

RULES OF ORIGIN COMPLEXITY AND SMALL EXPORTER PARTICIPATION ACROSS AGREEMENTS

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Abstract:

This analysis examines whether small exporter participation contracts across preferential agreement settings, addressing the distinction between formal market access and enterprise inclusion in international trade. Official exporter statistics and documented origin provisions form a balanced panel of 44 observations covering United States exports to Australia, Canada, Mexico, and South Korea from 2010 to 2020. Descriptive panel comparisons assess enterprise counts, employment composition, and sensitivity to size definitions and period boundaries. Counts of exporters with 1 to 99 employees declined across all destinations, ranging from 8.75 to 15.68 percent, while their representation among exporters with known employment fell by 3.21 to 4.72 percentage points. Expanding the employment boundary to 499 employees preserved the direction of contraction. However, excluding the terminal year changed Mexico's trajectory from decline to growth, revealing sensitivity to the observation endpoint. The contribution distinguishes participation levels from exporter composition within preferential trading relationships, informing the empirical application of heterogeneous firm theory. Trade institutions should monitor enterprise inclusion alongside agreement provisions and assess whether participation patterns persist across enterprise definitions and observation periods.

Key Words: Rules of Origin; Small Exporter Participation; Preferential Trade Agreements; Exporter Composition; Descriptive Panel Analysis

1. Introduction:

Preferential market access does not ensure broad participation by small exporters. Firms must satisfy rules governing product origin and demonstrate compliance before receiving preferential tariff treatment. These requirements connect trade policy to production decisions, input sourcing, and administrative capacity. Their significance extends beyond tariff reduction because the distribution of exporting opportunities depends on which enterprises can participate under the applicable conditions. Conconi et al. (2018) demonstrate that rules of origin can redirect intermediate input sourcing toward agreement partners. This raises a distinct empirical question: how does small exporter participation evolve across trading relationships governed by different origin arrangements?

Heterogeneous firm trade theory explains why identical market access conditions need not produce uniform enterprise responses. Firms differ in productivity, size, resources, and capacity to absorb the costs of serving foreign markets. Additional production or documentation requirements may therefore matter differently across enterprises, even within the same agreement. Melitz and Redding (2014) synthesize the theoretical importance of these differences for export selection and trade outcomes. Cherkashin et al. (2015) further distinguish the consequences of fixed costs incurred at different stages of enterprise activity. Together, these contributions suggest that participation should be examined through enterprise characteristics rather than inferred from aggregate export performance.

Rules of origin operate through related but distinguishable institutional channels. Product requirements determine which production processes and material combinations qualify for preferential treatment. Certification arrangements govern how eligibility is demonstrated, while cumulation provisions determine whether qualifying inputs or production can be combined across agreement parties. Bombarda and Gamberoni (2013) show that the implications of cumulation depend on firm heterogeneity. Conconi et al. (2018) identify sourcing distortions associated with product requirements. These findings establish that origin arrangements affect economic decisions, but they do not make a general legal threshold or documentation indicator a complete measure of the costs confronting small exporters.

Competing influences also complicate the interpretation of participation across agreements. Preferential arrangements can reduce uncertainty and encourage export investment while retaining origin requirements that condition eligibility. Handley and Limão (2015) identify a policy certainty channel through which agreements influence firm entry and sales. Demidova et al. (2012) show that trade policy differences interact with productivity and destination demand in shaping exporter sorting. Consequently, a destination with more demanding documentation may still attract a larger small exporter population because market opportunities and enterprise composition differ. Observed participation must therefore remain distinct from the effect attributed to any single agreement provision.

Measurement is central to this distinction. Export values describe commercial flows, exporter counts describe participation, and enterprise size shares describe the composition of the observed exporter population. These outcomes can change differently and answer different policy questions. Fernandes et al. (2016) document variation in exporter characteristics across countries and stages of development, demonstrating the value of examining the structure underlying aggregate trade. The present analysis measures small exporter participation through both enterprise counts and shares among exporters with known employment. Combining these outcomes distinguishes a reduction in participating enterprises from a change in their representation within the exporter population.

The research gap concerns the connection between documented agreement settings and comparable measures of small exporter participation. The closest literature establishes origin related sourcing responses, firm sorting, cumulation effects, and export investment under uncertainty. The reviewed evidence does not establish the participation trajectories examined here or their sensitivity to enterprise size definitions and observation boundaries. This analysis contributes a common measurement framework for comparing those trajectories across four destinations from a single exporting economy. Its contribution is a descriptive comparison of participation levels and composition across institutional settings, rather than a causal estimate of rules of origin complexity.

This study aims to examine how small exporter participation changed across United States export destinations with documented preferential origin arrangements between 2010 and 2020. The research question asks how participation levels and enterprise size composition evolved across Australia, Canada, Mexico, and South Korea, and whether the observed patterns depend on the enterprise size boundary or terminal year. The analysis combines official Census exporter statistics with agreement provisions in a balanced panel of 44 destination and year observations. It measures small exporters as enterprises with 1 to 99 employees and uses enterprises with 1 to 499 employees for a broader comparison. Annual counts and shares support comparisons across destinations while preserving the distinction between exporting activity and preference use.

