Mergers and the Demand for Protectionism

Felix Montag
NYU Stern, CEPR*

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Abstract

Merger control may clear a merger that leaves domestic production highly concentrated if import competition disciplines the merged firm. I show that the same import competition can raise its incentive to petition for tariffs, and that concentration raises the consumer harm from a given tariff. To quantify this trade-policy channel, I specify and estimate a structural model of demand and supply in the U.S. washer market and apply it to Whirlpool's acquisition of Maytag, which was followed by three tariff petitions. Whirlpool's premium from petitioning rather than offshoring rises with import competition. The merger raises this premium, mainly because Whirlpool captures Maytag's gains from tariffs. At the historical success rate of trade-remedy petitions, the three petitions together are profitable with the merger but not without it. Holding the likelihood of tariffs fixed, the merger raises the tariff-induced consumer harm by 11 to 16 percent.

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1 Introduction

Merger control aims to prevent mergers that harm consumers or workers by substantially lessening competition. It is administered separately from trade policy, which keeps it focused on competition and insulated from trade-policy considerations (Bradford and Chilton, 2021). As trade costs fall, foreign producers can constrain domestic incumbents, so a merger may not substantially lessen competition even if it leaves domestic production highly concentrated. Yet the same import competition that justifies clearance may raise the merged firm's demand for protection.

In this paper, I ask how domestic production concentration affects the incentive to petition for tariffs and the harm those tariffs cause consumers. The most common trade remedies are antidumping (AD) and countervailing duties (CVD). These are tariffs imposed by a domestic investigating authority, usually following a petition by a domestic producer. To assess whether to impose tariffs, the investigating authority examines whether imports of the product under investigation materially injure the domestic industry and whether they are sold at less than fair value (AD) or subsidized by a foreign government (CVD). While merger clearance decisions may rely on import competition to constrain the merged firm, U.S. trade law does not allow the investigating authority to consider the effects of these tariffs on downstream industries and consumers.[1]

I set up a stylized model where a domestic producer acquires its domestic rival and can subsequently choose to raise its foreign rival's cost by petitioning for tariffs or lower its own cost by offshoring production.[2] The model shows that the domestic merger can increase or decrease the attractiveness of petitioning versus offshoring for the acquirer and hence its propensity to file a tariff petition.

To quantify this empirically for a merger that was followed by tariff petitions, I specify and estimate the structural parameters of a rich empirical model featuring differentiated demand and oligopolistic supply in the U.S. washing machine market. Whirlpool, the largest U.S. washer producer, acquired Maytag, the second-largest, in 2006. The Department of Justice cleared the merger on the grounds that import competition would prevent a sub-

[1] Recognizing this tension, in 2022 the U.S. Senate Subcommittee on Competition Policy, Antitrust, and Consumer Rights asked the U.S. Government Accountability Office to review AD/CVD processes and domestic market competition considerations, particularly focusing on "how aspects of market competition factor into the AD/CVD process" (U.S. Government Accountability Office, 2022).

[2] Igami (2018) studies the relationship between competition and offshoring in the hard disk drive industry, showing that offshoring is pro-competitive and benefits consumers. Salop, Scheffman, and Schwartz (1984) discuss how regulation, such as tariffs, can be used to raise the cost of rivals.

stantial lessening of competition. Using the estimates, I quantify how the merger changed Whirlpool's expected profits from its three petitions and their implications for consumers.

The paper's central contribution is to show that domestic production concentration can raise both domestic producers' incentive to petition for tariffs and the harm to consumers from a given tariff. Mergers between domestic producers can therefore harm consumers through what I call the *trade-policy channel*: a merger can make tariffs that lessen import competition more likely and raise the consumer harm from a given tariff.

Following its acquisition of Maytag, Whirlpool offshored some washer production to Mexico when import competition was weak. As the market share of its foreign rivals grew, Whirlpool reshored its production to the U.S. and petitioned for antidumping duties on washers from Korea and Mexico and a countervailing duty on washers from Korea in 2011, for antidumping duties on washers from China in 2015, and for a global safeguard in 2017. Using the structural model, I show that the premium from petitioning over offshoring rises with the strength of import competition, and the merger more than doubles Whirlpool's gain from the two later petition rounds. Assuming a success probability for each petition of 67 percent, which is the historical rate at which AD/CVD petitions result in tariffs, I find that the sequence tariff petitions does not pay for Whirlpool in present value of variable profits without the merger, whereas it does with the merger. This suggests that the merger may have been pivotal to the petitioning decision.

Even if the likelihood of tariffs is unchanged, I find that the merger raises the tariff-induced consumer harm by 11 to 16 percent. Assuming that the merger was not pivotal to Whirlpool's decision to petition and that the petition success probability follows its historical rate, the merger adds $203 million to the expected discounted consumer surplus loss of the tariff sequence. If the merger was pivotal, then the merger-induced expected discounted consumer surplus loss of the tariff sequence is $1.6 billion.

The empirical analysis is based on the 2005 to 2015 U.S. residential washer market data set used by Montag (2026) and extends it until 2019, which allows me to study the two later tariff rounds. The centerpiece of this data set is *TraQline*, a representative survey of approximately 600,000 households annually that asks respondents about their appliance purchases and demographics.

The demand model closely follows Montag (2026) and features households that have income-dependent price sensitivity and can differ in their taste for front-loading washers. I estimate the demand parameters by combining aggregate and household moments as in Berry, Levinsohn, and Pakes (2004): the covariance between a product's price and its buyers' income, the front-loader share of buyers' second-choice brands, and a price instrument from the real exchange rates of the countries where each washer is produced.

The supply model differs from Montag (2026) along two dimensions. First, after recovering tariff-inclusive marginal costs assuming differentiated Bertrand-Nash competition, I recover tariff-exclusive marginal costs using a duty rate specific to the origin, the manufacturer, and the month. Because it is not clear whether sellers price on the duty they paid or on the duty on a replacement unit, I recover costs under two models. Under *duties paid*, I use monthly import data to infer when a washer crossed the border and assume that sellers price on the tariff rate that they actually paid. Under *replacement duties*, I assume that sellers price on the tariff rate for a replacement unit that would cross the border two months after the sale of a washer. For the main specifications, I choose replacement duties, because the price effects of the tariffs they imply come closest to the quasi-experimental estimates of Flaaen, Hortaçsu, and Tintelnot (2020).[3] Second, I estimate cost differences between production locations directly from product-level origin shares, which identifies the U.S.–Mexico comparison central to Whirlpool's offshoring decision.

Most directly, the paper relates to a literature concerned with the stringency of merger control. Nocke and Whinston (2022) show that current concentration thresholds are too lax in the absence of large efficiency gains. Retrospective analyses of consummated mergers, including Whirlpool–Maytag (Ashenfelter, Hosken, and Weinberg, 2013), find price effects that vary widely across cases (Kwoka, 2015; Bhattacharya, Illanes, and Stillerman, 2026). Asker and Nocke (2021) and Shapiro and Yurukoglu (2026) review this evidence. Breinlich, Nocke, and Schutz (2018) study optimal merger policy for international mergers in settings where multiple national agencies can block a transaction across jurisdictions.[4] Montag (2026) extends the scope of merger analysis by studying how the Whirlpool–Maytag merger affects total domestic welfare (consumers and workers) when potential acquirers for Maytag differ in their offshoring plans.

I extend this literature by identifying the trade-policy channel and providing a quantitative framework to assess whether a merger would change the profitability of tariffs for the merging parties and the resulting consumer harm. In the Whirlpool–Maytag case, the merger raised the profitability of tariffs most when import competition was strong. Mergers that leave domestic production highly concentrated and are cleared because of import competition therefore warrant particular scrutiny.[5] In contrast, cross-border mergers can reduce the merging parties' incentive to petition for tariffs.

[3]The main conclusions of the empirical analysis are insensitive to this assumption.

[4]Horn and Levinsohn (2001) and De Stefano and Rysman (2010) develop models in which a country chooses the level of domestic concentration through merger policy and show that when firms are exporters, national authorities have an incentive to increase domestic concentration.

[5]This is similar in spirit to a result by Caradonna, Miller, and Sheu (2025), showing that while cost efficiencies and rival entry can both limit post-merger price increases, if cost efficiencies are large, rival entry is less likely to be profitable.

The paper also contributes to a literature on market structure and lobbying. Classic political-economy models predict that organized sectors obtain protection (Grossman and Helpman, 1994; Goldberg and Maggi, 1999), and firm size predicts participation and intensity (Bombardini, 2008). Kang (2016) finds that while lobbying has a small effect on policy enactment, the returns to lobbying are high.

I contribute to this literature in two ways. First, I extend it beyond traditional political lobbying. AD/CVD petitions are a quasi-judicial channel, relatively insulated from direct political bargaining, that present incumbents with a choice between lowering costs through offshoring and raising costs of foreign rivals through tariff petitions. Second, I decompose the merger effect into three channels: the *appropriation effect* (the acquirer internalizes the benefits of tariffs to the target), the *strategic effect* (joint pricing raises the merged firm's gain from the tariff relative to the sum of standalone gains), and the *relocation gain* (the cost saving from offshoring the target's production, which only the merger makes possible and which petitioning forgoes).

While domestic producers could overcome the collective-action problem behind the appropriation effect by petitioning together, Section 2 shows that the most common petitioner is a single domestic producer. This is consistent with Bombardini and Trebbi (2012), who find that firms in more concentrated industries are more likely to lobby on trade issues individually rather than through a trade association, and with Moshary and Slattery (2026), who show that acquisitions among auto dealers raise lobbying because they reduce free-riding. The strategic effect corresponds to the mechanism in Cowgill, Prat, and Valletti (2024), where a merger raises lobbying because competition no longer dissipates the rents from favorable regulation. For the Whirlpool–Maytag merger, the appropriation effect is an order of magnitude larger than the strategic effect.

A related literature studies how AD/CVD cases can raise market power (Nieberding, 1999; Konings and Vandenbussche, 2005; Pierce, 2011; Rovegno, 2013) and facilitate collusion (Staiger and Wolak, 1989). Because dumping margins depend on foreign pricing, the option value of a petition can induce higher foreign prices even before a case is filed. Blonigen et al. (2013) find that binding quotas increased market power in the U.S. steel industry, whereas tariffs did not, which is consistent with strong domestic competition from minimill producers disciplining outcomes. Flaaen, Hortaçsu, and Tintelnot (2020) show that the initial AD/CVD actions on large residential washers primarily induced tariff jumping, whereas the 2018 global safeguards raised U.S. washer prices. I extend this literature to show that higher domestic production concentration can increase the likelihood of tariffs and the harm they cause.

The remainder is structured as follows: Section 2 reviews the relationship between trade

remedies and merger control, Section 3 specifies the stylized model, Section 4 describes the institutional setting and data, Section 5 details the empirical model and estimation, Section 6 presents the parameter estimates, Section 7 quantifies the trade-policy channel for Whirlpool, Section 8 discusses policy implications, and Section 9 concludes.

2 Trade Protection and Merger Control

AD and CVD measures are the most commonly used trade-defense instruments worldwide. Their criteria and procedures are codified in World Trade Organization (WTO) agreements and apply across WTO members. Global safeguards (GS) are also WTO-authorized but used much less frequently. While the following discussion focuses on the United States, its main features apply to other jurisdictions as well.

AD/CVD investigations are frequent. According to Bown et al. (2025), between 2000 and 2024 the EU initiated 224 AD, 52 CVD, and 7 GS investigations, India 456, 24, and 39, and the United States 335, 208, and 8, respectively. Between 2002 and 2024, AD/CVD measures accounted for 97 percent of all trade-remedy investigations initiated in the United States (Liu, 2026). In 2022, active AD/CVD orders covered $37.4 billion of imports (Liu, 2026).

In the U.S., Section 232 (national security-based trade measures) and Section 301 (retaliatory trade measures) actions have become more prevalent since 2018. These serve different purposes, are usually less targeted than AD/CVD, and are procedurally different. Whereas AD/CVD almost always originate from a petition filed by a domestic stakeholder, Section 232 and Section 301 actions are usually initiated by the government. Finally, they are not grounded in WTO authorized procedures. Based on interviews with practitioners, Liu (2026) reports that AD/CVD petitions remain the tool of choice for domestic producers seeking protection from import competition.

AD duties are imposed on imports that are sold at less than fair value and that materially injure, or threaten to materially injure, a domestic industry. Selling at less than fair value means that the export price is below the product's normal value, typically the price the exporter charges in its home market (Blonigen and Prusa, 2016). If home-market sales are unsuitable for comparison, Commerce may instead use the exporter's prices in a third country or a constructed value based on its production costs. For exporters from countries that Commerce designates as non-market economies, most prominently China, Commerce disregards home-market prices and costs altogether. It instead constructs normal value from the exporter's factors of production, valued at prices from a market-economy "surrogate" country at a comparable level of economic development.

CVD duties offset subsidies that foreign governments grant to exporters. As with AD, the subsidized imports must materially injure, or threaten to materially injure, a domestic industry. Although AD and CVD target different practices, their procedures are similar, and petitioners frequently file for both at the same time. Between 2000 and 2024, 62 percent of U.S. AD petitions were accompanied by a CVD petition, and five petitions sought countervailing duties alone.

Unlike AD/CVD, global safeguards can be imposed on fairly traded imports from all countries if a surge in imports seriously injures a domestic industry. As with AD/CVD, investigations usually start with a petition by domestic producers. In the U.S., following an affirmative injury determination by the USITC, the President decides whether to impose a safeguard, for an initial period of up to four years. Safeguards are therefore more exposed to the political process than AD/CVD.

AD/CVD procedures are simpler when the petitioners account for a large share of domestic production. Any domestic producer may petition, but under the WTO Antidumping Agreement a petition is filed "on behalf of the industry" only if its supporters account for at least 25 percent of domestic production of the like product and for more than 50 percent of the production of those expressing a view. If the petition itself shows support from more than half of domestic production, Commerce initiates without polling producers, which reduces procedural frictions and the risk of standing challenges (United States Code, 2025b, 2025a; Code of Federal Regulations, 2025; U.S. International Trade Commission, 2015).

Petitioning for AD/CVD is costly. It requires legal counsel, economic analysis, and participation in hearings and periodic sunset reviews. Practitioners interviewed by Liu (2026) put the lower-bound cost of an investigation at $1 million to $3 million, more with several subject countries, complex products, or joint AD and CVD allegations.

Given the substantial cost, the simpler procedures for petitioners with a larger share of domestic production, and benefits that accrue to all domestic producers, one might expect petitions to often involve all domestic producers. However, while coalitions and industry associations do petition, the most common petitioner is a single domestic producer, which filed 149 of the 339 U.S. AD/CVD petitions in 2000–2024 for which the number of U.S. producers is known. Table 1 reports the share of single-firm petitions for each number of U.S. producers of the like product. In 50 petitions the petitioner was the only domestic producer. With two to six producers, 52 percent of petitions are still filed by a single firm. With seven or more, this share falls to 12 percent, plausibly because a single firm rarely accounts for enough domestic production to meet the industry-support thresholds alone.

Industry associations rarely help domestic producers overcome this collective action problem. They typically serve broader purposes, and their members' trade interests of-

Table 1: Single-firm AD/CVD petitions by number of U.S. producers, 2000–2024

U.S. producers	1	2	3	4	5	6	7+
Filings	50	48	46	24	20	22	129
Single-firm petitions (%)	100	69	46	58	30	41	12

Notes: One observation per petition (like product by petition date); a petition seeking both antidumping and countervailing duties counts once. The number of U.S. producers is the total stated in the USITC staff report where the report gives one, otherwise the number of named active producers of the like product at the petition date. A single-firm petition is filed by one domestic producer alone. Excludes 7 filings for which the producer count is not established.

ten diverge. During the home appliance AD/CVD petitions, for example, the members of the Association of Home Appliance Manufacturers (AHAM) included both the petitioner, Whirlpool, and the U.S. affiliates of the Korean respondents, Samsung and LG. AHAM took no public position on the petitions.

An important reason for the popularity of AD/CVD petitions among domestic producers is their predictability. Investigations last at most 18 months, follow clearly defined criteria, and take place in a quasi-judicial framework that insulates them from political interference (Blonigen and Prusa, 2016). Commerce determines whether a petition has industry support, initiates the investigation, and determines the dumping or subsidy margin. The USITC determines whether the subject imports materially injure a domestic industry. While AD/CVD orders are reviewed periodically, many remain in effect for decades. Outcomes are predictable too. Of the U.S. AD/CVD investigations initiated between 2000 and 2024, 67 percent resulted in orders (Bown et al., 2025). This is consistent with domestic producers knowing when a petition is likely to succeed and when it is not worthwhile.

Under certain conditions, petitioners can also predict the duty rate. An AD investigation determines the dumping margin, the amount by which the exporter's price falls below normal value. A CVD investigation determines the subsidy margin. The resulting duty equals this margin. A petitioner that observes exporters' prices in their home and destination markets, or the subsidies they receive, can therefore predict the duty.

In practice, Commerce has considerable leeway, which creates uncertainty. Since products sold in home and export markets often differ, defining the foreign like product gives Commerce considerable freedom. Commerce has also used *zeroing*: when averaging comparisons across products, it sets to zero any comparison in which the export price exceeds normal value, which mechanically raises the dumping margin. Costs create further leeway. Home-market sales below cost are disregarded, and normal value can instead be constructed from costs. Since allocating fixed costs to products is notoriously difficult, and firms may rationally price below average total cost (but above average variable cost), such prices can

still result in a dumping finding.[6]

There is a fundamental tension between the mandate of competition authorities to protect consumers and the trade laws governing AD/CVD. While the USITC may collect information from downstream purchasers, AD/CVD laws do not allow it to consider the effects of duties on consumers, downstream purchasers, or the national interest (U.S. Government Accountability Office, 2022). In contrast, in merger control competition authorities aim to protect consumers from harm caused by mergers that substantially lessen competition. Domestic producers that face strong import competition can often argue that a merger between them will not substantially lessen competition. But since AD/CVD procedures are simpler when petitioners account for a larger share of domestic production, and domestic producers appear to find it difficult to petition jointly, these are precisely the mergers that may be followed by AD/CVD petitions and ultimately affect competition.

This raises the question of whether mergers cleared with reference to strong import competition are followed by AD/CVD petitions. A systematic analysis is constrained by data availability. While AD/CVD data are public, competition authorities rarely publish their competitive assessment, and market shares and the number of domestic producers at the antitrust-market level are generally not available. For a small number of cases, however, this information appears in redacted versions of published decisions.[7]

From these merger decisions, trade-remedy investigations, company filings, and media reports, I assemble a non-representative sample of nine horizontal mergers between domestic producers, affecting 16 antitrust markets, that were followed within five years by an AD/CVD petition in at least one of these markets.

Table 2 gives an overview of the nine merger cases. In five of them, the clearance decision cites import competition as a constraint on the merging parties. Two of the sample cases illustrate the pattern. In its *Owens Corning / Saint-Gobain Vetrotex* conditional approval, the European Commission cites customers stating that imports are a viable alternative to domestic producers for certain types of rovings (European Commission, 2007). Two years after the merger, a group of domestic producers, including Owens Corning, filed an AD petition on continuous glass fibre from China, which includes rovings. In the United States, the DOJ cleared the Whirlpool–Maytag merger on the grounds that foreign manufacturers posed a sufficiently large competitive constraint to prevent post-merger price increases (Department of Justice, 2006). Once these foreign manufacturers gained significant market

[6]Blonigen and Prusa (2016) explain that although the U.S. Antidumping Act of 1916 was originally designed to protect domestic producers from predatory pricing, the required predatory intent was soon dropped from the law, and it has since become an ordinary protection tool.

[7]This is especially true for the European Commission, which publishes reasoned merger decisions, often with detailed discussions of market definition.

Table 2: Domestic mergers followed by AD/CVD petitions

Jurisdiction	Year	Acquirer / target	Product market	Imports cited at clearance	First petition after merger
Australia	2005	Capral / Crane	Aluminium extrusions	+	2009
U.S.	2006	Whirlpool / Maytag	Clothes washers, dryers	+	2011
Canada	2006	Tenaris / Prudential	Oil country tubular goods	n.a.	2007
EU	2007	Owens Corning / Vetrotex	Glass fibre mats, rovings	+	2009
U.S.	2007	U.S. Steel / Lone Star	Oil country tubular goods	n.a.	2009
EU	2008	Sappi / M-real	Coated graphic paper	n.a.	2010
Brazil	2010	Braskem / Quattor	Polyethylene, polypropylene	+	2012
EU	2012	Outokumpu / Inoxum	Stainless steel flat products	–	2014
India	2018	Tata Steel / Bhushan	Flat carbon steel	+	2019

Notes: "Imports cited at clearance" encodes whether import competition was cited as material to the antitrust clearance: "+" indicates the authority accepted imports as a clearance factor; "–" indicates the merging parties argued imports were a constraint but the authority did not accept it; "n.a." indicates clearance via an expedited procedure (Competition Bureau ARC, FTC early termination, or EC short-form decision) with no detailed reasoning published. "First petition after merger" is the year in which the first AD or CVD investigation covering the product market was initiated after the merger.

shares, Whirlpool filed for AD and CVD on large residential washers from Korea and Mexico.

AD/CVD are sometimes discussed in merger cases, but usually as part of the competitive environment. For example, in its *ArcelorMittal / Ilva* decision, the European Commission writes "As the trade defence measures on certain [...] products cover some of the major steel producing and steel exporting countries, any assessment of the extent to which imports of HR, CR and HDG products may exert competitive pressure on EEA-based flat carbon steel producers and, in particular the merged entity post-Transaction, must be made in light of the situation as restored by anti-dumping duties" (European Commission, 2018, p. 56). The Commission thus treats the trade-defense environment as an exogenous input to merger analysis, rather than considering how the merger itself may alter the incentives to petition for new measures.

The remainder of the paper develops a stylized model of how mergers change petition incentives, estimates a structural model of the U.S. washer market, and quantifies the consumer-welfare consequences of the Whirlpool–Maytag merger.

3 Stylized Model

I specify a stylized model illustrating the link between mergers and the demand for protectionism.

3.1 Setup

Consider a market with three firms: a domestically producing incumbent (firm 1), a domestic acquisition target (firm 2), and a foreign rival (firm 3). Each produces a single, differentiated product for the domestic market only. A unit mass of consumers with heterogeneous preferences obtains utility

$$U_j = \delta_j - \alpha p_j + \varepsilon_j, \qquad U_0 = \varepsilon_0, \tag{1}$$

from product $j \in \{1, 2, 3\}$ and from the outside option, where δ_j is product-specific deterministic utility, p_j the price of product j, $\alpha > 0$ governs price sensitivity, and $\varepsilon_j, \varepsilon_0$ are i.i.d. Type I extreme value.

Marginal cost is c_D for domestic and c_F for foreign production, with $c_D > c_F$. Firms 1 and 2 initially produce at home, firm 3 abroad. Firm f can relocate all of its production at a fixed cost $R_f > 0$, paid once regardless of how many products it moves. R_2 is high enough that firm 2 never relocates, so only the merger makes relocation of product 2 possible. Firm 1 may instead petition for tariffs on all imports at cost $L > 0$, in which case the tariff follows with certainty. In practice, domestic producers rarely petition jointly (Section 2). Typically one producer, plausibly the largest, decides whether to petition, and the others free-ride on its decision. Firm 1 plays the role of this producer. The tariff's ad valorem level $\tau > 0$ is set exogenously by the trade commission and scales foreign marginal costs to $(1 + \tau)c_F$.

The model proceeds in three stages. In Stage 1, the competition authority (CA) clears or challenges a merger $\mathcal{M}$ proposed by firm 1. A merger is blocked whenever it substantially lessens competition in any market.[8] With only one market, this means that if a merger leads to a loss in consumer surplus through a substantial lessening of competition, a merger is blocked. The CA's baseline rule is therefore that it clears the merger whenever the predicted change in consumer surplus from unilateral market-power effects, $\Delta^{MP}CS(\mathcal{M})$, exceeds the largest tolerated reduction in consumer surplus. Where horizontal mergers alter firms' demand for trade protection, an additional trade-policy channel $\Delta^{TP}CS(\mathcal{M})$ follows from the equilibrium decisions in Stages 2 and 3. A CA that evaluates mergers on consumer surplus regardless of channel should apply its threshold to the total effect, $\Delta^{MP}CS(\mathcal{M}) + \Delta^{TP}CS(\mathcal{M})$.

In Stage 2, firm 1 offshores, petitions, or maintains the status quo, choosing whichever maximizes static profits net of fixed costs. It never both petitions and offshores, since the

[8] In the US, Section 7 of the *Clayton Act* prohibits acquisitions whose effect "may be substantially to lessen competition" in any market. In the EU, Article 2 of *Council Regulation (EC) No 139/2004* similarly prohibits acquisitions that lead to a "significant impediment to effective competition".

tariff would then raise its own costs. A cleared merger lets firm 1 price products 1 and 2 jointly. A blocked merger leaves firm 2 a separate domestic single-product firm at c_D.

In Stage 3, firms simultaneously choose prices in a Bertrand-Nash equilibrium and consumers make discrete purchase decisions. Let $s_j(\mathbf{p})$ denote the logit market share of product j and $s_0(\mathbf{p})$ the outside share. Given realized marginal costs $c_j \in \{c_D, c_F, (1+\tau)c_F\}$, each firm f maximizes $\sum_{j\in\mathcal{J}_f}(p_j - c_j)s_j(\mathbf{p})$ over its product set $\mathcal{J}_f$, so a single-product firm charges $p_j = c_j + 1/[\alpha(1 - s_j)]$. Consumer surplus is, up to an additive constant, $CS = \frac{1}{\alpha}\log\left(1 + \sum_j \exp(\delta_j - \alpha p_j)\right)$ (Small and Rosen, 1981).

