Trade Barriers and Market Power: Evidence from Argentina's Discretionary Import Restrictions*

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Abstract

Countries are increasingly turning to non-tariff barriers that are hard to measure and often illegal under WTO rules. What are the impacts of these policies, and what do they reveal about market power in international trade? We study a comprehensive system of discretionary import licenses imposed by Argentina, where we observe the universe of transaction-level requests and approval decisions between 2013 and 2015. Approvals varied across firms and products in a manner consistent with the government's trade and investment objectives, and over time to safeguard the current account. Interacting these sources of variation to construct an instrument, we estimate that stricter restrictions increased the prices paid by importers, a result that runs counter to competitive price-setting behavior. Informed by a model and a classifier-Lasso, the price and quantity responses identify—for each combination of importer, narrow product, and origin—which side (importer or exporter) holds market power. We find that larger importers are more likely to hold market power, and those trading with richer countries are less likely to. The market-power distribution strongly shapes the effects of quantitative restrictions and the magnitude of optimal tariffs. Import prices rose by 4% as a result of Argentina's import restrictions, but would have risen by 13% (fallen by 8%) had all foreign firms (Argentinian firms) held market power.

JEL Codes: F12, F13, F14.

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I Introduction

In recent years, in a context of a backlash against globalization, many countries have returned to protectionist trade policies (Colantone et al., 2021). To carry out their protectionist goals, governments often implement discretionary import restrictions that favor or punish particular firms and sectors at different times.[1] These policies often take the form of hard-to-measure non-tariff barriers that are illegal under WTO rules (Ederington and Ruta, 2016). As a result, detailed information about them is hard to come by and there is little analysis of their effects.

In this paper, we study a period of restrictive and highly discretionary trade policy imposed by Argentina. Between 2012–2015, the government of Cristina Fernández de Kirchner instituted a system of non-automatic import licenses—the Advanced Sworn Import Declaration system or DJAI by its initials in Spanish. The system required formal government approval to import any amount of any product. Import requests were granted or withheld at the government's complete discretion, with no law or regulation stipulating criteria for the decision. As we document, the policy affected a large fraction of imports—30% of requests covering 36.5% of requested value were denied—and the rates at which the requests were approved varied across firms, narrow products, and time. In contrast to typically studied sector- or product-level trade policies, the DJAI was de facto a system of firm-specific trade policies, as revealed by the fact that firm rather than 11-digit product identities explain far more of the variance in approvals. After a new government led by Mauricio Macri unexpectedly took office in 2015, the DJAI system was disbanded.

A unique aspect of this episode is that the Argentinean government not only flagrantly violated WTO rules, but also kept detailed records of these policies. The cornerstone of this paper is the electronic records for the universe of transaction-level import requests, government approval decisions, and imports between 2013 and 2015. Using these data we ask, first: what were the impacts of Argentina's DJAI-induced quantity restrictions on import prices and quantities, and how did they vary across firms? As highlighted by Goldberg and Pavcnik (2016), we have few estimates of the price effects of trade policy in part because measurement is difficult, as governments often apply policies at more disaggregated levels than trade data is recorded, and because endogeneity issues abound; problems that are magnified when measuring the impacts of non-tariff barriers, which are arguably more common than tariffs. This relative sparsity of credible estimates is glaring, as terms-of-trade effects are central to determining the welfare impacts of trade policy (Bagwell and Staiger, 1999). Our data are ideally suited to tackle these challenges, as we observe economy-wide non-tariff barriers at the transaction level alongside quantities and prices, and the discretionary nature of the policy provides us with plausible instruments.

Our analysis of price and quantity effects of trade policy aims at informing long-standing theoretical discussions. The vast majority of recent trade policy analyses have been conducted in perfectly competitive models (as summarized, for example, by Caliendo and Parro, 2022). However, starting with Brander (1981), a long tradition summarized by Brander (1995) demonstrates

[1] Staiger and Tabellini (1989) define discretionary trade policy as pursuing activist trade policy "judging each situation on a case by case basis" instead of according to pre-specified rules.

that, with market power, the impacts of trade policy are driven by profit-shifting and become sensitive to details about firm behavior. With this in mind, we further ask: were the observed price and quantity responses largely determined by competitive forces, or do they reveal that one side of the transaction holds market power? How do these distinctions matter for the effects of quantitative restrictions like those of the DJAI and of more traditional policies such as tariffs?

To answer these questions, we proceed in three steps. As a first step, we link the stringency of the import restrictions to observables that vary across firms, products, and time. While interesting in their own right, these determinants of discretionary trade policy serve as the basis for constructing an instrument for import restrictions that we use at several junctures in the paper. In terms of firm-specific characteristics, the government favored requests made by firms that, pre-DJAI, had positive trade balances, imported capital goods, were domestically owned, and were larger. We also find relevant product characteristics but, as noted above, firm rather than product identifiers mattered more for approval rates.[2]

Over time, the level of approval rates is linked to variation in macroeconomic conditions: during periods of mounting pressure on the exchange rate, foreign reserves dwindled and trade protection became more stringent. This connection between external imbalances and quantitative import restrictions has been noted by scholars of trade policy such as Bhagwati and Krueger (1973) and Irwin (2019)—including the notion that the restrictions are often co-opted to serve industrial policy goals—yet empirical evidence is scant. Taken together, these cross-sectional and temporal links are consistent with the government's rhetoric—laid out in public statements by high-ranking officials and collected as part of the WTO cases against Argentina—of imposing restrictions to encourage exports and domestic investment, protect employment, and reduce the demand for foreign currency (WTO, 2014; Conconi and Schepel, 2017).

As a second step, we turn to the impacts of the policy on imported quantities and border (i.e., pre-tariff) prices. Compared to the pre- and post- policy periods, during the DJAI period (2012–2015) the raw data show falling imported quantities and rising import prices within unique firm, HS11 product, and origin triplets. Moreover, the quantity reductions and the price increases were larger for firms whose pre-DJAI observables made them prone to stricter restrictions during the DJAI period. Of course, other things changed across the pre-, during-, and post-DJAI periods, notably the political regime and with it, most likely, the sets of firms the government favored. Therefore, to discover whether the DJAI-induced quantity restrictions indeed raised the prices paid by importers, we leverage quarterly variation within the DJAI period and exploit plausibly exogenous changes in the application of discretionary trade policy across firms, products, and time.

To instrument for DJAI-induced quantity restrictions, we interact the firm- and product-level determinants of approval rates previewed above (based on pre-DJAI characteristics) with the temporal variation in approval rates driven by macroeconomic conditions. A Lasso IV strategy that selects among a rich set of possible interactions reveals that the firms and products whose pre-

[2] Gawande and Krishna (2003) and McLaren (2016) summarize a body of research that studies determinants of trade protection. Rather than explicitly modeling the determination of trade policy, we limit this part of our analysis to identifying correlations between pre-determined firm observables and policy.

DJAI characteristics initially made them less-likely targets for rejections were increasingly targeted during quarters of macro instability within the DJAI period. This result is consistent with the government first restricting imports for firms that are less favored in its policy preferences, and only restricting relatively favored firms during periods of macroeconomic turmoil.[3]

The first stage of the Lasso IV tells us that the DJAI polices were binding, in the sense that reductions in import license approvals reduced imported quantities; so firms could not bypass the restrictions by inflating the size or frequency of requests. The second stage of the Lasso IV, a regression of prices on instrumented quantities, validates the previous cross-policy-period analysis: prices rose for firm-product pairs that experienced declines in import quantities as a result of more stringent import restrictions, with an elasticity of price to quantity equal to -0.13. We obtain similar findings from an alternative IV that seeks to exploit the random component of DJAI approval decisions within firm-product-quarter triplets.

Our key empirical finding that the quantitative trade restrictions *increased* transaction-level import prices runs against the textbook competitive trading environment in which, as in our context, the importing country allocates the import licenses. In such an environment, the importing country would either be unable to affect international import prices through import restrictions or, if it was able to, the restrictions would lower import prices as exporters move down their upward-sloping supply curves (e.g., see Dixit and Norman, 1980). These neoclassical effects underpin recent quantitative analyses of trade policy (e.g., Caliendo and Parro, 2015 or Fajgelbaum et al., 2020) as well as optimal-tariff arguments (Broda et al., 2008). In contrast, our finding is consistent with foreign market power: both under foreign monopoly (Helpman and Krugman, 1989) or under bargaining with sufficiently strong foreign market power (Antràs and Staiger, 2012), the equilibrium price lies along the import demand curve and therefore rises with quantitative import restrictions imposed by the importing country. In more direct support of a role for foreign market power, we find that import prices increased less with market-share-based proxies for market power on the importer's side and increased more with product-differentiation-based proxies for market power on the exporter's side. We also implement a battery of tests that rule out alternative explanations for rising prices in a competitive model, such as exporters charging risk premia, over-invoicing, quality upgrading, or quantity discounts.

As a third step, we ask what the observed firm-level responses reveal about domestic versus foreign market power, and how this matters for trade policy impacts. We lay out a standard model where consumers buy an outside good as well as many differentiated varieties corresponding to unique combinations of firm, narrow product, and origin triplets in the import data. These varieties are supplied by importer-exporter pairs with heterogeneous demand and supply shifters. In each pair, either the foreign exporter behaves as a monopolist (as in the classic analysis by Brander and Spencer, 1981) or the domestic firm behaves as a monopsonist. Alternatively, we

[3]As we argue that this reversal in targeting was primarily driven by a need to maintain reserves in response to macroeconomic fluctuations rather than by firm-product specific demand shocks, the instrument addresses concerns of reverse causality. A placebo shows that our instrument is not simply revealing that the types of firms initially favored by the government react more to periods of macroeconomic turmoil.

assume that the side with market power makes a take-it-or-leave-it offer, in which case the setup corresponds to the matching model of Antràs and Staiger (2012) when one of the sides holds full bargaining power. Output is determined both by ex-ante investments, as in the latter paper, and by standard revenue and cost curves conditional on these investments.[4]

A key contribution of our paper is to identify—for each combination of importer, narrow product, and origin—which side (importer or exporter) holds market power. In contrast, virtually all trade frameworks with heterogeneous firms assume both which side holds the market power and that this side is the same for all firms trading internationally. Specifically, the standard assumption is that exporters hold market power while importers are price-takers, as in models of exporting with monopolistic competition following Melitz (2003) or with oligopoly following Atkeson and Burstein (2008), or as in models of importing such as Halpern et al. (2015) and Antràs et al. (2017).[5] A recent exception is Alviarez et al. (2023), who structurally estimate the degree of importer versus exporter market power via GMM and a quantitative model with bilateral monopoly.[6]

Our identification is based on the sign of the price-quantity elasticity: when the importer holds market power, stricter restrictions lower the import price, revealing the (positive) supply elasticity as the exporter moves along its cost curve; and, when the exporter holds market power, stricter restrictions raise the import price, revealing the (negative) demand elasticity as the importer moves along its demand curve. The model clarifies that, to identify both the side holding market power and the demand and supply elasticities, we can estimate the same reduced-form specification as in the second step described above, but now allowing the price-quantity elasticities to take two different values. We implement this estimation using the same instrument as in our second step, in combination with the classifier-Lasso estimator of unobserved group heterogeneity from Su et al. (2016). This procedure simultaneously estimates many price-quantity elasticities and groups the importer-product-origin triplets according to the similarity of these elasticities.

Consistent with our assumptions, the estimator classifies the firm-product-origin triplets into (exactly) two groups, each characterized by price-quantity elasticities of opposite signs. For 47.9% of firm-product-origin observations (accounting for 53.8% of imported value), foreign exporters hold market power over Argentinean importers. However, there are substantial differences in this share across groups of firms, origin countries, and products depending on their characteristics: importers with larger market shares are more likely to hold market power; importers buying from richer countries are more likely to face foreign firms holding market power; and foreign firms are also

[4]The assumption that quantities and prices are determined bilaterally between importer and exporter is also in keeping with studies of trade policy in supply chains (Ornelas and Turner, 2008; Bernard and Dhingra, 2019; Grossman and Helpman, 2020), international outsourcing (Grossman and Helpman, 2005), and intermediation (Antràs and Costinot, 2011). Recent papers studying tariffs in competitive or monopolistically competitive models of supply chains include Blanchard et al. (2016), Antràs et al. (2022), and Caliendo et al. (2023).

[5]Some recent frameworks that instead assume that importers or intermediaries buying from export-good producers have market power include Morlacco (2019), Dominguez-Iino (2021), and Zavala (2022).

[6]A central difference, besides our focus on the price effects of a particular policy event with directly observable non-tariff barriers, is that we estimate who holds market power firm-product by firm-product, relying on the observed price and quantity responses to the rich policy variation coming from the discretionary nature of the DJAI system; we go on to explore how this heterogeneity correlates with firm, product, and country characteristics, and estimate its implications for the effects of non-tariff and tariff barriers.

more likely to hold market power in more sophisticated and differentiated products or when selling to their affiliates. We also estimate the elasticities of revenues and costs to ex-ante investments from the responses of import requests to expected approval rates; these margins turn out to be quantitatively important for the results that we summarize next.

Our counterfactuals demonstrate that the market-power distribution strongly shaped the aggregate price effects of Argentina's discretionary import restrictions, but mattered less for aggregate quantities. Compared to a no-policy scenario, the DJAI policy lowered import quantities by 31.1% and raised import prices by 4.0%. These aggregates mask heterogeneity between importers holding market power (for whom quantities decreased by 17.9% and prices decreased by 2.3%) and importers buying from exporters with market power (for whom quantities decreased by 40.6% and prices increased by 8.5%). Had all domestic firms held (lacked) market power, aggregate prices would have fallen by 7.9% (increased by 13.0%) due to the policy but changes in aggregate quantities would have been similar to the reduction we estimate for the actual distribution of market power. The reason market power had little impact on quantities but a large impact on prices is that, while we find similar ex-ante investment elasticities for exporters and importers, the estimated price-quantity elasticities for the two groups have opposite signs.

Finally, we demonstrate how the market power distribution shapes the impacts of traditional trade policies. Specifically, we characterize and quantify optimal tariffs across narrow product categories. Our optimal tariff formulas show how the elasticities estimated from the DJAI policy variation map to well-known components of the welfare impacts of tariffs (distortions, profit shifting, and pass-through). As we have mentioned, the framework we use for this characterization draws ingredients from canonical trade models. Our innovation is to embed these forces in an environment with heterogeneous market power across importers, to estimate this heterogeneity, and to show how it matters for policy.

In product-origin pairs where most of the domestic firms hold market power, the optimal tariffs are close to zero to avoid distortions. In contrast, in product-origin pairs where most of the foreign firms hold market power there are strong incentives to distort trade. Optimal ad-valorem equivalent tariffs are as large as 12% assuming that foreign firms make take-it-or-leave-it offers, or as low as -10%, an import subsidy, assuming foreign monopoly pricing.[7] Hence, our analysis demonstrates how the market-power distribution we uncover matters for optimal trade policy. Still, we cannot escape the fact that, conditional on this distribution, the assumptions on price setting still matter for the level and even the sign of optimal tariff policy, as originally pointed out by Eaton and Grossman (1986) in a different context.

As noted above, our paper relates to empirical studies of the price effects of trade policy. Fajgelbaum and Khandelwal (2022) provide a recent review, with studies from multiple countries and time periods finding that before-tariff import prices fall with higher tariffs, and analyses of the

[7] To understand this difference, we demonstrate that in both market structures the incentives to avoid tariff distortions and shift profits via tariffs are identical. However, under the foreign monopoly pricing market structure there are additional incentives to subsidize imports in order to tackle under-provision. This latter force dominates due to the strong export quantity response implied by the estimated elasticity of exporter costs to ex-ante investments.

US-China trade war concluding that US tariffs did not impact product-level import prices.

We draw three contrasts to this literature. First, the discretionary nature of Argentina's DJAI system is key in providing us with credible instruments for trade policy, an issue the literature has struggled with.[8] Second, our transaction-level request and approval data allows us to focus on non-tariff barriers that are more common than tariffs but harder to measure. An exception is Khandelwal et al. (2013), who find that Chinese export prices fall with quota removals on textile exporters, a response that they attribute to competitive forces as exporters no longer need to pay for export licenses; in contrast, in our context, trading rights were assigned by Argentina to domestic importers at zero cost. Third, we find robust evidence of import prices on average rising with quantitative trade restrictions, which we argue is inconsistent with a perfectly competitive environment. Going beyond the literature's focus on averages, we find substantial heterogeneity in the sign of this price effect across firms, origins, and products; through the lens of the model, this sign reveals whether the importer or exporter holds the market power. As we find that Argentinean firms are less likely to hold the market power when buying from richer countries, the distribution of market power provides a way to reconcile our findings for Argentina with existing estimates, albeit of tariff effects, from developed-country settings.

The paper is organized as follows. Section II describes the Argentinian context and the main features of trade policy over the DJAI period. Section III explores variation in the policy across firms, products, and time. Section IV studies the effect of the policy on import quantities and prices. Section V lays out and estimates the imperfect competition model. Section VI uses the estimated model to quantify the role of market power in driving policy impacts. Section VII concludes.

II Institutional Background and Data Sources

In this section, we provide some background on the DJAI system of discretionary trade restrictions—an acronym for "declaracion jurada anticipada de importaciones", the advanced sworn import declaration system—that operated in Argentina between 2012 and 2015.

II.A Context and Events

Following a period of relative stability, Argentina's current account began deteriorating and inflation started rising in the aftermath of the late-2000s global financial crisis. In October 2011, President Cristina Fernández de Kirchner won re-election. Amid stagnating GDP, a depreciating currency, and falling international reserves, her government began implementing exchange controls aimed at stemming capital outflows and curbing inflation. However, the foreign reserve outflows

[8] Evaluating the determinants and consequences of discretionary trade policy is also a topic of independent and growing interest. Recent papers explore the discretionary nature of Trump's trade war, either looking at tariff exemptions going to US firms based on their locations (Kim and Yoon, 2021), or inferring retaliatory non-tariff barriers imposed by China from unusual import patterns (Chen et al., 2022). Bernini and Garcia-Lembergman (2020) study how a previous system of Argentinian import licenses affected exporters. Special economic zones also allow countries to provide tariff reductions to those firms within the zone (potentially to price-discriminate across buyers, as argued by Grant, 2020).

continued and in February 2012, the government launched a sweeping new system of trade interventions to stem these outflows—the DJAI, which is the focus of this paper. The DJAI system went far beyond the non-automatic import licenses (NAILs) that preceded it which targeted a small subset of imported product categories.[9]

Enforcement of the DJAI system stopped on November 1st 2015, a week after an unexpectedly strong presidential election tally by the opposition forced a run-off election. The challenger, Mauricio Macri, won the run-off and the new government formally repealed the DJAI system on December 22nd, returning to a regime of automatic import licenses for most products (WTO, 2016). While the Macri administration imposed NAILs for a subset of products, these did not draw WTO complaints; and as we show below, virtually all import requests were approved during his term. We now turn to describing the DJAI system in more detail.

II.B Argentina's DJAI System

The DJAI system greatly expanded the extent of Argentina's discretionary trade policy, both by covering all imported products and by tying the release of foreign currency to approvals. Prior to importing, every firm had to request government authorization specifying the value, quantity, origin, and product code. Four different government agencies could block requests at their discretion. Blocked requests were placed in "observation" status, with firms potentially able to appeal the decision by identifying and contacting the agency that had placed the block. Once an import was approved, the Central Bank released foreign exchange, authorized letters of credit, or issued bank guarantees allowing the importer to pay the exporter. Customs allowed shipments to pass through only after approval (with firms having 180 days from the initial request to import the product).

No law or regulation was ever published stipulating the requirements to approve an import request. In informal communications with the general public and firms, government officials stated that the DJAI system's goals were to limit imports, improve the trade balance, foster import substitution and local investments, protect domestic workers and firms, and curb inflation.[10] Many of these policies violated WTO agreements, with three WTO investigations and rulings against Argentina providing further specifics on the trade-related requirements imposed on firms wishing to import (WTO, 2014, 2015). These included (i) offsetting the value of imports with an equivalent value of exports (often referred to as the one-to-one requirement), (ii) limiting imports in volume or in value, and (iii) making investments in Argentina.[11] To meet these goals, the government asked importers to submit information on past and projected imports, exports, investments and employment, as well as their total sales and fraction of foreign capital in total capital. Appendix B provides further details on the DJAI.

[9] The NAILs applied to four 8-digit products in 1999, to 200 in 2008 (5% of import value) and to 600 on the eve of the DJAI (17% of import value)(Bernini and Garcia-Lembergman, 2020).

[10] See Conconi and Schepel (2017) and Torretta and Vechio (2012) for further description of the policy context. For explicit statements from government officials see, for example, PEI (2011) or Giorgi (2012).

[11] The WTO Panel and Appellate Body also found evidence that firms were required to reach a certain level of local content in domestic production and, if foreign owned, to refrain from repatriating profits. Appendix B.3 contains additional details about the WTO disputes.

II.C Data Sources

We obtained access to confidential data on the universe of *import requests* filed as part of the DJAI system between January 2013, when digital bookkeeping started, and December 2017 (even though the Macri government disbanded the DJAI in December 2015, the electronic record-keeping system remained in place)—Secretaria de Comercio (2011-2017). For each request, we observe a firm identifier, the value and quantity requested, an 11-digit HS product code (HS11), the country of origin, and the measurement unit.[12] Crucially, we also observe the quantity and value that was approved. Throughout the paper, we define a "product" as a unique 11-digit code, origin, and measurement unit triplet.

The same data source reports records for the universe of actual trade transactions (quantity and value imported and exported) from January 2011 to December 2017 using the same firm and product identifiers. We validate that our trade data closely tracks aggregates from the OECD (Appendix Figure A.1). We also obtain information on the 6-digit HS codes covered by the NAILs system in place before and after the DJAI period from the Global Trade Alert (2011-2017) database.

To better understand the firm and industry level determinants of the DJAI trade restrictions, we match the firm-level identifiers in our trade datasets to the Dun & Bradstreet 2011 database (henceforth, D&B). This database provides the sales, employment, and ownership structure for each firm. We successfully match 68.5% of firms, representing 94.1% of value imported in our data.[13]

III Import Restrictions Across Firms, Products, and Time

In this section, we describe how the DJAI trade restrictions varied across firms, products, and time. Section III.A documents that the government frequently rejected import requests and that policies were more often firm-specific than product-specific. Section III.B examines the firm and product characteristics associated with higher protection, and compares these patterns to accounts from government officials and WTO investigations. Section III.C explores the variation in the severity of the restrictions over time and links it to macroeconomic conditions. Finally, Section III.D shows that declines in approval rates with the size and number of requests served as a deterrence to firms inflating requests.

We exploit the features of the firm, product, and time variation that we discuss here to construct an instrument to estimate both the causal effects of Argentina's quantitative restrictions and the key parameters for the design of optimal policy, as we discus in later sections. Given the paucity of empirical evidence on import licensing regimes, and discretionary trade policies more generally,

[12] The product code is an 11-digit code that combines an 8-digit HS (Harmonized System) code with an extra 3-digit code specific to Argentina. For example, the 8-digit code 8450.11.00 pertains to automatic washing machines with capacities under 10kg. The corresponding 11-digit codes offer more granularity, distinguishing between front-loading washers (8450.11.00.119), front-loading washer dryers (8450.11.00.219), and top-loading washer dryers (8450.11.00.390).

[13] We do not expect to match 100% of firms since our D&B data come from 2011, so importing firms that opened between 2012 and 2017 are unmatched. Using the Ultimate Parent Company (UPC) field we identify ownership for 7.5% of our firms covering 72.4% of import value, and we assume firms are domestically owned if there is no UPC. Through this approach we classify 6.0% of firms (accounting for 47.7% of import value) as foreign owned.

these descriptive findings are also of independent interest for scholars of trade policy.

III.A Approval Rates Across Requests

We start by exploring the frequency of approvals at the request level during and after the DJAI system. While the DJAI was in place, rejections were frequent and almost always full rather than partial: 29.2% of import requests were fully denied (36.5% of value requested) with a further 1.3% (2% of value) partially denied, as shown in Table 1. With the repeal of the DJAI system under the Macri government, 98.1% of requests covering 89.5% of value were fully approved, with the few rejections coming in product categories for which NAILs were still in place.

Table 1: Requests and Approvals: Descriptive Statistics

	During DJAI	Post DJAI
Number and Value of Requests and Approvals		
Requests per year	3,413,878	2,623,489
Requests fully approved	69.5%	98.1%
Requests partially approved	1.3%	0.2%
Requests fully rejected	29.2%	1.7%
Total value approved	63.5%	89.5%
Variance Decomposition of Approval Rates		
Normalized total sum of squares	0.210	0.015
Fraction explained by firm IDs	24.6%	10.6%
Fraction explained by product IDs	2.2%	8.5%

Notes: Table presents summary statistics for individual requests, approvals, and rejections across the universe of import license requests. The during DJAI period runs from January 1st, 2013 to October 31st, 2015. The post DJAI period runs from January 1st, 2016 to December 31st, 2017. We exclude the period November 1st, 2015 to December 31st, 2015 when elections occurred and power was transferred between political parties. Variance decomposition comes from the regression $AR_{sfi} = \mu_f + \mu_i + \varepsilon_{sfi}$ where AR_{sfi} is the ratio of quantity approved to quantity requested, s is an import request, f is a firm, i is a product (defined as a HS11-unit of measurement-origin combination) and μ_f and μ_i are firm and product fixed effects. We normalize the total sum of squares dividing by the degrees of freedom. The fraction of variation explained by firm IDs and product IDs is defined as partial SS/total SS, where SS stands for sum of squares. The partial SS is the residual SS excluding the variable minus the residual SS including the variable.

Were these approval decisions uniform across products and firms, and which of these dimensions mattered more? We project the share of the requested quantity that is approved, henceforth the approval rate, on firm and product fixed effects, with products narrowly defined as HS11-unit of measurement-origin triplets.[14] During the DJAI period, firm identities account for 24.6% of the

[14] To ensure that the fixed effect estimates are comparable, as in the two-way fixed effects literature, we restrict attention to the largest connected set of firms and products (containing more than 99% of firms and products).

total variance in approval rates while product identities account for only 2.2% (Table 1, column 1). The DJAI is therefore better described as a system of firm-specific trade policies, in contrast to the sector- or product-specific policies typically studied in the trade literature. Consistent with the Macri administration imposing a less discretionary and less restrictive approval system, the total variation in approval rates falls by a factor of 14 post DJAI. The policy also shifted towards targeting products rather than firms with the share accounted for by each becoming roughly similar (Table 1, column 2).

Section III.B explores the firm and product characteristics driving both these sources of variation in approval rates. However, as seen in the variance decomposition above, about three quarters of the variation remains unexplained after including firm and product fixed-effects. Section III.C investigates the variation over time and Section III.D the variation within the same firm and product depending on the size of the request.

III.B Variation in Approval Rates Across Firms and Products

We now turn to understanding the determinants of the DJAI policy and assessing whether they align with those extracted from statements by government officials and WTO investigations outlined in Section II.B. We group these characteristics into those that relate to international trade, investment, ownership, and firm size. Additionally, we explore whether these determinants operated at the firm-level, the product-level, or a combination of both.

To do so, we project firm-product level approval rates on a range of firm characteristics X_f and, in some specifications, HS11 product category characteristics Z_h, both measured in 2011 just prior to the DJAI period:[15]

$$AR_{fi} = \beta X_f + \gamma Z_h + \varepsilon_{fi}, \tag{1}$$

where approval rates AR_{fi} are at the firm f and product i level, with the product again narrowly defined as an HS11-unit-origin combination. To construct these approval rates, we take the ratio between the total quantity approved and the total quantity requested throughout the entire DJAI period. While different models of importer-policymaker interactions would suggest alternative aggregations, our definition is simple and transparent (see Section 3.4 for additional justification).[16]

Column 1 of Table 2 considers firm-level determinants X_f. We include all the covariates in the same regression, hence the coefficient on any one characteristic provides us with a conditional association.[17] To examine the goal of reducing imports and achieving firm-level trade balance, we include firm-level import and export values and a dummy for whether the firm has a trade surplus (applying the inverse hyperbolic sine transformation to imports and exports to allow for zeroes).

[15]We use the pre-DJAI period values to avoid reverse causality from the policy to the firm-level characteristics, such as a firm's trade surplus or employment. One remaining concern is that the government may have targeted similar industries under the DJAI system to the the industries targeted by the NAILs regime that preceded it inducing serial correlation in the error term. As we show in Appendix Table A.1, our findings are close to unchanged when excluding all products covered by NAILs prior to the DJAI.

[16]The patterns we describe next are virtually unchanged if instead we use the share of value approved or compute simple averages of request-level approval rates (see Appendix Tables A.2 and A.3).

[17]For completeness, Appendix Figure A.2 reports the pairwise correlations between all characteristics.

Table 2: Relationship Between DJAI Approval Rates and Firm and Product Category Characteristics

		Dependent Variable: Approval Rate					
		Complete DJAI Period				1^{st} Quarter of DJAI	
		(1)		(2)		(3)	
Firm-Level Characteristics							
Trade	IHS Imports	0.023***	(0.000)	0.012***	(0.000)	0.020***	(0.000)
	IHS Exports	0.0066***	(0.000)	0.0050***	(0.000)	0.0018***	(0.000)
	$\mathbb{1}$\{Trade Surplus\}	0.031***	(0.001)	0.0021**	(0.001)	0.018***	(0.002)
Investment	IHS K Imports	0.0063***	(0.000)	0.0034***	(0.000)	0.0044***	(0.000)
Ownership	$\mathbb{1}$\{Domestic Own.\}	0.027***	(0.001)	-0.026***	(0.001)	-0.021***	(0.001)
Size	log(Revenue)	0.020***	(0.000)	-0.0079***	(0.000)	-0.0052***	(0.000)
	$\mathbb{1}$\{Rev. miss.\}	0.34***	(0.002)	-0.15***	(0.003)	-0.11***	(0.005)
	log(Employees)	-0.017***	(0.000)	0.012***	(0.000)	0.0072***	(0.000)
	$\mathbb{1}$\{Emp. miss.\}	-0.041***	(0.002)	0.072***	(0.002)	0.066***	(0.004)
Product Category-Level Characteristics							
Trade	IHS Imports			0.041***	(0.001)	0.038***	(0.001)
	IHS Exports			0.00025	(0.000)	0.0023**	(0.001)
	$\mathbb{1}$\{Trade Surplus\}			0.017***	(0.001)	0.016***	(0.001)
Investment	IHS K Imports			-0.016***	(0.000)	-0.020***	(0.001)
Ownership	$\mathbb{1}$\{Domestic Own.\}			0.013***	(0.001)	0.0094***	(0.002)
Size	log(Revenue)			0.014***	(0.000)	0.012***	(0.001)
	log(Employees)			-0.029***	(0.000)	-0.025***	(0.001)
Observations		991,322		931,175		200,331	
R^2		0.881		0.892		0.923	
F-statistic		1,406,604		851,837		354,522	

Notes: Table shows regressions of firm-product-level approval rates on firm and product category characteristics. The approval rate AR is the firm-product ratio of total quantity approved to requested during the whole DJAI regime, January 2013 to October 2015 (columns 1 and 2), or during its first quarter, January to March 2013 (column 3). The firm and product category characteristics are calculated using 2011 data, before the start of the DJAI regime. Revenue and employment data come from the D&B database and are not recorded for all firms, so we code missing values as zero and include a dummy for missing observations as a separate regressor. We code firms without an Ultimate Parent Company code (also from D&B) as domestic. For the product-category-level aggregates, we first aggregate the raw levels before taking IHS or log transformations, weighting raw levels by 2011 import values except employment and revenues where we simply sum over all importing firms. Product-category-level characteristics are at the HS11 level and approval rates are at the firm-HS11-origin-measurement unit level. Robust (HC3) standard errors shown in parentheses. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

Consistent with the one-to-one requirement (WTO, 2014, 2015), we find that large exporters and firms with a trade surplus in 2011 were more likely to be approved for imports in the DJAI period.[18] Next, we find that larger importers in 2011 were more, not less, likely to be approved in the DJAI period. While at odds with the government's rhetoric of reducing imports, this finding is consistent with a desire to limit disruptions in the domestic economy as well as with large importers being more adept at navigating the DJAI system.

