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ASSESSING ASSOCIATIONS BETWEEN DISPLACEMENT DYNAMICS AND REFUGEE POPULATION SIZES USING GLOBAL ANNUAL HUMANITARIAN STATISTICAL RECORDS

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Abstract:

This analysis examines whether associations among global displacement populations persist when population levels are distinguished from annual changes. UNHCR records provide 2,753 annual observations across 211 countries and territories of origin during 2010 to 2023. Descriptive statistics and Spearman correlations compare population levels, consecutive annual changes and complete coverage samples. Among 2,523 matched observations, the asylum seeker correlation with refugee populations is 0.8552 in levels but 0.1144 in annual changes. Internal displacement exhibits a corresponding decline from 0.5041 to 0.1234. Annual refugee returns correlate positively with refugee population levels but show little monotonic association with annual population change. Positive returns accompany population growth in 48.18 percent of relevant observations. Restricting analysis to origins reported throughout the period preserves the principal patterns. The contribution is an empirical distinction between accumulated displacement scale and annual population adjustment, qualifying interpretations that equate population alignment with synchronized movement. International monitoring should assess continuing protection needs through separate reporting of population stocks, return flows and net changes.

Key Words: Displacement Dynamics; Internal Displacement; Refugee Returns; Refugee Stocks; Spearman Correlation

1. Introduction:

Refugee returns can increase while refugee populations continue to grow. This possibility creates a practical problem for interpreting international displacement statistics: measures of population size, pending protection claims and return movements describe different aspects of displacement. Institutions assessing protection needs must distinguish the number of people remaining displaced from movements occurring during a reporting period. A large return flow does not necessarily indicate a declining refugee population, just as similarly sized displacement populations need not experience synchronized annual changes. Understanding these distinctions matters for interpreting humanitarian caseloads and assessing whether recorded population movements correspond with reduced displacement. Existing research establishes the importance of examining refugee populations across countries and over time, but it also demonstrates the limits of aggregate measures. Fransen and de Haas, 2022, analyse global refugee migration through its intensity, geographical distribution and distance. Their findings show that changes in recorded displacement reflect both population developments and the inclusion of previously unreported populations. Their analysis also distinguishes refugee stocks from movements, since a population recorded at a particular date cannot directly describe the flows producing it. This distinction motivates a more focused question: do relationships among displacement population levels persist when the comparison concerns annual population changes?

Asylum seekers and internally displaced persons provide related but distinct information about displacement. Pending asylum claims represent people awaiting decisions within international protection systems, whereas internal displacement concerns people who remain within their country. Shared insecurity can increase both populations alongside refugee numbers, creating positive associations without establishing movement between categories. Administrative processing may also reduce pending asylum claims while increasing recognized refugee populations. Hatton, 2020, demonstrates that persecution, migration incentives and asylum policies jointly shape asylum movements. Adhikari, 2013, shows that economic opportunities, infrastructure, geography and social relationships influence decisions to flee during conflict. Together, these contributions explain why displacement categories can respond to related pressures while following different trajectories. They do not establish whether annual changes in those categories move together across a global origin sample. The aspirations and capabilities framework provides a theoretical basis for interpreting this divergence. De Haas, 2021, distinguishes the desire to move from the capacity to do so and situates both within structural opportunities and constraints. Applied to displacement, this perspective implies that exposure to similar pressures need not produce the same destination, legal position or timing of movement. Some people remain internally displaced, others seek international protection, and others return. The framework therefore supports examining these categories as related outcomes without treating them as successive stages in a single process. The theoretical issue is whether observed alignment reflects the accumulated scale of displacement or comparable annual adjustment.

Refugee returns make the distinction between accumulated populations and annual movement particularly important. Beaman, Onder, and Onder, 2022, examine actual Syrian refugee returns and show that return decisions vary with security and living conditions in origin locations and conditions experienced in exile. Their evidence explains why return is selective rather than a uniform response to displacement. However, an individual return decision and a net change in an origin's refugee population are different outcomes. Returns can occur while new displacement or other recorded population changes increase the remaining refugee stock. The reviewed evidence does not establish how strongly annual return flows correspond with net refugee population changes across a broad international sample, or whether that correspondence differs from their association with population levels. This study aims to determine how asylum seekers, internal displacement and refugee returns correspond with refugee population size, and whether these relationships differ between population levels and annual changes. The central research question is: how does alignment in recorded displacement populations differ from alignment in their annual dynamics? The

analysis examines asylum seeker and refugee populations, compares internal displacement with refugee populations, and assesses how annual return flows correspond with both refugee population levels and annual population change. These objectives concern observed associations rather than causal effects or individual transitions between categories.