3.2 Mergers, offshoring, and trade protection

I now ask how a merger between firms 1 and 2 changes firm 1's incentive to offshore rather than petition, and what this implies for consumer welfare. Proofs can be found in Appendix I. Let $\pi^r_{f,\mathcal{C}}$ denote firm f's variable profit in regime $r \in \{\text{off}, \text{pet}, \text{sq}\}$ chosen by firm 1, under merger configuration $\mathcal{C} \in \{\mathcal{S}, \mathcal{M}\}$, and $\Pi^r_{f,\mathcal{C}}$ total profit, net of the relevant fixed cost. For the merged entity I write $\pi^r_{\mathcal{M}}$ and $\Pi^r_{\mathcal{M}}$.

Proposition 1. *Assume offshoring is more profitable than petitioning at $\tau = 0$, and petitioning is more profitable than offshoring at some $\hat{\tau} > 0$. Then there exists a unique cutoff $\tau^* \in (0, \hat{\tau})$ such that firm 1 prefers petitioning over offshoring iff $\tau > \tau^*$.*

The petitioning payoff rises monotonically in τ. A higher tariff raises foreign costs only, shifts shares toward firm 1, and increases its markups. Offshoring instead lowers firm 1's own costs and leaves foreign costs unchanged, so its payoff is independent of τ and the two cross exactly once.

How this threshold moves with the appeal of the foreign product has no fixed sign. The reason is that a more attractive import hurts firm 1 most when the foreign rival is of intermediate strength. Whereas a weak foreign rival does not significantly constrain firm 1, a strong rival leaves firm 1 with a small profit and little to lose from a further increase in competitive pressure. Petitioning and offshoring leave the rival at different strengths relative to firm 1, so whether a stronger foreign rival hurts firm 1 more under petitioning or under offshoring, and hence whether it raises or lowers the threshold, depends on where each regime places the rival (Appendix I).

I first compare firm 1's gain from petitioning for a given τ, with and without the merger, against a status-quo baseline.

Proposition 2. *Let*

$$\Delta^{pet}_{1,\mathcal{M}} \equiv \Pi^{pet}_{\mathcal{M}} - \Pi^{sq}_{\mathcal{M}}, \qquad \Delta^{pet}_{1,\mathcal{S}} \equiv \Pi^{pet}_{1,\mathcal{S}} - \Pi^{sq}_{1,\mathcal{S}}, \tag{2}$$

be firm 1's petitioning premium with and without the merger. Then the merger's impact admits the exact decomposition

$$\Delta^{pet}_{1,\mathcal{M}} - \Delta^{pet}_{1,\mathcal{S}} = \underbrace{\left(\pi^{pet}_{2,\mathcal{S}} - \pi^{sq}_{2,\mathcal{S}}\right)}_{\text{appropriation}} + \underbrace{\left[(\pi^{pet}_{\mathcal{M}} - \pi^{sq}_{\mathcal{M}}) - (\pi^{pet}_{1,\mathcal{S}} + \pi^{pet}_{2,\mathcal{S}} - \pi^{sq}_{1,\mathcal{S}} - \pi^{sq}_{2,\mathcal{S}})\right]}_{\text{strategic}}. \tag{3}$$

Both the appropriation and the strategic effect are strictly positive, so the merger strictly increases firm 1's gains from tariffs.

The appropriation effect is the petitioning externality that the merger internalizes. Firm 1 can now appropriate the rents from tariff protection that would otherwise accrue to firm 2. The strategic effect is the increase in how much firms 1 and 2 jointly gain from tariffs. The merged firm has already internalized domestic competition, so the foreign rival constitutes a proportionally larger part of its competitive environment, and weakening that rival via the tariff benefits the merged entity more than the standalone firms. The aggregative-games framework of Nocke and Schutz (2018, 2025) underpins this result. As Appendix I shows, the appropriation effect and hence the total do not hinge on logit demand, whereas the strategic effect requires strategic pricing.

Next, I switch the baseline from status quo to offshoring. Let $\pi^{\text{off}_1}_{\mathcal{M}}$ denote the merged entity's variable profit when it offshores product 1 only, so that product 2 stays at c_D as it does for a standalone firm 2.

Proposition 3. *Let*

$$\Delta^{pet}_{1,\mathcal{M}} \equiv \Pi^{pet}_{\mathcal{M}} - \Pi^{off}_{\mathcal{M}}, \qquad \Delta^{pet}_{1,\mathcal{S}} \equiv \Pi^{pet}_{1,\mathcal{S}} - \Pi^{off}_{1,\mathcal{S}}, \tag{4}$$

be firm 1's petitioning premium with and without the merger. Then the merger's impact admits the exact decomposition

$$\Delta^{pet}_{1,\mathcal{M}} - \Delta^{pet}_{1,\mathcal{S}} = \underbrace{\left(\pi^{pet}_{2,\mathcal{S}} - \pi^{off}_{2,\mathcal{S}}\right)}_{\text{appropriation}} + \underbrace{\left[(\pi^{pet}_{\mathcal{M}} - \pi^{pet}_{1,\mathcal{S}} - \pi^{pet}_{2,\mathcal{S}}) - (\pi^{off_1}_{\mathcal{M}} - \pi^{off}_{1,\mathcal{S}} - \pi^{off}_{2,\mathcal{S}})\right]}_{\text{strategic}} - \underbrace{\left(\pi^{off}_{\mathcal{M}} - \pi^{off_1}_{\mathcal{M}}\right)}_{\text{relocation gain}}. \tag{5}$$

The appropriation effect and the relocation gain are strictly positive, and the relocation gain does not depend on τ. The strategic effect is strictly increasing in τ and can take either sign.

The relocation gain is the merger-specific cost saving on product 2 that is due to the acquirer offshoring production of the acquired product. The merged firm forgoes it when it petitions, and it is the same whatever duty the petition obtains. The strategic effect compares the merger's joint-pricing gain under the tariff with its joint-pricing gain under offshoring, at

a common location of product 2. The two worlds differ in two ways. By Proposition 2, the tariff raises the joint-pricing gain, and increasingly so as τ rises. Offshoring lowers product 1's cost and makes firm 1 a stronger competitor to firm 2, which in most configurations also raises the joint-pricing gain, since there is more cannibalization to internalize. Which world has the larger joint-pricing gain therefore depends on the duty and on the firms' relative strengths. Even a merger that lowers τ^* yields no petition if the duty the trade commission would set falls below the post-merger τ^*.

Finally, I turn to the consumer harm from a given tariff.

Proposition 4. *A domestic merger raises the consumer harm from a given tariff τ.*

The merger raises the harm through two channels. It raises the foreign share s_3, since higher domestic prices shift demand to the foreign product, and it concentrates domestic production into a single firm, which raises the strategic-complementarity multiplier that grows with each firm's market share. The harm rises regardless of the pre-merger s_3.

Appendix I.A develops a two-period extension in which the foreign rival can jump the tariff by relocating to the domestic market. Tariff jumping erodes the future rents from protection, but the first-period mechanism through which the merger raises the incentive to petition remains intact.

3.3 Cross-border mergers

A natural question is whether cross-border mergers generate the same forces. I extend the setup to four firms. Firm 4 is a second foreign producer with marginal cost c_F, acquired by firm 1 in a cross-border merger $\mathcal{X} = \{1, 4\}$, while firms 2 and 3 remain independent. One institutional constraint binds. If the merged entity petitions, it must relocate product 4's production from F to D at cost R_1, raising that product's marginal cost to c_D, since the firm will find it hard to credibly petition for duties on foreign-produced goods while itself importing the same goods. Offshoring remains available only for product 1, again at cost R_1. Let $\pi_{\mathcal{X}}^{\text{dom}}$ denote the merged entity's variable profit without a tariff when it produces both products at D, so that product 4 is at c_D as it is under petitioning.

Proposition 5. *Let*

$$\Delta_{1,\mathcal{X}}^{pet} \equiv \Pi_{\mathcal{X}}^{pet} - \Pi_{\mathcal{X}}^{sq}, \qquad \Delta_{1,\mathcal{S}}^{pet} \equiv \Pi_{1,\mathcal{S}}^{pet} - \Pi_{1,\mathcal{S}}^{sq}, \tag{6}$$

be firm 1's petitioning premium (relative to status quo) with and without the cross-border merger, where $\Pi_{\mathcal{X}}^{pet} = \pi_{\mathcal{X}}^{pet} - L - R_1$ includes both petitioning costs and the cost of relocating

product 4. Then the merger's impact admits the exact decomposition

$$\Delta^{pet}_{1,\mathcal{X}} - \Delta^{pet}_{1,\mathcal{S}} = \underbrace{\left(\pi^{pet}_{4,\mathcal{S}} - \pi^{sq}_{4,\mathcal{S}}\right)}_{\text{appropriation}} + \underbrace{\left[(\pi^{pet}_{\mathcal{X}} - \pi^{dom}_{\mathcal{X}}) - (\pi^{pet}_{1,\mathcal{S}} + \pi^{pet}_{4,\mathcal{S}} - \pi^{sq}_{1,\mathcal{S}} - \pi^{sq}_{4,\mathcal{S}})\right]}_{\text{strategic}} - \underbrace{\left(\pi^{sq}_{\mathcal{X}} - \pi^{dom}_{\mathcal{X}}\right)}_{\text{relocation loss}} - \underbrace{R_1}_{\text{relocation cost}} . \tag{7}$$

The appropriation effect is strictly negative. The relocation loss and the relocation cost are strictly positive and do not depend on τ. The strategic effect can take either sign.

The contrast with the domestic merger under the status-quo baseline (Proposition 2) is stark. There, the domestic target benefits from the tariff and the merger internalizes a positive externality. Here the target is a victim of the tariff, so internalizing its profit change means internalizing a loss. Petitioning credibly also requires relocating product 4, which costs the merged entity R_1 and the cost advantage of producing product 4 at F. This relocation loss is the mirror image of the relocation gain in Proposition 3: there, the merger enables moving the target's product to the cheaper location and petitioning forgoes the gain; here, petitioning forces the target's product to the costlier location and the merged entity incurs the loss. The strategic effect compares the merged entity's gain from the tariff, with product 4 produced at D and so exempt from the duty, with the standalone firms' combined gain. Besides the tariff's effect on the joint-pricing gain, as in Proposition 2, it therefore contains the duty that standalone firm 4 pays and the merged entity's product 4 escapes. Appendix I shows that it is positive when the target dominates the market, so that the escaped duty is large, and negative when firm 1 dominates and the target is small, since firm 1 then gains more from the duty on product 4 as a standalone firm than firm 4 loses. The appendix also reports the same decomposition against an offshoring baseline, where the appropriation effect is ambiguous in sign rather than negative.

While the overall effect of a cross-border merger on petitioning incentives remains parameter-dependent, the decompositions suggest that cross-border mergers are less likely to increase the demand for protectionism. I quantify these channels for a hypothetical cross-border merger in Appendix V.B.

4 Institutional Setting and Data

To study the interplay between import competition, concentration, and the demand for trade protection in a specific environment, I focus on the household appliance industry.

4.1 Household Appliance Industry

Different household appliance categories, such as laundry appliances, refrigerators, or dishwashers, often involve the same domestic producers and importers. This raises the question of why some of these industries experience tariff petitions whereas others do not. Before narrowing the focus of the quantitative analysis to U.S. clothes washers, I provide narrative evidence on differences in market structure and tariff petitions between different appliance categories.

In 2000, the import share for most major appliances in the EU and U.S. was below 10 percent. European manufacturers such as BSH and Electrolux had established a presence in the U.S. by the 1990s, and U.S. firms such as Whirlpool were similarly active in Europe. However, these firms produced locally rather than exporting across regions. The U.S. market saw new entry from LG and Samsung in the mid-2000s, and from Haier, which first attempted to acquire Maytag in 2005 and later entered successfully by acquiring GE Appliances in 2016. European markets experienced a similar pattern, with entry from Arçelik and Vestel (Turkey), followed by LG and Samsung (Korea), and later Haier and Hisense (China).

In 2006, Whirlpool, the leading U.S. appliance manufacturer, acquired Maytag, its main domestically producing rival. In 2005, Whirlpool, including the Kenmore washers it built for Sears, accounted for 46 percent of U.S. washer production and Maytag for 27 percent. Either firm met the 25 percent support threshold on its own, but only the merged firm, at 73 percent, exceeded the 50 percent above which Commerce initiates without polling producers (Section 2). As discussed in Section 2, the DOJ cleared the merger citing competition from imports.

The key variation between appliance markets lies in the import share and the decline of the number of major domestic producers. In 2010, the year before Whirlpool's first petitions, imports accounted for 41 percent of U.S. clothes washer sales and 67 percent of bottom-mount refrigerator sales, and Whirlpool accounted for the vast majority of U.S. production in both categories. EU washers reached a similar import share by 2018 (46 percent), but five producers still accounted for 88 percent of EU production.[9] For U.S. dishwashers, the import share was 17 percent even in 2018. The two categories with a high import share and a single dominant domestic producer are the ones in which Whirlpool petitioned.

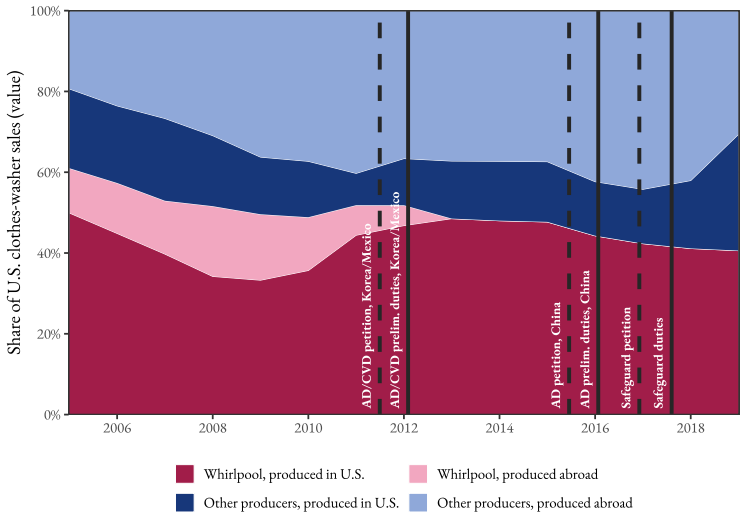
Whirlpool petitioned against bottom-mount refrigerators from Korea and Mexico in March 2011. Although Commerce found dumping, the USITC found no material injury,

[9]The outlier here is U.S. dryers, where there is no petition and where the import share increased from below 30 percent in 2010 to around 40 percent in 2018, with Whirlpool being by far the largest domestic producer. One possible explanation for this might be the price increases for clothes dryers following the washing machine tariffs, which were documented by Flaaen, Hortaçsu, and Tintelnot (2020).

concluding that imports had grown mainly in large models the domestic industry did not offer (U.S. International Trade Commission, 2012). Whirlpool's petition against large residential washers (LRWs), filed in December 2011, led to multiple rounds of tariffs. Preliminary antidumping and countervailing duties were first imposed on imports from Korea and Mexico in 2012, followed by antidumping duties on washers produced in China in 2016, and culminating in global safeguards in 2018 (Flaaen, Hortaçsu, and Tintelnot, 2020).

Figure 1 illustrates how the washer market developed from the merger until the global safeguards. In the early years after the merger, when the import share by Whirlpool's rivals was lower, Whirlpool offshored the combined firm's front-loader production. As rival import competition intensified, reaching 40 percent of sales by value in 2011, Whirlpool decided to reshore its entire clothes washer production and file its first washer petition at the end of 2011. Because rivals shifted production from the countries subject to duties to other origins after each origin-specific round, rivals' imports stayed at about 37 to 44 percent of sales until the global safeguard, and fell only once LG and Samsung began producing in the United States.

Figure 1: U.S. clothes washer import share by Whirlpool and its rivals



Notes: Shares of U.S. clothes-washer sales value by producer and production location, computed from TraQline (2005–2015) and OpenBrand (2016–2019) purchase data and plant-location weights (Appendix II.C). Whirlpool shares include clothes washers made by Whirlpool and sold by Sears under the Kenmore brand. All petitions were filed by Whirlpool. Dashed lines mark Whirlpool's petitions. Solid lines mark the first day imports from the named origins paid duties (preliminary cash deposits for AD/CVD). Apart from breaks of about two weeks before the final orders, deposits continued until the orders took effect.

4.2 Data

The primary data source is the TraQline household survey between 2005 and 2015, also used by Montag (2026). TraQline surveys approximately 600,000 U.S. households annually on major appliance purchases, including prices, detailed product characteristics, the retailer, second-choice brands, and household demographics. I extend the data set for 2016–2019 using TraQline survey years provided by Dewey Data (OpenBrand, 2022).[10] While the version provided by Dewey Data includes information on brand, retailer, price, consumer demographics, and second-choice brands, it does not include information on non-price product characteristics. I complement this data set with brand advertising spending from Kantar AdSpender, the brand repair rate from Consumer Reports, and the real exchange rates from the Penn World Table.

Products are defined as a combination of brand, retailer, and washer type (front-loader, top-loader with agitator, high-efficiency top-loader), and a market as U.S. clothes washers in a given year. For 2016–2019, I impute washer types with a classifier trained on 2011–2015 survey responses, restricted to the types each brand offered according to its 2015 sales, ENERGY STAR listings, and archived product lineups (Appendix II.B).[11]

I assign products to production countries using plant-location weights by owner, brand, washer type, and year for 2005–2019. They are compiled from annual reports, USITC investigation records, trade press, and firm-level import records, and validated against U.S. imports by origin (Appendix II.C).

For antidumping and countervailing duties on LRWs, I record the duties finally assessed by origin, manufacturer, and date from Federal Register notices and USITC reports, and, for the two exporters whose reviews found margins below the order, the order margin by which the order raised their import price (Appendix II.D). For all other duties, including the general tariff, the global safeguard, and, from September 2019, Section 301 duties on Chinese imports, I use the statutory rates and the duties collected at entry in monthly U.S. import data from the USITC.

To estimate the duty rates importers paid on their imports, I also use monthly U.S. imports by origin from the USITC and monthly shipments of LG and Samsung by origin, read off Figure 2 in Flaaen, Hortaçsu, and Tintelnot (2020), which is based on PIERS bill-of-lading data.

Total U.S. washer shipments come from the Association of Home Appliance Manu-

[10] TraQline has been part of OpenBrand since 2024.

[11] To keep the demand estimates uncontaminated by measurement error in the classifier, I estimate demand on 2005–2015 data and use the 2016–2019 data only to estimate product-level marginal costs in those years and infer cost differences between production locations.

Table 3: U.S. clothes washers: descriptive statistics

	2005	2011	2015	2019
Products				
Number of products	106	152	167	151
Brands	23	24	32	32
Brand owners	13	15	22	23
Mean price (2012 $)	600	583	572	593
Front-loader share (%)	28	37	26	29
Production origin (% of sales)				
United States	81	60	69	73
Mexico and Korea	4	35	3	6
China	1	4	29	5
Thailand and Vietnam	0	0	0	15
Germany	13	1	0	0
Market				
Duty wedge (%)	0.2	0.3	0.9	6.8
Shipments (million units)	9.23	7.56	9.12	10.62

Notes: Estimation samples. Prices, front-loader shares, and production-origin shares are weighted by sales volume. Production-origin shares exclude products without a sourced location (at most 0.7 percent of volume); remaining origins account for at most 0.9 percent. Washer types in 2019 are imputed. Shipments are total U.S. unit shipments of automatic washers (AHAM); 2019 is the published 2018 forecast grown at AHAM's reported 2019 growth rate. Duty wedge is the average ad valorem gap between the tariff-exclusive cost and the duty-inclusive import price per washer sold, in percent of the customs value, with U.S.-made washers at zero.

facturers (AHAM). This includes annual domestic production and imports and subtracts exports.

To obtain data on the joint distribution of household demographics, I draw a random sample of households from the IPUMS Current Population Survey (CPS) in each year.

Table 3 summarizes the estimation sample in four years spanning the sample period. Average prices fell between 2005 and 2015 and returned close to their 2005 level by 2019, while the origin of imports moved from Mexico and Korea to China and then to Thailand and Vietnam.

5 Empirical Model and Estimation

The stylized model in Section 3 showed that assessing whether a merger harms consumers through the trade-policy channel requires estimating the merging parties' variable profits under different merger, tariff, and production-location scenarios. To estimate these objects,

I specify a model of demand and supply tailored to the U.S. washer market.

5.1 Consumer Demand

The demand model mostly follows Montag (2026). Let utility for household i from purchasing product j be:

$$u_{ijt} \;=\; x_{jt}\beta \;+\; \sigma^{\mathrm{FL}}\nu_i^{\mathrm{FL}}x_{jt}^{\mathrm{FL}} \;-\; \alpha_i\, p_{jt} \;+\; \xi_{jt} \;+\; \varepsilon_{ijt}, \qquad \alpha_i \equiv \exp(\alpha + \kappa_\alpha \iota_i), \tag{8}$$

where x_{jt} collects observed non-price characteristics, brand-by-washer-type, retailer, and year effects, and brand-specific linear trends,[12] x_{jt}^{FL} is a front-loader indicator, $\nu_i^{\mathrm{FL}} \sim \mathcal{N}(0,1)$ is a random taste draw that captures heterogeneous preferences for front-loaders, ι_i is income, and ε_{ijt} is an idiosyncratic shock drawn from a Type I extreme value distribution.

The utility of the outside good is normalized to zero. Each consumer purchases the single product, or the outside good, that yields the highest utility.

Given the distributional assumptions, the market share of product j is

$$s_{jt}(\mathbf{p}) \;=\; \int \frac{\exp\!\big(\delta_{jt} + \mu_{ijt}\big)}{1 + \sum_{k\in J}\exp\!\big(\delta_{kt} + \mu_{ikt}\big)}\, dP(\iota_i, \nu_i), \tag{9}$$

where

$$\delta_{jt} = x_{jt}\beta + \xi_{jt}, \qquad \mu_{ijt} = \sigma^{\mathrm{FL}}\nu_i^{\mathrm{FL}}x_{jt}^{\mathrm{FL}} - \alpha_i p_{jt}.$$

Demand is estimated on the 2005–2015 sample, in which washer types are observed, by combining aggregate and household moments as outlined in Berry, Levinsohn, and Pakes (2004). I split the demand parameters into a linear component θ_1, the coefficients β on x_{jt}, and a nonlinear component $\theta_2 = (\sigma^{\mathrm{FL}}, \alpha, \kappa_\alpha)$. The nonlinear parameters are estimated by the method of simulated moments using three moment conditions. The first matches the covariance between a product's price and the average income of its buyers, which pins down κ_α. The second matches the covariance between purchasing a front-loader and the share of front-loaders among the buyer's second-choice brand, which pins down σ^{FL}. The third is the orthogonality condition between the demand shock ξ_{jt} and a cost shifter excluded from utility, the production-location-weighted real exchange rate $z_{jt} = \sum_c w_{jct}\, RER_{ct}$, where w_{jct} is the share of product j produced in country c, the plant-location weight described in Section 4, and RER_{ct} is the price level of consumption in c relative to the United States

[12] The price instrument introduced below moves mainly front-loaders relative to top-loaders over time, as front-loaders were imported and relocated between origins whereas most top-loaders were made in the United States. Brand-by-washer-type effects absorb shifts in a brand's position within each type that would otherwise load on price.

from the Penn World Table.[13] With as many moments as parameters, θ_2 is exactly identified. Market shares are simulated with 2,000 household draws per year from the CPS. Conditional on the estimate $\hat{\theta}_2$, the linear parameters θ_1 are obtained by ordinary least squares.

Market size M_t is the number of households that consider buying a washer in year t. The survey's respondent pool is flat over time while the share of respondents who bought a washer rises, and its projected national purchases exceed total U.S. washer shipments from 2008 onward. I therefore set M_t equal to a constant fraction of U.S. households and define the outside share s_{0t} as one minus the ratio of total U.S. washer shipments to M_t, treating the share of shipments outside the household channel as constant. Product shares are the survey's volume shares of inside purchases scaled by $1 - s_{0t}$. The fraction is chosen to equate the mean outside share over 2005–2015 to the one in Montag (2026), so the rule changes the time path of market size but not its level. The implied outside share rises from 0.22 in 2005 to 0.42 in 2012 and falls to 0.30 in 2015 and 0.21 in 2019, while M_t grows from 11.8 to 13.4 million households (Appendix III.B).

For 2016–2019, I hold the nonlinear parameters at the 2005–2015 estimate and recover the mean utilities δ_{jt} by inverting observed market shares year by year, with imputed washer types and household draws for each year.[14] The marginal costs recovered in the next subsection depend on mean utilities, prices, and $\hat{\theta}_2$ alone, so the characteristics that are unobserved after 2015 play no role there. This maintains that the distributions of price sensitivity and of front-loader tastes are stable after 2015.

5.2 Marginal Costs and Pricing

Let $j \in J_{ft}$ denote a product offered by firm f in year t with price p_{jt}, tariff-exclusive marginal cost mc_{jt}, and duty wedge τ_{jt}, which is the ad valorem gap between the tariff-exclusive cost and the duty-inclusive import price. The firm's variable profit is:

$$\pi_{ft} = \sum_{j \in J_{ft}} \Big[p_{jt} - (1 + \tau_{jt})\, mc_{jt} \Big] \cdot s_{jt}(\mathbf{p}) \cdot M_t, \tag{10}$$

where $s_{jt}(\mathbf{p})$ is the market share of product j as a function of all prices $\mathbf{p}$, and M_t is market size.

[13] The instrument is built for the products of LG, Samsung, Electrolux, Whirlpool, Maytag, General Electric, and MC Appliance. The remaining products, Kenmore and small brands, carry a zero and an indicator absorbed in x_{jt}.

[14] The linear parameters cannot be estimated on 2016–2019 data, since the product characteristics are not observed. The nonlinear parameters could in principle be re-estimated with imputed washer types, but imputing types for two of the eleven years in the 2005–2015 sample already moves the logit price coefficient by about one standard error.

Markups are pinned down by the derivatives of market shares with respect to prices. The Bertrand-Nash equilibrium prices solve:

$$\mathbf{p} = (\mathbf{1} + \boldsymbol{\tau}) \circ \mathbf{mc} - \left(\frac{\partial \mathbf{s}}{\partial \mathbf{p}} \circ \Omega \right)^{-1} \mathbf{s}, \tag{11}$$

where Ω is the ownership matrix and $\circ$ denotes the Hadamard product. I recover the duty-inclusive marginal cost $(1 + \tau_{jt})\, mc_{jt}$ for every year from 2005 to 2019 by inverting equation (11) at observed prices and market shares, and obtain mc_{jt} by dividing by $1 + \tau_{jt}$.

