IMPORT SUBSTITUTION AND FIRM PERFORMANCE: THE CASE OF INDONESIA'S REFRACTORY INDUSTRY

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ABSTRACT

Growing protectionist policies have renewed interest in import substitution industrialization (ISI) as a strategy to reduce dependence on imported intermediate goods and strengthen domestic manufacturing. Despite its increasing adoption, empirical evidence on the firm-level effects of tariff-based import substitution remains limited, particularly in small-scale manufacturing industries. This study examines the impact of Most Favored Nation (MFN) tariff protection on firm performance in Indonesia's refractory industry. Using an unbalanced panel dataset of 3,000 firm-year observations from BPS-Statistics Indonesia covering the period 2010–2015, the study employs a fixed-effects panel estimation to evaluate the effects of tariffs on output, input, employment, imports, and labor productivity while accounting for firm heterogeneity through interaction models. The findings reveal that higher tariff protection significantly reduces firm output, input utilization, and employment, reflecting increasing production costs and constrained access to imported intermediate inputs. Although tariffs are positively associated with labor productivity, the improvement primarily reflects a mechanical increase caused by labor downsizing rather than genuine technological upgrading or production efficiency. Moreover, private domestic, foreign-owned, and local government-owned firms are more adversely affected than central government-owned enterprises, indicating heterogeneous responses to protectionist policies. These findings challenge the effectiveness of unconditional tariff-based import substitution and suggest that sustainable industrial development requires conditional and time-bound protection, investment in upstream raw material processing, improved trade facilitation, and stronger technological capability to enhance long-term competitiveness within global value chains.

Keywords : Firms Performance, Import Substitution Industrialization, Manufacturing Industry, Tariff Protection, Trade Policy

A. INTRODUCTION

Import substitution, or Import Substituting Industrialization (ISI), has long influenced economic development across countries, rising and falling with global trade conditions. Its core objective is to expand demand for domestic goods by using trade barriers to restrict imports. The strategy gained broad popularity around 1950 in the post–World War II industrialization wave (Adewale, 2017) but lost momentum after the Washington Consensus around 1990 promoted free trade. Empirical outcomes remain mixed and highly context-specific. Russia, for example, adopted ISI after Western sanctions in 2014 over Crimea, which pushed domestic production, especially in food and beverages; imports of food products fell sharply from USD60 billion in 2014 to USD20 billion in 2017, producing Russia's first trade surplus (Tolkachev & Teplyakov, 2018; Kuznetsov et al., 2018). By contrast, ISI in sub-Saharan Africa during the 1970s–1980s is widely viewed as unsuccessful because of weak industrial capacity, agricultural disruption, shortages of skilled human resources, and politically driven import regulations (Mendes, Bertella & Teixeira, 2014; Gulhati & Sekhar, 1982; Howell, 1985; Millward & North, 1983).

In Indonesia, the government continues to pursue ISI because domestic producers remain highly dependent on imported inputs, particularly in upstream manufacturing, despite the merchandise trade surplus recorded since the COVID-19 period. In Q1-2021, the trade surplus reached USD5.5 billion, up from USD2.6 billion a year earlier, driven mainly by the non-oil and gas sector and concentrated in manufacturing subsectors such as food and beverages, basic metals, chemicals, and electronics (Bank Indonesia, 2021; Rezki et al., 2025). However, the main policy concern is structural import dependence: in 2020, raw materials and components accounted for 73.1% of imports, and including capital goods raised the input share to 89.8% (Badan Pusat Statistik, 2021). This dependence has led the government to support upstream and mid-stream industries through tariffs, SNI standards, import controls, and the P3DN framework. The refractory industry has been among the sectors receiving protection since late 2019, with compulsory SNI standards planned to strengthen competitiveness and consumer safety. As a non-metallic minerals subsector supplying diverse markets, the refractory industry exported more than USD1 million in 2019, yet domestic production met only about one-quarter of domestic demand. This study therefore examines the impact of ISI measures on domestic firm performance in Indonesia's refractory industry and assesses the feasibility of tariff-based protection. It contributes by providing the first comprehensive evidence on refractory ISI, extending beyond prior studies on India's aluminous bricks, Indonesia's casting products, and broader sectoral ISI analyses, which is particularly relevant amid renewed global protectionism after COVID-19 (Basit et al., 1981; Abdullah & Pratomo, 2020; Narjoko, 2018; Albertoni & Wise, 2020).