The empirical analysis uses UNHCR statistics covering 2,753 annual observations across 211 countries and territories of origin during 2010 to 2023. It combines descriptive distributions and Spearman rank correlations with comparisons restricted to consecutive observed years and origins reported throughout the period. Refugees, asylum seekers and internally displaced persons are measured as year-end stocks, while returned refugees are measured as annual flows. Matching the observations used for level and change comparisons helps distinguish differences in the relationship being examined from differences in sample composition. The complete coverage comparison further assesses sensitivity to unequal reporting duration. The contribution is an empirical distinction between displacement scale and annual population adjustment. On the matched sample, the asylum seeker association with refugee populations is 0.8552 in levels but 0.1144 in annual changes. Internal displacement exhibits a similar contrast. Annual returns correspond positively with refugee population levels but show little monotonic association with net annual population change. These findings qualify interpretations that treat positive relationships among displacement counts as evidence of synchronized movement. Their practical relevance lies in showing why international monitoring should report population stocks, return flows and net population changes separately. The evidence supports clearer interpretation of recorded displacement dynamics without attributing the observed relationships to unmeasured mechanisms.

2. Theory, Conceptual Framework and Research Questions Development:

This analysis treats displacement as a system of constrained mobility in which insecurity, access to protection and opportunities for return shape population distributions. The aspirations and capabilities framework distinguishes the desire to move from the ability to do so. People exposed to similar threats may remain displaced within their country, seek asylum abroad or return after exile because their resources and opportunities differ. De Haas, 2021, provides the theoretical basis for interpreting these outcomes as related responses to structural constraints rather than automatic consequences of displacement pressure. This perspective guides the comparison of asylum seekers, internally displaced persons and returned refugees with refugee population size. The conceptual framework comprises four observed measures recorded by country of origin and year during 2010-2023. Refugee population size represents the number of refugees under the UNHCR mandate at year end. Asylum seekers represent persons with pending claims at year end. Internal displacement represents persons of concern to UNHCR who remain displaced within their country. Returned refugees represent persons returning during the calendar year. Displacement dynamics therefore describes three separate dimensions rather than a latent construct or composite index. The framework examines their observed associations with refugee population size while preserving the distinction between population stocks and annual return flows.

Asylum seekers occupy an institutional position between seeking international protection and receiving a decision on their claim. Shared conditions in an origin country may increase both pending asylum claims and recognized refugee populations. However, administrative processing creates a competing mechanism. Recognition can reduce the pending caseload while increasing the refugee population, whereas processing delays can increase pending claims without a corresponding increase in recognized refugees. Hatton, 2020, explains how persecution, migration incentives and asylum policy jointly shape asylum movements. This evidence supports examining asylum seekers alongside refugees, but it does not establish a uniform direction for the association between their recorded stocks.

RQ1: How do asylum seeker populations and refugee population sizes vary together across countries of origin and within countries over time during 2010-2023?

Internal displacement captures movement without crossing an international border. Insecurity may expand internal displacement and refugee populations simultaneously, producing parallel increases. Yet limited resources, unsafe routes and restricted border access may keep displaced people within their country. Internal displacement can therefore accompany international displacement or reflect constraints that prevent it. Adhikari, 2013, finds that flight decisions depend on economic opportunities, infrastructure, geography and social relationships alongside violence. These findings justify examining the relationship between internal displacement and refugee populations without treating internally displaced persons as a measured pipeline into refugee status

RQ2: How do recorded internal displacement populations and refugee population sizes vary together across countries of origin and within countries over time during 2010-2023?

Returned refugees represent an annual movement toward the country of origin. Holding other population changes constant, return removes people from the refugee population abroad. Nevertheless, a larger refugee population also provides a larger population from which returns can occur. High return counts may consequently coexist with large refugee stocks, particularly when new displacement continues. Beaman, Onder, and Onder, 2022, find that security and living conditions in Syria, together with conditions experienced in exile, shape actual return decisions. Their findings support interpreting return as a selective response to conditions in both locations rather than a uniform reversal of displacement.

RQ3: How do annual refugee returns correspond with refugee population levels and annual changes within countries of origin during 2010-2023?

These questions organize a descriptive analysis of distributions, annual trajectories and observed associations. Comparisons distinguish differences across countries from changes within the same country. Annual changes use consecutive observed years, and missing country observations are not treated as zero populations. Fransen and de Haas, 2022, demonstrate that refugee statistics reflect both displacement patterns and changes in statistical coverage. Accordingly, the analysis interprets recorded increases and decreases within their measurement boundaries. The framework connects observable population categories through theoretically plausible relationships while allowing positive, negative or inconclusive patterns. Aggregate associations describe population dynamics; they do not identify individual transitions or causal effects.

3. Data:

This analysis documents the provenance, sample construction and measurement of annual displacement statistics for 2010-2023. It combines an audited country and year panel with descriptive comparisons that distinguish population levels, annual changes and refugee return flows.