The findings show that small exporter counts and their representation declined across all four destinations over the complete period. The direction persists under the broader enterprise definition, but Mexico's trajectory changes when the terminal year is excluded. These results contribute by showing why agreement assessment should distinguish participation levels, exporter composition, and period sensitivity. For trade institutions, the evidence supports monitoring enterprise participation alongside legal access conditions. Its relevance beyond the selected markets lies in this measurement distinction: comparisons of preferential trading arrangements become more informative when they identify whose participation changes and how the result depends on the population and period examined.

2. Theory, Conceptual Framework and Hypotheses Development:

2.1. Theoretical Foundation:

International trade agreements create preferential market access, but firms can benefit from these preferences only when their products satisfy applicable rules of origin. These rules establish the production, transformation, and documentation conditions required to obtain preferential tariff treatment. This analysis draws on institutional transaction cost theory and heterogeneous firm trade theory to explain how regulatory requirements influence exporters with different productive capacities and compliance resources. Under heterogeneous firm trade theory, additional market access costs affect firms differently because productivity and available resources determine their capacity to participate in international markets. Melitz and Redding (2014) establish the importance of firm heterogeneity in international trade, while Head and Mayer (2014) demonstrate the relevance of trade costs in explaining market access and trade patterns.

Rules of origin introduce a distinction between nominal preferential access and the effective ability to use that access. Product transformation requirements can influence input sourcing and production organization, while administrative requirements create documentation and verification costs. These obligations may disproportionately constrain small exporters because compliance expenditure can represent a larger share of their export revenue. However, rules of origin also protect preferential arrangements against trade deflection and may strengthen the credibility of origin certification. Their relationship with exporter participation is therefore theoretically conditional on compliance costs, preferential tariff margins, production structures, and institutional implementation.

The conceptual framework identifies rules of origin complexity as the explanatory construct and small exporter participation as the outcome construct. Three dimensions capture distinct regulatory mechanisms: product specific rules complexity, administrative and compliance complexity, and rules of origin restrictiveness. These dimensions are conceptually distinguishable, although their empirical measurement requires observable agreement provisions and comparable exporter participation records. The hypotheses specify expected associations rather than established causal effects because observational secondary data alone cannot eliminate confounding, selection, or reverse causality.

2.2. Product Specific Rules Complexity and Small Exporter Participation:

Product specific rules complexity refers to the conditions that exporters must satisfy to establish the originating status of their products. These conditions include changes in tariff classification, regional value content thresholds, and specific processing requirements. Their complexity increases when

exporters must satisfy multiple requirements or reorganize production to qualify for preferential treatment. The resulting adjustment costs influence sourcing decisions and the economic attractiveness of preferential market access. Conconi et al. (2018) demonstrate that rules of origin can alter intermediate input sourcing, establishing a direct connection between origin requirements and production organization.

For small exporters, product specific requirements may constrain participation when compliance requires alternative suppliers, additional domestic processing, or changes in input composition. Firms with limited production capacity may find these adjustments more expensive relative to their expected export revenue. Nevertheless, restrictive requirements do not necessarily reduce participation uniformly. Firms with established regional supply chains may already satisfy origin conditions, while firms relying on imported intermediate inputs face greater adjustment costs. This distinction suggests that the expected association depends on the relationship between origin requirements and existing production arrangements.

Firm heterogeneity provides the theoretical basis for this expectation. Melitz and Redding (2014) explain how differences in productivity and market access costs shape exporting decisions, while Demidova et al. (2012) show that trade policy differences and origin requirements are relevant to exporter sorting across destination markets. These contributions support the expectation that more demanding product requirements are associated with lower participation among exporters facing binding production constraints, although the magnitude and direction remain empirical questions.

H1: Higher product specific rules complexity is negatively associated with small exporter participation across preferential trade agreements.

2.3. Administrative and Compliance Complexity and Small Exporter Participation:

Administrative and compliance complexity concerns the procedures required to demonstrate conformity with rules of origin. These include certification requirements, supporting documentation, and customs verification procedures. Unlike product specific rules, which determine whether a product qualifies as originating, administrative requirements determine how exporters establish and demonstrate that qualification. This distinction matters because a technically eligible product may still fail to obtain preferential treatment when the administrative costs exceed the expected tariff benefit.

Administrative obligations can generate fixed and recurring costs. Exporters may need to maintain production records, document input origins, obtain certificates, and respond to verification requests. These requirements create a participation threshold because the expected benefit from preferential tariffs must justify the resources committed to compliance. Small exporters may face a higher relative burden when they distribute fixed compliance expenditure across smaller export volumes. Consequently, the association between administrative complexity and participation should become more negative when certification and verification procedures are demanding relative to available preference margins.

