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From Enrolment Parity to Academic Representation: Global Pathways in Higher Education Systems

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Abstract

Women's participation in tertiary education has expanded rapidly, yet access and representation in academic employment are usually studied separately. This article examines when gender parity in tertiary enrolment is reflected in women's representation in the academic workforce. Using World Development Indicators and UNESCO Institute for Statistics data for 2000–2022, it analyses 1,449 economy-year observations from 163 economies and territories. Gender parity is traced across primary, secondary and tertiary enrolment and academic staffing using the UNESCO parity band (0.97–1.03). Five-period pathway profiles, transition matrices, contextual and two-way fixed-effects models, five-year lags and doctoral-attainment extensions distinguish cross-system alignment from within-system change. In 2020–2022, 43 of 81 economies with complete data (53.1%) combined tertiary parity or female advantage with male advantage in academic staffing. Among 123 economies with matched observations in 2018–2022, the median female academic staff share was 9.8 percentage points below the benchmark implied by sex-specific tertiary enrolment rates, and 87.0% had a negative gap. A 10-point higher tertiary participation benchmark corresponded to a 10.7-point higher female staff share between economies but only 0.65 points within economies over time, an estimate that was not statistically robust. Five-year lags and doctoral-attainment models yielded similar results. The findings support an organisational-conversion account rather than an automatic pipeline mechanism: enrolment parity enlarges the potential supply of qualified women, but staffing outcomes depend on recruitment, retention, promotion and institutional conditions.

1. Introduction

The expansion of higher education is one of the most important social changes of the past half-century. Participation has widened across regions as tertiary study has moved from elite provision towards high-participation systems (Marginson 2016; Schofer and Meyer 2005). Women have been central to that growth, and in many national systems female tertiary enrolment now equals or exceeds male enrolment (Becker et al. 2010; Buchmann et al. 2008). This reversal is often treated as evidence that the gender problem in education has largely been solved, at least at the point of access. Yet the institutional workforce tells a different story. UNESCO estimates that women account for 45% of academic staff globally and only 30% of higher education leaders (Global Education Monitoring Report Team 2025). The contrast raises a basic question: when does parity in education become representation in the institutions that organise, teach and govern it?

This question is of substantive importance for both academic research and policy-making. An access-centred perspective conceptualises the expansion of women's enrolment as an increase in the supply of qualified candidates. Over time, this enlarged pool is expected to feed into academic labour markets and thereby reduce gender disparities in the workforce. In contrast, a gendered-organisations perspective does not assume such automatic translation. Universities are not neutral endpoints of an educational pipeline. Their meritocratic standards, recruitment networks, disciplinary hierarchies, promotion regimes, and implicit assumptions regarding care responsibilities and availability can perpetuate unequal

outcomes even when the composition of candidate pools has changed (Acker 1990; Bagilhole and Goode 2001; Benschop and Brouns 2003; O'Connor 2020; van den Brink and Benschop 2012, 2014). Achieving parity in enrolment may therefore be a necessary condition for equitable representation, but it is not a sufficient one.

Existing research documents women's under-representation in senior academic positions, leadership, scientific authorship and research careers (Aiston and Yang 2017; Bendels et al. 2018; Holman et al. 2018; Huang et al. 2020; Larivière et al. 2013; Morley 2013; West et al. 2013). Studies also identify gender differences in publication opportunities, research resources and the recognition attached to collaborative work (Duch et al. 2012; Sarsons et al. 2021). Much of this evidence is institution-specific, field-specific or concentrated in high-income systems. Comparative work shows that gender patterns differ sharply by national and organisational context, warning against treating the Western academy as a universal reference point (Aiston and Yang 2017; Islam et al. 2023; Mabokela and Mawila 2004; Morley and Crossouard 2016a, 2016b; Unterhalter 2025). Reports from the UNESCO International Institute for Higher Education in Latin America and the Caribbean (UNESCO IESALC 2021, 2023) have also drawn attention to the coexistence of women's enrolment advantage and continuing inequalities in academic careers and management. A recent World Bank panel study linked faculty gender diversity to financing and STEM outcomes in 58 European and Central Asian economies (Ahiase and Azizova 2026), but did not examine the global conversion of enrolment parity into academic staffing. What remains less well established is how the full system-level pathway changes over time, from primary and secondary parity, through tertiary participation, to academic staffing.