3.1 Data Sources, Population, and Sample Construction:

The analysis uses the Refugee Population Statistics Database provided by the United Nations High Commissioner for Refugees. The extraction uses the population endpoint of API version 1, with the parameters year from=2010, year to=2023 and coo_all=true. The four source fields are refugees, asylum_seekers, idps and returned_refugees. Destination countries are aggregated within each country of origin and calendar year. The extraction timestamp and source query are recorded in the accompanying workbook. API version 1 identifies the access interface, not a numbered statistical release. The extract contains historical observations available at extraction rather than archived information vintages for individual observation dates. The statistical unit is a country or territory of origin observed annually. The setting covers displacement recorded across global humanitarian reporting systems rather than a particular economic sector. Refugees, asylum seekers and internally displaced persons are population stocks measured at year end. Returned refugees are persons returning during the calendar year. UNHCR statistical metadata identifies country of origin and reporting period as central dimensions of refugee population measurement, as documented by the United Nations High Commissioner for Refugees, 2023. The target population comprises countries and territories of origin represented in global displacement statistics during the observation period. The accessible frame contains 212 origin labels and 2,767 observations. Selection includes every available record with an identifiable origin and numeric values for all four measures. The construction rules exclude special origin categories and nonnumeric observations. In the supplied extract, only the unknown origin category triggers exclusion. The retained sample contains 211 countries and territories and 2,753 observations. These rules are documented in the workbook; no dated preregistration accompanies them.

Table 1: Sample construction and analytical coverage

Stage	Origin Units	Observations	Reason or Rule
Extracted reporting frame	212	2,767	Available origin and year records during 2010-2023
Unknown origin exclusion	1	14	Origin code UNK cannot identify a country or territory
Additional exclusions for nonnumeric measures	0	0	All four source fields contain numeric values
Retained descriptive sample	211	2,753	Identifiable origin and complete observed measures
Complete coverage comparison	179	2,506	Origins observed in every year
Consecutive annual change comparison	207	2,523	Both current and preceding calendar year observed

The panel is unbalanced. Annual coverage ranges from 185 origins in 2010 to 205 in 2023, and 179 origins have observations in all 14 years. Across the 211 retained origins, 201 of the 2,954 possible origin and year combinations are absent. These absent combinations remain unavailable rather than becoming zero observations. The complete coverage comparison is a restricted sensitivity sample, not a replacement for the main sample.

3.2 Data Integration, Cleaning, and Quality Assurance:

The workbook contains one statistical extraction, so construction requires no external dataset merge. Origin code and calendar year jointly identify each observation. The audit finds no duplicate keys in either the extracted frame or the retained sample. Matching retained observations to their raw records reproduces every value in the four analytical measures. No conflicting values or increases in observations arise during construction. Each variable occupies a separate column and each origin and year combination occupies one row, following the data organization principles described by Wickham, 2014. Cleaning converts numeric source strings into numeric counts while preserving the raw records and inclusion flags. All retained counts are nonnegative integers. The four analytical measures contain no missing cells, and no observation is removed for a missing measure. Missing coverage therefore occurs through absent origin and year combinations rather than incomplete retained rows. No imputation, interpolation, external matching or frequency conversion is applied. All observations retain their source calendar year and person count units.

Reported zeros remain unchanged. The sample contains 126 zero asylum seeker counts, 2,337 zero internal displacement counts, 2,335 zero return counts and 111 zero refugee counts. Internal displacement and return zeros account for 84.89 percent and 84.82 percent of their respective observations. These values represent source reported zeros; the audit does not independently establish whether each denotes substantive absence or limitations in reporting coverage. Valid extreme observations remain in the sample. No trimming, winsorization or replacement threshold is imposed. The audit checks numeric type, nonnegativity, integer counts, key uniqueness and agreement between raw and retained values. These checks establish internal consistency rather than independent verification of population estimates. Fransen and de Haas, 2022, show why changes in displacement statistics require attention to reporting coverage and classification as well as population movements.

Excluding unknown origins affects population totals unevenly. Across the extracted observations, the excluded category accounts for 7.35 percent of asylum seeker counts and 0.82 percent of refugee counts. Its share of asylum seekers reaches 32.49 percent in 2015. Consequently, totals calculated from the retained sample represent identifiable origins and should not be presented as complete global totals. No eligibility rule was changed during this audit. The complete coverage comparison examines sensitivity to panel composition, although it cannot establish why particular origins have incomplete reporting.

3.3 Variable Measurement, Construction, and Validation:

The analysis operationalizes displacement dynamics through three observed measures: asylum seekers, internally displaced persons and returned refugees. Refugee population size is the outcome measure. The three dimensions remain separate

because they capture different legal positions, locations and temporal processes. Combining stocks and annual flows into an index would obscure these distinctions.

