in multi-tier supply chains. Alvarez-Blaser et al. (2025) is particularly relevant since the authors also observe manufacturer gate price and the corresponding retail price for individual products. One of the differences in our paper to these prior work on supply chain pass-through is that we study a country and product specific tariff shock rather than upstream cost in a stationary environment. In our setting, we show that the importer's derived demand along the domestic supply chain shapes how the burden of tariffs is shared between importers and their foreign suppliers. Regarding the role of distribution costs in shaping outcomes following policy shocks in a global setting, Burstein, Neves and Rebelo (2003) investigate how these costs affect the behavior of the real exchange rate during stabilization episodes. Atkin and Donaldson (2015) also emphasizes the role of domestic intermediaries in the cost pass-through from international trade.

Finally, our paper also relates to the work of Sangani (2025) which finds that cost shocks that are common to all market participants usually have a complete pass-through to retail prices in levels (dollars), but not in percentages. We find a complete pass-through in dollars to retail prices for this tariff shock that affected a fraction of the market participants, while uncovering heterogeneity in pass-through along the chain. Here, the pass-through of cost increases at the prior stage of the chain is incomplete (even in dollars) from the importer to the distributor but complete in percentages from the distributor/retailer to the consumer.

The rest of the text continues as follows. Section II provides institutional details on the 2019 tariffs on European products and the U.S. wine industry. Section III documents the aggregate effects of the tariffs based on customs data. Section IV presents the evidence of changes in product composition and tariff engineering as a mechanism to avoid tariffs. Section V provides a simple example of how intermediation affects both the percent and dollar tariff pass-through. Section VI presents the main results of the paper on pass-through along the supply chain based on confidential data from a large U.S. wine importer. Section VII rationalizes the empirical findings with a model of wine supply chain. Section VIII concludes.

II Import Tariffs and the Wine Industry in the United States

A *Airbus-Boeing Subsidy Dispute and Tariff Timeline*

The origin of the tariffs studied in this paper lies in the long-standing trade dispute between the United States and the European Union over aircraft subsidies. The dispute began in 2004, when the U.S. filed a complaint with the World Trade Organization (WTO) concerning subsidies granted by the E.U. to Airbus, a European aircraft manufacturer. The conflict continued for many years, involving counter-cases brought by the E.U. against Boeing (the U.S. aircraft manufacturer), WTO rulings, appeals, and bilateral negotiations. Until 2019, however, neither side had imposed punitive tariffs.

In April 2019, the Trump administration launched an investigation on the grounds that the E.U. had not fulfilled its obligations under prior WTO rulings. The proposed action included an ad valorem duty of up to 100% on 317 potential HS-8 product codes, among them still and sparkling wines. On October 2$^{\text{nd}}$, 2019, the WTO authorized the U.S. to impose countermeasures totaling up to \$7.5 billion annually. Later that same day, the U.S. Trade Representative announced a tariff on a range of products from E.U. member states, including aircraft, wines, cheese, and fresh fruit. For wine, the U.S. imposed a 25% tariff on still wine with $\leq 14\%$ alcohol by volume (ABV), packaged in containers of 2 liters or less, originating from France, Germany, Spain, and the United Kingdom. These tariffs took effect on October 18$^{\text{th}}$, 2019.[3]

After the U.S. tariffs went into effect, the E.U. imposed its own tariffs on a list of U.S. products in connection with the related WTO complaint against Boeing. The E.U. announced its retaliatory measures in November 2020 (U.S. wines were not included). In January 2021, the U.S. government expanded the list of products subject to additional tariffs, citing the aim of mirroring the E.U.'s reference period for calculating the volume of trade affected by tariffs. The expansion of tariffed products included all still wine imports from France and Germany (HS code 2204)—regardless of alcohol level or container size—excluding only sparkling wines (see Table D3 for the HS code descriptions). However, this expansion was short-lived. In March 2021, at the beginning of the Biden administration, the U.S. and the E.U. reached an agreement to suspend all tariffs related to the aircraft dispute for four months. In June 2021, the suspension was extended for five years. These tariffs may return in June 2026 unless a further agreement is reached or the suspension is extended.

B Institutional Details of the Wine Industry in the United States

The United States is the largest wine market in the world, with roughly 3.9 billion liters (equivalent to approximately 5 billion standard bottles) consumed annually in 2017. Of the total market in 2017, 83 percent (by volume) is of still wine with an ABV content less than or equal to 14%, and a further 11 percent is still wine with an ABV greater than 14%. The overall foreign share of consumption (by volume) is around 30 percent, similar for both wines above and below 14% ABV.[4] Sparkling wine comprises around 6 percent of the market, with an import share of 53%.

Figure 1 shows that in 2018, France, Spain, and Germany together accounted for 37% of total imported wine value. For wines with an ABV content of 14% or less, imports are more concentrated between Italy and France. Germany, with almost no production of higher-alcohol wines, has a negligible share in the above 14% ABV category.[5] Figure B1, in the Appendix, shows the combined share of quantities for these three countries is 25% for still wines of $\leq 14\%$ ABV and 37% for still wines of $> 14\%$ ABV.

The market for alcohol in the United States is regulated in several unique ways that ultimately prove useful in our study of the effects of tariffs across multiple stages of the supply chain. Two regulatory features of the U.S. wine market are particularly relevant: (1) the three-tier distribution system, and (2) labeling requirements. The three-tier distribution system mandated by U.S. states consists of domestic producers or importers, local distributors, and retailers. Each tier is required to operate independently from the others, with the goal of preventing any entity in one tier from

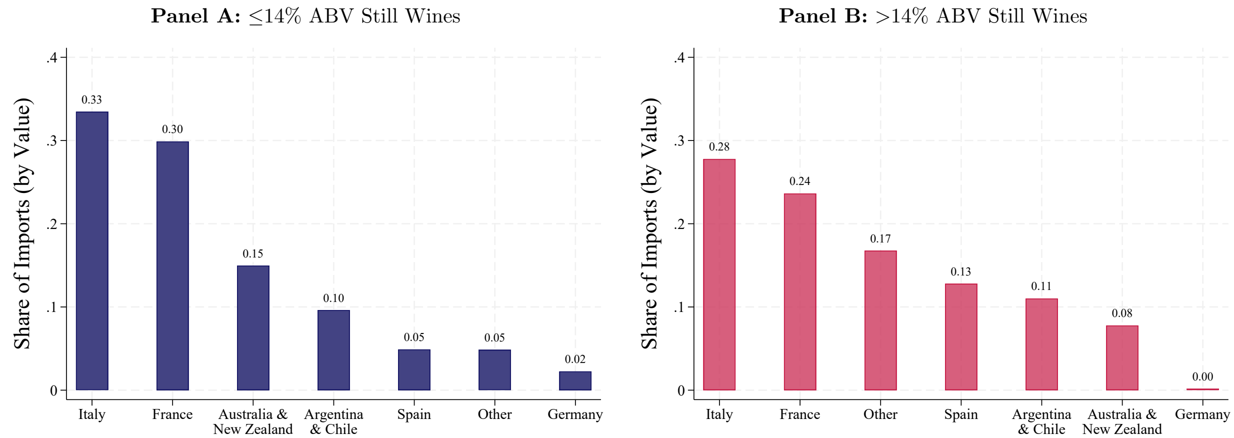
[3]President Trump had threatened tariffs on French wines in June 2019 (Dopp and Talev, 10 June, 2019). Furthermore, some news reports in mid-September 2019 suggested that the WTO would allow the U.S. to set tariffs from the Airbus dispute and therefore tariffs on wines might be imminent (von der Burchard, 17 September, 2019). Nevertheless, industry experts we spoke with described the tariffs largely as a surprise, leaving little time to prepare.

[4]These statistics are computed by combining domestic consumption data from the U.S. Alcohol and Tobacco Tax and Trade Bureau (TTB) with import data from the USITC for the year 2017, the last year for which TTB defined ABV splits identically to the Harmonized System for imports in the consumption data. Foreign shares calculated by value would likely be higher.

[5]The United Kingdom, part of the "Other" category in Figure 1 has a completely negligible amount of wine exports and is therefore omitted from all analysis.

exerting control over the others.[6] This leads to arm's-length transaction prices between the stages in the supply chain.

Figure 1: Source of U.S. Wine Import Value by Country, 2018



Notes: The figures exclude imports of wines in containers of over 2 liters.
Source: Authors' calculations for 2018, based on publicly available data from United States International Trade Commission (2010-2019).

A second regulatory feature of the U.S. wine market relates to labeling requirements. Any wine imported into the U.S. or sold across state lines is required to have a Certificate of Label Approval (COLA) issued by the Alcohol and Tobacco Tax and Trade Bureau (TTB).[7] For regulatory purposes, still wines are classified into two groups—at or below 14% ABV, and above 14% ABV—with distinct labeling requirements for each. Those at or below 14% can have a margin of error of ±1.5% from the labeled ABV, while those above 14% are allowed ±1.0%. However, a wine cannot be labeled in one group if its actual ABV places it in the other—for example, a wine labeled at 13.5% should not actually reach 14.5% (Alcohol and Tobacco Tax and Trade Bureau, 2019). Producers or importers typically only need to update a COLA if the wine's ABV shifts outside the permitted tolerance range or if it crosses the 14% threshold, requiring reclassification. The data from these label applications allow us to track the flow of new products into the U.S. market based on their ABV content.

III Tariff Effects in Aggregate Data: A First Look

To motivate our analysis of supply-chain pass-through, we first examine the aggregate effects of the 2019 tariffs. Using publicly available data, we document sharp declines in U.S. import quantities, with notable shifts in product composition. We provide a first look at tariff pass-through at the border, measured with unit values. We then show how compositional effects can complicate these estimates even at very detailed levels of HS categorization. This aggregate evidence bridges our

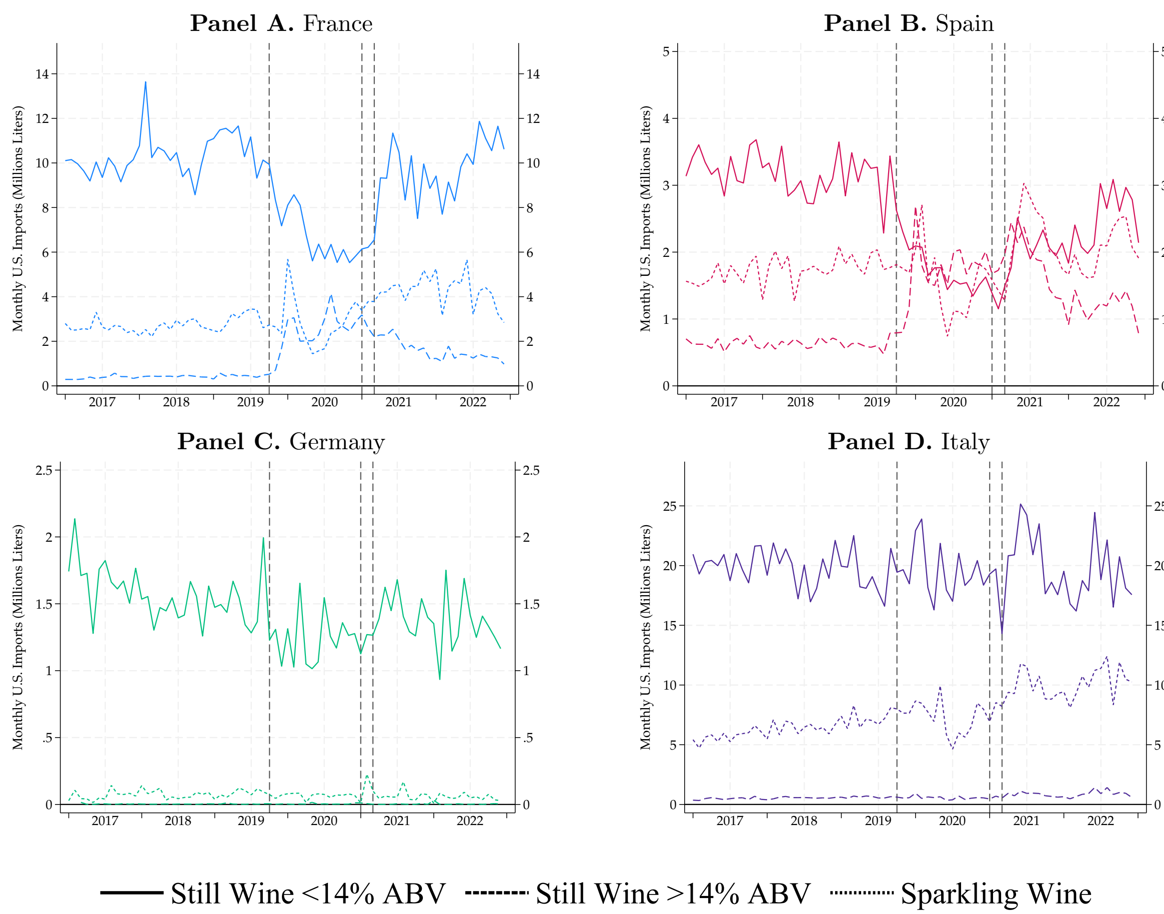
[6] A few states provide exceptions to this structure and allow producers or importers to obtain a wholesale license, enabling them to sell directly to retailers. While 17 states have state monopolies over the wholesaling or retailing of certain categories of alcoholic beverages (also known as control states), only four states (Mississippi, Pennsylvania, Utah, and Wyoming) impose such restrictions on wine sales of less than 16% ABV.

[7] Domestic products of less than 7% ABV are not required to have a COLA. Within the wine category there are also vermouths, sakes, and flavored wines which we exclude from all of our analysis.

work with the existing literature and sets the stage for our main contribution to trace how tariffs propagate from the border to consumers using more granular product data.

Figure 2 displays the monthly import quantities of wines from three of the tariff-affected countries (France, Spain, Germany) along with a non-affected country (Italy) for purposes of comparison. The solid lines in the Figure correspond to the still wines with ≤14% ABV (those facing tariffs beginning in October 2019), the dashed lines correspond to the still wines >14% ABV (those exempt from tariffs until briefly in early 2021), and the dotted lines correspond to sparkling wines (which did not face tariffs during the period of this study).

Figure 2: U.S. Monthly Import Quantities by Source Country and Wine Type, 2017–2022



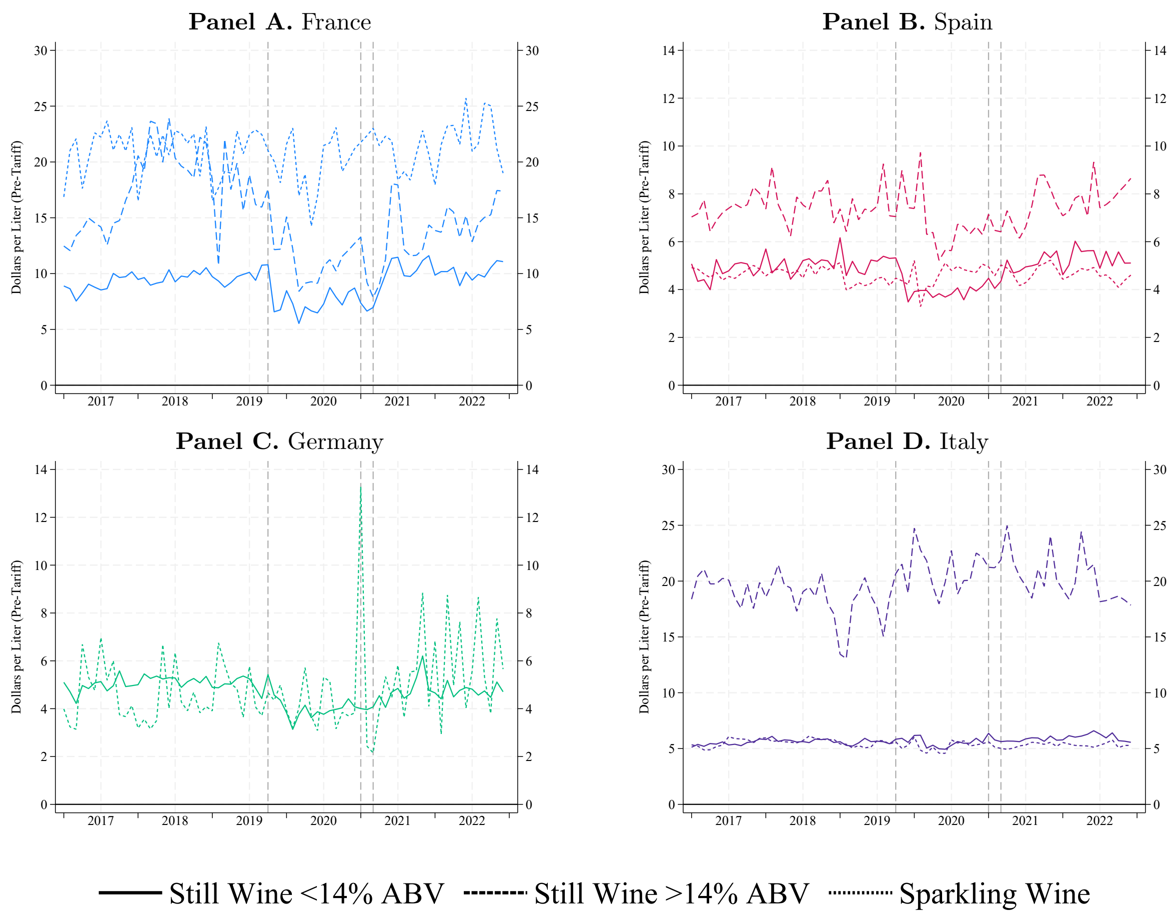
Notes: Still wines ≤14% ABV in containers of under 2 liters are classified under HS2204.21.50, still wines >14% ABV in containers of under 2 liters are classified under HS 2204.21.80, and sparkling wines are classified under HS 2204.10.00. Each series is seasonally adjusted using the X-13 ARIMA procedure. Vertical lines in the figure correspond to September, 2019 (tariffs on ≤14% ABV imposed), January 2021 (tariffs on all still wines from France and Germany), and March 2021 (tariffs removed).
Source: Authors' calculations based on publicly available data from United States International Trade Commission (2010-2019).