B. LITERATURE REVIEW

Import Substitution in Various Countries

Many countries abandoned import substitution industrialization (ISI) in the 1980s in favor of export promotion following mixed empirical outcomes, although several Asian economies achieved early industrialization success through ISI before transitioning to export-led growth (Krugman et al., 2018; Neumann, 2013; Felipe, 2019). A notable example is India, where domestically produced materials replaced imported aluminous bricks for the steel industry in 1974–1975 (Basit et al., 1981). ISI is grounded in the infant industry argument, which advocates temporary protection to enable developing-country industries to build competitiveness before competing internationally (Krugman et al., 2018). This rationale underpins Indonesia's refractory industry policy, where tariffs and non-tariff measures, including SNI standards and P3DN regulations introduced since 2019, seek to reduce import dependence because domestic production satisfies only about 25% of demand (Ministry of Industry, 2019a). Consistent with the infant industry framework, such protection is expected to promote technological upgrading and competitiveness if supported by strong institutions, complementary inputs, and time-bound implementation (Krugman et al., 2018; Neumann, 2013). However, Indonesia's refractory industry, dominated by micro and small enterprises, faces substantial structural constraints that may delay efficiency gains, while long-term competitiveness depends on entrepreneurial capabilities and adaptive competitive advantages beyond trade protection alone (Felipe, 2019; Chairul et al., 2025; Renaldi & Maya, 2025).

Table 1
Distribution of Indonesia's Refractory Industry

Scale enterprises	2006	2011
Large and Medium	11%	5%
Small and Micro	89%	95%

Source: Ministry of Industry, 2013

Global evidence shows that the effectiveness of import substitution industrialization (ISI) depends largely on structural and institutional conditions. South American countries, particularly Brazil and Argentina, experienced limited industrial transformation despite decades of ISI, with exports remaining dominated by raw commodities, industrial growth stagnating, employment declining, and income inequality worsening (Baer, 1972). In contrast, East Asian economies achieved stronger outcomes, although they continued to rely on imported raw materials, components, capital goods, and foreign services within global value chains (Eichengreen et al., 2007; Thangavelu et al., 2017). This dependence becomes more pronounced during global trade shocks, as increased exports are often accompanied by higher foreign value-added content (Riefky et al., 2025). GDP per capita also grew substantially faster in Japan and South Korea than in Brazil and Argentina between 1950 and 1990 (Baer, 1972). These contrasting outcomes indicate that the infant industry argument succeeds only when supported by strong institutions, as weak governance encourages rent-seeking and constrains

industrial development, whereas effective institutions and complementary reforms, such as South Korea's land reform, enable ISI to generate sustained structural transformation (Krugman et al., 2018; Neumann, 2013).

Import Substitution and Refractory Industry in Indonesia

In Indonesia, previous studies have assessed the feasibility of import substitution industrialization (ISI) across sectors such as food and beverages, industrial supplies, capital goods parts and accessories, textiles, wood and wood products, and paper products (Narjoko, 2018). However, evidence for the refractory industry remains limited to the study by (Abdullah & Pratomo, 2020), which examined the technical feasibility of using local silica and zircon sand but did not address broader trade and industry perspectives. Indonesia implemented ISI in the refractory industry during 1966–1983 (Felipe, 2019) and has considered its reintroduction since 2014 to reduce import dependence, as domestic production meets only 25% of demand (Ministry of Industry, 2019a). Although abundant non-metal mineral resources support this policy direction, their dispersed distribution increases logistical barriers, reinforcing evidence that tariff reductions are less effective when industries face inadequate infrastructure and high behind-the-border trade costs (Ministry of Industry, 2019b; Ardine et al., 2023). To date, government action has been limited to the *Making Indonesia 4.0* Roadmap and the implementation of mandatory Indonesian National Standards (SNI) since 2020 (Ministry of Industry, 2020).

Despite its critical importance, no prior study has executed an empirical analysis on the economic impact of ISI implementation, specifically the impact of trade protection on firm performance, leaving the actual effectiveness of such a policy wide open to doubt. The industry's structural stagnation further intensifies this uncertainty; micro and small-sized enterprises completely dominated the industry in 2006, and this composition did not exhibit significant changes by 2011 (see Table 1).