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
Refugee population	Outcome	Refugees under the UNHCR mandate, including people in refugee like situations, aggregated by origin across destinations	UNHCR population API, refugees	Persons at year end, annual	Source level retained; higher values indicate a larger recorded refugee population	Retain reported zero; leave absent origin and year combinations unavailable	2,753 observations; excludes UNRWA refugees and other people in need of international protection
Asylum seekers	Observed displacement dimension	Persons with pending asylum claims at year end, aggregated by origin across destinations	UNHCR population API, asylum seekers	Persons at year end, annual	Source level retained; higher values indicate a larger pending population	Retain reported zero; no imputation	2,753 observations; measures a pending stock rather than new applications
Internally displaced persons	Observed displacement dimension	Internally displaced persons of concern to UNHCR, including people in IDP like situations	UNHCR population API, idps	Persons at year end, annual	Source level retained; higher values indicate a larger recorded internal displacement population	Retain reported zero; no imputation	2,753 observations; coverage differs from the IDMC total internal displacement series
Returned refugees	Observed displacement dimension	Refugees returning to their country of origin during the calendar year	UNHCR population API, returned refugees	Persons during year, annual	Source flow retained; higher values indicate more recorded returns	Retain reported zero; no imputation	2,753 observations; return counts do not measure a return probability
Annual refugee population change	Calculated descriptive outcome	Current refugee population less its value in the preceding calendar year	Calculated from refugees using origin and year	Change in persons, annual	Positive values indicate growth; negative values indicate decline	Calculate only for consecutive observed years	2,523 observations across 207 origins; gaps are not bridged

Annual refugee population change is calculated through Equation 1.

$$\Delta R_{it} = R_{it} - R_{i,t-1}$$

Here, ΔR_{it} denotes the annual change in refugee population for origin i in calendar year t, R_{it} denotes its current year end population, and $R_{i,t-1}$ denotes its population at the preceding calendar year end. The calculation produces an absolute change in persons rather than a percentage growth rate. It remains defined when the preceding population is zero.

Table 3: Descriptive statistics for the retained sample

Measure	Valid Observations	Mean	Standard Deviation	Median	Minimum	Maximum
Refugees	2,753	91,725.06	498,276.78	974	0	6,848,865
Asylum seekers	2,753	14,614.56	56,136.90	739	0	1,200,130
Internally displaced persons	2,753	189,852.05	840,603.98	0	0	9,052,822
Returned refugees	2,753	2,378.76	22,545.56	0	0	660,000

These statistics pool observed origin and year records and therefore give greater representation to origins with longer coverage. The difference between means and medians indicates concentrated population distributions. Validation consists of source reconciliation and logical consistency checks appropriate to observed administrative counts. The analysis does not treat these measures as latent constructs.

3.4 Analytical Framework, Identification, and Reproducibility:

The analytical framework is descriptive and associational. It examines how the three displacement dimensions correspond with refugee population levels and how annual returns correspond with changes in refugee populations. Descriptive summaries report sample size, central tendency, dispersion, zero prevalence and reporting coverage. Spearman rank correlations summarize monotonic associations while limiting sensitivity to the scale of extreme population counts. Tied observations receive average ranks. Schober, Boer, and Schwarte, 2018, explain the suitability and interpretation of rank correlation for distributions with relevant extreme values. The implemented comparisons distinguish pooled population levels from consecutive annual changes. Pooled correlations use all 2,753 retained observations. Change comparisons use 2,523 consecutive pairs, including the association between annual return flows and annual refugee population change. These calculations do not equate a relationship across origins with a relationship within an origin. Population size, common displacement shocks and administrative classification can influence several measures simultaneously.

An exploratory coverage check recalculates pooled associations for the 179 origins observed throughout the period. This comparison uses 2,506 observations and assesses whether restricting coverage changes the descriptive pattern. It does not correct reporting errors or create a representative probability sample. No sampling based significance claims accompany the correlations because repeated observations within origins and shared shocks across origins make independent observation assumptions inappropriate. The descriptive design identifies neither causal effects nor individual movements between population categories. Refugee returns may reduce a refugee population while new displacement increases it during the same year. Aggregate annual records cannot separate these processes completely. Likewise, revised historical observations support retrospective description but do not establish what information was available to decision makers at each historical date.

4. Findings:

This analysis examines how asylum seekers, internal displacement and refugee returns correspond with refugee population size during 2010-2023. It distinguishes associations in population levels from relationships involving annual changes. Coverage comparisons assess whether the observed patterns depend on the composition of the reporting sample.

