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Perceived Tariff Policy Uncertainty and Logistics Cost Pressure: The Mediating Role of Supply Chain Adjustment in Vietnam

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Abstract
This study examines the relationship between perceived tariff policy uncertainty (TU), supply chain adjustment intensity (SCA), and logistics cost pressure (LCP) among firms engaged in seaborne import and export activities in Vietnam. Drawing on transaction cost economics, real options theory, and the dynamic capabilities perspective, the study proposes that tariff policy uncertainty affects logistics cost pressure both directly and indirectly through firms' supply chain adjustments. Data were collected from 320 valid firm-level survey responses across three regions of Vietnam and analyzed using partial least squares structural equation modelling (PLS-SEM). TU and LCP were specified as reflective constructs, whereas SCA was modelled formatively. The results show that TU is positively associated with SCA and LCP, while SCA is positively associated with LCP. The indirect effect of TU on LCP through SCA is also positive and significant, indicating complementary partial mediation. The model explains 33.7% of the variance in SCA and 42.0% in LCP and demonstrates positive out-of-sample predictive relevance. The findings suggest that tariff uncertainty generates logistics cost pressure not only through uncertainty itself but also through the organizational costs associated with supply chain reconfiguration. The study contributes to the trade-policy and logistics literature by identifying supply chain adjustment as an important transmission mechanism in an emerging-market context.

Keywords: Tariff Policy Uncertainty, Supply Chain Adjustment, Logistics Cost Pressure, Maritime Trade, Vietnam

1. Introduction

International trade has become increasingly exposed to policy uncertainty arising from tariff adjustments, retaliatory trade measures, changes in product coverage, and revisions to implementation schedules. For firms participating in international markets, the implications of tariff changes extend beyond the direct payment of import duties. Uncertainty surrounding the direction, timing, and scope of tariff policy may alter firms' expectations and induce changes in sourcing, inventory, shipment size, transportation routes, ports, markets, and logistics service providers. These responses are particularly relevant to maritime import–export firms because supply chain reconfiguration is costly. Changing a supplier, accelerating shipments, increasing inventories, or switching transportation routes may reduce exposure to tariff risk or potential disruptions, but such adjustments can simultaneously generate search costs, coordination costs, additional inventory requirements, longer transportation times, and unplanned logistics expenditures. Thus, the effect of tariff-related uncertainty on logistics costs may operate through both a direct uncertainty channel and an indirect supply chain adjustment channel.

Existing literature has extensively examined the implications of trade policy uncertainty for export participation, investment, employment, and firms' market-entry decisions. Studies by Handley and Limão (2015, 2017) [10, 11], Pierce and Schott (2016) [14], Crowley *et al*. (2018) [5], Caldara *et al*. (2020) [3], and Benguria *et al*. (2022) [2] demonstrate that firms respond not only to current tariff levels but also to uncertainty regarding future trade policy. A separate strand of logistics and supply-chain research emphasizes the economic importance of transportation time, reliability, resilience, and supply chain reconfiguration.

Nevertheless, these two streams remain insufficiently connected at the firm level. In particular, limited evidence explains how perceived tariff policy uncertainty is transmitted into logistics cost pressure through firms' actual supply chain adjustments. This distinction is important because tariff changes, perceived uncertainty, organizational responses, and monetary logistics expenditure represent different analytical levels and should not be treated as interchangeable concepts. The original report explicitly identifies this intersection as its principal research gap. Vietnam provides a relevant empirical setting because of its

strong integration into international production and trade networks and the substantial role of maritime transport in international merchandise flows. Rather than estimating the monetary effect of a one-percentage-point tariff increase, this study focuses on firms' perceptions and organizational responses to tariff policy uncertainty. Accordingly, this study examines three research questions: (1) whether perceived tariff policy uncertainty is associated with greater supply chain adjustment intensity; (2) whether tariff uncertainty and supply chain adjustment are associated with higher logistics cost pressure; and (3) whether supply chain adjustment serves as an intervening mechanism linking tariff uncertainty with logistics cost pressure.

The study makes three main contributions. First, it integrates trade policy uncertainty research with supply chain and logistics cost research within a unified firm-level framework. Second, it distinguishes policy uncertainty, supply chain action, and logistics cost pressure as separate constructs and explicitly models SCA as a formative construct. Third, it provides empirical evidence from 320 firms engaged in seaborne import and export activities in an emerging economy.