Panels A and B of Figure 2 reveal sharp drops in U.S. imports of ≤14% ABV wines from France and Spain, respectively. In contrast, there were only modest declines in U.S. imports from Germany (Panel C) and no noticeable changes in import quantities from a non–tariff-affected country such as Italy (Panel D). Perhaps equally striking as the declines in ≤14% ABV wines in Panels A and

B are the corresponding jumps in U.S. imports of >14% ABV wines from France and Spain in the months following the new October 2019 tariffs. There are essentially no U.S. imports of >14% ABV wines from Germany, reflecting the near-universal imports of Riesling wines from that country, a variety typically in the range of 8–12% ABV.

The sharp increase in U.S. imports of these French and Spanish still wines above 14% ABV, coinciding with the timing of the tariffs and rising from a low base (especially for imports from France), suggests purposeful tariff avoidance based on the limited product coverage of the tariffs. Furthermore, in Appendix Figure B2, we show that among the tariffed countries, Spain and Germany had no meaningful increase in products packaged in volumes greater than 2 liters, which were not tariffed. France, which did see a jump in such larger-volume products, nevertheless experienced a larger increase in still wines of > 14% ABV in bottle sizes under 2 liters. We will return to the substitution pattern towards > 14% ABV wines in greater detail in Section IV.

Figure 3: Import Unit Values by Source Country and Wine Type, 2017-2022

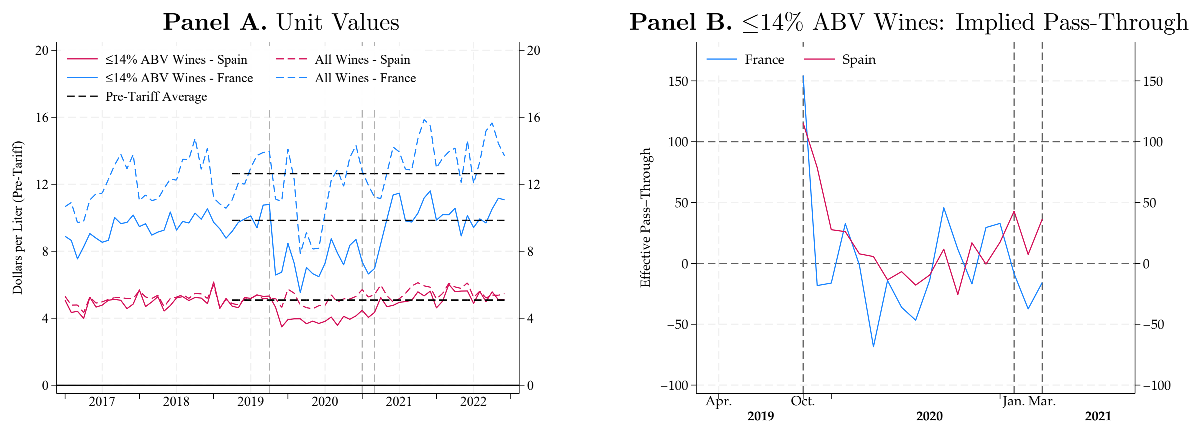


Notes: Wines ≤14% Alcohol are classified under HS2204.21.50, wines >14% alcohol are classified under HS 2204.21.80, and sparkling wines are classified under HS 2204.10.00. There are effectively zero imports of > 14% ABV wines from Germany, and so this line is omitted. Vertical lines in the figure correspond to September, 2019 (tariffs on ≤14% ABV imposed), January 2021 (tariffs on all still wines from France and Germany), and March 2021 (tariffs removed). *Source:* Authors' calculations based on publicly available data from United States International Trade Commission (2010-2019).

Combining values and quantities from publicly available trade statistics has been used for estimating rates of tariff pass-through at the border, most notably in Amiti, Redding and Weinstein (2019) and Fajgelbaum et al. (2019) for the 2018-2019 U.S. tariffs. The empirical approach is to relate changes in unit values to changes in tariff rates for particular country-product pairs. Indeed, an approximation of this approach can be visualized by inspecting whether or not the pre-tariff unit values remain constant (implying that the post-tariff unit values move up by the amount of the tariff – consistent with full pass-through), or decline in response (thus resulting in post-tariff unit values increasing by less than the amount of the tariff and consistent with partial pass-through). Figure 3 shows the unit values of the various types of wine imports by country. Focusing attention on the solid lines corresponding to ≤14% ABV wines subject to tariffs beginning in October 2019, it can be seen that across all tariff-affected countries there is evidence of declines in unit values that correspond to the timing of when tariffs were introduced. At face value, the empirical approach for measuring tariff pass-through at the border would interpret these patterns as evidence of incomplete pass-through.

Panel A of Figure 4 makes this concrete for the tariff-affected wines from both France and Spain, by visually using the mean unit value in a period before tariffs were imposed as a benchmark. Panel B of Figure 4 then relates these changes in unit values to the scale of the tariff, thereby translating these unit value movements over time into implied pass-through estimates during the tariff-affected period. From this perspective, it appears that foreign producers fully absorbed the tariffs by lowering prices, leaving tariff-inclusive prices unchanged.

Figure 4: Implied Pass-Through Rates



Notes: In Panel A, "all wines" series, dashed red and blue, include all wines in bottle sizes under 2 liters (sparkling, still ≤ 14% ABV, and still > 14% ABV). The pre-tariff average, dashed black line, is computed based on the average from April to September 2019.
Source: Authors' calculations based on publicly available data from United States International Trade Commission (2010-2019).

Yet this simple approach rests on many assumptions, not least of which is that the composition of products remains constant. Such an assumption is particularly strong for a product category like wine, which exhibits significant heterogeneity and quality differences. Indeed, Figure 3 shows that the unit values of >14% ABV wines (which were not tariffed) also shifted, potentially in response to the surge in U.S. imports during this period. The dropping of certain varieties from the import basket of ≤14% ABV wines (the treated group) could lead to biases in estimates of pass-through derived from publicly available data. Additional evidence comes from the movement in unit values across all wine categories under 2 liters (sparkling, still $\leq$14% ABV, and still $>$14% ABV), shown in Panel A of Figure 4. For this aggregated category, which includes tariffed wines, unit values are essentially flat for Spain during the tariff period and dip only temporarily for France.[8]

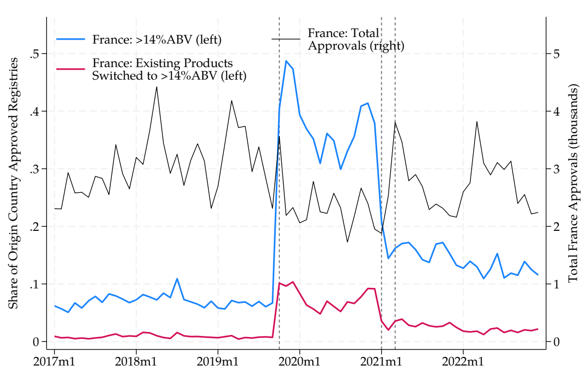
In summary, the results from this section highlight large movements in trade quantities from tariff-affected wines that appear to be partially offset by tariff-unaffected wines from the same export country. Movements in unit values provide suggestive evidence of low rates of tariff pass-through at the border, yet we highlight concerns in how changes in product composition (reinforced by the relative movements in trade quantities) may affect this traditional interpretation of the data. We explore changes in product composition and tariff avoidance strategies in greater detail in the next section.

IV Product Composition and Tariff Engineering

Product characteristics often shift in response to tariff schedules, a phenomenon well documented in the literature. One well-known example is the addition of fuzzy fabric to the soles of Converse shoes to reclassify them as 'textile-soled house slippers' (HS6405.20, 7.5 percent tariff) instead of 'sports footwear' (HS6404.11, 37.5 percent ad valorem tariff).[9] Here, we examine how wine producers adjusted product composition around the 2019 tariffs using data from COLA applications to the U.S. TTB.[10]

Figure 5: Certificate of Label Approval (COLA) Rates

Panel A. The Case of France



Panel B. Δ COLA Shares 2019 vs 2018

	Overall Increase in $>$ 14% ABV	Increase from Products Switching ABV
France	39 p.p.	9 p.p.
Spain	37 p.p.	4 p.p.
Italy	3 p.p.	1 p.p.
U.S.	-1 p.p.	0 p.p.

Notes: Panel A shows the share of COLA approvals of still wines for France by ABV level (blue and red lines; left axis) as well as the overall COLA approvals (black line; right axis). Panel B translates these movements into estimates of the overall tariff-induced change in COLA shares, presumably for tariff avoidance.
Source: Authors' calculations based on data from U.S. TTB Certificates of Label Approval (COLA) provided by COLA Cloud.

As a first step in understanding product composition changes underlying the dramatic import switching behavior in Figure 2, the left panel of Figure 5 plots the share of COLA approvals for still wine by month that are above 14% ABV for French originated products. The blue line shows

[8]One potential explanation for the temporary dip in France's unit values is another change in product composition, in which U.S. inventories of more expensive French wines were drawn down more heavily.

[9]See Mangini (2023) for a discussion.

[10]An alternative measure of re-classification of products to avoid tariffs relies on comparing E.U. export reports and U.S. import reports as done in a different setting by Fisman and Wei (2004). However, HS codes for European exports have a different disaggregation for wine that does not have the 14% ABV cutoff distinction.

that the share of label approvals for still wines above 14% ABV increased by nearly 40 percentage points immediately after the tariffs took effect, before declining once the tariffs were removed.[11]

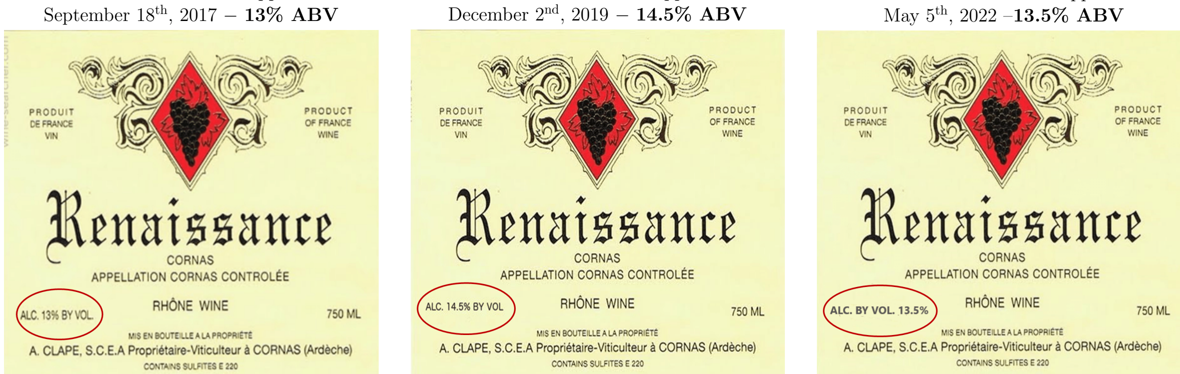
We next match applications during the tariff period to earlier applications of the same product.[12] The red line in the left panel of Figure 5 plots the share of COLA approvals for still wine products with >14% ABV for which we observe a prior COLA approval with ≤14% ABV. For France, this share jumped by nearly 10 percentage points in the months directly following the 2019 tariffs, accounting for roughly 25 percent of the increase in >14% ABV wines. The right panel of Figure 5 documents these statistics for France and Spain (countries affected by tariffs that had some degree of >14% ABV wines) and two countries unaffected by tariffs (Italy and the U.S.). An example of this switching behavior is shown in Figure 6: a French wine that had a COLA approval at 13% ABV in fall 2017 was re-submitted in December 2019 at 14.5% ABV with the same brand, appellation, and product name. A later label application in spring 2022—one year after the tariff ended—listed 13.5% ABV. Additional examples are presented in Appendix B3.

Figure 6: Example of Product ABV Switching

Panel A. Date of Label Application: September 18th, 2017 – **13% ABV**

Panel B. Date of Label Application: December 2nd, 2019 – **14.5% ABV**

Panel C. Date of Label Application: May 5th, 2022 –**13.5% ABV**



Another way to assess the tariff's impact is to examine changes in the distribution of ABV across still wines approved by the U.S. TTB over different periods. Figure 7 presents histograms of the ABV values of still wine approvals for French products for three periods: January 2015 to September 2019 (before tariffs were implemented), October 2019 to February 2021 (after tariffs were imposed), and March 2021 to December 2023 (following the suspension of tariffs). To facilitate comparison, the bars in red indicate new wine approvals with ABV up to the 14% threshold and bars in blue indicate new wine approvals above the threshold. To further identify the role of wines submitted for new COLA approvals that reflect wines reclassifying to *cross* the threshold ABV value (in either direction)—what we term "threshold-switchers"— we use gray bars that stack on top.[13] There is a notable shift in the distribution towards >14% wines after tariffs were implemented, with many of the new approvals bunching right around the 14% threshold value. Because the tariffs applied only to wines ≤14% ABV, the clustering just above this threshold reflects deliberate

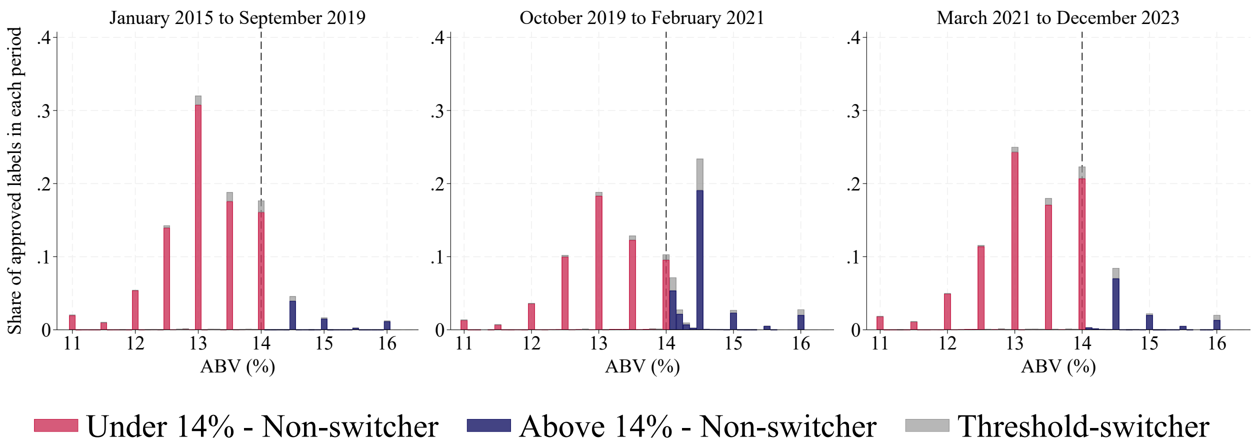
[11] The fall occurs in January of 2021, when tariffs were imposed on all French still wines. Hence, there were no differential tariffs between ≤14% and >14% ABV still wines to exploit.

[12] We define a product by its unique combination of brand name, product name, country of origin, wine appellation, and barcode (the last one if available).

[13] The wine in Figure 6 is part of the red bar at 13% in the first panel, then as a gray bar at 14.5% in the middle panel, and then as a gray bar at 13% in the right panel.

tariff avoidance. The significant share of gray bars added to those in blue also highlight the role of tariff engineering via threshold switching wines. The right panels reveal that the distribution of ABV values has mostly returned to the pre-tariff state after tariffs were suspended.

Figure 7: Distribution of Alcohol Content in New COLA Registries, France



Notes: The distributions are winsorized at 11% on the lower end and 16% at the upper end. Sparkling wines are excluded. 6.4% of the COLAs from French wines do not have an ABV value in our data and are excluded from this figure.
Source: Authors' calculations based on data from U.S. TTB Certificates of Label Approval (COLA) provided by COLA Cloud.

In Appendix Figure B5, we show the distribution for Spanish, German, and Italian wines. Products from Spain display a similar pattern to those from France. By contrast, the panel for Germany highlights how the concentration of Riesling wines at low ABV values limits the ability to avoid tariffs. Finally, there is no evident reclassification or shift in the ABV distribution for products from Italy, which was unaffected by the tariffs.

Given the speed with which we observe the tariff-engineering behavior documented in Figure 5 above, it seems unlikely that the wines changing threshold levels to avoid the higher tariff involved actual changes in alcohol content. Rather, these adjustments likely reflected changes in what was reported on wine labels. Using testing data from the Liquor Control Board of Ontario for 1992-2009, Alston, Fuller, Lapsley, Soleas and Tumber (2015) document that alcohol content was underreported on average, and that, conditional on underreporting, the true alcohol content was understated by 0.42 percentage points.

V A Simple Example of Intermediation Impacts on Tariff Pass-Through

Before proceeding with our analysis of more granular data from a large U.S. wine importer, we display a simple example of how domestic intermediaries can affect tariff pass-through to consumers. Specifically, consider a foreign firm with two domestic distribution stages before sale to the final consumer. The foreign producer receives p_F for its product from a U.S. importer that in turn charges a simple fixed percent markup $\mu_I > 1$ to a retailer: $p_I = \mu_I p_F$. The retailer then charges a similar fixed percent markup in its sales to the final consumer: $p_R = \mu_R p_I$. There are no other domestic distribution costs.