The duty wedge τ_{jt} combines the rates on firm $f(j)$'s washers from each origin with its production-location shares,

$$\tau_{jt} \;=\; \sum_{c} w_{jct}\, \tau_{cf(j)t}, \tag{12}$$

where $\tau_{cf(j)t}$ sums the ordinary duty, the antidumping and countervailing duties, the global safeguard, and the Section 301 duty.

For antidumping duties, the rate in the wedge is not necessarily the duty paid. An antidumping investigation aims to identify the difference between the price at which the exporter sells the product in the export market and the product's normal value (usually its price in the exporter's home market) using pre-petition export prices. The antidumping duty is then the rate that corrects this difference. In the U.S. system, the exporter can later request a review. If the review finds that the exporter has since raised its export price toward normal value, the deposits above the duty assessed are refunded. The exporter can therefore raise its export price instead of paying the duty, and the order then works like a voluntary export restraint. While it makes a difference to the exporter and Treasury whether the exporter pays duties or increases its export price, this does not make a difference to the domestic petitioner.[15] For an exporter that takes this route, the rate in the wedge is therefore the margin of the order, not the duty assessed in the review.

Which rate a seller bears depends on when the unit it sells entered the country. I therefore construct the duty wedge under two models. Under *duties paid*, the tariff rate is the one in force when the units sold in year t entered the country, which draw on inventories that entered before each round of duties took effect. Under *replacement duties*, the tariff rate is the rate on a replacement unit entering two months after the sale, the opportunity cost of the unit sold. The two differ most in 2016, 2018, and 2019, when duties took effect on imports already in stock or in-quota entries were still being sold. In 2018, the volume-weighted duty wedge of imported washers is 14 percent under duties paid and 27 to 41 percent under replacement duties. The range reflects the 2018 safeguard's tariff-rate quota,

[15] In this application, only LG (Korea) and Electrolux (Mexico) requested a review.

for which I report replacement duties both at the in-quota rate until the quota filled and at the above-quota rate throughout.[16]

To estimate how marginal costs differ across production locations, I regress the log marginal cost on the production-location shares:

$$\ln mc_{jt} = \sum_{c \neq \text{U.S.}} w_{jct}\,\gamma_c + \zeta_t\, w_{j\,\text{U.S.}\,t} + x_j\lambda + FE_{b(j)} + FE_{r(j)} + FE_t + \eta_{b(j)}\,t + \omega_{jt}. \quad (13)$$

The origin effect γ_c is the log cost of producing in country c relative to the United States for a product of the same brand, washer type, and retailer. It is a reduced-form difference by assembly origin that bundles labor, parts, and freight. Because a product's cost combines its origins through the shares w_{jct}, moving production changes cost proportionally, which I use below. The coefficient ζ_t is zero before 2018; for 2018 and 2019, it allows the cost of U.S.-made washers to move relative to imports in the safeguard years beyond what the origin effects capture.

Brand fixed effects $FE_{b(j)}$, retailer fixed effects $FE_{r(j)}$, year fixed effects FE_t, and brand-specific linear trends $\eta_{b(j)}\,t$ absorb cost differences across brands, retailers, and years.[17] The characteristics x_j, with coefficients λ, are the washer type, exterior colour shares, and front-loader indicators by brand group,[18] and ω_{jt} is a transitory cost shock.

The sample comprises 2,192 product-years of 2005–2019. Standard errors are clustered by brand.

Counterfactuals change production locations and duties. Changing a product's origin shares by Δw_{jct} changes its marginal cost to $mc_{jt}\exp\left(\sum_c \Delta w_{jct}\,\gamma_c\right)$, and changing the duty rates changes τ_{jt} through equation (12); an antidumping order at margin τ raises the import price of the subject products by τ whether or not the exporter would later be reviewed. Counterfactual prices solve equation (11) at these costs, with mean utilities, the demand parameters, and ownership held fixed.

Confidence intervals for the counterfactuals and the standard errors of the demand parameters come from 200 bootstrap draws. Each draw redraws the households and the micro-moment samples and, for 2016–2019, assigns each buyer a washer type from the classifier's probabilities. On each draw I re-estimate the demand parameters, invert mean utilities and marginal costs so that the draw reproduces the observed prices and shares, and re-estimate the origin effects on costs rebuilt from cost residuals resampled within brand. Counterfactual equilibria are re-solved on each draw at its parameters, mean utilities, and costs. The

[16] The duty data and the construction of both models are described in Appendices II.D and III.C.

[17] Products without a sourced production location have zero origin shares and their own year effects.

[18] Characteristics that are not observed after 2015 are dropped for all years. On 2005–2015, this moves the Germany, Mexico, China, and Korea effects by at most 0.2 standard errors (Appendix IV.A).

duty wedge is held at its point value, so the intervals reflect parameter uncertainty but not uncertainty in the duty construction.

5.3 Trade-Policy Channel of Mergers

With the tools to estimate firm profits under different merger, offshoring, and tariff scenarios, I can now connect the empirical model to the propositions in Section 3. The stylized model shows that the change in the merging parties' incentive to petition for tariffs decomposes into an appropriation effect, a relocation gain, and a strategic effect. I now define their empirical analogues.

A petition yields a tariff-origin pair (τ, O): ad valorem rates τ, which may differ by origin and firm, on imports from an origin set O, entering marginal costs through the duty wedge in equation (12). I assume that the industry knows in advance which duties a petition would obtain. For antidumping and countervailing duties, the assumption is that it is common knowledge to the industry by how much the importer is selling below normal value or how much its production is being subsidized. I assume that the dumping and subsidy margins are constant over time. For the safeguard, I assume that the industry can foresee the quota and the rates. A firm that pays the fixed cost of petitioning obtains these duties with certainty.[19]

Section 7 applies this assumption to the three petitions Whirlpool filed, simulating the duties each delivered as a hypothetical duty in every year of the sample. Let $\pi_{f,t,\mathcal{S}}(\tau, O; \ell)$ denote the variable profits of firm f in year t under separate ownership ($\mathcal{S}$), and $\pi_{t,\mathcal{M}}(\tau, O; \ell)$ the variable profits of the merged entity ($\mathcal{M}$), which owns both merging firms' products. Profits are evaluated at tariff-origin pair (τ, O) and production-location regime $\ell \in \{\text{off}, \text{sq}, \text{dom}\}$ (offshore, status quo, domestic), which sets the origin shares w_{jct} of the merging parties' products. When evaluating profits under a tariff petition, I take the with-tariff regime for the incumbent to be domestic production, i.e., $\ell = \text{dom}$. For simplicity, in the remainder I denote the acquirer as $f = 1$ and the acquisition target as $f = 2$.

Three location rules are maintained throughout. The petitioner reshores its remaining foreign production when it petitions, so the with-tariff regime is $\ell = \text{dom}$. Without a petition, the acquirer either keeps its production locations of the previous year (the status-quo baseline) or moves its front-loader production to Mexico (the offshoring baseline). With the merger, the target's front-loaders move with the acquirer's. Standing alone, the target produces in the United States in every regime, the counterpart of firm 2's prohibitive relo-

[19] A common probability of success $\rho < 1$ would multiply every petitioning premium by ρ, and the filing cost cancels in the comparison between the merger and no-merger cases, so the decomposition below is unchanged up to scale.

cation cost in Section 3. Rivals keep the production locations of the previous year. For the merged entity I write $\pi_{t,\mathcal{M}}(0, O; \ell, \text{dom})$ for variable profits when the acquirer's products are in regime ℓ and the target's products stay domestic.

The appropriation effect of a merger is the target's gain from the duties,

$$\text{Appropriation}_t(\tau, O) = \pi_{2,t,\mathcal{S}}(\tau, O; \text{dom}) - \pi_{2,t,\mathcal{S}}(0, O; \text{dom}). \tag{14}$$

Because the merger lets the target's front-loaders move with the acquirer's, the merged entity's no-tariff profit also contains a relocation gain,

$$\text{Relocation}_t(O, \ell) = \pi_{t,\mathcal{M}}(0, O; \ell) - \pi_{t,\mathcal{M}}(0, O; \ell, \text{dom}), \tag{15}$$

the merged entity's gain from locating the target's products offshore. The strategic effect compares the merged entity with the two separate firms at a common location of the target's products,

$$\begin{aligned} \text{Strategic}_t(\tau, O, \ell) = &\Big[\pi_{t,\mathcal{M}}(\tau, O; \text{dom}) - \pi_{1,t,\mathcal{S}}(\tau, O; \text{dom}) - \pi_{2,t,\mathcal{S}}(\tau, O; \text{dom})\Big] \\ &- \Big[\pi_{t,\mathcal{M}}(0, O; \ell, \text{dom}) - \pi_{1,t,\mathcal{S}}(0, O; \ell) - \pi_{2,t,\mathcal{S}}(0, O; \text{dom})\Big]. \end{aligned} \tag{16}$$

The merger's effect on the acquirer's petitioning premium is the appropriation effect plus the strategic effect minus the relocation gain, as in equation (5).

Finally, I quantify the consumer-surplus effect of a given tariff. For a tariff-origin pair (τ, O) and regime ℓ, the change in consumer surplus in year t under ownership configuration $\mathcal{C} \in \{\mathcal{M}, \mathcal{S}\}$ is (Small and Rosen, 1981)

$$CS_t^{\mathcal{C}}(\tau, O; \ell) \;=\; M_t \int \frac{1}{\alpha_i} \left[\ln\Big(\sum_{j=0}^{J} e^{V_{ijt}^{(\tau, O;\, \text{dom},\, \mathcal{C})}} \Big) - \ln\Big(\sum_{j=0}^{J} e^{V_{ijt}^{(0, O;\, \ell,\, \mathcal{C})}} \Big) \right] dP(\iota_i, \nu_i), \tag{17}$$

where $V_{ijt}^{(\tau, O;\, \ell, \mathcal{C})} = \delta_{jt} + \mu_{ijt}^{(\tau, O;\, \ell, \mathcal{C})}$ uses the equilibrium prices implied by $\mathcal{C}$, (τ, O), and ℓ.

For a given tariff-origin pair (τ, O) and regime ℓ, the merger-induced change in consumer surplus from a tariff is

$$\Delta CS_t^{\mathcal{M}}(\tau, O; \ell) \;:=\; CS_t^{\mathcal{M}}(\tau, O; \ell) \;-\; CS_t^{\mathcal{S}}(\tau, O; \ell), \tag{18}$$

so $\Delta CS_t^{\mathcal{M}}(\tau, O; \ell) < 0$ indicates that the merger amplifies the consumer harm from a tariff.

6 Parameter Estimates

6.1 Demand

Table 4 summarizes the demand estimates. Column (1) reports the first stage: a one-unit increase in the production-location-weighted real exchange rate raises the price by \$189, and the Kleibergen–Paap F-statistic of 22.5 indicates a strong instrument. Accounting for price endogeneity moves the price coefficient from -0.18 in the OLS logit of Column (2) to -0.48 in the IV logit of Column (3), and the average own-price elasticity from -1.0 to -2.8, consistent with prices being higher for products of higher unobserved quality.

Column (4) reports the mixed logit. Higher-income households are less price-sensitive: the income coefficient κ_α of -0.134 implies that an additional \$100,000 of income lowers the price coefficient by 13 percent. Households differ substantially in their taste for front-loaders. The dispersion σ^{FL} of 2.40 means that one standard deviation of the front-loader taste is worth about \$375 in price for a household with an income of \$50,000. The average own-price elasticity at the product level is -3.59, and it varies little across years, between -3.5 and -3.8.[20]

6.2 Marginal Costs and Duties

The tariff-inclusive marginal costs recovered from the pricing equilibrium average between \$351 and \$428 per washer across the years 2005–2019, with Lerner indices between 0.34 and 0.41. Figure 2 displays their distribution across all products together with the tariff-exclusive costs under replacement duties at the in-quota safeguard rate, for 2005–2011 and for 2012–2019. In the first period, when imports bore only the ordinary tariff, the two distributions closely coincide. In the second, the duties move the imported products, 25 to 40 percent of each year's volume, and the shift is large for those that bear a duty. Among the imported washers of 2018 and 2019, the median duty removes 22 and 21 percent of the recovered cost.

Table 5 reports the duty wedge by year under the two duty models. Under duties paid, the wedge on imported washers lies between 3 and 6 percent from 2012 to 2017 and rises with the safeguard. In 2018 and 2019, imported washers bear 14 and 17 percent under duties paid and 27 and 25 percent under replacement duties at the in-quota rate. The two models differ in the years in which duties took effect on imports already in stock. In 2016, the Chinese washers sold that year had mostly entered before the antidumping duty of July 2016 and paid the 1 percent ordinary tariff, whereas replacing them cost 38 to 57 percent in duty, so

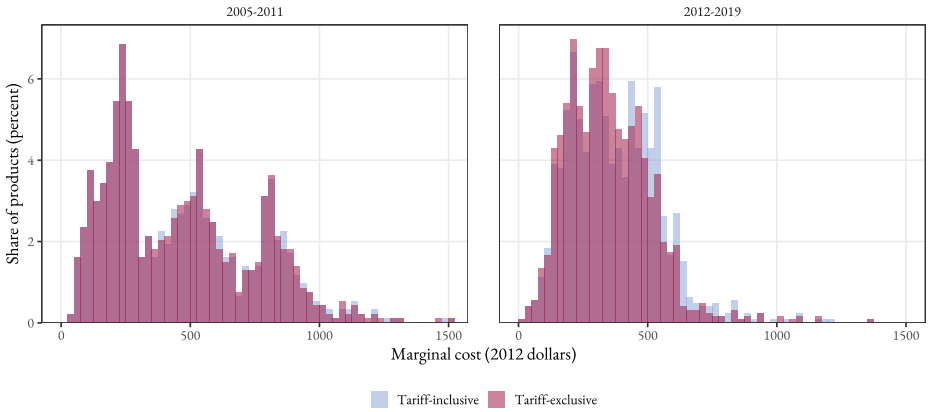
[20] Montag (2026) reports an average elasticity of -2.54 for the same sample. The difference comes from the brand-by-washer-type effects, the updated production-location weights in the instrument, and the updated market-size rule (Appendices III.A and III.B).

Table 4: Demand estimates

	(1) First stage	(2) Logit OLS	(3) Logit IV	(4) Mixed logit
Dependent variable:	Price	$\hat{\delta}_{jt}$	$\hat{\delta}_{jt}$	
Real exchange rate	1.885 (0.397)			
Price ('00 2012 $)		−0.176 (0.056)	−0.477 (0.185)	
Common price coefficient α				−0.381 (0.029)
Income effect κ_α				−0.134 (0.015)
Unobserved taste σ^{FL}				2.402 (0.066)
Observations	1,590	1,590	1,590	1,590
Kleibergen–Paap F-statistic	22.5			
Avg. own-price elasticity		−1.034	−2.797	−3.590

Notes: Column (1) reports the first-stage regression of prices on the production-location-weighted real exchange rate. Column (2) presents estimates from the simple logit model without instrumentation. Column (3) shows estimates from the simple logit using the real exchange rate as an instrument for price. Column (4) displays results from the mixed logit model described in Section 5. Estimation sample 2005–2015. All columns include retailer, brand-by-washer-type, and year fixed effects, brand-specific linear trends, and the product characteristics. Standard errors in parentheses: clustered at the brand level in columns (1)–(3), bootstrap in column (4). Own-price elasticities of residual demand are computed at the product level and averaged across products, weighting by sales volume.

Figure 2: Marginal cost estimates with and without import duties, 2005–2019



Notes: Histograms of the tariff-inclusive marginal cost $(1+\tau_{jt})\,mc_{jt}$ recovered from the pricing equilibrium and of the tariff-exclusive marginal cost mc_{jt} under replacement duties at the in-quota safeguard rate, across all products in the estimation samples of 2005–2011 and 2012–2019.

Table 5: Duty wedge under the two duty models, 2011–2019 (percent)

	2011	2012	2013	2014	2015	2016	2017	2018	2019
All washers									
Duties paid	0.3	1.5	1.8	1.3	0.9	1.2	2.2	5.6	6.8
Replacement, in-quota	0.3	3.6	1.8	1.3	0.9	6.7	2.7	11.1	10.2
Replacement, above-quota	0.3	3.6	1.8	1.3	0.9	6.7	3.3	16.6	11.2
Imported washers									
Duties paid	0.6	3.6	5.5	4.3	3.0	3.2	5.6	14.0	17.0
Replacement, in-quota	0.6	8.4	5.7	4.3	3.0	17.9	6.7	27.5	25.3
Replacement, above-quota	0.6	8.4	5.7	4.3	3.0	17.9	8.2	41.1	27.9

Notes: Volume-weighted duty wedge τ_{jt} of the products in the estimation sample, in percent of the customs value; imported washers are products with a positive non-U.S. production share. Duties paid: the rate in force when the units sold in the year entered the country. Replacement: the replacement duty, the rate on a replacement unit entering two months after the sale, with the 2018 safeguard at the in-quota rate until the quota filled or at the above-quota rate throughout. Before 2011 only the ordinary duty applies and the models coincide.

the wedge is 3.2 percent under duties paid and 17.9 percent under replacement duties. The same gap, at a smaller scale, opens in 2012 with the Korean and Mexican deposits and in 2018 with the safeguard, where the replacement rate also depends on whether the quota had filled.

6.3 Production-Location Cost Differences

Table 6 reports the cost decomposition of equation (13) under the three duty wedges. Production abroad lowers marginal cost relative to the United States for a product of the same brand, washer type, and retailer. The difference is around 21 log points for Mexico, 17 for China, 15 for Korea, and 28 for Thailand under duties paid, with similar estimates under replacement duties. The Vietnam effect is small and imprecise, and the Germany effect is positive and imprecise. How the duty wedge is removed from the recovered costs matters little for the origin effects.

The U.S. terms show that the cost of U.S.-made washers rose by 10 to 18 log points in 2018 and 20 to 22 in 2019 relative to imports in the safeguard years beyond what the origin effects capture. A partial explanation for this may be the rise in U.S. production costs in 2018 due to the tariffs of 25 percent on steel and 10 percent on aluminum imposed in March 2018. Furthermore, the safeguard itself also covered washer parts, with a tariff-rate quota of 50,000 units in its first year and a duty of 50 percent above it, so domestic assembly of imported cabinets, tubs, and baskets became more expensive at the margin. Flaaen, Hortaçsu, and Tintelnot (2020) find that the effective tariff rate on parts hardly changed

Table 6: Marginal cost decomposition, 2005–2019

	(1)	(2)	(3)
Duty wedge	Duties paid	Replacement duties	
		In-quota	Above-quota
Share of production in:			
Germany	0.136	0.149	0.149
	(0.128)	(0.127)	(0.128)
Mexico	−0.212	−0.234	−0.234
	(0.048)	(0.049)	(0.049)
China	−0.171	−0.166	−0.158
	(0.039)	(0.039)	(0.041)
Korea	−0.151	−0.152	−0.152
	(0.054)	(0.058)	(0.059)
Thailand	−0.277	−0.293	−0.321
	(0.067)	(0.076)	(0.090)
Vietnam	−0.045	−0.071	−0.106
	(0.084)	(0.085)	(0.084)
Other origins	−0.266	−0.279	−0.289
	(0.048)	(0.048)	(0.048)
U.S. share × 2018	0.101	0.133	0.175
	(0.054)	(0.062)	(0.075)
U.S. share × 2019	0.199	0.210	0.218
	(0.067)	(0.071)	(0.072)
Observations	2,192	2,192	2,192
Within R^2	0.541	0.542	0.542
Implied cost change (percent):			
U.S. to Mexico	−19.1 (3.9)	−20.8 (3.8)	−20.9 (3.9)
U.S. to Germany	14.6 (14.7)	16.1 (14.8)	16.0 (14.8)
U.S. to Korea	−14.0 (4.6)	−14.1 (5.0)	−14.1 (5.1)
U.S. to China	−15.7 (3.3)	−15.3 (3.3)	−14.6 (3.5)
U.S. to Thailand	−24.2 (5.1)	−25.4 (5.6)	−27.4 (6.5)
U.S. to Vietnam	−4.4 (8.1)	−6.8 (7.9)	−10.1 (7.6)

Notes: Regressions of log tariff-exclusive marginal cost on the shares of each product produced in each origin (U.S. production as the base), the U.S. share in 2018 and 2019, product characteristics, fixed effects, and brand-specific time trends, equation (13), with the duty wedge of Table 5 removed from the recovered costs. All columns include brand, retailer, and year fixed effects, brand-specific linear trends, and the product characteristics (washer type, exterior colour shares, and front-loader indicators by brand group). Products without a sourced production location have zero origin shares and their own year effects. Standard errors clustered at the brand level in parentheses. The cost change from moving production from the U.S. to origin c is $100(\exp(\gamma_c) - 1)$, with delta-method standard errors.

after the safeguard, which points to the quota rather than the duty binding for most parts imports.

The lower panel reports the cost changes implied by the origin effects when production moves out of the United States, which the counterfactuals of Section 7 use. Moving production from the United States to Mexico lowers marginal cost by 19 to 21 percent, to China by 15 to 16 percent, and to Korea by 14 percent. Moving it to Germany raises marginal cost by 15 to 16 percent, with a standard error of about 15 percentage points.

6.4 Price Effects of the Duties

The duty wedges of Table 5 together with the pricing equilibrium imply how much of each round of duties reached consumer prices. For each round and year, I re-solve the pricing equilibrium without the round's duties, once at the production locations of the year and once at those of the year before the round, holding mean utilities, the demand parameters, and ownership fixed. The comparison with the observed prices gives the price effect of the round; the comparison between the two location configurations separates the duty itself from the relocation of production it triggered. Flaaen, Hortaçsu, and Tintelnot (2020) estimate the price effects of the 2016 China duties and the 2018 safeguard directly from weekly retail prices, which provides an external check on the cost side of the model.[21]

Table 7 reports the results. Under duties paid, the China antidumping duty raised the average washer price by 0.6 percent in 2016 and the safeguard by 2.4 percent in 2018, well below the 3.4 and 11.5 percent that Flaaen, Hortaçsu, and Tintelnot (2020) estimate. Under replacement duties at the in-quota rate, the effects are 4.1 and 6.0 percent, and at the above-quota rate 3.7 and 8.7 percent. The China effect matches the estimate of Flaaen, Hortaçsu, and Tintelnot (2020) and the safeguard effect reaches one half to three quarters of it. Most of these price effects are due to the exposed products, which account for 35 to 42 percent of volume. Their prices rose by 9.8 percent in 2016 and 14.1 percent in 2018 under replacement duties at the in-quota rate. The Korean and Mexican duties of 2012 raised the average washer price by 1.2 to 1.7 percent in 2012–2014 under duties paid and by 1.5 to 2.6 percent under replacement duties at the in-quota rate.

Panel C decomposes the price effect under replacement duties at the in-quota rate. The duty at the year's production locations accounts for almost all of it in the first year of each round (89 to 94 percent) and for 35 to 68 percent in the later years. The relocation of production adds between 0.2 and 0.8 percentage points until 2018 and 2.0 points in 2019, when LG and Samsung began producing in the United States at higher cost. The last

[21] Their estimates compare washers with ranges over eight months around each policy date, whereas the model compares annual equilibria. Both include the relocation that took place between the periods compared.