2. Literature Review and Hypothesis Development

Tariff policy uncertainty differs from the actual level of tariffs imposed on traded goods. A tariff may be relatively high but predictable, whereas firms may experience substantial uncertainty when the direction, timing, product coverage, or market applicability of future tariff policies is unclear. Existing studies show that firms respond not only to current tariff rates but also to the possibility of future policy changes. Handley and Limão (2015, 2017) [10, 11] demonstrate that trade policy uncertainty affects firms' export entry and investment decisions, while Pierce and Schott (2016) [14] and Feng *et al*. (2017) [8] show that changes in the range of possible future tariffs can significantly alter trade and firm behavior. Crowley *et al*. (2018) [5] further find that firms may adjust market-entry and exit decisions in response to anticipated tariff changes even before such changes materialize. More directly, Caldara *et al*. (2020) [3] and Benguria *et al*. (2022) [2] provide evidence that tariff-related developments increase trade policy uncertainty at both aggregate and firm levels. These studies support the distinction between objective tariff changes and firms' perceived tariff policy uncertainty (TU), which is the focus of the present study.

Greater tariff policy uncertainty can induce firms to modify their supply-chain arrangements. Such responses may include changes in suppliers, sourcing countries, inventory levels, shipment sizes, destination markets, ports, transport routes, and logistics service providers. Real options theory suggests that uncertainty increases the value of flexibility when decisions involve sunk or difficult-to-reverse costs (Dixit & Pindyck, 1994) [6]. At the same time, firms with ongoing production and delivery commitments may be unable to postpone decisions and instead adjust their supply-chain configurations. From a transaction cost perspective, such adjustments entail search, evaluation, negotiation, monitoring, coordination, and switching costs (Williamson, 1985). The dynamic capabilities perspective further suggests that firms differ in their ability to sense environmental change and reconfigure resources (Teece, 2007) [15], although adjustment intensity itself should not be equated with dynamic capability. Accordingly, higher perceived tariff policy uncertainty is expected to be associated with more intensive supply-chain adjustment.

H1. Perceived tariff policy uncertainty is positively associated with supply chain adjustment intensity.

Tariff policy uncertainty may also be directly associated with logistics cost pressure. Uncertainty can increase information-processing requirements, contingency planning, coordination efforts, and the likelihood of unplanned logistics expenditures. Importantly, this study distinguishes logistics cost pressure (LCP) from tariff payments and from objectively measured monetary logistics expenditure. LCP reflects the pressure perceived by firms from increasing, volatile, or unplanned logistics-related costs. Therefore:

H2. Perceived tariff policy uncertainty is positively associated with logistics cost pressure.

Supply-chain adjustment itself may further increase logistics cost pressure, particularly during the transition period. Changing suppliers, routes, shipment structures, inventory policies, or logistics providers may improve resilience but also generate additional switching and coordination costs. Christopher and Peck (2004) [4] and Fan and Stevenson (2018) [7] emphasize the importance of flexibility and risk-management responses, whereas Grossman *et al*. (2023) [9] highlight the trade-off between supply-chain resilience and efficiency. Similarly, Ahn and Tan (2025) [1] consider the adjustment frictions involved in supply-chain diversification. In maritime logistics, total cost also extends beyond freight rates to warehousing, handling, inventory, delays, and reliability-related costs. Hummels and Schaur (2013) [12] and Kumar *et al*. (2018) [13] show that transportation time and reliability have important economic consequences. Thus, supply-chain reconfiguration designed to reduce policy exposure may simultaneously generate short-run logistics cost pressure.

H3. Supply chain adjustment intensity is positively associated with logistics cost pressure.

Taken together, these arguments imply that supply-chain adjustment may constitute a mechanism through which tariff policy uncertainty is associated with logistics cost pressure. Prior trade-policy studies have primarily examined export participation, investment, productivity, or employment, whereas logistics studies have focused on cost, time, reliability, and resilience. In Vietnam, existing studies have documented firms' responses to trade integration and export opportunities and examined logistics performance, but the reviewed literature does not jointly examine the TU–SCA–LCP mechanism among firms engaged in seaborne export and import activities. The present study therefore proposes:

H4. Perceived tariff policy uncertainty has a positive indirect association with logistics cost pressure through supply chain adjustment intensity.