C. METHOD

Model Specification, Classification, and Data Sources

The refractory industry comprises companies manufacturing non-metallic mineral products engineered to withstand high-temperature industrial processes, such as cement, glass, and steel production (Pranggono, 2007). Standard classifications categorize this sector under non-metal mineral processing, with Table 2 delineating the specific product categories under the Indonesian KBLI codes 23911 to 23929.

Table 2
Industrial Classification Codes and Products of Refractory Industry in Indonesia

Industrial Classification Code	Name of Product
23911	Manufacture of refractory mortars, concretes, etc.
23912	Manufacture of refractory bricks, blocks tiles, and similar refractory ceramic constructional goods

Industrial Classification Code	Name of Product
23913	Manufacture of refractory ceramic products
23919	Manufacture of other refractory articles
23921	Manufacture of bricks
23922	Manufacture of tiles from clay ceramic/soil
23923	Manufacture of sanitary equipment from porcelain
23929	Manufacture of building materials from clay / ceramic, not stone brick, and tiles

Source: United Nations, 2020

This study utilizes a fixed-effects econometric framework adapted from Narjoko (2018) to quantify the impact of tariff protections on these classified firms:

$$Performance_{it} = \alpha_i + \beta_1 NRP_{it} + Z_{it} + \varepsilon_{it}$$

Where $NRP_{i,t}$ denotes the nominal rate of protection for firm *i* in year *t*. Firm performance is measured using five dependent variables: Output, Input, Productivity, Labor, and Import. A fixed-effects estimator is employed to control for unobserved time-invariant firm characteristics, such as managerial quality, technological capability, and location, which are likely correlated with tariffs, thereby ensuring consistent estimates. The Hausman test further supports the fixed-effects specification by rejecting the null hypothesis of no systematic differences between fixed- and random-effects estimators ($p < 0.01$). The model also interacts tariffs with firm-level characteristics, including export orientation, firm size, and ownership origin, while controlling for industry-level factors through the four-firm concentration ratio (CR4), foreign ownership share in real value-added, and skill intensity measured by the non-production-to-production worker ratio.

Table 3 defines the five firm performance measures (Narjoko, 2018; Head & Ries, 1999), and Table 4 presents the independent variables based on the specifications of Narjoko (2018) and Head and Ries (1999). Together, the interaction terms and industry controls provide a comprehensive framework for capturing structural heterogeneity across firms.

Table 3
Dependent Variables Used in the Estimation

Variables	Measurement	Description	Source
Output	In rupiah units	Measure aggregating the added value of each firm in the refractory industry in year *t* and dividing by the wholesale price index to obtain the real added value of each firm	Industrial Statistics compiled by the BPS-Statistics Indonesia from 2010 to 2015
Input	In rupiah units	The total input value used by firm *i* during year *t*	
Productivity	In rupiah/labor units	Real added value of each firm divided by the number of workers	
Labor	In person units	The number of paid and unpaid workers employed by firm *i* during year *t*	
Import	In rupiah units	The input value imported by firm *i* during year *t*	

Source: Author's analysis, 2026

Table 4
Independent and Control Variables Used in the Estimation

Variables	Description of the variable	Expected sign	Source
Tariff	Most Favored Nation (MFN) weighted rate data measured in percentage from the Indonesian refractory industry	-	World Integrated Trade Solution (WITS)
CR4	The sum of the four largest firms' market shares in the Indonesian refractory industry in year *t*	+/-	Industrial Statistics compiled by the BPS-Statistics Indonesia from 2010-2015
Ln_foreign	The percentage of foreign ownership of company *i* in year *t*, obtained by multiplying the percentage of capital ownership by foreign parties with the total added value generated by the firm	-	Industrial Statistics compiled by the BPS-Statistics Indonesia from 2010-2015
Skill_intensity	The proportion of total unproductive workforce divided by the total productive workforce in a firm *i* during year *t*	-	Industrial Statistics compiled by the BPS-Statistics Indonesia from 2010-2015
Tariff*export	A dummy variable that shows whether during the last 1-year firm *i* has exported its products abroad, then interacted with the tariff rate	-	Industrial Statistics compiled by the BPS-Statistics Indonesia from 2010-2015
Tariff *large	A dummy variable of the scale of the firms (categorized as large scale if employed ≥ 100 labors and medium scale if employed 20-99 labors), then interacted with the tariff rate	-	Industrial Statistics compiled by the BPS-Statistics Indonesia from 2010-2015
Tariff *domestic	The status of capital ownership, valued as 1 if the ownership of a firm is from domestic, 0 otherwise, then interacted with the tariff rate	-	Industrial Statistics compiled by the BPS-Statistics Indonesia from 2010-2015
Tariff *foreign	The status of capital ownership, valued as 1 if the ownership of a firm is from foreign, 0 otherwise, then interacted with the tariff rate	-	Industrial Statistics compiled by the BPS-Statistics Indonesia from 2010-2015
Tariff *local	The status of capital ownership, valued as 1 if the ownership of a firm is from local government, 0 otherwise, then interacted with the tariff rate	-	Industrial Statistics compiled by the BPS-Statistics Indonesia from 2010-2015
Wholesale price index	The denominator index to compile real variables of value added in refractory industry	-	BPS-Statistics Indonesia