Table 7: Price effects of the duties by round (percent)

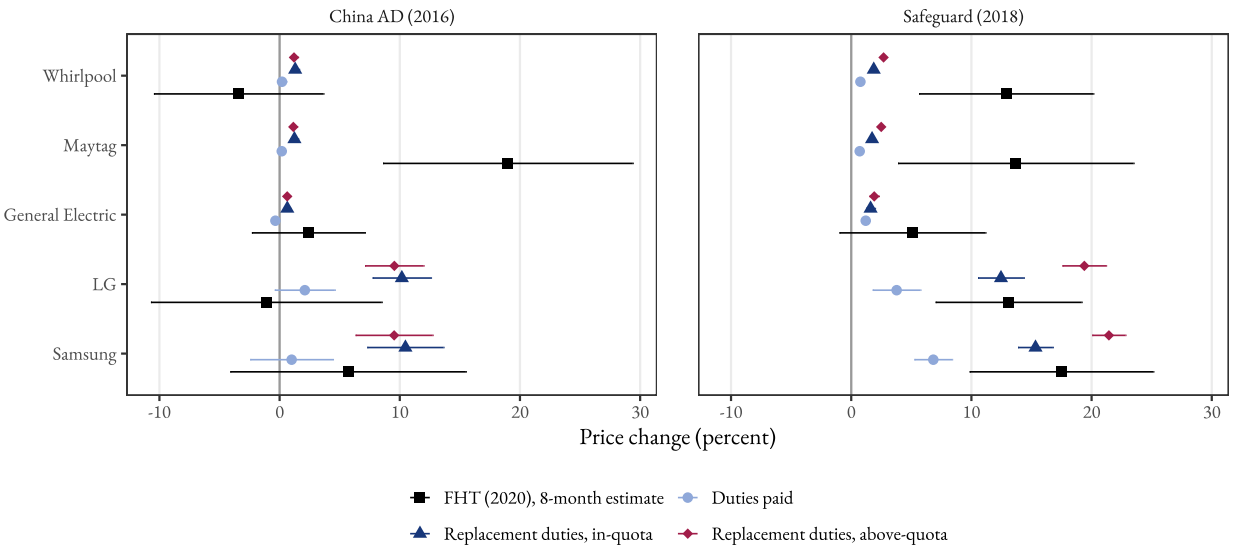
	Korea and Mexico			China		Safeguard	
	2012	2013	2014	2016	2017	2018	2019
A. All washers							
Duties paid	1.16	1.72	1.41	0.57	1.45	2.40	4.29
	(0.26)	(0.35)	(0.47)	(0.59)	(1.47)	(0.17)	(0.81)
Replacement duties, in-quota	2.57	1.87	1.54	4.06	1.17	5.97	6.43
	(0.27)	(0.36)	(0.47)	(0.55)	(1.49)	(0.18)	(0.78)
Replacement duties, above-quota	2.61	1.93	1.62	3.74	0.70	8.67	7.34
	(0.27)	(0.36)	(0.47)	(0.56)	(1.51)	(0.19)	(0.76)
Flaaen, Hortaçsu, and Tintelnot (2020), 8-month estimate				3.4		11.5	
				(1.7)		(1.8)	
B. Exposed products							
Duties paid	2.73	3.45	2.54	2.27	3.36	5.44	9.53
	(0.59)	(0.83)	(1.05)	(1.42)	(3.38)	(0.44)	(2.03)
Replacement duties, in-quota	6.08	3.83	2.86	9.78	2.72	14.11	14.58
	(0.60)	(0.84)	(1.06)	(1.35)	(3.44)	(0.44)	(1.96)
Replacement duties, above-quota	6.17	3.98	3.05	9.02	1.66	20.70	16.76
	(0.60)	(0.84)	(1.06)	(1.36)	(3.47)	(0.45)	(1.92)
Volume share of exposed products	42.0	41.0	42.3	35.6	37.7	35.5	35.2
C. Decomposition, replacement duties in-quota, all washers							
Duty at the year's locations	2.28	1.23	0.82	3.81	0.40	5.42	4.39
	(0.02)	(0.01)	(0.01)	(0.05)	(0.01)	(0.07)	(0.05)
Relocation	0.29	0.65	0.72	0.25	0.77	0.55	2.05
	(0.27)	(0.36)	(0.47)	(0.56)	(1.49)	(0.16)	(0.78)
Total	2.57	1.87	1.54	4.06	1.17	5.97	6.43
	(0.27)	(0.36)	(0.47)	(0.55)	(1.49)	(0.18)	(0.78)
Duty at pre-round locations	3.01	4.03	4.09	5.61	10.50	5.92	7.56
	(0.03)	(0.04)	(0.05)	(0.10)	(0.26)	(0.08)	(0.17)

Notes: Volume-weighted log price changes in percent from re-solving the pricing equilibrium of year t with and without the round's duties. Total: observed prices against prices without the round's duty at the production locations of the year before the round. Duty at the year's locations: observed prices against prices without the round's duty at the year's locations. Relocation: the remainder, the price effect of the change in production locations since the year before the round, valued at the origin effects of Table 6. Duty at pre-round locations: the round's duty applied at the pre-round locations, without relocation. Exposed products carry a positive duty from the round at the year's or the pre-round locations. Bootstrap standard deviations in parentheses (Section 5); duty rates are held fixed across draws. The estimates of Flaaen, Hortaçsu, and Tintelnot (2020) are their difference-in-differences estimates for washers eight months after the China antidumping duties (their Table 1, column 2) and the safeguard (column 6), from the specification with product characteristics, with standard errors.

row shows what the duties would have done without relocation. Had LG and Samsung kept producing in China, the antidumping duty would have raised prices by 5.6 percent in 2016 and 10.5 percent in 2017, against 4.1 and 1.2 percent with the move to Thailand and Vietnam. The safeguard, which no relocation abroad could escape, raised prices by about as much as it would have without relocation.

Figure 3 compares the effects by brand. For the importers in the safeguard, replacement duties at the in-quota rate reproduce the estimates of Flaaen, Hortaçsu, and Tintelnot (2020). I find price increases of 12.5 percent for LG and 15.3 percent for Samsung against their 13.1 and 17.5, where duties paid give 3.8 and 6.8 percent and the above-quota rate 19.4 and 21.4. For the China duties, the model's 10 percent for both brands lies above their imprecise brand estimates. For the domestic brands, the estimates are more different. Flaaen, Hortaçsu, and Tintelnot (2020) find that Whirlpool, Maytag, and General Electric raised prices by 13, 14, and 5 percent after the safeguard. If I allow prices of U.S.-made washers only to respond to the duties through competition with imports, their prices rise by at most 3 percent.

Figure 3: Brand-level price effects of the duties: model and Flaaen, Hortaçsu, and Tintelnot (2020)



Notes: Volume-weighted total price effect of the round's duties on each brand's washers (observed prices against prices without the round's duty at the pre-round production locations), in percent, under the three duty wedges, with 95 percent bootstrap intervals. The estimates of Flaaen, Hortaçsu, and Tintelnot (2020) are their brand-specific difference-in-differences estimates for washers eight months after the China antidumping duties and the safeguard (their Table 2, specification with product characteristics), with 95 percent confidence intervals.

While I cannot pin down why the estimated price effects for U.S.-made washers disagree, there are several candidate explanations. First, if price effects differ between different

products and sales of different models are heterogeneous, then the volume-weighted price effects produced by the model can disagree with estimates from a difference-in-differences price analysis. Second, as discussed previously, the U.S. simultaneously introduced tariffs on washer inputs, such as steel, aluminum, and washer parts, which should increase the cost of making washing machines in the United States.

In Section 7, I use replacement duties at the above-quota rate, the rate of the hypothetical safeguard there. They measure the opportunity cost of selling a washer, the duty on the unit that replaces it. Cavallo, Llamas, and Vazquez (2025) find that retail prices responded within days of the 2025 U.S. tariff announcements, before the goods sold could have borne any new duty, which is consistent with retailers pricing on replacement costs.

7 Quantifying the Trade-Policy Channel for Whirlpool

In this section, I quantify the trade-policy channel of Whirlpool's acquisition of Maytag for each of the three petitions Whirlpool filed. The first petition, filed in December 2011, obtained antidumping duties on washers from Korea and Mexico and a countervailing duty on washers from Korea in February 2013. The second, filed in December 2015, added an antidumping order on washers from China in February 2017. The third, filed in May 2017, obtained a global safeguard in February 2018 with an above-quota rate of 50 percent.

Under the assumption of Section 5 that the industry knows in advance which duties a petition would obtain, I simulate the duties each petition delivered as a hypothetical duty in every year from 2005 to 2019: the order rates by origin and manufacturer for the first round, those rates and the China order for the second, and the safeguard on top of the China and Mexico orders for the third.[22] For each year and round, I compare the petitioning premium, its decomposition into the appropriation effect, the relocation gain, and the strategic effect, and the consumer-surplus effect of the duties with and without the merger.

A petition is filed after the year's production and pricing decisions are taken, with the following year in view. I therefore read each petition at the premium of the year after filing: 2012 for the Korea and Mexico round, 2016 for the China round, and 2018 for the safeguard. Rivals keep the production locations of the year of filing, which is what the petitioner observes when it files.

I compare petitioning to the baseline where Whirlpool offshores its production in the absence of petitioning. Without a petition, Whirlpool and, after the merger, Maytag move

[22]The Korea order was revoked one week after the safeguard took effect and is not part of the third round. Products outside the scope of the orders bear none of these duties. Both the petition and the no-petition world carry the ordinary duty and, from September 2019, the Section 301 duty.

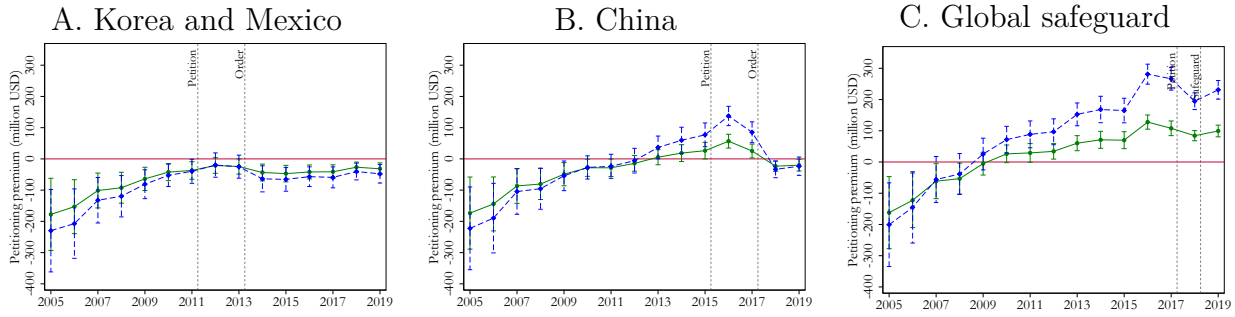
their front-loader production to Mexico, while standalone Maytag produces in the United States. Appendix V reports the status-quo baseline, in which Whirlpool keeps the production locations of the previous year.

Kenmore washers, which Whirlpool and LG make for Sears, are treated as Sears products. Sears sets their prices, and Whirlpool and LG do not account for how their decisions affect Kenmore sales. The appendix also reports the results when Kenmore products are treated as products of their main manufacturer.

Tariff-exclusive costs are recovered under replacement duties at the above-quota rate (Section 6). Some evidence on the 2025 U.S. tariffs suggests that firms first sold inventory imported before the tariffs took effect and priced it without passing the tariffs through (Hacıoğlu-Hoke, Malladi, and Feler, 2026), so Appendix V also reports the results under duties paid, as well as under replacement duties at the in-quota rate.

One caveat applies to the safeguard round. The safeguard was a tariff-rate quota, with the 50 percent rate applying above 1.2 million imported units. In the simulated equilibria with the duty, imports exceed the quota in 2018 and 2019 but fall below it in the earlier years, so the above-quota rate overstates the duty on the marginal unit there.

Figure 4: Domestic merger: petitioning premium by tariff round



Notes: The figure plots Whirlpool's variable profit from the duties of each petition relative to its no-petition alternative, offshoring, by year, without the merger (green, circles) and under the Whirlpool–Maytag merger (blue, diamonds). Panel A applies the Korea and Mexico orders, Panel B those orders and the China order, and Panel C the 50 percent safeguard together with the China and Mexico orders, each as a hypothetical duty in the year shown. Positive values indicate that petitioning is more profitable than offshoring in variable-profit terms. Vertical lines mark the filing of the petition and the order or safeguard. Capped bars are 95 percent confidence intervals from the 200 bootstrap draws.

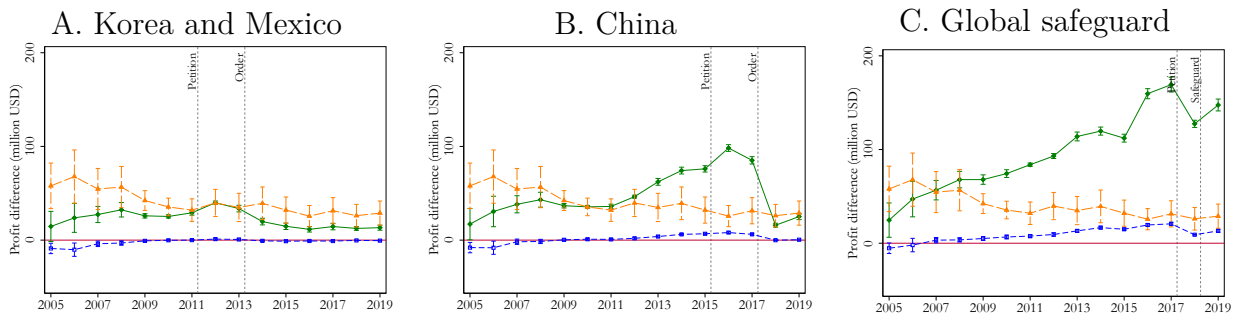
Figure 4 plots the petitioning premium, Whirlpool's variable profit from the duties of each petition relative to offshoring, by year and round, with and without the merger. The premium rises across rounds and, within each round, with the strength of import competition. The Korea and Mexico orders in Panel A never pay for themselves. The premium is negative in every year, with or without the merger. The China round in Panel B has little value to Whirlpool while Chinese production is small and turns positive in 2013, once LG and Samsung have moved production there, peaks at $57 million in 2016 without the merger,

and turns negative in 2018 when production has moved on to Thailand and Vietnam. The safeguard in Panel C is worth petitioning for from 2010 on without the merger and rises to $128 million in 2016.

The merger raises the petitioning premium for the China and safeguard rounds in the year after filing. For the China round the merger raises the premium from $57 to $137 million in 2016, and for the safeguard from $84 to $195 million in 2018. In the two later rounds the merger thus more than doubles what Whirlpool stood to gain from petitioning. For the Korea and Mexico round the merger does not materially change the premium.

While the estimates imply that the first petition may not have been profitable for Whirlpool, the level of profits may be misleading. First, the estimated premium is in variable profits. While filing costs of $1 to 3 million (Section 2) and reshoring the remaining foreign production add fixed costs to petitioning, it can also save the fixed costs of running a foreign plant on top of the U.S. plant. Second, Whirlpool may have anticipated that its Korea and Mexico petitions were only the first step and that later petition rounds would be more profitable, as they reduced the scope for tariff jumping.

Figure 5: Domestic merger: decomposition of the merger's effect on the petitioning premium



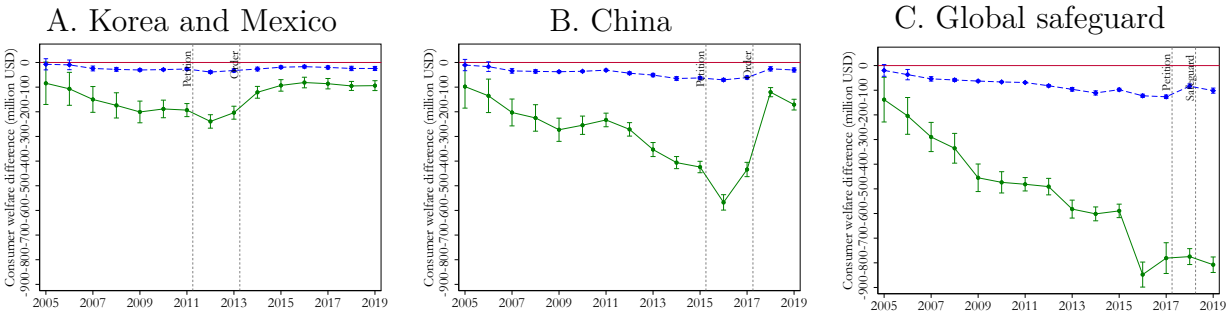
Notes: The figure decomposes the merger-induced change in Whirlpool's petitioning premium into the appropriation effect (green, diamonds), the relocation gain (orange, triangles), and the strategic effect (blue, squares) defined in Section 5. Panel A applies the Korea and Mexico orders, Panel B those orders and the China order, and Panel C the 50 percent safeguard together with the China and Mexico orders, each as a hypothetical duty in the year shown. Vertical lines mark the filing of the petition and the order or safeguard. Capped bars are 95 percent confidence intervals from the 200 bootstrap draws.

Figure 5 decomposes the merger's effect on the premium into the appropriation effect, the relocation gain, and the strategic effect of Section 5. The appropriation effect accounts for most of the merger's effect and grows with the intensity of import competition. It is $40 million in 2012 for the Korea and Mexico orders, $98 million in 2016 for the China round, and $127 million in 2018 for the safeguard. The merger allows Whirlpool to appropriate these rents that otherwise would have accrued to its standalone domestic rival, Maytag.

The relocation gain is the same in every round, since it does not depend on the duties. It is the merged firm's gain from producing Maytag's front-loaders in Mexico rather than in

the United States, between $26 and $68 million a year, and it falls over time as Maytag's front-loader volume shrinks. Because petitioning requires reshoring, the merged firm forgoes this gain by petitioning. The strategic effect, the additional gain from the duties that joint pricing creates, is small. It is close to zero for the Korea and Mexico orders, $8 million for the China round in 2016, and $9 million for the safeguard in 2018, and it is smaller than the relocation gain in every round and year. Joint pricing alone would therefore not have made petitioning much more attractive to the merged firm. The merger mostly raises the return to petitioning because it lets Whirlpool appropriate Maytag's gain from the duties.

Figure 6: Domestic merger: consumer-surplus effect of the duties



Notes: The figure plots the change in consumer surplus from the duties of each petition without the merger (green, circles) and the additional change induced by the Whirlpool–Maytag merger (blue, diamonds), relative to the no-petition alternative in which Whirlpool offshores its front-loader production. Panel A applies the Korea and Mexico orders, Panel B those orders and the China order, and Panel C the 50 percent safeguard together with the China and Mexico orders, each as a hypothetical duty in the year shown. Vertical lines mark the filing of the petition and the order or safeguard. Capped bars are 95 percent confidence intervals from the 200 bootstrap draws.

Figure 6 plots the consumer surplus loss from the duties of each petition without the merger and the additional loss induced by the merger. The loss without the merger grows with the breadth of the duties and with import competition. The Korea and Mexico orders cost consumers $239 million in 2012, the China round $567 million in 2016, and the safeguard $775 million in 2018.[23] Each petition also hurt consumers more because of the merger. The merger-induced loss is $39 million in 2012, $71 million in 2016, and $84 million in 2018, between 11 and 16 percent of the loss without the merger. This merger-induced loss arises because the merged firm raises its prices more in response to the duties and because the resulting higher domestic prices shift more demand toward the tariffed imports.

Taken together, the results show that the merger raised the return to Whirlpool's petitions, as well as the consumer harm from the imposed tariffs in each round. Both effects are largest for the safeguard, which cannot be escaped through tariff jumping. The remaining

[23]The annual loss from the safeguard is of the same order of magnitude as the $841 million annual consumer loss from the actual safeguard estimated by Flaaen, Hortaçsu, and Tintelnot (2020). They use a difference-in-differences design to estimate the price effect of the tariffs and multiply it by annual washer shipments.

Table 8: Petition sequence 2012–2022, present value in 2011

	No merger	Merger	Difference
Panel A: Petitioning premium			
100% success probability	\$146M	\$486M	\$340M
67% success probability	−\$24M	\$67M	\$91M
Panel B: Change in consumer surplus			
100% success probability	−\$3,031M	−\$3,440M	−\$409M
67% success probability	−\$1,360M	−\$1,563M	−\$203M

Notes: Discounted to 2011 at 8%. The first round applies in 2012–2015, the second in 2016–2017, and the third in 2018–2022; 2020–2022 at the values of 2019 with rivals at their 2019 locations. A petition is filed only after the previous one has succeeded; when it fails, the duties in force stay.

questions are whether the merger might have been pivotal to Whirlpool's decision to petition and what the overall consumer surplus effect of the trade-policy channel might have been.

To understand whether the merger may have been pivotal to Whirlpool's decision to petition, I compare the present value of the full sequence of tariff rounds for Whirlpool in 2011 with and without the merger.[24] I use the observed timing of the petitions, assume that Whirlpool's alternative to petitioning is offshoring, and use the previously estimated annual effects of petitions on profits and consumer surplus. I include discounted profit and consumer surplus effects up until 2022, which was the last full year of the safeguard. Since the data ends in 2019, I value 2020–2022 at the values of 2019 and discount to 2011 at 8 percent.[25] Petition success was not certain, even for petitions Whirlpool chose to file, as Whirlpool's unsuccessful petition for AD/CVD on bottom-mount refrigerators in 2011 shows. I therefore consider a scenario in which each petition succeeds with certainty and another scenario where petitions succeed with probability 67 percent, the share of U.S. AD/CVD investigations that resulted in orders (Section 2). A new petition is filed only after the previous one has succeeded. A failed petition leaves the duties already in force in place.

The merger is pivotal for petitioning whenever the net fixed cost of petitioning and reshoring lies between the discounted variable profit effect of petitioning without and with the merger. Table 8 shows that if every petition succeeds, the merger raises the present value of the sequence to Whirlpool from \$146 to \$486 million. While petitioning also raises variable profits without the merger in this case, the merger more than triples the discounted

[24] I choose 2011 because this is when Whirlpool filed its first petition. Discounting to 2006, the year of the merger, scales all values by 0.68.

[25] At discount rates of 5 and 10 percent, the values in Table 8 change but the signs do not.

variable profit gains from petitioning. With a success probability of 67 percent, the petition sequence does not pay in variable profits without the merger (−$24 million) but does with it ($67 million).

If the merger is not pivotal to Whirlpool's decision to petition, the merger adds $203 to $409 million to the expected discounted consumer surplus loss. If the merger is pivotal, the entire loss of $1.6 to $3.4 billion is merger-induced. In reality, the merger may instead have raised Whirlpool's filing probability. While I cannot estimate Whirlpool's filing probability, the estimates in Panel B can be used to compute the expected discounted merger-induced consumer surplus loss for any hypothetical change in filing probabilities. This would be the difference between the filing probability with the merger times the merger column of Panel B and the filing probability without the merger times its no-merger column. For example, an increase in the filing probability induced by the merger from 50 percent to 80 percent and assuming a success probability of 67 percent would result in an expected discounted merger-induced consumer surplus loss through the trade-policy channel of $570 million.

8 Discussion and Policy Implications

The analysis has established that the most common AD/CVD petitioner is a single domestic producer, and that more concentrated domestic production makes single-firm petitions easier, makes petitioning more profitable to the petitioner, and increases the harm from tariffs to downstream industries and consumers. While downstream industries and consumers prefer cheaper imports, even if they are dumped or subsidized, domestic producers in the protected industry and their workers stand to benefit from protection. In smaller markets, a petitioner may recover the fixed cost of petitioning only if domestic production is concentrated, so concentration can increase the ability to obtain protection. In larger markets, where petition costs matter less, a producer in a fragmented domestic industry may prefer to cut its own costs by offshoring, but may prefer to petition once the industry is more concentrated. Higher domestic concentration can therefore increase the incentive for domestic producers to petition and be a precondition for domestic workers to obtain legitimate protection from dumped or subsidized imports.

Whether conditions that facilitate petitioning are desirable is a question on which policymakers may disagree, since some domestic stakeholders may gain from protection, whereas others lose. Competition authorities, however, have a narrower mandate, which is to prevent mergers that substantially lessen competition. Since mergers between domestic producers can lessen competition through the trade-policy channel, I outline how competition authorities could respond within that mandate.

The first question is which mergers warrant attention. The stylized model shows that mergers between domestic producers can strengthen the incentive to petition, whereas cross-border mergers tend to weaken it. In the washer market, the Whirlpool–Maytag merger raises the petitioning premium over offshoring, especially when import competition is strong, which is precisely when merging parties are most likely to argue that they are constrained by imports. Competition authorities should therefore scrutinize the trade-policy channel in mergers between domestic producers that face strong import competition.

Where the trade-policy channel is likely to substantially lessen competition, a natural response would be a behavioral remedy that bars the merged firm from petitioning for AD/CVD. This would be problematic for two reasons. First, it would deny the merged firm, and possibly the domestic industry as a whole, legitimate protection against dumped or subsidized imports and make it more attractive for exporters to dump or seek export subsidies. Second, petitioning the government is protected by the First Amendment, and under the *Noerr–Pennington* doctrine, which derives from that protection, petitioners in the United States are immune from antitrust liability even if the purpose of the petition is anticompetitive. A remedy restricting petitioning may therefore raise constitutional concerns.

A more viable alternative would be to discount import competition as a competitive constraint in merger cases where the trade-policy channel is likely important. The DOJ's 1982 Merger Guidelines state that although "[...] firms located outside the United States may exert an important competitive influence on domestic prices, they may be subject to additional constraints not present in the purely domestic context" and then list changes in exchange rates, tariffs, and political conditions as constraints that may limit foreign firms' ability to respond to domestic price increases (Department of Justice, 1982, Section II.C). The 1984 Merger Guidelines add a subsection on *Special Factors Affecting Foreign Firms*, which explains that quotas and voluntary export restraints can cause actual import sales, shipment data, or capacity to overstate the competitive significance of foreign firms (Department of Justice, 1984, Section 3.23). This shows that discounting import competition in light of the existing trade-policy environment is consistent with past agency practice.

It remains to account for how a merger may change the future tariff environment. One way to do so is to require merging parties that rely on imports as a post-merger constraint to state whether these imports are dumped or subsidized. If the imports constrain the merging parties only as long as they are dumped or subsidized, they should be discounted in the competitive assessment, since the merger makes a successful petition against them more likely. If they are not dumped or subsidized, they can be included in the competitive assessment. These statements could later enter the record of any AD/CVD investigation, for example through a statement of interest by the competition authority. The petitioner

should then explain why imports are dumped or subsidized at the time of the petition but were not at the time of the merger review.

Federal agencies, including the DOJ and the FTC, can submit such statements of interest in AD/CVD cases, but almost never do (U.S. Government Accountability Office, 2022). Under current law, they would also carry little weight, since the USITC may not consider the effects of duties on downstream industries and consumers when determining injury. This restriction is not imposed by the WTO. Canada, the European Union, and New Zealand all apply some form of public-interest test that can lower or eliminate duties when their costs to downstream users and consumers outweigh their benefits (U.S. Government Accountability Office, 2022). Introducing a similar test into U.S. AD/CVD law would give competition authorities' submissions in AD/CVD investigations real weight.

9 Conclusion

This paper studies the relationship between domestic production concentration, the profitability of tariff petitions, and the harm they cause consumers. Since mergers and acquisitions are the point at which competition authorities can act on concentration, I specify a three-stage model in which a competition authority adjudicates an acquisition by a domestic incumbent, the domestic incumbent subsequently chooses among petitioning for tariffs, offshoring, or maintaining the status quo, and firms finally compete in prices. Using this model, I show that mergers between domestic producers can increase the profitability of tariff petitions to the domestic incumbent, as well as the harm from such tariffs to consumers, which I call the trade-policy channel of mergers.

I quantify the trade-policy channel in a case study of the Whirlpool–Maytag merger in the U.S. washer industry, in which competitive constraints from imports were central to the merger clearance decision. I find that the merger increased the profitability of observed post-merger tariff petitions by Whirlpool, as well as the harm from the resulting tariffs to consumers. I also find that the choice between offshoring and petitioning turns on the strength of import competition. When it is weak, Whirlpool prefers to lower its own costs through offshoring. When it is strong, petitioning becomes more profitable than offshoring, and the merger raises this petitioning premium further. Since strong import competition is exactly the circumstance in which imports can be treated as a pivotal competitive constraint in merger clearance, the trade-policy channel warrants scrutiny precisely when the import-competition argument is made.