3. Research Methodology

3.1 Research design and data collection

This study employed a quantitative cross-sectional survey design to examine the relationships among perceived tariff policy uncertainty (TU), supply chain adjustment intensity (SCA), and logistics cost pressure (LCP). The unit of analysis was the firm engaged in export or import activities using maritime transport in Vietnam. Respondents were managers or professional staff with direct knowledge of export–import, logistics, supply chain, purchasing, freight forwarding, customs, or related activities.

A purposive sampling approach was used. The survey was

conducted across the Northern, Central, and Southern regions of Vietnam from July 1 to August 31, 2026. Three screening criteria were applied: respondents had to consent to participate, their firms had to engage in seaborne export or import activities during the reference period, and they had to possess direct knowledge of the relevant activities. All 320 completed responses satisfied these conditions. The initial contact list comprised 350 firms or organizational contacts, resulting in a usable response rate of 91.4%. The survey referred to the January–December 2025 policy period, with respondents identifying a relevant market and product group or HS code as the reference context.

The final dataset contained 320 observations with complete information for all core indicators. No missing values or responses outside the permitted 1–5 range were detected. One organizational name appeared twice but was associated with different respondent profiles and reference contexts. Because the available records did not provide sufficient grounds for identifying either response as invalid, both were retained in the baseline model, while an additional analysis with one record removed was conducted as a sensitivity check.

3.2 Measurement

The measurement model comprised 18 indicators: five for TU (TU1–TU5), eight for SCA (SCA1–SCA8), and five for LCP (LCP1–LCP5). All indicators were coded in the same direction, with no reverse-coded items. TU and LCP were measured on five-point agreement scales ranging from 1 ("strongly disagree") to 5 ("strongly agree"). SCA used a five-point intensity scale ranging from 1 ("no adjustment") to 5 ("very strong adjustment").

TU captures firms' perceived difficulty in predicting the direction, scope, timing, and stability of tariff-policy changes, whereas LCP represents perceived pressure arising from logistics-related costs. Both constructs were specified as reflective. In contrast, SCA was specified as a formative construct because its eight indicators represent distinct adjustment actions involving order or delivery timing, shipment size and frequency, inventory, suppliers, sourcing countries or destination markets, ports and transport routes, logistics service providers or transaction conditions, and contingency arrangements. These actions jointly form the overall intensity of supply-chain adjustment rather than functioning as interchangeable manifestations of a single latent condition.

3.3 Data analysis

Partial least squares structural equation modelling (PLS-SEM) was employed because the model simultaneously incorporates reflective and formative measurement and examines both direct and indirect relationships. TU and LCP were estimated using Mode A, whereas SCA was estimated using Mode B under the path-weighting scheme. The analysis was conducted using Python 3.12 and the plspm 0.5.7 package.

For the reflective constructs, measurement quality was assessed using indicator loadings, Cronbach's alpha, rho_A, composite reliability, average variance extracted (AVE), and the heterotrait–monotrait ratio (HTMT). The formative SCA construct was assessed using outer VIFs, indicator weights, loadings, and their statistical significance. The structural model was evaluated through collinearity diagnostics, path coefficients, R^2, and f^2. Statistical inference for the direct and indirect effects was based on 5,000 bootstrap samples using two-tailed tests and 95% percentile confidence intervals. Predictive performance was additionally assessed using PLSpredict with 10 folds and 10 repetitions, with RMSE compared against a linear benchmark.

Because the data are cross-sectional and perception-based, the estimated paths are interpreted as statistical associations rather than causal effects of tariff-rate changes. In particular, the indirect TU→SCA→LCP relationship represents statistical mediation within the specified model and does not establish temporal causality.

4. Results

4.1 Sample characteristics and data quality

A total of 320 valid responses were obtained from 350 firms or contact points approached during the survey period, yielding a usable response rate of 91.4%. All observations satisfied the three screening criteria and contained complete responses for the 18 core indicators of tariff policy uncertainty (TU), supply chain adjustment intensity (SCA), and logistics cost pressure (LCP). No out-of-range values or missing observations were identified for these indicators. Two records shared the same organizational label but differed in location, respondent position, response date, and reference market. Because no respondent identifier was available to establish whether these observations were duplicates, both were retained in the baseline analysis, followed by a sensitivity test using 319 observations.