Source: Author's analysis, 2026

D. RESULTS

Descriptive Statistics

Table 5 presents summary statistics for 3,000 firm-year observations, revealing profound structural heterogeneity across the Indonesian refractory industry. Real output exhibits immense variance, ranging from IDR 113,325 to IDR 3.786 billion, with a standard deviation of IDR 179.3 million against a mean of IDR

21.04 million. Input consumption mirrors this dispersion, with a standard deviation of IDR 87.55 million relative to a mean of IDR 8.83 million. Labor deployment averages 19,866 workers but features an expansive standard deviation of 460,767 and peaks at over 24 million, reflecting the coexistence of large conglomerates and small enterprises. Trade participation is heavily export-oriented (94.6% of observations), whereas foreign import values drop to zero for many entities but peak at IDR 1.818 billion for core firms relying on foreign intermediates. Ownership is overwhelmingly dominated by domestic private investors (98.4% mean), with foreign (1.2%) and local government (0.4%) ownership representing minor shares. Crucially, nominal MFN tariff rates demonstrate a remarkably tight distribution between 6.09% and 6.24% (mean: 6.16%, standard deviation: 0.06%), underscoring that tariffs are determined by national institutional mandates rather than individual firm lobbying, thereby mitigating potential endogeneity concerns.

Table 5
Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
output (in rupiah)	3000	21042361	179300000	113325	3786000000
input (in rupiah)	3000	8831147.4	87550863	12160	2378000000
import (in rupiah)	3000	1874160.4	35991783	0	1818000000
labor (in person)	3000	19866.6	460767.83	20	24081123
cr4 (in percentage)	3000	.327	.085	.187	.432
skill intensity (proportion value)	3000	.123	.256	0	2.258
tariff (in percentage)	3000	6.16	.06	6.09	6.24
productivity (in rupiah/labor)	3000	105.462	566.324	.109	13760.58
lnforeign (in percentage)	3000	.21	1.569	0	14.944
export (dummy variable)	3000	.946	.226	0	1
foreign (dummy variable)	3000	.012	.11	0	1
domestic (dummy variable)	3000	.984	.127	0	1
local (dummy variable)	3000	.004	.063	0	1

Source: Authors'calculation, 2026

Main Result

Tables 6 and 7 present fixed-effects panel data estimations evaluating the empirical impacts of MFN tariffs on refractory firm performance across three specifications to ensure coefficient robustness: a baseline model (1), a model adding

sectoral controls (cr4, lnforeign, and skill intensity) (2), and a complete framework incorporating firm-heterogeneity interactions (3). Baseline estimations in Table 6 show that tariffs have a statistically significant negative relationship with real output, labor deployment, and total input values. Conversely, Table 7 reveals an insignificant negative relationship with import values, alongside a positive, statistically significant coefficient linking protection to firm productivity. The reduction in total inputs is driven by higher domestic and imported input prices and restricted accessibility to high-quality intermediates (Fiorini et al., 2018; Ethier, 1982; Irene et al., 2020; Konings, 2007; Markusen, 1989). These dynamics align with findings by Endito et al. (2026), which confirm that Indonesian manufacturing productivity relies heavily on foreign intermediates and machinery for technological absorption, rendering domestic producers vulnerable to efficiency stagnation under protective tariffs. Finally, the statistically insignificant decline in imported inputs in Table 7 is driven by tariff-induced input costs, which elevate total production costs and reduce manufacturing value-added (Shu & Steinwender, 2019).