The transaction cost mechanism is consistent with the evidence that rules of origin impose costs beyond changes in production. Felbermayr et al. (2019) identify administrative burdens and sourcing distortions associated with origin requirements, while Head and Mayer (2014) establish the importance of accounting for trade costs when evaluating international trade relationships. However, certification also provides a mechanism for establishing eligibility and protecting preferential arrangements against trade deflection. Administrative procedures may therefore support participation when they are predictable and inexpensive, even though greater procedural complexity is expected to discourage participation when compliance costs are binding.

H2: Higher administrative and compliance complexity is negatively associated with small exporter participation across preferential trade agreements.

2.4. Rules of Origin Restrictiveness and Small Exporter Participation:

Rules of origin restrictiveness reflects the limitations imposed on the use of foreign inputs, production arrangements, and permissible origin accumulation. Its principal dimensions include cumulation restrictions, de minimis threshold restrictions, and territoriality requirements. These provisions influence whether exporters can combine inputs and production activities across jurisdictions while retaining preferential origin status. Restrictiveness differs from procedural complexity because it limits the range of production arrangements that qualify for preferential treatment rather than merely increasing the effort required to demonstrate compliance.

Restrictive cumulation provisions may reduce the range of suppliers whose inputs qualify as originating. Similarly, narrow de minimis allowances can constrain the permissible use of nonoriginating materials, while territoriality requirements can limit qualifying production arrangements across borders. These restrictions may influence exporter participation through production costs, supplier availability, and the feasibility of meeting origin conditions. Small exporters operating within fragmented production networks may experience stronger constraints because they have fewer opportunities to reorganize sourcing or production without substantial expenditure.

The relationship is nevertheless not mechanically negative. Preferential sourcing arrangements may create opportunities for firms already integrated into regional production networks. Bombarda and Gamberoni (2013) demonstrate that cumulation arrangements interact with firm heterogeneity and can generate differentiated exporting responses. Their analysis indicates that relaxing origin restrictions does not necessarily produce uniform participation gains across all firms. Conconi et al. (2018) further

establish that origin requirements can redirect intermediate input sourcing toward agreement partners. Together, these findings justify testing whether greater restrictiveness is associated with lower small exporter participation while recognizing that production networks and firm characteristics may condition the observed relationship.

H3: Higher rules of origin restrictiveness is negatively associated with small exporter participation across preferential trade agreements.

2.5. Conceptual Framework and Empirical Interpretation:

The conceptual framework proposes three relationships linking distinct dimensions of rules of origin complexity to small exporter participation. Product specific rules complexity captures production qualification requirements, administrative and compliance complexity captures the procedures required to demonstrate origin, and rules of origin restrictiveness captures limitations on permissible sourcing and production arrangements. The dependent construct concerns the participation of small enterprises in export markets under preferential trade arrangements.

The three hypotheses specify negative associations, but they do not imply that all dimensions impose equivalent costs or that their estimated relationships will be statistically significant. Their empirical interpretation requires the explanatory measures and exporter participation outcomes to refer to compatible agreements, economies, products, and observation periods. Agreement provisions cannot independently establish firm participation, and aggregate export values cannot identify small enterprise behavior without corresponding firm level information. Accordingly, the framework represents theoretically expected associations rather than confirmed causal relationships.

The distinction between conceptual constructs and observed measures is essential. Product specific provisions, administrative procedures, and restrictive origin conditions are observable characteristics of agreements when their legal requirements can be consistently classified. Small exporter participation must be measured using identifiable enterprise records or a directly comparable small exporter indicator. The framework does not assume that these measures form validated latent constructs or that an unverified composite complexity index accurately represents the underlying legal provisions.

The proposed relationships are therefore suitable for empirical evaluation only where the required observations can be matched and their measurement consistency established. Without such matching, the framework provides testable theoretical propositions but does not establish an estimable model. This distinction preserves the interpretation of H1, H2, and H3 and prevents aggregate trade relationships from being presented as evidence of small enterprise participation.

3. Data:

This analysis combines official exporter statistics with documented rules of origin provisions for four United States export destinations. The panel establishes data provenance, defines the retained sample, and links participation measures to observable agreement characteristics.

3.1 Data Sources, Population, and Sample Construction:

Exporter statistics come from six releases of A Profile of U.S. Importing and Exporting Companies, published by the U.S. Census Bureau. Tables or Exhibits 5a and 5b provide exporter counts by employment category and destination, together with total and known export values. The releases cover observations from 2010 to 2020 and retain their respective publication vintages (U.S. Census Bureau, 2012, 2014, 2016, 2018, 2020).

The empirical population comprises identified United States merchandise exporters serving Australia, Canada, Mexico, and South Korea. The accessible sampling frame consists of the published destination rows and employment categories for these markets. Destination selection is purposive, reflecting the availability of comparable exporter statistics and documented preferential agreements. Coverage includes merchandise exports across sectors.

The observation unit is the exporting country, destination, and calendar year. Four destinations observed over 11 years produce a balanced panel of 44 observations. Export values represent annual flows in current USD million. Exporter counts identify enterprises exporting during each year. Enterprises may serve several destinations, so destination counts cannot be summed to obtain unique national exporter totals.