The sample covered all three major regions of Vietnam, with 49.7% of respondents located in the South, 34.1% in the North, and 16.2% in the Central region. Small and micro firms accounted for 39.1% of the sample, medium-sized firms for 37.8%, and large firms for 23.1%. Firms engaged in both exporting and importing represented the largest group (41.6%), followed by export-only firms (30.6%) and import-only firms (27.8%). Respondents had an average of 8.16 years of professional experience, while the average proportion of shipments transported by sea was 69.15%.

The descriptive statistics indicated moderate-to-high levels across the three constructs. Mean values for the TU indicators ranged from 3.200 to 3.497. Among the SCA indicators, adjustment of inventories or replenishment plans recorded the highest mean (SCA3 = 3.406), whereas adjustment of ports, routes, or transshipment points had the lowest mean (SCA6 = 3.066). For LCP, the highest means were observed for LCP5 (3.450) and LCP1 (3.441), while LCP3 had the lowest mean (3.219). All indicators covered the full response range from 1 to 5. The reference markets were also diverse, with South Korea and the European Union accounting for 24.4% and 22.8% of responses, respectively. Notably, 47.2% of respondents characterized the direction of tariff changes as mixed, reinforcing the interpretation of TU as firm-level perceived uncertainty rather than a homogeneous measure of objective tariff exposure.

Table 1: Reliability, convergent validity, and discriminant validity

Construct	No. of items	Cronbach's α	rho_A	CR (rho_C)	AVE	HTMT
Tariff Policy Uncertainty (TU)	5	0.899	0.902	0.925	0.713	—
Logistics Cost Pressure (LCP)	5	0.898	0.899	0.924	0.71	—
TU–LCP	—	—	—	—	—	0.59

For the reflective constructs, all indicator loadings exceeded the recommended threshold. TU loadings ranged from 0.817 to 0.878, while LCP loadings ranged from 0.815 to 0.864. All 95% bootstrap confidence intervals were above zero; therefore, all indicators were retained.

Both constructs demonstrated satisfactory internal consistency and convergent validity. For TU, Cronbach's alpha, rho_A, composite reliability, and average variance extracted (AVE) were 0.899, 0.902, 0.925, and 0.713, respectively. The corresponding values for LCP were 0.898, 0.899, 0.924, and 0.710. Discriminant validity was also supported, as the HTMT ratio between TU and LCP was 0.590, with a 95% confidence interval of [0.500, 0.670], below the conservative threshold of 0.85.

SCA was specified as a formative construct. The outer VIF values ranged from 1.321 to 1.580, indicating no problematic multicollinearity among its eight indicators. Six indicators—SCA1, SCA2, SCA3, SCA4, SCA6, and SCA7—had positive and statistically significant outer weights at the 1% level. SCA5 and SCA8 had nonsignificant weights of 0.041 ($p = 0.569$) and 0.109 ($p = 0.147$), respectively, but their outer loadings remained 0.543 and 0.657. These two indicators were retained because they represented distinct substantive domains—market/country adjustment and contingency planning—that were not fully captured by the remaining indicators. A redundancy analysis was not performed because the survey did not include an independent global measure of SCA; using a composite created from the same eight indicators would have produced a circular validity test.

Table 2: Assessment of the formative measurement model for SCA

Indicator	Outer VIF	Outer weight	95% CI	p-value	Outer loading	Decision
SCA1	1.357	0.201	[0.065, 0.334]	0.004	0.621	Retained; significant weight
SCA2	1.576	0.215	[0.065, 0.359]	0.004	0.716	Retained; significant weight
SCA3	1.58	0.251	[0.092, 0.399]	0.002	0.732	Retained; significant weight
SCA4	1.391	0.195	[0.059, 0.324]	0.004	0.641	Retained; significant weight
SCA5	1.385	0.041	[−0.099, 0.183]	0.569	0.543	Retained for content relevance
SCA6	1.446	0.226	[0.092, 0.358]	<0.001	0.693	Retained; significant weight
SCA7	1.321	0.247	[0.121, 0.368]	<0.001	0.656	Retained; significant weight
SCA8	1.56	0.109	[−0.039, 0.254]	0.147	0.657	Retained for content relevance

No structural multicollinearity problem was detected. When TU and SCA jointly predicted LCP, the VIF for both predictors was 1.508. The model explained 33.7% of the variance in SCA ($R^2 = 0.337$; adjusted $R^2 = 0.335$) and 42.0% of the variance in LCP ($R^2 = 0.420$; adjusted $R^2 = 0.416$). These values represent explained variance in the latent constructs and should not be interpreted as the proportion of monetary logistics costs attributable to tariffs.