Now suppose a tariff is imposed on this imported product with incomplete pass-through at the border: the foreign producer absorbs λ percent of the new tariff (τ). The effective price received by the foreign producer is then $p_F^* = p_F(1-\lambda\tau)$. Various models can be used to micro-found the incomplete border pass-through rate λ. In the case of no additional layers of domestic intermediation and a perfectly competitive domestic market, the consumer price would be simply $p_F^*(1+\tau)$. Consumers would bear at most the tariff amount per unit, whether measured in percentage terms or in dollar terms.

In contrast, imperfect competition along the domestic supply chain can generate different outcomes. Using the same fixed percent markup rule in this tariff scenario, the price charged by the importer to the retailer is then: $p_I^* = \mu_I(p_F^*(1+\tau))$. And then finally, the consumer pays to the retailer $p_R^* = \mu_R\mu_I p_I^* = \mu_R\mu_I(p_F^*(1+\tau))$. There is now a nontrivial distinction between percent pass-through and pass-through estimates on a dollar basis (Sangani, 2025). In our example, percent pass-through of tariff rates assessed at the retailer stage is $\frac{\frac{\Delta p_R^*}{p_R}}{\Delta\tau}$ while the equivalent measure using the paid tariff rate is $\frac{\frac{\Delta p_R^*}{p_R}}{(1-\lambda\Delta\tau)\Delta\tau}$. In contrast, on a dollars and cents basis, assessed dollar pass-through is given by $\frac{\Delta p_R^*}{p_F\Delta\tau}$ while paid dollar pass-through is $\frac{\Delta p_R^*}{p_F(1-\lambda\Delta\tau)\Delta\tau}$. In this simple example with fixed markups, this can be rearranged to show that the dollar pass-through is simply the percent pass-through multiplied by the cumulative markup, $\mu_R\mu_I$. The pass-through equations for both the Importer and Retailer stages are summarized in Table 1 below, where we focus on the "paid" measures for the sake of brevity.

Table 1: Fixed Percentage Markup with Incomplete Border Pass-through

	Price		Pass-Through	
Stage	**Baseline**	**Tariff**	**Percent**	**Dollar**
Foreign Producer	p_F	$p_F(1-\lambda\tau)$		
Importer	$\mu_I p_F$	$\mu_I p_F(1-\lambda\tau)(1+\tau)$	$\frac{(1-\lambda\tau)(1+\tau)-1}{(1-\lambda\tau)\tau}$	$\frac{\mu_I((1-\lambda\tau)(1+\tau)-1)}{(1-\lambda\tau)\tau}$
Retailer	$\mu_R p_I$	$\mu_I\mu_R p_F(1-\lambda\tau)(1+\tau)$	$\frac{(1-\lambda\tau)(1+\tau)-1}{(1-\lambda\tau)\tau}$	$\frac{\mu_R\mu_I((1-\lambda\tau)(1+\tau)-1)}{(1-\lambda\tau)\tau}$

Notes: This table presents theoretical equations of prices and pass-through for three stages of a supply chain. The parameter λ reflects the percent of the tariff absorbed by the foreign producer. The terms μ_I and μ_R capture the markups of the importer and retailer, respectively. The τ term is the ad-valorem tariff.

The table makes clear that the percent pass-through remains constant across the two downstream stages and is bounded below one when there is incomplete border pass-through ($\lambda > 0$). On the other hand, the dollar pass-through is a function of the markups that cumulate across stages. Moreover, the dollar pass-through can exceed one even when the border pass-through is incomplete. Specifically, in this example the dollar cost of a tariff increase to final consumers can exceed the tariffs paid (dollar pass-through greater than one) whenever the following is true:

$$\mu_R\mu_I > \frac{(1-\lambda\tau)\tau}{((1-\lambda\tau)(1+\tau)-1)} \tag{1}$$

While this example is meant to motivate the analysis of the domestic intermediation sector for studying consumer pass-through, it relies on restrictive assumptions in which markups are fixed and do not respond to the tariff shock. We relax this assumption in subsequent sections and provide more discussion below.

VI Tariff Pass-Through Along the Supply Chain

A Data

The aggregate evidence highlights broad shifts in import volumes and border prices, and the simple markup example shows how successive margins can amplify tariff incidence beyond the statutory rate. However, neither perspective reveals how these mechanisms play out in practice for actual firms. To address this, we turn to confidential transaction-level data from a major U.S. wine importer, which allow us to trace tariffs from foreign producers through the importer to U.S. distributors.

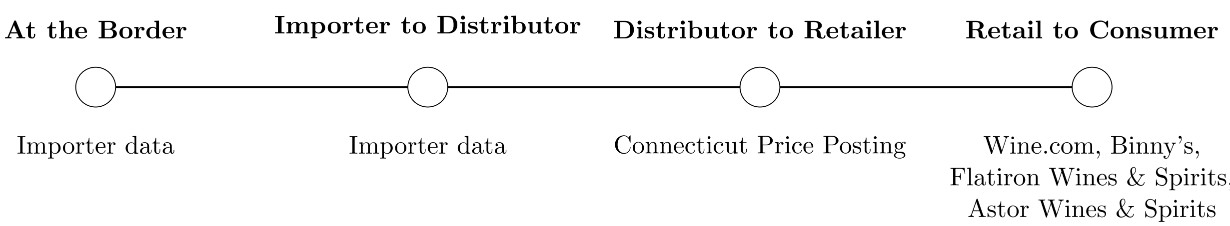
The confidential dataset contains all purchase and sales invoices of the importer's Spanish and French wines between October 2018 and March 2022 (covering one year before tariffs were imposed and one year after they were lifted). Under a non-disclosure agreement, we keep the firm's identity anonymous. This importer has significant sales volume and distributes to nearly all states in the U.S. On the purchase side from foreign producers, the data consists of purchase orders and their corresponding customs forms. Key variables include the foreign exporter, product, vintage, quantity, price, transport costs, and tariffs paid. On the sales side to U.S. distributors, the data consist of sales invoices that similarly include product, vintage, distributor identifier, quantity and price.

We trace these products along the supply chain using multiple supplementary data sources. Specifically, we obtain distributor-to-retailer price data for Connecticut, one of the few states that operates a price-posting system requiring distributors to report their prices to the state liquor control board. To our knowledge, enforcement regarding the accuracy of these reports and the consistency of posting is limited, so this particular data is of limited value for time-series analysis.

Finally, we obtain retail price data from the e-commerce platform Wine-Searcher. The platform tracks monthly retail prices at various wine stores, and we acquired the monthly wine prices at Wine.com, Binny's, Flatiron Wines & Spirits, and Astor Wines & Spirits for the wine products we observe in the transaction-level data provided by the U.S. importer.

Figure 8 summarizes the data sources at each stage of the supply chain.

Figure 8: Data Sources Along the Supply Chain

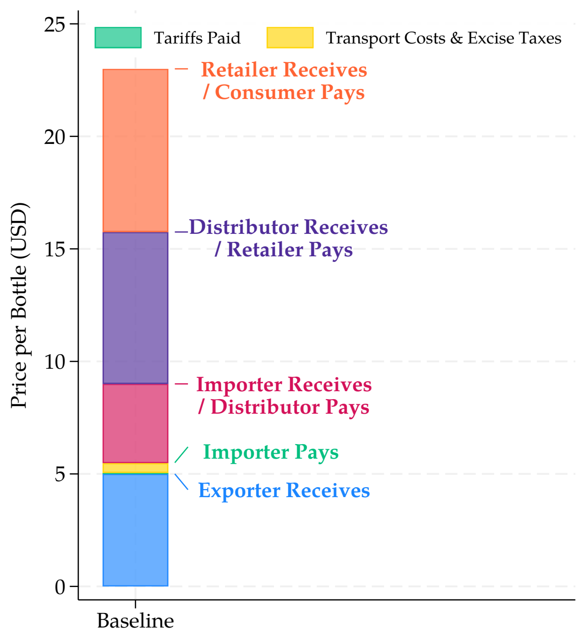


B From Foreign Supplier to Domestic Consumer: The Evolution of Wine Prices

Before analyzing price changes from the 2019-2021 tariffs, we first outline the pricing structure across the supply chain. Figure 9 illustrates the typical evolution of prices for the set of products sold by our importer.

Consider an example product for which the importer pays the foreign supplier $5 per bottle. The importer pays more to bring the product into the U.S. once tariffs, transport costs, and excise taxes are included. Specifically, the pre-2019 tariffs were a specific tariff of 6.7 cents per liter, transport costs were 21 cents per bottle, excise taxes were 22 cents per bottle, and storage costs averaged between 25 and 56 cents per bottle.[14]

Figure 9: Prices Along the Supply Chain: Baseline (Pre-Tariffs)



Notes: To construct the price levels in the figure, we compute the average gross markups at each stage and add them to the base price paid to the exporter of $5 per bottle for the example product. The gross markup from importer to foreign producer computes the average ratio of sales price (pooling all distributors-months) to purchase price (pooling all months). The gross markup from distributor to importer is calculated from the average of ratio of the Connecticut distributors' sales price (pooling distributors-months) to the importer's sales price (pooling all distributors-months). Finally, gross markups are computed based on pre-tariff months only. Average gross markups are weighted with total product quantities imported in the pre-tariff period. Results are similar if we restrict to have a common sample of product-vintages that we observe in all stages.
Source: Authors' calculations based on data from the Liquor Control Division of the State of Connecticut, a U.S. wine importer, and retail price information from Wine-Searcher.

To analyze how prices change along the chain, we calculate gross markups for each product-vintage of wine sold. We then average these values across all products. Specifically, we compute the average ratio of importer sales price to importer purchase price, distributor sales price to importer

[14] We observe transport costs at the shipment level; hence, per-bottle transport costs are calculated as the quantity-weighted share of the total transport costs of a given shipment. There are also additional costs beyond transportation and taxes. According to our importer, storage costs in the industry range from $0.75 to $1.50 per case per month. We estimate that products are stored for roughly four months on average after arrival in port before being sold to distributors.

sales price, and retail sales price to distributor sales price. For this computation, we restrict the sample to the year prior to the tariffs, calculate averages weighted by import quantities, and pool across months and distributors/retailers.

Using the calculation above of the weighted average relative (pre-tariff) prices, the wine price charged to the distributor is about \$9 per bottle, reflecting a gross markup (inclusive of other variable costs) of about 80 percent relative to the exporter's price. Using Connecticut price posting data, we observe that retailers pay distributors about \$16 per bottle, reflecting an additional gross markup of 75 percent. Finally, using online retail price data, we find that consumers pay about \$23 per bottle, after a further 50 percent markup from the distribution stage.[15] However, for the analysis of tariff pass-through, it is important to keep in mind that tariffs are charged only on the price paid to foreign exporters—about one-quarter of the final price that retailers charge consumers.

We next discuss the internal and external validity of the numbers shown here. The U.S. Census Annual Retail Trade Survey and the U.S. Census Annual Wholesale Report for 2019 show a gross margin as a percentage of sales of around 30 percent for the beer, wine, and liquor industry, for both retailers and wholesalers.[16] Our estimated gross margins as a percentage of sales are somewhat higher for wine distributors and the importer, at around 45 percent each, and near 35 percent for wine retailers. These reports also indicate that the margins of the retail and wholesale wine industries are not exceptional. Retail margins are quite similar to those of electronics and appliance stores, general merchandise stores, and health and personal care stores. Wholesale margins are comparable, for example, to those in apparel, hardware and plumbing, and machinery and equipment.

C Tariff Pass-Through Estimates Along the Chain

Pass-Through at the Border

We now turn to estimates of tariff pass-through at each stage of the supply chain. Reflecting recent evidence in Flaaen, Hortaçsu and Tintelnot (2020), which shows that tariff costs were spread across both tariffed goods (washers) and non-tariffed goods (dryers), we take a cautious approach in constructing the control group for this study. Specifically, we define the control group as the sample of products sold by foreign producers that *only* sell products unaffected by tariffs (sparkling wines and still wines with an ABV >14%). We then classify as *indirectly treated* those non-tariffed products from producers that also sell tariffed products. Naturally, our main treatment group consists of wines subject to the new tariffs (still wines with an ABV ≤14%). Treatment status is defined based on ABV during the tariff period.[17] Based on these criteria, 63% of all purchases fall into the treatment group, 21% into the control group, and 16% into the indirectly treated group.

We thus follow an event study approach to estimating tariff pass-through described in equation (2) in which our unit of observation is the purchase of wine product i in month t from various foreign

[15] Alvarez-Blaser et al. (2025) find that manufacturer and retail markups are negatively correlated across products in the cross section. In our setting, we do not observe the foreign producers' markups. Looking at a later stage in the chain, we do find that the gross markups of the importer and the combined gross markups of the wholesaler and retailer are uncorrelated (weakly positively correlated when weighting products by sales quantity).

[16] For the purposes of the survey, both importers and distributors are included in the wholesale category. Data from the Retail Trade Survey can be found here. Data from the Wholesale Report can be found here.

[17] In cases where a product crossed the 14% threshold during the tariff period—which was very rare in our transaction-level data—we defined treatment status according to the ABV classification with the larger import volume during that period.

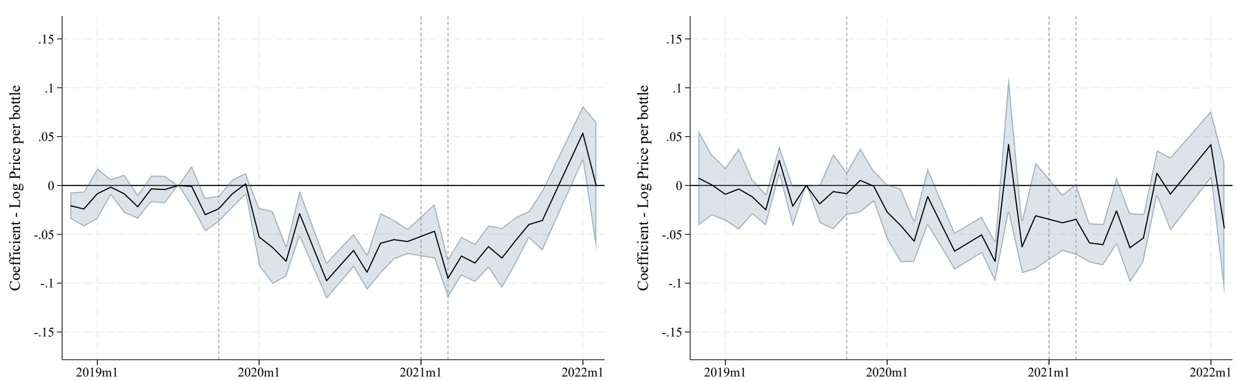
producers to the U.S. importer from which we obtain data. T represents the month when tariffs were imposed and ω_t and δ_i represent month and product fixed effects, respectively. We cluster standard errors at the product level, and we apply weights corresponding to the total quantity purchased before tariffs were imposed.

$$\begin{aligned} \log(\text{Purchase price per bottle})_{it} = & \sum_{t \neq T-3} \alpha_1^t \text{ Month}_t \times \text{Below 14\% ABV}_i \\ & + \sum_{t \neq T-3} \alpha_2^t \text{ Month}_t \times \text{Indirect treatment}_i \\ & + \omega_t + \delta_i + \varepsilon_{it} \end{aligned} \tag{2}$$

Panel A of Figure 10 shows that the purchase price paid by the U.S wine importer started to fall three months after tariffs took effect, and remained low relative to the control group for nearly eight months after the tariffs expired. A difference-in-differences regression finds an average price decline by 5.2% (S.E. = 1.0%) for tariff-affected wines relative to the control group of products.[18] Panel B of Figure 10 also shows a price decrease for the indirectly treated products—an average difference-in-differences coefficient of -4.1% (S.E. = 0.8%). This suggests that the importer and exporter negotiated prices for the entire bundle of products, not just those that were tariffed. Appendix C.3 explores heterogeneity in this rate of pass-through across the products sold by the importer, finding that the changes in the price obtained by the foreign supplier are fairly homogeneous across the distribution of gross mark-ups.

Figure 10: Event-Study Regression of Tariff Pass-Through: Importer Purchase Price

Panel A. Tariffed Products **Panel B.** Indirectly Treated Products



Notes: The figure shows the results of the event study regression in equation 2. The control group consists of products that were not tariffed (sparkling or still wines >14%) that were sold by producers that did not sell tariffed products to the importer. The indirectly treated products are non-tariffed products sold by producers that also sold tariffed products to the importer. We omit the period three months before tariffs were imposed. 90% confidence intervals computed from standard errors clustered at the product level. The sample is weighted by the total quantities purchased of a product in the period before the tariffs were imposed. Because imports are lumpy, we are forced to drop a few months from our sample due to insufficient data to jointly observing imports of the two treatment groups and the control group: Oct. 2018, May and July 2020, Nov. and Dec. 2021, and Mar. 2022.
Source: Authors' calculations based on data from a U.S. wine importer.

[18]This number comes from the difference-in-differences regression in which we categorize the months into four groups based on the event-study plot. We have the base period (Oct. 2018–Sep. 2019); a delay period (Oct. 2019–Dec. 2019); the treatment period (Jan. 2020–Feb. 2021); and a post-treatment period (Mar. 2021–Mar. 2022). See Table C1 for detailed regression results.