We next assess the goal of fostering investments in Argentina. Consistent with this objective, we find that approval rates were increasing in firm-level capital good imports in 2011, which provide a proxy for investment.[19] Similarly, domestically-owned firms were treated more favorably, a finding that is broadly consistent with the government's nationalistic rhetoric. Finally, firms with higher revenue or lower employment in 2011 featured higher approval rates in the DJAI period.[20] The coefficients are positive on both the revenue and employment firm-size measures when only one of the two is included (Appendix Table A.5). This is consistent with the government helping larger firms but, conditional on revenues, disfavoring larger employers, contradicting the stated goal (e.g., see Giorgi, 2012) of protecting domestic workers. Since the magnitudes of the two coefficients are similar but of opposite sign, another interpretation is that the government prioritized firms with high labor productivity. Taken together, we find supporting evidence for several of the government-stated determinants of the DJAI policy.

Column 2 of Table 2 adds to our previous specification the product-level analogues, Z_h, of the firm-level variables. We take import-value weighted averages within HS11 product categories h; this product definition is closer to both the level of granularity that product-specific trade policy is typically conducted at and that governments may make industrial policy decisions at. We find that both firm and product-level characteristics mattered. For the set of trade variables, signs and magnitudes are similar for both. This means, for example, that products with larger total exports, and firms with higher exports within product categories, both received higher approval rates. The picture is more nuanced for the remaining determinants.[21]

Finally, we repeat the exercise using the approval rates from just the first 3 months of the DJAI regime covered by our data (Table 2, column 3). Results are very similar. The predicted values from this specification are a key input to constructing shift-share type instruments for changes in approval rates that we introduce in the next section. While we have endeavored to evaluate the

[18] Reassuringly, Appendix Table A.4 continues to find a significant discontinuity in approval rates for firms with a positive trade balance when conditioning on cubic polynomials of the log ratio of exports to imports as well as more flexibly accounting for firms with zero exports or imports.

[19] Firm-level investment data is not available in any of our databases. We define capital goods using a UN correspondence from 6-digit HS codes to broad economic categories (https://unstats.un.org/unsd/trade/classifications/correspondence-tables.asp) and again take the inverse hyperbolic sine.

[20] As revenue and employment data come from D&B and we only match two thirds of the firms via tax identifiers, we code missing values as zero and include a dummy for missing observations as a separate regressor.

[21] While column 1 showed that the government granted higher approval rates to firms that imported more capital, column 2 shows this comes through disfavoring all but the biggest capital importers in product categories with large amounts of investment. Meanwhile, the favorable treatment of domestically-owned and high labor productivity firms seen in column 1 was driven by product-level variation, with the government actually disfavoring domestic firms compared to foreign ones within product categories and similarly high labor productivity firms compared to low.

major determinants of approval rates mentioned by government officials and WTO reports, for our primary goal of building an instrument we will not require the list of determinants to be complete. Furthermore, a Lasso approach will select the categories that provide the strongest first stage.

III.C Variation in Approval Rates Over Time

We now turn to exploring how the probability of approval varied over time within the DJAI period. The top panel of Figure 1 (solid line) plots the share of requested value approved at a monthly frequency and shows that there was substantial heterogeneity in the overall approval rate during the DJAI. At the start of our data, about 85% of the value requested was approved. The share approved fell rapidly to around 50% in late 2013, from where it started an uneven recovery to about 70% followed by another fall to 60% at the tail end of the DJAI regime. After the general election of October 25th, 2015, when the DJAI policy stopped being enforced, there was a sudden and permanent jump in the share of requested value approved.[22]

This variation in the stringency of the policy was closely related to macroeconomic conditions. In particular, approval rates co-moved with the level of international reserves in the DJAI period, as shown in the top panel of Figure 1 (dashed line). The R^2 for the regression of the share of value approved on reserves is 0.663 during the DJAI.

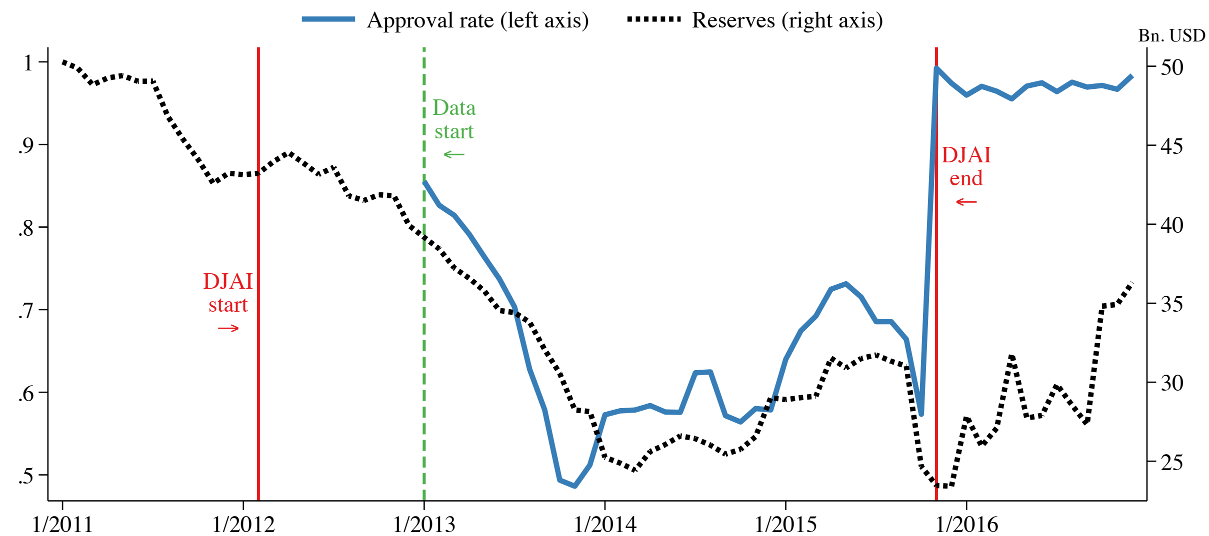
To understand this co-movement between foreign reserves and import restrictions, it is first worthwhile spelling out the link between exchange rate stabilization objectives and import licensing. In late 2011, in the context of a deteriorating macroeconomic outlook and rising current account deficit, there was growing pressure on the exchange rate. In order to limit the inflationary consequences of a devaluation, the government attempted to stabilize the exchange rate by strengthening exchange controls. Hence, a gap between the formal and informal exchange rates began to open up (bottom left panel, Figure 1). This gap constituted a subsidy to imports, which were paid for at the official exchange rate. As a consequence, the relative demand for imports versus exports increased through 2012 (bottom right panel, Figure 1), draining international reserves. The DJAI system allowed the government to stem the reserves outflow by rejecting import requests. However, the pressures on the exchange rate and foreign reserves did not abate during the DJAI period, and variants of this sequence of events were repeated throughout the next three years—with the fraction of rejected requests increasing at times when the gap between the official and unofficial exchange rate grew and reserves dwindled.

Below, we rely on this relationship between macroeconomic fluctuations—captured by Argentina's foreign reserve position—and import restrictions during the DJAI, along with the previous cross-sectional determinants, to obtain plausibly exogenous variation in trade policies. The pattern of falling, rising, then falling reserves, that we later exploit (depicted in the top panel of Figure 1) was driven by a number of macroeconomic forces. CEPAL (2013; 2014; 2015) highlights substantial

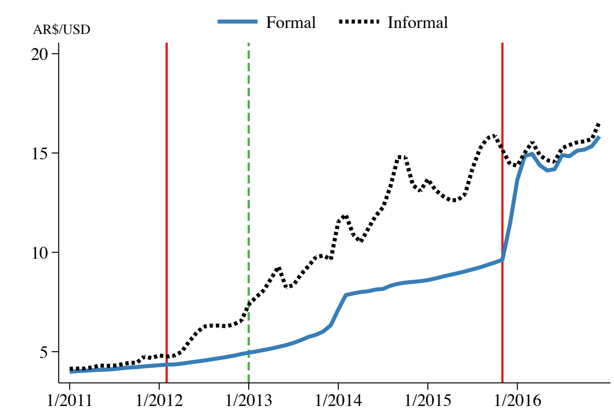
[22] Appendix Figure A.3 shows daily approvals around the time of government transition. A few days after the general election of October 25th, 2015, and before the runoff election of November 22nd, the outgoing government started approving most requests. The new government took office on December 10th, and formally repealed the DJAI system on December 21st. We see a significant spike in requests (all approved) on that date and, in the following weeks, the new government approved almost every request.

Figure 1: Approvals, Foreign Reserves, Exchange Rates, and Trade Over the DJAI Period

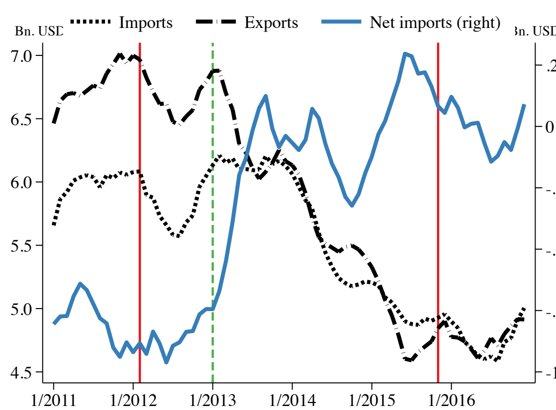
(a) Approvals and foreign reserves over time



(b) Formal and informal dollar exchange rates over time



(c) Imported and exported value over time



Notes: The solid vertical lines indicate the first and last months when the DJAI system was in place. The dashed vertical line indicates the start of our import request data series. Panel A plots the monthly time series of the share of requested value approved (solid line, left axis) and foreign currency reserves (dashed line, right axis). Reserves are monthly averages of the level of foreign currency reserves from FRED (Federal Reserve Bank of St. Louis). The R^2 for the regression of approval rates on reserves is 0.663 from January 2013 to October 2015 and 0.034 from November 2015 to December 2016. Panel B: average monthly exchange rate in the formal market (from BCRA, the Argentinian Central Bank) and in the informal market (from Ambito.com). Panel C: monthly value of net imports (imports−exports), imports and exports from FRED, smoothed with a 12-month centered moving average.

movements in the value of energy imports due to historically high global energy prices and years of disinvestment in the oil and gas sector (Argentina became a net importer of energy in 2011), a slowdown in the Brazilian economy (the main destination for Argentina's manufacturing exports), a fall in the international price of soybeans (Argentina's largest export), as well as shocks to consumer spending abroad (fueled by the fact Argentinians in foreign countries could exchange currency at the official rate).[23] In addition to these fluctuations, a series of notable foreign debt repayment events, coupled with limited access to external credit in part due to legal disputes regarding debt defaulted on in 2001, directly impacted reserves by similar magnitudes.[24]

III.D Was the Policy Binding?

The nature of the DJAI system raises the question of whether firms managed to import unconstrained amounts by inflating the size or frequency of their requests. Our main empirical analysis in Section IV shows that plausibly exogenous reductions in approval rates reduced the total quantity of firm-product imports, establishing that the policy did affect imports and that firms were not able to fully "game the system". We provide here two preliminary pieces of evidence suggesting that the quantity restrictions indeed had bite (see Appendix C for details).

First, assuming that approval rates were not fully predictable at the time of making a request, we can test whether firms were effective at inflating the size or number of requests in order to import their desired amount. In that scenario, quantities approved would have translated by less than one-for-one into quantities imported: firms would have imported their full approved allowance when approval rates were lower than expected, but less than their allowance when approval rates were higher than expected. However, we find one-for-one pass-through of approvals into imports, thus rejecting the null that firms were able to fully game the system (Appendix Figure C.1).

Second, inflating requests was costly, since approval rates were declining both in the requested quantity and in the number of requests per quarter, conditioning in both cases on firm-product-quarter fixed effects (Appendix Figure C.2, with no such penalty observed in post DJAI).

Motivated in part by the possibility that successive requests may not be independent, when analyzing the impacts of the policy we aggregate the quantities requested, approved, and imported over quarters. We summarize the stringency of the DJAI by this aggregate approval rate, defined as the total quantity approved divided by the quantity requested over each quarter.[25]

[23] As we discuss in Section IV.B.3, our later results are robust to excluding energy sector imports and tourism expenditures are not included in our import data.

[24] In this context, legal rulings, such as that of the US Supreme Court in June 2014 requiring Argentina to pay hedge funds who had not participated in its debt restructuring, also had an impact on the gap between the formal and informal exchange rates and on the path of reserves (CEPAL, 2014). Appendix Table A.7 lists these debt-related events and Appendix Figure A.4 displays impacts on reserves.

[25] While transparent and model free, our aggregate approval rates are likely to be monotonic transformations of the payoff-relevant severity of the restrictions. We note that our key price regressions will not utilize approval rates.

IV The Effects of Import Restrictions on Quantities and Prices

We now turn to exploring the impact of Argentina's quantitative trade restrictions on import quantities and prices. The effect on quantities establishes that these policies were binding, while the effect on prices speaks to terms of trade effects and to the nature of international price setting. Did prices paid by Argentinian importers fall with the quantity restrictions, as a neoclassical trade model would predict, or did they increase as in models with foreign market power? In this section, we first graphically explore the evolution of prices and quantities for products and firms that were more or less restricted. Then, we develop an instrumental variable strategy that leverages policy heterogeneity across firms, products, and time. In the subsequent two sections, using a trade model, we build on the empirical strategy from this section to estimate key parameters that inform the extent of domestic versus foreign market power, as well as the role of that market power in shaping the impacts of trade policy.

IV.A Quantities and Prices Pre, During, and Post the DJAI Period

We focus on prices paid by Argentinian importers to foreign sellers at the border (i.e., exclusive of tariffs). Controlling for firm-product fixed effects, we find that, on average, quantities fell 46.7% and prices rose by 5.4% between the pre DJAI (2011) and during-DJAI (2012-2015) periods (see Appendix Figure A.5). Both trends reverted comparing the during-DJAI and post-DJAI (2016-2017) periods. We observe similar patterns on the extensive margin (number of firms importing or products per firm).

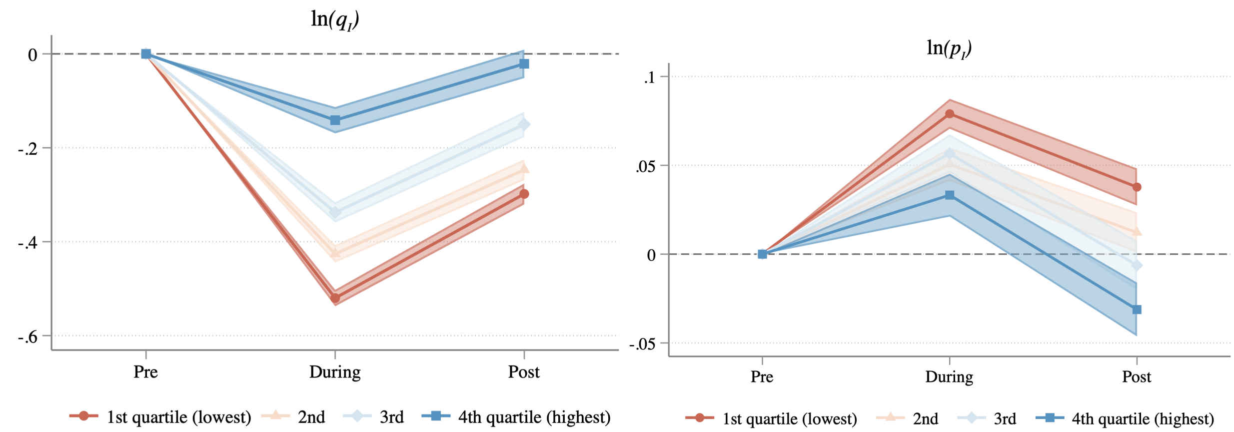
These patterns may conflate time trends due to, for example, exchange rate fluctuations (most obviously, recall that the DJAI was a response to a growing gap between formal and informal exchange rates that raised relative demand for imports). Additionally, price rises may be driven by features of the system itself, beyond the quantitative restrictions, namely the additional administrative burden the system imposed.[26] As a first step to making causal statements, we explore the evolution of quantities and prices across firm-product pairs that were differentially restricted by the DJAI system. We group firm-products into quartiles of approval rates predicted from pre-DJAI characteristics using the estimates from the previous section (column 2, Table 2). The lowest quartile are those whose pre-DJAI characteristics were associated with the lowest likelihood of approvals during the DJAI.

Regressing annualized log quantities and prices on firm-product fixed effects and quartile-specific period dummies, we find that firm-product pairs for which the policy was more stringent experienced relatively larger reductions in import quantities (Figure 2, left panel) and higher price increases (right panel) during the DJAI. If these price effects are causal, as we seek to show next, they run counter to standard competitive trade models where trade restrictions reduce import prices.[27]

[26]We note that the direct costs were small given the simple logistics of filling out the declaration.

[27]To fully establish that the terms of trade worsened, we also need to measure impacts on export prices. We find that export prices were unrelated to the firm-product level stringency of the DJAI policy (Appendix Figure A.6). This implies that the ratio of export to import prices within firm-products deteriorates with the stringency of the import restrictions. Like most papers studying the impact of import restrictions, our empirical strategy cannot

Figure 2: Quantities and Prices Pre, During, and Post DJAI by Quartiles of Approval Rate



Notes: Plots of the μ_{tj} fixed effects from estimating $y_{fit} = \mu_{tj} + \mu_{fi} + \epsilon_{fit}$ where t is a period, i is a (HS11-origin-unit) product, f is a firm, and j is the (firm-product-specific) quartile of predicted approval rates based on pre characteristics (using the coefficients in column 2 of Table 2). The dependent variable is annual firm-product log quantities in the left panel and annual firm-product log import prices (quantity weighted across shipments) in the right panel. The pre DJAI period runs from January 2011 to January 2012, during from February 2012 to October 2015, and post from January 2016 to December 2017. Standard errors are clustered at the firm-HS4 product level with shading denoting 95% confidence intervals.

While this difference-in-difference analysis mitigates the two endogeneity problems raised above, time trends and the burden of submitting to the DJAI, two identification concerns remain. The first is reverse causation, i.e., the worry that predicted approval rate quartiles capture responses to changes in quantities or prices rather than vice versa.[28] The second concern with a three-period panel analysis is that the firms and sectors targeted by the government may have been on different trajectories or simultaneously exposed to other policies during this period. Notably, this period spanned both major policy changes by the Fernández de Kirchner government (e.g., restrictions on US dollar purchases) and subsequent policy reversals due to the unexpected turnover in political regime when Macri won the election. As a result, firms and products that benefited most from other government policies between the pre and during periods may have benefited least between during and post, and vice versa. Thus, to provide causal evidence that the DJAI system raised prices by restricting quantities, we now turn to exploiting more granular heterogeneity in the application of discretionary trade policy and focus on the variation over time *within* the DJAI period, when such reversals are less plausible.

capture economy-wide effects. However, we are not aware of models where export prices would rise relative to import prices, while at the same time import prices rise more in the varieties the policy restricts the most, as we find.

[28]Predicted approval rates come from projecting DJAI-period approval rates on pre-DJAI characteristics and so are potentially functions of DJAI policies. That said, given the policy objective of restricting imports, policymakers are likely to respond to rising import quantities of particular products or firms by setting low approval rates. Thus, we expect relative quantities to rise for more restricted firm-product pairs due to reverse causality, not fall as we find.

IV.B Causal Impacts Using Variation in Macro Imbalances During the DJAI

To answer the central question of how DJAI-induced quantity restrictions affected import prices, we now regress log prices $\ln(p_{fit})$ at the firm f, product i (again defined as HS11-origin-unit of measurement triplet), and period t level on log quantities imported, $\ln(q_{fit})$:

$$\ln(p_{fit}) = \beta \ln(q_{fit}) + \mu_{fi} + \gamma_t + \mu_{fi}t + e_{fit}. \tag{2}$$

As discussed in the previous section, for more credible identification, we focus only on variation within the DJAI period, with t indexing the eleven quarterly periods spanning the second quarter of 2013 through the last quarter of 2015.[29] μ_{fi} and γ_t are firm-product and quarter-year fixed effects that capture firm-specific product characteristics and common time trends. We also include firm-product specific linear trends, $\mu_{fi}t$, to capture the possibility that individual firm-products are on different trajectories. As before, prices are quantity-weighted averages of shipment-level unit values. Since we log quantities, and prices are only available for positive imports, we implicitly focus on the intensive margin. We turn to the extensive margin later in this section.

The focus on variation within the DJAI period provides protection from biases related to changes in wider policy regimes. However, given the discretionary nature of the DJAI system, approval rates may still respond to import quantities and values or to underlying determinants observed by the policymaker but not us. We therefore propose a set of instrumental variables for $\ln(q_{fit})$ that exploit plausibly exogenous variation in approval rates coming from the interaction of pre-determined firm and sector characteristics and external macroeconomic imbalances.

IV.B.1 Building the Policy Instrument

As we have shown in Section III.C, the overall level of approval rates during the DJAI system fell, rose, and then fell again, as the government used quantity restrictions to stem the loss of reserves during periods of macroeconomic turmoil. Approval rates also varied substantially across firms and products according to the policy preferences described in Section III.B. When these two objectives conflicted, the government might have changed its targeting of firms and products. Specifically, when imports needed to be reigned in due to macroeconomic concerns, the government could have responded either by further restricting the firms it had previously targeted, or by targeting initially more-favored firms.

In order to evaluate these possibilities and build intuition, we first project quarterly approval rates during the DJAI on interactions between initial approval rates and external reserves. These interactions will ultimately serve as instruments for quantities in equation (2). This additional step of detailing impacts on approval rates shows how the instruments affected trade policy over the DJAI period. The first stage regression of quantities on the instruments (that we report in Section

[29] We exclude the first quarter of 2013 as we use that period to measure the predicted initial approval rates that form part of our instrument. As discussed in Section III.D, our choice of three-month periods ensures that our measure of total imported quantity captures both the average quantity approved per request and the number of requests over the three months, reducing the possibility that our inference is skewed by firms gaming requests. As shown in Appendix C, approved requests must be imported within 6 months of the request and pass-through is almost complete within 3 months. For robustness, we also present results using half-yearly variation.

IV.B.2) combines the impacts on both approval rates and firms' reactions to approval rates.

Specifically, we regress approval rates AR_{fit} at the firm-product-quarter fit level on interactions between external reserves $\ln(Reserves_t)$ and predicted initial approval rates $\widehat{AR}_{fh}^{Q1\text{-}13}$ at the firm-HS11 product category fh level. We construct $\widehat{AR}_{fh}^{Q1\text{-}13}$ using the predicted values we obtained from column 3 of Table 2 that projects approval rates in the first quarter of 2013—the earliest quarter in which approvals data were recorded—on pre-DJAI firm and product category characteristics. Our regressions are run on subsequent quarters, the second quarter of 2013 through the fourth quarter of 2015. We start with a simple linear interaction; however, given our flat priors on how targeting changes with macroeconomic conditions, we also explore various powers of both $\ln(Reserves_t)$ and $\widehat{AR}_{fh}^{Q1\text{-}13}$ as potential instruments:

$$AR_{fit} = f\left(\ln(Reserves_t), \widehat{AR}_{fh}^{Q1\text{-}13}; \kappa\right) + \mu_{fi} + \gamma_t + \mu_{fi}t + v_{fit}. \tag{3}$$

Once again we include firm-product and time fixed effects as well as firm-product specific linear time trends. Standard errors, here and for the two-stage least squares specification below, are two-way clustered at the firm-product fi level and the HS11 product category h to account for serial correlation in the errors across quarters. We explore alternative clusterings below.

Table 3 reports the results of these regressions. Column 1 imposes a linear interaction term. We find a positive and highly significant coefficient. Firms and product categories with initially higher predicted approval rates experienced larger drops in approval rates when reserves fell. It appears that, at least in relative terms, there was a reversal of fortune as the government, wanting to stem the outflow of foreign reserves, turned to restricting imports of firms and product categories it had initially favored. Given our limited understanding of the relationship between trade policy and macroeconomic imbalances, this is a result of independent interest.

Column 2 replaces the independent variable with interactions between powers of approval rates and reserves (both up to the fourth order) selected by an IV Lasso run on the price on quantity regression, equation (2).[30] The Lasso selects a single instrument, $\ln(Reserves_t)^4 \times (\widehat{AR}_{fh}^{Q1\text{-}13})^4$, with projections of approval rates on this interaction again showing a positive and significant coefficient, suggesting the reversal in fortune has curvature. Finally, column 3 allows for different firm and product category characteristics to matter more as certain policy objectives may be faster to be abandoned when reserves fall. To do so, we interact powers of reserves with powers of predicted approval rates broken up into the portions accounted for by the trade, investment, ownership and size characteristics examined in Section III.B. An IV Lasso (with the first stage again regressing $\ln(q_{fit})$ on the instrument set) picks two interactions, one with trade-related and one with ownership-related characteristics, with the former driving our "reversal of fortune".

IV.B.2 The Causal Impact of Import Restrictions on Quantities and Prices

We now turn to our main specification, regression (2), that examines the price effects from changes in quantities induced by the DJAI restrictions. As previewed above, for our baseline

[30] Specifically, the IV Lasso selects among instruments from the following first stage regression: $\ln(q_{fit}) = f(\ln(Reserves_t), \widehat{AR}_{fh}^{Q1\text{-}13}; \kappa) + \mu_{fi} + \gamma_t + \mu_{fi}t + v_{fit}$.

specification we instrument quantities with interactions between powers of external macroeconomic imbalances and predicted initial approval rates. The IV Lasso selects a single interaction term with the following first stage:[31]

$$\ln(q_{fit}) = \phi \ln(Reserves_t)^4 \times (\widehat{AR}_{fh}^{Q1\text{-}13})^4 + \mu_{fi} + \gamma_t + \mu_{fi}t + \eta_{fit}. \quad (4)$$

We have already shown above that this interaction term correlates strongly with actual approval rates. As shown in column 1 of Table 4, the first stage regression of quantities on the interaction shows that these instrument-induced increases in approval rates carry through to quantities with a highly-significant positive sign on the coefficient ϕ (the first stage is strong with a Cragg-Donald first-stage F statistic of 326.6). Thus, the first stage estimate establishes that the import restrictions

Table 3: Approval Rates and Lasso-Selected Instruments

	Linear	Lasso	Alt. Lasso
	AR_{fit}	AR_{fit}	AR_{fit}
$\ln(Reserves_t) \times (\widehat{AR}_{fh}^{\text{Q1-13}})$	0.267***		
	(0.0250)		
$\ln(Reserves_t)^4 \times (\widehat{AR}_{fh}^{\text{Q1-13}})^4$		0.000427***	
		(0.0000532)	
$(\ln(Reserves_t))^4 \times (\widehat{AR}_{Trade,fh}^{\text{Q1-13}})^4$			0.0000715***
			(0.0000141)
$(\ln(Reserves_t))^4 \times (\widehat{AR}_{Ownership,fh}^{\text{Q1-13}})^2$			-0.294**
			(0.130)
Time (t) FE	Yes	Yes	Yes
Firm-Product (fi) FE	Yes	Yes	Yes
Firm-Product (fi) Trends	Yes	Yes	Yes
Observations	2,155,766	2,155,766	2,167,721

Notes: Column 1 regresses quarterly approval rates on the interaction between log reserves and the predicted initial approval rate. Column 2 replaces the independent variable with the interaction chosen by the IV Lasso procedure from regressing log prices on log quantities and instrumenting log quantities with interactions of powers of log reserves and predicted initial approval rates (See Section IV.B.2). Column 3 replaces the independent variable with the interaction chosen by the same Lasso procedure but separating out the components of predicted initial approval rates into different subsets of the firm and product characteristics examined in Section III.B: trade, investment, ownership, and size. Sample covers the second quarter of 2013 to the last quarter of 2015 with t denoting quarters. Predicted initial approval rate calculated from approval rates in the first quarter of 2013 projected on firm and product category characteristics from 2011 (column 3 of Table 2). Standard errors two-way clustered at the firm-product level and HS11 product category level shown in parentheses. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

[31] Given our large number of fixed effects and trends, for computational feasibility we first regress $\ln q_{fit}$ on the fixed effects in equation (4) and then run the Lasso via the ivlasso command in Stata on the residualized $\ln q_{fit}$. We report two-way clustered standard errors from running the regressions with the selected instruments directly, as the standard errors are strictly larger than those produced by ivlasso. For robustness, we also present bootstrapped standard errors, drawing firm-product pairs with replacement and running the full two-step lasso procedure.

of the DJAI system were effective at reducing quantities.

We now present our estimates of the impact of these DJAI-induced quantity restrictions on import prices. Column 2 reports the OLS regression of log prices on log quantity imported, specification (2). We find a negative relationship, with an elasticity of -0.189 that is hard to interpret given endogeneity issues endemic to regressing prices on quantities. Column 3 reports the IV regression and finds that DJAI-induced quantity restrictions (coming about through the changes in targeting induced by deteriorating macroeconomic conditions that lie behind our instrument) increased prices with an elasticity of -0.133. A 10% drop in the quantity imported raised firm-product prices by 1.3%.[32] Column 4 reports the reduced form.

Can we interpret these IV estimates as causal? The identifying assumption is that firms and product categories with characteristics associated with initially high approval rates are not subsequently on different trends that coincide with shocks to reserves. Our instrument draws on predicted approval rates based on pre-determined characteristics and actual approval behavior at the start of our DJAI approval data; i.e., choices of firms and policymakers made before the deterioration in foreign reserves. These approval choices were then reversed in relative terms when macroeconomic shocks—such as those highlighted in Section III.C—led to widening gaps between formal and informal exchange rates and worsening external imbalances. Thus, we argue that such a reversal was primarily based on a desire to preserve foreign currency rather than policymaker responses to firm-product specific shocks, including those to import demand.

Consistent with this assumption, Bhagwati and Krueger (1973) note in their multi-country study that the temporal variation in import licensing policy is driven by macroeconomic imbalances, while its cross-sectional variation is driven by industrial policy preferences. We also note that shocks to the import demand of either initially more or less favored firm-products cannot generate the sign patterns we find. The first stage above is consistent with import demand shocks to initially-targeted fis both mechanically reducing reserves and lowering quantities of the initially favored vis a vis the initially targeted, ceteris paribus. However, such demand shocks would lower the prices of initially favored firm-products vis a vis the initially targeted, not raise them as we find in the second stage.

Further mitigating this endogeneity concern, the fact that reserves fell, rose, then fell again (see Figure 1) means that confounding trends would have to be nonlinear, and would be hard to reconcile with the similar price responses we found in the between policy period analysis where such a bias would likely work in the opposite direction.[33] The obvious remaining concern is that

[32]Should we expect the OLS estimate to be biased downwards? Supply shocks attenuate OLS estimates of upward sloping supply curves and demand shocks attenuate downward sloping demand curve estimates. As we discuss in Section V, we interpret our IV estimates as some average of these two slopes. Thus, we have no prior on whether this average should be larger or smaller than the average of attenuated OLS estimates.