4.1 Sample Characteristics and Population Concentration:

The retained sample contains 2,753 annual observations across 211 countries and territories of origin. All four population measures have complete numeric values within retained records, and no duplicate origin and year identifiers occur. Fourteen records with unknown origin are excluded. Annual coverage increases from 185 origins in 2010 to 205 in 2023. A complete coverage subset contains 179 origins and 2,506 observations, while consecutive annual comparisons contain 2,523 observations across 207 origins. The distributions are concentrated in a limited number of large displacement populations. The mean refugee population is 91,725 persons, compared with a median of 974 and a maximum of 6,848,865. Asylum seekers have a mean of 14,615, a median of 739 and a maximum of 1,200,130. Internal displacement averages 189,852 persons, but its median is zero. Annual refugee returns average 2,379 persons and also have a zero median. These differences make the mean an incomplete description of the typical observed origin.

Reported zeros account for 84.89 percent of internal displacement observations and 84.82 percent of return observations. Their prevalence contrasts with asylum seeker and refugee populations, where zero shares are 4.58 percent and 4.03 percent. Consequently, comparisons involving internal displacement and returns contain substantial tied ranks. Source reported zeros remain in the calculations and are not interpreted as independently verified absence. Recorded refugee populations across identifiable origins increase from 10.38 million in 2010 to 31.46 million in 2023. Within the same 179 origins observed throughout the period, the corresponding population increases from 10.38 million to 29.17 million. Growth therefore remains evident under constant origin coverage, although its magnitude changes. These totals describe the retained reporting frame rather than complete global populations. This distinction accords with Fransen and de Haas, 2022, who demonstrate the importance of separating displacement trends from changes in statistical coverage.

4.2 Associations with Refugee Population Levels:

Asylum seeker populations have the largest pooled association with refugee population size. Their Spearman coefficient is 0.8558, compared with 0.4980 for internal displacement and 0.5245 for annual returns. These coefficients describe the correspondence between population rankings across observed origin and year records. They do not measure the number of additional refugees associated with an additional person in another category.

Table 4: Spearman associations with refugee population size

Observed Measure	Full Sample	Matched Consecutive Year Sample	Complete Coverage Sample	Range Across Annual Samples
Asylum seekers	0.8558	0.8552	0.8300	0.8671 to 0.8974
Internally displaced persons	0.4980	0.5041	0.4963	0.4244 to 0.5349
Annual returned refugees	0.5245	0.5270	0.5298	0.4842 to 0.5734

For RQ1, the evidence indicates that origins with larger asylum seeker populations generally also have larger refugee populations. The association remains positive in every annual sample, with coefficients between 0.8671 and 0.8974. Its persistence within individual years shows that the pooled relationship does not arise solely from combining different reporting years. However, it does not establish that pending asylum claims subsequently become recognized refugees. Hatton, 2020, identifies persecution and asylum policy as interconnected influences on asylum movements, providing a substantive context for the observed correspondence without establishing an individual transition mechanism.

For RQ2, internal displacement also corresponds positively with refugee population size, although the association is smaller than that observed for asylum seekers. Annual coefficients range from 0.4244 to 0.5349. The findings indicate that substantial internal and international displacement can coexist within the same origins. They do not demonstrate that internally displaced persons subsequently cross international borders. Adhikari, 2013, finds that resources, infrastructure and social relationships shape flight decisions alongside violence. The aggregate pattern is compatible with differentiated displacement responses, but the available counts do not identify which constraints produce those responses.

4.3 Annual Changes and Refugee Returns:

The correspondence between population levels does not carry over at comparable magnitude to annual changes. On the matched sample of 2,523 consecutive observations, the asylum seeker association with refugee populations is 0.8552 in levels but 0.1144 in annual changes. Internal displacement shows a corresponding contrast between 0.5041 in levels and 0.1234 in changes. Thus, origins with similarly ranked displacement populations do not necessarily experience closely aligned annual increases or decreases.

Table 5: Spearman associations involving annual refugee population change

Relationship	Consecutive Year Sample	Complete Coverage Subset
Annual asylum seeker change and annual refugee population change	0.1144	0.1176
Annual internal displacement change and annual refugee population change	0.1234	0.1138
Annual refugee return flow and annual refugee population change	−0.0348	−0.0364
Observations	2,523	2,327

For RQ3, annual refugee returns have a positive association with refugee population levels but an association close to zero with annual refugee population change. The coefficient changes from 0.5270 for population levels to −0.0348 for annual population change on the same matched observations. Larger refugee populations can therefore coexist with larger return flows, while the scale of returns alone provides little monotonic separation between annual population expansion and contraction in this sample. Among the 384 consecutive observations with positive refugee returns, 198 record a declining refugee population, 185 record an increasing population and one records no change. Returns coincide with population decline in 51.56 percent of these

observations and population growth in 48.18 percent. The near division between increases and decreases shows why return counts cannot be interpreted directly as net reductions in refugee populations.