Model (3) incorporates comprehensive industry controls and tariff interaction terms to assess the heterogeneous effects of trade protection across firms. The interaction between tariffs and export orientation yields negative coefficients across all performance measures, with statistical significance only for output and input in Table 6, while the large negative effect on imports in Table 7 remains insignificant. These findings are consistent with Cruz and Bussolo (2015), who argue that export-oriented firms depend more heavily on imported high-quality inputs and are therefore more vulnerable to import tariff increases. Tariff retaliation further reduces export performance by forcing firms to redirect exports away from markets imposing higher tariffs (Irene et al., 2020). Consequently, higher import tariffs reduce the output of export-oriented firms and overall industry performance, potentially constraining broader regional economic growth in Indonesia (Sugiarti & Astuty, 2025).

Table 6
Fixed-Effects Estimation Results: Tariff Impact on Output, Workers, and Input

	Output			**Workers**			**Input**		
Variables	1	2	3	1	2	3	1	2	3
tariff	-4.387 ***	-3.525 ***	1.99	-26.77 ***	-24.94 ***	-3.995	-4.276 ***	-3.664 ***	1.139
	(0.814)	(0.244)	(-2.659)	(0.407)	(0.544)	(-4.051)	(0.200)	(0.267)	(-2.916)
cr4		-0.797 ***	-1.014 ***		-1.991 ***	-0.173		-0.586 ***	-0.816 ***
		(0.173)	(0.168)		(0.386)	(0.257)		(0.189)	(0.185)
lnforeign		0.161 ***	0.420 ***		-0.0610	0.409 ***		0.140 ***	0.350 ***
		(0.0265)	(0.0497)		(0.0590)	(0.0757)		(0.0290)	(0.0545)
skill_intensity		-0.137 **	-0.132 **		0.0320	-0.0314		-0.0154	-0.0165
		(0.0656)	(0.0635)		(0.146)	(0.0967)		(0.0718)	(0.0696)
tariff*export			-0.0317 ***			-0.00608			-0.0483 ***
			(0.0113)			(0.0172)			(0.0124)
tariff*domestic			-0.0803 ***			-0.0197			-0.0767 ***
			(0.0265)			(0.0404)			(0.0291)
tariff*foreign			-0.0875 ***			-0.0267			-0.0826 ***
			(0.0266)			(0.0404)			(0.0291)
tariff*local			-0.0826 ***			-0.0236			-0.0805 ***
			(0.0283)			(0.0431)			(0.0310)
tariff*large			-0.0693 ***			0.521 ***			-0.0788 ***
			(0.00605)			(0.00922)			(0.00664)
Constant	40.97 ***	35.90 ***	51.91 ***	170.5 ***	159.8 ***	40.64 ***	39.54 ***	35.94 ***	54.20 ***
	(-1.133)	(-1.465)	(-1.986)	(-2.508)	(-3.268)	(-3.025)	(-1.233)	(-1.604)	(-2.178)
Observations	3000	3000	3000	3000	3000	3000	3000	3000	3000
R-squared	0.185	0.206	0.263	0.634	0.638	0.843	-0.155	0.166	0.223
Number of firms	500	500	500	500	500	500	500	500	500

Notes: Standard errors are in parentheses. *** *p < 0.01,* ** *p < 0.05,* * *p < 0.10.*
Source: Authors' calculation.

Table 7
Fixed-Effects Estimation Results: Tariff Impact on Import and Productivity