The bootstrap procedure with 5,000 resamples supported all three direct hypotheses. TU was positively associated with SCA ($\beta = 0.581$, SE = 0.038, $t = 15.192$, $p < 0.001$, 95% CI [0.510, 0.661]), supporting H1. TU also had a positive direct association with LCP after SCA was included in the model ($\beta = 0.265$, SE = 0.052, $t = 5.111$, $p < 0.001$, 95% CI [0.156, 0.357]), supporting H2. Finally, SCA was positively associated with LCP ($\beta = 0.457$, SE = 0.047, $t = 9.703$, $p < 0.001$, 95% CI [0.372, 0.557]), supporting H3. These three core path coefficients are consistent with the main results reported in the study.

The effect-size analysis further differentiated the relative contribution of the three relationships. TU had a large effect on SCA ($f^2 = 0.508$), whereas its direct effect on LCP was small ($f^2 = 0.080$). The effect of SCA on LCP was of medium magnitude ($f^2 = 0.239$).

The indirect effect of TU on LCP through SCA was also positive and statistically significant ($\beta = 0.265$, SE = 0.032, $p < 0.001$, 95% CI [0.215, 0.342]), supporting H4. The direct effect remained significant and positive, while the total effect of TU on LCP was 0.531 ($p < 0.001$, 95% CI [0.450, 0.606]). This pattern is consistent with complementary partial mediation: TU was associated with LCP both directly and indirectly through SCA. However, because the data are cross-sectional, the mediation result represents a statistical indirect association rather than evidence of temporal or causal mediation. The report explicitly adopts this interpretive boundary.

Table 3: Structural model results and hypothesis testing

Hypothesis	Relationship	β	SE	t-value	p-value	95% CI	f^2	Result
H1	TU → SCA	0.581	0.038	15.192	<0.001	[0.510, 0.661]	0.508	Supported
H2	TU → LCP	0.265	0.052	5.111	<0.001	[0.156, 0.357]	0.08	Supported
H3	SCA → LCP	0.457	0.047	9.703	<0.001	[0.372, 0.557]	0.239	Supported

Out-of-sample predictive performance was assessed using ten-fold cross-validation repeated ten times. Q^2_predict values for the five LCP indicators ranged from 0.264 to 0.302 and were positive in all cases. In addition, PLS prediction errors measured by RMSE were lower than those from the linear benchmark model for all five indicators. These findings indicate useful predictive performance for LCP within the implemented prediction procedure.

Table 4: Direct, indirect, and total effects of TU on LCP

Effect	Path	β	SE	p-value	95% CI	Interpretation
Direct effect	TU → LCP	0.265	0.052	<0.001	[0.156, 0.357]	Positive and significant
Indirect effect (H4)	TU → SCA → LCP	0.265	0.032	<0.001	[0.215, 0.342]	Complementary partial mediation
Total effect	TU → LCP	0.531	0.04	<0.001	[0.450, 0.606]	Positive and significant

The substantive conclusions were also stable across several robustness checks. After removing one of the two records with the duplicated organizational label, the coefficients for TU→SCA, TU→LCP, and SCA→LCP were 0.578, 0.266, and 0.453, respectively. Using an equally weighted SCA score produced corresponding coefficients of 0.574, 0.274, and 0.445. Finally, after adding controls for location, firm size, trade orientation, industry, respondent position, experience, and the proportion of sea freight, the relationships of TU with LCP ($\beta = 0.241$, $p < 0.001$) and SCA with LCP ($\beta = 0.466$, $p < 0.001$) remained positive and significant. Overall, the direction and substantive interpretation of the main relationships were not sensitive to alternative data treatment or construct scoring.