Table 6: Refugee population changes where positive returns are recorded

Refugee Population Outcome	Observations	Share of Positive Return Observations
Decline	198	51.56 percent
Increase	185	48.18 percent
No change	1	0.26 percent
Total	384	100.00 percent

The median annual refugee population change among positive return observations is a decline of 49.5 persons, whereas the mean is an increase of 39,580.54 persons. This divergence indicates that large population increases in some origins coexist with recorded returns and influence the average. The evidence does not imply that returns cause population growth. It demonstrates that annual return flows and net population changes capture different processes. Beaman, Onder, and Onder, 2022, document how actual return decisions respond to conditions in both origin and destination locations, supporting the interpretation of returns as selective movements rather than a uniform reversal of displacement.

4.4 Coverage Sensitivity and Resolution of the Research Questions:

The exploratory complete coverage comparison preserves the principal ordering of population level associations. The asylum seeker coefficient decreases from 0.8558 to 0.8300, the internal displacement coefficient changes from 0.4980 to 0.4963, and the return coefficient changes from 0.5245 to 0.5298. Restricting the sample therefore does not reverse any association or alter the finding that asylum seekers have the largest correspondence with refugee population size. The temporal comparison is also similar under complete coverage. Correlations between annual changes remain 0.1176 for asylum seekers and 0.1138 for internal displacement. The association between return flows and annual refugee population change remains close to zero at −0.0364. These comparisons address sensitivity to reporting duration; they do not remove classification differences, validate reported zeros or recover excluded unknown origins.

The coefficients describe the observed sample without significance labels or claims of population inference. Repeated observations within origins and shared displacement shocks preclude treating all records as independent observations for conventional correlation tests. Schober, Boer, and Schwarte, 2018, emphasize that correlation measures association and requires interpretation in relation to the substantive question. Accordingly, the numerical contrasts indicate differences in observed correspondence rather than causal effects or the absence of an effect. The three research questions yield a consistent empirical distinction. Asylum seekers and internal displacement correspond positively with refugee population levels, but their annual changes show much smaller associations with refugee population change. Refugee returns correspond positively with population levels while showing little monotonic association with net annual change. The central finding is therefore that alignment in displacement population size does not establish alignment in annual population dynamics.

5. Methods:

5.1 Research Design and Analytical Scope:

The analysis uses a descriptive panel design to examine whether associations among displacement populations differ between population levels and annual changes. The unit of analysis is a country or territory of origin observed annually during 2010 to 2023. The analytical quantities are sample rank correlations; distributional summaries and the frequency of population increases and decreases. These quantities describe recorded displacement patterns rather than causal effects. The design distinguishes three comparisons. The first examines whether origins with larger asylum seeker populations also have larger refugee populations. The second examines the correspondence between internal displacement and refugee populations. The third assesses how annual refugee returns relate to both refugee population levels and annual population change. Comparing these relationships separates accumulated displacement scale from annual population adjustment. Useful variation arises across origins and across reporting years within origins. Pooled comparisons combine both sources of variation, while annual comparisons examine population rankings within individual years. Consecutive annual differences describe changes within each origin. Differencing does not identify individual movements between population categories or isolate the causes of population change. Shared insecurity, administrative classification and reporting practices remain possible explanations for observed associations.

5.2 Measurement Alignment and Analytical Samples:

Table 1 documents sample construction, while Table 2 defines the observed measures and their temporal interpretation. Refugees, asylum seekers and internally displaced persons are measured at year end. Returned refugees are measured over the calendar year. The analysis preserves this distinction and does not combine stocks and flows into a composite measure. Population level calculations use 2,753 observations across 211 origins. Annual calculations use the available origins in each reporting year. Each observed origin and year record receives equal weight; the calculations are not weighted by population size. Consequently, pooled summaries describe the distribution of recorded observations, with more extensively reported origins contributing more records. Consecutive annual comparisons require observations for both the current and immediately preceding calendar year. Records are sorted by origin code and year before constructing previous observations. A pair is retained only when its calendar years differ by one. The resulting sample contains 2,523 observations across 207 origins. Relative to the population level sample, this restriction removes 211 initial observations and 19 observations following reporting gaps.

Annual refugee population change follows Equation 1. The same consecutive difference rule is applied separately to asylum seekers and internal displacement. Differences remain absolute changes in persons. Reported zeros remain valid inputs, while absent origin and year combinations are not imputed. Annual return flows retain their current year values when compared with refugee population change. A matched population level comparison uses the same 2,523 observations retained for annual change calculations. This restriction allows the contrast between levels and changes to be assessed without simultaneously

changing the observed records. A separate complete coverage sample contains 179 origins and 2,506 observations. Its consecutive annual comparison contains 2,327 observations.