The total quantities of tariffed wines purchased by this importer dropped by 19% between the pre-tariff and tariff periods, relative to the control group. This decline in quantities is driven by a differential response in the intensive margin, as the growth in the total number of products purchased by the importer is similar across our three product group categories over the sample period.[19]

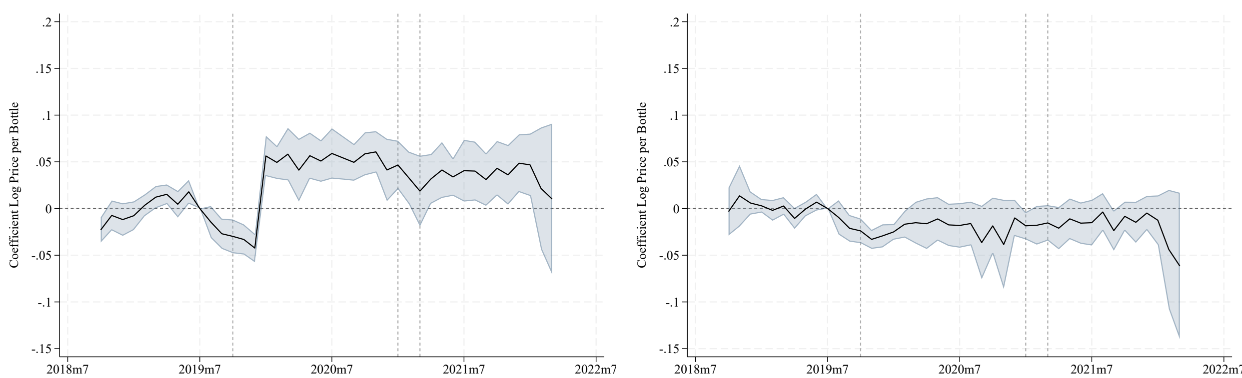
Pass-Through to Distributors

We now move on to a second stage in the impacts of tariffs on prices through the supply chain: the sales price of wine products from the importer to U.S. distributors. We use the same event-study approach as in Section VI but replace the left-hand side variable with the sales price product i to distributor j in period t. Moreover, equation (3) now includes distributor fixed effects (ϕ_j) along with time and product fixed effects. We continue to weight the regression by the total quantity sold of a product (to a distributor) in the pre-tariff period, and cluster standard errors at the product level.

$$
\begin{aligned}
\log(\text{Sales price per bottle})_{ijt} = & \sum_{t \neq T-3} \beta_1^t \, \text{Month}_t \times \text{Below 14\% ABV}_i \\
& + \sum_{t \neq T-3} \beta_2^t \, \text{Month}_t \times \text{Indirect treatment}_i \\
& + \eta_t + \varphi_i + \phi_j + \epsilon_{it}
\end{aligned}
\tag{3}
$$

Figure 11: Event-Study Regression of Tariff Pass-Through: Sales Price to Distributors

Panel A. Tariffed Products **Panel B.** Indirectly Treated Products



Notes: The figure shows the results of the event study regression in equation 3. The control group consists of products that were not tariffed (sparkling or wines >14%) that were sold by producers that did not sell tariffed products to the importer. The indirectly treated products are non-tariffed products sold by producers that also sold tariffed products to the importer. We omit the period three months before tariffs were imposed. 90% confidence intervals computed from standard errors clustered at the product level. The sample is weighted by the total quantities sold of a product to a distributor in the period before the tariffs were imposed.
Source: Authors' calculations based on data from a U.S wine importer.

Panel A of Figure 11 documents, similar to the pass-through at the border, a price increase

[19]We explore the possibility of quantity discounts at the shipment level for both purchases and sales of the importer in Appendix C.1. In general, we do not find any evidence for quantity discounts at the wine-shipment level.

three months after the tariff took effect. The difference-in-differences regression has a coefficient of 5.4% (S.E. = 1.4%) of tariffed wine products relative to the control group. We see some lasting effect of the increase in price for roughly a year after tariffs expire, coming down close to the end of our sample data. Panel B of Figure 11 shows no evidence of price effects on indirectly treated products. We once again explore aspects of heterogeneity in the rate of pass-through at this stage in Appendix C.3, and we find that pass-through to distributors was somewhat larger for products with lower initial importer margins.

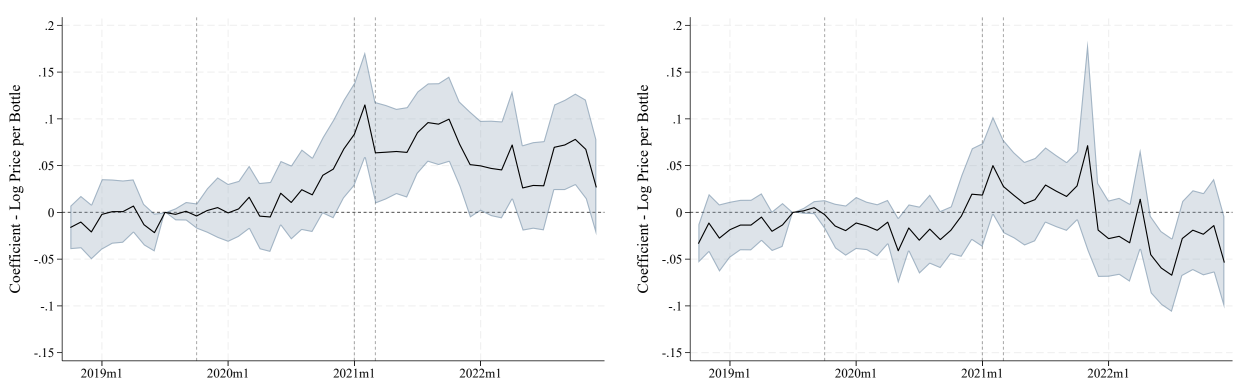
Sales quantities of tariffed wines fell by 12.7% between the pre-tariff and tariff periods, relative to the control group. Since the decline in sales is smaller than the decline in purchases, it indicates a relative decline in inventories for tariffed wines compared to the control group. Changes in the number of products sold were very similar between tariffed products and the other categories, indicating that the sales reduction was driven by a differential response in the intensive margin.

Pass-Through to Consumers

We turn finally to the end stage of prices affected by these wine tariffs as the product is sold from retailers to consumers. This stage merits particular emphasis as these are the price changes both experienced by the consumer and also incorporated into estimates of inflation tracked carefully by policymakers. The underlying price data for this analysis no longer comes directly from the importer, but nevertheless we focus on the same set of wine products and vintages. The regression specification is similar to the above, but we modify our fixed effects to include month and product-by-retailer fixed effects, reflecting the fact that we have different retail locations for a given bottle of wine.

Figure 12: Event-Study of Retail Sales Price

Panel A. Tariffed Products   **Panel B.** Indirectly Treated Products



Notes: The figure shows the results of the event study regression in equation 3. The control group consists of products that were not tariffed (sparkling or wines >14%) that were sold by producers that did not sell tariffed products to the importer. The indirectly treated products are non-tariffed products sold by producers that also sold tariffed products to the importer. We omit the period three months before tariffs were imposed. The 90% confidence intervals are computed from standard errors clustered at the product level.
Source: Authors' calculations based on data from a U.S wine importer and retail price information from Wine-Searcher.

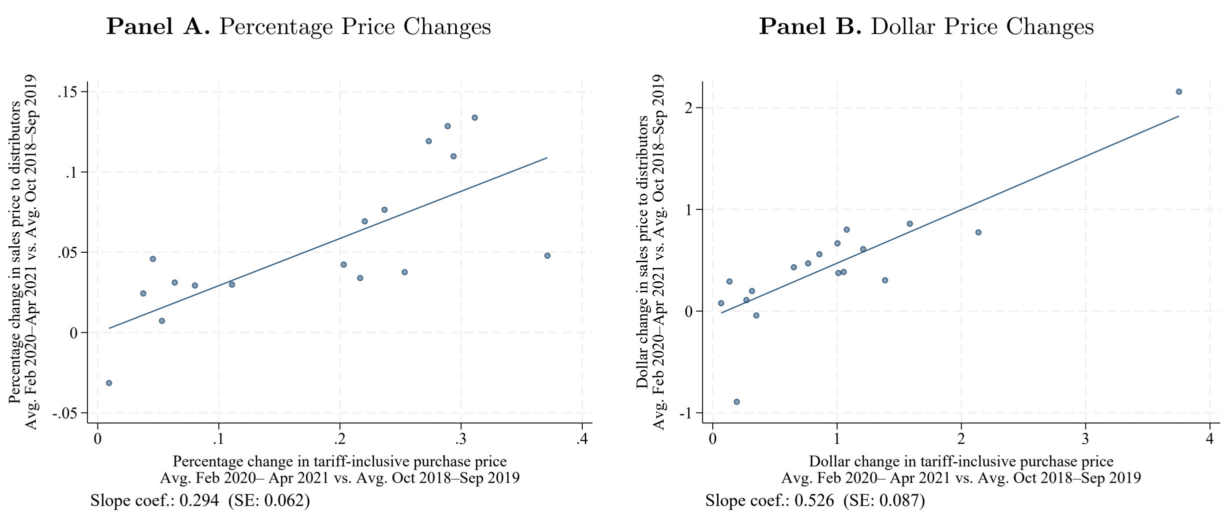
Panel A of Figure 12 exhibits a price increase to consumers which took a full 12 months to materialize after tariffs took effect. Our difference-in-differences estimate has a coefficient of 6.9%

(S.E. = 2.4%) of tariffed wine relative to the control group.[20] The longer lag of price effect at this stage could reflect the additional time that the product spends in transit and in inventory at the distributor and subsequently the retailer. Prices remain high more or less through the remainder of our sample after tariffs expire (essentially through the end of 2022). The indirectly affected wines (Panel B) do not exhibit any significant price increases.

Corroboration of Pass-Through Along the Chain

The results thus far suggest that the price changes resulting from tariffs pass along the stages of the supply chain, and ultimately to the final consumer. To reinforce that this is indeed the case, rather than a coincidence of price changes at each stage driven by different factors, we exploit the product-level detail of our data and consider the correlation of these product-level price changes across stages. The binscatter displayed in Figure 13 shows a strong positive correlation between the change in tariff-inclusive purchase prices of the importer (x-axis) and the change in importer sales price (y-axis). Panel A demonstrates this relationship on a percent basis, while Panel B indicates the correlation is even stronger on a dollar basis. The estimated coefficients indicate imperfect pass-through from the importer to the distributor both in percent and in levels.

Figure 13: Binscatter of Correlation Between Changes in Tariff-Inclusive Purchase Prices and Changes in Importer Sales Prices to Distributors



Notes: The binscatter includes all products and is weighted by the total quantity of purchased products in the pre-tariff period. To calculate the change in prices we first compute the average price for each product in the periods displayed in the figure axis'. Slope coefficient and robust standard error displayed below the figure.
Source: Authors' calculations based on data from a U.S wine importer.

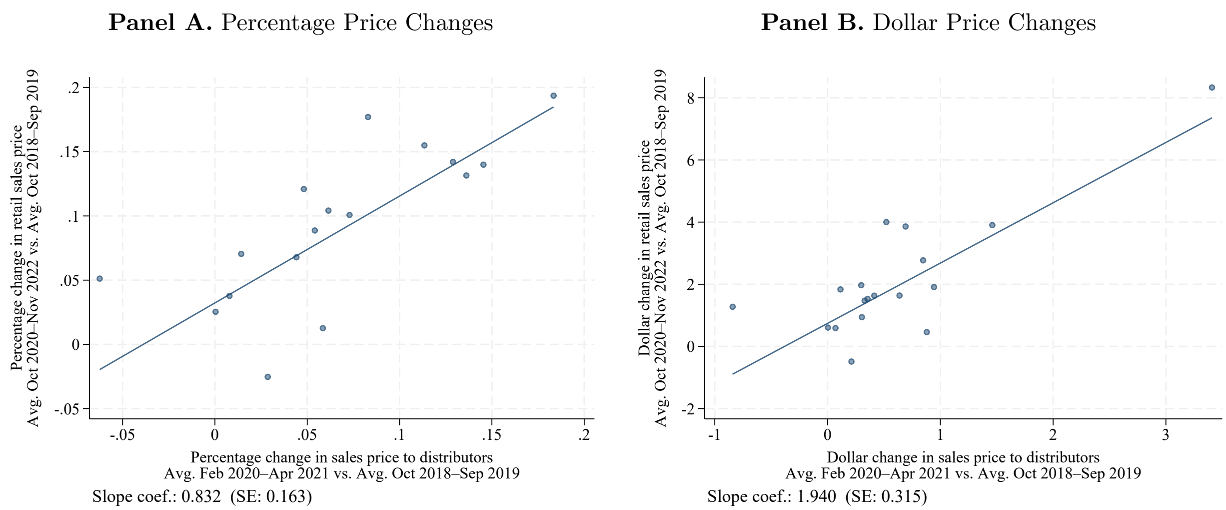
Further along the chain, Figure 14 shows a strong positive correlation between the price changes from importer to distributor (x-axis) and the price changes from retailer to consumer (y-axis). Panel A evidences a correlation with slope coefficient that is not statistically different from 1, consistent with the estimates of full pass-through from distributors/retailers to consumers in percentages.

[20] The periods used in the difference-in-differences estimate at this stage are the following: the base period (Oct. 2018–Sep. 2019); a delay period (Oct. 2019–Oct. 2020); the treatment period (Nov. 2020–Oct. 2022); and a post-treatment period (Nov. 2021–Dec. 2022). See Table C1 for detailed regression results.

Panel B indicates the more than full pass-through in levels. All told, these results reinforce the interpretation of this section as showing pass-through of tariffs into prices along the supply chain.

To explore the sensitivity of our findings, we also run a version of our event study at each stage of the supply chain, restricting the analysis to a balanced sample of products. The results are remarkably similar in this balanced sample. In particular, at the border we estimate a price reduction of 5.1% (S.E. 1.0%). For sales to distributors, we find a price increase of 5.4% (S.E. 1.4%) in the balanced sample. Finally, at retail, we estimate a 6.9% (S.E. 2.4%) price increase to consumers. Our balanced-sample estimates are quite close to the full-sample estimates, since we are able to match most products across the three stages, especially as a share of quantities sold by the importer.

Figure 14: Binscatter of Correlation Between Changes in Importer Sales Price to Distributors and Changes in Price at Retail



Notes: This figure includes all products matched between the importer and Wine-Searcher. The binscatter is weighted by the total quantity of products sold in the pre-tariff period. To calculate the change in prices we first compute the average price for each product in the periods displayed in the figure axis'. The slope coefficient and robust standard error are displayed below the figure.
Source: Authors' calculations based on data from a U.S wine importer and retail price information from Wine-Searcher.

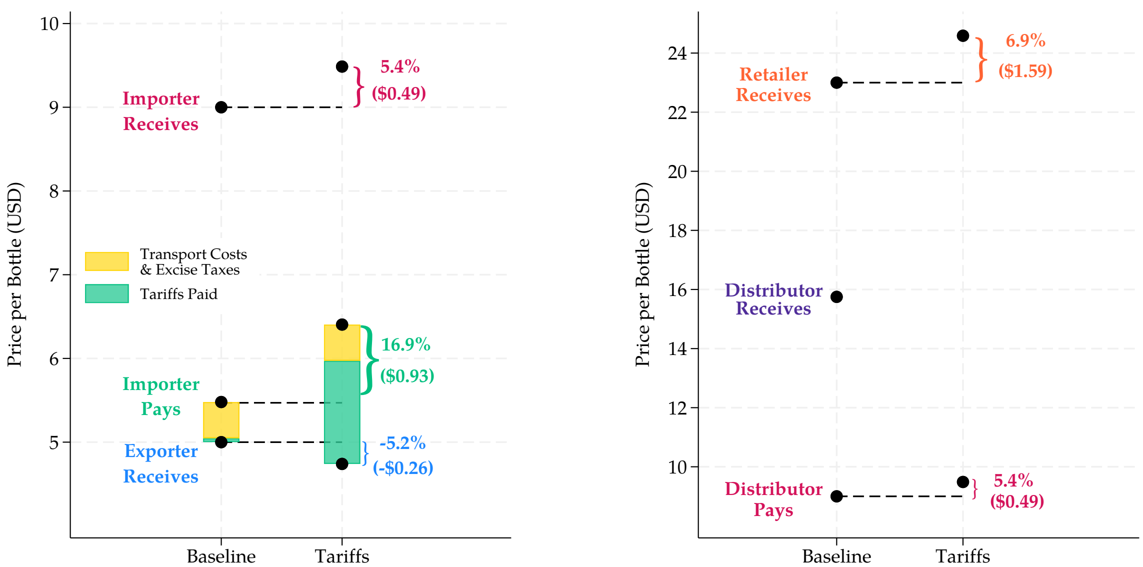
Summarizing Tariff Impacts Along the Chain

The results in this section trace out the price effects of the 2019 wine tariffs across all U.S. stages of the supply chain from importer to final consumer. Linking these impacts together allows for a unique perspective on the interplay between tariffs, markups and the ultimate impact on consumer prices.

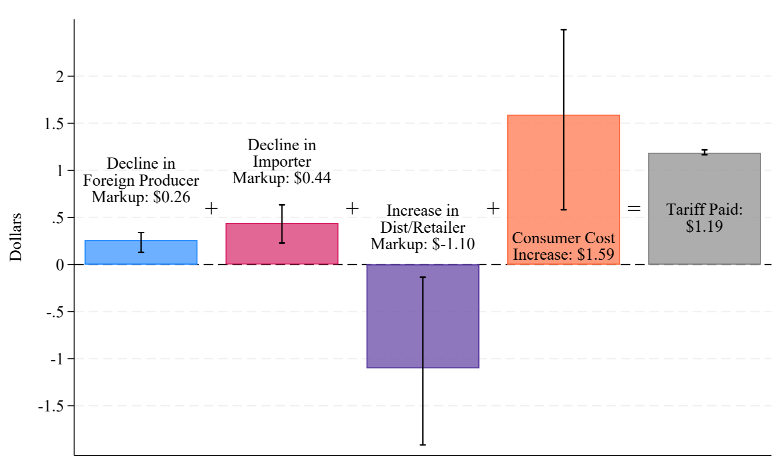
Panels A and B of Figure 15 visualize the results of this section, building on the example product in Figure 9, for which the importer paid \$5 to the exporter before the tariff. Panel A describes the changes impacting the domestic importer. While the foreign producer reduced the price they received by an average of 5.2% (\$0.26 per bottle), this is only a fraction (22%) of the resulting tariff liability: $\$5 \times (1 - 0.052) \times 0.25 = \$1.19$ per bottle, or a net tariff of 23.7% on the initial price. The roughly 19% increase in costs (\$0.93 per bottle) is also partially offset by the 5.4% (\$0.49 per bottle) increase the importer passed on to the distributor. The result is that the initial 64% (\$3.52) markup (i.e. the gross markup exclusive of import shipping costs, excise taxes, storage, and tariffs) of the importer declined to 48% (\$3.08) after the new tariffs are imposed. Hence, in dollar terms the importer markup declined by \$0.44 per bottle. The impacts to the foreign producer and U.S. importer are summarized, on a per-bottle basis, in the blue and red bars in Panel C of Figure 15.