Table 1: Sample construction

Stage	Destination Units	Observations	Implemented Rule
Selected accessible frame	4	44	Four destinations observed annually from 2010 to 2020
Statistical extraction	4	44	Retain selected destination rows and published employment categories
Count reconciliation	4	44	Confirm that employment categories sum to total identified exporters
Agreement matching	4	44	Assign agreement provisions by destination and applicable period

Stage	Destination Units	Observations	Implemented Rule
Retained descriptive panel	4	44	Preserve all selected observations and disclosure markers

Agreement information covers NAFTA, the Australia-United States agreement, the Korea-United States agreement, and USMCA. Institutional treaty repositories supply the provisions governing origin tolerances, certification arrangements, certification exceptions, and cumulation (Department of Foreign Affairs and Trade, n.d.; Global Affairs Canada, n.d.-a, n.d.-b; Office of the United States Trade Representative, n.d.; Organization of American States, n.d.-a, n.d.-b).

3.2 Data Integration, Cleaning, and Quality Assurance:

Statistical records were aligned using exporting country, destination, and calendar year. The destination designation Korea South was standardized as South Korea. The resulting dataset contains 44 unique destination and year combinations, with no duplicate keys or increase in observations during agreement matching.

Temporal matching preserves changes within calendar years. South Korea retains preagreement classifications in 2010 and 2011 and a partial year classification in 2012. Canada and Mexico retain the sequence of NAFTA and USMCA provisions within 2020. Different legal thresholds within the transition year remain separately identified rather than averaged.

Validation confirmed that all seven published employment categories sum to total identified exporters in every observation. All exporter counts are nonnegative. Known export values are positive and do not exceed total export values. Seven monetary cells in the Australia observation for 2010 carry disclosure suppression markers. These markers remain unchanged in the raw data. Suppression affects export values by employment category but does not affect the exporter counts used to construct participation measures (U.S. Census Bureau, 2012).

Unknown employment remains a separate category. These enterprises are excluded from calculations requiring observed employment size. No employment classification is imputed, interpolated, or replaced with zero. The published statistical categories distinguish enterprises with reported employment from those grouped under unknown employment (U.S. Census Bureau, 2018, 2020).

Export values retain their original current dollar units. The analysis applies no currency conversion, inflation adjustment, frequency conversion, or outlier removal. Publication identifiers remain attached to the observations, preserving the distinction between observation years and source release dates.

3.3 Variable Measurement, Construction, and Validation:

Small exporter participation is measured by the number of identified enterprises with 1 to 99 employees serving each destination. This measure combines the published categories of 1 to 19, 20 to 49, and 50 to 99 employees. A broader participation measure combines the five observed employment categories below 500 employees. Both constructions exclude unknown employment. Equation 1 defines the small exporter count:

$$S_{dt} = A_{dt} + B_{dt} + C_{dt}$$

Here, S_{dt} denotes small exporters serving destination d during year t . The terms A_{dt} , B_{dt} , and C_{dt} denote exporter counts in the three employment categories identified above. Equation 2 defines the small exporter share:

$$P_{dt} = \frac{S_{dt}}{K_{dt}}$$

Here, P_{dt} denotes the proportion of small exporters among enterprises with known employment. K_{dt} denotes total identified exporters less exporters with unknown employment. Multiplication by 100 expresses the ratio as a percentage.

Table 2: Variable dictionary

Variable or indicator	Analytical role	Definition and construction	Source and identifier	Unit and frequency	Transformation and direction	Missing value rule	Coverage and limitation
Small exporter count	Participation outcome	Sum of exporters with 1 to 99 employees	Census Tables or Exhibits 5a and 5b	Enterprises, annual	Higher values indicate greater participation	Require all three count categories	44 observations; destination participation
Small exporter share	Participation composition	Small exporter count divided by exporters with known employment	Census counts; Equation 2	Ratio, annual	Higher values indicate greater small exporter representation	Exclude unknown employment from denominator	44 observations
Exporters with 1 to 499 employees	Broader participation measure	Sum of five observed employment categories below 500 employees	Census employment categories	Enterprises, annual	Higher values indicate greater participation	Exclude unknown employment	44 observations
Share of exporters	Broader composition	Broader count divided by	Census employment	Ratio, annual	Higher values indicate greater	Exclude unknown	44 observations