These findings have implications for policy. At the core sits a conflict of mandates between the competition authority, which aims to prevent mergers that substantially lessen

competition, and the USITC, which cannot consider downstream users and consumers in AD/CVD cases. Given its mandate, the competition authority should consider the trade-policy channel in mergers that substantially increase domestic production concentration in markets with a high import share. In these cases, it could place less weight on import competition as a constraint on the merged entity, especially when these imports are likely to be dumped or subsidized. Introducing a public-interest test into U.S. AD/CVD law would allow the USITC to consider the effects of duties on users and consumers. This would also give the DOJ and FTC a reason to submit statements of interest in AD/CVD investigations that follow a merger.

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Appendix for Online Publication

I Appendix to Section 3

This appendix proves the propositions of Section 3 and develops the two-period extension in which the foreign rival can jump the tariff.

Proof of Proposition 1. Define

$$F(\tau) \;\equiv\; \pi_1^{\text{pet}}(\tau) - L \;-\; \Big(\pi_1^{\text{off}} - R_1\Big).$$

A marginal increase in τ raises only foreign costs $(1+\tau)c_F$. Via best responses, s_j shift toward firm 1 and its markups increase. Envelope and standard logit pass-through yield $\frac{d}{d\tau}\pi_1^{\text{pet}}(\tau) > 0$, and π_1^{off} is τ-invariant, so $F'(\tau) > 0$. By the maintained assumption, $F(0) < 0$ and $F(\hat{\tau}) > 0$. By continuity and the intermediate value theorem, there exists $\tau^* \in (0, \hat{\tau})$ with $F(\tau^*) = 0$. Strict monotonicity gives uniqueness and the "iff" structure.

□

Comparative statics of the indifference cutoff τ^* in the appeal of the foreign product are most transparent in a two-product reduction (firms 1 and 3 only). They are summarized in Section 3 and stated here.

Proposition 6. *In a two-product reduction (eliminate firm 2 and product 2), the comparative static $d\tau^*/d\delta_3$ has no fixed sign: depending on the remaining primitives, the indifference cutoff $\tau^*(\delta_3)$ can rise or fall as the foreign product becomes more attractive.*

As δ_3 rises, the foreign product becomes more appealing and firm 1's profit falls. The rate at which it falls, firm 1's exposure Ψ, is proportional to firm 1's margin $p_1 - c_1$ times its own share s_1 times the rival's share s_3. A better rival costs firm 1 in proportion both to how much business that rival is positioned to capture and to how much firm 1 still has to lose. A weak rival does not threaten firm 1's profits, whereas a dominant rival leaves firm 1 with little to lose. Exposure is therefore highest at intermediate levels of competition and disappears in either limit.[26] The two regimes evaluate exposure at two different points on this curve, since the duty raises the foreign rival's cost and moves it back toward the

[26]This is not true for any demand system. Under CES demand with monopolistic competition (where each firm takes the price index as given), markups are constant and the price of firm 1 does not react to the quality of product 3. In a finite-firm CES oligopoly, markups depend on market shares and some strategic interaction is restored, but it remains weaker than under logit demand.

weak-rival end while leaving firm 1 at the domestic cost. Which regime leaves firm 1 more exposed, and hence the sign of $d\tau^*/d\delta_3$, depends on which side of the peak the two points fall. When the rival is weak under the duty, petitioning insulates firm 1 more than offshoring and a more attractive foreign product lowers τ^*. When the rival remains dominant under the duty, the duty hands firm 1 back a meaningful share and thereby raises its exposure to further improvements in the rival's appeal, so offshoring insulates more and τ^* rises.

The proof signs the comparative static in the limit of a vanishing cost gap $c_D - c_F$ and extends it by continuity to an open set of small gaps. It establishes that both signs arise, not which sign obtains at the cost gap estimated in Section 6.

Proof of Proposition 6. In the two-product reduction (firms 1 and 3 only), let $\pi_1^{\text{pet}}(\tau, \delta_3)$ and $\pi_1^{\text{off}}(\delta_3)$ denote firm 1's variable profits under petitioning and offshoring, respectively. Define

$$F(\tau, \delta_3) \;\equiv\; \pi_1^{\text{pet}}(\tau, \delta_3) - L \;-\; \Big(\pi_1^{\text{off}}(\delta_3) - R_1\Big),$$

and let $\tau^*(\delta_3)$ solve

$$F(\tau^*(\delta_3), \delta_3) = 0.$$

By Proposition 1, for fixed primitives the cutoff $\tau^*(\delta_3)$ is unique and satisfies $F_\tau(\tau^*(\delta_3), \delta_3) > 0$ (since only π_1^{pet} depends on τ, and a higher duty strictly increases its profit). By the implicit function theorem,

$$\frac{d\tau^*}{d\delta_3} = -\frac{F_{\delta_3}}{F_\tau}, \qquad F_\tau > 0,$$

so the sign of $\frac{d\tau^*}{d\delta_3}$ is the sign of $-F_{\delta_3}$.

The exposure function Ψ. Consider a two-product logit duopoly with an outside good and costs (c_1, c_3). Here and in the remaining proofs I use the aggregative-games representation of the logit pricing game (Nocke and Schutz, 2018, 2025): each firm's profit depends on its rivals' prices only through the scalar aggregator $H \equiv 1 + \sum_{j \in \mathcal{J}} \exp(\delta_j - \alpha p_j)$, and the pricing game has a unique equilibrium (Nocke and Schutz, 2025, Proposition 1). Let (p_1, p_3) be this equilibrium. Standard logit algebra gives

$$s_j(p) = \frac{\exp(\delta_j - \alpha p_j)}{1 + \exp(\delta_1 - \alpha p_1) + \exp(\delta_3 - \alpha p_3)}, \qquad \frac{\partial s_1}{\partial \delta_3} = -\,s_1 s_3 \;<\; 0 \quad \text{for fixed prices.}$$

Equilibrium markups satisfy the single-product condition

$$p_j - c_j = \frac{1}{\alpha(1 - s_j)}.$$

Profits are $\pi_1 = (p_1 - c_1)s_1$. Differentiating with respect to δ_3 and using the envelope theorem

$(\partial\pi_1^*/\partial p_1 = 0)$ yields

$$\frac{d\pi_1^*}{d\delta_3} = (p_1 - c_1)\Big(\underbrace{\frac{\partial s_1}{\partial \delta_3}}_{(-)} + \underbrace{\frac{\partial s_1}{\partial p_3}}_{(+)}\underbrace{\frac{dp_3}{d\delta_3}}_{(+)}\Big).$$

The first term (direct share loss) is negative. The second term (strategic price response) is positive, as the rival raises price in response to higher quality ($\partial p_3/\partial\delta_3 > 0$), which softens the market share loss. Solving the two equilibrium pricing conditions for the price response and substituting back gives the closed form

$$\frac{d\pi_1^*}{d\delta_3} = -\Psi, \qquad \Psi \equiv (p_1 - c_1)\, s_1 s_3 \,\frac{1 - s_3}{1 - D}, \qquad D \equiv \frac{(s_1 s_3)^2}{(1 - s_1)(1 - s_3)},$$

which is strictly negative at any interior equilibrium, since $D \le s_1 s_3 \le \frac{1}{4}$ when $s_1 + s_3 < 1$. A stronger foreign product always erodes firm 1's profit; the *exposure* $\Psi > 0$ measures by how much. The equilibrium shares, and hence Ψ, depend on the primitives only through $T_j \equiv \exp(\delta_j - \alpha c_j)$, each firm's *type* (Nocke and Schutz, 2025, Section 2). Write $\Psi(T_1, T_3)$. The two regimes evaluate Ψ at different points. Petitioning keeps firm 1 at the domestic cost and scales the foreign type down by the duty, so with $\varepsilon \equiv \alpha(c_D - c_F) > 0$ and $\Delta \equiv \alpha\tau c_F > 0$,

$$F_{\delta_3} = \frac{d\pi_1^{\text{pet}}}{d\delta_3} - \frac{d\pi_1^{\text{off}}}{d\delta_3} = \Psi\Big(T_1^{\text{off}}, T_3^{\text{off}}\Big) - \Psi\Big(e^{-\varepsilon}\, T_1^{\text{off}},\ e^{-\Delta}\, T_3^{\text{off}}\Big),$$

where $T_j^{\text{off}} \equiv \exp(\delta_j - \alpha c_F)$.

Ψ vanishes at both extremes of T_3. Fix T_1. Combining the share formula with the markup condition, the equilibrium conditions read $s_j H = T_j\, e^{-1/(1-s_j)}$, the *fitting-in relation* of the aggregative framework. As $T_3 \to 0$, $H \ge 1$ gives $s_3 \le T_3/e \to 0$, while $s_1 e^{1/(1-s_1)} \le T_1$ bounds s_1 away from one, so $\Psi \le C(T_1)\, s_3 \to 0$. As $T_3 \to \infty$, write $u \equiv 1 - s_3$ and use the exact identity $1/s_3 = 1 + \Big(1 + T_1 e^{-1/(1-s_1)}\Big)\, e^{1/(1-s_3)}/T_3$, which forces $s_3 \to 1$ (if s_3 were bounded away from one along a sequence, the right-hand side would converge to one). Since $s_1 \le u$, $1 - s_1 \ge s_3$, and $1 - D \ge 1 - s_1 s_3 \ge 1 - u$,

$$\Psi \;\le\; \frac{1}{\alpha}\,\frac{u^2}{(1-u)^2} \;\longrightarrow\; 0.$$

In between, $\Psi(T_1, \cdot)$ is continuous and strictly positive.

Both signs of F_{δ_3} arise. Because $\Psi(T_1, \cdot)$ is strictly positive in the interior and vanishes in both limits, there are pairs $T_3^a < T_3^b$ with $\Psi(T_1, T_3^a) < \Psi(T_1, T_3^b)$ (fix T_3^b and take T_3^a close enough to zero) and pairs with the reverse ranking (fix T_3^a and take T_3^b large enough). Given such a pair, choose the primitives so that the two regimes sit at it: set $\tau = \ln\Big(T_3^b/T_3^a\Big)/(\alpha c_F)$

and $\delta_3 = \ln T_3^b + \alpha c_F$, so that $T_3^{\text{off}} = T_3^b$ and $T_3^{\text{pet}} = T_3^a$. Then

$$F_{\delta_3} \longrightarrow \Psi\big(T_1, T_3^b\big) - \Psi\big(T_1, T_3^a\big) \neq 0 \qquad \text{as } \varepsilon \to 0,$$

and by continuity of the equilibrium in ε, the sign of F_{δ_3} equals the sign of $\Psi(T_1, T_3^b) - \Psi(T_1, T_3^a)$ once the cost gap $c_D - c_F$ is small enough. Since F_{δ_3} is continuous in ε and its limit is bounded away from zero, the sign is preserved on an open set of cost gaps, not merely in the knife-edge limit $c_D \to c_F$. Finally, place the cutoff at the chosen duty. Setting $L - R_1 = \pi_1^{\text{pet}}(\tau) - \pi_1^{\text{off}}$ (with R_1 large enough that both fixed costs are positive) gives $F(\tau, \delta_3) = 0$, and since F is strictly increasing in the duty, $F(0, \delta_3) < 0$, so the maintained assumptions of Proposition 1 hold with $\tau^* = \tau$.

Conclusion. $d\tau^*/d\delta_3 = -F_{\delta_3}/F_\tau$ has no fixed sign with respect to δ_3. When the foreign rival is weak under the duty (the rising part of Ψ), a more attractive foreign product lowers the indifference duty τ^*; when the rival remains strong (the falling part), it raises τ^*. □

Proof of Proposition 2. Rearranging terms shows

$$\Big[(\pi_{\mathcal{M}}^{\text{pet}} - L) - \pi_{\mathcal{M}}^{\text{sq}}\Big] - \Big[(\pi_{1,\mathcal{S}}^{\text{pet}} - L) - \pi_{1,\mathcal{S}}^{\text{sq}}\Big] = \Big(\pi_{2,\mathcal{S}}^{\text{pet}} - \pi_{2,\mathcal{S}}^{\text{sq}}\Big) + \Big[(\pi_{\mathcal{M}}^{\text{pet}} - \pi_{\mathcal{M}}^{\text{sq}}) - (\pi_{1,\mathcal{S}}^{\text{pet}} + \pi_{2,\mathcal{S}}^{\text{pet}} - \pi_{1,\mathcal{S}}^{\text{sq}} - \pi_{2,\mathcal{S}}^{\text{sq}})\Big].$$

Appropriation effect. Standalone firm 2 sets p_2 to maximize π_2, so the envelope theorem eliminates the own-price channel. Two rival-price channels remain:

$$\frac{d\pi_2}{dc_3} = (p_2 - c_2)\left[\frac{\partial s_2}{\partial p_1}\frac{dp_1^*}{dc_3} + \frac{\partial s_2}{\partial p_3}\frac{dp_3^*}{dc_3}\right] = (p_2 - c_2)\cdot \alpha\, s_2\left[s_1\,\frac{dp_1^*}{dc_3} + s_3\,\frac{dp_3^*}{dc_3}\right] > 0.$$

Both terms are positive: $dp_3^*/dc_3 > 0$ by direct cost pass-through, and $dp_1^*/dc_3 > 0$ because prices are strategic complements in the logit Bertrand game (a higher c_3 raises p_3, which raises firm 1's best-response price). The duty raises c_3, so $\pi_{2,\mathcal{S}}^{\text{pet}} - \pi_{2,\mathcal{S}}^{\text{sq}} > 0$.

Strategic effect. I show that the tariff raises the merged firm's profit by strictly more than it raises the sum of standalone profits:

$$\Big(\pi_{\mathcal{M}}^{\text{pet}} - \pi_{\mathcal{M}}^{\text{sq}}\Big) \;>\; \Big(\pi_{1,\mathcal{S}}^{\text{pet}} + \pi_{2,\mathcal{S}}^{\text{pet}} - \pi_{1,\mathcal{S}}^{\text{sq}} - \pi_{2,\mathcal{S}}^{\text{sq}}\Big).$$

I use the aggregative-games framework of Nocke and Schutz (2018, 2025) introduced in the proof of Proposition 6. The uniqueness of equilibrium extends to multiproduct firms (Nocke

and Schutz, 2025, Proposition 1). A multiproduct firm's portfolio is summarized by the sum of its product types, so the merged entity has type $T_{\mathcal{M}} = T_1 + T_2$ (Nocke and Schutz, 2025, Section 2).

The tariff raises c_3 to $(1+\tau)c_F$, lowering T_3 while leaving T_1, T_2, and $T_{\mathcal{M}}$ unchanged. By Proposition 1 of Nocke and Schutz (2025), this strictly lowers the equilibrium aggregator H^* and strictly raises every rival's profit. I show that this profit increase is strictly larger for the merged entity than for the standalone firms combined. To establish this, it suffices to show that $d\pi_{\mathcal{M}}/dc_3 > d(\pi_{1,\mathcal{S}} + \pi_{2,\mathcal{S}})/dc_3$ at every $c_3 \in [c_F, (1+\tau)c_F]$, since integrating over this interval yields the desired level comparison.

Let $S_f \equiv \sum_{j \in \mathcal{J}_f} s_j$ denote firm f's market share. The aggregative structure yields a uniform markup across all products of the same firm. The *ι-markup* (Nocke and Schutz, 2018, eq. 4) on product j is the product of the Lerner index and the perceived demand elasticity under monopolistic competition, which simplifies to:

$$\mu_j \;\equiv\; (p_j - c_j) \cdot \alpha,$$

where α is the marginal utility of income.[27] A key property is that all products of the same firm share a common ι-markup: $\mu_j = \mu_f$ for all $j \in \mathcal{J}_f$, where $\mu_f = 1/(1 - S_f)$ (Nocke and Schutz, 2025, eq. 5). This implies $p_j - c_j = \mu_f/\alpha = 1/[\alpha(1 - S_f)]$ for all $j \in \mathcal{J}_f$, consistent with the Bertrand-logit FOC.

For any firm $f \neq 3$, the tariff enters firm f's problem only through the aggregator H. Its own type T_f does not depend on c_3, and under the aggregative structure its equilibrium profit depends on rivals only through H. Let

$$\Phi \;\equiv\; -\frac{1}{\alpha H^*}\frac{dH^*}{dc_3} \;\geq\; 0$$

denote the common rate at which the tariff erodes the equilibrium aggregator. Then every such firm's equilibrium profit satisfies

$$\frac{d\pi_f}{dc_3} \;=\; g(S_f)\,\Phi, \qquad g(S) \equiv \frac{S}{1 - S + S^2}.$$

To see this, the common ι-markup gives $\pi_f = S_f/[\alpha(1 - S_f)]$, and firm f's share solves the same fitting-in relation as in the proof of Proposition 6, now at the firm level: $S_f H = T_f\, e^{-1/(1-S_f)}$. Differentiating the fitting-in relation at fixed T_f yields $\partial S_f/\partial H = -(1 -$

[27] In the notation of Nocke and Schutz (2025) the logit scale parameter is λ, where $\lambda = \frac{1}{\alpha}$.

$S_f)^2 g(S_f)/H$. Differentiating π_f with respect to H and substituting in $\partial S_f/\partial H$ yields

$$\frac{\partial \pi_f}{\partial H} = \frac{1}{\alpha(1-S_f)^2}\,\frac{\partial S_f}{\partial H} = -\frac{g(S_f)}{\alpha H}.$$

Multiplying this by the equilibrium response dH^*/dc_3 gives $\frac{d\pi_f}{dc_3}$. The entire cross-price feedback is absorbed into the single scalar dH^*/dc_3.

Applying this to the merged entity and to the two standalone domestic firms gives

$$\frac{d\pi_{\mathcal{M}}}{dc_3} = g(S_{\mathcal{M}})\,\Phi^{\mathcal{M}}, \qquad \frac{d(\pi_{1,\mathcal{S}} + \pi_{2,\mathcal{S}})}{dc_3} = \Big[g(s_1) + g(s_2)\Big]\,\Phi^{\mathcal{S}},$$

where $\Phi^{\mathcal{M}}$ and $\Phi^{\mathcal{S}}$ denote this aggregator-erosion rate in the merged and standalone equilibria. The pointwise inequality $d\pi_{\mathcal{M}}/dc_3 > d(\pi_{1,\mathcal{S}} + \pi_{2,\mathcal{S}})/dc_3$ is therefore

$$g(S_{\mathcal{M}})\,\Phi^{\mathcal{M}} \;>\; \Big[g(s_1) + g(s_2)\Big]\,\Phi^{\mathcal{S}}. \tag{A.1}$$

Because the merged firm enters only through its combined type $T_{\mathcal{M}} = T_1 + T_2$, the left-hand side of (A.1) depends on the domestic primitives only through $T_{\mathcal{M}}$. Hold $T_{\mathcal{M}}$ and T_3 fixed and let

$$\Xi(T_1, T_2) \;\equiv\; \Big[g(s_1) + g(s_2)\Big]\,\Phi^{\mathcal{S}}$$

be the standalone gain as the combined type is split between the two domestic firms, $T_1 + T_2 = T_{\mathcal{M}}$. When all of $T_{\mathcal{M}}$ is assigned to one firm, the other exits and the standalone market coincides with the merged market, so $\Xi(T_{\mathcal{M}}, 0) = g(S_{\mathcal{M}})\,\Phi^{\mathcal{M}}$. Proving inequality (A.1) is therefore equivalent to proving $\Xi(T_1, T_2) \;<\; \Xi(T_{\mathcal{M}}, 0)$. The intuition behind why the domestic gain of a tariff is strictly largest under full concentration is that the domestic merger leaves the foreign rival a proportionally larger part of the competitive environment, so weakening it through the tariff benefits the merged firm more.

To compare the effects of the merger on Ξ on a more gradual scale, we can consider shifting a marginal amount of type from the smaller to the larger domestic firm. In the standalone regime each domestic firm sells a single product, so its share s_i obeys the fitting-in relation $s_i H = T_i\, e^{-1/(1-s_i)}$. Taking logs, $\ln s_i + \ln H = \ln T_i - 1/(1-s_i)$, and totally differentiating in its type T_i and the aggregator H,

$$\left(\tfrac{1}{s_i} + \tfrac{1}{(1-s_i)^2}\right) ds_i = d\ln T_i - d\ln H.$$

With $N(s) \equiv s(1-s)^2/(1-s+s^2)$, the bracket equals $1/N(s_i)$, so

$$ds_i = N(s_i)\Big(d\ln T_i - d\ln H\Big). \tag{A.2}$$

$N(s_i)$ is firm i's share response to its own type, holding H fixed.

The aggregator H then moves so that the market clears. With outside share $s_0 = 1/H$, clearing is $s_0 + s_1 + s_2 + s_3 = 1$; differentiating it ($ds_0 = -s_0\, d\ln H$) and substituting (A.2) for a transfer $dT_1 = -dT_2 > 0$ toward the larger firm ($s_1 > s_2$) gives

$$d\ln H = \frac{N(s_1)/T_1 - N(s_2)/T_2}{s_0 + N(s_1) + N(s_2) + N(s_3)}\, dT_1 < 0,$$

where the numerator is negative because $N(s_i)/T_i = \rho(s_i)/H$ with $\rho(s) \equiv N(s)/\varphi(s)$ and $\varphi(s) \equiv s\, e^{1/(1-s)}$, and ρ is strictly decreasing. Writing $d(s) \equiv 1 - s + s^2$, direct differentiation gives $(\ln\varphi)' = 1/N$ and $1 - N'(s) = s(2-s)/d(s)^2$, so $\Big(\ln\rho(s)\Big)' = -\,(2-s)/\Big[d(s)(1-s)^2\Big] < 0$. The aggregator falls for the familiar reason that a merger without efficiencies raises prices. Concentrating production in the larger, higher-markup firm pushes domestic prices up, shifting demand to the foreign product and the outside good.

Normalize the speed of the transfer so that $-\,d\ln H = 1$. Substituting back into (A.2) and clearing, the transfer moves shares by

$$ds_1 = a + N(s_1), \quad ds_2 = -\Big(a + s_0 + N(s_1) + N(s_3)\Big), \quad ds_3 = N(s_3), \quad ds_0 = s_0, \tag{A.3}$$

where, with $\Sigma \equiv s_0 + \sum_j N(s_j)$ and $\rho_i \equiv \rho(s_i)$,

$$a \;\equiv\; \frac{\Sigma\,\rho_1}{\rho_2 - \rho_1} \;>\; 0$$

because ρ is strictly decreasing and $s_1 > s_2$. Differentiating $\Xi = A\,N(s_3)/\Sigma$ with $A \equiv g(s_1) + g(s_2)$ along (A.3) and collecting terms,

$$d\Xi = \frac{N(s_3)}{\Sigma}\Big(a\,K + D_0\Big), \tag{A.4}$$

with

$$\begin{aligned} K &\equiv \Big[g'(s_1) - g'(s_2)\Big] - \frac{A}{\Sigma}\Big[N'(s_1) - N'(s_2)\Big], \\ D_0 &\equiv g'(s_1)N(s_1) - g'(s_2)\Big(s_0 + N(s_1) + N(s_3)\Big) + A\,N'(s_3) \\ &\qquad - \frac{A}{\Sigma}\Big[s_0 + N'(s_3)N(s_3) + N'(s_1)N(s_1) - N'(s_2)\Big(s_0 + N(s_1) + N(s_3)\Big)\Big]. \end{aligned}$$

The same construction applies to the erosion rate itself. Differentiating $\Phi = N(s_3)/\Sigma$ along (A.3),

$$d\Phi = \frac{N(s_3)}{\Sigma^2}\Big(D_0^{\Phi} + a\Big[N'(s_2) - N'(s_1)\Big]\Big),$$

with

$$D_0^{\Phi} \equiv N'(s_3)\Big(s_0 + N(s_1) + N(s_2)\Big) - s_0 - N'(s_1)N(s_1) + N'(s_2)\Big(s_0 + N(s_1) + N(s_3)\Big).$$

Neither D_0 nor D_0^{Φ} has a fixed sign, but the totals do: at every share vector with $0 < s_2 < s_1$ and $s_1 + s_2 + s_3 < 1$,

$$a\,K + D_0 \;>\; 0 \qquad \text{and} \qquad D_0^{\Phi} + a\Big[N'(s_2) - N'(s_1)\Big] \;>\; 0.$$

Both brackets are explicit functions of the share vector alone, and I verify the two inequalities numerically on this entire set.[28] Proposition 4 of Nocke and Whinston (2022) establishes the fixed-equilibrium version of this comparison for CES and logit demand. There, a sum-preserving concentration of rival shares raises the aggregator's responsiveness to a firm's type, holding the equilibrium fixed. The step here additionally tracks the equilibrium adjustment induced by a merger without synergies. Hence $d\Xi > 0$ and $d\Phi > 0$ at every point of the path with $s_1 > s_2$, so Ξ rises as type concentrates and is largest under full concentration. The proof of Proposition 4 uses the same monotonicity of the erosion rate Φ.

Therefore Ξ is maximized under full concentration, (A.1) holds at every c_3, and the strategic component is strictly positive. Combining the two parts,

$$\Big[(\pi_{\mathcal{M}}^{\text{pet}} - L) - \pi_{\mathcal{M}}^{\text{sq}}\Big] - \Big[(\pi_{1,\mathcal{S}}^{\text{pet}} - L) - \pi_{1,\mathcal{S}}^{\text{sq}}\Big] > 0.$$

□

While I rely on logit demand, the result that the merger increases firm 1's gains from tariffs is true under mild assumptions on demand (downward-sloping demand, substitutability across products, and standard regularity conditions). In particular, while the strategic effect is zero under CES demand with monopolistic competition, the appropriation effect, and thus the overall effect, remain positive.

[28] Every admissible primitive vector (qualities, costs, α, the duty, and any cost level c_3 on the integration path above) induces a vector of standalone equilibrium shares, and the two brackets depend on the primitives only through that vector. Checking every admissible share vector therefore covers the model's entire parameter space. I evaluate both brackets on a uniform grid of mesh 0.002 over this set (10,261,124 configurations with $s_1 > s_2$), on a boundary-refined grid with shares as small as 10^{-4}, and at 2×10^7 random draws with a fixed seed and find no violations.

Proof of Proposition 3. Expand and collect terms as in Proposition 2.