[33]Of course, with only one temporal shock, we cannot fully eliminate concerns that spurious trends beyond those captured by our μ_{fi} trends and μ_t fixed effects may in part drive our results. However, the pattern of falling, rising, then falling reserves meant that early in the within-DJAI period, the initially-favored firms are the ones relatively heavily restricted, a pattern that then reverses. In the between policy period analysis in Section IV.A, the initially favored firms are the ones restricted relatively less going from the pre-DJAI period to the DJAI period, a pattern that then reverses post DJAI. Thus, confounding trends specific to more-favored firms would bias our estimates in opposite directions in the two analyses, at least if these trends are slow moving. Yet we obtain similarly positive price responses suggesting any such biases are small.

Table 4: The Effects of Quantity Restrictions on Prices Within the DJAI Period

	(1)	(2)	(3)	(4)	(5)
	1^{st}Stage	OLS	2^{nd} Stage	Reduced Form	Post DJAI
	$\ln(q_{fit})$	$\ln(p_{fit})$	$\ln(p_{fit})$	$\ln(p_{fit})$	$\ln(p_{fit})$
$\ln(Res_t)^4 \times \left(\widehat{AR}_{fh}^{\text{Q1-13}}\right)^4$	0.00283***			-0.000377***	-0.0000710
	(0.000261)			(0.000139)	(0.000163)
$\ln(q_{fit})$		-0.189***	-0.133***		
		(0.00740)	(0.0460)		
			[0.0420]		
Time (t) FE	Yes	Yes	Yes	Yes	Yes
Firm-Product (fi) FE	Yes	Yes	Yes	Yes	Yes
Firm-Product (fi) Trends	Yes	Yes	Yes	Yes	Yes
Observations	1,820,700	1,820,700	1,820,700	1,820,700	1,326,321
K-P F-stat			118.1		
C-D F-stat			326.6		

	(6)	(7)	(8)	(9)	(10)
	Alt. Lasso	Alternative IV		Extensive Margin	
	$\ln(p_{fit})$	$\ln(q_{fit})$	$\ln(p_{fit})$	$\mathbb{1}\{q_{fit} > 0\}$	$\text{IHS}(q_{fit})$
$\ln(q_{fit})$	-0.201***		-0.267***		
	(0.0472)		(0.0636)		
AR_{fit}		0.135***			
		(0.0151)			
$\ln(Res_t)^4 \times (\widehat{AR}_{fh}^{\text{Q1-13}})^4$				0.000209***	0.00132***
				(0.0000213)	(0.000128)
Time (t) FE	Yes	Yes	Yes	Yes	Yes
Firm-Product (fi) FE	Yes	Yes	Yes	Yes	Yes
Firm-Product (fi) Trends	Yes	Yes	Yes	Yes	Yes
Firm-Time and HS11-Time FE	No	Yes	Yes	No	No
Observations	1,829,235	1,233,265	1,233,265	21,389,016	21,389,016
K-P F-stat	53.5		79.0		
C-D F-stat	156.0		219.6		

Notes: Table presents the price effects of DJAI-induced quantity restrictions using an IV Lasso regression of log prices on log quantities at the firm-product-quarter level. Column 1 reports the first stage, equation (4), of log quantities on the instrument, Lasso-selected powers of log reserves interacted with powers of predicted initial approval rates. Column 2 reports the OLS and column 3 the IV estimate of equation (2), with column 4 showing the reduced form. Sample covers the second quarter of 2013 to the last quarter of 2015 with t denoting quarters. Predicted initial approval rate calculated from approval rates in Q1 2013 projected on firm and product category characteristics from 2011 (column 3 of Table 2). Column 5 re-runs the reduced-form specification on the post DJAI sample (2016–2017). Column 6 uses the Lasso with initial approval rates broken down by characteristic (again from column 3 of Table 3). Columns 7–8 instrument $\ln(q_{fit})$ with residual variation in firm-product-time approval rates after conditioning on firm-time and HS11-time fixed effects. Columns 9 and 10 regress an indicator for positive imported quantities and the inverse hyperbolic sine transformation of imported quantities, respectively, on the instrument. Sample in these last two columns includes all possible firm-product-quarter triplets (with triplets with no variation dropped). Standard errors two-way clustered at the firm-product level and HS11 product category level shown in parentheses. Square parentheses denote bootstrapped standard errors based on 500 bootstraps, drawing with replacement firm-product pairs and running the full Lasso IV procedure (mean -0.133 with 95% CI [-0.050, -.214]). Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

that the types of firms and products with initially high approval rates may be more affected by macroeconomic instability even outside the DJAI period, a possibility we dismiss via a placebo specification below.

IV.B.3 Robustness

We first provide reassurance that our findings are not driven by spurious trends, specifically that initially-favored firm-products do not respond differently to the macroeconomic fluctuations that lie behind the temporal variation in reserves within our instrument. Column 5 of Table 4 reports a simple placebo test, rerunning the reduced form specification in column 2 on the post-DJAI sample (2016 through 2017). Unlike during the policy period, the interaction of reserves and initial approval rates has no relationship with import prices in the post-DJAI period. Thus, it does not appear to be the case that initially-favored firm-products are more affected by poor macroeconomic conditions, a scenario that would violate our exclusion restriction.

Next, we explore alternative instruments. Column 6 uses the most flexible Lasso specification (column 3 of Table 3), where predicted approval rates are broken down by characteristic (i.e. trade related or ownership related). Magnitudes rise but the negative price effect remains. Columns 7–8 pursue an alternative IV strategy that exploits the randomness of the approval process and compares firms who were fortunate to receive an approval to those who were not. Given our analysis in Section III.B, we posit that approval rates are functions of firm-specific and product-category-specific factors and use the residual approval outcomes as our instrument. Practically, the actual approval rate for the firm-product-quarter, AR_{fit}, serves as the instrument for log quantity, and we include firm-quarter and HS11-quarter fixed effects to flexibly control for the expected value of the firm and product category approval rates. Column 7 presents the resulting first stage and column 8 the IV regression. Reassuringly, despite exploiting this very different source of variation—plausibly-random deviations in discriminatory trade policy—we again find prices rising significantly in response to quantity restrictions.[34]

For completeness, columns 9 and 10 of Table 4 repeat our first-stage specification, regression (4), on the extensive margin (for obvious reasons, we cannot analyze price changes on this margin). We replace the log quantity imported with either: 1) $\mathbb{1}\{q_{fit} > 0\}$, a dummy for whether firm f imports product i at time t, or 2) $\text{ihs}(q_{fit})$, the inverse hyperbolic sine of fit quantity imported (that takes the value 0 when $q_{fit} = 0$ and approaches $\ln q_{fit}$ for higher values). We borrow from our primary IV strategy and so project these objects on the fourth-order interaction between reserves and initial approval rates.[35] Consistent with the intensive margin results, we see that instrument-induced increases in the severity of the DJAI restrictions significantly reduces both the probability

[34]The coefficient on $\ln q_{fit}$ is larger in magnitude than our baseline IV, consistent with us estimating a different LATE. Alternatively, if policymakers observe and partially respond to firm-product-specific shocks e_{fit} in making their approval decisions (rather than responding to e_{ft} and e_{ht} as we allow), this estimate may still be biased.

[35]We fill out the intensive margin dataset to include all possible firm-product-time triplets that are non zero in at least one time period. As new firm entrants are not in our data during the initial period in 2011, we adjust specification (1) used to estimate predicted approval rates by interacting all firm-level variables with dummies that take the value 1 if a firm is missing in 2011. Thus, for these missing firms, we only use product-level characteristics to determine predicted initial approval rates.

a firm imports a product and the ihs(q_{fit}) that combines both the intensive and extensive margins.

Appendix Table A.8 reports additional specifications for our baseline IV estimate of column 3. First, we use the simpler linear interaction between log reserves and initial approval rates as our instrument. Second, we run the IV regression at the half-yearly level rather than quarterly. Third, we control for potential market-level impacts working through a common price aggregator at the sector level by including HS2-year fixed effects. Fourth, we control for much more disaggregated product-level shocks at the HS11-origin-unit-time level (most of the variation used to estimate the firm-product trends is absorbed by these fixed effects, thus we instead control for firm-specific linear time trends). Fifth, we exclude energy imports that were one of the drivers of fluctuations in reserves over this period. Finally, we two-way cluster the standard errors at both the firm-time and HS11-time level (the levels of the two components that are combined to form the predicted approval rate shocks) rather than at the firm-product and product-category level, with the Lasso now choosing $\ln(Reserves_t)^4 \times (\widehat{AR}_{fh}^{Q1\text{-}13})^2$ as the single instrument. Reassuringly, in all cases we find significant and similar negative elasticities of price to DJAI-induced quantity restrictions.

IV.C Interpretation and Alternative Mechanisms

The fact that prices rise with quantity restrictions is inconsistent with neoclassical trade models. In those models, quantity restrictions improve the terms of trade by reducing import demand and moving foreign exporters down their (upward sloping) export supply curve. In contrast, if there is imperfect competition with some degree of foreign market power, import prices may increase with quantitative restrictions. In the next sections, we extend our previous empirical strategy to estimate a trade model with imperfect competition. Before doing so, we provide further supportive evidence of market power playing a role by exploring heterogeneity in the price responses with respect to observable correlates of market power. We also consider whether our finding could be rationalized by several mechanisms that are consistent with a competitive model.

The top panel of Table 5 extends the analysis of the previous section to include an interaction between import quantities and proxies of market power or alternative mechanisms, with the proxies generically denoted by m_{fi}. In all cases, we instrument with the interaction between our IV and the corresponding measure (with the main effect of m_{fi} swept out by the firm-product fixed effects).

We start by assessing whether the strength of the price effects depends on proxies for firms' market power. We measure the importer market power with the share of Argentina's total imports of HS11 product category h from origin country c that importing firm f accounts for.[36] If this share equals one, the firm is the sole importer; hence the greater this share the greater we would expect a firm's market power to be. Alternatively, we capture a number of mechanisms through which foreign sellers of sophisticated products or specialized inputs may hold the market power with a dummy for whether the imported product is differentiated according to the Rauch classification (Rauch, 1999). In support of these conjectures, we find that firm-product pairs where the Argentinian importer has

[36]We use pre-DJAI data from 2011. Since we do not know the identity of the foreign sellers, we can only identify situations where buyers may have substantial market power.

greater buyer power see prices rise substantially less (column 1), while in pairs where the foreign exporter has greater seller power prices rise substantially more (column 2).

While these results are consistent with imperfect competition as the reason why prices rise with quantitative restrictions, we now explore other potential explanations for why prices rise that could be consistent with a competitive model: risk premia, over-invoicing, quality upgrading, and quantity discounts.

First, if exporters charge uncertainty premia based on the risk of rejection, import prices may rise with tighter quantitative restrictions. Such a premia would be larger if shipments are sent in advance of approval and so risk being stuck in customs, as may be necessary for sea shipments that take many days to arrive. Thus, columns 3 and 4 of Table 5 present interactions with product-category level shares of shipments sent by sea and by air, respectively, and find no support for the risk hypothesis: the price increase is smaller when the product travels by sea and larger when it travels by air.[37] Columns 5–7 further explore the heterogeneity in price responses with characteristics of the exporting country. Shipments are more likely to be sent prior to approval when the distance to Argentina is longer, and so face more rejection risk. We also consider whether the exporting country shares a common language or legal origin with Argentina, both of which are likely to make contracting easier and, under the risk mechanism, attenuate the import price increases. We find no support for any of the three risk-related conjectures, with two of the interactions insignificant and the third of the wrong sign.

These country characteristic regressions control for interactions with GDP per capita of the exporting country, since it is correlated with all three risk characteristics. GDP per capita is relevant to our market power mechanism, because richer countries are likely to have higher bargaining power vis a vis Argentina given their positions in Global Value Chains as discussed in Antràs (2020). In contrast to the risk interactions, GDP per capita is highly significant with a negative coefficient; prices rise more with quantity restrictions when importing from rich countries, suggestive of a market power story.

A second potential explanation for the observed price increases is that firms may have inflated invoices to benefit from the gap between the formal and the informal exchange rate (albeit with a higher chance of rejection). As all firms have an incentive to inflate, the quarter fixed effects address this worry. A further concern is that foreign subsidiaries may be in a better position to inflate as such an action is simply a form of transfer pricing. As we found that foreign firms faced lower approval rates, under this scenario we would expect initially-targeted firms prices to increase most when reserves fall, but we find the opposite. Alternatively, foreign subsidiaries may have less market power as they are buying from their owners. Column 8 introduces an interaction between quantities and foreign ownership and finds some support for such a market power explanation with price rises 23% greater for these importers (although the difference is not significant).

[37] We calculate the propensity for a product to be shipped by sea or air using shipment-level mode of transport data at the HS11-level from 10 randomly selected days over our DJAI sample period from importgenius.com. Of these 778,852 shipments, 437,318 contain missing information on transportation type, 126,107 were shipped by sea, 82,953 by air, 131,667 by land, and 807 through other means.

Table 5: Heterogeneity in Price and Quantity Effects, Quality Upgrading, and Quantity Discounts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$m_{fi} =$	Importer Share	Rauch Diff.	Sea Share	Air Share	Log Distance	Comm. Lang.	Comm. Legal	Foreign
	$\ln(p_{fit})$	$\ln(p_{fit})$	$\ln(p_{fit})$	$\ln(p_{fit})$	$\ln(p_{fit})$	$\ln(p_{fit})$	$\ln(p_{fit})$	$\ln(p_{fit})$
$\ln(q_{fit})$	-0.193***	0.219	-0.252***	-0.123***	0.722**	0.389***	0.496***	-0.109
	(0.0528)	(0.169)	(0.0752)	(0.0440)	(0.306)	(0.0987)	(0.123)	(0.0996)
$\ln(q_{fit}) \times m_{fi}$	0.133**	-0.378**	0.298**	-0.133	-0.0386	-0.125	-0.157**	-0.0251
	(0.0642)	(0.165)	(0.145)	(0.181)	(0.0331)	(0.107)	(0.0657)	(0.0935)
$\ln(q_{fit}) \times \ln(GDP/cap_c)$					-0.162***	-0.164***	-0.183***	
					(0.0313)	(0.0317)	(0.0344)	
Observations	1,163,347	1,820,700	1,732,178	1,732,178	1,812,134	1,811,865	1,812,134	1,820,700
K-P F-stat	54.7	23.2	155.7	66.3	111.0	119.2	111.3	26.3
C-D F-stat	137.7	144.3	56.7	17.3	40.5	45.7	42.1	80.5

	(9)	(10)	(11)	(12)	(13)	(14)
	OLS	IV	OLS	IV	OLS	IV
	Upgrading HS11 within HS8		Upgrading Origin within HS11		Decomposing $\ln(q_{fit}/n^I_{fit})$, $\ln(n^I_{fit})$	
	$\ln(p_{ft,HS8})$	$\ln(p_{ft,HS8})$	$\ln(p_{ft,HS11})$	$\ln(p_{ft,HS11})$	$\ln(p_{fit})$	$\ln(p_{fit})$
$\ln(q_{fit})$	-0.00185	-0.290	0.0854	0.825		
	(0.00521)	(0.186)	(0.0983)	(1.180)		
$\ln(q_{fit}/n^I_{fit})$					-0.196***	-0.177***
					(0.00763)	(0.0508)
$\ln(n^I_{fit})$					-0.0649***	-0.101
					(0.00375)	(0.348)
Observations	1,226,289	1,226,289	1,102,590	1,102,590	1,829,235	1,829,235
K-P F-stat		93.4		75.1		10.3
C-D F-stat		241.0		196.1		23.4

Notes: Top panel explores heterogeneity in the baseline price response resulting from policy-induced quantity restrictions presented in column 3 of Table 4. Sample covers the second quarter of 2013 to the last quarter of 2015 with t denoting quarters. Each column interacts $\ln(q_{fit})$ with one or more variables generically denoted by m_{fi} that, under different mechanisms related to market power and risk, should strengthen or weaken the price response. All interactions are instrumented with our previous instrument, $\ln(Res_t)^4 \times (\widehat{AR}_{fh}^{\text{Q1-13}})^4$, interacted with the corresponding variable. Main effects are swept out by the fi fixed effects. Column headers describe the interaction term m_{fi}. Importer market share in column 1 is measured by the share of each firm f in Argentina's total imports from country of origin c and HS11 code h. Rauch differentiation in column 2 is a dummy variable that takes the value 1 if the product is defined as differentiated by Rauch (1999). Sea share and air share in columns 3 and 4 are the share of the corresponding HS11 product that arrives in Argentina by sea and by air, respectively. Columns 5–7 consider three country of origin characteristics (log distance to Argentina, whether they share a common language with Argentina, and whether they share a common legal origin with Argentina) and further include interactions with log GDP per capita of the origin country. Foreign ownership in column 8 is a dummy indicating that the firm's ultimate owner is non Argentine. Bottom panel examines whether quality upgrading and quantity discounts, are likely to be driving our findings. Columns 9–12 explore quality upgrading by first regressing log unit values on HS11-unit, origin, firm and quarter fixed effects and constructing import-value weighted leave-out averages of the recovered HS11-unit fixed effects by HS8-unit-firm-quarter (columns 8 and 9) and of the recovered origin fixed effects by HS11-firm-time (columns 10 and 11). These metrics are regressed on log quantity imported, instrumented by powers of reserves interacted with initial approval rates in columns 9 and 11. Columns 12 and 13 explore quantity discounts by decomposing $\ln(q_{fit})$ into the log average shipment size and the log shipments per quarter. Column 12 presents the OLS, column 13 instruments the two dependent variables using an IV Lasso among interactions of powers of reserves and determinant-specific initial approval rates. All columns include time t and firm-product fi fixed effects and firm-product trends. Standard errors two-way clustered at the firm-product level and HS11 product category level shown in parentheses. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

A third potential explanation is that quantity restrictions led firms to upgrade quality and thus raise prices—a mechanism noted by Krishna (1987) and Feenstra (1988) among others. This concern is partially mitigated by our use of the most disaggregated notion of products that is recorded within our data, HS11-unit-origin combinations. Lacking data on changes in varieties sourced within this triplet, we examine changes in two observable sourcing margins. First, when fi quantities are restricted, do importers increase their expenditure shares on adjacent HS11 product groups (within the same HS8) with high unit values? Second, within a particular HS11 product group, do they shift expenditure to other origins with higher unit values? Columns 8–11 of Table 5 present these two exercises and find no evidence for quality upgrading (with the latter test even having the wrong sign).[38] The fact we do not see firms move to higher unit-value alternatives also speaks against the possibility that, after an import request was rejected, the importing firm moved on to the next-best supplier who was more expensive.

Finally, we examine mechanisms related to quantity discounts. These may arise as a result of imperfect competition and second degree price discrimination, in which case they are closely related to the imperfect competition model we write down below (e.g., see Meleshchuk, 2017 for Colombian evidence). Alternatively, they may come from increasing returns to scale at the order level. To examine these possibilities, we decompose the quarterly quantity imported into the average quantity per shipment ($\ln q_{fit}/n^I_{fit}$) and the number of shipments in the quarter ($\ln n^I_{fit}$) and regress prices on both terms. Column 12 of Table 5 presents the OLS specification and column 13 the IV.[39] In both columns, the coefficient on $\ln q_{fit}/n^I_{fit}$ is larger than that on $\ln n^I_{fit}$ but the coefficients on $\ln n^I_{fit}$ are economically sizable.[40] Taken together, the evidence is not supportive of a pure quantity discount story, such as per shipment fixed costs, where the coefficient on $\ln n^I_{fit}$ should be zero.

V Trade Framework and Estimation

As we have argued, restricted import quantities generating higher prices is inconsistent with perfectly competitive trade models, while models with market power rationalize this phenomenon. In this section, we estimate a simple importing model with heterogeneous importer-exporter matches. A key novelty is to allow for heterogeneity in whether domestic importers or foreign exporters hold market power. Key elasticities can be identified from a price-on-quantity specification as above, but now allowing these slopes to vary based on whether or not the importer holds market power.

[38] We first regress unit values on HS11-unit, origin, firm and quarter fixed effects. For the first measure, we construct import-value weighted averages of the recovered HS11-unit fixed effects by HS8-unit-firm-quarter. We use a leave out average, excluding the observation's own fit-level unit values to avoid price changes induced by the quantity reduction itself affecting our inference. For the second measure, we construct a similar import-value weighted average of the recovered origin fixed effects by HS11-firm-quarter. We then regress these metrics on quantity imported, again instrumenting quantity by reserves interacted with initial approval rates (columns 8 and 10 present the OLS, columns 9 and 11 the IV).

[39] As we now require two instruments that load differentially on $\ln q_{fit}/n^I_{fit}$ and $\ln n^I_{fit}$, we run the IV Lasso specification that uses different subsets of characteristics (trade, investment, ownership, and size related characteristics). Previously, the IV selected two interactions as instruments. When run on this specification, it selects three instruments, $\ln(Reserves_t)^4 \times (\widehat{AR}_{fh}^{ownership})$, $\ln(Reserves_t)^4 \times (\widehat{AR}_{fh}^{ownership})^2$ and $\ln(Reserves_t)^4 \times (\widehat{AR}_{fh}^{trade})^3$.

[40] The coefficient on $\ln n^I_{fit}$ is significant for the OLS. Despite being larger in magnitude than for the OLS and almost 60% of the size of the coefficient on $\ln q_{fit}/n^I_{fit}$, the IV coefficient has large standard errors and is insignificant.

Exploiting the quantitative trade restrictions imposed by Argentina and our policy instrument, a classifier-Lasso identifies both these elasticities and the distribution of market power. In this section, we explore correlates of market power across firms, and in the next we demonstrate the policy relevance of this distribution through counterfactuals.

V.A Environment

Preferences and Technologies Consumers have quasi-linear preferences over internationally traded goods and an outside numeraire good. They own an exogenous amount of the numeraire, which can be interpreted as labor.[41] There is a given set of heterogenous domestic variety producers, each corresponding to a product-origin i and importer f combination, as defined in the empirical section. Each variety producer buys inputs from a foreign supplier with whom it is exogenously matched, paying an endogenously determined price to the foreign supplier and selling its output domestically or internationally at prices that it takes as given.[42]

The equilibrium has two types of decisions by importers and exporters: ex-ante investments and ex-post production and pricing. First, the domestic producer fi or the foreign exporter matched to fi invests in an input x_D or x_F, respectively, with sunk cost $\psi_D\left(x_D\right)$ or $\psi_F\left(x_F\right)$ in units of the numeraire. These inputs may represent capacity or product customization; as such, they shift the revenue or cost functions.

Second, the exporter uses the cost function $\Psi\left(q, x_F\right)$ to produce output q. This output is shipped to the importer, who obtains a net revenue $R\left(q, x_D\right)$ and pays an import price p for the import (we describe how q and p are determined below). As we do not observe the exporter's purchases or the importer's sales or domestic expenditures, we leave the microfoundations of the cost and revenue functions unspecified.

One-sided ex-ante investments are a core conceptual feature of Antràs and Staiger (2012). We assume that only the side holding market power makes the investment, with the other using a pre-set capacity $\underline{x}_j$. This assumption, which could be relaxed at some tractability cost, is consistent with low surplus for the side without market power deterring ex-ante investment.

Policies We introduce the quantitative restrictions described in Section II. An import request q^R must be made to the government, a quantity $q^A \leq q^R$ is approved, and a quantity $q \leq q^A$ is imported. As discussed in Section III.D, firms were penalized for larger requests, which precluded gaming the DJAI system. To capture this feature, we assume a full rejection ($q^A = 0$) if firms petitioned a quantity above what they would import absent trade policy (and a random approval rate otherwise). This assumption implies a distribution of approval rates with mass point at zero

[41] Our pricing structure with an outside good rules out firm interactions in pricing. These interactions could be incorporated using the oligopolistic model of Atkeson and Burstein (2008) or its monopsonistic version in Dominguez-Iino (2021) and Zavala (2022).

[42] This simplification is similar to Antràs and Staiger (2012). Adding endogenous downstream prices through monopolistic competition with CES preferences would not affect our functional forms, parameter estimation, or quantification of the quantitative restrictions. However, doing so would add an extra motivation for optimal tariffs at the cost of making their discussion and quantification less transparent.

if the quantity requested is too high, which is consistent with the data.[43] In counterfactuals, we also study optimal per-unit tariffs.

Market Structure We make progress by identifying a key aspect of market structure—whether exporters or importers hold market power—at a highly disaggregated level (by importer, product, and origin). Even conditioning on this key aspect, we cannot empirically distinguish between plausible assumptions on how the firm with market power sets prices. Therefore, we carry on the full analysis under the following two common views.

First, in the style of Brander and Spencer (1981), we assume a classic form of market power: either foreign monopoly or domestic monopsony. Under foreign monopoly the exporter requests a quantity-price combination on the marginal revenue curve of the importer, $\frac{\partial R}{\partial q}$; similarly, under domestic monopsony, the importer requests a quantity-price combination on the marginal cost curve of the exporter, $\frac{\partial \Psi}{\partial q}$.

Second, in the style of Antràs and Staiger (2012) we assume that importer and exporter bargain over the surplus, with bargaining weight β on the importer.[44] Because firms obtain a constant fraction of surplus, the quantity requested maximizes the joint surplus. To mirror the "all or nothing" market power from the previous market structure with monopoly or monopsony, we allow for either $\beta = 0$ (foreign market power) or $\beta = 1$ (domestic market power). This assumption is equivalent to assuming that the side with market power makes a take-it-or-leave it offer, and it ensures that the same empirical moments identify the model parameters regardless of the market structure. Firm-level market power, defined as the average β across narrow product-origin pairs within firms, still varies continuously across firms.

Functional Forms We impose linear cost functions for the ex-ante investments and log-linear functional forms for cost and revenue functions as a function of imports. The investment costs are:

$$\psi_j \left(x_j\right) = Z_j \max \left(x_j - \underline{x}_j, 0\right) \text{ for } j = D, F, \tag{5}$$

where $\left(\underline{x}_j, Z_j\right)$ for $j = D, F$ are variety-fi specific. The cost function accommodates minimum capacity levels $\underline{x}_D$ and $\underline{x}_F$ that each side can use at no additional cost. In this way, we justify that only the side holding market power makes ex-ante investments. The revenue function is

$$R\left(q; x_D\right) = a q^{1-\frac{1}{\sigma}} x_D^{\alpha_D}, \tag{6}$$

while the cost function is

$$\Psi\left(q; x_F\right) = z q^{1+\frac{1}{\eta}} x_F^{-\alpha_F}, \tag{7}$$

where (a, z) are variety-fi-specific demand and supply shifters, (σ, η) are the import demand and export supply elasticities, and (α_D, α_F) are the elasticities of revenues and costs with respect to

[43] Rather than this stark penalty function, at some tractability cost we could instead incorporate that the probability of a full rejection increases smoothly with the quantity requested, as suggested by the relationships shown in Appendix Figure C.2.

[44] For a given β, our framework would coincide with Antràs and Staiger (2012) if we assumed foreign ex-ante investments in all relationships, and that q has zero marginal cost up to the capacity constraint x_F and infinite marginal cost above, so that $q = x_F$.

ex-ante investments. We assume $\sigma > 1$ and $\eta > 0$, and $\alpha_j \in (0,1)$ for $j = D, F$. We also impose the following parameter restriction which is necessary for interior solutions:[45]

$$\max\left[\alpha_D\left(1+\frac{1}{\eta}\right), \alpha_F\left(1-\frac{1}{\sigma}\right)\right] < \frac{1}{\eta}+\frac{1}{\sigma}. \tag{8}$$

This condition turns out to be satisfied at our estimated parameter values.

Information Importers and exporters are aware of the variety-fi-specific cost and demand shifters $(a, z, Z_D, Z_F, \underline{x}_D, \underline{x}_F)$, but are uncertain about the realization of the quantity approved q^A at the time of making the ex-ante investment or the quantity request.

V.B Estimation Strategy

In the data, we observe import requests q^R_{fit}, import quantities q_{fit}, import prices p_{fit}, and approval rates λ_{fit} for each importer-product fi and quarter t (where a "product" is again defined as a unique HS11 code, origin, and measurement unit combination). The main novelty is the heterogeneity across firm-products in whether the importer or the exporter holds the market power, where $\beta_{fi} = 0$ corresponds to foreign market power and $\beta_{fi} = 1$ to domestic market power.

Identification of β_{fi} relies on the simple idea that, under domestic market power, the import price *falls* with quantity restrictions, as the price moves along the foreign marginal or average cost curve, depending on market structure. In contrast, under foreign market power, the import price *increases* as the price moves along the domestic marginal or average revenue curve. In short, the identification of β_{fi} depends only on the sign of the elasticity of price to quantity, the focus of our previous reduced-form empirics. Aggregating the resulting β_{fi}s across importers (or products) results in a measure of market power that varies continuously across products (or importers), a feature that we exploit to show the importance of market power heterogeneity for policy in the next section.

To implement the estimation we first solve for the endogenous variables $\left(p_{fit}, q^R_{fit}\right)$ as a function of the demand, supply, and ex-ante investment elasticities $\Theta \equiv (\sigma, \eta, \alpha_D, \alpha_F)$; demand, supply, and ex-ante investment shifters $\vartheta_{fit} \equiv \left(a_{fit}, z_{fit}, Z_{Dfit}, Z_{Ffit}, \underline{x}_{Dfit}, \underline{x}_{Ffit}\right)$; and approval rates λ_{fit}.

Proposition 1. *The import price satisfies:*

$$\ln p_{fit} = \begin{cases} \zeta^p_{fit} - \frac{1}{\sigma}\ln q_{fit} & \text{if } \beta_{fi} = 0, \\ \zeta^p_{fit} + \frac{1}{\eta}\ln q_{fit} & \text{if } \beta_{fi} = 1; \end{cases} \tag{9}$$

and the requested quantity satisfies:

$$\ln q^R_{fit} = \begin{cases} \zeta^q_{fit} + \frac{\alpha_F}{\frac{1}{\eta}+\frac{1}{\sigma}-\alpha_F\frac{\sigma-1}{\sigma}}\ln\tilde{\lambda}_{fit} & \text{if } \beta_{fi} = 0, \\ \zeta^q_{fit} + \frac{\alpha_D}{\frac{1}{\eta}+\frac{1}{\sigma}-\alpha_D\frac{\eta+1}{\eta}}\ln\tilde{\lambda}_{fit} & \text{if } \beta_{fi} = 1; \end{cases} \tag{10}$$

where ζ^p_{fit} and ζ^q_{fit} are functions of β_{fi}, elasticities Θ, and fundamentals ϑ_{fit}; and where $\tilde{\lambda}_{fit}$ is the

[45] This condition guarantees that the profit functions of importers and exporters are globally concave. If this condition is violated, there may be increasing returns and firms may want to grow infinitely large.

following moment of the distribution of approval rates:

$$\tilde{\lambda}_{fit} = \mathbb{E}\left[\lambda^{1-\frac{1}{\sigma}} \frac{1+\frac{1}{\eta}}{1-\frac{1}{\sigma}} - \lambda^{1+\frac{1}{\eta}} \mid \mathcal{I}_{fit}\right], \tag{11}$$

where $\mathbb{E}[\cdot \mid \mathcal{I}_{fit}]$ *denotes an expectation over the distribution of the approval rate* λ *given the beliefs* $\mathcal{I}_{fit}$ *held by importer* fi *at time* t*.*

Appendix D.1 provides proofs. These conditions hold regardless of which of the two market structures we assume. Proposition 1 implies that the we can split the parameter identification into two steps, which we now turn to.