Variable or indicator	Analytical role	Definition and construction	Source and identifier	Unit and frequency	Transformation and direction	Missing value rule	Coverage and limitation
with 1 to 499 employees	measure	exporters with known employment	categories		representation	employment from denominator	
Unknown employment share	Classification coverage	Unknown employment exporters divided by all identified exporters	Census unknown employment category	Ratio, annual	Higher values indicate less complete employment classification	Preserve published category	44 observations
Known export value coverage	Statistical coverage	Known export value divided by total export value	Census aggregate export values	Ratio, annual	Higher values indicate greater enterprise linkage coverage	Use published aggregate values	44 observations
General origin tolerance	Origin requirement feature	Published de minimis percentage	NAFTA Article 405; AUSFTA Article 5.2; KORUS Article 6.6; USMCA Article 4.12	Percent, agreement period	Higher values permit a larger general tolerance	Preserve preagreement and transition classifications	40 observations with one threshold
Prescribed certificate form	Administrative feature	One where a prescribed certificate applies; zero otherwise	Agreement certification provisions	Binary, agreement period	One indicates a prescribed form requirement	Preserve preagreement and transition classifications	40 observations with one code
Certification exception threshold	Administrative feature	Treaty value below which certification exceptions apply	NAFTA Article 503; KORUS Article 6.16; USMCA Article 5.5	USD, agreement period	Higher values extend the exception threshold	Preserve uncoded and preagreement entries	31 numeric observations
Partner cumulation	Origin arrangement feature	One where qualifying production or inputs may cumulate among parties	Agreement cumulation provisions	Binary, agreement period	One indicates availability	Preagreement entries remain inapplicable	42 applicable observations; constant at one

The legal indicators preserve differences between substantive origin requirements and administrative procedures. NAFTA distinguishes accumulation and origin tolerances from certification obligations (Organization of American States, n.d.-a, n.d.-b). AUSFTA permits claims based on importer knowledge or supporting information without a prescribed statement format (Department of Foreign Affairs and Trade, n.d.). KORUS and USMCA provide certification arrangements involving importers, exporters, or producers (Global Affairs Canada, n.d.-b; Office of the United States Trade Representative, n.d.).

Across 44 observations, small exporter counts average 29,286.59 enterprises, with a sample standard deviation of 17,526.98, a median of 22,916.50, and a range from 10,834 to 61,624. The small exporter share averages 73.88 percent, with a standard deviation of 4.16 percentage points and a range from 66.93 to 81.32 percent. Unknown employment represents an average of 23.62 percent of identified exporters.

3.4 Analytical Framework, Identification, and Reproducibility:

The analysis is descriptive. It compares annual exporter participation and composition across destinations while documenting applicable origin provisions. Participation measures identify enterprises exporting to each destination and do not distinguish transactions by preference claim status. The agreement indicators retain separate interpretations. Origin tolerances describe permitted nonoriginating material content subject to legal conditions. Certification indicators describe documentation arrangements. Cumulation identifies whether qualifying production or inputs can be combined among agreement parties (Department of Foreign Affairs and Trade, n.d.; Global Affairs Canada, n.d.-a, n.d.-b; Office of the United States Trade Representative, n.d.; Organization of American States, n.d.-a, n.d.-b).

Destination comparisons reflect market size, industrial composition, firm sorting, and trade conditions alongside agreement characteristics. Repeated annual observations do not create independent legal variation where provisions remain constant. Annual exporter counts also span both legal regimes during the North American transition in 2020. The workbook preserves original statistical rows, source URLs, publication identifiers, PDF pages, agreement articles, and construction formulas. Calculated measures link directly to extracted counts and values. Common annual frequency, explicit employment boundaries, and consistent denominators support comparison across destinations while preserving disclosure and timing distinctions.

4. Methods:

4.1 Research Design and Analytical Scope:

This analysis uses a descriptive comparative panel design to examine changes in small exporter participation across preferential trading relationships. The unit of analysis is the United States export

destination and calendar year. Four destinations observed annually from 2010 to 2020 provide 44 observations. The design compares participation levels, enterprise size composition, and changes over alternative observation periods.

The analytical targets are destination specific changes in exporter counts and shares, together with unadjusted differences across recorded agreement characteristics. These comparisons describe participation within institutional settings. They do not estimate the causal effect of agreement provisions.

The design distinguishes enterprise participation from export values and preference utilization. This distinction follows the separation of exporter characteristics and trade outcomes developed by Fernandes et al. (2016). It also preserves the distinction between participation and other trade margins examined by Fontagné et al. (2015). A firm exporting to multiple destinations may appear in several destination counts. Consequently, the analysis does not aggregate these counts into a national total of unique enterprises.

The sample construction table and variable dictionary in the Data section define eligibility, source provenance, and measurement. The retained panel supports comparisons among the selected destinations rather than population inference across all preferential agreements.

4.2 Measurement and Descriptive Calculations:

Equations 1 and 2 define the small exporter count and its share among exporters with known employment. The primary enterprise boundary includes 1 to 99 employees. The broader comparison includes 1 to 499 employees. Both measures retain the published employment categories and exclude unknown employment from calculations requiring an observed size classification.