Appropriation effect. The same logic as in Proposition 2 applies. Logit demand implies $\partial s_2/\partial p_3 = \alpha s_2 s_3 > 0$, and Bertrand pass-through implies $dp_3/dc_3 > 0$, so a duty on firm 3 strictly raises firm 2's profit pre-merger: $\pi^{\text{pet}}_{2,\mathcal{S}} > \pi^{\text{sq}}_{2,\mathcal{S}}$. Conversely, pre-merger offshoring by firm 1 lowers c_1 to c_F and reduces p_1. Since products are substitutes ($\partial s_2/\partial p_1 > 0$), this cannibalizes firm 2's demand, implying $\pi^{\text{off}}_{2,\mathcal{S}} < \pi^{\text{sq}}_{2,\mathcal{S}}$. Combining these inequalities yields $\pi^{\text{off}}_{2,\mathcal{S}} < \pi^{\text{sq}}_{2,\mathcal{S}} < \pi^{\text{pet}}_{2,\mathcal{S}}$. Hence the appropriation term is strictly positive:

$$\pi^{\text{pet}}_{2,\mathcal{S}} - \pi^{\text{off}}_{2,\mathcal{S}} > 0.$$

Strategic effect. Decompose each ownership structure's petitioning-over-offshoring gain by inserting $\pm\pi^{\text{sq}}$:

$$\pi^{\text{pet}}_f - \pi^{\text{off}}_f = \underbrace{\left(\pi^{\text{pet}}_f - \pi^{\text{sq}}_f\right)}_{\text{tariff gain}} - \underbrace{\left(\pi^{\text{off}}_f - \pi^{\text{sq}}_f\right)}_{\text{offshoring gain}},$$

where f denotes either the merged entity $\mathcal{M}$ or the sum of standalone firms $1,\mathcal{S}$ and $2,\mathcal{S}$. The strategic effect therefore decomposes as:

$$\begin{aligned}
&\left(\pi^{\text{pet}}_{\mathcal{M}} - \pi^{\text{off}}_{\mathcal{M}}\right) - \left(\pi^{\text{pet}}_{1,\mathcal{S}} + \pi^{\text{pet}}_{2,\mathcal{S}} - \pi^{\text{off}}_{1,\mathcal{S}} - \pi^{\text{off}}_{2,\mathcal{S}}\right) \\
&= \underbrace{\left[\left(\pi^{\text{pet}}_{\mathcal{M}} - \pi^{\text{sq}}_{\mathcal{M}}\right) - \left(\pi^{\text{pet}}_{1,\mathcal{S}} + \pi^{\text{pet}}_{2,\mathcal{S}} - \pi^{\text{sq}}_{1,\mathcal{S}} - \pi^{\text{sq}}_{2,\mathcal{S}}\right)\right]}_{\text{Term A: merger's excess tariff gain}} - \underbrace{\left[\left(\pi^{\text{off}}_{\mathcal{M}} - \pi^{\text{sq}}_{\mathcal{M}}\right) - \left(\pi^{\text{off}}_{1,\mathcal{S}} + \pi^{\text{off}}_{2,\mathcal{S}} - \pi^{\text{sq}}_{1,\mathcal{S}} - \pi^{\text{sq}}_{2,\mathcal{S}}\right)\right]}_{\text{Term B: merger's excess offshoring gain}}.
\end{aligned}$$

Inserting $\pm\pi^{\text{off}_1}_{\mathcal{M}}$ splits Term B into the relocation gain and the merger's excess gain from offshoring product 1 alone:

$$\text{Term B} = \underbrace{\left(\pi^{\text{off}}_{\mathcal{M}} - \pi^{\text{off}_1}_{\mathcal{M}}\right)}_{\text{relocation gain}} + \underbrace{\left[\left(\pi^{\text{off}_1}_{\mathcal{M}} - \pi^{\text{sq}}_{\mathcal{M}}\right) - \left(\pi^{\text{off}}_{1,\mathcal{S}} + \pi^{\text{off}}_{2,\mathcal{S}} - \pi^{\text{sq}}_{1,\mathcal{S}} - \pi^{\text{sq}}_{2,\mathcal{S}}\right)\right]}_{\text{Term B}'}.$$

The strategic effect of the proposition is Term A − Term B′, and the relocation gain is the third term of the decomposition.

The relocation gain is strictly positive and does not depend on τ. Both profits are evaluated at $c_3 = c_F$, so τ does not enter. Moving product 2 from c_D to c_F raises the merged entity's type $T_{\mathcal{M}} = T_1 + T_2$ and leaves T_3 unchanged. Differentiating the firm-level fitting-in relation $S_{\mathcal{M}} H = T_{\mathcal{M}}\, e^{-1/(1-S_{\mathcal{M}})}$ as in (A.2) gives $dS_{\mathcal{M}} = N(S_{\mathcal{M}})\,(d\ln T_{\mathcal{M}} - d\ln H)$, and

market clearing with $ds_0 = -s_0\, d\ln H$ gives

$$d\ln H = \frac{N(S_{\mathcal{M}})}{s_0 + N(S_{\mathcal{M}}) + N(s_3)}\, d\ln T_{\mathcal{M}} < d\ln T_{\mathcal{M}}.$$

Hence $S_{\mathcal{M}}$ rises, and with it $\pi_{\mathcal{M}} = S_{\mathcal{M}}/[\alpha(1 - S_{\mathcal{M}})]$.

Term A is strictly positive. By Proposition 2, the tariff raises the merged entity's profit by strictly more than it raises the sum of standalone profits. Term A is exactly the strategic effect from Proposition 2, which is strictly positive.

Sign of the strategic effect. If $c_D = c_F$, offshoring offers no cost advantage, so $\pi_f^{\text{off}} = \pi_f^{\text{sq}}$ for all firms, the relocation gain and Term B′ both vanish, and the strategic effect equals Term A > 0. If $\tau = 0$, the tariff offers no protection, so $\pi_f^{\text{pet}} = \pi_f^{\text{sq}}$ for all firms and Term A $= 0$. The strategic effect then equals $-$Term B′, the merger's joint-pricing gain with product 1 at c_D minus the same gain with product 1 at c_F. This difference has no general sign. In numerical evaluations of the model it is negative for most parameter values, because the stronger firm 1 under offshoring leaves more cannibalization for the merger to internalize, and positive when firms 1 and 3 are strong and firm 2 is weak. So the strategic effect can take either sign.

Monotonicity. Term A is continuous and strictly increasing in τ. Its derivative in τ is proportional to the pointwise inequality established in the proof of Proposition 2, evaluated at $c_3 = (1+\tau)c_F$. Term B′ does not depend on τ, so the strategic effect, Term A $-$ Term B′, is strictly increasing in τ.

Therefore, the appropriation component and the relocation gain are strictly positive, and the strategic component is strictly increasing in τ and can take either sign. □

Proof of Proposition 4. Consumer surplus under logit demand is, up to an additive constant, $CS = \frac{1}{\alpha}\log H^*$ (Small and Rosen, 1981), so the tariff's marginal consumer harm

$$-\frac{dCS}{dc_3} = -\frac{1}{\alpha H^*}\frac{dH^*}{dc_3}$$

is exactly the aggregator-erosion rate Φ from the proof of Proposition 2. As there, the merger raises total harm over $c_3 \in [c_F, (1+\tau)c_F]$ if and only if it raises Φ at each c_3.

The proof of Proposition 2 shows that Φ strictly rises along the type transfer that concentrates the domestic side. Holding $T_{\mathcal{M}} = T_1 + T_2$ and T_3 fixed, $d\Phi > 0$ at every point of the path with $s_1 > s_2$. Thus $\Phi^{\mathcal{S}}$ is largest when all of $T_{\mathcal{M}}$ sits in a single firm, where the

standalone market coincides with the merged one and $\Phi^{\mathcal{S}} = \Phi^{\mathcal{M}}$. Hence

$$\Phi^{\mathcal{M}} \;\geq\; \Phi^{\mathcal{S}} \qquad \text{at every } c_3,$$

with equality only in the degenerate limit $T_1 \to 0$ or $T_2 \to 0$. Integrating over c_3, the merger raises the total consumer harm from the tariff, for any pre-merger foreign share s_3. □

Proof of Proposition 5. Expand the petitioning premia, noting that $\Pi^{\text{pet}}_{\mathcal{X}} = \pi^{\text{pet}}_{\mathcal{X}} - L - R_1$, $\Pi^{\text{sq}}_{\mathcal{X}} = \pi^{\text{sq}}_{\mathcal{X}}$, $\Pi^{\text{pet}}_{1,\mathcal{S}} = \pi^{\text{pet}}_{1,\mathcal{S}} - L$, and $\Pi^{\text{sq}}_{1,\mathcal{S}} = \pi^{\text{sq}}_{1,\mathcal{S}}$:

$$\Delta^{\text{pet}}_{1,\mathcal{X}} - \Delta^{\text{pet}}_{1,\mathcal{S}} = \left(\pi^{\text{pet}}_{\mathcal{X}} - \pi^{\text{sq}}_{\mathcal{X}}\right) - \left(\pi^{\text{pet}}_{1,\mathcal{S}} - \pi^{\text{sq}}_{1,\mathcal{S}}\right) - R_1.$$

Add and subtract $(\pi^{\text{pet}}_{4,\mathcal{S}} - \pi^{\text{sq}}_{4,\mathcal{S}})$ and $\pi^{\text{dom}}_{\mathcal{X}}$:

$$\begin{aligned}\Delta^{\text{pet}}_{1,\mathcal{X}} - \Delta^{\text{pet}}_{1,\mathcal{S}} = {} & \left(\pi^{\text{pet}}_{4,\mathcal{S}} - \pi^{\text{sq}}_{4,\mathcal{S}}\right) \\ & + \left[(\pi^{\text{pet}}_{\mathcal{X}} - \pi^{\text{dom}}_{\mathcal{X}}) - (\pi^{\text{pet}}_{1,\mathcal{S}} + \pi^{\text{pet}}_{4,\mathcal{S}} - \pi^{\text{sq}}_{1,\mathcal{S}} - \pi^{\text{sq}}_{4,\mathcal{S}})\right] - \left(\pi^{\text{sq}}_{\mathcal{X}} - \pi^{\text{dom}}_{\mathcal{X}}\right) - R_1.\end{aligned}$$

Appropriation effect (< 0). The tariff raises the costs of all foreign-produced units. Standalone firm 4 faces cost $(1+\tau)c_F$ under petitioning versus c_F under status quo. In the logit model, a single-product firm's equilibrium profit is $\pi_j = s_j/[\alpha(1-s_j)]$, which is strictly increasing in its market share s_j. The tariff raises firm 4's price, shifting demand toward domestic firms (1 and 2) and the outside good, strictly reducing s_4.

More precisely, the tariff raises the costs of both foreign firms (3 and 4) symmetrically, leaving their competitive position relative to each other unchanged but weakening both relative to domestic firms 1 and 2. The aggregate foreign share falls, and firm 4's profit strictly declines: $\pi^{\text{pet}}_{4,\mathcal{S}} < \pi^{\text{sq}}_{4,\mathcal{S}}$.

Relocation loss (> 0, independent of τ). Both profits are evaluated at $c_3 = c_F$, so τ does not enter. Relocating product 4 from c_F to c_D lowers the merged entity's type $T_{\mathcal{X}}$ and leaves the types of firms 2 and 3 unchanged, which lowers its equilibrium profit (Nocke and Schutz, 2025, Proposition 1); the own-type comparative static in the proof of Proposition 3 gives the same conclusion with the direction of the move reversed. Hence $\pi^{\text{sq}}_{\mathcal{X}} - \pi^{\text{dom}}_{\mathcal{X}} > 0$.

Relocation cost ($-R_1 < 0$). Immediate from $R_1 > 0$.

Strategic effect (no fixed sign). Adding and subtracting firm 4's standalone profits

writes the strategic effect as

$$\left(\pi^{\text{sq}}_{4,\mathcal{S}} - \pi^{\text{pet}}_{4,\mathcal{S}}\right) + \left[\left(\pi^{\text{pet}}_{\mathcal{X}} - \pi^{\text{dom}}_{\mathcal{X}}\right) - \left(\pi^{\text{pet}}_{1,\mathcal{S}} - \pi^{\text{sq}}_{1,\mathcal{S}}\right)\right] :$$

the duty that standalone firm 4 pays and the merged entity's domestic product 4 escapes, plus the difference between the merged entity's gain from the tariff, which under the merger falls on firm 3 alone, and firm 1's standalone gain from the tariff on firms 3 and 4. The first term is strictly positive by the appropriation step. The bracket has no fixed sign, and at $\tau = 0$ every term vanishes. Both signs arise.

For the positive sign, let the target dominate the market. Fix $\tau > 0$. By continuity of the equilibrium in types, it suffices to sign the limit market in which firms 2 and 3 are negligible ($\delta_2, \delta_3 \to -\infty$), so that only firm 1 (at c_D) and product 4 compete, and to let $\delta_4 \to \infty$. Firm 1's profit terms vanish in this limit, since its share vanishes in every configuration, and so does the merged entity's gain from the tariff, since product 4 is at c_D in both of its profits and the tariff falls on the negligible firm 3 alone. For standalone firm 4, write the profit difference as an integral of the own-cost derivative. By the aggregative apparatus from the proof of Proposition 2, a firm's equilibrium profit responds to its own type by $d\pi_f/d\ln T_f = g(S_f)\big[1 - N(S_f)/\Sigma\big]/\alpha$, while $d\ln T_4/dc_4 = -\alpha$. As $\delta_4 \to \infty$, the own-cost integrand $-d\pi_4/dc_4 = g(S_4)\big[1 - N(S_4)/\Sigma\big]$ converges to one uniformly over the cost range $[c_F, (1+\tau)c_F]$, because $S_4 \to 1$ and $N(S_4)/\Sigma \to 0$.[29] Hence $\pi^{\text{sq}}_{4,\mathcal{S}} - \pi^{\text{pet}}_{4,\mathcal{S}} \to \tau c_F$, and the strategic effect converges to $\tau c_F > 0$: when the target dominates, the escaped duty is the whole of the strategic effect.

For the negative sign, let firm 1 dominate the market and the target be small, with firm 3 negligible. The merged entity's gain from the tariff is then negligible, and the strategic effect reduces to firm 4's duty burden minus firm 1's standalone gain from the duty on product 4. A dominant firm 1 gains more from a duty on a small rival than that rival loses, so the strategic effect is negative. This step is numerical.[30]

Therefore the appropriation effect is strictly negative, the relocation loss and the relocation cost are strictly positive and independent of τ, and the strategic effect can take either sign. □

[29] S_4 is decreasing in product 4's cost, so uniform convergence over the compact cost range follows from pointwise convergence at the highest cost. For the second claim, $N(S) \le \frac{4}{3}(1-S)^2$ since $d(S) \ge \frac{3}{4}$, while $\Sigma \ge s_0 \ge (1 - S_4)/(1 + T_1/e)$, where $T_1 \equiv \exp(\delta_1 - \alpha c_D)$: every rival share satisfies $s_j/s_0 = T_j\, e^{-1/(1-s_j)} \le T_j/e$.

[30] With $\alpha = 1$, $c_D = 1$, $c_F = 0.5$, $\delta_1 = 6$, $\delta_4 = 1$ and $\delta_2, \delta_3 \to -\infty$, the strategic effect is -0.036 at $\tau = 0.5$ and -0.117 at $\tau = 2$; with all four firms present, $\delta = (5, 0, 0, 0)$ and $\tau = 0.5$, it is -0.008. Over 4,000 random draws with $\delta_j \sim U(-3, 6)$, $\tau \sim U(0.05, 2)$, $c_F \sim U(0.3, 0.99)$, $c_D = 1$ and $\alpha = 1$, the strategic effect is negative in 535 draws, the relocation loss is positive and the appropriation effect negative in every draw, and the decomposition holds to 10^{-9}. The script is in the replication package.

When the baseline is offshoring instead of status quo, the same decomposition applies with π^{off} in place of π^{sq} and, in place of $\pi_{\mathcal{X}}^{\text{dom}}$, the merged entity's variable profit $\pi_{\mathcal{X}}^{\text{off}_1}$ when it offshores product 1 and produces product 4 at D:

$$\Delta_{1,\mathcal{X}}^{\text{pet}} - \Delta_{1,\mathcal{S}}^{\text{pet}} = \left(\pi_{4,\mathcal{S}}^{\text{pet}} - \pi_{4,\mathcal{S}}^{\text{off}}\right) + \left[(\pi_{\mathcal{X}}^{\text{pet}} - \pi_{\mathcal{X}}^{\text{off}_1}) - (\pi_{1,\mathcal{S}}^{\text{pet}} + \pi_{4,\mathcal{S}}^{\text{pet}} - \pi_{1,\mathcal{S}}^{\text{off}} - \pi_{4,\mathcal{S}}^{\text{off}})\right] - \left(\pi_{\mathcal{X}}^{\text{off}} - \pi_{\mathcal{X}}^{\text{off}_1}\right) - R_1.$$

The appropriation term is ambiguous in sign: when τ is small, firm 4 may prefer the petitioning world (firm 1 remains a weak competitor at c_D); when τ is large, the direct cost penalty on firm 4 dominates. The relocation loss is strictly positive by the argument above, since only product 4 moves and the types of firms 2 and 3 are unchanged, and it does not depend on τ. The strategic effect is ambiguous in sign, and the relocation cost R_1 is still strictly positive. By contrast, in the domestic merger (Proposition 3), the appropriation effect is strictly positive.

I.A Foreign-Rival Response in a Two-Period Model

To assess the robustness of these results, I consider a two-period extension in which firm 3 can respond to the tariff by relocating production to the domestic market. Firm 1 maximizes the discounted sum of profits $\Pi_1 = \Pi_1^{t=1} + \beta\Pi_1^{t=2}$, where $\beta \in [0, 1]$.

In the first period, marginal costs are determined as in the static model. In the second period, if a tariff is in place, firm 3 may choose to pay a fixed cost R_3 to relocate. A necessary condition for firm 3 to relocate to D is that the tariff is high enough that $c_D < (1 + \tau)c_F$. I focus on the case where R_3 is small enough that tariff jumping is firm 3's best response.[31]

Tariff jumping strictly reduces the incentive to petition relative to offshoring: it erodes the future rents from protection while leaving the offshoring payoff unchanged. However, petitioning can remain optimal even with perfect patience ($\beta = 1$) and certainty of tariff jumping in $t = 2$, provided the short-run windfall from the tariff is sufficiently large. The appropriation and strategic effects from Propositions 2 and 3 operate in full during the period of tariff protection.

In the second period, the comparison across merger regimes is more complex: tariff jumping equalizes the foreign rival's costs, but the merger also changes the offshoring counterfactual by enabling relocation of product 2 and alters equilibrium pricing through

[31] MNEs that already have a global network of plants may choose trade re-routing instead of opening a new plant somewhere. This simply scales down the fixed cost R_3 and the same economic intuition goes through.

joint ownership. The net second-period effect is parameter-dependent, but the first-period mechanism through which the merger increases the incentive to petition remains intact.

II Appendix to Section 4: Data

This appendix describes the construction of the data set used in Sections 5 to 7.

II.A Household Survey Data: TraQline and OpenBrand

This section describes how the survey responses are aggregated into products and how household incomes are constructed.

Product data. As in Montag (2026), a product is the combination of retailer, brand, and washer type (front-loader, top-loader with an agitator, or high-efficiency top-loader without an agitator), and a market is the U.S. in a calendar year. Retailers are Best Buy, H.H. Gregg, Home Depot, Lowe's, Sears, and all others. Each brand has one owner per year.[32] Buyers who do not report the loading type (about 2 percent) are not used. A product's volume is the sum of the quantities its buyers report, its price is sales value divided by volume in 2012 dollars, and its characteristics and demographics are averages over the buyers who answered the respective question. The characteristics module is asked of about one fifth of buyers. The second-choice brand is the first other brand a buyer reports having considered. Before 2011 the survey does not ask whether a top-loader has an agitator. Before 2011, I therefore classify top-loaders with a nominal price of at least \$850 as high-efficiency models and the others as agitator models. For 2016–2019 the washer type of each buyer is imputed (Appendix II.B), and the aggregation weights each buyer by the probability of each type.

Sample. The survey yields 2,939 products in 2005–2015 and between 349 and 363 products a year in 2016–2019. Many are based on one or two buyers, and some lack brand information. I exclude products labeled "Other Brands" or "Store Brand/Generic," products with a share of inside volume below 0.01 percent, products priced above \$4,000, front-loaders priced below \$130, and products without income information. This leaves 1,984 products in 2005–2015, which represent between 97.3 and 99.0 percent of the washer sales volume in the survey. The estimation sample further keeps only products with at least one buyer in the characteristics module (in 2016–2019, a probability of at least one half of having such a buyer), because the prices of products with one to three buyers are unreliable. This leaves 1,590 products

[32] The acquirer owns the target's brands for the whole calendar year in which the acquisition closes: the Maytag brands belong to Whirlpool from 2006 and GE and Hotpoint to Haier from 2016. Magic Chef washers belong to MC Appliance from 2011, and Kenmore belongs to Sears throughout.

Table A.1: Washer products and estimation samples by year

	Products			Volume share	Front-loader share
Year	Survey	After filters	Estimation sample	(%)	(%)
2005	208	152	106	97.6	28
2006	224	156	120	97.9	33
2007	242	160	128	97.4	36
2008	257	184	147	97.6	40
2009	242	172	134	98.0	44
2010	254	173	149	98.0	43
2011	279	186	152	97.4	37
2012	301	206	165	97.2	31
2013	313	198	160	96.9	28
2014	312	201	162	96.9	29
2015	307	196	167	96.7	26
2016	362	189	161	96.4	27
2017	362	177	150	96.3	28
2018	363	176	145	95.2	28
2019	349	176	151	94.8	29

Notes: Products are combinations of retailer, brand, and washer type in the TraQline (2005–2015) and OpenBrand (2016–2019) data; washer types in 2016–2019 are imputed (Appendix II.B). The filters exclude products labeled Other Brands or Store Brand/Generic, products with a share of inside volume below 0.01 percent, prices above $4,000, front-loaders priced below $130, and products without income information. The estimation sample keeps products with at least one buyer in the characteristics module. Volume share is the estimation sample's share of the sales volume of all survey products. The front-loader share is weighted by volume.

in 2005–2015, between 96.7 and 98.0 percent of volume, and 607 products in 2016–2019. Table A.1 reports the counts by year.

Household income. The CPS data include exact household incomes, whereas the survey only reports income ranges. To estimate the relationship between price sensitivity and household income with a single parameter, I assign exact income values to each buyer based on the empirical income distribution and the reported ranges, proceeding as follows:

1. Compute midpoints of the nonoverlapping income ranges reported for each buyer.
2. For each year, fit a log-normal distribution to the set of midpoint values.
3. Draw 1,000,000 random incomes from this fitted log-normal distribution.
4. Allocate each drawn income to the corresponding reported income bucket.
5. For each buyer, randomly draw (with replacement) an income value from the set of incomes matching the buyer's income bucket.

The CPS households are 1,000 householders drawn at random from the Annual Social and Economic Supplement of each year, with household income in 2012 dollars; each bootstrap draw redraws them.

II.B Washer-Type Imputation for 2016–2019

This section describes how washer types are assigned to the 2016–2019 buyers, how the types a brand offered restrict the assignment, and how the method is validated.

Classifier. The 2016–2019 data do not report the washer type. I classify each buyer with a two-step gradient-boosting model trained on the 2011–2015 buyers, the years in which the survey asks whether a top-loader has an agitator. The first step predicts front-loader versus top-loader, the second agitator versus high-efficiency among top-loaders. The features are the price paid (in levels and relative to the brand-year and market medians), brand, retailer, quarter, exterior color, whether a dryer was bought with the washer and its price, the other brands considered, and the buyer's demographics. Each buyer receives a probability for each type. Point estimates use these probabilities as weights when buyers are aggregated into products (Appendix II.A). Each bootstrap draw assigns each buyer one type drawn from them.

Types offered by brand. Each step of the classifier is estimated and applied only to buyers of brands that offered both options in that year. Where a brand offered only one, the type is fixed. For 2011–2015 a brand offered a type in a year if at least one of its buyers reports it. For 2016–2019 the types offered are the brand's types in 2015, plus types with positive evidence for the year, minus types ruled out by a complete archived lineup without them. The evidence is a hand-collected record of 1,017 brand-year-type cells for 2011–2019 from archived Home Depot and Sears listings, brand lineup pages, ENERGY STAR lists, and the February 2019 retailer catalogs in the replication package of Flaaen, Hortaçsu, and Tintelnot (2020), with 192 top-loader models classified as agitator or impeller models. It confirms 284 cells and rules out 75; the rest are unclear. The record was collected without reference to the survey's type shares. Brand-years with no information remain unrestricted and account for 0.2 to 0.5 percent of volume. In 2016–2019 this rules out agitator top-loaders for LG and any top-loaders for the European brands.