5.3 Descriptive Estimation and Association Measures:

The analysis first calculates valid observation counts, arithmetic means, sample standard deviations, medians, minima, maxima and zero frequencies. Sample standard deviations use the number of valid observations less one as the denominator. Annual totals describe the retained origins and are distinguished from complete global totals. Valid extreme observations remain unchanged. Spearman rank correlation measures monotonic association between each displacement dimension and the relevant refugee population outcome. This choice accommodates concentrated distributions and reduces sensitivity to the numerical magnitude of extreme counts. It preserves information about ordering without assuming a linear relationship between population counts. Schober, Boer, and Schwarte, 2018, explain the interpretation of rank correlation for distributions with extreme observations and emphasize its distinction from causal effects. Equation 2 defines the implemented association measure.

$$\rho_S = \frac{\sum_{k\in\mathcal{S}}[a_k - \bar{a}]\,[b_k - \bar{b}]}{\sqrt{\sum_{k\in\mathcal{S}}[a_k - \bar{a}]^2}\sqrt{\sum_{k\in\mathcal{S}}[b_k - \bar{b}]^2}}$$

Here, ρ_S denotes the sample Spearman correlation, $\mathcal{S}$ denotes the records included in a particular comparison, and k indexes those records. The quantities a_k and b_k are the ranks of the two compared measures, while $\bar{a}$ and $\bar{b}$ are their mean ranks within that sample. Equal values receive average ranks. Ranks are recalculated separately for every analytical sample and annual comparison. Population level correlations compare each observed displacement dimension with refugee population size. Temporal correlations compare annual asylum seeker changes and annual internal displacement changes with annual refugee population change. A separate calculation compares current annual return flows with annual refugee population change. These are distinct comparisons: changes in pending or internal displacement populations are not treated as equivalent to return flows.

To clarify the interpretation of returns, consecutive observations are classified according to whether refugee populations increase, decrease or remain unchanged. Among observations with positive returns, the analysis calculates the count and percentage in each category. The percentage denominator is the number of consecutive observations with a return count greater than zero. Mean and median refugee population changes are also calculated within this group. Calculations use Python with panda's version 2.2.3 and SciPy version 1.17.0. Numerical summaries use pandas descriptive functions, and rank correlations use its Spearman correlation implementation. Calculations retain available numerical precision; displayed coefficients are rounded to four decimal places. The coefficients describe the observed reporting sample. They are presented without significance labels, standard errors or confidence intervals. Repeated observations within origins and shared shocks across origins make conventional independent observation inference inappropriate for the descriptive comparisons undertaken here.

5.4 Quality Assurance, Sensitivity and Reproducibility:

Quality assurance checks origin and year key uniqueness, numeric completeness, nonnegative integer counts and agreement between retained observations and their raw source records. The audit matches each analytical record to its source record using origin code and calendar year, then compares all four population measures. The tabular structure keeps each measure in a separate column and each observation in a separate row, consistent with the data organization principles described by Wickham, 2014. Distributional assessment uses means, medians, ranges and zero frequencies to identify concentration and limited differentiation among observations. Reported zeros are preserved without reclassifying them as independently verified absence. No trimming, winsorization, interpolation or replacement of valid extreme values is applied.

Sensitivity analysis addresses two specific threats. First, matched sample calculations distinguish the level versus change comparison from differences in record availability. Second, the exploratory complete coverage restriction assesses sensitivity to unequal reporting duration. Population level and annual change associations are recalculated within their respective complete coverage samples. Comparisons focus on changes in coefficient direction, magnitude and ordering rather than repeated statistical significance. Annual population level correlations provide an additional check on pooling across years. For each reporting year, the analysis recalculates associations using that year's available origins. The reported minimum and maximum summarize variation across these annual coefficients; they are not confidence limits. This comparison assesses whether the pooled pattern also appears within individual reporting years. The workbook retains raw records, analytical observations, inclusion flags, source identifiers and measurement definitions. These materials allow the reported counts and selection decisions to be traced to the supplied extraction. Peng, 2011, distinguishes reproducibility using existing computational inputs from independent replication using new evidence. The methodological contribution rests on consistent measurement and matched comparisons: established descriptive tools distinguish population scale from annual adjustment while preserving the limits of aggregate observational evidence.