Descriptive statistics comprise valid observation counts, arithmetic means, sample standard deviations, medians, and observed ranges. Each destination and year observation receives equal weight. Sample standard deviations use the number of valid observations less one as the denominator. Percentage measures are calculated from their underlying ratios, while their standard deviations are expressed in percentage points. Equation 3 measures proportional changes in exporter counts:

$$G_{d,a,b} = 100 \left[\frac{S_{db}}{S_{da}} - 1 \right]$$

Here, $G_{d,a,b}$ denotes the percentage change for destination d between initial year a and terminal year b . The terms S_{da} and S_{db} denote exporter counts in those years. The calculation requires a positive initial count. The same construction applies to the broader enterprise category. Equation 4 measures changes in exporter composition:

$$D_{d,a,b} = 100[P_{db} - P_{da}]$$

Here, $D_{d,a,b}$ denotes the change in percentage points. The terms P_{da} and P_{db} denote the small exporter ratios defined by Equation 2. This calculation distinguishes changes in representation from percentage changes in enterprise counts. Unknown employment coverage is calculated by dividing exporters with unknown employment by total identified exporters. Known export value coverage is calculated by dividing known export value by total export value. These indicators describe classification and enterprise linkage coverage.

4.3 Analytical Procedures and Variation Assessment:

The analytical sequence begins with the retained statistical records and their destination and year identifiers. Exporter counts are linked to the published employment categories, participation measures are calculated, and observations are assigned their applicable agreement descriptions. Descriptive statistics and destination comparisons are then calculated from these records.

The main temporal comparison uses 2010 and 2020 as endpoints. Agreement characteristics retain their actual timing. South Korea's preagreement observations and its partial exposure year remain separately classified. The North American transition observations preserve both applicable regimes rather than assigning an averaged legal threshold.

The administrative comparison uses observations containing one numeric origin tolerance and one prescribed form code. Forty observations meet this condition, divided equally between the two recorded form categories. Arithmetic mean participation shares are calculated within each category, and their difference is reported in percentage points. The four remaining observations retain their preagreement or transition classifications and remain in the full descriptive panel.

Before interpreting agreement comparisons, the analysis examines whether recorded indicators provide independent variation. Across the 40 observations with single numeric codes, the prescribed form indicator and origin tolerance identify the same grouping. Partner cumulation is constant across applicable observations, and the numeric certification exception threshold is also constant. These checks determine which comparisons the recorded provisions can support.

The resulting group difference is an unadjusted descriptive contrast. No sampling uncertainty or statistical significance is assigned to it. Destination characteristics, enterprise composition, and other market conditions remain potential explanations for differences between groups.

4.4 Validation, Sensitivity, and Reproducibility:

Validation checks address extraction accuracy and the consistency of calculated measures. The analysis verifies unique destination and year keys, reconciles employment categories with total identified

exporters, checks nonnegative enterprise counts, and confirms that known export values are positive and do not exceed total export values. These checks apply to every retained observation.

Source disclosure markers remain unchanged. Suppressed monetary cells are not interpolated or replaced with zero. Unknown employment remains a separate category rather than being allocated to an observed enterprise size group. Published count values receive no outlier adjustment or other modification.

Two exploratory sensitivity comparisons address consequential analytical boundaries. The first expands the enterprise definition from 99 to 499 employees while retaining the same destinations and period. The second changes the terminal year from 2020 to 2019 while retaining the primary enterprise definition. The first comparison assesses sensitivity to employment classification. The second assesses whether the direction and magnitude of the full period changes depend on the endpoint.

Sensitivity is evaluated through changes in direction, proportional magnitude, and exporter composition. The broader enterprise comparison uses the same 44 observations. The endpoint comparison draws on the same panel but changes the terminal observation used for each destination. These procedures assess descriptive stability without establishing a regulatory mechanism.

Spreadsheet formulas link participation measures directly to extracted counts and values. Supporting calculations use Python's standard library for numerical summaries and consistency checks. The workbook retains source URLs, publication identifiers, PDF pages, table labels, original statistical rows, and legal article locators. These records make the descriptive comparisons traceable from the reported results to their underlying observations.

5. Findings:

This analysis examines small exporter participation across four United States export destinations from 2010 to 2020. It compares changes in exporter counts and composition, evaluates observable agreement characteristics, and assesses sensitivity to enterprise size and period boundaries. The findings distinguish measured participation patterns from relationships that the available data can identify.

5.1 Sample Composition and Measurement Coverage:

The balanced panel comprises 44 observations covering Australia, Canada, Mexico, and South Korea over 11 years. Exporter counts are complete across all published employment categories, which reconcile with total identified exporters in every observation. Seven suppressed monetary cells affect Australia in 2010 but do not reduce coverage of the participation measures.

Table 1: Descriptive statistics

Indicator	Observations	Mean	SD	Median	Minimum	Maximum
Exporters with 1 to 99 employees	44	29,286.59	17,526.98	22,916.50	10,834	61,624
Exporters with 1 to 499 employees	44	35,212.91	20,029.49	28,374.50	13,903	71,145
Small exporter share, percent	44	73.88	4.16	73.86	66.93	81.32
Share of exporters with 1 to 499 employees, percent	44	90.13	2.44	90.23	85.80	93.88
Unknown employment share, percent	44	23.62	2.52	22.68	20.78	29.23
Known export value coverage, percent	44	86.92	6.49	89.93	73.78	93.32

Small exporters constitute most enterprises with known employment, although their representation varies across destinations and years. Unknown employment accounts for 23.62 percent of identified exporters on average. Consequently, the size shares describe enterprises with observed employment rather than the complete exporter population.