Figure 15: Summary of Tariff Effects Along the Supply Chain

Panel A. Foreign Producer and Importer Impact | **Panel B.** Distributor-Retailer and Consumer Impact



Panel C. Tariff Cost Along the Supply Chain



Notes: This figure visualizes the price changes for a bottle of wine for which the importer paid \$5 to the exporter before the imposition of tariffs. The 90% confidence intervals in brackets are computed from a bootstrap with 5000 iterations and clustered at the product level. Each repetition of the bootstrap draws a set of products from the purchases data (with replacement) and uses that sample to estimate the difference-in-differences coefficients in the three stages.
Source: Authors' calculations based on data from a U.S wine importer and retail price information from Wine-Searcher.

Panel B illustrates the impact to the combined gross markups of the distributor and retailer. The 5.4% increase in costs (or \$0.49 per bottle) paid by the distributor passes through into what the retailer eventually sold to the consumer—a 6.9% increase in price or \$1.59 per bottle. Hence, the gross markup of the combined distributor and retailer actually expanded by \$1.10 per bottle following the tariff. These impacts are summarized in the purple and orange bars in Panel C of Figure 15. But what is particularly notable from Panel C is that our point estimates indicate that the dollar increase in consumer costs resulting from the tariffs (\$1.59 per bottle) is actually *higher* than the tariff revenue (\$1.19 per bottle). Hence, tariff revenue for this particular tariff event was more than fully offset by increases in consumer prices. Considering the estimation uncertainty along multiple stages, we can say with 90% confidence that the consumer dollar cost per dollar of tariff revenue exceeds 68%.[21]

The results on markup responses to this tariff shock shares similarities and differences with other findings and assumptions in the literature. Alvarez-Blaser et al. (2025) find a negative correlation between manufacturer and retail markups in their setting; despite being a single cost shock, our results do suggest offsetting markup changes between the foreign producer and U.S. importer and the distributor/retailer. Other recent work studying tariff pass-through in Minton and Somale (2025) assume constant dollar markups in distribution stages following full pass-through at the border. Our results find greater than constant dollar markups, as the cost increase to the importer (\$0.93) varies along the chain but is ultimately much higher (\$1.59) by the time it reaches the final consumer.

This discussion emphasizes not only important distinctions between pass-through estimates in percent vs. dollars, but how those distinctions can be magnified through different stages of the supply chain when the relevant cost shock (such as tariffs) occurs relatively upstream. In Table 2, we calculate the relative pass-through of this cost shock at each stage along two different dimensions. The first dimension is the distinction between pass-through in dollars vs. percent (as in Sangani (2025)). The second dimension considers the relevant magnitude of the cost shock. The first two columns of Table 2 calculate the pass-through of the overall cost shock, where the calculations keep the original shock (in percent and dollar terms) constant along the chain. The third and fourth columns calculate the pass-through of just the prior-stage cost shock, which are the firm-relevant objects at each stage in the chain. What is clear from these columns is that neither the percent nor dollar pass-through rates are constant across stages.

In our example, the foreign producer absorbed 0.052/0.25 =20.6% of the tariff, and so using this value of λ, the rate increase in tariffs paid relevant to the domestic portion of the supply chain is 23.7% (the $(1-\lambda\tau)\tau$ from above translates to $(1-.052)0.25 = 0.237$). Similarly, the dollar value paid in tariffs is equal to \$1.19 ($p_F(1-\lambda\tau)\tau$ from above translates to $5*(1-.206*.25)*.25 =$\$1.19). From here it can be shown that the pass-through both in levels and dollars at the border will be identical at 78 percent.

Unlike the simple example illustrated in Section V, the markups assessed were not fixed after the tariff was imposed, and so cannot be derived from the analytical expressions in that section. From our empirical estimates however, it is clear that the pass-through estimates in later stages—from the importer to the distributor, and then from the distributor through the retailer and to the

[21]This one-sided test as well as the confidence intervals in Figure 15 and Table 2 result from a bootstrap in which we draw products from the importer purchases data (with repetition) and then use those products in regressions for all subsequent stages of the chain.

consumer—exhibit pass-through rates in dollars that exceed the pass-through rates expressed in percent. Moreover, the gap between these estimates expands dramatically with each stage, such that the pass-through estimate on consumer prices looks to be a modest 29 percent when expressed as percent, but is 134 percent when expressed in dollar terms.

Table 2: Summary of Pass-Through Estimates Along the Supply Chain

	Pass-Through of Tariff Cost		**Pass-Through of Prior Stage Cost Increase**	
	(in percent)	(in levels)	(in percent)	(in levels)
Exporter →Importer	78% $\frac{.237-.052}{.237}$	78% $\frac{\$0.93}{\$1.19}$	78% $\frac{.237-.052}{.237}$	78% $\frac{\$0.93}{\$1.19}$
	[71%,89%]	[71%,89%]	[71%,89%]	[71%,89%]
Importer →Distributor	23% $\frac{.054}{.237}$	41% $\frac{\$0.49}{\$1.19}$	29% $\frac{.054}{.186}$	53% $\frac{\$0.49}{\$0.93}$
	[14%,35%]	[25%,63%]	[18%,42%]	[33%,76%]
Dist./Retailer →Consumer	29% $\frac{.069}{.237}$	134% $\frac{\$1.59}{\$1.19}$	128% $\frac{.069}{.054}$	326% $\frac{\$1.59}{\$0.49}$
	[11%,46%]	[49%,210%]	[50%,213%]	[128%,543%]

Notes: Fractions shown in gray may not equal percent pass-through exactly due to rounding. The 90% Confidence intervals in brackets are computed from a bootstrap with 5000 iterations and clustered at the product level. Each repetition of the bootstrap draws a set of products from the purchases data (with replacement) and uses that sample to estimate the difference-in-differences coefficients in the three stages.
Source: Authors' calculations based on data from a U.S wine importer.

VII A model of tariff pass-through along the supply chain

In order to rationalize the empirical findings from the previous section, we develop a stylized model of tariff pass-through along the supply chain. The aim of the model is to provide a rationale for why (a) the consumer price can rise by as much as the tariff paid (in dollar terms), even though the foreign supplier reduces its price, and (b) why the importer bears a substantial share of the tariff burden while the retailer appears to pass on the tariff fully (in percentage terms). Here in the main text we present the main components and results of the model, while the mathematical details are provided in Appendix A.2.[22]

We consider four types of agents: a continuum of consumers with CES preferences for wines; two domestic intermediary tiers (importers and retailers, abstracting from wholesalers for simplicity); and foreign wine suppliers.

We focus on a case in which the tariff is imposed only on a small subset of wines available to consumers. This setup mimics the empirical context, where imports account for one-third of consumption and only about one-third of those imports were tariffed. A consequence of this

[22]The advantages of the model presented here are its relative simplicity and intuitive features mapping to the setting of the wine market in the U.S. Alvarez-Blaser et al. (2025) for example, employ a model with Nash bargaining between stages of the chain to determine how profits are split in order to rationalize the negative correlation in markup changes they observe in their data.

assumption is that the profitability of the retailer's outside option—offering a domestic wine or another non-tariffed foreign wine in the same shelf space—remains roughly unchanged. For our purposes, we do not go deeper into modeling domestic wine suppliers.

There are many importers, each of which imports a single differentiated variety of wine. For each variety, there are many foreign suppliers that supply these wines competitively. An outside option for the foreign supplier is to sell the wine to other markets, where they face downward-sloping demand.[23] This gives rise to an upward-sloping supply curve for each wine variety in the U.S. market. We assume the importer acts as a price taker in the input market when purchasing foreign wines.[24] Each importer operates in a monopolistically competitive market when selling wines to retailers. The retailers, in turn, operate in a monopolistically competitive market when selling wines to consumers.

The retailers' and importers' variable costs consist of the price of the wine at the respective stage of production. Retailers also have an opportunity cost, F, of providing shelf-space to a wine. Therefore, a retailer will sell a wine only if the participation constraint is met, that variable profits are at least as large as F. We abstract away from other variable costs the retailers and importers may face, and only impose that the profits of the importer are weakly positive.

In the absence of tariffs, the equilibrium for the wine market is displayed in Panel A of Figure 16. The foreign supply of wine is represented by a gray straight line, and the intersection with the importer's marginal revenue curve (red dashed curve) determines the equilibrium point F_1. Tracing upward, we find point E_1 on the retailer's marginal revenue curve (blue dashed curve) and, finally, point D_1 on the demand curve (in black) with corresponding price p_1. The segments D_1–E_1 and E_1–F_1 represent the retailer's and importer's markups, respectively. In this no-tariff situation, and where the participation constraint by the retailer is non-binding, the retailer's profits are captured by Area Π_1 (in green).

The second case introduces tariffs but when the participation constraint by the retailer is non-binding. In Panel B, the ad-valorem tariff, denoted by τ, creates a wedge between the price that the producer receives (c_2) and the price paid by the importer ($(1+\tau)c_2$). At this new tariff-inclusive price, the quantity traded leads to points D_2, E_2, and F_2 on the demand curve, retailer's marginal revenue, and importer's marginal revenue, respectively. Given the upward sloping foreign export supply curve, tariff pass-through at the border is incomplete, and hence the importer price paid rises to $(1+\tau)c_2$, less than $(1+\tau)c_1$. Again, the retailer and importer maintain their initial percentage markups, while the retailer's profit corresponds to Area Π_2 (in red). Here, the consumer price rises more than the tariff per unit.

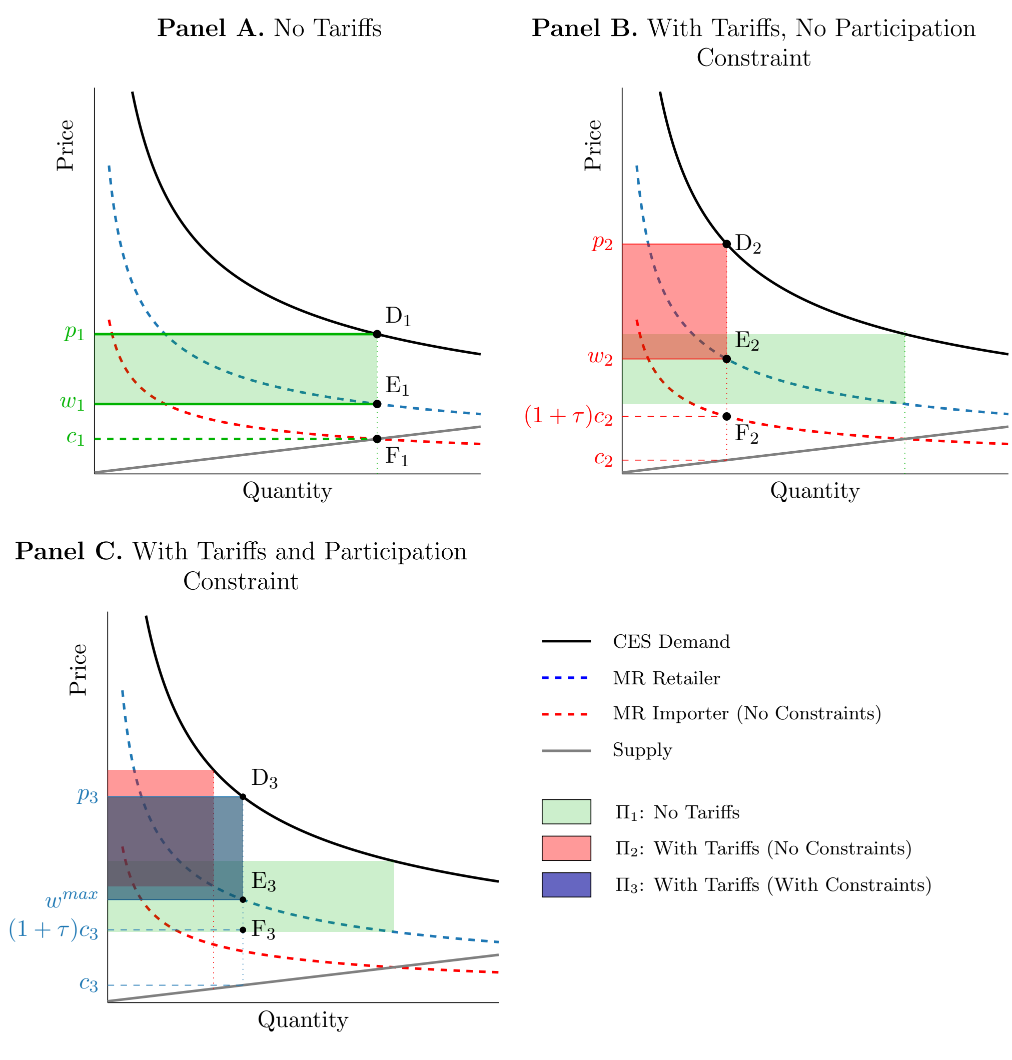
Finally, the third case in Panel C combines tariffs with a retailer participation constraint, recognizing the retailer's shelf fixed cost F. When $\Pi_1 > F$ but $\Pi_2 < F$, the constraint ensures that profits just meet F. Otherwise, the retailer would drop the wine from its portfolio. The new price obtained by the foreign suppliers adjusts to c_3 with a tariff-inclusive price $(1+\tau)c_3$. The constrained equilibrium generates points D_3, E_3, and F_3, corresponding to demand, retailer's marginal revenue, and importer's tariff-adjusted price. Here, the importer's mark-up shrinks, and the retailer's profit is represented by Area Π_3 (equal to fixed costs F; in blue).

[23] In Table B1 we show that for French, Spanish, and German wines the U.S. was an export destination of no more than 20% of products. Therefore, other markets are completely viable outside options.

[24] This assumption can be relaxed without altering the main conclusions. See Appendix A.3 for the mathematical derivations under this scenario.

This model offers several useful features. Without domestic intermediation and with perfectly competitive foreign suppliers, a decline in the foreign price would necessarily lead the domestic consumer price increase to be *less* than the tariff revenue per unit of the imported good. With domestic intermediation, however, it is possible that the consumer price increase exceeds the tariff paid. There also exist scenarios in which the domestic intermediation could actually dampen the consumer price increase; for example, if at the initial equilibrium without tariffs the retailer's participation constraint was already binding. Then, a small increase in the tariff would be fully absorbed by the importer.[25] If domestic intermediaries follow a fixed mark-up rule, as in Panel B, increasing the number of layers in domestic intermediation makes it more likely that the consumer price increase exceeds the tariff revenue per unit.

Figure 16: Tariff Pass-Through Along the Supply Chain With and Without Participation Constraints



[25] If the tariff increase is too large, the importer would stop importing the product entirely when the importer's profits become negative.

VIII Discussion and Conclusions

This paper studied the pass-through of tariffs across multiple stages of a distribution supply chain in the United States, using tariffs imposed on European wines in 2019 as a case study. For the central question of "who pays for tariffs", we find that it is possible that domestic consumers fully pay for these costs, even when border pass-through is incomplete. The reason is that markups along the chain of intermediation between importer and consumer can scale up the percent pass-through in tariff costs, cumulating over distribution stages and resulting in a direct dollar impact on prices to be greater than tariffs paid, even though the percent change in consumer price is less than the tariff ad-valorem rate.

These results are helpful for understanding the full incidence of the tariffs introduced in 2025 and how that incidence could ultimately translate into effects on inflation, disposable personal income, and profits. The framework in this paper is useful for addressing these questions and provides benchmarks for policymakers to interpret the data. For example, suppose that the border pass-through of tariffs was complete. Given a tariff rate increase of around 16 percentage points (thus far through September 2025) and a prevailing set of gross markups affecting PCE goods of 110%, then markups could decline 15 percentage points (13.7 percent) even while the consumer dollar cost increases of the associated imported goods would still fully cover increased tariff revenue (dollar pass-through equal to one).[26] In this scenario, the percent pass-through of tariffs to consumer prices would be only 48 percent (the inverse of the markup).[27] Other scenarios could consider alternative assumptions on border pass-through or changes in distribution markups.

This paper has several additional findings useful for policymakers studying the measurement of tariff pass-through, many of which result from the use of confidential data from a large U.S. wine importer. First, we find that aggregate customs data is ill-suited to measure pass-through at the border in the setting of 2019 tariffs on wine because of strong compositional changes induced by the tariffs. In an example of tariff engineering, products switched their alcohol content to avoid the tariffs, and new products were introduced that were not subject to the tariffs.

Second, we trace the pass-through of the tariffs along the supply chain from the foreign producer to the final consumer, unpacking how prices and markups adjust to this cost shock along multiple stages. We find that foreign producers partially absorb the tariff by lowering their prices, leading to incomplete pass-through at the border. In the next stage, domestic importers only pass about a 5% price increase (out of the 25% tariff) to their distributors, resulting in a contraction in their markups relative to before the tariffs. Finally, markups actually expand between distributors and final consumers: despite an additional stage of markups, prices increase to the consumer by close to 7 percent relative to before tariffs were imposed. Despite a significantly smaller percent increase in prices than the percent applied in new tariffs, multiple markups resulted in the dollar increase in what consumers paid ($1.59 per bottle, in our example) that was ultimately greater than the increase in tariff revenue ($1.19 per bottle).