Step 1: Elasticities of Price to Quantity Imported We use the pricing equation (9) to identify $\{\beta_{fi}, \eta, \sigma\}$ from price-to-quantity elasticities estimated from DJAI-induced quantity restrictions. Conveniently, this specification admits the Su et al. (2016) classifier-Lasso for identifying and estimating latent group structures in panel data models. In our context, the classifier-Lasso simultaneously groups firm-product pairs by market power β_{fi} and estimates group-specific slopes by shrinking fi-specific regression coefficients to these unknown group-specific values—with the procedure also revealing whether two is the appropriate number of groups.[46] Thus, as long the procedure identifies two groups with opposite elasticity signs, we recover the β_{fi}s as well as the demand elasticity σ (from the $\beta_{fi} = 0$ cases) and the supply elasticity η (from the $\beta_{fi} = 1$ cases) from the same price-on-quantity specification explored in the reduced-form analysis above.[47]

We estimate equation (9) using the same identification strategy (and same sets of fixed effects) as in Section IV.B, instrumenting again for $\ln(q_{fit})$ with the interaction of log reserves and initial approval rates predicted by pre-DJAI firm and product characteristics.[48] Through the lens of the model, the exclusion restriction is that this interaction is independent of idiosyncratic realizations of the fi-level demand and supply shocks (a_{fit}, z_{fit}), after conditioning on the various fixed effects. We argue that this restriction plausibly holds for the same reasons discussed in Section IV.B.2. Appendix D.2.1 provides further details.

Step 2: Elasticities of Quantity Requested to Expected Quantitative Restriction In the second step, we use (10) and the first-step estimates of $\{\beta_{fi}, \eta, \sigma\}$ to identify the investment elasticities $\{\alpha_D, \alpha_F\}$ from the relationship between quantities requested and expected approval rates. The requests respond to the moment $\tilde{\lambda}_{fit}$ of the approval-rate distribution defined in (11):

[46] We utilize the penalized GMM variant for linear models which, aided by the sparseness of the problem when slopes are homogeneous within group, introduces an objective function with a mixed additive-multiplicative structure that allows for simultaneous classification and estimation. See Appendix D.2 for a formal definition (similar to expression (3.2) of Section 3.1 of Su et al., 2016).

[47] In the monopoly/monopsony model the price is pinned down by either the marginal revenue or marginal cost curve depending on who holds market power: $p = (1-\beta_{fi}) R_q + \beta_{fi} \Psi_q$. In the bargaining model, conditional on importing q, the price equals either average domestic revenue or average foreign cost: $p = (1-\beta_{fi}) \frac{R}{q} + \beta_{fi} \frac{\Psi}{q}$. Our power-function assumptions on R and Ψ imply that, given β_{fi}, $\partial \ln p_{fit} / \partial \ln q_{fit}$ is the same in both market structures.

[48] To implement, we extend the Su et al. (2016) estimation algorithm to deal with unbalanced panels. We mimic our reduced-form specification in equation (2) by first residualizing log prices and quantities using firm-product fixed effects, quarter fixed effects, and firm-product linear trends. See Appendix D.2.1 for further details.

more pessimistic beliefs induce lower investment, reducing the returns to importing and thus lowering the quantity requested.[49] Higher estimated elasticities of quantities requested to expected approval rates indicate a higher importance of ex-ante investments for domestic or foreign producers (α_D if $\beta_{fi} = 1$ or α_F if $\beta_{fi} = 0$). The moment $\tilde{\lambda}_{fi}$ depends on producer fi's expectations about the approval rate at time t, the construction of which we discuss below; in practice, it is strongly correlated with the probability of a full approval. Appendix D.2.2 provides details.

V.C Estimation Results

Demand and Cost Elasticities The method in Step 1 recovers two estimated coefficients, one for each group, equal to -0.208 and 0.129 (columns 1 and 2 of Table 6). The negative coefficient implies $\hat{\sigma} = -1/(-0.208) = 4.798$ and the positive coefficient implies $\hat{\eta} = 1/0.129 = 7.776$.[50]

The opposite signs of the estimated coefficients provide support for our model-based interpretation that we are either recovering the slope of the downward sloping revenue curve or the upward sloping cost curve. Moreover, a BIC-type information criterion determines that the preferred number of groups is indeed two.[51] This result provides support for our joint assumptions that β_{fi} only takes the values 0 or 1, the demand elasticity σ is common across firm-products with $\beta = 0$, and the supply elasticity η is common across firm-products with $\beta = 1$.[52] Table 7 presents the bootstrapped standard errors and confidence intervals associated with our elasticity estimates.

For comparison, column 3 of Table 6 repeats the results from our earlier analysis from Section IV.B that imposed one common price-to-quantity elasticity (by construction, this corresponds to imposing a single group). Viewed through the lens of our model, our reduced-form estimate of -0.133 reflects a weighted average of negative inverse revenue elasticities (when the foreign firm holds the market power) and positive inverse cost elasticities (when the domestic firm does).

Correlates of Market Power The estimation classifies each firm-product fi into groups for which $\beta_{fi} = 0$ (foreign market power) or $\beta_{fi} = 1$ (domestic market power). Out of all the firm-product-quarter observations in our dataset, in 52.1% of cases the domestic firm has market power, accounting for 46.2% of total imported value.[53]

[49]Formally, the $\frac{\partial \ln q_{fit}}{\partial \ln \tilde{\lambda}_{fit}}$ implied by (10) is negative whenever the second-order conditions of the optimization problem over ex-ante investments are satisfied. In our estimation we indeed find $\frac{\partial \ln q_{fit}}{\partial \ln \tilde{\lambda}_{fit}} < 0$ for both groups of β_{fi}.

[50]Our import demand elasticity of 4.80, estimated at the firm-product level, falls within the range of gravity-based estimates summarized by Head and Mayer (2014). For Argentina, Broda et al. (2006) estimate an average elasticity of 5.61 across 3-digit HS codes and Soderbery (2018) estimates an average of 3.21 across 4-digit HS codes. Our cost elasticity estimate of 7.78 stands at the upper end of the range of supply elasticity estimates in that paper for 4-digit sectors in Argentina, and it is estimated at a more disaggregated level (narrow product categories by firm).

[51]We follow Su et al. (2016) and minimize an information criterion (IC) among the alternatives of 1, 2, 3, and 4 groups. The group coefficients are -0.133 with 1 group; (-0.496,-0.037, 0.364) with 3 groups; and (-0.274, -1.516, 0.092, 0.496) with 4 groups.

[52]When solving the model for counterfactuals, we will rely on the assumption that the common demand (supply) elasticity is also the same for firms with $\beta = 1$ ($\beta = 0$).

[53]The share of firm-product pairs (rather than firm-product-quarter triplets fit) with $\beta_{fi} = 1$ is higher at 63.8%. We report shares at the fit level, and implicitly run regressions at that level through our choice of weights, to account for the fact that the β_{fi} estimates are more precise when we observe prices and quantities over many quarters.

Table 6: Estimates of the Price Equation

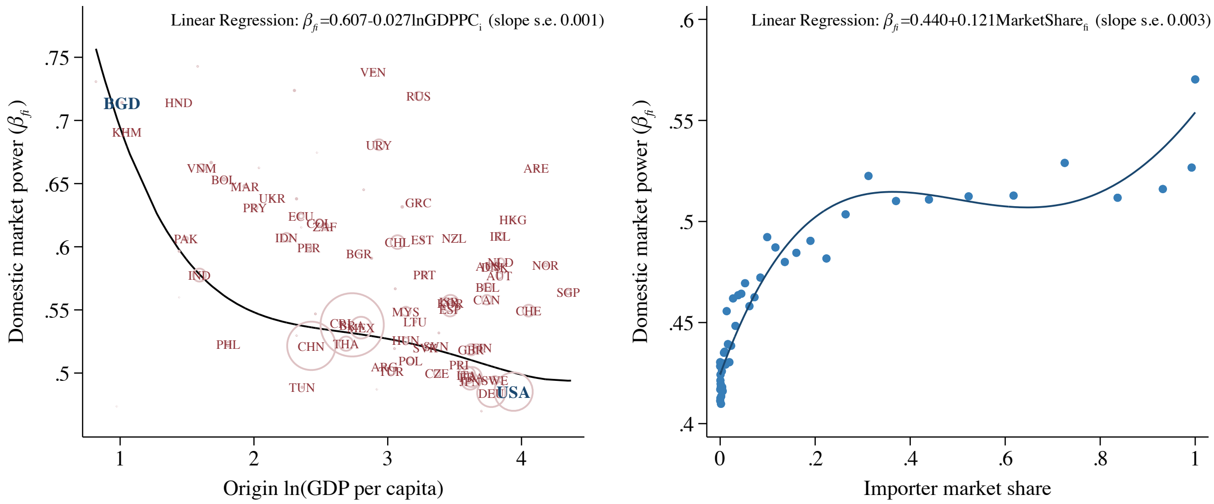
	(1)	(2)	(3)
	C-Lasso IV PGMM		IV
	$\ln(p_{fit})$		$\ln(p_{fit})$
$\ln(q_{fit})$	-0.208***	0.129***	-0.133***
	(0.049)	(0.018)	(0.041)
	[0.048]	[0.020]	
Sample	Group A	Group B	Full
Observations	1,820,700		1,820,700
K-P F-stat	19.5		150.5
C-D F-stat	103.6		416.4

Notes: Column 3 replicates the result in column 3 of Table 4, which assumes a single common coefficient while columns 1–2 allow for heterogeneity in coefficients across two groups with unknown membership using the classifier-Lasso (C-Lasso) method developed by Su et al. (2016) and their Penalized GMM estimator. To implement, we mimic our previous procedure by first residualizing log prices $\ln(p_{fit})$ and quantities $\ln(q_{fit})$ using firm-product fixed effects, quarter fixed effects, and firm-product linear trends. We instrument $\ln(q_{fit})$ with $\ln(Res_t)^4 \times (\widehat{AR}_{fh}^{\text{Q1-13}})^4$. The sample covers the second quarter of 2013 to the last quarter of 2015. Standard errors two-way clustered at the firm-product level and HS11 product category level shown in parentheses. Square parentheses denote bootstrapped standard errors based on 500 bootstraps, drawing with replacement firm-product pairs and running the full procedure. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

These averages mask considerable heterogeneity across exporter origins, narrow products, and firms. The β_{fi} estimates display intuitive correlations with the proxies of buyer market power that we explored in Table 5. Figure 3 displays two of these relationships. First, the β_{fi} are lower for importers buying from richer countries. For example, for products imported from Bangladesh, a country at the 14th percentile of the GDP per capita distribution that lies on the polynomial of best fit, Argentinian firms hold the market power in 71% of observations; the same fraction shrinks to 49% for imports from the US, at the 94th percentile of GDP per capita. Second, the β_{fi} are higher for firm-products where the importer is large relative to its market. For small importers, those with market shares within an origin-HS11 product category close to zero, the domestic importer holds the market power in only 43% of cases; this share rises to 57% when a firm is the exclusive importer. These patterns are partly driven by industry composition: the slopes halve when we include industry fixed effects, implying that poorer countries tend to specialize in industries where exporters have less market power (see Appendix Figure A.7).

Appendix Table A.9 explores heterogeneity across products, showing that the foreign exporter is more likely to hold the market power when a product is differentiated (as well as reporting linear regressions for the relationships above). The fraction of observations where the foreign exporter holds market power is 13.6 percentage points higher for differentiated products. In addition, we show that an importer is 3 percentage points less likely to hold market power when it is a foreign subsidiary rather than domestically owned. Finally, Appendix Table A.10 presents the average

Figure 3: Correlates of Market Power: GDP Per Capita and Import Market Shares



Notes: This figure plots the relationship between the domestic market power estimates, the $\beta_{fi}s$, and either the origin country's log GDP per capita (left panel) or the importers market share in the relevant origin-HS11 product category (right panel). In both panels, solid lines represent polynomial fits (4th degree) with each firm-product estimate weighted by the number of firm-product-quarter observations it represents. The left panel additionally plots the average values for each country with the size of the marker representing the value of log total imports (with the top 75 exporters labeled with ISO country codes and outliers removed for visual clarity). Right panel additionally plots values from 50 point binscatter.

market power by product category. We find higher foreign market power for products that would typically be classified as more sophisticated such as machinery, optical equipment, and vehicles; and lower for foodstuffs, mineral products, textiles and footwear, and chemicals.

Investment Elasticities In Step 2, we construct the "expected approval rate", $\tilde{\lambda}_{fit}$ and estimate equation (10), which specifies how quantities requested respond to expected approvals, separately for firm-products with $\hat{\beta}_{fi} = 1$ and $\hat{\beta}_{fi} = 0$. We assume that firms form the expectation $\tilde{\lambda}_{fit}$ about the approval rate using last-period realizations. Specifically, we first compute the realized value $\tilde{\lambda}^{obs}_{fit}$ using the moment definition in (11) and the estimates of $\{\hat{\sigma}, \hat{\eta}\}$, and then define $\tilde{\lambda}_{fit}$ as the fitted value from a regression of $\tilde{\lambda}^{obs}_{fit}$ on its lag $\tilde{\lambda}^{obs}_{fit-1}$.[54] This approach is formally equivalent to proxying for $\tilde{\lambda}_{fit}$ with the realized value $\tilde{\lambda}^{obs}_{fit}$ and running an IV regression where past realizations $\tilde{\lambda}^{obs}_{fit-1}$ serve as an instrument for $\tilde{\lambda}^{obs}_{fit}$. Under this interpretation, using lagged values as an instrument deals with potential reverse causation coming from the fact that, likely as a government strategy to deter gaming, larger requests resulted in lower approval rates (see Section III.D). Additionally, the IV addresses attenuation concerns coming from the fact that the expected approval rate is proxied

[54]This approach to estimating expectations, where we assume the agent's expectations are rational and we specify the variables they use to form their expectations, follows Manski (1991) and is applied by Dickstein and Morales (2018) in the context of international trade.

Table 7: Estimates of the Model Parameters

Parameter	Description	Estimate	Std. Err.	95% Conf. Interval
σ	Demand elasticity (Domestic)	4.798***	1.699	[3.466, 11.669]
η	Cost elasticity (Foreign)	7.776***	1.238	[5.504, 10.661]
α^D	Investment elasticity (Domestic)	0.174***	0.030	[0.108, 0.234]
α^F	Investment elasticity (Foreign)	0.198***	0.044	[0.117, 0.276]

Notes: The table shows model parameters estimated from the import pricing equation in (9) and the quantity requested equation in (10). The standard errors are based on 100 bootstraps, drawing with replacement firm-product pairs and running the full procedure presented in Section V.B and described in detail in Appendix E. The confidence intervals are based on percentiles of the bootstrap distribution. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance based on the confidence intervals.

with the realized value, leading to classical measurement error under the rational-expectations assumption that the realized value equals the expectation plus an independent mean-zero error.

Appendix Table A.11 presents the results. The estimates of α are similar for both groups: 1.239 for firm-products classified as $\beta_{fi} = 0$ and 1.232 for firm-products classified as $\beta_{fi} = 1$. The implied investment elasticities are $\alpha_D = 0.174$ for domestic importers and $\alpha_F = 0.198$ for foreign exporters, shown with standard errors and confidence intervals in Table 7.

VI Policy Impacts and The Distribution of Market Power

VI.A Quantity Restrictions

We now use the estimated model to construct counterfactual quantities and prices in the absence of quantitative restrictions. The reduced-form estimates from Section IV are not well-suited for these counterfactuals because they ignore the heterogeneity in price and quantity responses across firms with different market power, and because they conflate the mechanical impact of changing approval rates with their endogenous impact on quantities requested (two features that are independently captured by our structural estimates).

The solid lines in the panels a), b), and c) of Figure 4 show, for each quarter, the difference between the actual value-weighted log import quantities, prices, and import values, and their counterfactual without quantitative restrictions (thus, a negative number means a negative policy impact).[55] Table 8 reports value-weighted averages over the entire policy period. We find an average quantity decline of 31.1% and price increase of 4.0% due to the DJAI. Overall, import values decline by 27.1%.[56] The dashed line in panel c) shows the policy impact corresponding to a

[55] To implement, we use the elasticities of quantities and prices with respect to the realized and expected quantitative restrictions estimated above. Removing the quantitative restrictions yields estimated quantity and price changes, which we apply to the observed levels of prices and quantities to obtain a counterfactual series without restrictions. We report weighted averages where the weights are the counterfactual values without restrictions. Appendix E.1 presents these implementation details.

[56] We exclude firm-products with zero import approvals in that quarter. Including these cases, and imputing the requested quantity and value for the counterfactual, raises the magnitude of the value decline to 31.6%.

Table 8: The Impact of the Quantity Restrictions in the DJAI Period

		Δln Quantities		Δln Prices		Δln Values	
Estimated β	Full sample	-0.311***	(0.049)	0.040***	(0.008)	-0.271***	(0.052)
	Only $\beta_{fi} = 0$	-0.406***	(0.074)	0.085***	(0.014)	-0.321***	(0.077)
	Only $\beta_{fi} = 1$	-0.179***	(0.010)	-0.023***	(0.004)	-0.202***	(0.012)
Counterfactual β	If all $\beta_{fi} = 0$	-0.314***	(0.048)	0.130***	(0.021)	-0.184***	(0.060)
	If all $\beta_{fi} = 1$	-0.301***	(0.049)	-0.079***	(0.019)	-0.380***	(0.064)

Notes: The table presents value-weighted averages of the coefficients estimated in Figure 4 over the entire DJAI policy period (2013–2015). The standard errors in parentheses are based on 100 bootstraps, drawing with replacement firm-product pairs and running the full estimation procedure (including the classifier Lasso). Asterisks indicate 10% (*), 5% (**), and 1% (***) significance based on confidence intervals derived from percentiles of the bootstrap distribution. Over the entire DJAI period, the total impact was -0.271 (s.e. 0.052) and the direct impact was -0.035 (s.e. 0.009). The change in import values is equal to -0.035*** (0.009), 87% of the -0.271 total value reduction, if focusing only on the direct effect due to the reduction of approval rates, i.e., holding the requested quantity fixed.

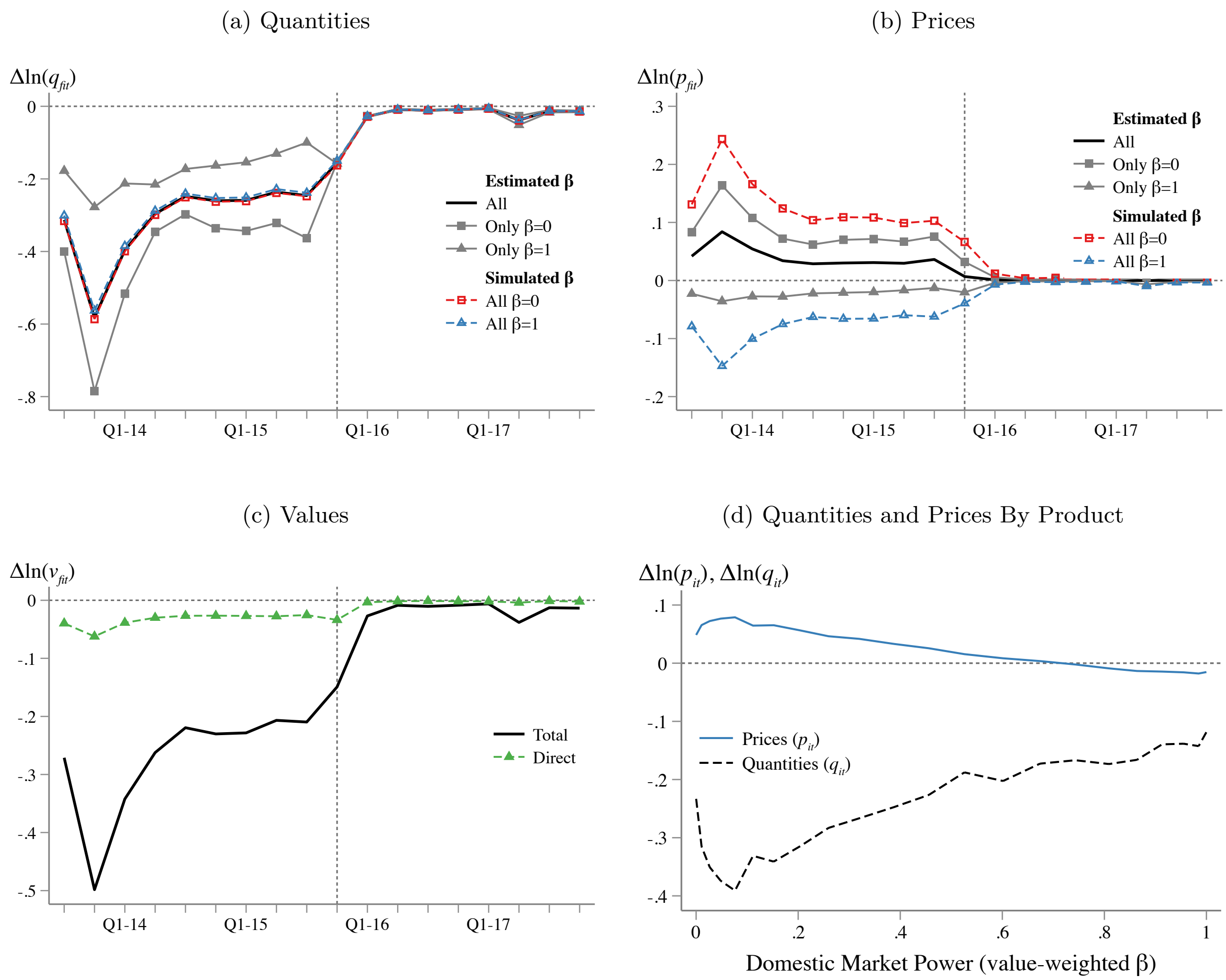
no-policy scenario with full approval rates but with quantities requested as in the actual equilibrium. We see a small policy impact in this case, implying that the majority of the effect of the restrictions on import values (87.1% when comparing averages) is due to reductions in requested quantities in response to low expected approval rates—driven by the investment elasticities we estimate—rather than the mechanical reduction due to the low approval rates themselves.

These policy impacts mask heterogeneity across groups defined by which side holds the market power, as shown by the gray solid lines in panels a) and b). Due to the DJAI, the domestic firm-products with market power saw an average quantity decrease of 17.9% and a price *decrease* of 2.3%; while those without market power saw a quantity decrease of 40.6% and price *increase* of 8.5%. For quantities, the difference in magnitudes stems almost completely from the fact that the group without market power ($\beta_{fi} = 0$) was also more heavily restricted (remember that our estimates revealed similar elasticities of quantities requested to expected approval rates for the two groups). In contrast, the opposite signs of the price effects come from the differently signed price-quantity elasticities estimated for the two market-power groups.

We also find considerable heterogeneity across products. Panel d) of Figure 4 displays product-level impacts on prices and quantities as a function of the import-value weighted β of firms within each product. The average price effects are positive for the majority of products, with the best fit relationship indicating negative effects for products where importers with market power account for more than 70.8% of imports.

Finally, we compute what the aggregate policy impacts would have been under counterfactual market-power distributions. The dashed lines in panels a) and b) of Figure 4, and the last two rows of Table 8, report what the quantity and price impacts would have been had foreign exporters held the market power in all relationships (i.e., flipping any $\beta_{fi} = 1$ to $\beta_{fi} = 0$) or had all domestic firms held market power (flipping any $\beta_{fi} = 0$ to $\beta_{fi} = 1$). Each counterfactual flips the elasticity of one

Figure 4: Impact of the Restrictions on Imports



Notes: The sample includes the firm-product pairs at the quarterly level over the DJAI policy period (2013–2015), and the same pairs in the post-DJAI period (2016–2017). We exclude outliers with extreme price responses (the top and bottom 1% of the distribution). The vertical dashed lines indicate the last quarter of 2015, corresponding to the last period when the DJAI policy was active. Panel a) shows the value-weighted impact of the policy restrictions on import quantities. We first define the variety-level policy impact as $\ln q_{fit} - \ln q_{fit}^{CF}$ for firm-product fi in quarter t, where q_{fit}^{CF} is the counterfactual absent the quantitative restrictions. We then plot the quarter-year dummies of an import value-weighted regression of these firm-product impacts on quarter-year dummies, using as weights the counterfactual values without restrictions. The lines represent different samples (using each firm-product's estimated β) or different simulated market power scenarios. In the simulated scenarios, either all domestic firms hold the market power ($\beta = 1$), or all foreign exporters hold it ($\beta = 0$). Panels b) and c) follow the same approach but for prices and values. In Panel c), we plot the impact on import values (labeled "Total") as well as the impact considering only the mechanical effect of approval rates, i.e., holding the requested quantity fixed (labeled "Direct"). Panel d) shows the product-level value-weighted impacts of the DJAI policy for the entire DJAI period against the market power of domestic firms within each product (with products defined as HS11-origin-unit of measurement triplets). The lines are connected binscatter points. The domestic market power of a product i on the horizontal axis is the value-weighted fraction of firms with $\beta_{fi} = 1$.

group, but not the policy shock it experienced. We see no difference in counterfactual quantities because the elasticities of quantity requested to the policy are similar for both groups. However, we do see magnified price effects: had all domestic firms held market power, prices would have fallen on average by 7.9% due to the quantity restrictions; and had all foreign firms held market power, they would have increased by 13%.

VI.B Optimal Tariffs

We finally demonstrate how the market-power distribution mediates the incentives to impose tariffs, a more traditional policy tool. To this end, we calculate how optimal tariffs vary across products with the fraction of firms who hold market power. Our analysis also quantifies the role of market structure (monopoly/monopsony versus bargaining) in shaping this relationship. Appendix E.2 provides proofs and implementation details.

Optimal Tariff Formulas In the model, aggregate real income equals the sum of consumer surplus, endowment income, profits, and tariff revenue. Our previously stated assumptions that downstream and factor prices are taken as given imply that only profits and tariff revenue respond to tariffs. The following proposition summarizes the model-implied optimal tariffs.

Proposition 2. *Given a change $d\tau_i$ in the product-i tariff, the change in aggregate real income is:*

$$dW_i = \underbrace{\tau_i \sum_f dq_{fi}}_{\text{Distortion}} + \underbrace{\sum_{f:\beta_{fi}=0} q_{fi} d\tau_i}_{\text{Profit Shifting}} \underbrace{-\chi^M \sum_{f:\beta_{fi}=0} \frac{\partial^2 R_{fi}}{\partial q_{fi}^2} dq_{fi}}_{\text{Pass-Through}}, \tag{12}$$

where $\chi^M = 1$ in the monopsony or monopoly case (Brander and Spencer, 1981) and $\chi^M = 0$ in the bargaining case (Antràs and Staiger, 2012). Moreover,

$$\frac{\tau_i^*/p_i}{1+\tau_i^*/p_i} = \begin{cases} \frac{\frac{\sigma-1}{\sigma}}{\frac{\eta+1}{\eta}} \left(\frac{1}{\eta} + \frac{1}{\sigma} - \frac{\sigma-1}{\sigma}\alpha_F - \chi^M \frac{1+\alpha_F}{\sigma-1} \right) & \text{if } \beta_{fi}=0 \text{ for all firms in } i \text{ and firms are identical,} \\ 0 & \text{if } \beta_{fi}=1 \text{ for all firms in } i. \end{cases} \tag{13}$$

Equation (12) shows the incentives to impose tariffs when firms are heterogeneous in market power, while (13) shows the closed-form solution when firms are homogenous. The first two terms in (12)—distortion and profit shifting—are common across market structures. The first term captures that tariffs distort total surplus (pushing towards a zero optimal tariff), and the second that they shift profits away from foreign suppliers (pushing towards a positive optimal tariff).[57] This profit-shifting force is present only when some foreign firms hold market power (i.e., when at least some $\beta_{fi} = 0$); otherwise, the planner and importer's objectives are aligned, both aiming to maximize domestic profits under the same constraints. In addition, in the foreign monopoly case ($\chi^M = 1$), optimal tariffs also reflects pass-through and capture the rate at which the marginal benefit of

[57] When $\chi^M = 0$ and firms are homogeneous, (13) implies that the optimal tariff is positive if the necessary parameter restriction (8) for an interior solution holds.

Table 9: Optimal Tariff with Homogeneous Firms and Foreign Market Power

	Investment Elasticity	Optimal Tariff	Std.Err.	95% Conf. Interval
Bargaining	Estimated α_F	0.136***	0.018	[0.100, 0.177]
	$\alpha_F = 0$	0.310***	0.036	[0.230, 0.361]
Monopoly/Monopsony	Estimated α_F	-0.094*	0.043	[-0.162, 0.007]
	$\alpha_F = 0$	0.055*	0.031	[-0.006, 0.112]

Notes: The table shows the optimal ad-valorem equivalent tariff (τ^*/p) when firms are homogeneous and domestic firms have zero market power. The standard errors are based on 100 bootstraps, drawing with replacement firm-product pairs and running the full estimation procedure (including the classifier-Lasso). The confidence intervals are based on percentiles of the bootstrap distribution. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance based on the confidence intervals.

importers changes with imports.[58] Given constant revenue and cost elasticities, this third force pushes towards a lower (potentially negative) tariff.

In sum, under both market structures (monopoly and bargaining), the incentives to distort trade decrease with domestic market power, as measured by the fraction of firms within a sector that hold market power, and the optimal policy is free trade when all domestic firms hold market power.[59] However, when enough foreign firms hold market power, the optimal policy in the monopoly model is a tariff (if the profit shifting motive dominates) or an import subsidy (if the pass-through force does), while in the bargaining model it is necessarily a tariff. These forces also appear in Brander and Spencer (1981) and Antràs and Staiger (2012);[60] our contribution, besides providing a closed-form characterization, is that we can quantify optimal tariffs and relate them both to demand and supply elasticities, as in standard formulations, and to the novel distribution of market power.

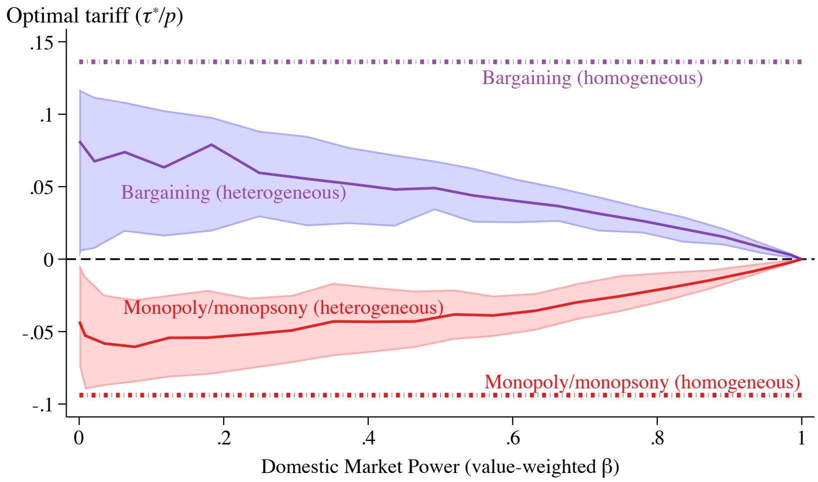
Quantification We first compute the optimal tariffs with homogenous firms and zero market power using equation (13). Table 9 shows that, in this case, our estimates imply an import subsidy of 9.4% under the monopoly/monopsony model and an import tariff of 13.6% under bargaining. These estimates are significantly different from each other, although some caution is warranted regarding the finding of an import subsidy in the former case, as an optimal tariff of zero falls within the 95% confidence interval. The qualitative difference between the optimal policies (a subsidy versus a tax) arises due to the ex-ante investment elasticity, α_F, which magnifies the "pass-through" component in (12) in the monopoly/monopsony model. Had we ignored this margin and imposed $\alpha_F = 0$, we would have estimated a lower overall export response to the tariff, leading to

[58] As is well known, increasing the tariff faced by a foreign monopolist is beneficial only if it raises the tariff-inclusive price less than one-for-one. With $\chi^M = 1$, the optimal tariff in (13) satisfies the well-known formula $\frac{\tau}{p} = \left(\frac{dq/q}{dp/p}\right)^{-1}$.