Validation. I test the method on the years with observed types using rolling origins. The model is trained on 2011 through year t, the types of $t+1$ to 2015 are imputed, and the imputed products are compared with the observed ones at horizons of one to four years. The types offered in a test year are the origin year's observed types plus evidence minus ruled-out types, as in 2016–2019 with the types of 2015. Table A.2 reports, averaged over

Table A.2: Forward validation of the washer-type imputation

	Years ahead			
	1	2	3	4
Maximum type-share error (pp)	3.0	4.6	8.0	11.5
Brand-type cells within 2 SE (share)	0.68	0.58	0.54	0.39
Product price error (MAPE, %)	3.7	4.8	5.6	5.8
Front-loader price bias (%)	-1.7	-4.0	-6.8	-7.9
Spurious and missing products (% of volume)	0.7	0.8	0.7	1.0
Observed type ruled out (% of volume)	0.1	0.1	0.2	0.3

Notes: Rolling-origin test on the 2011–2015 TraQline buyers: the classifier is trained on 2011 through year t ($t = 2011, \ldots, 2014$), the types of $t + 1$ to 2015 are imputed, and the imputed and observed products are compared; each entry averages over the origin-year pairs at the horizon (four pairs at one year ahead, one at four). The types offered in a test year are the origin year's observed types plus positive evidence minus ruled-out types, as in 2016–2019 with the types of 2015. Maximum type-share error: largest absolute error in the yearly shares of the three washer types. Cells within 2 SE: share of brand-type cells whose imputed market share is within two standard errors of the observed one. Product price error: mean absolute percentage error of product prices. Front-loader price bias: mean percentage deviation of imputed from observed front-loader prices. Spurious and missing products: volume of imputed products without an observed counterpart and of observed products without an imputed one. Observed type ruled out: volume of buyers whose observed type is not among the types offered.

origins, the maximum error in the yearly type shares, the share of brand-type market-share cells within two standard errors of their observed value, the mean absolute percentage error of product prices, the bias of front-loader prices, and the volume of spurious and missing products. Type shares are within 3 percentage points one year ahead and within 11.5 points four years ahead. Front-loader prices are biased downward, by 1.7 percent one year ahead and 7.9 percent four years ahead, because cheaper top-loaders are imputed as front-loaders. Relative to the classifier without it, the restriction to offered types removes a third to a half of the spurious and missing product volume (1.0 to 1.9 percent without the restriction) and rules out the observed type for 0.1 to 0.3 percent of volume. Two consequences follow. First, imputing the types of 2014–2015 and re-estimating demand on 2005–2015 moves the IV logit price coefficient from -0.463 to -0.666 and the first-stage F-statistic from 22.3 to 12.8. I therefore estimate demand on 2005–2015 only. Second, with demand held fixed, origin cost effects estimated with imputed 2014–2015 types move by at most 0.02, but relocation effects estimated with washer-type controls are attenuated toward zero by 0.8 to 1.2 standard errors, so the location cost gaps estimated on the 2016–2019 data are conservative.

Deployment. The front-loader share of sales is 26.6 percent in 2015, the last year with observed types, and 27.1, 27.9, 27.7, and 29.2 percent in 2016 to 2019. The type mix of the large brands is stable across the two periods, except that Frigidaire's front-loader share

Table A.3: Front-loader shares of Samsung and LG: survey and imports

	2015 (observed)	2016	2017 (imputed)	2018	2019
Survey					
Samsung	41.7	37.1	37.9	40.3	45.8
LG	50.3	52.0	48.5	46.5	48.5
Samsung and LG	45.9	43.8	42.6	43.1	47.0
Samsung, LG, and Kenmore front-loaders	51.3	47.8	46.1	46.1	49.2
Imports	48.1	52.8	44.8	51.6	52.9
Difference (pp)	3.2	-4.9	1.4	-5.5	-3.7

Notes: Front-loader share of sales volume in percent. Survey: observed washer types in 2015 and imputed types in 2016–2019; the last survey row adds the Kenmore front-loaders made by LG. Imports: front-loader share of U.S. imports from Korea, Thailand, and Vietnam by HTS loading type and of LG's and Samsung's imports from China (Appendix II.C), with their U.S. production in 2018–2019 assigned the type mix of imports. Difference: survey including Kenmore minus imports, in percentage points.

rises from 51 to 63 percent. Samsung and LG are the brands the classifier separates worst, because their front-loaders and high-efficiency top-loaders sell at similar prices. Table A.3 compares their imputed front-loader share with the front-loader share of U.S. imports from Korea, China, Thailand, and Vietnam, which are mostly their washers. The imports include the Kenmore front-loaders made by LG, so the survey figure adds them. In 2015, where types are observed, the survey share is 3.2 percentage points above the import share. In 2016–2019 it is within 1.4 points in 2017 and 3.7 points in 2019, and about 5 points below in 2016 and 2018. I do not adjust the imputed shares to the import shares.

II.C Production Locations and Plant-Location Weights, 2005–2019

This section describes the production locations assigned to each product and their validation against U.S. imports.

Plant locations. For each owner, brand, washer type, and year, I record the share of the product's volume made in the U.S., Germany, Mexico, China, Korea, Thailand, Vietnam, or elsewhere. For Whirlpool and the Maytag brands, the locations come from the court record of the front-loader litigation, which lists the plant of each platform and model, and from the USITC record of the Korea and Mexico case, which dates the end of German and Mexican supply in 2012. For GE, the USITC record and GE's product pages place front-loaders in China in 2006–2012, in Louisville from 2013 to mid-2018, and in China again thereafter, and top-loaders in Louisville, except for the high-efficiency top-loaders imported from Korea in 2010–2011. Electrolux's annual reports and the USITC record date the phase-out of Webster

City, Iowa, in 2008–2011 and the move to Juárez, Mexico. For LG and Samsung, locations before 2012 come from the USITC record. From 2012 I split each firm's shipments by origin according to its bill-of-lading imports in Figure 2 of Flaaen, Hortaçsu, and Tintelnot (2020), with U.S. production from 2018 at the firms' announced plant openings and ramp-up. Kenmore washers are assigned the locations of their manufacturer: Whirlpool for top-loaders, and Whirlpool until 2008 and LG from 2009 for front-loaders. The smaller owners are located from company sources. Where a relocation is dated within a year, the year's shares are split by the date. Otherwise the new location applies from the following year. Products of brands for which no source exists have no location and account for at most 0.7 percent of volume in any year.

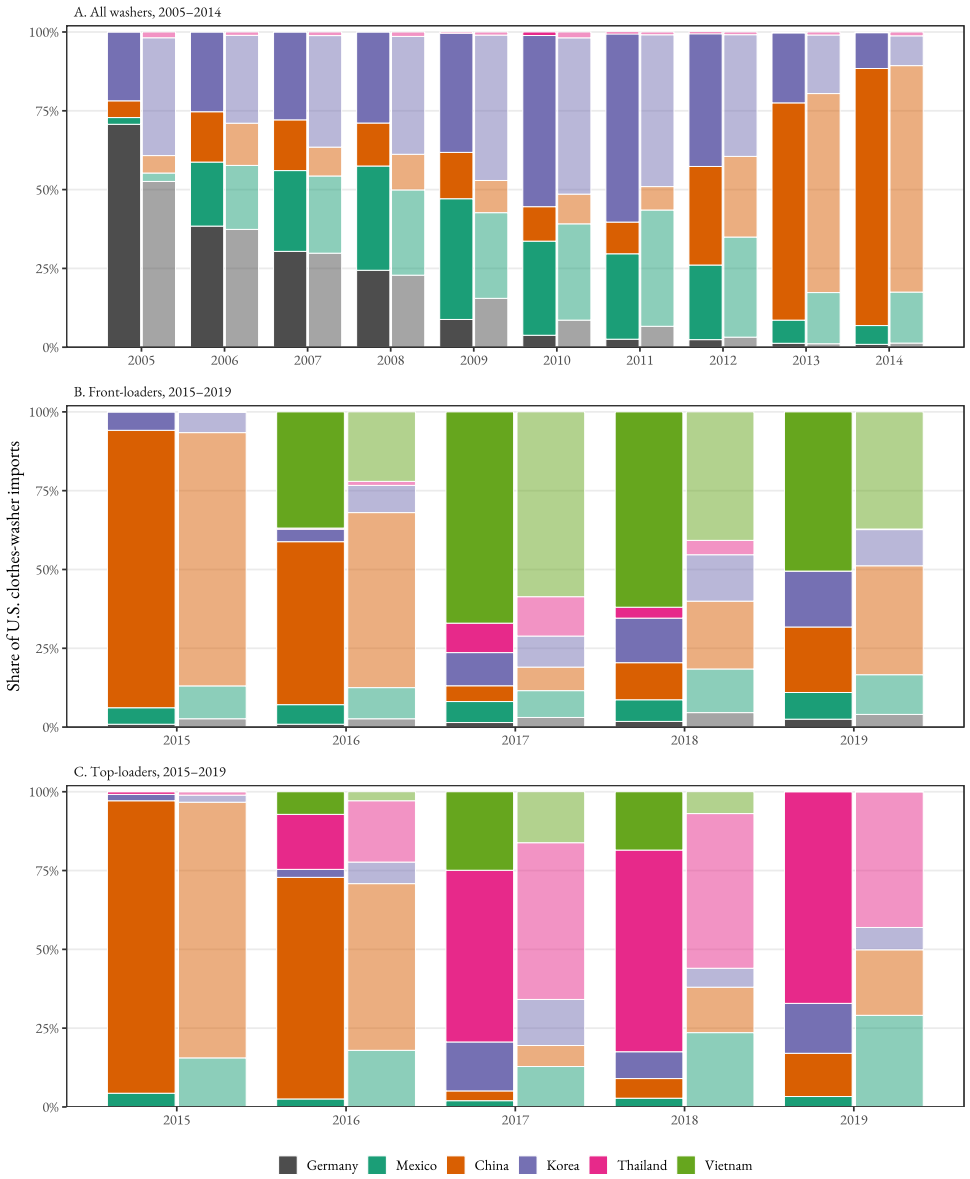
Validation against imports. Multiplying each product's volume by its origin shares and summing over products gives the imports by origin implied by the weights. Figure A.1 compares their origin mix with that of U.S. general imports of washers from the U.S. International Trade Commission. The mean absolute error in origin shares is 4.3 percentage points pooled over 2005–2014, against 7.2 points under the locations of Montag (2026); 2.6 and 3.9 points for front- and top-loaders in 2015; and between 3 and 11 points by type in 2016–2019, against 11 to 29 points if the 2015 locations were carried forward.

II.D Import Duties

This section describes the duty rates on imported washers by origin, manufacturer, and month.

Antidumping and countervailing duties. Whirlpool's petitions led to the imposition of four AD/CVD orders on large residential washers. These were antidumping and countervailing duties on Korea and antidumping duties on Mexico, with preliminary deposits from June and August 2012 and orders from February 2013, and antidumping duties on China, with preliminary deposits from July 2016 and an order from February 2017. The Korea orders were revoked in February 2018. Table A.4 lists the duty each manufacturer paid on entries in each period. The duty paid is the rate finally assessed in the administrative review of the period. Where no review was requested or the review was rescinded, entries were assessed at the cash deposit. Entries between the preliminary and the final determination bear the lower of the deposit and the final rate. Where a review assessed a higher rate on the basis of adverse facts available, which penalizes conduct in the review rather than pricing in the period, I keep the deposit. Manufacturers without their own rate bear the all-others rate, and Kenmore washers bear the rate of the manufacturer. Provisional deposits usually expire after four months. Imports that enter between their expiry but before the final order bear

Figure A.1: Origin shares of U.S. washer imports: implied by the plant-location weights and actual



Notes: For each year, the left bar is the origin mix of imports implied by the plant-location weights and the right bar the origin mix of U.S. general imports of washers in units. Panel A pools front- and top-loaders, since the HTS line for washers above 10 kg does not separate them before 2015. Panels B and C use the loading-type lines from 2015. Imports from other origins (at most 5 percent of units) are excluded.

no duty. The orders exclude top-loaders with a capacity below 3.7 cubic feet. Haier-brand and Magic Chef washers, which are compact or portable, are treated as outside their scope.

For the exporters that were reviewed, the duty ultimately paid is not the rate by which the orders raised their import prices. Deposits above the duty assessed in the review are refunded with interest, and each review result becomes the deposit rate for later entries. LG deposited 13.02 percent on its Korean washers under the order and was assessed 1.38, 1.62, 0, 0.64, and 0 percent in the five periods of review. Electrolux deposited 36.52 percent on its Mexican washers and was assessed between 2.06 and 6.22 percent. The wedge of Section 5 therefore carries the order margin for LG's Korean washers from 3 August 2012 to the revocation on 14 February 2018 and for Electrolux's Mexican washers from 3 August 2012 onward, and the duty paid for every other manufacturer, for which the deposit was the final duty.

Other duties. The ordinary duty, the safeguard duties of 2018–2019, and the Section 301 duty on Chinese washers from September 2019 are measured as the duties collected at entry in percent of customs value, by origin and month, from the U.S. International Trade Commission's data on imports for consumption. The collected duties contain no antidumping or countervailing deposits. In months without entries from an origin, the rate collected on the origin's entries over the calendar year applies.

Duties by manufacturer and month. Antidumping and countervailing rates differ by manufacturer, so the imports of an origin are split by manufacturer. For Korea in 2012–2018 and China in 2016–2017, LG's and Samsung's monthly imports are the origin's general imports multiplied by their shares of the two firms' combined shipments in Figure 2 of Flaaen, Hortaçsu, and Tintelnot (2020), and the other manufacturers take the remainder. Figure A.2 shows the resulting duty rate by origin, manufacturer, and month. Annual rates are the import-weighted means of the monthly rates. Section 5 combines these rates with the production locations of Appendix II.C into the duty each product bears.

III Appendix to Section 5: Model and Estimation Details

III.A Demand Estimation Details

This section gives the moment conditions and the computational steps behind the demand estimates of Section 5.

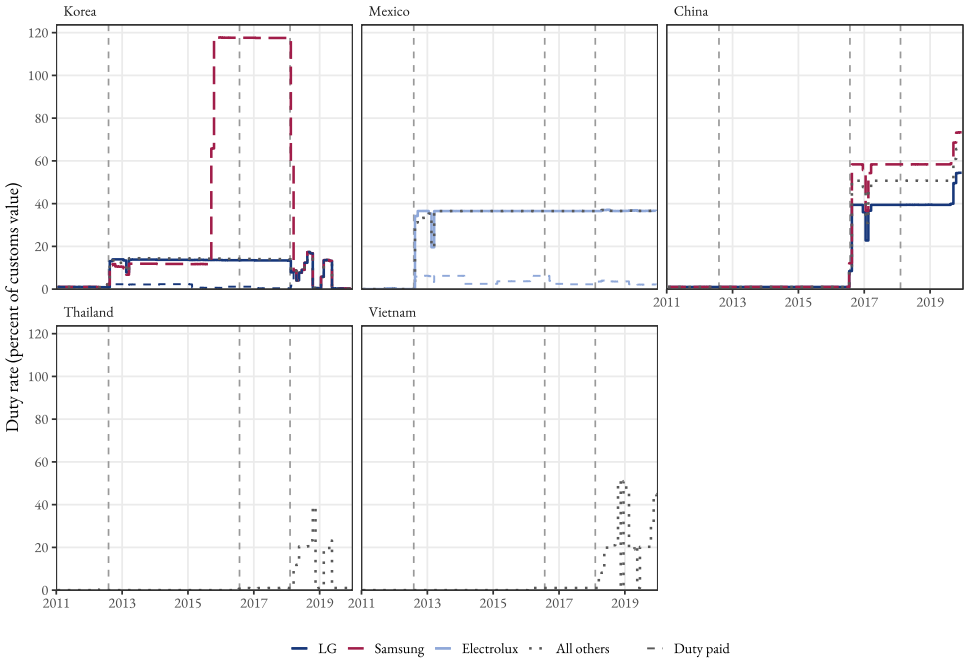
Estimation steps. Following Berry, Levinsohn, and Pakes (2004), I first estimate the nonlinear parameters $\theta_2 = (\sigma^{\mathrm{FL}}, \alpha, \kappa_\alpha)$ together with the mean utilities δ_{jt}, and then recover

Table A.4: Antidumping and countervailing duties paid on large residential washers

Manufacturer	Period	Rate (%)	Wedge (%)	Basis
Korea, antidumping				
LG	3 Aug 2012–31 Jan 2014	1.38	13.02	review result
	1 Feb 2014–31 Jan 2015	1.62	13.02	review result
	1 Feb 2015–31 Jan 2016	0.00	13.02	review result
	1 Feb 2016–31 Jan 2017	0.64	13.02	review result
	1 Feb 2017–31 Jan 2018	0.00	13.02	review result
	1 Feb 2018–14 Feb 2018	0.64	13.02	deposit
Samsung	3 Aug 2012–25 Dec 2012	9.62		deposit (provisional entries)
	26 Dec 2012–30 Jan 2013	9.23		deposit (final determination)
	14 Feb 2013–31 Jan 2014	9.23		deposit (adverse facts in review)
	1 Feb 2014–15 Sep 2015	9.23		deposit
	16 Sep 2015–14 Feb 2018	82.35		deposit
All others	3 Aug 2012–25 Dec 2012	11.36		deposit (provisional entries)
	26 Dec 2012–30 Jan 2013	11.80		deposit (final determination)
	14 Feb 2013–14 Feb 2018	11.80		deposit
Korea, countervailing				
LG	5 Jun 2012–2 Oct 2012	0.00		deposit
	14 Feb 2013–14 Feb 2018	0.00		deposit
Samsung	5 Jun 2012–2 Oct 2012	1.20		deposit (provisional entries)
	14 Feb 2013–31 Dec 2013	1.85		deposit (adverse facts in review)
	1 Jan 2014–14 Sep 2015	1.85		deposit
	15 Sep 2015–14 Feb 2018	34.77		deposit
All others	5 Jun 2012–2 Oct 2012	1.20		deposit (provisional entries)
	14 Feb 2013–14 Feb 2018	1.85		deposit
Mexico, antidumping				
Electrolux	3 Aug 2012–31 Jan 2014	6.22	36.52	review result
	1 Feb 2014–31 Jan 2015	2.47	36.52	review result
	1 Feb 2015–31 Jan 2016	3.67	36.52	review result
	1 Feb 2016–11 Sep 2016	6.22	36.52	deposit (adverse facts in review)
	12 Sep 2016–31 Jan 2017	2.47	36.52	deposit (adverse facts in review)
	1 Feb 2017–31 Jan 2018	2.25	36.52	review result
	1 Feb 2018–31 Jan 2019	3.53	36.52	review result
	1 Feb 2019–31 Jan 2020	2.06	36.52	review result
All others	3 Aug 2012–26 Dec 2012	33.30		deposit (provisional entries)
	27 Dec 2012–30 Jan 2013	36.52		deposit (final determination)
	14 Feb 2013–	36.52		deposit
China, antidumping				
LG	26 Jul 2016–14 Dec 2016	38.43		order rate (provisional entries)
	15 Dec 2016–21 Jan 2017	32.12		deposit (final determination)
	3 Feb 2017–	38.43		deposit
Samsung	26 Jul 2016–14 Dec 2016	57.37		order rate (provisional entries)
	15 Dec 2016–21 Jan 2017	52.51		deposit (final determination)
	3 Feb 2017–	57.37		deposit
All others	26 Jul 2016–14 Dec 2016	49.72		order rate (provisional entries)
	15 Dec 2016–21 Jan 2017	44.28		deposit (final determination)
	3 Feb 2017–	49.72		deposit

Notes: Duty paid on entries in the period, in percent of customs value, by case and manufacturer. The wedge column gives the rate that enters the duty wedge of Section 5 where it differs from the duty paid; for all other rows the two coincide. Manufacturers not listed bear the all-others rate (among them Mabe for Mexico and Haier and MC Appliance for China; Daewoo, with its own rates, is not in the product set); Whirlpool and Samsung, which have their own Mexican rates, shipped no washers from Mexico under the order. An open period end means in force at the end of 2019. Where a period spans the two weeks between the expiry of the provisional deposits and the order, no duty applied in those weeks. Entries between the final determination and the expiry of the provisional deposits bear the final-determination deposit. The basis of each rate is described in the text. Sources: Federal Register notices and USITC reports.

Figure A.2: Duty rates on washer imports by origin, manufacturer, and month, 2011–2019



Notes: Sum of the ordinary duty, the safeguard, the Section 301 duty on Chinese washers from September 2019, and the antidumping and countervailing rates of the duty wedge, by origin and month. For LG's Korean and Electrolux's Mexican washers, the solid line is the wedge (the order margin) and the dashed line the duty paid. Manufacturers with their own antidumping or countervailing rate are shown separately. All other manufacturers bear the all-others rate. Whirlpool's and Samsung's Mexican rates are not shown, since neither shipped washers from Mexico under the order. Vertical dashed lines mark the first duties of the three rounds. Deposits on Korea and Mexico (August 2012), deposits on China (July 2016), and the safeguard (February 2018).

the linear parameters θ_1. For a candidate θ_2, the mean utilities of each market are obtained by inverting the observed market shares (Berry, 1994), using the contraction mapping of Berry, Levinsohn, and Pakes (1995) accelerated by SQUAREM (Reynaerts, Varadha, and Nash, 2012) and reformulated in terms of the households' probabilities of choosing the outside good (Brunner et al., 2020); where SQUAREM fails to converge, the plain contraction takes over. The outer loop searches for the θ_2 that minimizes the sum of squared moments below. Market shares are simulated with 2,000 households per market, two independent draws of 1,000 from the year's CPS sample, each with a standard-normal front-loader taste shock from scrambled Halton draws (Owen, 2017). Household incomes, in the CPS draws and in the product averages of the income moment, are capped at \$400,000.

Moment conditions. The three moments are, with the market index t suppressed and s_j the observed share of product j,

$$m_1(\theta) = \sum_j s_j \, p_j \left\{ \bar{\iota}_j - E\left[\iota \mid y^1 = j, \theta \right] \right\}, \tag{A.5}$$

where $\bar{\iota}_j$ is the average income of the buyers of product j in the survey, y^1 denotes the first choice, and the expectation is the model's average income of the households that choose j;

$$m_2(\theta) = \sum_j s_j \, x_j^{\mathrm{FL}} \sum_{b' \neq b_j} x_{b'}^{\mathrm{FL}} \left\{ \hat{P}_{jb'} - E\left[\mathbb{1}(b^2 = b') \mid y^1 = j, \theta \right] \right\}, \tag{A.6}$$

where b_j is the brand of product j, b^2 the second-choice brand, $\hat{P}_{jb'}$ the share of the buyers of j who name b' as their second choice, $x_{b'}^{\mathrm{FL}}$ the front-loader share of brand b''s sales, and the expectation the model's probability that a household choosing j has b' as its second choice; and

$$m_3(\theta) = \frac{1}{J} \sum_{j,t} z_{jt} \, \xi_{jt}(\theta), \tag{A.7}$$

where J is the number of product-years, z_{jt} the instrument of Section 5, set to zero for products without one, and $\xi_{jt}(\theta)$ the residual from regressing the mean utilities on x_{jt}, so that the fixed effects and trends are partialled out inside the moment. Products whose buyers report no income or no second choice are left out of the first and second moment. The estimator is $\hat{\theta}_2 = \arg\min_{\theta_2} m(\theta_2)' m(\theta_2)$ with $m = (m_1, m_2, m_3)$. Given $\hat{\theta}_2$ and $\hat{\delta}_{jt}$, the linear parameters solve

$$\hat{\delta}_{jt} = x_{jt}\beta + \xi_{jt} \tag{A.8}$$

by ordinary least squares, with the brand-by-washer-type, retailer, and year effects and the brand trends in x_{jt}.

Instrument and fixed effects. Column (1) of Table 4 is the linear model with price instrumented by z_{jt}, the fixed effects and trends partialled out, standard errors clustered by brand, and the Kleibergen–Paap F-statistic as the first-stage statistic.

Mean utilities and marginal costs, 2005–2019. The products of all years are stacked and treated market by market: the mean utilities of each year are the inversion above at $\hat{\theta}_2$, with the imputed washer types of 2016–2019 entering through the product volumes, prices, and the front-loader indicator, and with 2,000 households per year drawn as above. The household choice probabilities at the inverted mean utilities give the price derivatives of market shares, and equation (11) with the ownership matrix of the year gives the duty-inclusive marginal cost of every product; one of the 2,197 products, a Magic Chef top-loader in 2008 with a volume of two units, has a non-positive recovered cost and is excluded from the cost regressions.

III.B Market Size in Estimation

Market size M_t is 0.1042 times the number of U.S. households in year t, and the outside share s_{0t} is one minus total U.S. shipments of automatic washers divided by M_t. Households are the sum of the household weights over householders in the CPS Annual Social and Economic Supplement of each year. Shipments are AHAM factory shipments to the U.S. market. The constant 0.1042 equates the mean outside share over 2005–2015 to 0.321, the mean under the respondent-based market size of Montag (2026), so the rule changes the time path of market size but not its level. Table A.5 lists the series.

III.C Duty Wedge and Tariff-Exclusive Costs

This section describes how the duty rates of Appendix II.D are turned into the rate a seller bears under the two models of Section 5.

Duties paid on the units sold. The units a manufacturer sells from an origin in year t are its product volumes scaled to total U.S. shipments, spread evenly over the months of the year. They are drawn first in, first out from a stock of the manufacturer's monthly imports from that origin, each month's entries carrying the rate of Appendix II.D in that month. For LG's Korean and Electrolux's Mexican washers, the antidumping rate attached to entries from 3 August 2012 is the order margin. The stock starts empty in January 2011, each year's imports are scaled to equal that year's sales, stock older than twelve months is written off, and where the stock runs out the month's own entries and rate apply. The duty paid on the units sold in t is the volume-weighted rate of the entries they draw on. Before 2011, when only the ordinary duty applied, it is the calendar-year rate.

Table A.5: Market size and outside share by year

Year	Shipments (million units)	Households (million)	Market size (million households)	Outside share
2005	9.23	113.5	11.8	0.220
2006	9.50	114.5	11.9	0.204
2007	8.83	116.1	12.1	0.270
2008	8.29	116.9	12.2	0.319
2009	7.86	117.3	12.2	0.357
2010	8.00	118.5	12.4	0.352
2011	7.56	120.0	12.5	0.395
2012	7.31	121.2	12.6	0.421
2013	8.18	122.5	12.8	0.360
2014	8.63	124.0	12.9	0.332
2015	9.12	124.7	13.0	0.298
2016	9.67	126.1	13.1	0.264
2017	10.09	126.5	13.2	0.235
2018	10.49	127.7	13.3	0.212
2019	10.62	128.7	13.4	0.208

Notes: Shipments are AHAM factory shipments of automatic washers to the U.S. market; 2019 is the 2018 figure grown at the 1.2 percent AHAM reported for 2019. Households are from the CPS Annual Social and Economic Supplement. Market size is 0.1042 times the number of households, and the outside share is one minus shipments over market size.