Finally, we document important features of the timing between when tariffs are imposed, and when these price changes occur along the supply chain. For the case of tariffs on European wines, price impacts to the consumer didn't materialize until 12 months after tariffs were imposed, re-

[26]The new markup that would achieve this level is given by $\mu_2 = \frac{\mu_1+\tau}{1+\tau}$ with μ_1 being the initial markup – 110% in this scenario.

[27]It can be shown that this pass-through is ultimately just $\frac{1}{\mu_1}$—see Appendix A.4.

flecting the role of inventories and multiple stages of trade intermediation.[28] Additional research on inventory behavior, the stages and timing of domestic production and distribution chains, and markup behavior would benefit our overall understanding of the impacts of future tariffs on domestic economies.

[28]See Minton and Wheaton (2023) for more ways in which lags can be introduced between cost shocks and consumer prices.

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Who Pays for Tariffs Along the Supply Chain? Evidence from European Wine Tariffs

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Online Appendix

A Model Details

A.1 Basic Model

In this section we describe the mathematical details of the model described in Section VII. There are four types of agents: consumers, retailers, importers, and foreign suppliers. For simplicity, we abstract from the additional layer of wholesalers.

A.2 Model Setup

Final Demand

A continuum of consumers have CES preferences for wines. This results in the following iso-elastic demand function:

$$q(p) = Dp^{-\sigma} \quad , \sigma > 1 \tag{A1}$$

Retailer Problem

The retailer purchases the wine from an importer at price w and sells it to consumers at price p. In addition to the marginal cost w, the retailer faces a fixed shelf cost F for carrying the wine. The retailer operates under monopolistic competition. Therefore, the retailer's profit maximization problem is given by equation A2. If the variable profits of the retailer are not sufficient to cover the fixed cost F, the retailer will not carry the wine.

$$\max_p \Pi_r(p; w) = \begin{cases} (p-w)Dp^{-\sigma} - F & \text{if} \quad \max_p (p-w)Dp^{-\sigma} \geq F \\ 0 \quad \text{if} \quad \max_p (p-w)Dp^{-\sigma} < F \end{cases} \tag{A2}$$

The retailer's pricing rule is given by the standard CES constant markup rule and the quantity demanded by the retailer from the importer are shown in equations A3.

$$\begin{aligned} p(w) &= \mu w \qquad \text{where} \quad \mu \equiv \frac{\sigma}{\sigma - 1} \\ q_r(w) &= D(\mu w)^{-\sigma} \end{aligned} \tag{A3}$$

With these, we can determine the retailer's participation constraint in terms of the wholesale price w that requires variable profits to be weakly above the fixed cost F. This condition is given by equation A4, where $B \equiv D\frac{(\sigma-1)^{\sigma-1}}{\sigma^{\sigma}}$.

$$\Pi_r(w)^{\text{var}} = (\mu - 1)w \cdot q_r(w) = Bw^{1-\sigma} \geq F \tag{A4}$$

Then, we can define the maximum wholesale price, w^{max}, that the retailer is able to pay to carry the wine, given the participation constraint. This value is given by equation A5. Therefore, we say that if $w < w^{max}$ the participation constraint (PC) is slack or non-binding, and if $w = w^{max}$ the PC is binding.

$$w^{max} = \left(\frac{B}{F}\right)^{\frac{1}{\sigma-1}} \tag{A5}$$

Importer Problem

The importer purchases the wine from a foreign supplier at price c and sells it to the retailer at price w. It must also pay for the tariff with rate τ. The importer operates under monopolistic competition when setting price and takes the foreign price c as given (we relax this second assumption in a later subsection). First, let us consider the case when the retailer's PC is non-binding. In this case, the importer's profit maximization problem is given by equation A6.

$$\max_{w} \ \Pi_i(w; c, \tau)^{\text{int}} = (w - (1+\tau)c)D(\mu w)^{-\sigma} \tag{A6}$$

The importer's pricing rule will again be the standard CES markup over marginal cost rule: $w^{int} = \mu \cdot (1+\tau)c$.

In case that $w^{int} > w^{max}$ –the retailer's PC is binding– then the importer is forced to set $w = w^{max}$. Overall, the importer's optimal pricing rule is given by equation A7. The first case corresponds to the interior pricing solution, as the PC is non-binding. The second case corresponds to the situation where the PC is binding, but the importer can still make non-negative profits. The third case corresponds to the situation where the PC is binding and the importer cannot make non-negative profits, in which case the importer will not import the wine.

$$w(c) = \begin{cases} \mu \cdot (1+\tau)c & \text{if} \quad \mu \cdot (1+\tau)c \leq w^{max} \\ w^{max} & \text{if} \quad \mu \cdot (1+\tau)c > w^{max} \text{ and } w^{max} \geq (1+\tau)c \\ \text{N/A} & \text{if} \quad \mu \cdot (1+\tau)c > w^{max} \text{ and } w^{max} < (1+\tau)c \end{cases} \tag{A7}$$

The optimal quantity demanded by the importer is thus given by equation

$$q(c) = \begin{cases} D\mu^{1-\sigma} \cdot ((1+\tau)c)^{-\sigma} & \text{if} \quad \mu \cdot (1+\tau)c \leq w^{max} \\ D\mu^{-\sigma} \cdot (w^{max})^{-\sigma} & \text{if} \quad \mu \cdot (1+\tau)c > w^{max} \text{ and } w^{max} \geq (1+\tau)c \\ 0 & \text{if} \quad w^{max} < (1+\tau)c \end{cases} \tag{A8}$$

Foreign Producer

Based on the evidence that European wines are mostly sold in other markets outside of the U.S. (see Table B1), we assume that foreign producers have an upward-sloping supply curve when selling to the U.S. market. The foreign producer has a supply curve given by equation A9, where $K > 0$ and $\eta > 1$, and operates in a perfectly competitive market. We abstract from the foreign producer facing fixed costs of production and hence from incentives for the foreign producer to stop exporting altogether to the U.S.

$$c(q) = Kq^{\eta} \tag{A9}$$

Pre-Tariff Equilibrium

We focus on a case in which prior to the imposition of tariffs, the PC is slack and it is profitable for the importer to sell the wine. The equilibrium in this model, which is summarized in Panel A of Figure 16, is determined by the exporter sales price, c_1, such that A10 holds. We use the 1 subscript to denote pre-tariff outcomes.

$$c_1 = K\left[D\mu^{1-\sigma} \cdot (c_1)^{-\sigma}\right]^{\eta} \tag{A10}$$

Then, from the equilibrium quantity imported –given by $q_1 \equiv q(c_1)$– we can trace the equilibrium prices set by the importer to retailers and by the retailer to consumers. These are, respectively, given by $w_1 = \mu \cdot c_1$ and $p_1 = \mu^2 \cdot c_1$.

Post-Tariff Equilibrium

In the post-tariff equilibrium we may have either an interior solution or the retailer's PC binding. First, let us discuss the results when we are still under an interior solution, which is captured in Panel B of Figure 16. The tariff creates a wedge between the producer's supply and the importer's marginal revenue. Due to the upward-sloping supply curve and downward-sloping demand, both the foreign producer receives a lower price and the importer pays a higher (tariff-inclusive) price. The new equilibrium quantities are given by $q_2 = q_1 \cdot (1+\tau)^{\frac{-\sigma}{1+\sigma\eta}}$. Where we use the 2 subscript to denote the post-tariff equilibrium when the PC is slack. This determines the price that the foreign producer perceives as $c_2 = c_1 \cdot (1+\tau)^{\frac{-\sigma\eta}{1+\sigma\eta}}$ and the tariff-inclusive (TI) price paid by the importer as $c_{2,TI} = c_2(1+\tau) < c_1(1+\tau)$. Meanwhile, the rest of the prices along the chain are given by $w_2 = (1+\tau)\mu \cdot c_2$, and $p_2 = (1+\tau)\mu^2 \cdot c_2$.

Despite the retailer's PC is non-binding there is generally no full pass-through of tariff on consumer prices because the exporter reduces it's sales price to the importer. Meanwhile, both the importer and the retailer preserve their original gross markups and therefore consumers are likely to face significant price increases. The percentage change in the tariff-inclusive price paid by the importer is given by equation A11. For the rest of the chain we have full pass-through as $\Delta\%w_2 = \Delta\%p_2 = \Delta\%c_{2,TI}$. Note that in the special cases in which $\sigma \to \infty$ there is zero pass-through at the border, and therefore, the foreign producer absorbs all the cost. Additionally, if $\eta = 0$ we have full pass-through at the border and thus full pass-through at retail prices.

$$\Delta\%c_{2,TI} \equiv \frac{c_2(1+\tau) - c_1}{c_1} \cdot 100\% = \left([1+\tau]^{\frac{1}{1+\sigma\eta}} - 1\right) \cdot 100\% \leq \tau \tag{A11}$$

So far this model cannot explain why there is imperfect pass-through from the importer to the distributor but full pass-through from the distributor/retailer to consumers. For this purpose, now consider the case where the tariff shock is large enough so that $\mu \cdot (1+\tau)c_2 > w^{max}$ (i.e. the PC of the retailer is binding).

For starters, we already know that the equilibrium quantity will be given by $q_3 = D\mu^{-\sigma} \cdot (w_{max})^{-\sigma} > q_2$ (and $q_3 < q_1$). Therefore, the price perceived by the importer will equal $c_3 = K(q_3)^{\eta}$, and hence the price paid by the importer is $c_{3,TI} = c_3(1+\tau) > c_2(1+\tau)$. As the importer is forced to cap the price at which it sells the wine to the retailer, it will necessarily shrink its gross markup.

We now turn to determine how the pass-through is different at each stage of the supply chain. First, at the border, as total quantities are lower than in the initial equilibrium, but higher than in situation with non-binding PC, we have that the foreign producers take a smaller cut in prices: $\Delta\%c_3 < \Delta\%c_2$. Then it follows directly that the importer is paying a higher tariff-inclusive price than in the non-binding PC equilibrium: $\Delta\%c_{2,TI} < \Delta\%c_{3,TI}$. Further along the chain, the importer is now having it's gross markup reduced as there is limit in the price it can set for the retailer: $\Delta\%w_3 < \Delta\%w_2$. However, note that the retailer has the same pricing rule and therefore passes along the entire cost increase it faces: $\Delta\%p_3 = \Delta\%w_3$ (even though it is a lower overall increase than in the non-binding scenario $\Delta\%p_2$).

A.3 Model with Importer Monopsony

In this section, we consider the case in which the importer also has market power over its purchase price to the exporter. The rest of the model remains the same.

Importer Problem

By allowing the importer to have market power over its purchase price, its maximization problem (when the retailer's PC is non-binding) is now given by equation A12. In it, the importer internalizes the supply curve of the foreign producers: $c(q) = Kq^{\eta} = K(D(\mu w)^{-\sigma})^{\eta}$. By doing so, the importer has an additional incentive to restrict quantities as this lowers the purchase price.

$$\text{(A12)} \qquad \max_{w} \Pi_i(w;\tau)^{\text{int}} = \left(w - (1+\tau)\cdot K(D(\mu w)^{-\sigma})^{\eta}\right) D(\mu w)^{-\sigma}$$

In this case, the optimal sales price of the importer is given by $w_2 = \left[(1+\tau)KD^{\eta}\mu^{1-\sigma\eta}(1+\eta)\right]^{\frac{1}{1+\sigma\eta}}$. This implies that the price paid to the importer, when the PC is slack, is $c_2 = KD\mu^{-\sigma}(w_2)^{-\sigma\eta}$. Therefore, we can determine the percentage change in the tariff-inclusive price paid by the importer, shown in equation A13. Notice that we obtain the same percentage pass-through at the border as in the case of no monopsony.

$$\text{(A13)} \qquad \Delta\%c_{2,TI} \equiv \frac{c_2(1+\tau) - c_1}{c_1} = \left([1+\tau]^{\frac{1}{1+\sigma\eta}} - 1\right)\cdot 100\%$$

Now, let us consider the pass-through when the PC is binding. In this case the importer again has to set its sales price to $w_3 = w^{max}$ and therefore the equilibrium quantities are given by $q_3 = D\mu^{-\sigma}\cdot(w_{max})^{-\sigma} > q_2$. Notice that these are the same quantities under the model without monopsony. Therefore, as the quantities have been capped, this restricts the market power that the importer exerts over the foreign producer, and therefore, the price perceived by the foreign producer is $c_3 = K(q_3)^\eta$. In this case, importer monopsony power over the foreign producers results in the same level of pass-through at the border, and through the supply chain, as in the version without monopsony.

A.4 Additional Equations on Pass-Through

This appendix provides additional equations in the spirit of section V in the main text that further illustrate the connections between percent pass-through, dollar pass-through, and markups.

In this section we simplify to only consider one distribution stage, but allow flexibility to markups to be different before tariffs (μ_1) vs after tariffs (μ_2). As a reminder, we define p_F as the price that foreign producer receives (pre-tariff) and λ as the percent of the tariffs absorbed by the importer. Our exercise of interest here is what post-tariff markup would make the additional consumer dollar costs be exactly equal to the tariffs paid. We also consider the case with complete border pass-through ($\lambda = 0$). Hence, we write:

$$\text{(A14)} \qquad \begin{aligned} \frac{p_F(1-\lambda\tau)(1+\tau)\mu_2 - p_F\mu_1}{p_F(1-\lambda\tau)\tau} =& 1 \\ (1+\tau)\mu_2 =& \tau + \mu_1 \\ \mu_2 =& \frac{\mu_1+\tau}{1+\tau} \end{aligned}$$

, which shows that the new markup is offsetting the change in tariffs. The resulting percent change in markups from before is then given by:

$$\text{(A15)} \qquad \begin{aligned} \frac{(\mu_1-1)-(\mu_2-1)}{(\mu_1-1)} &= \frac{\mu_1 - \frac{\mu_1+\tau}{1+\tau}}{(\mu_1-1)} \\ &= \frac{\tau(\mu_1-1)}{(\mu_1-1)(1+\tau)} \\ &= \frac{\tau}{(1+\tau)} \end{aligned}$$

The resulting percent pass-through under this scenario is then:

$$\text{(A16)} \qquad \begin{aligned} \frac{\frac{\Delta p^*}{p}}{(1-\lambda\Delta\tau)\Delta\tau} =& \frac{\frac{p_F(1-\lambda\tau)(1+\tau)\mu_2 - p_F\mu_1}{p_F\mu_1}}{(1-\lambda\tau)\tau} \\ =& \frac{\frac{(1+\tau)(\frac{\mu_1+\tau}{1+\tau})-\mu_1}{\mu_1}}{\tau} \\ =& \frac{(\tau+\mu_1)-\mu_1}{\mu_1\tau} \\ =& \frac{1}{\mu_1} \end{aligned}$$

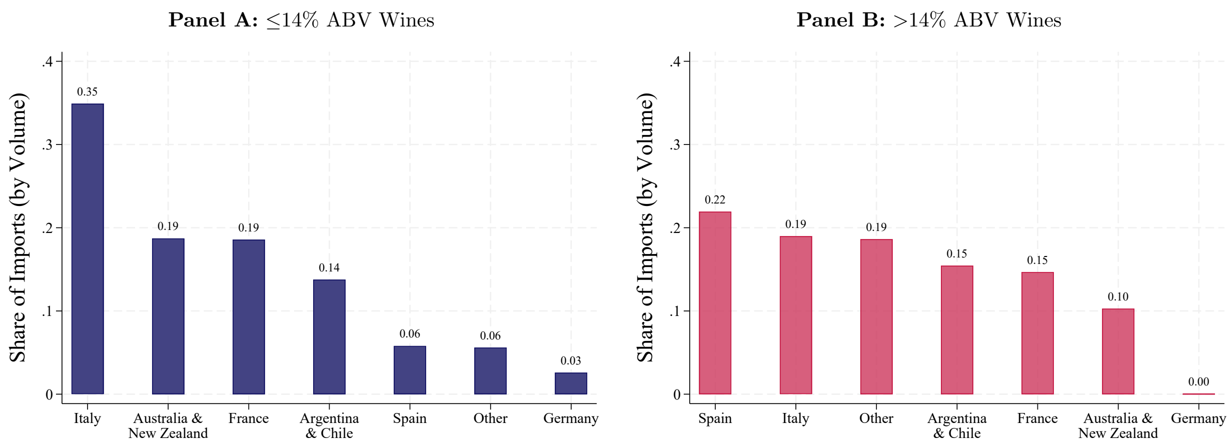
which is independent of the tariff rate, as the new markup has exactly offset the change.

B Additional Results - Aggregate Effects

B.1 Aggregate Imports

This appendix section shows some additional results related to aggregate effects of the tariffs. Figure B1 shows the distribution of quantity import shares by country for wines below and above 14% ABV in 2018. Relative to the value shares shown in Figure 1, France has a lower share of quantities as French products tend to be higher priced than those from other countries. Spain, on the other hand has a higher share of quantities than values for wines above 14% ABV. For other countries, the share of quantities is similar to the share of values.