[59] This feature is in keeping with the intuition of Eaton and Grossman (1986), who, in a different setup, note that in Bertrand or Cournot games between domestic and foreign suppliers there are no incentives to impose tariffs if domestic firms use the conjectural variations of a Stackelberg leader.

[60] Monopoly and monopsony models in the spirit of Brander and Spencer (1981) do not typically feature ex-ante investments, captured here by α_D and α_F, which turn out to play a significant quantitative role. Similarly, the model in Antràs and Staiger (2012) does not feature the ex-post curvature in revenue and cost functions conditional on the ex-ante investment, captured here by σ and η.

Figure 5: Optimal Tariffs and Domestic Market Power



Notes: This plot depicts the product-level optimal tariff implied by the model (in ad-valorem equivalent terms, using a weighted price for each product with weights equal to values under the counterfactual optimal tariffs) against the market power of domestic firms within each product. We plot a random sample of 20,000 products (HS11-origin-unit triplets). The domestic market power of product i on the horizontal axis is the value-weighted fraction of firms with $\beta_{fi} = 1$ (using the same weights as above). The horizontal dashed lines show the optimal tariff when firms are homogeneous and $\beta_{fi} = 0$ derived in equation (13) in Proposition 2. The solid lines depict optimal tariffs within each bin of domestic market power, while the shaded areas display the interquartile range (the top and bottom 25 percentiles of the distribution of optimal tariffs within bins).

an optimal positive tax also in this case (as shown in the last row of the table).

Next, for each product i we solve for the optimal tariff τ_i^* allowing for the heterogeneity in market power that we have estimated. Appendix E.2.3 shows in detail how to compute optimal tariffs using the estimated parameters and observed prices and quantities. To implement, we first use the estimated model to construct functions that map counterfactual tariffs to firm-product specific quantity and revenue outcomes, $q_{fi}(\tau)$ and $R_{fi}(\tau)$. The demand and supply shifters entering these functions are backed out from the observed data given the estimated elasticities and β_{fi}. Using these functions, we can construct the welfare change from any given tariff perturbation, dW_i in (12), as a function of τ. Finally, we find τ_i^* such that $dW_i = 0$.

Figure 5 shows the product-level optimal tariffs τ_i^* in ad-valorem equivalent terms under bargaining (in purple) and under foreign monopoly (in red), against the value-weighted average of domestic market power β_{fi} in each product i. When all domestic importers hold market power (average market power equal to 1), optimal tariffs are zero, as stated in Proposition 2. As we move leftwards towards products where foreign exporters hold greater market power, the incentives to extract rent from them increase. This "profit shifting" force dominates the "distortion", as defined in (12), resulting in a positive tariff under bargaining. However, under foreign monopoly there is a strong under-provision of imports, as measured by the "pass-through" component in (12); this force dominates the profit-shifting, turning the optimal policy from a tariff to an import subsidy. At the bottom end, in products where very few domestic firms hold market power, the optimal policies approximate the values corresponding to rows 1 and 3 of Table 9, shown here by the two horizontal dashed lines.

To sum up, the market power distribution that we estimated mediates the incentives to distort trade, causing large heterogeneity in optimal tariffs across products. The higher the number of domestic firms with market power within a product, the lower these incentives. Accounting for ex-ante investment elasticities plays a crucial rate for pass-through, and for the differences in the optimal policies implied by different market structures.

VII Conclusion

This paper studies an episode of discretionary trade policy in Argentina whereby every import shipment required explicit government approval. A unique dataset covering the universe of import requests, approval decisions, and imported values and quantities at the transaction level allows us to better understand price and quantity responses to non-tariff barriers. The discretionary nature of the policy provides an instrumental variable strategy that draws on differences in approval rates across firms and products that were reversed during times of macroeconomic stress, when the government tightened quantitative restrictions to stem the outflow of foreign reserves.

We find that import prices rose in response to policy-induced quantity reductions. Rising prices are inconsistent with competitive trade models, but are consistent with models with foreign market power, where these restrictions move importers up their demand curve. We find no evidence for a host of alternative explanations in competitive setups, such as risk premia or quality upgrading.

A model of imperfect competition with matched importer-exporter pairs where either the importer or exporter holds market power illuminates how the distribution of such power matters for trade policy. The framework reveals that the previous reduced-form estimate of the price-to-quantity elasticity recovers a weighted average of demand and supply elasticities. A classifier-Lasso is able to simultaneously group each importer-product pair into behaving like either a domestic monopsonist or a customer of a foreign monopolist, and to estimate both demand and supply elasticities using the same exogenous variation provided by the instrument.

Having recovered the full distribution of market power, we find that larger importers are more likely to hold market power and those trading with richer countries are less likely to. The counterfactuals reveal how the price and quantity effects of Argentina's quantitative restrictions as well as optimal tariffs depend on the distribution of market power. Had Argentinian firms held the market power in all their relationships, import prices would have fallen by 7.9% as a result of the government's non-tariff-barriers, rather than risen by 4.0% as we estimate.

Overall, our findings suggest that the ability of trade policy to manipulate international prices is shaped by the weak market power of firms in developing countries. Our finding that foreign market power is rife in determining prices, particularly for Argentinean firms buying from richer countries, echoes Antràs (2020) and World Bank (2020), who conjecture that developing countries' positions in global value chains give them limited bargaining power. These possibilities, as well as theories of which firms hold market power, are topics that require further exploration.

References

Alviarez, V. I., M. Fioretti, K. Kikkawa, and M. Morlacco (2023): "Two-Sided Market Power in Firm-to-Firm Trade," Working Paper 31253, National Bureau of Economic Research.

Antràs, P. (2020): "Conceptual Aspects of Global Value Chains," *The World Bank Economic Review*, 34, 551–574.

Antràs, P. and A. Costinot (2011): "Intermediated Trade," *The Quarterly Journal of Economics*, 126, 1319–1374.

Antràs, P., T. Fort, A. Gutiérrez, and F. Tintelnot (2022): "Trade Policy and Global Sourcing: A Rationale for Tariff Escalation," Working Paper 30225, National Bureau of Economic Research.

Antràs, P., T. C. Fort, and F. Tintelnot (2017): "The Margins of Global Sourcing: Theory and Evidence from US Firms," *American Economic Review*, 107.

Antràs, P. and R. W. Staiger (2012): "Offshoring and the Role of Trade Agreements," *American Economic Review*, 102, 3140–83.

Atkeson, A. and A. Burstein (2008): "Pricing-to-Market, Trade Costs, and International Relative Prices," *The American Economic Review*, 98, 1998–2031.

Bagwell, K. and R. W. Staiger (1999): "An Economic Theory of GATT," *American Economic Review*, 89, 215–248.

Bernard, A. B. and S. Dhingra (2019): "Importers, Exporters and the Division of the Gains from Trade," *Working paper*.

Bernini, F. and E. Garcia-Lembergman (2020): "The Impact of Import Barriers on Firm Performance: Evidence from Import Licenses in Argentina 2000-2011," *Working paper*.

Bhagwati, J. N. and A. O. Krueger (1973): "Exchange Control, Liberalization, and Economic Development," *The American Economic Review*, 419–427.

Blanchard, E. J., C. P. Bown, and R. C. Johnson (2016): "Global Supply Chains and Trade Policy," Working Paper 21883, National Bureau of Economic Research.

Brander, J. A. (1981): "Intra-Industry Trade in Identical Commodities," *Journal of International Economics*, 11, 1–14.

——— (1995): "Strategic Trade Policy," *Handbook of International economics*, 3, 1395–1455.

Brander, J. A. and B. J. Spencer (1981): "Tariffs and the Extraction of Foreign Monopoly Rents Under Potential Entry," *Canadian Journal of Economics*, 371–389.

Broda, C., J. Greenfield, and D. Weinstein (2006): "From Groundnuts to Globalization: A Structural Estimate of Trade and Growth," Working Paper 12512, National Bureau of Economic Research.

Broda, C., N. Limao, and D. E. Weinstein (2008): "Optimal Tariffs and Market Power: the Evidence," *American Economic Review*, 98, 2032–65.

Caliendo, L., R. C. Feenstra, J. Romalis, and A. M. Taylor (2023): "A Second-Best Argument for Low Optimal Tariffs on Intermediate Inputs," *Journal of International Economics*, 145, 103824.

Caliendo, L. and F. Parro (2015): "Estimates of the Trade and Welfare Effects of NAFTA," *The Review of Economic Studies*, 82, 1–44.

——— (2022): "Trade policy," *Handbook of International Economics*, 5, 219–295.

CEPAL (2013): "Preliminary Overview of the Economies of Latin America and the Caribbean 2013," *ECLAC*.

——— (2014): "Preliminary Overview of the Economies of Latin America and the Caribbean 2014," *ECLAC*.

——— (2015): "Preliminary Overview of the Economies of Latin America and the Caribbean 2015," *ECLAC*.

Chen, T., C.-T. Hsieh, and Z. M. Song (2022): "Non-Tariff Barriers in the US-China Trade War," Working Paper 30318, National Bureau of Economic Research.

Colantone, I., G. Ottaviano, and P. Stanig (2021): "The Backlash of Globalization," *Working paper*.

Conconi, P. and H. Schepel (2017): "Argentina Import Measures: How a Porsche is worth Peanuts," *World Trade Review*, 16, 349–369.

Dickstein, M. J. and E. Morales (2018): "What Do Exporters Know?" *Quarterly Journal of Economics*, 133.

Dixit, A. and V. Norman (1980): *Theory of International Trade: A Dual, General Equilibrium Approach*, Cambridge University Press.

Dominguez-Iino, T. (2021): "Efficiency and Redistribution in Environmental Policy: an Equilibrium Analysis of Agricultural Supply Chains," Tech. rep.

Dun & Bradstreet (2011): "WorldBase Database," (accessed November 5, 2022).

Eaton, J. and G. Grossman (1986): "Optimal Trade and Industrial Policy Under Oligopoly," *Quarterly Journal of Economics*, 101, 383–406.

Ederington, J. and M. Ruta (2016): "Nontariff Measures and the World Trading System," *Handbook of Commercial Policy*, 1, 211–277.

Fajgelbaum, P. D., P. K. Goldberg, and P. J. Kennedy (2020): "The Return to Protectionism," *Quarterly Journal of Economics*, 135, 1–55.

Fajgelbaum, P. D. and A. K. Khandelwal (2022): "The Economic Impacts of the US–China Trade War," *Annual Review of Economics*, 14, 205–228.

Feenstra, R. C. (1988): "Quality Change Under Trade Restraints in Japanese Autos," *The Quarterly Journal of Economics*, 103, 131–146.

Gawande, K. and P. Krishna (2003): "The Political Economy of Trade Policy: Empirical Approaches," *Handbook of International Trade*, 1, 139–152.

Giorgi, D. (2012): “Defender el Trabajo Argentino,” *Página 12*, April 7.

Global Trade Alert (2011-2017): “Global Trade Alert Database,” *St.Gallen Endowment for Prosperity through Trade (SGEPT)*, https://www.globaltradealert.org (accessed October 1, 2021).

Goldberg, P. K. and N. Pavcnik (2016): “The Effects of Trade Policy,” in *Handbook of Commercial Policy*, Elsevier, vol. 1, 161–206.

Grant, M. (2020): “Why Special Economic Zones? Using Trade Policy to Discriminate Across Importers,” *American Economic Review*, 110, 1540–71.

Grossman, G. M. and E. Helpman (2005): “Outsourcing in a Global Economy,” *The Review of Economic Studies*, 72, 135–159.

——— (2020): “When Tariffs Disturb Global Supply Chains,” Working Paper 27722, National Bureau of Economic Research.

Halpern, L., M. Koren, and A. Szeidl (2015): “Imported Inputs and Productivity,” *American Economic Review*, 105, 3660–3703.

Head, K. and T. Mayer (2014): “Chapter 3 - Gravity Equations: Workhorse,Toolkit, and Cookbook,” in *Handbook of International Economics*, ed. by G. Gopinath, E. Helpman, and K. Rogoff, Elsevier, vol. 4 of *Handbook of International Economics*, 131–195.

Helpman, E. and P. R. Krugman (1989): *Trade Policy and Market Structure*, MIT press.

Irwin, D. A. (2019): “Does Trade Reform Promote Economic Growth? A Review of Recent Evidence,” Working Paper 25927, National Bureau of Economic Research.

Khandelwal, A. K., P. K. Schott, and S.-J. Wei (2013): “Trade Liberalization and Embedded Institutional Reform: Evidence from Chinese Exporters,” *American Economic Review*, 103, 2169–95.

Kim, W. and Y. J. Yoon (2021): “Trump Tariffs and Firm Relief: Winners and Losers from the Steel Tariff Exclusion Request,” *Applied Economics Letters*, 28, 1357–1362.

Krishna, K. (1987): “Tariffs Versus Quotas with Endogenous Quality,” *Journal of International Economics*, 23, 97–112.

Manski, C. (1991): “Nonparametric Estimation of Expectations in the Analysis of Discrete Choice Under Uncertainty,” in *Proceedings of the Fifth International Symposium in Economic Theory and Econometrics*, ed. by G. E. T. William A. Barnett, James Powell, Cambridge University Press.

McLaren, J. (2016): “The Political Economy of Commercial Policy,” *Handbook of Commercial Policy*, 1, 109–159.

Meleshchuk, S. (2017): “Price Discrimination in International Trade: Empirical Evidence and Theory,” Tech. rep.

Melitz, M. J. (2003): “The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity,” *Econometrica*, 71, 1695–1725.

Morlacco, M. (2019): "Market Power in Input Markets: Theory and Evidence from French Manufacturing," *Working paper*.

Ornelas, E. and J. L. Turner (2008): "Trade Liberalization, Outsourcing, and the Hold-up Problem," *Journal of International Economics*, 74, 225–241.

PEI (2011): *Plan Estratégico Industrial 2020*, Ministerio de Industria.

Rauch, J. E. (1999): "Networks Versus Markets in International Trade," *Journal of International Economics*, 48, 7–35.

Secretaria de Comercio (2011-2017): "Transaction-Level Data on Requests from DJAIs and Customs Records," *Subsecretaria de Comercio Exterior, Ministerio de Economia y Finanzas Publicas, Republica Argentina*.

Soderbery, A. (2018): "Trade Elasticities, Heterogeneity, and Optimal Tariffs," *Journal of International Economics*, 114, 44–62.

Staiger, R. W. and G. Tabellini (1989): "Rules and Discretion in Trade Policy," *European Economic Review*, 33, 1265–1277.

Su, L., Z. Shi, and P. C. Phillips (2016): "Identifying Latent Structures in Panel Data," *Econometrica*, 84, 2215–2264.

Torretta, P. J. and A. Vechio (2012): "Anticipated Import Affidavit and Services Payments Restrictions in Argentina: A Few Considerations After the first Months of Their Validity," *Global Trade and Customs Journal*, 7, 312–314.

World Bank (2020): *World Development Report 2020: Trading for Development in the Age of Global Value Chains*, The World Bank.

WTO (2014): *Reports of the Panel. Argentina - Measures Affecting the Importation of Goods*, World Trade Organization Docs.: WT/DS438/R, WT/DS444/R, WT/DS445/R.

——— (2015): *Reports of the Panel. Argentina - Measures Affecting the Importation of Goods. Reports of the Appellate Body*, World Trade Organization Docs.: WT/DS438/AB/R, WT/DS444/AB/R, WT/DS445/AB/R.

——— (2016): *Argentina - Measures Affecting the Importation of Goods. Status Report by Argentina*, 16-0310, World Trade Organization Docs.: WT/DS438/23, WT/DS444/23, WT/DS445/24.

Zavala, L. (2022): "Unfair Trade? Monopsony Power in Agricultural Value Chains," *The World Bank*.

Trade Barriers and Market Power: Evidence from Argentina's Discretionary Import Restrictions

Appendices for Online Publication

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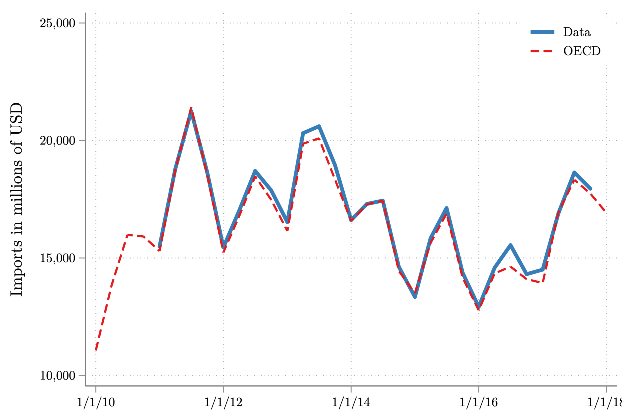
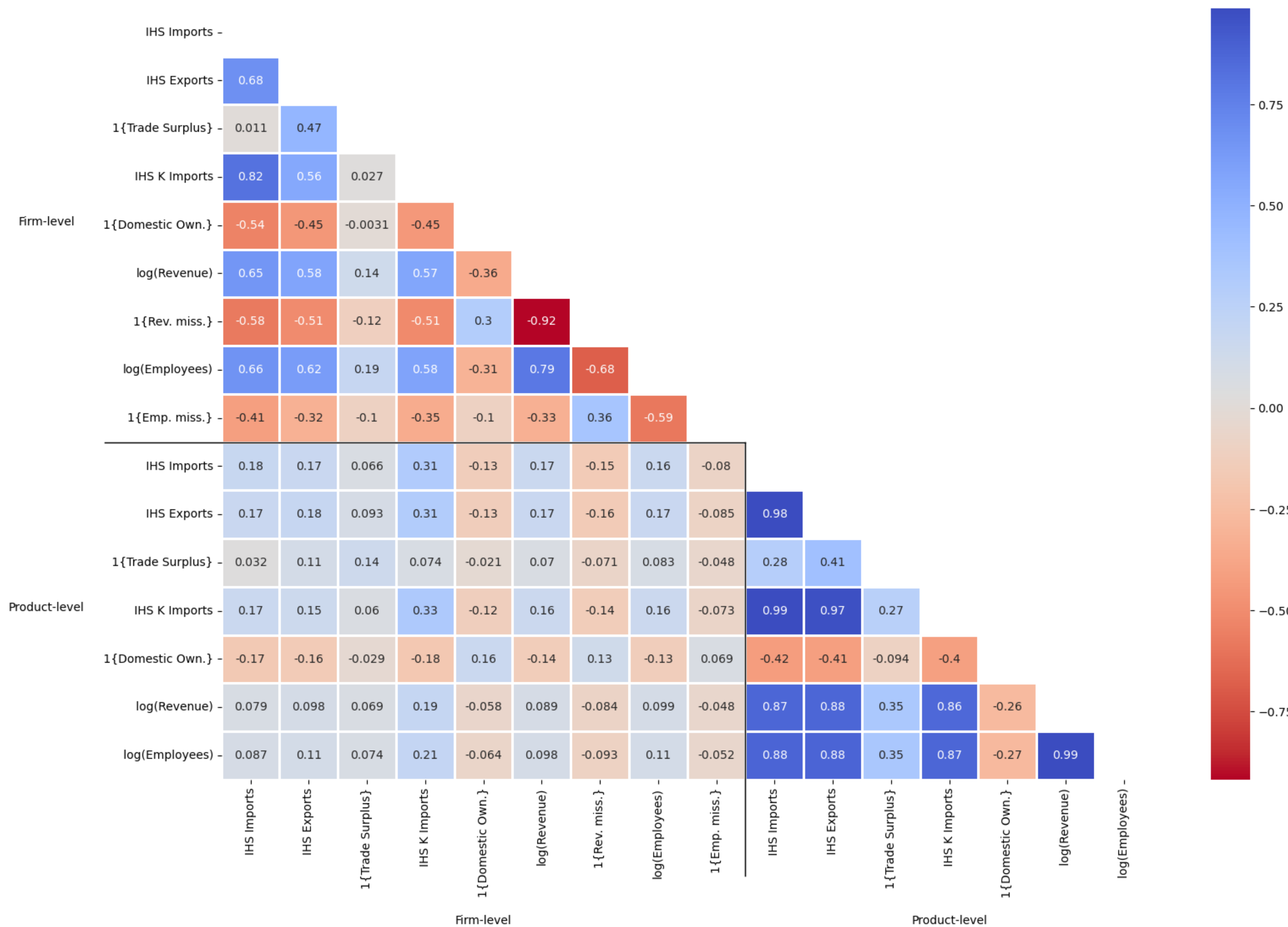
A Additional Figures and Tables

Figure A.1: Comparing Our Trade Flows Data to OECD Data



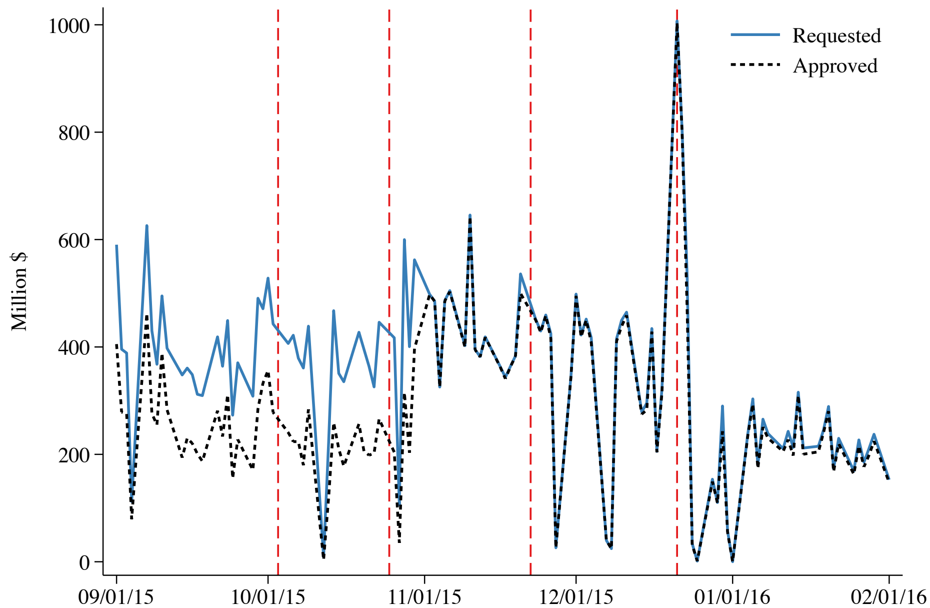
Notes: Figure compares our data on the universe of trade transactions between January 2011 and December 2017 with official OECD data sources (Organization for Economic Co-operation and Development, "International Trade: Imports: Value (Goods): Total for Argentina [ARGXTIMVA01CXMLQ]", (2010-2017). retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/ARGXTIMVA01CXMLQ (accessed June 23, 2021).

Figure A.2: Pairwise Correlations Between Firm and Product Category Characteristics



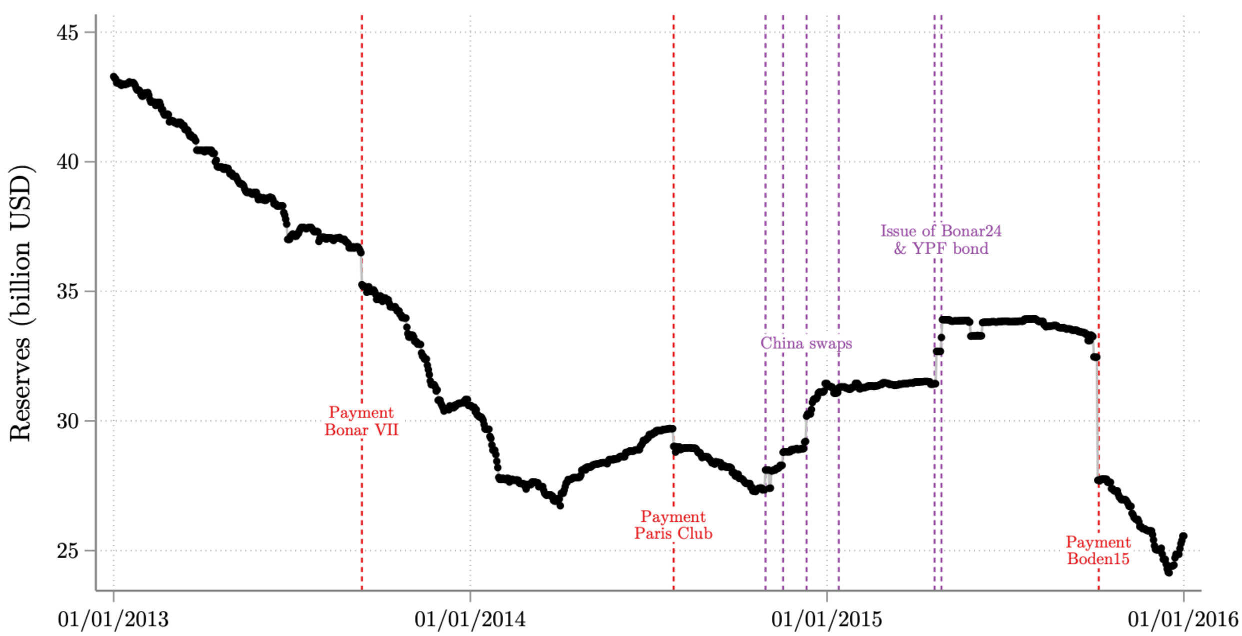
Notes: Correlation matrix between the firm-level and product category-level characteristics used in Table 2, with variable descriptions provided in that table and the main text.

Figure A.3: Daily Requested and Approved Values Around the End of the DJAI



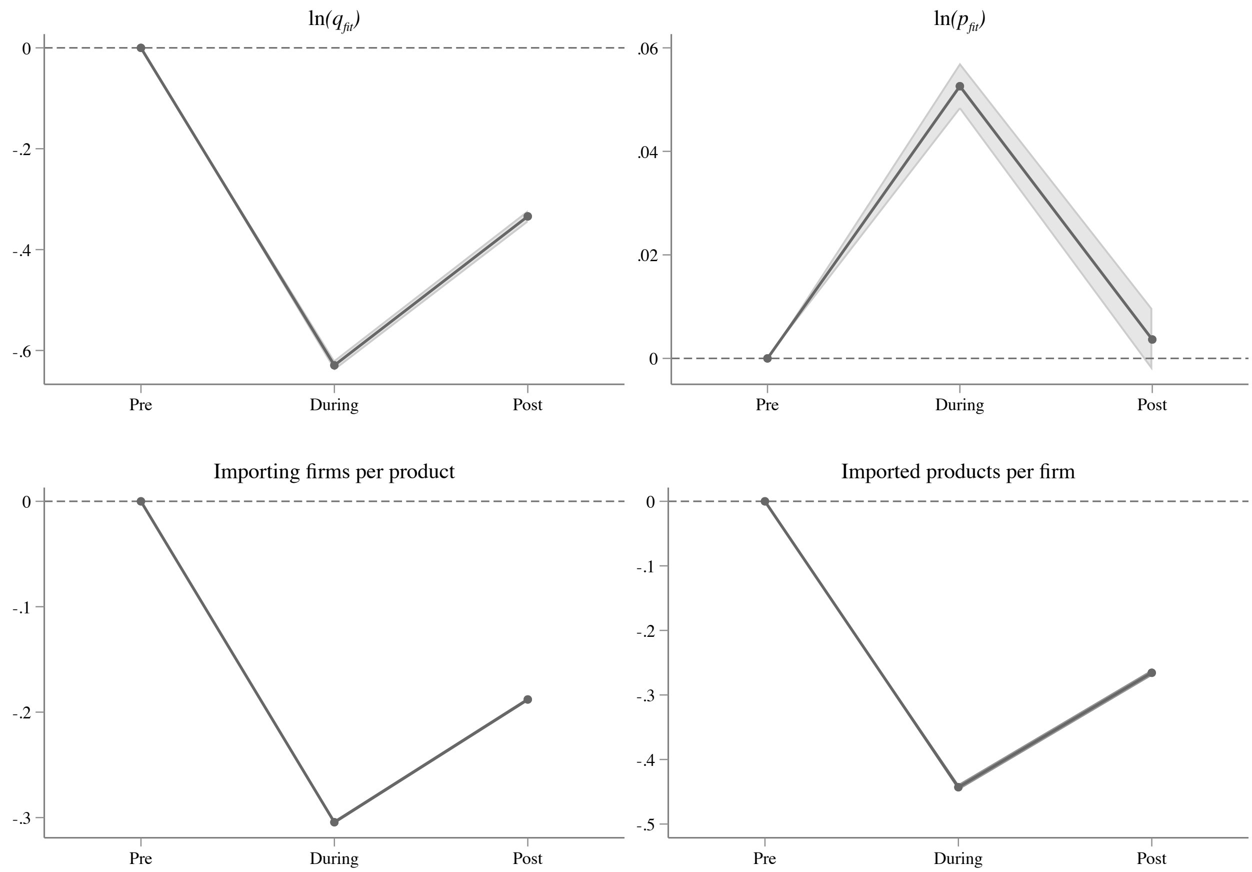
Notes: Daily value requested and approved, excluding weekends. The vertical lines indicate the date of the general election (25th October 2015), of the runoff election (22nd November 2015), of Macri's inauguration (10th December 2015), and the date that the DJAI was repealed (21st December 2015).

Figure A.4: Evolution of Foreign Reserves and Dates of Debt Issue and Repayment



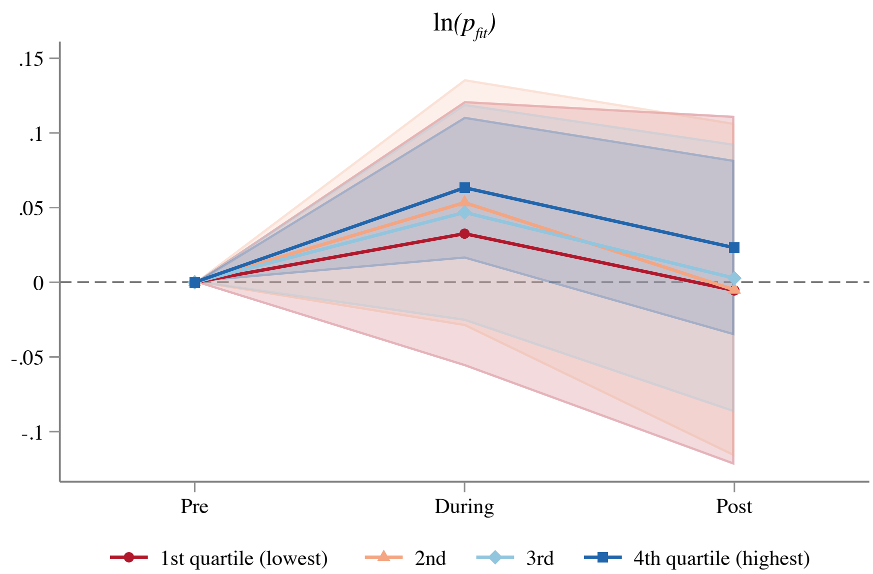
Notes: Daily reserves data from Ambito.com. Event dates identified from news articles. Appendix Table A.7 provides a more complete list of relevant events.