Replacement duties. The rate on a replacement unit is the rate in force on the day of entry, taken as two months after the month of sale and averaged over the days of that month, by origin and manufacturer; the rate of year t is the mean over its twelve sale months. The rates are the statutory ones of Appendix II.D: the ordinary duty, the Section 301 duty, the antidumping and countervailing rates with the order margin for LG's Korean and Electrolux's Mexican washers, and the safeguard at its statutory rate times the share of the origin's entries subject to it, either at the in-quota rate until the quota filled (October 2018 and May 2019) or at the above-quota rate throughout, the two bounds reported in Section 5. Under both models, washers outside the scope of the orders bear the ordinary duty, and a product's wedge combines the rates of its origins and manufacturer through equation (12).

The order margin. The order margin enters the wedge under the following conventions. I treat the margin as a comparison of the average transaction price in the home market to the average transaction price in the export market and use the same margin for all models of the exporter made in the subject country. I apply the order margin from the first day of the first period of review, including the provisional period in which the deposit was the preliminary margin (12.15 and 33.30 percent), since the margin of the final determination is the better measure of the normal value Commerce assessed. I do not assign different margins to different models because Commerce publishes one margin per exporter and origin. For an exporter requesting a review, I assume that the exporter prices products in the review period knowing this is going to affect the reviewed duty. Where a review assessed a higher rate on adverse facts available, the wedge stays at the order margin and the duty paid at the deposit, since the assessment penalizes conduct in the review rather than pricing in the period. The cash tied up in deposits between entry and liquidation is not modelled. While strictly speaking the exporter's problem has a kink where its export price reaches normal value, the pricing model treats the outcome as the Bertrand equilibrium at a marginal cost equal to normal value, which is what lets the inversion of equation (11) recover the tariff-exclusive cost.

Table A.6: Production-location cost differences, 2005–2015, with and without the characteristics observed until 2015

Origin	With the characteristics	Without the characteristics
Germany	0.171	0.187
	(0.130)	(0.132)
Mexico	−0.223	−0.215
	(0.063)	(0.057)
China	−0.185	−0.185
	(0.053)	(0.050)
Korea	−0.139	−0.143
	(0.056)	(0.060)
Thailand	−0.141	−0.229
	(0.070)	(0.044)
Other	−0.304	−0.291
	(0.058)	(0.059)
Observations	1,585	1,585
Within R^2	0.558	0.550

Notes: Origin effects γ_c of equation (13) on the 2005–2015 products, tariff-exclusive marginal cost under replacement duties at the in-quota rate, with the regressors, fixed effects, and trends of Table 6. The first column adds the eight characteristics that are observed only until 2015: stacked pair, ENERGY STAR certification, noise insulation, the number of special programs, child lockout, the brand's repair rate and an indicator for its availability, and the brand's advertising spending. Standard errors in parentheses, clustered by brand. Vietnam has no production in 2005–2015.

IV Appendix to Section 6: Further Estimates and Robustness

IV.A Cost Decomposition with the Characteristics Observed Until 2015

Eight product characteristics of the 2005–2015 data are not observed after 2015: whether the washer is part of a stacked pair, its ENERGY STAR certification, noise insulation, the number of special programs, a child lockout, the brand's repair rate and an indicator for its availability, and the brand's advertising spending. The cost decomposition of Section 6 leaves them out for all years. Table A.6 estimates the decomposition on the 2005–2015 products with and without them. The Germany, Mexico, China, and Korea effects move by at most 0.2 standard errors. The Thailand effect, which rests on a single brand in these years, moves by 1.3 standard errors, and the residual-origin effect by 0.2.

V Appendix to Section 7

This appendix reports the estimates behind Figures 4 to 6 at the year after each petition, under the main specification and three variants, and the trade-policy channel of a hypothetical cross-border merger.

V.A Estimates at the Year After Each Petition

Table A.7 reports the petitioning premium with and without the merger, its decomposition, and the consumer-surplus effects at the year after each petition was filed, with 95 percent confidence intervals. The first row of each panel is the specification of the main text. The second row places rivals at their current-year production locations instead of the previous year's. The third row treats Kenmore products as products of their main manufacturer (Whirlpool for the top-loaders and for the front-loaders of 2005–2009, LG for the later front-loaders), so that Whirlpool and LG set their prices and are the residual claimants of their profits. The fourth row evaluates petitioning against the status-quo baseline, in which Whirlpool keeps the production locations of the previous year if it does not petition, instead of offshoring its front-loaders. Placing rivals at their current-year locations lowers the premium of the China round, since part of the rivals' Chinese production had already moved on in 2016, and leaves the safeguard round almost unchanged. Treating Kenmore as integrated raises the premium and the consumer-surplus effects in every round. Against the status quo the premium is higher in every round, since the alternative to petitioning is less profitable, and the relocation gain is zero in 2016 and 2018, when Maytag's washers were made only in the United States.

Table A.7: Trade-policy channel of a domestic merger, tariff rounds at the order rates, by specification

	Petitioning premium		Merger-induced change			Consumer surplus	
	No merger	Merger	Appropriation	Relocation gain	Strategic	No merger	$\Delta^{\mathcal{M}}$
Panel A: Korea and Mexico orders (filed 2011; year 2012)							
Main specification	−$21M	−$20M	$40M	$40M	$1M	−$239M	−$39M
	[−$46M, $4M]	[−$59M, $19M]	[$38M, $42M]	[$25M, $54M]	[$0M, $2M]	[−$266M, −$212M]	[−$45M, −$33M]
Rivals at current-year locations	−$28M	−$35M	$33M	$40M	$0M	−$199M	−$35M
	[−$54M, −$3M]	[−$74M, $5M]	[$31M, $35M]	[$25M, $55M]	[$0M, $1M]	[−$224M, −$174M]	[−$41M, −$29M]
Kenmore integrated	−$11M	−$6M	$41M	$39M	$2M	−$240M	−$44M
	[−$35M, $13M]	[−$44M, $32M]	[$39M, $43M]	[$25M, $53M]	[$1M, $3M]	[−$266M, −$213M]	[−$50M, −$38M]
Status-quo baseline	$18M	$35M	$34M	$20M	$2M	−$203M	−$32M
	[$9M, $27M]	[$19M, $51M]	[$33M, $36M]	[$13M, $27M]	[$2M, $3M]	[−$217M, −$189M]	[−$35M, −$28M]
Duties paid	−$18M	−$16M	$34M	$33M	$1M	−$217M	−$33M
	[−$43M, $7M]	[−$53M, $22M]	[$33M, $36M]	[$20M, $46M]	[$0M, $2M]	[−$244M, −$191M]	[−$39M, −$28M]
In-quota replacement duties	−$21M	−$20M	$40M	$40M	$1M	−$239M	−$39M
	[−$46M, $4M]	[−$59M, $19M]	[$38M, $42M]	[$25M, $54M]	[$0M, $2M]	[−$266M, −$211M]	[−$45M, −$33M]
Panel B: Korea, Mexico and China orders (filed 2015; year 2016)							
Main specification	$57M	$137M	$98M	$26M	$8M	−$567M	−$71M
	[$35M, $79M]	[$106M, $168M]	[$95M, $102M]	[$14M, $37M]	[$7M, $9M]	[−$599M, −$536M]	[−$77M, −$65M]
Rivals at current-year locations	$28M	$81M	$74M	$26M	$5M	−$441M	−$54M
	[$6M, $50M]	[$50M, $113M]	[$71M, $77M]	[$14M, $37M]	[$4M, $6M]	[−$466M, −$416M]	[−$59M, −$48M]
Kenmore integrated	$87M	$178M	$103M	$25M	$13M	−$576M	−$88M
	[$66M, $109M]	[$147M, $208M]	[$99M, $106M]	[$14M, $36M]	[$11M, $14M]	[−$606M, −$545M]	[−$94M, −$81M]
Status-quo baseline	$104M	$206M	$92M	$0M	$10M	−$520M	−$57M
	[$102M, $107M]	[$202M, $210M]	[$90M, $94M]	[$0M, $0M]	[$9M, $10M]	[−$541M, −$500M]	[−$60M, −$54M]
Duties paid	$55M	$136M	$96M	$25M	$9M	−$514M	−$72M
	[$31M, $79M]	[$102M, $169M]	[$92M, $100M]	[$13M, $37M]	[$8M, $10M]	[−$549M, −$479M]	[−$78M, −$67M]
In-quota replacement duties	$57M	$138M	$98M	$25M	$8M	−$572M	−$70M
	[$35M, $79M]	[$107M, $169M]	[$94M, $102M]	[$14M, $37M]	[$7M, $9M]	[−$603M, −$541M]	[−$76M, −$64M]
Panel C: Safeguard, 50% above-quota rate, with the China and Mexico orders (filed 2017; year 2018)							
Main specification	$84M	$195M	$127M	$26M	$9M	−$775M	−$84M
	[$68M, $101M]	[$168M, $221M]	[$124M, $131M]	[$14M, $38M]	[$9M, $10M]	[−$807M, −$743M]	[−$93M, −$74M]
Rivals at current-year locations	$86M	$199M	$129M	$26M	$9M	−$783M	−$85M
	[$70M, $103M]	[$172M, $225M]	[$126M, $133M]	[$14M, $38M]	[$9M, $10M]	[−$815M, −$751M]	[−$94M, −$76M]
Kenmore integrated	$115M	$234M	$131M	$26M	$14M	−$776M	−$102M
	[$99M, $131M]	[$208M, $260M]	[$127M, $135M]	[$14M, $38M]	[$13M, $14M]	[−$808M, −$744M]	[−$111M, −$92M]
Status-quo baseline	$118M	$251M	$123M	$0M	$10M	−$737M	−$63M
	[$115M, $121M]	[$245M, $258M]	[$120M, $126M]	[$0M, $0M]	[$10M, $10M]	[−$762M, −$712M]	[−$65M, −$62M]
Duties paid	$93M	$219M	$141M	$29M	$14M	−$718M	−$100M
	[$73M, $114M]	[$187M, $252M]	[$137M, $145M]	[$14M, $43M]	[$13M, $15M]	[−$740M, −$695M]	[−$109M, −$92M]
In-quota replacement duties	$89M	$207M	$136M	$29M	$11M	−$760M	−$93M
	[$71M, $107M]	[$178M, $237M]	[$132M, $140M]	[$15M, $42M]	[$11M, $12M]	[−$787M, −$732M]	[−$102M, −$84M]

Notes: Values in million USD per year, at the year after the petition was filed. Petitioning premium: Whirlpool's profit gain from the duties of the petition without the merger and the merged firm's. Merger-induced change in the premium, decomposed: the appropriation effect is standalone Maytag's profit gain from the duties; the relocation gain is the merged firm's profit without the duties with Maytag's products at the locations of the baseline minus its profit with them in the U.S., where standalone Maytag produces; the strategic effect compares the merged firm with the two separate firms with Maytag's products in the U.S. in both worlds. The merged premium minus the premium without the merger equals the appropriation effect plus the strategic effect minus the relocation gain. Consumer surplus columns report the change in consumer surplus from the duties without the merger and the merger-induced change. Duties of each petition applied as a hypothetical duty in the year shown: rounds 1 and 2 at the rates of the orders by origin and manufacturer, cumulating (round 2 adds the China order to round 1); round 3 the 50% safeguard on all non-U.S. production together with the China and Mexico orders in force at the rates of the orders (the Korea order, revoked in February 2018, is not included). Products outside the scope of the orders bear none of these duties. Both worlds carry the ordinary duty and, from September 2019, the Section 301 duty. Whirlpool produces in the U.S. in the duty world, with its front-loaders in Mexico without the duties under offshoring and at the locations of the previous year in the status quo; the Maytag brands do the same with the merger and produce in the U.S. in every world without it. Kenmore production in Germany and Mexico (Whirlpool's) moves to the U.S. in the duty world; Kenmore production in Asia (LG's) stays where it is. The first row of each panel is the specification of the main text: rivals at their production locations of the previous year, Kenmore products owned by Sears as in the data, and the offshoring baseline. The second row places rivals at their current-year locations. The third row treats Kenmore products as products of their main manufacturer (Whirlpool for the top-loaders and for the front-loaders of 2005–2009, LG for the later front-loaders), at the production locations of the first row. The fourth row evaluates petitioning against the status quo, in which Whirlpool keeps its production locations of the previous year without the duties. The fifth and sixth rows change only the duties removed from the recovered marginal costs to obtain tariff-exclusive costs and origin effects, with the duties of each petition as in the first row: the fifth row removes the duties paid on the units sold instead of the duties on a replacement unit, and the sixth row removes the duties on a replacement unit at the in-quota rate of the safeguard until the quota fills instead of the above-quota rate. In the round-3 tariff world, predicted in-scope imports at the 50% rate stay below the quota of the safeguard (1.2 million units) in 2005–2017 (in at least one equilibrium of the scenarios in the table); in those years the above-quota rate overstates the duty on the marginal unit. 95% confidence intervals from the 200 bootstrap draws.

Table A.8: Petition sequence 2012–2022 by specification, present value in 2011

	Petitioning premium			Change in consumer surplus		
	No merger	Merger	Difference	No merger	Merger	Difference
Panel A: 100% success probability						
Main specification	\$146M	\$486M	\$340M	−\$3,031M	−\$3,440M	−\$409M
	[−\$13M, \$306M]	[\$243M, \$729M]	[\$256M, \$423M]	[−\$3,212M, −\$2,850M]	[−\$3,670M, −\$3,210M]	[−\$460M, −\$358M]
Rivals at current-year locations	\$51M	\$288M	\$237M	−\$2,551M	−\$2,905M	−\$354M
	[−\$111M, \$213M]	[\$42M, \$534M]	[\$153M, \$322M]	[−\$2,725M, −\$2,377M]	[−\$3,127M, −\$2,682M]	[−\$404M, −\$303M]
Kenmore integrated	\$261M	\$638M	\$377M	−\$3,051M	−\$3,529M	−\$478M
	[\$106M, \$417M]	[\$399M, \$877M]	[\$294M, \$460M]	[−\$3,231M, −\$2,872M]	[−\$3,760M, −\$3,299M]	[−\$531M, −\$425M]
Status-quo baseline	\$467M	\$969M	\$502M	−\$2,719M	−\$3,022M	−\$303M
	[\$451M, \$483M]	[\$938M, \$1,001M]	[\$486M, \$519M]	[−\$2,793M, −\$2,645M]	[−\$3,104M, −\$2,939M]	[−\$314M, −\$292M]
Duties paid	\$185M	\$563M	\$378M	−\$2,888M	−\$3,312M	−\$424M
	[\$20M, \$350M]	[\$313M, \$813M]	[\$293M, \$463M]	[−\$3,059M, −\$2,717M]	[−\$3,532M, −\$3,092M]	[−\$474M, −\$375M]
In-quota replacement duties	\$152M	\$501M	\$349M	−\$3,021M	−\$3,439M	−\$418M
	[−\$10M, \$313M]	[\$255M, \$746M]	[\$264M, \$434M]	[−\$3,199M, −\$2,842M]	[−\$3,667M, −\$3,211M]	[−\$469M, −\$368M]
Panel B: 67% success probability						
Main specification	−\$24M	\$67M	\$91M	−\$1,360M	−\$1,563M	−\$203M
	[−\$131M, \$83M]	[−\$96M, \$230M]	[\$35M, \$147M]	[−\$1,474M, −\$1,246M]	[−\$1,710M, −\$1,416M]	[−\$237M, −\$170M]
Rivals at current-year locations	−\$70M	−\$26M	\$43M	−\$1,135M	−\$1,312M	−\$177M
	[−\$178M, \$39M]	[−\$192M, \$139M]	[−\$13M, \$100M]	[−\$1,244M, −\$1,025M]	[−\$1,454M, −\$1,169M]	[−\$210M, −\$144M]
Kenmore integrated	\$28M	\$136M	\$108M	−\$1,369M	−\$1,603M	−\$235M
	[−\$77M, \$132M]	[−\$24M, \$296M]	[\$52M, \$164M]	[−\$1,481M, −\$1,256M]	[−\$1,750M, −\$1,457M]	[−\$269M, −\$200M]
Status-quo baseline	\$190M	\$391M	\$200M	−\$1,150M	−\$1,282M	−\$132M
	[\$181M, \$200M]	[\$373M, \$409M]	[\$191M, \$210M]	[−\$1,184M, −\$1,117M]	[−\$1,321M, −\$1,244M]	[−\$138M, −\$126M]
Duties paid	−\$4M	\$104M	\$109M	−\$1,299M	−\$1,502M	−\$203M
	[−\$115M, \$107M]	[−\$63M, \$272M]	[\$51M, \$166M]	[−\$1,411M, −\$1,187M]	[−\$1,647M, −\$1,358M]	[−\$236M, −\$170M]
In-quota replacement duties	−\$24M	\$70M	\$94M	−\$1,359M	−\$1,565M	−\$206M
	[−\$132M, \$85M]	[−\$95M, \$235M]	[\$37M, \$151M]	[−\$1,472M, −\$1,245M]	[−\$1,711M, −\$1,418M]	[−\$240M, −\$173M]

Notes: Million USD, present value in 2011 at 8%, of the petition sequence of Table 8 for each specification of Table A.7. The first round applies in 2012–2015, the second in 2016–2017, and the third in 2018–2022, each at the values of the specification in the year; 2020–2022 at the values of 2019 at the production locations of 2019. A petition is filed only after the previous one has succeeded; when it fails, the duties in force stay. Petitioning premium: Whirlpool's profit gain from the duties without the merger and the merged firm's. Consumer surplus: the change from the duties without and with the merger. 95% confidence intervals in brackets: the point estimate plus or minus 1.96 standard deviations of the present values of the 200 bootstrap draws.

V.B Cross-Border Merger

This subsection quantifies the trade-policy channel of a hypothetical cross-border merger between Whirlpool and LG, the empirical counterpart of Section 3.3, for the three petitions of Section 7.

Without the merger, Whirlpool, Maytag, and LG are separate firms, so the premium and the consumer-surplus effect without the merger are those of Section 7. With the merger, Whirlpool and LG are under joint ownership, and Maytag is a standalone firm that produces in the United States in every regime. A firm that imports the subject goods itself can hardly petition credibly for duties on them. Petitioning therefore requires the merged firm to produce every LG-made washer in the United States, including the Kenmore washers LG makes for Sears. Without a petition, Whirlpool moves its front-loaders to Mexico, as in the main text, and LG keeps its production locations of the previous year. Rivals keep the production locations of the previous year, and Sears keeps setting the prices of the Kenmore washers.

Following Proposition 5, I decompose the merger's effect on the petitioning premium into three terms. The appropriation effect is standalone LG's gain from the duties. The *relocation loss* is the merged firm's variable profit without the duties with LG's washers at LG's locations minus its variable profit with them in the United States. The strategic effect compares the merged firm's gain from the duties with the combined gain of the two separate firms, holding the merged firm's LG washers in the United States in both regimes. It therefore includes the duties that these washers, being made in the United States, do not pay. As in the main text, the fixed cost of relocating production is not included. Proposition 5 signs the appropriation effect against the status-quo baseline. Against the offshoring baseline used here, its sign is ambiguous in the stylized model (Appendix I), so it is an empirical question. Standalone LG pays the duties only on the washers it makes in the subject origins. In the simulations, its washers are made entirely in Korea in 2011 and 2012, mostly in China from 2014 to 2017, and mostly in Thailand and Vietnam in 2018 and 2019.

The 95 percent confidence intervals are from the same 200 bootstrap draws as in Section 7, so the columns without the merger in Table A.9, intervals included, are those of the main specification in Table A.7.

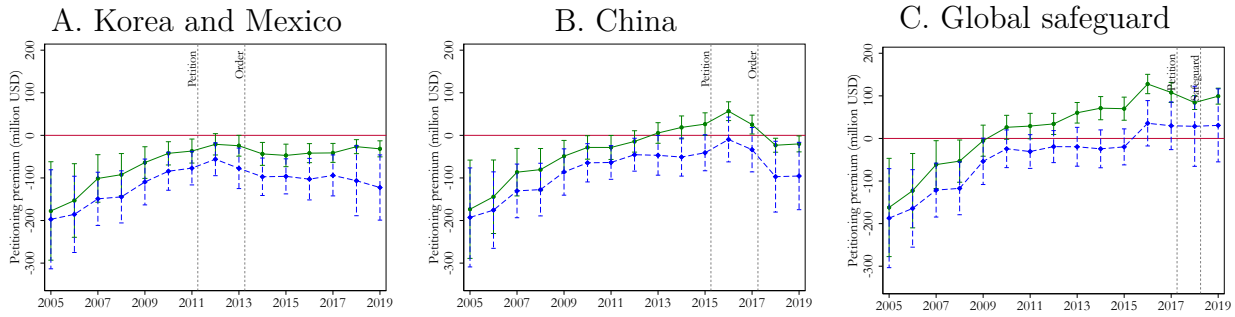
Figure A.3 and Table A.9 show that the cross-border merger lowers Whirlpool's petitioning premium in every round and year, the opposite of the domestic merger. At the year after filing, the premium falls from −\$21 to −\$56 million for the Korea and Mexico round, from \$57 to −\$10 million for the China round, and from \$84 to \$29 million for the safeguard, where the merged premium is not significantly different from zero. Three forces drive the decline. First, the appropriation effect is negative: the duties cost LG \$28 million in 2012,

Table A.9: Trade-policy channel of a cross-border merger of Whirlpool and LG, tariff rounds at the order rates

	Petitioning premium		Merger-induced change			Consumer surplus	
	No merger	Merger	Appropriation	Relocation loss	Strategic	No merger	$\Delta^{\mathcal{M}}$
Panel A: Korea and Mexico orders (filed 2011; year 2012)							
Main specification	−$21M	−$56M	−$28M	$34M	$28M	−$239M	$4M
	[−$46M, $4M]	[−$95M, −$18M]	[−$31M, −$25M]	[$12M, $57M]	[$23M, $33M]	[−$266M, −$212M]	[−$42M, $49M]
Panel B: Korea, Mexico and China orders (filed 2015; year 2016)							
Main specification	$57M	−$10M	−$130M	$67M	$131M	−$567M	$122M
	[$35M, $79M]	[−$62M, $43M]	[−$136M, −$125M]	[$28M, $106M]	[$120M, $143M]	[−$599M, −$536M]	[$67M, $177M]
Panel C: Safeguard, 50% above-quota rate, with the China and Mexico orders (filed 2017; year 2018)							
Main specification	$84M	$29M	−$203M	$87M	$234M	−$775M	$220M
	[$68M, $101M]	[−$65M, $123M]	[−$212M, −$194M]	[$10M, $163M]	[$213M, $255M]	[−$807M, −$743M]	[$111M, $329M]

Notes: Values in million USD per year, at the year after the petition was filed. Hypothetical cross-border merger of Whirlpool and LG; the Maytag brands form a standalone firm that produces in the U.S. in every world, with and without the merger. Petitioning premium: Whirlpool's profit gain from the duties of the petition without the merger and the merged firm's. With the merger, LG's washers and the Kenmore production LG makes for Sears (which keeps setting their prices) produce in the U.S. in the duty world; without the duties, they are at their locations of the previous year. Without the merger, LG produces at its locations of the previous year in both worlds. Whirlpool produces in the U.S. in the duty world and has its front-loaders in Mexico without the duties, with and without the merger; Kenmore production in Germany and Mexico (Whirlpool's) moves to the U.S. in the duty world. Merger-induced change in the premium, decomposed: the appropriation effect is standalone LG's profit gain from the duties; the relocation loss is the merged firm's profit without the duties with LG's washers at LG's locations minus its profit with them in the U.S.; the strategic effect compares the merged firm with the two separate firms with the merged firm's LG washers in the U.S. in both worlds, and includes the duties that these washers, being made in the U.S., do not pay. The merged premium minus the premium without the merger equals the appropriation effect plus the strategic effect minus the relocation loss; the fixed cost of relocating LG's production is not included. Consumer surplus columns report the change in consumer surplus from the duties without the merger and the merger-induced change. Duties of each petition applied as a hypothetical duty in the year shown: rounds 1 and 2 at the rates of the orders by origin and manufacturer, cumulating (round 2 adds the China order to round 1); round 3 the 50% safeguard on all non-U.S. production together with the China and Mexico orders in force at the rates of the orders (the Korea order, revoked in February 2018, is not included). Products outside the scope of the orders bear none of these duties. Both worlds carry the ordinary duty and, from September 2019, the Section 301 duty. In the round-3 tariff world, predicted in-scope imports at the 50% rate stay below the quota of the safeguard (1.2 million units) in 2005–2017 (in at least one equilibrium of the scenarios in the table); in those years the above-quota rate overstates the duty on the marginal unit. 95% confidence intervals from the 200 bootstrap draws.

Figure A.3: Cross-border merger: petitioning premium by tariff round



Notes: The figure plots Whirlpool's variable profit from the duties of each petition relative to its no-petition alternative, by year, without the merger (green, circles) and under a hypothetical Whirlpool–LG merger (blue, diamonds). With the merger, petitioning requires the merged firm to produce LG's washers and the Kenmore washers LG makes for Sears in the United States. Without a petition, Whirlpool's front-loaders are in Mexico and LG's washers at their locations of the previous year. Standalone Maytag produces in the United States. Panel A applies the Korea and Mexico orders, Panel B those orders and the China order, and Panel C the 50 percent safeguard together with the China and Mexico orders, each as a hypothetical duty in the year shown. Vertical lines mark the filing of the petition and the order or safeguard. Capped bars are 95 percent confidence intervals from the 200 bootstrap draws.

$130 million in 2016, and $203 million in 2018. It is positive only in the years in which LG's production lies mostly outside the subject origins (2016 and 2017 for the Korea and Mexico orders, 2019 for the China round), so that the duties fall mainly on its rivals. Second, the relocation loss is between $10 and $96 million a year and is the least precisely estimated term. Third, the strategic effect at the year after filing is large and positive, $28 million in 2012, $131 million in 2016, and $234 million in 2018, far above the domestic merger's, because it contains the duties that the merged firm's LG washers escape. It never outweighs the appropriation effect and the relocation loss together.

The cross-border merger also lowers the consumer-surplus loss from the duties at the year after each petition, by $4 million in 2012 (not significantly different from zero), $122 million in 2016, and $220 million in 2018, since the merged firm's LG washers are made in the United States and bear no duty. The reduction holds in every year for the safeguard, but the merger raises the loss from the Korea and Mexico orders from 2013 on and from the China round in 2018 and 2019.