The distinction between firm composition and aggregate trade activity matters because firms differ in productivity, market access costs, and destination selection. Demidova et al. (2012) demonstrate that trade policy differences interact with firm characteristics and demand conditions. The descriptive measures here capture participation and composition without directly measuring those underlying mechanisms.

5.2 Participation Changes Across Destinations:

Small exporter participation declined in every destination between 2010 and 2020. The proportional contraction ranged from 8.75 percent for South Korea to 15.68 percent for Australia. Canada recorded the largest absolute reduction, with 8,480 fewer small exporters.

Table 2: Changes in small exporter participation

Destination	Small Exporters in 2010	Small Exporters in 2020	Count Decline, Percent	Small Exporter Share in 2010, Percent	Small Exporter Share in 2020, Percent	Share Decline, Percentage Points
Australia	18,342	15,466	15.68	74.48	70.76	3.72
Canada	60,376	51,896	14.05	81.32	77.92	3.39
Mexico	28,660	25,888	9.67	75.82	71.10	4.72
South Korea	11,873	10,834	8.75	70.14	66.93	3.21

Declining counts coincide with declining representation among exporters with known employment. Small exporter participation therefore contracted more sharply than the corresponding known employment

exporter population. Mexico experienced the largest compositional decline, at 4.72 percentage points, despite a smaller proportional count reduction than Australia or Canada.

These differences establish heterogeneous participation trajectories across trading relationships. They accord with the relevance of firm and destination heterogeneity emphasized by Demidova et al. (2012), but they do not isolate an origin requirement effect. In particular, aggregate destination counts do not reveal whether firms changed sourcing, claimed preferences, or incurred additional compliance costs.

5.3 Agreement Characteristics and Hypothesis Assessment:

Forty observations contain a single numeric origin tolerance and a single prescribed form indicator. Twenty combine a tolerance of 7 percent with a prescribed form requirement. The other twenty combine a tolerance of 10 percent with no prescribed form requirement. These indicators therefore contain perfectly overlapping variation in the available analytical sample.

The prescribed form group records an average small exporter share of 77.26 percent, compared with 70.81 percent in the group without a prescribed form. The unadjusted difference is 6.45 percentage points. Although this comparison runs against the expected negative administrative relationship, it also compares different destinations and origin tolerances. It cannot establish an independent administrative effect.

Conconi et al. (2018) identify origin related sourcing responses using variation across products, countries, and time. Their approach illustrates why a general tolerance threshold cannot substitute for detailed product requirements. The workbook contains no product specific complexity measure, so the corresponding hypothesis cannot receive an empirical decision.

The administrative hypothesis is likewise not separately identified from the origin tolerance indicator. For the restrictiveness hypothesis, partner cumulation equals one in all 42 applicable observations, and every numeric certification exception threshold equals USD 1,000. These indicators provide no variation through which their separate relationships with participation can be estimated.

Bombarda and Gamberoni (2013) show that cumulation arrangements interact with firm heterogeneity. The constant cumulation indicator here cannot reproduce that contrast. The hypothesis assessment therefore concerns identification: the available evidence neither confirms nor rejects the proposed mechanisms.

5.4 Sensitivity to Enterprise Size and Period Boundaries:

Expanding the enterprise size boundary from 99 to 499 employees preserves the direction of the full period participation changes. Counts decline by 13.30 percent in Australia, 11.68 percent in Canada, 5.98 percent in Mexico, and 6.11 percent in South Korea. Their shares among exporters with known employment also decline in every destination.

Table 3: Sensitivity of exporter count changes

Destination	Enterprises with 1 to 99 employees, 2010 to 2020	Enterprises with 1 to 499 employees, 2010 to 2020	Enterprises with 1 to 99 employees, 2010 to 2019
Australia	Decline of 15.68 percent	Decline of 13.30 percent	Decline of 11.02 percent
Canada	Decline of 14.05 percent	Decline of 11.68 percent	Decline of 9.30 percent
Mexico	Decline of 9.67 percent	Decline of 5.98 percent	Increase of 1.84 percent
South Korea	Decline of 8.75 percent	Decline of 6.11 percent	Decline of 4.08 percent

The broader enterprise definition produces smaller contractions in every destination. This indicates that the full period decline is more pronounced among enterprises with 1 to 99 employees than among the broader group with 1 to 499 employees.

The endpoint comparison qualifies the apparent uniformity of the full period result. Through 2019, small exporter counts had declined in Australia, Canada, and South Korea, whereas Mexico recorded an increase of 1.84 percent. Mexico's subsequent decline of 11.30 percent between 2019 and 2020 reversed that earlier gain. Its full period direction is therefore sensitive to the terminal year.

The findings establish declining small exporter counts and representation across all four destinations over the complete observation period. The direction persists under a broader enterprise definition, while the endpoint comparison reveals a distinct Mexican trajectory. These results document participation changes across agreement settings without attributing them to rules of origin complexity.