Table 5: Out-of-sample predictive performance for LCP

Robustness check	Specification	Results	Interpretation
Exclusion of duplicated organizational label	n = 319	TU→SCA = 0.578; TU→LCP = 0.266; SCA→LCP = 0.453	Results remain close to the baseline estimates
Equal-weighted SCA score	Mean of eight SCA indicators	TU→SCA = 0.574; TU→LCP = 0.274; SCA→LCP = 0.445	Signs and relative magnitudes remain stable
Addition of control variables	Location, firm size, trade orientation, industry, respondent position, experience, and sea-freight share	TU→LCP = 0.241; SCA→LCP = 0.466; both p < 0.001	Main conclusions remain unchanged
Retention of all indicators	All TU/LCP indicators retained; SCA5 and SCA8 retained	Reflective measurement quality remained satisfactory; SCA VIF remained low	Content validity was preserved

Taken together, the results support all four hypotheses and show that perceived tariff policy uncertainty is positively associated with both supply chain adjustment intensity and logistics cost pressure, while supply chain adjustment constitutes a statistically significant indirect channel linking TU to LCP. The model explains 33.7% of the variance in SCA and 42.0% in LCP and retains its main conclusions across the reported robustness analyses. These coefficients should nevertheless be interpreted as associations among perception-based constructs rather than as causal estimates of the monetary cost effect of a one-percentage-point change in tariff rates.

5. Discussion and Recommendations

The findings provide evidence that perceived tariff policy uncertainty is associated with logistics cost pressure through both direct and indirect channels. The strongest structural relationship is between tariff policy uncertainty and supply chain adjustment intensity (TU→SCA: $\beta = 0.581$; $f^2 = 0.508$), suggesting that firms respond to greater policy uncertainty by intensifying adjustments to sourcing, inventories, shipment arrangements, routes, and related logistics decisions. This finding is consistent with the mechanism emphasized by Handley and Limão (2015, 2017) [10, 11] and Crowley *et al*. (2018) [5], whereby firms respond not only to prevailing tariffs but also to uncertainty regarding future trade policy. However, SCA in this study measures actions undertaken rather than firms' adaptive capability or the effectiveness of those actions; therefore, a higher level of adjustment should not automatically be interpreted as superior performance.

Both TU and SCA are positively associated with logistics cost pressure, although their relative magnitudes differ. The direct TU→LCP relationship is comparatively small ($\beta = 0.265$; $f^2 = 0.080$), whereas SCA→LCP is stronger ($\beta = 0.457$; $f^2 = 0.239$). This pattern indicates that logistics cost pressure is related not only to the uncertainty itself but also to the organizational and operational resources required to reconfigure supply chains. Adjustments involving shipment timing, inventories, sourcing, or transport routes may generate transition costs, additional coordination requirements, longer lead times, or higher inventory commitments. Importantly, this result does not imply that firms should avoid adjustment, because the study does not measure the longer-term resilience benefits that such actions may generate.

The significant indirect effect of TU on LCP through SCA ($\beta = 0.265$, $p < 0.001$) further supports this interpretation. Because the direct effect remains significant, the results are consistent with complementary partial mediation: tariff policy uncertainty is associated with logistics cost pressure both directly and through intensified supply chain adjustments. Nevertheless, the cross-sectional design does not establish temporal causality, and the coefficients should therefore be interpreted as statistical associations rather than causal effects of tariff changes.

These findings have several practical implications. First, exporting and importing firms should strengthen tariff-information management by tracking policy developments by product, origin, market, and effective date, while clearly distinguishing preliminary announcements from officially implemented measures. Verified information should then be translated into conditional operating plans rather than triggering immediate adjustment in every case. Second, alternative sourcing, inventory, shipment, and routing options should be compared on a total-cost basis, including transportation, handling and storage, inventory carrying costs, transition-management costs, and identifiable risk-related costs. This approach is preferable to focusing solely on freight rates.

Finally, logistics service providers and industry associations can support firms by improving the transparency, traceability, and timeliness of information on schedules, quotations, additional charges, and policy changes. Regulatory agencies can further reduce decision uncertainty by making official information easier to retrieve by

commodity, market, and effective date and by maintaining clear channels for policy clarification. These recommendations are intended to improve information quality and coordination; the present evidence does not support prescribing a specific tariff level or estimating economy-wide monetary savings.

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