Figure A.5: Quantities and Prices Pre, During, and Post DJAI



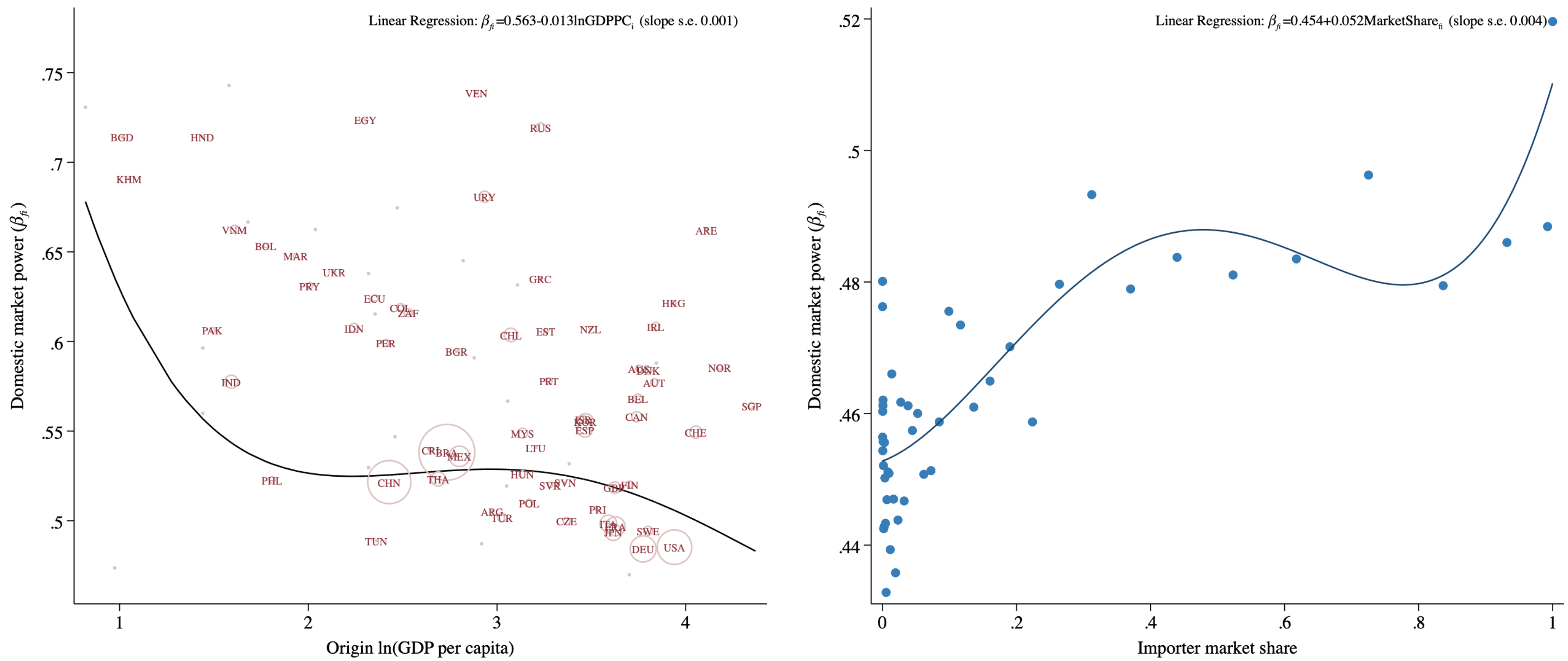
Notes: Top row shows plots of the μ_t fixed effects from estimating $y_{fit} = \mu_t + \mu_{fi} + \epsilon_{fit}$ where t is a period (pre, during, and post DJAI), i a product, and f is a firm. The pre-DJAI period runs from January 2011 to January 2012, the during-DJAI period from February 2012 to October 2015, and the post-DJAI period from January 2016 to December 2017. The left-hand-side variable is log total annual imported quantities in the left panel ($\ln q$) and log import prices (quantity weighted) in the right panel ($\ln p$). Standard errors are clustered at the firm-HS4 product level with shading denoting 95% confidence intervals. Left panel of bottom row plots μ_t fixed effects from estimating $y_{it} = \mu_t + \mu_i + \epsilon_{it}$ where left-hand-side variable is the annual number of firms importing at the product i level (i.e. HS11-unit-origin) and μ_i are product fixed effects. Right panel of bottom row plots μ_t fixed effects from estimating $y_{ft} = \mu_t + \mu_f + \epsilon_{ft}$ where left-hand-side variable is the annual number of imported products per firm and μ_f are firm fixed effects.

Figure A.6: Export Prices Pre, During, and Post DJAI by Quartiles of Predicted Approval Rate



Notes: Plots of the μ_{tj} fixed effects from estimating $y_{fit} = \mu_{tj} + \mu_{fi} + \epsilon_{fit}$ where t is a period, i a (HS11-origin-unit) product, f is a firm, and j is the (firm-product-specific) quartile of predicted approval rates based on pre characteristics (using the coefficients in column 2 of Table 2). The dependent variable is annual firm-product log export prices (quantity weighted across shipments). The pre DJAI period runs from January 2011 to January 2012, during from February 2012 to October 2015, and post from January 2016 to December 2017. Standard errors are clustered at the firm-HS4 product level with shading denoting 95% confidence intervals.

Figure A.7: Correlates of Market Power Controlling For Industry Composition



Notes: This figure plots the relationship between the domestic market power estimates, the $\beta_{fi}s$, and either the origin country's log GDP per capita (left panel) or the importers market share in the relevant origin-HS11 product category (right panel). Unlike figure 3 in the main text, here we control for differences in industry composition by including 4-digit HS fixed effects. In both panels, solid lines represent polynomial fits (4th degree) with each firm-product estimate weighted by the number of firm-product-quarter observations it represents. The left panel additionally plots the average values for each country with the size of the marker representing the value of log total imports (with the top 75 exporters labeled with ISO country codes and outliers removed for visual clarity). Right panel additionally plots values from 50 point binscatter.

Table A.1: Approval Rates Under the DJAI: Excluding Products Initially Covered by NAILS

		Dependent Variable: Approval Rate Excluding NAIL Products			
		(1)		(2)	
Firm-Level Characteristics					
Trade	IHS Imports	0.024***	(0.000)	0.012***	(0.000)
	IHS Exports	0.0067***	(0.000)	0.0049***	(0.000)
	$\mathbb{1}$\{Trade Surplus\}	0.028***	(0.001)	0.0020**	(0.001)
Investment	IHS K Imports	0.0058***	(0.000)	0.0033***	(0.000)
Ownership	$\mathbb{1}$\{Domestic Own.\}	0.028***	(0.001)	-0.024***	(0.001)
Size	log(Revenue)	0.021***	(0.000)	-0.0082***	(0.000)
	$\mathbb{1}$\{Rev. miss.\}	0.34***	(0.002)	-0.16***	(0.003)
	log(Employees)	-0.018***	(0.000)	0.013***	(0.000)
	$\mathbb{1}$\{Emp. miss.\}	-0.043***	(0.003)	0.074***	(0.003)
Product Category-Level Characteristics					
Trade	IHS Imports			0.046***	(0.001)
	IHS Exports			-0.00096**	(0.000)
	$\mathbb{1}$\{Trade Surplus\}			0.015***	(0.001)
Investment	IHS K Imports			-0.020***	(0.000)
Ownership	$\mathbb{1}$\{Domestic Own.\}			-0.0044***	(0.001)
Size	log(Revenue)			0.014***	(0.000)
	log(Employees)			-0.029***	(0.001)
Observations		771,749		731,379	
R^2		0.879		0.891	
F-statistic		1,048,611		642,882	

Notes: Table shows regressions of firm-product-level approval rates on firm and product category characteristics, excluding product categories covered by non-automatic import licenses prior to the start of the DJAI. The approval rate AR is the firm-product ratio of total quantity approved to requested during the whole DJAI regime, January 2013 to October 2015. The firm and product category characteristics are calculated using 2011 data, before the start of the DJAI regime. Revenue and employment data come from the D&B database and are not recorded for all firms, so we code missing values as zero and include a dummy for missing observations as a separate regressor. We code firms without an Ultimate Parent Company code (also from D&B) as domestic. For the product-category-level aggregates, we first aggregate the raw levels before taking IHS or log transformations, weighting raw levels by 2011 import values except employment and revenues where we simply sum over all importing firms. Product-category-level characteristics are at the HS11 level and approval rates are at the firm-HS11-origin-measurement unit level. Robust (HC3) standard errors shown in parentheses. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

Table A.2: Relationship Between DJAI Share of Value Approved and Firm and Product Category Characteristics

		Dependent Variable: Share of Value Approved					
		Complete DJAI Period				1^{st} Quarter of DJAI	
		(1)		(2)		(3)	
Firm-Level Characteristics							
Trade	IHS Imports	0.023***	(0.00013)	0.011***	(0.00015)	0.020***	(0.00044)
	IHS Exports	0.0066***	(0.000065)	0.0049***	(0.000064)	0.0017***	(0.00013)
	𝟙{Trade Surplus}	0.031***	(0.00085)	0.0019**	(0.00085)	0.019***	(0.0018)
Investment	IHS K Imports	0.0063***	(0.000086)	0.0035***	(0.000097)	0.0044***	(0.00022)
Ownership	𝟙{Domestic Own.}	0.027***	(0.00061)	-0.027***	(0.00062)	-0.021***	(0.0012)
Size	log(Revenue)	0.020***	(0.00012)	-0.0081***	(0.00015)	-0.0053***	(0.00027)
	𝟙{Rev. miss.}	0.34***	(0.0019)	-0.16***	(0.0026)	-0.11***	(0.0048)
	log(Employees)	-0.017***	(0.0002)	0.012***	(0.00021)	0.0073***	(0.00035)
	𝟙{Emp. miss.}	-0.040***	(0.0023)	0.074***	(0.0023)	0.066***	(0.0037)
Product Category-Level Characteristics							
Trade	IHS Imports			0.044***	(0.00063)	0.038***	(0.0013)
	IHS Exports			0.0024***	(0.00046)	0.0023**	(0.00093)
	𝟙{Trade Surplus}			0.014***	(0.00074)	0.016***	(0.0015)
Investment	IHS K Imports			-0.021***	(0.00047)	-0.020***	(0.00091)
Ownership	𝟙{Domestic Own.}			0.0099***	(0.0012)	0.0092***	(0.0023)
Size	log(Revenue)			0.012***	(0.00027)	0.012***	(0.00054)
	log(Employees)			-0.026***	(0.00046)	-0.025***	(0.00093)
Observations		991,322		931,175		200,331	
R^2		0.88		0.892		0.923	
F-statistic		1,399,847		847,944.2		353,238.4	

Notes: Table shows regressions of firm-product-level approval rates on firm and product category characteristics. The approval rate AR is the firm-product ratio of total value approved to requested during the whole DJAI regime, January 2013 to October 2015 (columns 1 and 2), or during its first quarter, January to March 2013 (column 3). The firm and product category characteristics are calculated using 2011 data, before the start of the DJAI regime. Revenue and employment data come from the D&B database and are not recorded for all firms, so we code missing values as zero and include a dummy for missing observations as a separate regressor. We code firms without an Ultimate Parent Company code (also from D&B) as domestic. For the product-category-level aggregates, we first aggregate the raw levels before taking IHS or log transformations, weighting raw levels by 2011 import values except employment and revenues where we simply sum over all importing firms. Product-category-level characteristics are at the HS11 level and approval rates are at the firm-HS11-origin-measurement unit level. Robust (HC3) standard errors shown in parentheses. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

Table A.3: Relationship Between DJAI Average Request-level Approval Rates and Firm and Product Category Characteristics

		Dependent Variable: Average Request-level Approval Rate					
		Complete DJAI Period				1^{st} Quarter of DJAI	
		(1)		(2)		(3)	
Firm-Level Characteristics							
Trade	IHS Imports	0.024***	(0.00013)	0.012***	(0.00015)	0.020***	(0.00043)
	IHS Exports	0.0060***	(0.00006)	0.0044***	(0.000059)	0.0016***	(0.00013)
	𝟙{Trade Surplus}	0.030***	(0.0008)	0.00086	(0.0008)	0.019***	(0.0018)
Investment	IHS K Imports	0.0056***	(0.00008)	0.0029***	(0.000091)	0.0044***	(0.00021)
Ownership	𝟙{Domestic Own.}	0.031***	(0.00056)	-0.022***	(0.00057)	-0.020***	(0.0011)
Size	log(Revenue)	0.021***	(0.00012)	-0.0071***	(0.00014)	-0.0053***	(0.00026)
	𝟙{Rev. miss.}	0.36***	(0.0019)	-0.14***	(0.0024)	-0.11***	(0.0048)
	log(Employees)	-0.019***	(0.00019)	0.011***	(0.0002)	0.0073***	(0.00034)
	𝟙{Emp. miss.}	-0.047***	(0.0022)	0.067***	(0.0021)	0.069***	(0.0034)
Product Category-Level Characteristics							
Trade	IHS Imports			0.044***	(0.00059)	0.038***	(0.0013)
	IHS Exports			0.0016***	(0.00043)	0.0019**	(0.00092)
	𝟙{Trade Surplus}			0.014***	(0.00069)	0.016***	(0.0014)
Investment	IHS K Imports			-0.020***	(0.00044)	-0.020***	(0.0009)
Ownership	𝟙{Domestic Own.}			0.014***	(0.0011)	0.010***	(0.0022)
Size	log(Revenue)			0.013***	(0.00026)	0.012***	(0.00053)
	log(Employees)			-0.027***	(0.00044)	-0.026***	(0.00092)
Observations		991,322		931,175		200,331	
R^2		0.896		0.907		0.926	
F-statistic		1703254		1062276		383,625.0	

Notes: Table shows regressions of firm-product-level approval rates on firm and product category characteristics. The firm-product level approval rate AR is simple average of request-level quantity approved to requested during the whole DJAI regime, January 2013 to October 2015 (columns 1 and 2), or during its first quarter, January to March 2013 (column 3). The firm and product category characteristics are calculated using 2011 data, before the start of the DJAI regime. Revenue and employment data come from the D&B database and are not recorded for all firms, so we code missing values as zero and include a dummy for missing observations as a separate regressor. We code firms without an Ultimate Parent Company code (also from D&B) as domestic. For the product-category-level aggregates, we first aggregate the raw levels before taking IHS or log transformations, weighting raw levels by 2011 import values except employment and revenues where we simply sum over all importing firms. Product-category-level characteristics are at the HS11 level and approval rates are at the firm-HS11-origin-measurement unit level. Robust (HC3) standard errors shown in parentheses. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

Table A.4: Approval Rates Under the DJAI: Trade Surplus

		Dependent Variable: Approval Rate Complete DJAI Period (1)		(2)	
Firm-Level Characteristics					
Trade	𝟙{Imported}	0.26***	(0.002)	-0.030***	(0.004)
	𝟙{Exported}	0.10***	(0.001)	0.11***	(0.001)
	log(Imports)	0.032***	(0.000)	0.027***	(0.000)
	log(Exports/Imports)	-0.0029***	(0.000)	0.0017***	(0.000)
	$(\log(\text{Exports/Imports}))^2$	-0.00076***	(0.000)	-0.00061***	(0.000)
	$(\log(\text{Exports/Imports}))^3$	0.000023***	(0.000)	0.0000045	(0.000)
	𝟙{Trade Surplus}	0.074***	(0.001)	0.037***	(0.001)
Investment	𝟙{K Imported}			0.036***	(0.002)
	log(K Imports)			0.0042***	(0.000)
Ownership	𝟙{Domestic Own.}			0.021***	(0.001)
Size	log(Revenue)			0.020***	(0.000)
	𝟙{Rev. miss.}			0.33***	(0.002)
	log(Employees)			-0.017***	(0.000)
	𝟙{Emp. miss.}			-0.038***	(0.002)
Observations		1,094,106		991,322	
R^2		0.836		0.881	
F-statistic		2,032,451		1,021,052	

Notes: Table shows regressions of firm-product-level approval rates on firm-level characteristics, allowing for a more flexible specification for the trade surplus. The approval rate AR is the firm-product ratio of total quantity approved to requested during the whole DJAI regime, January 2013 to October 2015 (columns 1 and 2), or during its first quarter, January to March 2013 (column 3). The firm characteristics are calculated using 2011 data, before the start of the DJAI regime. Revenue and employment data come from the D&B database and are not recorded for all firms, so we code missing values as zero and include a dummy for missing observations as a separate regressor. We code firms without an Ultimate Parent Company code (also from D&B) as domestic. Robust (HC3) standard errors shown in parentheses. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

Table A.5: Approval Rates Under the DJAI: Single Size Metrics

		Dependent Variable: Approval Rate							
		Just Revenues as Size Metric				Just Employment as Size Metric			
		(1)		(2)		(3)		(4))	
Firm-Level Characteristics									
	IHS Imports	0.026***	(0.000)	0.012***	(0.000)	0.037***	(0.000)	0.012***	(0.000)
Trade	IHS Exports	0.0059***	(0.000)	0.0054***	(0.000)	0.0050***	(0.000)	0.0055***	(0.000)
	𝟙{Trade Surplus}	0.033***	(0.001)	0.0050***	(0.001)	0.050***	(0.001)	0.0025***	(0.001)
Investment	IHS K Imports	0.0058***	(0.000)	0.0038***	(0.000)	0.0045***	(0.000)	0.0039***	(0.000)
Ownership	𝟙{Domestic Own.}	0.041***	(0.001)	-0.025***	(0.001)	0.11***	(0.001)	-0.028***	(0.001)
Size	log(Size)	0.012***	(0.000)	-0.000080	(0.000)	0.0076***	(0.000)	0.0043***	(0.000)
	𝟙{Size. miss.}	0.25***	(0.001)	-0.036***	(0.002)	0.12***	(0.002)	0.034***	(0.002)
Product Category-Level Characteristics									
	IHS Imports			0.047***	(0.001)			0.040***	(0.001)
Trade	IHS Exports			0.0014***	(0.000)			0.0034***	(0.000)
	𝟙{Trade Surplus}			0.0087***	(0.001)			0.010***	(0.001)
Investment	IHS K Imports			-0.025***	(0.000)			-0.020***	(0.000)
Ownership	𝟙{Domestic Own.}			0.017***	(0.001)			0.010***	(0.001)
Size	log(Size)			-0.0019***	(0.000)			-0.0056***	(0.000)
Observations		991,322		931,195		991,322		937,735	
R^2		0.880		0.891		0.875		0.891	
F-statistic		1794943.6		1039476.5		1749029.6		1043787.4	

Notes: Table shows regressions of firm-product-level approval rates on firm and product category characteristics. Columns 1 and 2 use a single size metric, revenues. Columns 3 and 4 use a single size metric, employment. The approval rate AR is the firm-product ratio of total quantity approved to requested during the whole DJAI regime, January 2013 to October 2015 (columns 1 and 2), or during its first quarter, January to March 2013 (column 3). The firm and product category characteristics are calculated using 2011 data, before the start of the DJAI regime. Revenue and employment data come from the D&B database and are not recorded for all firms, so we code missing values as zero and include a dummy for missing observations as a separate regressor. We code firms without an Ultimate Parent Company code (also from D&B) as domestic. For the product-category-level aggregates, we first aggregate the raw levels before taking IHS or log transformations, weighting raw levels by 2011 import values except employment and revenues where we simply sum over all importing firms. Product-category-level characteristics are at the HS11 level and approval rates are at the firm-HS11-origin-measurement unit level. Robust (HC3) standard errors shown in parentheses. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

Table A.6: Approval Rates Under the DJAI: Intermediate Goods' Imports

		Dependent Variable: Approval Rate			
		Complete DJAI Period		1^{st} Quarter of DJAI	
		(1)		(2)	
Firm-Level Characteristics					
Trade	IHS Imports	0.011***	(0.00015)	0.020***	(0.00044)
	IHS Exports	0.0049***	(0.000064)	0.0017***	(0.00013)
	𝟙{Trade Surplus}	0.0014*	(0.00085)	0.018***	(0.0018)
Investment	IHS K Imports	0.0037***	(0.000097)	0.0046***	(0.00022)
Ownership	𝟙{Domestic Own.}	-0.026***	(0.00062)	-0.021***	(0.0012)
Size	log(Revenue)	-0.0080***	(0.00015)	-0.0052***	(0.00027)
	𝟙{Rev. miss.}	-0.15***	(0.0025)	-0.11***	(0.0048)
	log(Employees)	0.012***	(0.00021)	0.0073***	(0.00035)
	𝟙{Emp. miss.}	0.074***	(0.0023)	0.067***	(0.0037)
Product Category-Level Characteristics					
Trade	IHS Imports	0.041***	(0.00063)	0.037***	(0.0013)
	IHS Exports	0.0021***	(0.00045)	0.0017*	(0.00094)
	𝟙{Trade Surplus}	0.013***	(0.00074)	0.015***	(0.0015)
Investment	IHS K Imports	-0.019***	(0.00047)	-0.019***	(0.00091)
Ownership	𝟙{Domestic Own.}	0.014***	(0.0012)	0.012***	(0.0023)
Size	log(Revenue)	0.012***	(0.00027)	0.012***	(0.00054)
	log(Employees)	-0.026***	(0.00046)	-0.025***	(0.00093)
Intermediates	𝟙{Intermediate Good}	0.027***	(0.00068)	0.021***	(0.0014)
Observations		929,819		199,997	
R^2		0.892		0.923	
F-statistic		806,243.0		334,411.6	

Notes: Table shows regressions of firm-product-level approval rates on firm and product category characteristics. The firm-product level approval rate AR is firm-product ratio of total quantity approved to requested during the whole DJAI regime, January 2013 to October 2015 (columns 1 and 2), or during its first quarter, January to March 2013 (column 3). The firm and product category characteristics are calculated using 2011 data, before the start of the DJAI regime. We define capital goods and intermediate goods using a UN correspondence from 6-digit HS codes to broad economic categories (https://unstats.un.org/unsd/trade/classifications/correspondence-tables.asp). Revenue and employment data come from the D&B database and are not recorded for all firms, so we code missing values as zero and include a dummy for missing observations as a separate regressor. We code firms without an Ultimate Parent Company code (also from D&B) as domestic. For the product-category-level aggregates, we first aggregate the raw levels before taking IHS or log transformations, weighting raw levels by 2011 import values except employment and revenues where we simply sum over all importing firms. Product-category-level characteristics are at the HS11 level and approval rates are at the firm-HS11-origin-measurement unit level. Robust (HC3) standard errors shown in parentheses. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

Table A.7: Events Affecting the DJAI System and Foreign Reserves

Date	Description	Notes
October 23, 2011	CFK wins second presidential term	
October 31, 2011	Currency controls start	
February 1, 2012	DJAI system starts	
August 26, 2013	US Appeals court upholds Griesa's decision against Argentina on 2001 sovereign default case	Informal exchange rate increase
September 12, 2013	Payment of sovereign-debt bond Bonar VII	Reserves decrease
January 13, 2014	US Supreme Court agrees to hear Argentina case	Informal exchange rate increase
June 16, 2014	US Supreme Court denies Argentina's second petition	Informal exchange rate increase
July 28, 2014	Payment of restructured sovereign debt to the Paris Club	Reserves decrease
October 30, 2014	1st installment of currency swap with China	Reserves increase
November 17, 2014	2nd installment of currency swap with China	Reserves increase
December 11, 2014	3rd installment of currency swap with China	Reserves increase
January 13, 2015	4th installment of currency swap with China	Reserves increase
April 21, 2015	Issue of sovereign-debt bond Bonar 2024	Reserves increase
April 28, 2015	YPF issues corporate bonds	Reserves increase
October 6, 2015	Payment of sovereign-debt bond Boden 2015	Reserves decrease
October 25, 2015	Macri ties with Scioli in first round presidential election	
November 22, 2015	Macri wins runoff election	
December 10, 2015	Macri's inauguration	
December 16, 2015	Currency controls lifted	
December 22, 2015	DJAI system ends	

Notes: List of events related to currency controls, implementation of the DJAI system, debt issue, and debt repayment. Event dates identified from news articles.

Table A.8: The Effects of Quantity Restrictions on Prices Within DJAI Period: Alternative Specifications

	(1) No Lasso $\ln(p_{fit})$	(2) Half-yearly $\ln(p_{fit})$	(3) ht FE $\ln(p_{fit})$	(4) it FE $\ln(p_{fit})$	(5) No Energy $\ln(p_{fit})$	(6) Alt. Cluster $\ln(p_{fit})$
$\ln(q_{fit})$	-0.130***	-0.183**	-0.116**	-0.164**	-0.134***	-0.132*
	(0.0464)	(0.0824)	(0.0580)	(0.0764)	(0.046)	(0.0771)
Time (t) FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Product (fi) FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Product (fi) Trends	Yes	Yes	Yes	No	Yes	Yes
HS2-Time FE	No	No	Yes	No	No	Yes
Firm (f) Trends	No	No	No	Yes	No	No
Product-Time (it) FE	No	No	No	Yes	No	No
Observations	1,820,700	1,123,220	1,820,700	1,460,411	1,816,417	1,820,700
K-P F-stat	115.9	46.8	139.9	40.4	119.3	20.4
C-D F-stat	296.5	133.0	164.5	82.0	329.3	231.0

Notes: Table presents the price effects of DJAI-induced quantity restrictions using a Lasso IV regression of log prices on log quantities at the firm-product-quarter level. Log quantities instrumented with Lasso-selected powers of log reserves interacted with powers of predicted initial approval rates. Predicted initial approval rate calculated from approval rates in Q1 2013 and firm and product category characteristics from 2011 (column 3 of Table 2). Sample covers the second quarter of 2013 to the last quarter of 2015. Columns 1–5 reproduce the 2SLS specification in column 3 of Table 4 with modifications. Column 1 relies on the linear interaction $\ln(Res_t) \times \widehat{AR}_{fh}^{\text{Q1-13}}$ as the instrument (column 1 of Table 2). Column 2 replicates the analysis over 6-month periods. Column 3 includes HS2-time fixed effects. Column 4 adds HS11-origin-unit-time fixed effects but limits the linear trends to be firm-specific rather than firm-product specific. Column 5 excludes energy products (2-digit HS code 27) from the estimation sample. Standard errors two-way clustered at the firm-product level and HS11 product category level shown in parentheses (except column 6 that two-way clusters at the firm-time and HS11-time levels). Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

Table A.9: Correlation Between Estimated Market Power and Proxies of Market Power

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$\hat{\beta}_{fi}$	$\hat{\beta}_{fi}$	$\hat{\beta}_{fi}$	$\hat{\beta}_{fi}$	$\hat{\beta}_{fi}$	$\hat{\beta}_{fi}$	$\hat{\beta}_{fi}$	$\hat{\beta}_{fi}$
Importer Market Share$_f$	0.121***				0.100***	0.074***	0.035***	0.056***
	(0.003)				(0.004)	(0.004)	(0.004)	(0.004)
ln GDP Per Capita$_i$		-0.027***			-0.036***	-0.022***	-0.011***	-0.024***
		(0.001)			(0.002)	(0.002)	(0.002)	(0.002)
Rauch Differentiation$_i$			-0.136***		-0.141***	-0.120***	-0.018	-0.015
			(0.002)		(0.003)	(0.003)	(0.015)	(0.015)
Foreign Ownership$_f$				-0.030**	-0.012***	-0.030***	-0.028***	-0.008***
				(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.440***	0.607***	0.640***	0.534***	0.687***	0.724***	0.605***	0.548***
	(0.001)	(0.004)	(0.002)	(0.001)	(0.006)	(0.006)	(0.015)	(0.015)
Weighted by N_{fi}	Yes	Yes	Yes	Yes	Yes	No	No	Yes
4-digit HS FE	No	No	No	No	No	No	Yes	Yes
Observations	203,855	380,615	392,880	392,880	197,956	197,956	197,913	197,913
R^2	0.0061	0.0013	0.0081	0.0009	0.0179	0.0124	0.0329	0.0438

Notes: We project firm-product market power $\hat{\beta}_{fi}$ estimates on importer market shares within origin-HS11 product categories, log GDP per capita, Rauch differentiability, and foreign ownership, with these proxies for market power described in Table 5. The row labeled "weighted by N_{fi}" indicates whether the regression is weighted by the number of observations for each firm-product. The row labeled "4-digit HS FE" indicates whether the regression includes HS4 industry fixed effects. Standard errors robust to heteroskedasticity in parentheses. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

Table A.10: Average Market Power by 2-digit HS Section

HS Section		(1) Unweighted	(2) Weighted	(3) % Value
1	Live Animals and Animal Products	0.712	0.637	0.2
2	Vegetable Products	0.650	0.546	0.7
3	Animal or Vegetable Fats and Oils	0.734	0.649	0.1
4	Prepared Foodstuffs	0.679	0.608	1.4
5	Mineral Products	0.731	0.646	19.2
6	Chemical or Allied Industries	0.701	0.615	14.9
7	Plastics and Rubber Articles	0.637	0.521	6.2
8	Leather, Handbags and Similar	0.671	0.569	0.2
9	Wood and Articles of Wood	0.665	0.574	0.2
10	Pulp of Wood, Cellulosics, Paper	0.682	0.585	2.0
11	Textiles	0.705	0.618	1.9
12	Footwear, headgear	0.694	0.619	0.6
13	Glass, Ceramics, Articles of Stone	0.633	0.516	0.9
14	Pearls, Jewelry, Precious Metals	0.596	0.482	0.2
15	Base Metals and Articles of Base Metal	0.625	0.497	5.6
16	Machinery and Mechanical Appliances	0.624	0.496	24.4
17	Vehicles and Transport Equipment	0.552	0.439	17.4
18	Optical, Measurement Instruments, etc	0.625	0.498	2.7
19	Arms and Ammunition	0.536	0.407	0.0
20	Miscellaneous Manufactured Articles	0.613	0.490	1.3
	Total	0.638	0.521	100.0

Notes: The table presents average estimated bargaining power (β) by HS sections. Column 1 shows unweighted averages of the βs and column 2 averages weighted by the number of observations in a firm-product cell. The last column (3) shows the percentage of total import value accounted for by each HS section.

Table A.11: Estimates of the Requests Equation

	(1)	(2)	(3)	(4)
	IV		OLS	
	$\ln q^R_{fit}$		$\ln q^R_{fit}$	
$\ln \tilde{\lambda}^{obs}_{fit}$	1.235***	1.229***	-0.963***	-1.076***
	(0.162)	(0.195)	(0.030)	(0.033)
	[0.165]	[0.183]		
Time (t) FE	Yes	Yes	Yes	Yes
Firm-Product (fi) FE	Yes	Yes	Yes	Yes
Firm-Product (fi) Trends	Yes	Yes	Yes	Yes
Sample	$\hat{\beta}_{fi} = 0$	$\hat{\beta}_{fi} = 1$	$\hat{\beta}_{fi} = 0$	$\hat{\beta}_{fi} = 1$
Observations	379,875	283,694	379,875	283,694
K-P F-stat	223.8	146.6		
C-D F-stat	8,405.5	6,004.5		
	(5)	(6)	(7)	(8)
	1^{st} stage		Red. form	
	$\ln \tilde{\lambda}^{obs}_{fit}$		$\ln q^R_{fit}$	
$\ln \tilde{\lambda}^{obs}_{fit-1}$	-0.157***	-0.154***	-0.193***	-0.189***
	(0.010)	(0.013)	(0.018)	(0.020)
Time (t) FE	Yes	Yes	Yes	Yes
Firm-Product (fi) FE	Yes	Yes	Yes	Yes
Firm-Product (fi) Trends	Yes	Yes	Yes	Yes
Sample	$\beta = 0$	$\beta = 1$	$\beta = 0$	$\beta = 1$
Observations	379,875	283,694	379,875	283,694

Notes: The OLS estimating equation is $\ln q^R_{fit} = b^q \ln \tilde{\lambda}^{obs}_{fit} + \mu_{fi} + \mu_t + \mu_{fi} \times t + e_{fit}$ where q^R_{fit} is the quantity requested, $\tilde{\lambda}^{obs}_{fit}$ is the realized value of the term over which we take the expectation in equation (11), μ_{fi} are firm-product fixed effects, μ_t are quarter-year fixed effects, and $\mu_{fi} \times t$ are firm-product trends. We estimate this specification separately for each sample, $\hat{\beta}_{fi} = 0$ and $\hat{\beta}_{fi} = 1$, using lags of the realized moment $\tilde{\lambda}^{obs}_{fit-1}$ to instrument for $\tilde{\lambda}^{obs}_{fit}$. Standard errors two-way clustered at the firm-product level and HS11 product category level shown in parentheses. Square parentheses denote bootstrapped standard errors based on 100 bootstraps, drawing with replacement firm-product pairs and running the full estimation procedure. Asterisks indicate 10% (*), 5% (**), and 1% (***) significance.