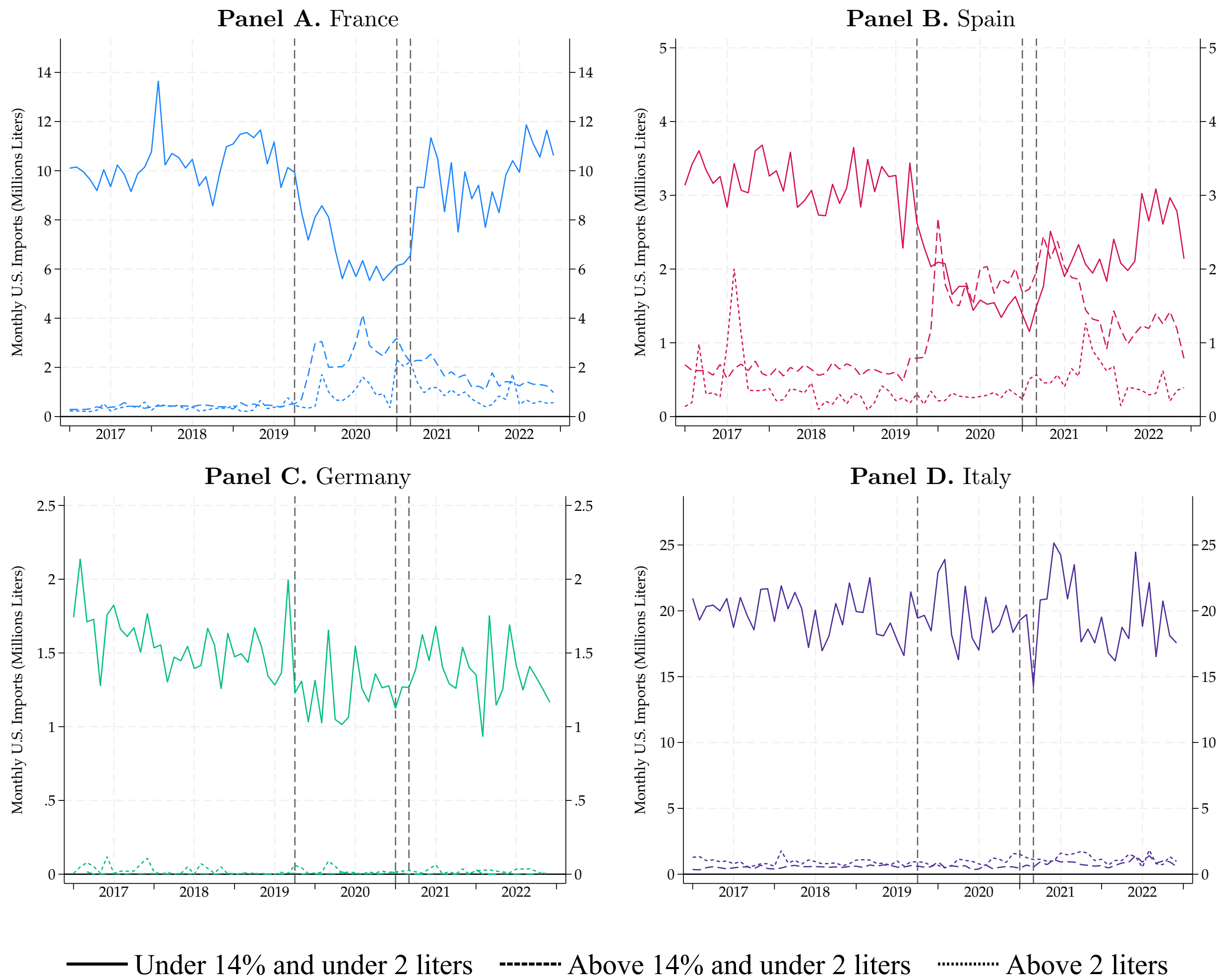
Figure B1: Source of U.S. Wine Import Quantities by Country, 2018



Notes: The figures exclude imports of wines in containers of over 2 liters.
Source: Authors' calculations for 2018, based on publicly available data from United States International Trade Commission (2010-2019).

Figure B2 presents evidence of the behavior of bulk wine imports, which were also exempted from tariffs (German and French bulk still wines were eventually tariffed during the first two months of 2021). We see that bulk wine imports from France (panel A) showed a relevant increase in 2020. However, such an increase was still significantly smaller than the increase in ≥14% ABV wines of under 2 liters. Meanwhile, bulk wine imports from Spain and Germany remained virtually at the same level while tariffs were imposed (Panels B and C).

Figure B2: U.S. Monthly Import Quantities, 2017–2022



Notes: Wines ≤14% Alcohol in bottles of under 2 liters are classified under HS2204.21.50, wines >14% alcohol in bottles of under 2 liters are classified under HS 2204.21.80, and wines of over 2 liters are classified under HS 2204.22 and 2204.29. Each series is seasonally adjusted using the X-13 ARIMA procedure.
Source: Authors' calculations based on publicly available data from United States International Trade Commission (2010-2019).

B.2 Destination of European Wine Exports

We turn to data on the export destinations of still wine products produced by France, Spain, Germany, and Italy. The overall message of Table B1 is that while the U.S. is an important export market for these countries, it is far from the dominant one as the share of exports to the U.S. is below 20% for France, Spain, and Germany.

Table B1: European Export Markets for Still Wine (HS2401.21): 2018-2022

		Share of Exports				
Country	**Partner**	**2018**	**2019**	**2020**	**2021**	**2022**
France						
	Europe	31	31	34	32	32
	China	17	15	14	14	11
	USA	18	19	15	17	18
	UK	12	13	14	14	14
	ROW	11	11	11	12	13
	Other Asia	10	11	11	11	12
Spain						
	Europe	43	42	45	42	42
	ROW	18	20	18	19	22
	UK	14	14	16	16	13
	USA	12	13	12	12	14
	China	8	8	5	6	4
	Other Asia	4	4	4	5	5
Germany						
	Europe	60	58	67	66	65
	USA	11	10	9	10	10
	UK	14	16	10	7	7
	ROW	8	8	7	8	10
	China	5	5	5	5	5
	Other Asia	3	3	3	4	4
Italy						
	Europe	46	46	48	48	47
	USA	26	26	24	24	25
	ROW	12	13	13	13	13
	UK	9	8	8	8	7
	Other Asia	4	5	5	5	6
	China	3	3	2	3	2

Source: Authors' calculations based on publicly available data from Eurostat.

B.3 Additional Evidence on Tariff Engineering

Figure B3: Example of Product ABV Switching

Panel A. Date of Label Application: July 12th, 2018
13.5% ABV

Panel B. Date of Label Application: October 4th, 2019
14.1% ABV

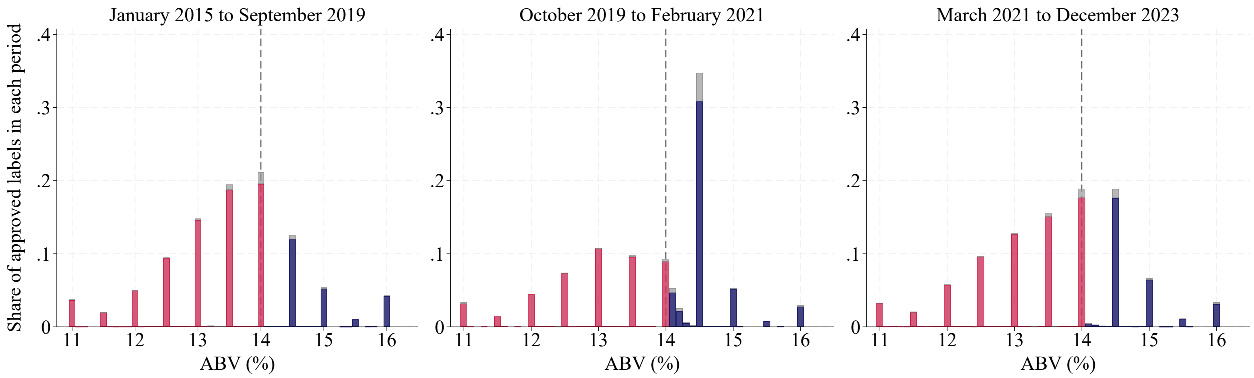
Figure B4: Example of Product ABV Switching

Panel A. Date of Label Application: November 17th, 2016
13% ABV

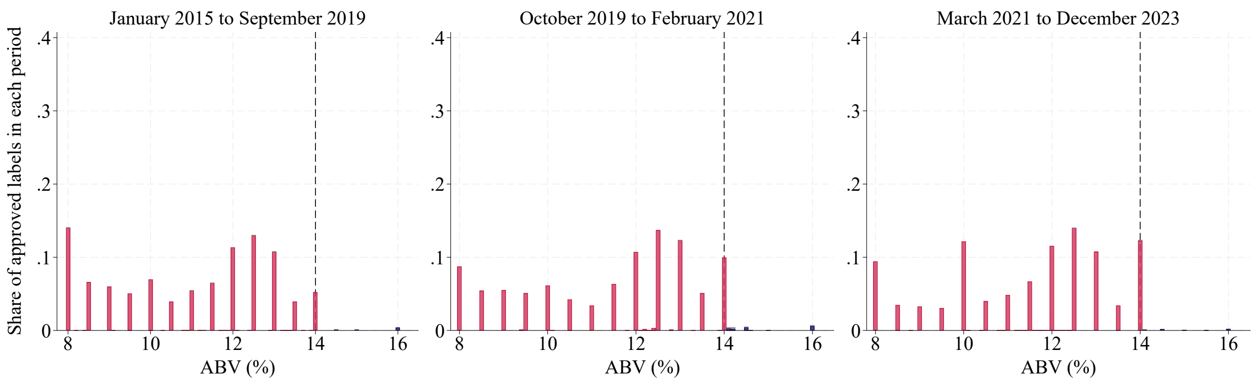
Panel B. Date of Label Application: August 10th, 2020
14.5% ABV

Figure B5: Distribution of Alcohol Content in New COLA Registries, by Country

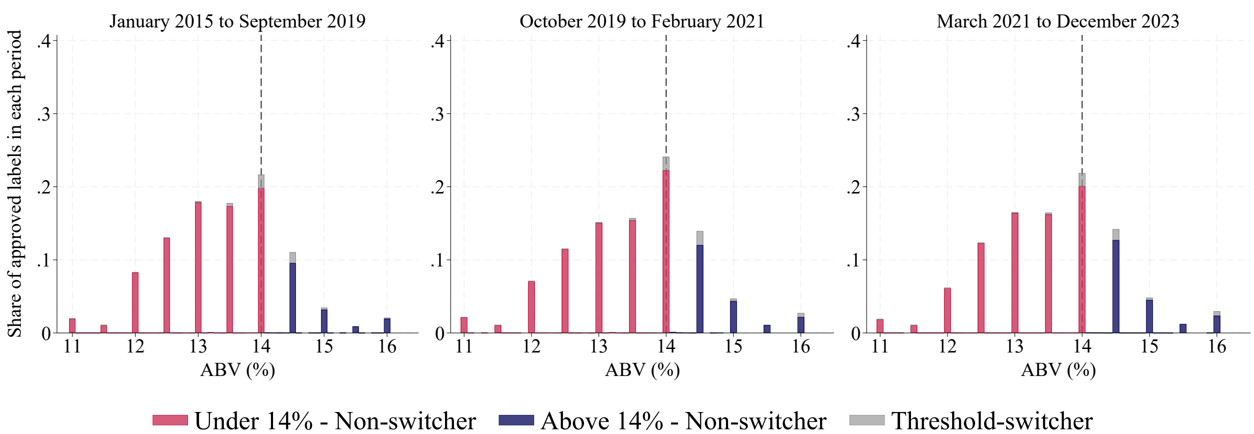
Panel A: Spain



Panel B: Germany



Panel C: Italy



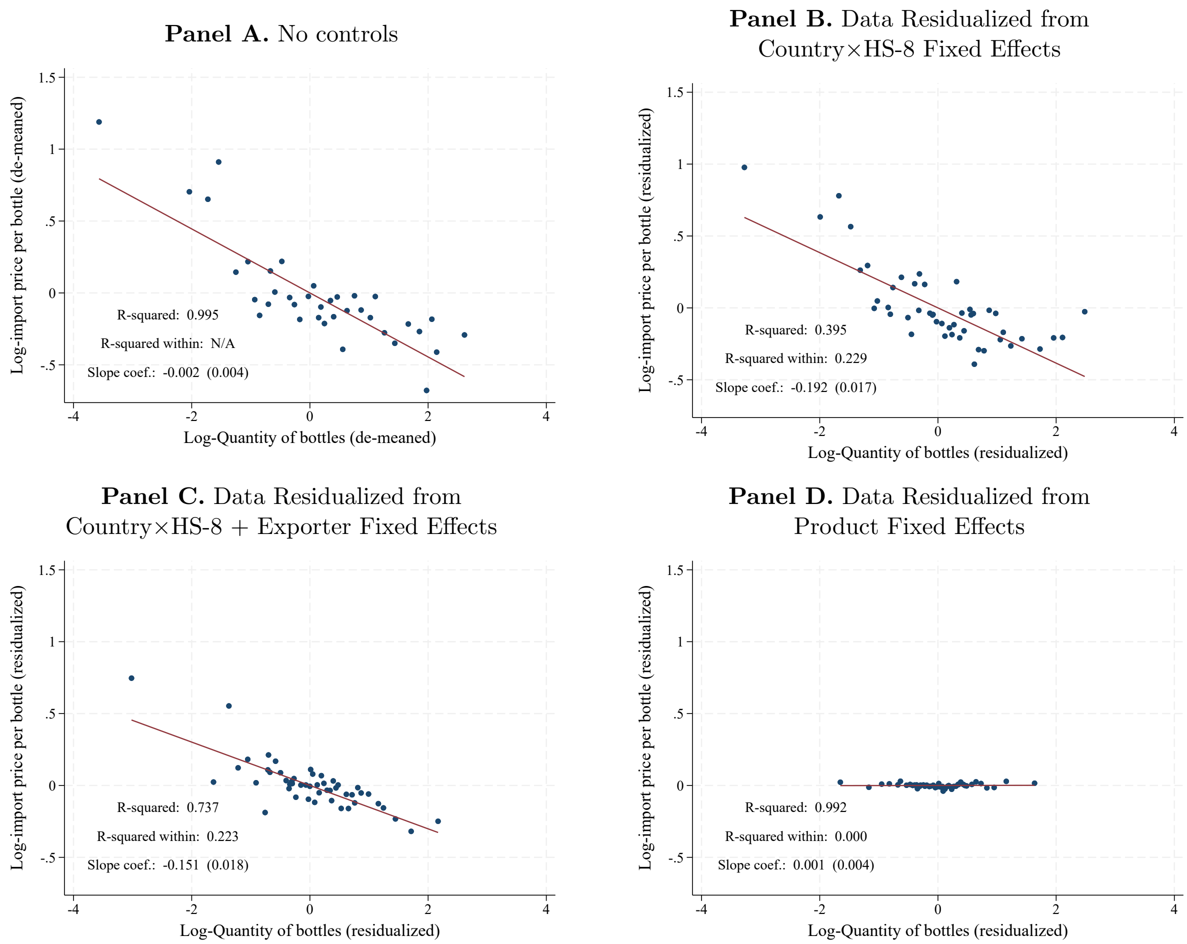
Notes: The distributions are winsorized at 11% for both countries on the lower end. At the upper end, the distributions are winsorized at 16% for all countries. Sparkling wines are excluded. 6.9% of the COLAs from these four countries do not have an ABV value in our data and are excluded from this figure.
Source: Authors' calculations based on data from U.S. TTB Certificates of Label Approval (COLA) provided by COLA Cloud.

C Additional Results - Pass-Through

C.1 Shipment-Level Pricing

The transaction-level detail of the data in this paper allows an exploration of other patterns that may pertain to the interpretation of pass-through estimates. On such pattern is whether there exist discounts in price for greater quantities purchased. In Figure C1 we correlate prices paid at the product-shipment level with the quantity purchased by the importer. We report an increasingly rich specification from Panel A to Panel C to mimic a conventional unit value regression from micro-level trade data like the Longitudinal Foreign Trade Transactions Dataset (LFTTD). In Panel A we include no additional controls. We then use country by HS-8 fixed effects in Panel B and further add foreign exporter fixed effects in Panel C. These results consistently show that the log-import unit value per bottle is negatively correlated with the quantity of log-bottles purchased, consistent with quantity discounts in pricing. However, once we investigate this relationship using the exact product information we have, the negative correlation completely disappears. Panel D shows this result: once we residualize the log-import price per bottle with product fixed effects, none of the remaining variation is explained by the quantity purchased. This suggests, at least at the product-shipment level, that there aren't significant quantity discounts that that would complicate the interpretation of our pass-through estimates. Instead, this correlation seems to be driven completely by heterogeneity across products—products with lower prices are purchased in larger quantities.

Figure C1: Binscatter of Log-Price per Bottle on Log-Bottles Purchased

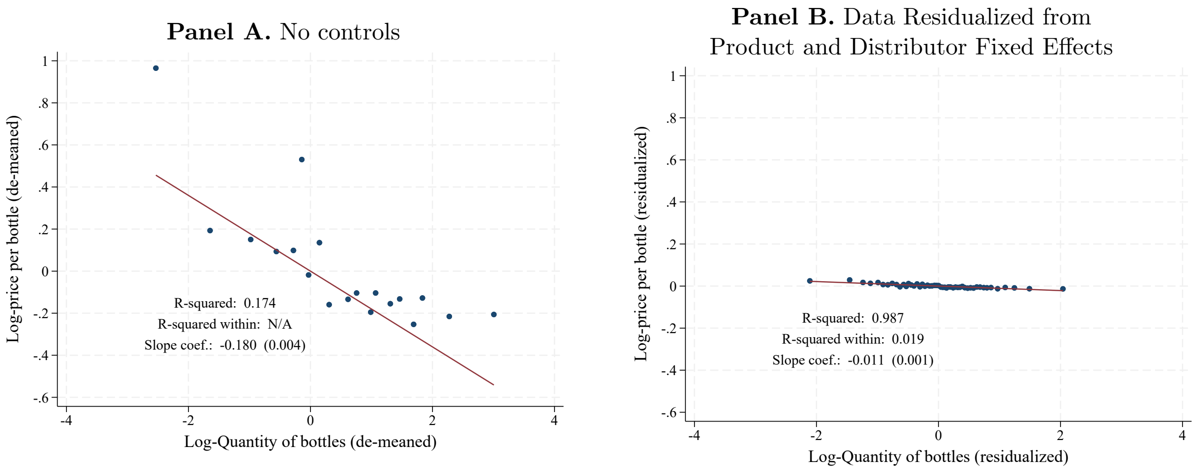


Notes: All scatter plots have the same sample. Robust standard errors in parenthesis next to coefficient. R-squared within corresponds to the R-squared of the slope variable after accounting for the fixed effects. The tariff period is excluded from the sample. Each observation is a different product-shipment.
Source: Authors' calculations based on data from a U.S. wine importer.