6. Discussion:

Preferential trading arrangements can coexist with a shrinking small exporter presence. Table 2 shows that both small exporter counts and their shares declined across all four destinations, indicating contraction relative to the exporter population with known employment. Equations 1 and 2 distinguish these two dimensions: fewer participating enterprises and reduced representation among exporters. The contribution is the joint assessment of participation levels, composition, and sensitivity across agreement settings. Fernandes et al. (2016) demonstrate that exporter characteristics vary with country size and development. The present evidence adds a destination comparison from one exporting economy, showing that participation must be assessed separately from the existence of preferential access. It does not establish that agreement provisions caused the contraction.

The participation pattern directs attention toward enterprise capacity without identifying a specific transmission channel. Table 3 shows that declines become smaller when the employment boundary

expands from 99 to 499 employees. This difference makes enterprise size consequential for interpreting participation, although it does not distinguish compliance costs from productivity, demand, or other influences. Cherkashin et al. (2015) show that fixed costs at different stages of firm activity can produce different export responses. Their findings provide a theoretical explanation for why administrative simplification and productive capacity support need not generate equivalent outcomes. The present contribution is narrower: the measured contraction is more pronounced under the smaller enterprise definition, so an undifferentiated enterprise category would conceal relevant variation.

The distinction between declining counts and declining shares sharpens the interpretation of exporter composition. Equation 2 measures representation among exporters with known employment, rather than participation among all domestic small enterprises. The simultaneous reductions reported in Table 2 therefore indicate a shift in the composition of the observed exporter population. They do not demonstrate firm exit, since enterprises may also change employment categories. Fontagné et al. (2015) distinguish regulatory effects across export participation, export values, and prices using firm and product information. That distinction matters here because destination participation cannot establish which adjustment pathway dominates. The analytical advance is to separate an observed compositional change from assumptions about the behavior producing it.

The agreement comparison also changes how administrative indicators should be interpreted. The higher average small exporter share in the prescribed form group cannot establish an advantage from documentation requirements because form requirements and origin tolerances vary together across the usable observations. This overlap shows why a legal feature should not be treated as a complete measure of the trading environment. Handley and Limão (2015) demonstrate that preferential agreements can influence export investment through policy certainty, even when current tariffs are low. Their results identify an additional reason why documentation rules alone may provide an incomplete account of participation. For decision makers, Tables 1 and 2 support monitoring exporter composition and employment coverage alongside agreement provisions, rather than evaluating access through legal design alone.

The international relevance lies in distinguishing the opportunities created by agreements from the participation trajectories observed within them. Handley and Limão (2017) identify export expansion associated with reduced policy uncertainty in trade between China and the United States. The contraction documented here concerns United States exporters serving several destinations and does not contradict that mechanism, since the populations, outcomes, and comparisons differ. Table 3 further shows that Mexico's full period decline depends on including the terminal year, whereas the other destinations had already experienced contraction. Policy assessment should therefore compare enterprise size groups and alternative period boundaries before interpreting participation changes as persistent structural outcomes. Future analysis can build on this distinction by linking enterprise employment, product requirements, preference claims, and market entry histories to identify which mechanisms account for the observed composition changes.

7. Conclusion and Implications:

Preferential access can coexist with declining participation by smaller enterprises, making inclusion a separate criterion for evaluating international trade arrangements. This analysis shows that declining participation extends across different agreement settings and remains evident under a broader enterprise definition, while its interpretation depends partly on the observation endpoint. Its contribution lies in distinguishing participation levels from exporter composition and demonstrating why both require attention when assessing preferential trade. This distinction strengthens the empirical application of heterogeneous firm theory by showing that institutional access and the distribution of participation represent different outcomes. The evidence supports closer examination of enterprise capacity and market conditions without attributing observed changes to a particular regulatory mechanism. Managers can use these insights to monitor destination exposure, compare participation across enterprise categories, and investigate persistent contraction before committing support resources. Trade institutions should complement legal access assessments with enterprise participation indicators, consistent employment classifications, and comparisons across alternative periods. Operationally, linking administrative trade records with enterprise characteristics would improve the information available for targeting assistance and evaluating implementation. Such monitoring can help institutions identify changes in smaller enterprises' representation and direct investigation toward affected groups. Internationally, this approach makes inclusion observable alongside market access, supporting more accountable trade assessment.

The panel offers a foundation for extending analysis across exporting economies, sectors, and institutional settings. Linking enterprise histories to product requirements and preference claims would distinguish market entry, exit, employment transitions, and actual agreement use. Additional information on compliance expenditure, sourcing arrangements, and productivity would support direct mechanism testing. More destinations and independently varying legal provisions would permit stronger separation of institutional relationships from market characteristics. Comparisons around agreement changes, supported by appropriate comparison groups and explicit identification assumptions, could assess causal effects. These extensions would establish whether the observed participation patterns generalize and which interventions address their underlying causes.

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