6. Discussion:

Large displacement populations and rapid displacement change are different empirical phenomena. Tables 4 and 5 establish this distinction through a matched sample comparison: the asylum seeker association with refugee populations is 0.8552 in levels but 0.1144 in annual changes. Internal displacement exhibits the same contrast. The contribution lies in showing that correspondence among population stocks provides limited information about the synchronization of their annual movements. Equation 1 makes this distinction explicit by separating accumulated refugee populations from annual population change. Carling and Schewel, 2018, distinguish aspirations to migrate from the ability to move, offering a theoretical basis for expecting different mobility outcomes under related pressures. The findings add an aggregate measurement implication: closely aligned population rankings should not be interpreted as closely aligned displacement trajectories. The attenuation in Table 5 narrows the interpretation of shared displacement pressures. If larger asylum seeker and internal displacement populations directly indicated synchronized annual refugee expansion, the relationships between their annual changes would resemble their population level associations more closely. Instead, the observed changes show substantially smaller correspondence. This pattern is compatible with differences in movement timing, access to destinations and administrative classification, although it does not identify their

separate contributions. Bohra Mishra and Massey, 2011, demonstrate through individual evidence from Nepal that migration decisions during conflict remain shaped by household and individual characteristics alongside violence. The aggregate findings add a boundary to such explanations: relationships between accumulated populations cannot reveal how those individual decisions combine into annual movements. Equation 1 therefore changes the substantive interpretation, not merely the numerical scale of analysis.

Refugee returns reveal a further distinction between movement and population reduction. Table 4 shows that larger refugee populations coexist with larger return flows, while Table 5 shows little monotonic correspondence between return flows and annual refugee population change. Table 6 makes the practical implication visible: positive returns accompany population growth in almost half of the relevant observations. Return activity therefore cannot serve alone as evidence of declining displacement. Ghosn and colleagues, 2021, show that violence and anchoring shape refugees' preferences concerning return. The present analysis addresses a different outcome, demonstrating that recorded returns and net population change need separate interpretation. Its contribution is to distinguish the occurrence of return from its correspondence with the remaining population abroad. Return counts measure movement toward origins, whereas Equation 1 measures the net change remaining after all recorded population processes. Reporting structure also changes what aggregate relationships can establish. The complete coverage comparisons in Tables 4 and 5 preserve the main contrast between population levels and annual changes, indicating that uneven reporting duration alone does not explain it. Nevertheless, the prevalence of reported zeros in internal displacement and returns limits the differentiation available within those measures. Excluding unknown origins also affects asylum seeker coverage more than refugee coverage. These features identify a substantive problem for international comparison: the apparent scale and composition of displacement depend partly on which populations can be assigned to recognized reporting categories. FitzGerald and Arar, 2018, explain how the construction of the refugee category shapes assessments of displacement and policy responses. The findings extend this concern to empirical interpretation by showing why stable associations across coverage samples still require attention to classification and reporting boundaries.

The international relevance lies in separating indicators used to describe protection needs from indicators used to assess population change. Czaika and Hobolth, 2016, find that restrictive asylum and visa policies can redirect migration into irregular channels in Europe. Their evidence concerns policy induced movement between channels, whereas Tables 4 and 5 demonstrate that global population categories can remain closely associated without comparable annual synchronization. The findings therefore caution against transferring interpretations from a particular destination system to aggregate origin populations. For monitoring, decision makers should report refugee stocks, pending asylum populations, internal displacement, returns and net refugee population change separately. Table 6 further supports assessing return activity alongside continuing population growth rather than treating returns as a sufficient measure of reduced displacement. The theoretical refinement is a distinction between accumulated displacement scale and annual population adjustment, providing a basis for more precise comparisons across international protection systems.

7. Conclusion and Implications:

Movement toward home does not necessarily mean that displacement is receding. This analysis shows that alignment in accumulated populations can coexist with limited correspondence in annual change. The contribution is an empirical distinction between displacement scale and population adjustment, demonstrated across an international reporting frame. This distinction qualifies interpretations that infer synchronized movement from similarly ranked population counts. It refines theoretical accounts of constrained mobility by showing why accumulated outcomes and annual trajectories require separate interpretation. The evidence supports associations rather than causal pathways, preserving the distinction between observed patterns and their possible explanations. For humanitarian managers, the findings support separating assessments of continuing protection needs from assessments of movement activity. Resource allocation should consider the population remaining abroad alongside annual expansion or contraction, rather than treating recorded movement alone as evidence of declining need. International monitoring systems should maintain consistent definitions, distinguish reporting gaps from substantive absence, and preserve comparable coverage when evaluating change. Operational reporting can improve by presenting accumulated caseloads and annual adjustments together while explaining their different meanings. This approach can reduce the risk of premature judgments about recovery and support assistance decisions responsive to continuing needs. Its social relevance lies in making displaced populations visible when movement statistics alone suggest improvement.

The annual aggregate design creates opportunities for more detailed investigation of timing and population transitions. Linked administrative records could distinguish recognition, departure, return and renewed displacement, while household panels could examine how individual decisions produce aggregate change. More detailed reporting metadata would help assess the meaning of recorded zeros and changes in coverage. Comparisons across protection regimes could investigate whether institutional arrangements alter the observed relationships. Future analyses could incorporate verified information on insecurity, processing practices and access restrictions to evaluate specific mechanisms. Such extensions would test the transferability of the descriptive findings while developing stronger grounds for causal interpretation.

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