We also verify these same patterns hold at the next stage of the supply chain for shipment-product sales from the importer to distributors. Figure C2 illustrates that, just as with the import prices, the correlation of the log-price per bottle with quantities (Panel A) disappears when controlling for heterogeneity across products (Panel B).

In fact, the importer tends to set near-uniform prices across distributors. When running our regression of log-sales price per bottle on product fixed effects, we explain 98.4% of the sales price variation. If we also include distributor fixed effects, we explain 98.5% of the sales price variation.

Figure C2: Binscatter of Log-Price per Bottle on Log-Bottles Sold



Notes: The two set of scatter plots have the same sample. Both axis' in panel (A) have been de-meaned to protect the anonymity of the importer. Robust standard errors in parenthesis next to coefficient. R-squared within corresponds to the R-squared of the slope variable after accounting for the fixed effects. The tariff period is excluded from the sample.
Source: Authors' calculations based on data from a U.S. wine importer.

C.2 Baseline Pass-Through Regression

Table C1 below shows the regression for our baseline pass-through results discussed in the main text. The main coefficients that are discussed in the text are in the third row: "Treatment Period $\times$ Treated".

Table C1: Difference-in-Differences Pass-Through Results

	Importer Purchase Price (1)	Importer Sales Price (2)	Retail Price (3)
Delay Period × Treated	-0.002	-0.029***	0.013
	(0.007)	(0.007)	(0.016)
Delay Period × Indirectly Treated	0.001	-0.025***	-0.008
	(0.008)	(0.004)	(0.013)
Treatment Period × Treated	-0.051***	0.054***	0.069***
	(0.010)	(0.014)	(0.024)
Treatment Period × Indirectly Treated	-0.041***	-0.019	0.008
	(0.008)	(0.019)	(0.019)
Post-Treatment Period × Treated	-0.047***	0.042**	0.059**
	(0.010)	(0.018)	(0.029)
Post-Treatment Period × Indirectly Treated	-0.045***	-0.010	-0.011
	(0.011)	(0.013)	(0.028)
R^2	0.995	0.977	0.985
Product FE	Yes	Yes	–
Month FE	Yes	Yes	Yes
Distributor FE	N/A	Yes	N/A
Product-Retailer FE	N/A	N/A	Yes
Weighted	Yes	Yes	No

* p<0.10, ** p<0.05, *** p<0.01. Standard errors clustered at the product level. The importer purchases regression is weighted by the total quantity purchased by the importer of each product between October 2018 and September 2019. The importer sales regression is weighted by the total quantity sold by the importer to each distributor between October 2018 and September 2019. For the three regressions the base period is October 2018–September 2019. For the importer purchases and sales to distributors regressions the delay period is between October 2019 and December 2019; the treatment period is between January 2020 and February 2021; the post-treatment period is between March 2021 and March 2022. For the retail prices regression the delay period is between October 2019 and October 2020; the treatment period is between November 2021 and October 2022; the post-treatment period is between November 2022 and December 2022.

C.3 Results on Heterogeneity in Pass-through

In this section, we explore whether pass-through was heterogeneous across initial product-level markups. We focus on initial markups because, under the firm's optimizing behavior, they incorporate information about demand and supply elasticities.

For each product, we compute the quantity-weighted average purchase price, sales price, shipping costs, and federal excise taxes in the period prior to the imposition of tariffs.[29] We then calculate percentage markups as the ratio of the sales price to the purchase price (inclusive of taxes and shipping costs), and dollar markups as the difference between these two prices. We show results in the form of binscatters to aggregate results and we de-mean each variable across products.

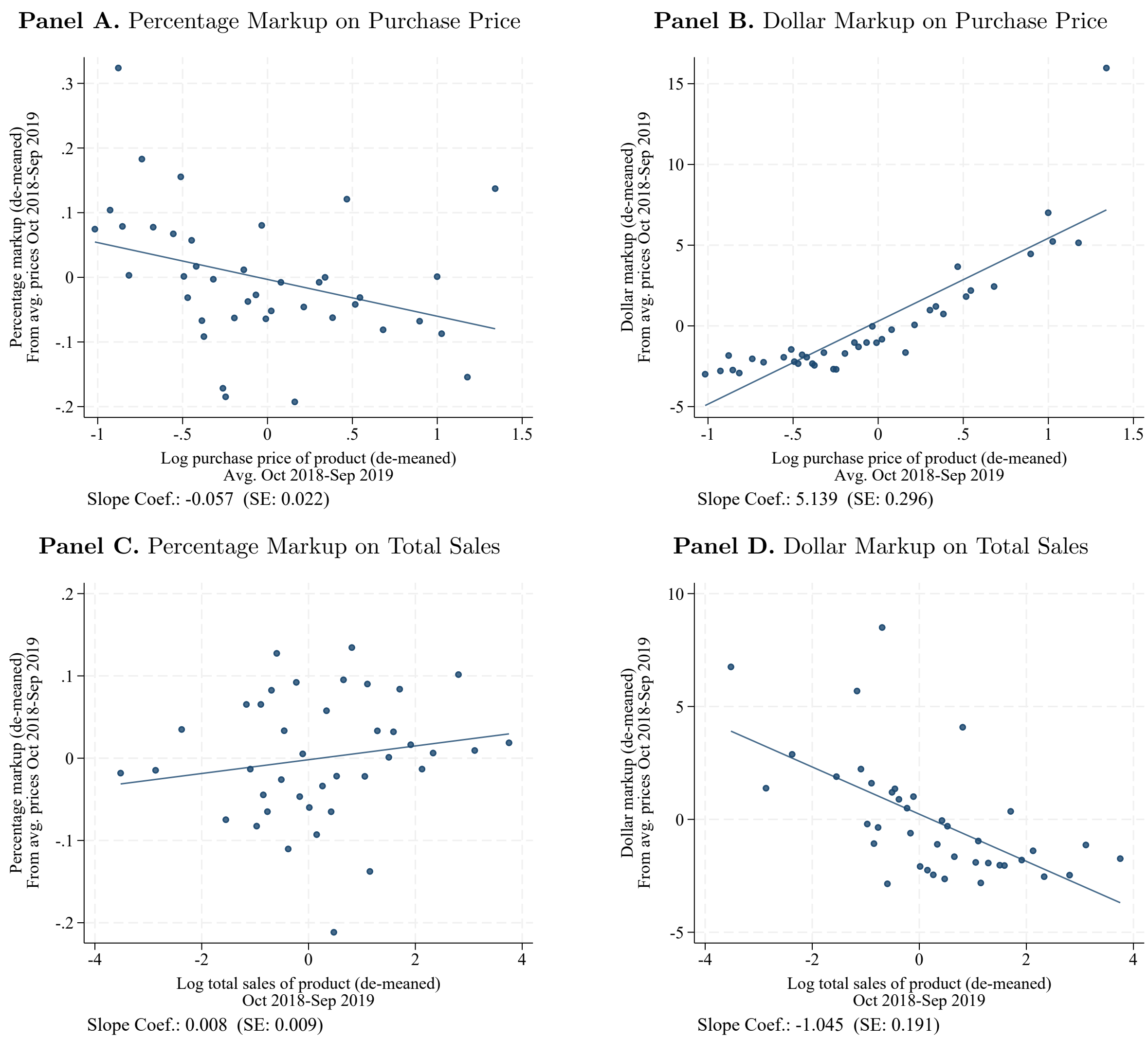
Heterogeneity in Initial Markups

Before proceeding to analyze pass-through, we first investigate the variables with which initial markups are correlated.

[29] For sales price the aggregation is across distributors as well unless explicitly stated otherwise.

Figure C3 shows that products with higher purchase prices have lower percentage markups (Panel A) but higher dollar markups (Panel B). In both cases, the slope coefficient is statistically different from zero. We also find that percentage markups are uncorrelated with total product sales (the slope coefficient in Panel C is statistically insignificant). Dollar markups (Panel D), however, are negatively correlated with total sales, reflecting the fact that sales values are larger for lower-priced products, which tend to have lower dollar markups.

Figure C3: Binscatter of Markups on Product Purchase Price and Total Product Sales - Only pre-tariff period



Notes: Markups computed from the average purchase and sales price, as well as the average shipping cost and excise taxes for each product in the pre-period. The markup is the ratio or difference between the sales price and the purchase price plus shipping costs and taxes. Both axis' have been de-meaned across all products. Binscatter and linear fit are weighted by the total quantities sold in the pre-period.
Source: Authors' calculations based on data from a U.S. wine importer.

Heterogeneity in Pass-through at the Border and to Distributors

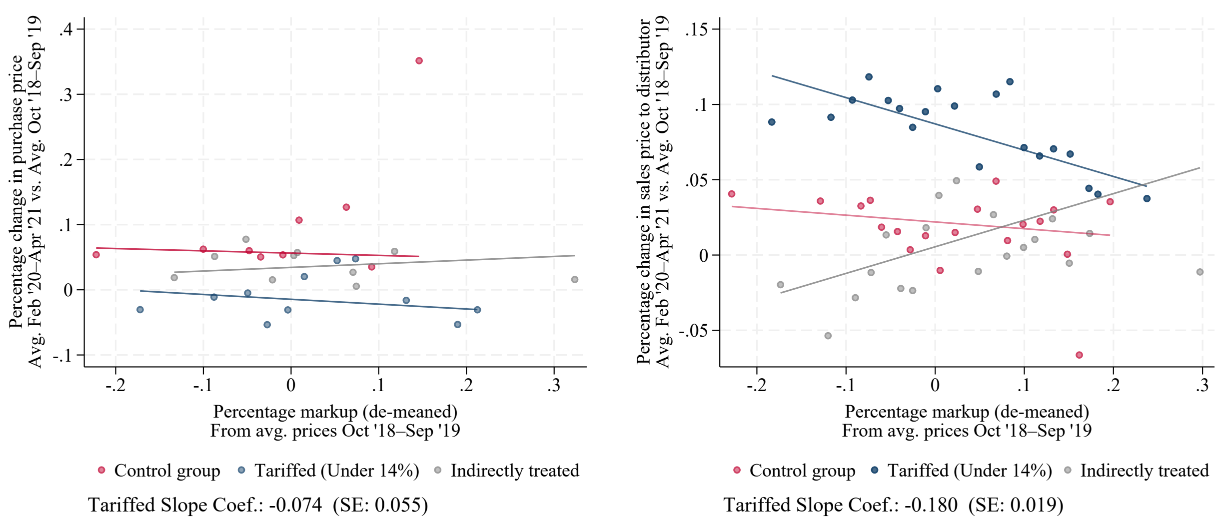
To calculate a tariff rate pass-through for each product, we compute for both purchases and sales a (quantity-weighted) average pre-tariff price (Oct. 2018–Sep. 2019) and post-tariff price (Jan. 2020–Feb. 2021). We then compute the percentage change in both of those prices.

Panel A of Figure C4 presents the binscatter of changes in purchase prices (in percentage terms) against initial markups, separately for control (red), treated (blue), and indirectly treated (grey) products. Overall, we find no strong evidence of heterogeneity in how import purchase prices at the border changed with respect to product markups. Moreover, the differences between the percentage change in purchase prices of the tariffed and control groups are comparable to the estimated event-study coefficients shown in Figure 10. Specifically, the quantity-weighted average product in the control group experienced a 5.6% increase in purchase price, compared with a 2.4% decrease for the treated group.

Panel B of Figure C4 examines whether pass-through to distributors varied by initial markup. Among the tariffed products, we find that the percentage change in sales price was larger for those with initially lower markups. The slope coefficient for this relationship is large and statistically significant, consistent with standard findings that pass-through is greater for more competitive products. Finally, the difference between tariffed and control groups mirrors the event-study results: the quantity-weighted average product in the control group saw a 2.7% sales price increase, while tariffed products experienced a 7.5% increase.

Figure C4: Binscatter of Changes in Prices on Initial Product Markups

Panel A. Percentage change in purchase price **Panel B.** Percentage change in sales price



Notes: Coefficient below each figure corresponds to the slope of the linear fit of the under 14% ABV wines; robust standard error in parenthesis. Both axis' have been de-meaned from the average. The binscatter and linear fit are weighted by quantities purchased in the pre-period.
Source: Authors' calculations based on data from a U.S. wine importer.

D Additional Details

D.1 Tax Exemptions and Duty Drawbacks

There are two forms of tax reductions relevant to the U.S. wine industry. The first is the Craft Beverage Modernization Act (CBMA), a regulation in effect since 2018. It provides a form of tax refund on federal excise taxes. A wine producer can allow its purchasers—either a distributor or importer, depending on whether the producer is domestic or foreign—to claim the refund. Each producer may authorize refunds for up to 750,000 gallons of wine per year.

To complicate matters, not all the 750,000 gallons receive the same refund. For wines with ABV below 16%, the federal excise tax rate is \$1.07 per gallon and the CBMA provides a refund of \$1.00 for the first 30,000 gallons, \$0.90 for the next 100,000 gallons (up to 130,000), and \$0.535 for the remaining eligible gallons. If a producer has multiple buyers, it has to decide how to allocate the CBMA credits across them.

CBMA refunds apply to all wines—regardless of country of origin or ABV level—up to the producer's quota. Therefore, it is unlikely that they were used to offset tariffs on French, Spanish, or German wines with ABV under 14%.

Second, there are duty drawbacks. This regulation is particularly relevant because it allows wine importers to claim a refund of the tariffs and federal taxes paid on wine imported into the U.S., provided they export U.S. wine abroad (excluding Canada and Mexico). To claim the drawback, the importer must provide evidence that they exported "interchangeable" wine to the one that was imported, within five years of the import date. An "interchangeable" wine is defined as one that has the same color (i.e., red, white, or rosé) and is priced within 50% of the import price per liter. Additionally, only still wines with up to 14% ABV are eligible for drawback. The drawback is equal to the amount of tariffs and federal excise taxes paid on the imported wine, up to a maximum of 99% of the taxed amount.

In principle, because the tariffs paid under the Airbus dispute were eligible for duty drawbacks, wine importers could have used the duty drawback to avoid paying the tariffs on imported wine. However, in practice, this mechanism is not widely used and the amount of tariff revenue claimed for drawback did not increase during the 25% tariff period or in the subsequent two years after. The difficulty for importers to use the drawback mechanism has two reasons. First, it requires importers to already be exporters (or to become exporters within five years). Second, the wines that tend to be exported from the U.S. are mostly bulk wines which are considerably cheaper than the finer imported wines. Specifically, wines in containers under 2 liters account for 45% of U.S. exports (by volume) from 2018–2024 while wines in containers over 10 liters account for 52% of the exports. While wine imports in containers over 2 liters to the U.S. from France, Spain, and Germany are virtually zero, as shown in Figure B2. Therefore, it is difficult to meet the 50% price difference requirement. As evidence against the use of the drawback mechanism to avoid the 2019-2021 tariffs, Table D2 shows that the amount of duty drawback claimed remained both stable and low during the 2018–2023 period.

Table D2: Value of Drawback Claims

Year	Value of Drawback Claims (Millions of Dollars)	Fraction of Eligible Import Value Claimed
2018	39.63	0.90%
2019	30.42	0.70%
2020	10.42	0.29%
2021	31.82	0.73%
2022	34.17	0.74%
2023	36.39	0.83%

Sources: U.S. Customs and Border Protection, obtained from Stuart Spencer (August 5, 2024)., USITC. Author's calculations.

D.2 Wine HS Codes and Tariff Timeline

Table D3: Wine 8-digit HS Codes and Tariffs Timeline

Never covered	
2204.10.00	Sparkling wine
First round: October 2019 - March 2021. France, Germany, United Kingdom, and Spain	
2204.21.50	Wine, not over 14% in containers not over 2 liters.
Second round: Jan 2021 - March 2021. France and Germany	
2204.21.20	Effervescent grape wine, in containers holding 2 liters or less.
2204.21.30	Tokay wine (not carbonated) not over 14% alcohol, in containers not over 2 liters.
2204.21.60	"Marsala" wine, over 14% vol. alcohol, in containers holding 2 liters or less.
2204.21.80	Grape wine, other than "Marsala", not sparkling or effervescent, over 14% vol. alcohol, in containers holding 2 liters or less.
2204.22.20	Wine of fresh grapes, other than sparkling wine, of an alcoholic strength by volume $\leq$14% in containers holding over 2 liters but not over 4 liters.
2204.22.40	Wine of fresh grapes, other than sparkling wine, of an alcoholic strength by volume >14% in containers holding over 2 liters but not over 4 liters
2204.22.60	Wine of fresh grapes, other than sparkling wine, of an alcoholic strength by volume $\leq$14% in containers holding over 4 liters but not over 10 liters
2204.22.80	Wine of fresh grapes, other than sparkling wine, of an alcoholic strength by volume >14% in containers holding over 4 liters but not over 10 liters
2204.29.61	Wine of fresh grapes, other than sparkling wine, of an alcoholic strength by volume $\leq$14% in containers holding >10 liters
2204.29.81	Wine of fresh grapes, other than sparkling wine, of an alcoholic strength by volume >14% in containers holding >10 liters
2204.30.00	Grape must, not elsewhere specified or indicated, in fermentation or with fermentation arrested otherwise than by addition of alcohol.