B Additional Details on the DJAI System

B.1 The DJAI Process

The DJAI process was ordered by Argentina's Federal Public Revenue Administration (Administración Federal de Ingresos Públicos, AFIP) on January 5th, 2012, and entered into force on February 1st, 2012. Here we describe in more detail the steps involved in the process. The information in this section is taken from the World Trade Organization Reports of the Panel (WTO, 2014).

Importers were required to file an Advance Sworn Import Declaration (DJAI) through AFIP's electronic portal. The DJAI had to be submitted prior to the issuance of an order form, purchase order, or similar document issued as part of a purchase of items from abroad. The DJAI had to specify detailed information about the prospective import, including value, quantity, origin, product code and measurement unit.[1]

After it was filed, a declaration could be flagged by the government, in which case it would enter the "observed" status. Goods covered by a DJAI in observed status could not be imported into Argentina. If not flagged, the DJAI would instead move to "exit" status which allowed the importation to proceed. Exit status was also necessary to obtain authorization from the Central Bank of Argentina to open letters of credit, the issuance of bank guarantees, or to make payments in foreign currency. If a DJAI in exit status was not used within 180 calendar days from initiation, the DJAI would be voided.

The following governmental agencies were entitled to flag a declaration by entering "observations":

- The Federal Public Revenue Administration (AFIP),
- The Secretariat of Trade (Secretaría de Comercio),
- The National Drugs, Food and Medical Technology Administration (Administración Nacional de Medicamentos, Alimentos y Tecnología Médica, ANMAT), and
- The Planning Secretariat for the Prevention of Drug Addiction and the Fight Against Drug Trafficking (Secretaría de Programación para la Prevención de la Drogadicción y la Lucha contra el Narcotráfico, SEDRONAR).

An agency could enter an observation within 72 hours after a DJAI had been filed, except for the Secretariat of Trade which had 15 working days.

If a DJAI was in observed status, prospective importers could try to get the observation lifted. To do so, they were required to (a) identify the entity that entered the observation; (b) contact such agency in order to be informed of supplementary documents or information that must be provided; and, (c) provide the information required. Importers would not know the reasons for the

[1] The product code is an 11-digit code that combines a 8-digit code from the NCM (Nomenclatura Común del Mercosur), based on the Harmonized System, and an extra 3-digit code specific to Argentina.

observation, or the additional documents or information required for the observation to be lifted, until they approached the relevant agencies (which were sometimes not identifiable).

If the agency lifted the observation within 180 calendar days from initiation, the DJAI would proceed to exit status. If the observation was not lifted within 180 calendar days from initiation, the DJAI would be voided.

B.2 The Investment, Employment, Production and International Trade Plan

In December of 2013, the Secretariat of Trade set up an online form that prospective importers had to fill out. The form asked for information on sales, number of workers, investments (machinery, construction, automobiles, and real estate), exports (goods and services), and imports (goods and services) for the past two years as well as projected for the incoming year. Figure B.1 contains a copy of part of the form.[2]

In November of 2014, the form was extended to include the fraction of foreign capital in total capital as well as additional information on investment projects (including their financing and their impact on capacity) and workers' education and R&D activities, as reported in the press by Juegen (2014). The first page of the new form, which was called "Investment, Employment, Production and International Trade Plan", can be seen in Figure B.2.

B.3 The Case at the WTO

In December of 2012, the European Union, the United States and Japan each filed complaints against Argentina with the WTO, requesting the establishment of a Panel pursuant to Article 6 of the Understanding on Rules and Procedures Governing the Settlement of Disputes (DSU). The complaints focused on two measures: the DJAI procedure and the imposition of several trade-related requirements (TRRs) as a condition to import into Argentina. In particular, the TRRs were: (a) offsetting the value of imports with, at least, an equivalent value of exports (one-to-one requirement); (b) limiting imports (import reduction requirement); (c) reaching a certain level of local content in domestic production (local content requirement); (d) making investments in Argentina (investment requirement); and, (e) refraining from repatriating profits from Argentina (non-repatriation requirement).

In its final reports on June of 2014, the Panel found that both the DJAI procedure and the TRRs were inconsistent with Article XI:1 of the GATT 1994, as they had limiting effects on the importation of goods into Argentina and were characterized by a lack of transparency and predictability (WTO, 2014).[3] According to the Panel, the DJAI procedure was a mechanism used to enforce the TRRs and as such was part of Argentina's "managed trade" policy, which had the

[2]While there are no official records of this online form, screenshots of the form can be accessed via the online accounting website Contadores en Red at https://perma.cc/R7RV-LVLU, or in a report by lawfirm Beccar Varela that can be accessed at https://perma.cc/UMV6-BHB7.

[3]Specifically, no law, regulation, or administrative act provided specific criteria by which the government agencies may flag a DJAI by entering "observations". The evidence used by the Panel includes, inter alia, communications addressed to Argentine officials by private companies; statements by Argentine officials and notes posted on government websites; articles in newspapers and magazines, mostly published in Argentina; statements by company officials; data from industry surveys; and reports prepared by market intelligence entities.

stated goals of re-industrialization, import substitution, and trade deficit reduction. Indeed, in its Industrial Strategic Plan of 2020, published in 2011, the Argentine government stated that import substitution is a state policy and a key tool to re-industrialize the country, with a target of 45% reduction in imports (PEI, 2011). The Panel found that the TRRs started in 2009. On January of 2015, the Appellate Body upheld the Panel's findings.

A key piece of evidence in the WTO disputes was a long list of agreements between particular firms and the government, whereby the former would commit to satisfying one or more of the TRRs in exchange for access to imports. According to the complainants, the demands of government officials were typically communicated orally in face-to-face meetings, and were characterized by wide-ranging discretion in what they demanded (Conconi and Schepel, 2017).

Figure B.1: The 2013 Secretariat of Trade Contact Form

FORMULARIO DE CONTACTO - SECRETARIA DE COMERCIO INTERIOR
EMPRESA

Motivo del Contacto:	

EMPRESA	
CUIT de la Organización:	
Nombre de la Organización:	
Actividad Principal a la que representa:	
Cámara a la que pertenece la Empresa:	Si no pertenece a una cámara, ingrese "ninguna"
Apellido del Contacto:	
Nombre del Contacto:	
Teléfono del Contacto:	
Correo Electrónico del Contacto:	
Provincia del Contacto:	
Localidad del Contacto:	
Dirección del Contacto:	

DATOS DE LA EMPRESA

	Año 2012	**Año 2013**	**Año 2014** (Proyectado)
Facturación (en Pesos)			
Ventas al Mercado Interno (en Pesos)			
Cantidad de Empleados			
Inversión (en Pesos)			
Adquisición de Maquinaria			
Obra civil de construcción, ampliación o refacciones			
Adquisición de rodados			
Adquisición de inmuebles			
Total			
Exportaciones (en Dólares)			
Bienes			
Servicios			
Total			
Importaciones (en Dólares)			
Bienes			
Servicios			

Figure B.2: The 2015 Investment, Employment, Production and International Trade Plan

Presidencia de la Nación | Ministerio de Economía y Finanzas Públicas | SECRETARÍA DE COMERCIO | **2015**

PLAN DE INVERSIÓN, EMPLEO, PRODUCCIÓN Y COMERCIO EXTERIOR 2015

Razón social de la organización: ....
CUIT (sin guiones ni espacios): ....
Actividad principal de la empresa: ....
Año de inicio de actividad de la empresa: ....
Porcentaje de capital extranjero sobre capital total de la empresa: ....
Cámara(s) a la que pertenece la empresa: ....
Apellido y Nombre del contacto: ....
Correo electrónico del contacto: ....
Teléfono del contacto: ....
Dirección: ....
Localidad: ....
Provincia: ....

La empresa, ¿pertenece a un grupo empresario?	
En caso afirmativo, indique el nombre del grupo:	
Razón social de las empresas integrantes	**CUIT (sin guiones)**

DATOS DE LA EMPRESA

**Proyectado*		Año 2011	Año 2012	Año 2013	Año 2014*	Año 2015*	Año 2016*
Ventas totales	**Total**	0	0	0	0	0	0
	De bienes producidos localmente						
	Reventa de productos importados						

Empleo	Dic-2011	Dic-2012	Dic-2013	Jun-2014	Dic-2014	Jun-2015	Dic-2015
Cantidad de Empleados Registrados *Sólo incluir personal en relación de dependencia de la firma*							

Principales 5 productos de la Empresa según facturación **Proyectado*

Nombre del Producto	Tipo de bien	Posición Arancelaria	Unidad de Medición	Unidades Físicas		Valor de la Producción (en Pesos)	
				2014*	2015*	2014*	2015*
					Total del Valor de la Producción (en Pesos)		

Balanza Comercial *(*Proyectado)*		Año 2011	Año 2012	Año 2013	Año 2014*	Año 2015*	Año 2016*
Exportaciones (En USD FOB) No incluir exportaciones de terceros	**Total**	0	0	0	0	0	0
	Bienes						
	Servicios						
Importaciones (En USD CIF)	**Total**	0	0	0	0	0	0
	Bienes de capital						
	Insumos						
	Bienes finales						
	Servicios						
Saldo Comercial (En USD)		0	0	0	0	0	0

Tipo de Inversión (en Pesos) *(*Proyectado)*		Año 2011	Año 2012	Año 2013	Año 2014*	Año 2015*	Año 2016*
Adquisición de Maquinaria	**Total**	0	0	0	0	0	0
	Nacional						
	Importado						
Obra civil de construcción, ampliación o refacciones							
Adquisición de rodados							
Adquisición de inmuebles							
Otros (especificar)							
Total		0	0	0	0	0	0

Financiamiento de la inversión (en Pesos) *(*Proyectado)*		Año 2011	Año 2012	Año 2013	Año 2014*	Año 2015*	Año 2016*
Crédito Bancario							
Reinversión de utilidades	En Pesos						
	Proporción de las utilidades totales (%)						
Mercado de capitales							
Otro (especificar)							

Si la maquinaria a importar es usada describa sus características, el monto en dólares de la misma y el número de expediente (en caso de encontrarse en trámite):

....

Si se financia con Crédito Bancario, detalle la Línea de Crédito y el Banco (Ej: Crédito del Bicentenario, linea Pyme del BNA, etc):

....

C Was the Policy Binding?

This section contains additional evidence against the hypothesis that firms managed to fully game the system by inflating their import requests. First, we show that approvals were converted one-to-one into imports which would not be expected under a null hypothesis of full gaming. Second, we show that requesting higher quantities and/or making more requests was costly as both were associated with lower approval rates.

Under the assumption that approval rates were uncertain when making requests, we can test whether firms were effective at inflating the size or number of requests in order to import their desired amount. If they were, quantities approved would have translated by less than one-for-one into quantities imported. The reason is that firms would import their full approved amount when approval rates were lower than expected, but less than their allowance when approval rates were higher than expected.

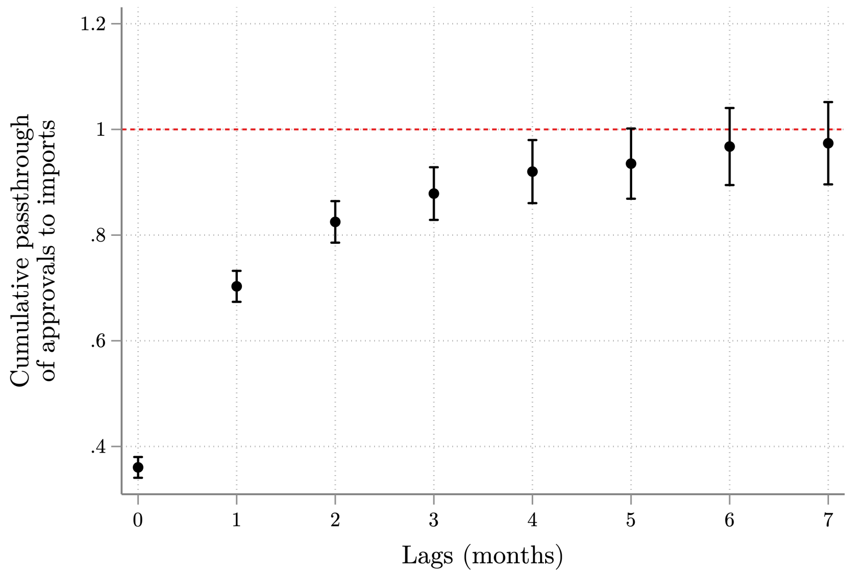
Figure C.1 plots estimates of a passthrough regression of the form

$$\Delta \ln(q_{fit}) = \alpha + \sum_{k=0}^{7} \beta^k \Delta \ln(q^A_{fit-k}) + e_{fit}, \tag{14}$$

where t is a month-of-sample, i is a product, and f is a firm. The figure plots the cumulative partial sum of the β^k coefficients and 95% confidence intervals. An increase in approvals of 10% is associated with an increase in imports slightly under 4% in that same month, but also to subsequent increases in imports so that after five months the accumulated increase is 10%. That is consistent with the institutional characteristics of the DJAI, since a requested import could only be converted to actual imports within 180 days of the initiation of the request. In conclusion, we find a one-for-one pass-through of approvals into imports, thus rejecting the null that firms were able to fully game the system.

We now show that inflating requests was costly, since approval rates were declining both in the requested quantity and in the number of requests per quarter. Panel a) of Figure C.2 plots a binscatter from regressing the request-level approval rate on request size, after conditioning on firm-product-quarter fixed effects. Panel b) plots approval rates on the order of requests within a firm-product-quarter cell, again conditioning on firm-product-quarter fixed effects. Both plots show strong downward sloping relationships during the DJAI period (and no such patterns outside the DJAI period, shown in blue).

Figure C.1: Passthrough from Quantity Approved to Imported

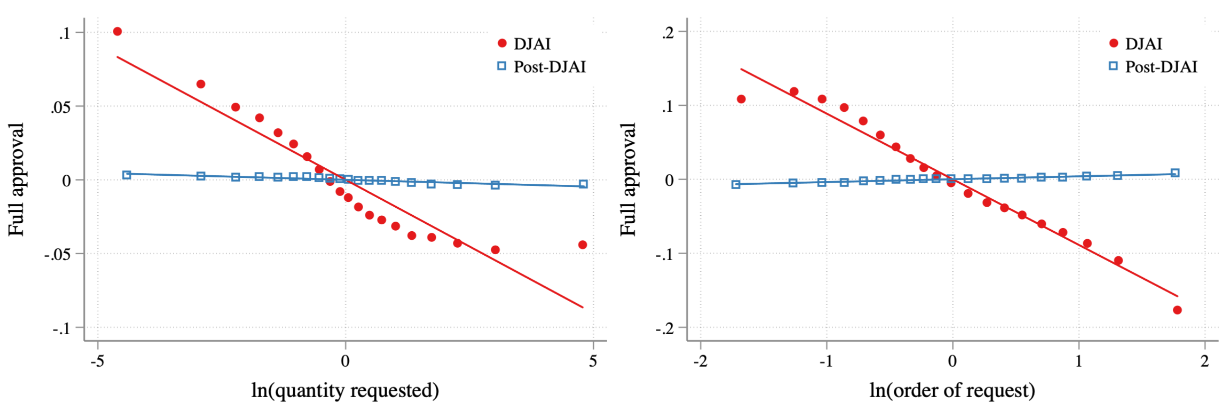


Notes: Cumulative partial sums of the β^k coefficients from the estimation of equation (14) and their 95% confidence intervals. The value for zero months on the horizontal axis is β^0, the one for one month is $\beta^0 + \beta^1$, and so on. The standard errors are clustered by firm-product. The data is monthly aggregates in 2014.

Figure C.2: Approvals, Request Sizes, and Request Frequencies

(a) Intensive margin

(b) Extensive margin



Notes: Binned scatter plots (and a linear fit) from regressing approval rates at the transaction level either on the log of the quantity requested (panel a), or on the order of the request (panel b) within a firm-product-quarter. In both cases, we condition approval rates on firm-product-quarter fixed effects. We define a product as a HS11-unit-origin triplet.

D Appendix to Section V (Trade Framework and Estimation)

D.1 Proof of Proposition 1

Setup In this section we show the solution to the model laid out in Section V.A. Each fi operates under either domestic ($\beta = 1$) or foreign ($\beta = 0$) market power. In the "bargaining" model, $\beta = 1$ ($\beta = 0$) means that the domestic importer (foreign exporter) makes a take-it-or-leave it offer. In the "monopoly/monopsony" model, $\beta = 1$ ($\beta = 0$) means that the domestic monopsonist (foreign monopolist) operates along the marginal cost (marginal revenue) curve of the foreign exporter (domestic importer). In either case, only the firm holding the market power makes ex-ante investments.

First, under monopoly/monopsony, a domestic monopsonist chooses investments x_D in anticipation that, ex-post, it will sell a quantity q at a price p on the marginal cost curve of the foreign exporter, $p = \Psi_q(q, x_F)$:

$$\max_{x_D, q^R} \mathbb{E}\left[\max_{q \leq q^A} R(q; x_D)\, q - \Psi_q(q, \bar{x}_F)\, q \mid q^R\right] - \psi_D(x_D). \tag{15}$$

In turn, a foreign monopolist chooses investments x_F in anticipation that, ex-post, it will sell a quantity q at the price p on the marginal revenue curve of the domestic importer,

$$\max_{x_F, q^R} \mathbb{E}\left[\max_{q \leq q^A} R_q(q; \bar{x}_D) - \Psi(q; x_F) \mid q^R\right] - \psi_F(x_F), \tag{16}$$

and the price satisfies

$$p(q; x) = (1-\beta)\, R_q(q, x_D) + \beta \Psi_q(q; x_F). \tag{17}$$

Second, with bargaining and $\beta = 1$, the domestic firm chooses investments x_D in anticipation that the quantity produced will be efficient, i.e. it solves:

$$\max_{x_D, q^R} \beta \mathbb{E}\left[\max_{q \leq q^A} R(q; x_D) - \Psi(q; \bar{x}_F) \mid q^R\right] - \psi_D(x_D). \tag{18}$$

Similarly, with $\beta = 0$ the foreign firms chooses:

$$\max_{x_F, q^R} (1-\beta)\, \mathbb{E}\left[\max_{q \leq q^A} R(q; \bar{x}_D) - \Psi(q; x_F) \mid q^R\right] - \psi_F(x_F). \tag{19}$$

And the price satisfies

$$p(q; x) = (1-\beta)\, \frac{R(q, x_D)}{q} + \beta \frac{\Psi(q; x_F)}{q}. \tag{20}$$

The solution to the quantity requested q^R depends on the distribution of approved quantities q^A given q^R. As we have discussed in the Section V.A under the header "Policies", firms were penalized for larger requests and we capture this we assume a full rejection ($q^A = 0$) if firms petitioned a quantity above what they would import absent trade policy (and a random approval rate otherwise), implying a distribution of approval rates with mass point at zero if the quantity requested is too high, which is consistent with the data.

Solution with Bargaining Using (6) and (7), the requested quantity in the second stage satisfies

$$\left(1-\frac{1}{\sigma}\right)R\left(q^R,x_D\right)=\left(1+\frac{1}{\eta}\right)\Psi\left(q^R;x_F\right), \tag{21}$$

which can be written as follows:

$$q^R(x)\equiv\left(\frac{\left(1-\frac{1}{\sigma}\right)a}{\left(1+\frac{1}{\eta}\right)z}x_D^{\alpha_D}x_F^{\alpha_F}\right)^{\frac{1}{\frac{1}{\eta}+\frac{1}{\sigma}}}. \tag{22}$$

Naturally, larger ex-ante investments or demand shocks, or lower export costs, lead to larger requests. Letting $\lambda\equiv\frac{q^A}{q^R(x)}$ be the approval rate and using (21) and (22), the first-stage investment problem of importers in (18) (assuming $\beta=1$) and of exporters in (19) (with $\beta=0$) can be written, respectively:

$$\max_{x_D\geq\underline{x}_D}\tilde{\lambda}\Psi\left(q_R\left(x_D,\underline{x}_F\right);\underline{x}_F\right)-\psi_D\left(x_D\right), \tag{23}$$

$$\max_{x_F\geq\underline{x}_F}\frac{1-\frac{1}{\sigma}}{1+\frac{1}{\eta}}\tilde{\lambda}R\left(q_R\left(\underline{x}_D,x_F\right);\underline{x}_D\right)-\psi_F\left(x_F\right), \tag{24}$$

where $\tilde{\lambda}$ is the moment of the distribution of approval rates defined in (11). The objective functions in (23) and (24) are strictly concave in x_D and x_F whenever the second-order conditions (8) are satisfied, which holds in our estimation. The interior solutions to (23) and (24) respectively yield:

$$\beta\tilde{\lambda}z\frac{\eta+1}{\eta}\frac{\alpha_D}{\frac{1}{\eta}+\frac{1}{\sigma}}\left(\frac{\left(1-\frac{1}{\sigma}\right)a}{\left(1+\frac{1}{\eta}\right)z}\right)^{\frac{1+\frac{1}{\eta}}{\frac{1}{\eta}+\frac{1}{\sigma}}}x_D^{\alpha_D\frac{1+\frac{1}{\eta}}{\frac{1}{\eta}+\frac{1}{\sigma}}-1}\underline{x}_F^{\alpha_F\left(\frac{1+\frac{1}{\eta}}{\frac{1}{\eta}+\frac{1}{\sigma}}-1\right)}=Z_D, \tag{25}$$

and

$$(1-\beta)\tilde{\lambda}\frac{1-\frac{1}{\sigma}}{1+\frac{1}{\eta}}a\frac{\sigma-1}{\sigma}\frac{\alpha_F}{\frac{1}{\eta}+\frac{1}{\sigma}}\left(\frac{\left(1-\frac{1}{\sigma}\right)a}{\left(1+\frac{1}{\eta}\right)z}\right)^{\frac{1}{\frac{1}{\eta}+\frac{1}{\sigma}}\frac{\sigma-1}{\sigma}}\underline{x}_D^{\alpha_D\left(1+\frac{1}{\frac{1}{\eta}+\frac{1}{\sigma}}\frac{\sigma-1}{\sigma}\right)}x_F^{\alpha_F\frac{\frac{\sigma-1}{\sigma}}{\frac{1}{\eta}+\frac{1}{\sigma}}-1}=Z_F. \tag{26}$$

When $\beta=0$ the solution to (25) and (26) is $x_D=\underline{x}_D$ and

$$x_F=A_F^x\left(\vartheta;\Theta,\beta\right)\tilde{\lambda}^{\frac{\frac{1}{\eta}+\frac{1}{\sigma}}{\frac{1}{\eta}+\frac{1}{\sigma}-\alpha_F\left(\frac{\sigma-1}{\sigma}\right)}} \tag{27}$$

for some function $A_F^x(\cdot)$. In this case, using (22), the quantity requested takes the form:

$$q^R=A_F^q\left(\vartheta;\Theta\right)\tilde{\lambda}^{\frac{\alpha_F}{\frac{1}{\eta}+\frac{1}{\sigma}-\alpha_F\left(\frac{\sigma-1}{\sigma}\right)}} \tag{28}$$

for some function $A_F^q(\cdot)$ and we have that $\frac{\partial q_R}{\partial\tilde{\lambda}}>0$ if and only if $1>\alpha_F\frac{\frac{\sigma-1}{\sigma}}{\frac{1}{\eta}+\frac{1}{\sigma}}$, implied by (8). Moreover, in this case, from (20), the import price satisfies:

$$p=a\overline{x}_D^{\alpha_D}\left(\lambda q^R\right)^{-\frac{1}{\sigma}}, \tag{29}$$

where q^R is a function of $\tilde{\lambda}$ and of the all parameters and fundamentals through (28).

When $\beta=1$ the solution to (25) and (26) is $x_F=\underline{x}_F$ and

$$x_D=A_D^x\left(\vartheta;\Theta,\beta\right)\tilde{\lambda}^{\frac{\frac{1}{\eta}+\frac{1}{\sigma}}{\frac{1}{\eta}+\frac{1}{\sigma}-\alpha_D\left(1+\frac{1}{\eta}\right)}}. \tag{30}$$

In this case, using (22), the quantity requested takes the form:

$$q^R = A_D^q(\vartheta;\Theta)\,\tilde{\lambda}^{\frac{\alpha_D}{\left(\frac{1}{\eta}+\frac{1}{\sigma}\right)-\alpha_D\left(1+\frac{1}{\eta}\right)}}, \tag{31}$$

and we have that $\frac{\partial q_R}{\partial \tilde{\lambda}} > 0$ if and only if $1 > \alpha_D \frac{1+\frac{1}{\eta}}{\frac{1}{\eta}+\frac{1}{\sigma}}$, implied by (8). Moreover, in this case, from (20), the import price satisfies:

$$p = z\overline{x}_F^{-\alpha_F}\left(\lambda q^R\right)^{\frac{1}{\eta}}, \tag{32}$$

where q^R is a function of $\tilde{\lambda}$ and of the all parameters and fundamentals through (31).

Combining (28) and (31) we obtain (10) in the main text.

Solution with Monopoly or Monopsony We let $\beta = 1$ index domestic monopsony and $\beta = 0$ index foreign monopoly. Then using (6) and (7), the requested quantity in the second stage satisfies

$$\left(1-\frac{1}{\sigma}\right)^{2-\beta} R\left(q^R, x_D\right) = \left(1+\frac{1}{\eta}\right)^{1+\beta}\Psi\left(q^R; x_F\right), \tag{33}$$

which can be written as follows:

$$q^R(x) = \left(\frac{\left(1-\frac{1}{\sigma}\right)^{2-\beta} a}{\left(1+\frac{1}{\eta}\right)^{1+\beta} z} x_D^{\alpha_D} x_F^{\alpha_F}\right)^{\frac{1}{\frac{1}{\eta}+\frac{1}{\sigma}}}. \tag{34}$$

Using (15) and (16), the ex-ante investment problems of importers and exporters can be written, respectively:

$$\max_{x_D \geq \underline{x}_D} \frac{\eta+1}{\eta}\tilde{\lambda}\Psi\left(q_R\left(x_D, \underline{x}_F\right); \underline{x}_F\right) - \psi_D\left(x_D\right), \tag{35}$$

$$\max_{x_F \geq \underline{x}_F} \frac{\sigma-1}{\sigma}\frac{1-\frac{1}{\sigma}}{1+\frac{1}{\eta}}\tilde{\lambda}R\left(q_R\left(\underline{x}_D, x_F\right); \underline{x}_D\right) - \psi_F\left(x_F\right), \tag{36}$$

The quantity requested in (34) is the same, up to a constant, to the solution in the bargaining model in (22). Similarly, problems (35) and (36) are the same as (23) and (24), respectively, up to a shifter in the payoff function. Therefore, the quantity requested as function of fundamentals takes the same form as in (28) (under foreign monopoly) and as in (31) (under domestic monopsony) up to a different constant multiplying the $A_F^q(\vartheta;\Theta)$ and $A_D^q(\vartheta;\Theta)$ shifters.

Finally, the pricing equation (17) can be written:

$$p = \begin{cases} \frac{\sigma-1}{\sigma} a\overline{x}_D^{\alpha_D}\left(\lambda q^R\right)^{-\frac{1}{\sigma}} & \text{if foreign firm is monopolist,} \\ \frac{1+\eta}{\eta} z\overline{x}_F^{-\alpha_F}\left(\lambda q^R\right)^{\frac{1}{\eta}} & \text{if domestic firm is monopsonist.} \end{cases} \tag{37}$$

These expressions are equal (up to a constant) to the pricing equation in (29) and (32).

D.2 Appendix to Sections V.B and V.C (Estimation Strategy and Results)

In this section we provide the details of the estimation procedure outlined in Section V.B. We first use a classifier-Lasso method to simultaneously classify firm-products by their bargaining power and estimate the demand and cost elasticities. Given those estimates, we next estimate the elasticities of ex-ante investment for domestic and foreign firm-products.

D.2.1 Step 1: Elasticities of Price to Quantity Imported

C-Lasso estimation by Penalized GMM We start by estimating our linear pricing equation (9) with the classifier-Lasso (C-Lasso) method developed by Su et al. (2016). This method allows to estimate panel data models where the regression coefficients are heterogeneous across groups but homogeneous within a group and the group membership is unknown. We use their Penalized GMM estimator, which is applicable to linear models with endogeneity.

We start by rewriting the pricing equation as follows:

$$\tilde{p}_{jt} = b_j \tilde{q}_{jt} + \xi_{jt},$$

where

$$b_j \equiv \begin{cases} \gamma_A & \text{if } j \text{ is in group A} \\ \gamma_B & \text{if } j \text{ is in group B} \end{cases}.$$

Instead of the two groups with $\beta = 0$ and $\beta = 1$ in equation (9) we now have two arbitrary groups, A and B. The reason is that the penalized GMM procedure estimates two group-specific coefficients on which we do not impose any sign restrictions. However, to map those estimates to the model parameters we moreover need that one coefficient is negative and the other positive. We deal with that in the next sub-section.

The variables $\tilde{p}$ and $\tilde{q}$ are the residuals of regressing log prices ($\ln p_{fit}$ in equation (9) where there fi indexes a firm-product) and log quantities ($\ln q_{fit}$ in equation (9)) on firm-product fixed effects, time (quarter) fixed effects, and firm-product trends. The unobserved model error ξ is the linear residual of the structural error of equation (9) (ζ^p_{fit}) with respect to the same set of fixed effects and trends. This is the same set of fixed effects and trends as our preferred specification in column 3 of Table 4 in the empirical section of the paper. So, in effect, we are re-estimating that equation but allowing for heterogeneity in two groups to be determined as part of the estimation routine. In the remainder of this section, after residualizing we refer to j as an importer but it maps to the firm-product combinations (f-i) in the rest of the paper. As before, t indexes quarters.

Criterion Function We estimate $\boldsymbol{b} = (b_1, \ldots, b_N)$ and $\boldsymbol{\gamma} = (\gamma_A, \gamma_B)$ by minimizing the Penalized GMM criterion function

$$Q_\rho(\boldsymbol{b}, \boldsymbol{\gamma}) = Q(\boldsymbol{b}) + \frac{\rho}{N} \sum_{j=1}^{N} |b_j - \gamma_A| \cdot |b_j - \gamma_B|, \tag{38}$$

where ρ is a tuning parameter that we set equal to $Var(\tilde{p}_{jt}) \times T^{-1/3}$, N is the number of importers (i.e., firm-product combinations), and

$$Q(\boldsymbol{b}) = \frac{1}{N} \sum_{j=1}^{N} \frac{1}{T_j} \sum_{t \in T(j)} \Gamma_{jt} \xi_{jt}.$$

We define $T(j)$ as the subset of periods $t = 1, \ldots, T$ where importer j is active, and let T_j be the number of periods that it is active. Finally, Γ_{jt} is the policy instrument used in column 3 of Table 4. This objective is an modification of the the Penalized GMM criterion in Su et al. (2016) adapted to account for unbalanced panels.

C-Lasso Algorithm We obtain the estimates $\hat{\boldsymbol{b}}$ and $\hat{\boldsymbol{\gamma}}$ with the following iterative algorithm. Note that the objective function is not convex in $\boldsymbol{b}$ even though it is (conditionally) convex in γ_k when one fixes γ_ℓ for $\ell \neq k$.