Variables	Import			Productivity		
	1	2	3	1	2	3
tariff	-4.963	-3.263	14.84	21.19 ***	19.62 ***	4.373
	(-3.551)	(-4.451)	(17.18)	(0.494)	(0.659)	-4.928
cr4		-3.055	-3.472		-1.897 ***	-0.301
		(-3.038)	(-2.982)		(0.468)	(0.312)
lnforeign		-0.402 **	0.0907		0.240 ***	0.0563
		(0.165)	(0.256)		(0.0715)	(0.0921)
skill_intensity		-14.76***	-16.30 ***		-0.331 *	-0.247 **
		(-3.586)	(-3.606)		(0.177)	(0.118)
tariff*export			-15.01			-0.00626
			(14.09)			(0.0210)
tariff*domestic			0.000496			-0.0775
			(0.102)			(0.0492)
tariff*foreign			-0.0471			-0.0788
			(0.103)			(0.0492)
tariff*local			-			-0.0769
						(0.0524)
tariff*large			0.213			-0.631 ***
			(0.147)			(0.0112)
Constant	46.49 **	44.53	21.02	-127.9 ***	-118.9 ***	25.61 ***
	(21.90)	(26.95)	(28.27)	(-3.042)	(-3.962)	(-3.68)
Observations	101	101	101	3000	3000	3000
R-squared	0.024	0.213	0.287	0.424	0.431	0.752
Number of firms	21	21	21	500	500	500

Notes: Standard errors are in parentheses. *** *p < 0.01,* ** *p < 0.05,* * *p < 0.10.*
Source: Authors' calculation.

The interaction terms indicate substantial heterogeneity in firms' responses to tariff protection. Compared with central government-owned enterprises, domestic private, foreign, and local government-owned firms experience significantly larger declines in output and input following tariff increases, while effects on employment, imports, and productivity are generally insignificant. These findings differ from evidence for India (Topalova & Khandelwal, 2011), reflecting stronger financial support and resilience among Indonesia's state-owned enterprises. Foreign-owned firms are particularly vulnerable because of their greater reliance on imported inputs and higher production costs under protective tariffs (Kowalski et al., 2013; Halpern et al., 2015). Firm size also matters: large firms exhibit

significantly lower output, input, and productivity than medium-sized firms as tariffs rise, although employment increases, suggesting greater labor rigidities and slower production adjustment under trade shocks (Topalova & Khandelwal, 2011; Hu & Liu, 2014).

Among the control variables, the concentration ratio (CR4) negatively affects firm performance, with significant reductions in output and input, consistent with evidence that greater market concentration lowers profitability and production (Feeny & Rogers, 2000; Cowling & Waterson, 1976; Gopinath et al., 2002). A higher foreign ownership share in value added positively influences output, employment, and input but significantly reduces imports, indicating technological spillovers and greater domestic input sourcing (Konings, 2001; Yasar et al., 2007; Pasali & Chaudhary, 2020; Sjöholm et al., 2010). Finally, skill intensity is negatively associated with output, imports, and productivity, suggesting that lower labor efficiency and weaker technology absorption reduce firm performance and discourage reliance on imported inputs (Lisi & Malo, 2014; Cuaresma & Wörz, 2005).

E. CONCLUSION

Import substitution industrialization (ISI), grounded in the infant industry argument, seeks to protect domestic industries to promote technological learning, reduce import dependence, and foster industrialization. Consistent with this rationale, Indonesia has implemented tariff protection, mandatory Indonesian National Standards (SNI), and local content requirements (P3DN) in the refractory industry. Using a fixed-effects panel approach, this study finds that MFN tariffs have significant negative effects on firm output, input use, and employment, while the observed positive association with productivity reflects short-run labor reductions rather than genuine efficiency gains. Interaction models further indicate that foreign-owned, domestic private-owned, and local government-owned firms are more vulnerable to tariff increases than central government-owned enterprises. These findings suggest that tariff protection alone is insufficient to strengthen industrial performance, particularly where fragmented supply chains, high behind-the-border trade costs, and limited technological capabilities constrain competitiveness.

The results imply that sustainable industrial development requires policies extending beyond tariff protection. Rather than relying solely on trade barriers, policymakers should strengthen the investment climate, improve logistics, expand upstream processing of refractory minerals, enhance technological absorption, and monitor downstream prices to prevent higher production costs in industries such as cement and steel. Tariff protection should be conditional, time-bound, and accompanied by complementary measures, including targeted input-cost compensation and trade facilitation, to avoid long-term inefficiency and rent-seeking. Although the fixed-effects estimator controls for time-invariant firm characteristics, the findings represent robust conditional relationships rather than definitive causal effects because time-varying factors, such as energy prices, raw material availability, and downstream demand, may also influence firm performance. Future research should incorporate these variables and employ quasi-

experimental designs based on exogenous tariff changes to strengthen causal identification.

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