1. Start with initial values $\boldsymbol{b}^{(0)} = (b_1^{(0)}, \ldots, b_N^{(0)})$ and $\boldsymbol{\gamma}^{(0)} = (\gamma_A^{(0)}, \gamma_B^{(0)})$ that satisfy $\sum_{j=1}^N |b_j^{(0)} - \gamma_k^{(0)}| \neq 0$ for $k \in \{A, B\}$. We choose $\boldsymbol{\gamma}^{(0)} = (0, 0)$ and set all the elements of $\boldsymbol{b}^{(0)}$ equal to the homogeneous 2SLS estimate. Set iteration index to $r = 1$.
2. Given $(\boldsymbol{b}^{(r-1)}, \gamma_B^{(r-1)})$, choose $(\boldsymbol{b}, \gamma_A)$ to minimize
$$Q\left(\boldsymbol{b}\right) + \frac{\rho}{N} \sum_{j=1}^{N} |b_j - \gamma_A| \cdot |b_j^{(r-1)} - \gamma_B^{(r-1)}|$$
and obtain the updated estimates $(\boldsymbol{b}^{(r,A)}, \gamma_A^{(r)})$. Next, given those new estimates $(\boldsymbol{b}^{(r,A)}, \gamma_A^{(r)})$, choose $(\boldsymbol{b}, \gamma_B)$ to minimize
$$Q\left(\boldsymbol{b}\right) + \frac{\rho}{N} \sum_{j=1}^{N} |b_j^{(r,0)} - \gamma_A^{(r)}| \cdot |b_j - \gamma_B|$$
and obtain the updated estimates $(\boldsymbol{b}^{(r,B)}, \gamma_B^{(r)})$. At the end of this step we have obtained $(\boldsymbol{b}^{(r,A)}, \boldsymbol{b}^{(r,B)}, \gamma_A^{(r)}, \gamma_B^{(r)})$.
3. Repeat step 2 until convergence. The convergence criterion is
$$\frac{\sum_{k \in \{A,B\}} \left[\gamma_k^{(r)} - \gamma_k^{(r-1)}\right]^2}{\sum_{k \in \{A,B\}} \left[\gamma_k^{(r-1)}\right]^2 + 0.0001} < \epsilon_{tol},$$
and
$$\frac{\sum_{k \in \{A,B\}} \sum_{j=1}^N \left[b_j^{(r,k)} - b_j^{(r-1,k)}\right]^2}{\sum_{k \in \{A,B\}} \sum_{j=1}^N \left[b_j^{(r-1,k)}\right]^2 + 0.0001} < \epsilon_{tol}$$
where ϵ_{tol} is a tolerance level set to 0.001.
4. Classification rule. We define the final iterative estimate of $\boldsymbol{\gamma}$ as $\hat{\boldsymbol{\gamma}} = (\hat{\gamma_A}, \hat{\gamma_B}) = (\gamma_A^{(R)}, \gamma_B^{(R)})$, where $r = R$ is the terminal iteration index obtained in step 3. We also define $\hat{\boldsymbol{b}}^{(A)} = \boldsymbol{b}^{(R,A)}$ and $\hat{\boldsymbol{b}}^{(B)} = \boldsymbol{b}^{(R,B)}$. We then define the individual estimates as
$$\hat{b}_j \equiv \begin{cases} \hat{\gamma_A} & \text{if } \min\left\{|\hat{b}_j^{(A)} - \hat{\gamma_A}|, |\hat{b}_j^{(B)} - \hat{\gamma_A}|\right\} < \min\left\{|\hat{b}_j^{(A)} - \hat{\gamma_B}|, |\hat{b}_j^{(B)} - \hat{\gamma_B}|\right\}, \\ \hat{\gamma_B} & \text{if else.} \end{cases}$$
Intuitively, importer j is classified to the group $k \in \{A, B\}$ that has the coefficient $\hat{\gamma_k}$ closest to the individual-level estimates $\hat{b}_j^{(A)}$ and $\hat{b}_j^{(B)}$.

Post-Lasso The Penalized GMM estimator generally does not have desirable asymptotic properties. Su et al. (2016) propose instead post-C-Lasso estimators that are obtained by pooling all individuals in an estimated group to estimate group-specific parameters. We therefore use the group membership obtained with the C-Lasso and estimate the group coefficients by 2SLS for each group. We refer to the post-Lasso estimates as $\tilde{\gamma_A}$ and $\tilde{\gamma_B}$.

Recovering the Ex-Post Model Parameters In the previous sub-section we obtained estimates of membership to either group A or group B, and the post-Lasso group-specific coefficients $\tilde{\gamma_A}$ and $\tilde{\gamma_B}$. From the trade framework, we have that the importer-level coefficients are

$$b_j = \begin{cases} -\frac{1}{\sigma} & \text{if } \beta_j = 0 \\ \frac{1}{\eta} & \text{if } \beta_j = 1. \end{cases}$$

Therefore, in order to use our estimates to recover estimates of the bargaining power β_j and of the demand and cost elasticities σ and η, we need that one of the groups has a negative coefficient and the other one a positive coefficient.

If group A is negative and B is positive, i.e. $\tilde{\gamma_A} < 0 < \tilde{\gamma_B}$, the estimated bargaining power is $\hat{\beta}_j = 0$ for importers classified into group A and $\hat{\beta}_j = 1$ for those classified into group B and the elasticity estimates are $\hat{\sigma} = -1/\tilde{\gamma_A}$ and $\hat{\eta} = 1/\tilde{\gamma_B}$.

If instead group A is positive and group B is negative, i.e. $\tilde{\gamma_B} < 0 < \tilde{\gamma_A}$, the estimated bargaining power is $\hat{\beta}_j = 1$ for importers classified into group A and $\hat{\beta}_j = 0$ for those classified into group B, and the elasticity estimates are $\hat{\eta} = 1/\tilde{\gamma_A}$ and $\hat{\sigma} = -1/\tilde{\gamma_B}$.

Determining the Number of Groups So far we have assumed that there are two underlying groups, but we can go one step back and use a data-driven approach to select the number of groups. We follow Su et al. (2016) and minimize an information criterion (IC) among a set of candidate number of groups $K = 1, 2, 3, 4$. For K groups the IC is

$$IC(K) = \ln\left(\frac{1}{N}\sum_{k=1}^{K}\sum_{j\in G_K(k)}\frac{1}{T_j}\sum_{t\in T(j)}\left[\tilde{p}_{jt} - \tilde{b}^{k,K}\tilde{q}_{jt}\right]^2\right) + \rho^{IC}K,$$

where $G_K(k)$ is the set of firms j classified into group k when we have K groups, $\tilde{b}^{k,K}$ is the post-Lasso coefficient estimate of group k when we have K groups, and ρ^{IC} is a tuning parameter that we set equal to $\frac{2}{3}(N \cdot T)^{-\frac{1}{2}}$, with $T \equiv \max_i T_i$.

D.2.2 Step 2: Elasticities of Quantity Requested to Expected Quantitative Restriction

Estimating the Investment Elasticities Given estimates of bargaining power $\hat{\beta}_{fi}$ and of the demand and cost elasticities $\hat{\sigma}$ and $\hat{\eta}$ we estimate the investment elasticities for domestic firms α_D and foreign firms α_F. Once again, we make the distinction between firms (f) and products (i). We can re-write equation (10) as follows:

$$\ln q^R_{fit} = b^q \ln\tilde{\lambda}_{fit} + \mu_{fi} + \mu_t + \mu_{fi}\times t + \left(\tilde{a}_{fit} + \tilde{z}_{fit} - \tilde{Z}_{Dfit}\right), \tag{39}$$

where μ_{fi} and μ_t are firm-product and time fixed effects, $\mu_{fi} \times t$ are firm-product linear trends, and $(\tilde{a}_{fit}, \tilde{z}_{fit}, \tilde{Z}_{Dfit})$ are demand and cost shocks net of firm-product trends and common shocks every period. This equation holds separately on the two sub-samples ($\beta_{fi} = 0$ or $\beta_{fi} = 1$) and

$$b^q = \begin{cases} \frac{\alpha_F}{\left(\frac{1}{\eta}+\frac{1}{\sigma}\right)-\alpha_F\left(1-\frac{1}{\sigma}\right)} & \text{if } \beta_i = 0, \\ \frac{\alpha_D}{\left(\frac{1}{\eta}+\frac{1}{\sigma}\right)-\alpha_D\left(1+\frac{1}{\eta}\right)} & \text{if } \beta_i = 1. \end{cases}$$

We do not observe the expectation $\tilde{\lambda}_{fit}$, but assuming rational expectations implies

$$\tilde{\lambda}^{obs}_{fit} = \tilde{\lambda}_{fit} + \varepsilon_{fit}, \tag{40}$$

where $\tilde{\lambda}^{obs}_{fit}$ is the realized value of the term over which we take the expectation in (11),

$$\tilde{\lambda}^{obs}_{fit} = (\lambda_{fit})^{1-\frac{1}{\hat{\sigma}}} \frac{1+\frac{1}{\hat{\eta}}}{1-\frac{1}{\hat{\sigma}}} - (\lambda_{fit})^{1+\frac{1}{\hat{\eta}}}, \tag{41}$$

and ε_{fit} is an expectational error that is mean-zero and independent from the realization. We replace (41) in (39) and then run (39) instrumenting for $\tilde{\lambda}^{obs}_{fit}$ using its lagged value in the following first-stage:

$$\ln \tilde{\lambda}^{obs}_{fit} = b^q_{FS} \ln \tilde{\lambda}^{obs}_{fit-1} + \mu_{fi} + \mu_t + \mu_{fi} \times t + \tilde{e}_{fit}. \tag{42}$$

E Appendix to Section VI (Policy Impacts)

E.1 Appendix to Section VI.A (Impacts of the Quantity Restrictions)

Impacts of the Restrictions For each firm f, imports of product i in quarter t are given by $q_{fit} = q^R_{fit}\lambda_{fit}$, where q^R_{fit} is the total quarter-level quantity requested, and λ_{fit} is the realized approval rate for that quarter. Defining x^{cf} as the counterfactual value of variable x had there been no quantity restrictions, we can write the counterfactual quantities and prices as follows:

$$q^{cf}_{fit} = q_{fit} \left(\frac{\tilde{\lambda}^{cf}_{fit}}{\tilde{\lambda}_{fit}} \right)^{b^q_{fi}} \frac{\lambda^{cf}_{fit}}{\lambda_{fit}}, \tag{43}$$

$$p^{cf}_{fit} = p_{fit} \left(\frac{q^{cf}_{fit}}{q_{fit}} \right)^{b^p_{fi}}, \tag{44}$$

where

$$b^q_{fi} = \begin{cases} b^q_0 \equiv \frac{\alpha_F}{\left(\frac{1}{\eta}+\frac{1}{\sigma}\right)-\alpha_F\left(1-\frac{1}{\sigma}\right)} & \text{if } \beta_{fi} = 0, \\ b^q_1 \equiv \frac{\alpha_D}{\left(\frac{1}{\eta}+\frac{1}{\sigma}\right)-\alpha_D\left(1+\frac{1}{\eta}\right)} & \text{if } \beta_{fi} = 1, \end{cases}$$

and

$$b^p_{fi} = \begin{cases} b^p_0 \equiv -\frac{1}{\sigma} & \text{if } \beta_j = 0, \\ b^p_1 \equiv \frac{1}{\eta} & \text{if } \beta_j = 1. \end{cases}$$

The elasticities b^q_{fi} and b^p_{fi} are known from the estimation, and $\lambda^{cf}_{fit} = \lambda^{cf} = 1$ and $\tilde{\lambda}^{cf}_{fit} = \tilde{\lambda}^{cf} = \frac{\frac{1}{\eta}+\frac{1}{\sigma}}{1-\frac{1}{\sigma}}$ are the counterfactual values of $\tilde{\lambda}_{fit}$ and λ_{fit} corresponding to eliminating quantity restrictions.

The approval rate λ_{fit} is data, but we need to compute $\tilde{\lambda}_{fit}$ in the observed equilibrium. We use the same fitted values that we used in the estimation of the requests equation described in the Appendix Section D.2. Since, by construction, $0 \leq \tilde{\lambda}_{fit} \leq \tilde{\lambda}^{cf}$, we top-code estimates of $\tilde{\lambda}_{fit}$ that exceed $\tilde{\lambda}^{cf}$. We do not obtain estimates below zero because the estimating equation is in logs. To calculate the effect of the quantity restrictions after the DJAI period, we re-estimate the requests equation on the sample after the fourth quarter of 2015.

We also compute counterfactual quantities and prices due to the direct effects of the quantity restrictions (i.e., ignoring the indirect impacts through investments when expected approval rates change) as: $q^{direct}_{fit} = q_{fit}(\lambda^{cf}_{fit}/\lambda_{fit})$ and $p^{direct}_{fit} = p_{fit}(\lambda^{cf}_{fit}/\lambda_{fit})^{b^p_{fi}}$.

Impacts Under Different Market Power The effect of quantity restrictions had all firms in the economy had market power $\beta = r \in \{0,1\}$ for every imported product is:

$$\begin{aligned}\frac{q^{\beta=r,cf}_{fit}}{q^{\beta=r}_{fit}} &= \frac{q^{cf}_{fit}}{q_{fit}}\left(\frac{\tilde{\lambda}^{cf}_{fit}}{\tilde{\lambda}_{fit}}\right)^{b^q_r - b^q_{fi}}, \\ \frac{p^{\beta=r,cf}_{fit}}{p^{\beta=r}_{fit}} &= \frac{p^{cf}_{fit}}{p_{fit}}\left(\frac{q^{\beta=r,cf}_{fit}}{q^{\beta=r}_{fit}}\frac{q_{fit}}{q^{cf}_{fit}}\right)^{b^p_r}\left(\frac{q^{cf}_{fit}}{q_{fit}}\right)^{\left(b^p_r - b^p_{fi}\right)},\end{aligned}$$

where $q^{\beta=r}_{fit}$ and $p^{\beta=r}_{fit}$ denote quantities and prices had all firms had $\beta = r \in \{0,1\}$ for the observed quantity restrictions, and $q^{\beta=r,cf}_{fit}$ and $p^{\beta=r,cf}_{fit}$ denote quantities and prices had all firms had $\beta = r$ in a a counterfactual scenario without quantity restrictions.

E.2 Proof of Proposition 2 and Computation of Optimal Tariffs

We proceed in steps to derive the optimal tariffs in Proposition 2. First in E.2.1 we solve for the monopoly or monopsony case. Then, in E.2.2 we solve for the bargaining case. Within each case, we first set up the problem with heterogeneous firms and then move to homogeneous firms for closed form solutions. Finally in E.2.3 we detail the procedure to compute optimal tariffs.

Under either market structure, the planner's objective function is $K + \Pi^D + TR$ where K is a constant that includes the endowment of the outside good and consumer surplus, Π^D is aggregate profits of domestic firms, and TR is tariff revenue. The latter two are endogenous to tariffs. The planner's objective function when choosing the tariff of product i is:

$$\max_{\tau_i} W_i \equiv \sum_f \left[\underbrace{a_{fi} q_{fi}^{1-\frac{1}{\sigma}} x^{\alpha_D}_{Dfi}}_{=R_{fi}(q_f; x_{Dfi})} - (p_{fi} + \tau_i)\, q_{fi} - \underbrace{Z_{Dfi}\left(x_{Dfi} - \overline{x}_{Dfi}\right)}_{\equiv \psi_{Dfi}(x_{Dfi})}\right] + \sum_f \tau_i q_{fi}, \tag{45}$$

where the sum is over firms f within product i, subject to equilibrium conditions that are specific to each market structure as described next. In what follows, we omit writing the product index i and solve for optimal tariffs independently across products.

E.2.1 Optimal Tariffs under Monopoly or Monopsony

Market Allocation For each firm f in product i, the equilibrium price, quantity and ex-ante investments $\{p_f, q_f, x_{Df}, x_{Ff}\}$ are determined as follows. First, under monopoly ($\beta_{fi} = 0$) the tariff-inclusive price $p_f + \tau$ lies along the domestic import demand curve $\frac{\partial R_f}{\partial q_f}$; while under monopsony ($\beta_{fi} = 1$) the before-tariff price p_f lies along the foreign export supply curve $\frac{\partial \Psi_f}{\partial q_f}$:

$$p_f + \tau = 1_{\beta_f=0} \underbrace{\left(1 - \frac{1}{\sigma}\right) a_f x_{Df}^{\alpha_D} q_f^{-\frac{1}{\sigma}}}_{=\frac{\partial R_f\left(q_f; x_{Ff}\right)}{\partial q_f}} + 1_{\beta_f=1} \left(\underbrace{\left(1 + \frac{1}{\eta}\right) z_f \overline{x}_{Ff}^{-\alpha_F} q_f^{\frac{1}{\eta}}}_{\frac{\partial \Psi_f\left(q_f; \overline{x}_{Ff}\right)}{\partial q_f}} + \tau \right), \tag{46}$$

where $1_{\beta_f=k}$ is an indicator for whether $\beta_f = k$. Under a domestic monopsony ($\beta_f = 1$) the domestic firm solves

$$\max_{x_{Df}} \max_{q_f} R\left(q_f, x_{Df}\right) - \left(p_f + \tau\right) q_f - \psi_{Df}\left(x_{Df}, \overline{x}_{Ff}\right), \tag{47}$$

subject to $p_f + \tau$ in (46) while under a foreign monopoly ($\beta_f = 0$) the foreign firm solves

$$\max_{x_{Ff}} \max_{q_f} p_f q_f - \Psi\left(q_f, x_{Ff}\right) - \psi_F\left(x_{Ff}\right). \tag{48}$$

These two optimization problems yield the market equilibrium conditions for $\{q_f, x_{Ff}, x_{Df}\}$:

$$\left(\frac{\sigma - 1}{\sigma}\right)^{1+1_{\beta_f=0}} a_f q_f^{-\frac{1}{\sigma}} \overline{x}_{Df}^{\alpha_D} = \tau + \left(\frac{\eta + 1}{\eta}\right)^{1+1_{\beta_f=1}} z_f q_f^{\frac{1}{\eta}} x_{Ff}^{-\alpha_F}, \tag{49}$$

$$x_{Ff} = 1_{\beta_f=0} \left(\frac{\alpha_F z_f q_f^{1+\frac{1}{\eta}}}{Z_{Ff}}\right)^{\frac{1}{1+\alpha_F}} + 1_{\beta_f=1} \overline{x}_{Ff}, \tag{50}$$

$$x_{Df} = 1_{\beta_f=0} \overline{x}_{Df} + 1_{\beta_f=1} \left(\frac{\alpha_D a_f q_f^{\frac{\sigma-1}{\sigma}}}{Z_{Df}}\right)^{\frac{1}{1-\alpha_D}} \tag{51}$$

for all f. The first condition is the first-order optimization over q of monopsonists (if $\beta_f = 1$) or monopolists (if $\beta_f = 0$). The last two conditions are the optimal ex-ante investment decisions.[4]

Optimal Tariff with Heterogeneous Firms Totally differentiating W_i in (45) and using (49) and (51) we have

$$dW_i = \tau \sum_f dq_f - \sum_{f:\beta_f=0} q_f dp_f. \tag{52}$$

[4] The parameter restriction (8) is necessary for the firms' problem to have an interior solution for any $\tau \geq 0$. In turn, given $\tau \geq 0$, the inflection points include the global optimum if the stronger conditions $\frac{\sigma-1}{\sigma} < \min\left[1, \frac{1+\frac{1}{\eta}}{1+\alpha_F}\right]$ (for monopoly) or $\frac{\sigma-1}{\sigma} \frac{1}{1-\alpha_D} < \min\left[1, 1 + \frac{1}{\eta}\right]$ (for monopsony) hold. Given $\tau < 0$ and these conditions, local or global optimality is further satisfied if the revenue (cost) shifter a_f (z_f) is sufficiently low (high). Global concavity of the firms problems for any τ is satisfied under the even stronger condition $\frac{\sigma-1}{\sigma} < 1 < \frac{1+\frac{1}{\eta}}{1+\alpha_F}$ (for monopoly) or $\frac{\sigma-1}{\sigma} \frac{1}{1-\alpha_D} < 1 < 1 + \frac{1}{\eta}$ (for monopsony).

Using that $dp_f = -d\tau + \frac{\partial^2 R_f}{\partial q_f^2} dq_f$ when $\beta_f = 0$ from (46) we obtain (12) when $\chi^M = 1$ in the proposition. Setting $dW_i = 0$ in (52), the optimal tariff satisfies:

$$\tau^* = -\frac{1}{\sigma} \frac{\sum_{f:\beta_{fi}=0} \left(p_f\left(\tau^*\right) + \tau^*\right) q_f'\left(\tau^*\right)}{\sum_f q_f'\left(\tau^*\right)} - \frac{\sum_{f:\beta_{fi}=0} q_f\left(\tau^*\right)}{\sum_f q_f'\left(\tau^*\right)}, \tag{53}$$

where $p_f(\tau)$ and $q_f(\tau)$ are the price and quantity of firm f in the market allocation that solves (49) to (51) given a tariff τ.

Closed-Form Solution with Homogeneous Firms We now derive (13) in the monopoly/monopsony case with homogeneous firms. When $\beta_{fi} = 1$ for all f (monopsony), then (53) implies $\tau^* = 0$ regardless of whether firms are homogeneous or not in other dimensions. In the monopoly case with homogeneous firms, (53) becomes:

$$\tau^* = -\frac{p\left(\tau^*\right) + \tau^*}{\sigma} - \frac{q\left(\tau^*\right)}{q'\left(\tau^*\right)}. \tag{54}$$

Solving for x_F from (50) and replacing in (49) we obtain:

$$\left(\frac{\sigma-1}{\sigma}\right)^2 a q\left(\tau\right)^{-\frac{1}{\sigma}} \overline{x}_D^{\alpha_D} = t + \left(\frac{\eta+1}{\eta}\right) z \left(\frac{\alpha_F z}{Z_F}\right)^{-\frac{\alpha_F}{\alpha_F+1}} q\left(\tau\right)^{\frac{\frac{1}{\eta}-\alpha_F}{\alpha_F+1}}. \tag{55}$$

Totally differentiating this expression we obtain:

$$-\frac{q\left(\tau\right)}{q'\left(\tau\right)} = \left(\frac{\frac{1}{\eta}-\alpha_F}{\alpha_F+1} + \frac{1}{\sigma}\right)\left(\frac{\sigma-1}{\sigma}\right)\left(p+\tau\right) - \left(\frac{\frac{1}{\eta}-\alpha_F}{\alpha_F+1}\right)\tau. \tag{56}$$

Combining (54) with (56) we obtain (13) for the case of $\beta = 0$ and $\chi^M = 1$.

E.2.2 Optimal Tariffs under Bargaining

Market Allocation For each firm f in product i, the equilibrium price, quantity and ex-ante investments $\{p_f, q_f, x_{Df}, x_{Ff}\}$ are determined as follows. First, under foreign market power ($\beta_{fi} = 0$) the tariff-inclusive price $p_f + \tau$ lies along the average domestic revenue curve $\frac{R_f}{q_f}$; while under domestic bargaining power ($\beta_{fi} = 1$) the before-tariff price p_f lies along the average foreign cost curve $\frac{\Psi_f}{q_f}$:

$$p_f + \tau = 1_{\beta_f=0} \underbrace{a_f x_{Df}^{\alpha_D} q_f^{-\frac{1}{\sigma}}}_{=\frac{R_f\left(q_f;x_{Ff}\right)}{q_f}} + 1_{\beta_f=1}\left(\underbrace{z_f \overline{x}_{Ff}^{-\alpha_F} q_f^{\frac{1}{\eta}}}_{\frac{\Psi_f\left(q_f;\overline{x}_{Ff}\right)}{q_f}} + \tau\right). \tag{57}$$

Under a domestic monopsony ($\beta_f = 1$) the domestic firm solves the problem (47) subject to $p_f + \tau$ in (57), while under a foreign monopoly ($\beta_f = 0$) the foreign firm solves the problem (48). These two optimization problems yield the market equilibrium conditions for q_f:

$$\frac{\sigma-1}{\sigma} a_j q_j^{-\frac{1}{\sigma}} x_{Dj}^{\alpha_D} = \tau + \left(1 + \frac{1}{\eta}\right) z_j q_j^{\frac{1}{\eta}} x_{Fj}^{-\alpha_F} \text{ for all } f, \tag{58}$$

as well as the market equilibrium conditions for $\{x_{Ff}, x_{Df}\}$ shown in (50) and (51).

Optimal Tariff with Heterogeneous Firms Totally differentiating W_i in (45) and using (57), (58) and (51) we obtain (12) when $\chi^M = 0$ in the proposition. Setting $dW_i = 0$ in this case, the optimal tariff satisfies:

$$\tau^* = -\frac{\sum_{f:\beta_{fi}=0} q_f\left(\tau^*\right)}{\sum_f q_f'\left(\tau^*\right)}, \tag{59}$$

where $q_f\left(\tau\right)$ is the market allocation that solves (50), (51), and (58) given a tariff τ.

Closed-Form Solution with Homogeneous Firms When $\beta_{fi} = 1$ for all f, then (59) implies $\tau^* = 0$ regardless of whether firms are homogeneous or not in other dimensions. In the $\beta_{fi} = 1$ case with homogeneous firms, (59) becomes:

$$\tau = -\frac{q\left(\tau^*\right)}{q'\left(\tau^*\right)}. \tag{60}$$

Solving for x_F from (50), replacing in (58) and totally differentiating we obtain:

$$\left(\frac{\alpha_F}{1+\alpha_F}\frac{\eta+1}{\eta} - \left(\frac{1}{\sigma}+\frac{1}{\eta}\right)\right) R_q \frac{dq}{q} + \tau\left(\frac{1}{\eta} - \frac{\alpha_F}{\alpha_F+1}\frac{\eta+1}{\eta}\right)\frac{dq}{q} = d\tau \tag{61}$$

Further combining this expression with (60) we obtain (13) for the case of of $\beta = 0$ and $\chi^M = 0$ in the text. We have $\tau^* > 0$ if and only if the second-order conditions from the investment problem (8) is satisfied.

E.2.3 Numerical Computation of Optimal Tariffs

We solve for the optimal tariff τ_i^* in (53) (monopoly and monopsony) and in (59) (bargaining) for each product i. For this, we must construct the functions $q_f\left(\tau\right)$ and $p_f\left(\tau\right)$ for every firm f in product i.

Numerically, $q_f\left(\tau\right)$ is obtained for each firm f as the implicit solution to the firm's first-order condition (49) (monopoly and monopsony) or (58) (bargaining) after plugging in the solutions for x_{Df} and x_{Ff} from (50) and (51). Letting χ^M be an indicator that equals 1 if we are in the monopoly/monopsony model and 0 in the bargaining model, the equation that determines $q_f\left(\tau\right)$ is

$$\left(\frac{\sigma-1}{\sigma}\right)^{1+\chi^M} a_f^0 q_f\left(\tau\right)^{-\frac{1}{\sigma}} = \tau + \left(1+\frac{1}{\eta}\right) z_f^0 q_f\left(\tau\right)^{\frac{1}{\eta}-\left(1+\frac{1}{\eta}\right)\frac{\alpha_F}{1+\alpha_F}} \text{ if } \beta_f = 0, \tag{62}$$

where $a_f^0 \equiv a_f \overline{x}_{Df}^{\alpha_D}$ and $z_f^0 \equiv \alpha_F^{-\frac{\alpha_F}{1+\alpha_F}} z_f^{\frac{1}{1+\alpha_F}} Z_{F,f}^{\frac{\alpha_F}{1+\alpha_F}}$, and

$$\left(\frac{\sigma-1}{\sigma}\right) a_f^1 q_f\left(\tau\right)^{-\frac{1}{\sigma}+\frac{\sigma-1}{\sigma}\frac{\alpha_D}{1-\alpha_D}} = \tau + \left(1+\frac{1}{\eta}\right)^{1+\chi^M} z_f^1 q_f\left(\tau\right)^{\frac{1}{\eta}} \text{ if } \beta_f = 1, \tag{63}$$

where $a_f^1 \equiv \alpha_D^{\frac{\alpha_D}{1-\alpha_D}} a_f^{\frac{1}{1-\alpha_D}} Z_{D,f}^{-\frac{\alpha_D}{1-\alpha_D}}$ and $z_f^1 = z_f \overline{x}_{Ff}^{-\alpha_F}$.

To solve for (62) and (63) for each firm, we must recover the unobserved fundamentals $\left(a_f^0, z_f^0, a_f^1, z_f^1\right)$. We recover these fundamentals as a function of observed quantities and prices of each firm within each product in an initial equilibrium. From the equilibrium conditions (46) and (57) in an observed equilibrium with quantities q_f^{obs} and prices p_f^{obs} we have:

$$p_f^{obs} + \tau^{obs} = 1_{\beta_f=0}\left(\frac{\sigma-1}{\sigma}\right)^{\chi^M} a_f^0\left(q_f^{obs}\right)^{-\frac{1}{\sigma}} + 1_{\beta_f=1}\left(\left(1+\frac{1}{\eta}\right)^{\chi^M} z_f^1\left(q_f^{obs}\right)^{\frac{1}{\eta}} + \tau^{obs}\right). \tag{64}$$

Using (62) to (64) in an observed equilibrium $\left(p_f^{obs}, q_f^{obs}, \tau^{obs}\right)$ we can recover $\left(a_f^0, z_f^0, a_f^1, z_f^1\right)$ as a function of these observables and elasticities. Plugging these solutions for $\left(a_f^0, z_f^0, a_f^1, z_f^1\right)$ back into (62) to (64), we obtain equations that we can use for implementation:

$$\frac{\sigma-1}{\sigma}\left(p_f^{obs}+\tau^{obs}\right)\left(\frac{q_f\left(\tau\right)}{q_f^{obs}}\right)^{-\frac{1}{\sigma}}-\left(\frac{\sigma-1}{\sigma}p_f^{obs}-\frac{1}{\sigma}\tau^{obs}\right)\left(\frac{q_f\left(\tau\right)}{q_f^{obs}}\right)^{\frac{1}{\eta}-\left(1+\frac{1}{\eta}\right)\frac{\alpha_F}{1+\alpha_F}}=\tau \text{ if } \beta_f=0, \tag{65}$$

$$\left(\tau^{obs}+\left(1+\frac{1}{\eta}\right)p_f^{obs}\right)\left(\frac{q_f\left(\tau\right)}{q_f^{obs}}\right)^{-\frac{1}{\sigma}+\frac{\sigma-1}{\sigma}\frac{\alpha_D}{1-\alpha_D}}-\left(1+\frac{1}{\eta}\right)p_f^{obs}\left(\frac{q_f\left(\tau\right)}{q_f^{obs}}\right)^{\frac{1}{\eta}}=\tau \text{ if } \beta_f=1, \tag{66}$$

and

$$p_f\left(\tau\right)+\tau=1_{\beta_f=0}\left(p_f^{obs}+\tau^{obs}\right)\left(\frac{q_f\left(\tau\right)}{q_f^{obs}}\right)^{-\frac{1}{\sigma}}+1_{\beta_f=1}p_f^{obs}\left(\frac{q_f\left(\tau\right)}{q_f^{obs}}\right)^{\frac{1}{\eta}}. \tag{67}$$

These equations used to obtain prices and quantities for each counterfactual tariff are a function of estimated elasticities and observed prices and quantities, and they are independent from market structure (i.e., the indicator χ^M does not enter in these expressions). We define $q_f\left(\tau\right)$ and $p_f\left(\tau\right)$ for each f using (65) to (67) and then solve numerically for τ^* using (53) and (59). We apply this solution to the post-period without quantitative restrictions, so that (62) and (63) hold in the observed equilibrium.