This article addresses that gap through a global, longitudinal analysis covering the period 2000–2022 and advances three main contributions. First, it conceptualises educational parity and academic representation as sequentially linked stages of a single process rather than as independent indicators. To this end, it constructs comparable gender parity indices for enrolment at the primary, secondary, and tertiary levels, as well as for academic staff, and uses these to identify six theoretically specified pathway configurations. Second, it examines temporal dynamics in addition to static levels. By defining five observation windows, the study enables economies to transition among pathway types, thus rendering patterns of persistence and change empirically observable. Third, it analytically separates cross-sectional differences between economies from longitudinal changes within economies. This distinction is essential: economies exhibiting more gender-balanced tertiary participation may also display higher proportions of women in academic positions, but such a cross-sectional association does not imply that an increase in women's tertiary enrolment within a given economy causally leads to a commensurate increase in women's representation in its academic workforce.

The paper asks four questions:

1. How does gender parity change across primary enrolment, secondary enrolment, tertiary enrolment and the academic workforce?
2. Which parity-to-representation pathway configurations characterise national systems, and how have their prevalence and persistence changed since 2000?
3. Is tertiary gender parity associated with women's academic representation between economies and within the same economy over time?
4. Does gender balance in doctoral attainment provide an additional pathway to women's academic representation?

The results indicate substantial progress in the absence of fully automatic conversion mechanisms. The proportion of national economies exhibiting cumulative female disadvantage declined markedly, whereas instances of female advantage at the point of labour market entry became increasingly prevalent. Concurrently, the academic representation bottleneck persisted as the modal trajectory in all observation periods and exhibited a high degree of temporal stability. Strong cross-national associations initially observed between system types diminished in magnitude and became statistically imprecise once time-invariant economic characteristics were accounted for. Collectively, these findings reorient the central policy question from whether a sufficient number of women access higher education to how institutional structures and practices transform an expanded pool of qualified women into equitable academic career outcomes.

2. From access to organisational conversion

2.1 Massification and the reversal of educational gender gaps

Worldwide higher education expansion has been driven by state building, economic change, credential demand and the diffusion of education as a legitimate social right (Marginson 2016; Schofer and Meyer 2005). Women's participation has risen especially quickly. Comparative research attributes the reversal of many educational gender gaps to changing labour-market returns, family decisions, school performance and broad institutional change (Becker et al. 2010; Buchmann et al. 2008). The result is not a uniform global female advantage. Low-income systems and some regions continue to face large female disadvantages, while other systems report substantially more women than men in tertiary education. Field segregation also persists within apparently equal systems. Aggregate parity can therefore coexist with strongly gendered subject choices, and cross-national evidence suggests that field segregation does not simply disappear as economies develop (Charles and Bradley 2002, 2009).

Parity indicators are valuable because they place women and men on a common scale. The UNESCO convention treats a gender parity index between 0.97 and 1.03 as parity (UNESCO Institute for Statistics 2019). A value below 0.97 indicates male advantage and a value above 1.03 indicates female advantage. This band recognises that exact equality is neither statistically necessary nor empirically stable. However, parity at one educational level says little about the next. Primary and secondary parity can

coexist with a tertiary access gap, while tertiary parity can coexist with male dominance in academic employment.

The language of a pipeline captures the sequential character of these stages but can imply a mechanically connected flow. The pool of tertiary students is not the same as the pool eligible for academic employment. Entry into academic work usually requires postgraduate study, disciplinary specialisation and time. Workforce composition is also a stock shaped by earlier recruitment cohorts and slow turnover. This stock-flow difference means that present enrolment and present staff composition should not be expected to match exactly. Yet a persistent gap, especially after accounting for lags and doctoral attainment, signals more than a simple timing problem.

2.2 Universities as gendered organisations

Acker's (1990) theory of gendered organisations provides the central explanation for why access may not be converted into representation. Organisational jobs, hierarchies and evaluation criteria are presented as abstract and gender-neutral, but they often presume an unencumbered worker and reward career patterns more available to men. Academic merit is also produced through local judgements about excellence, fit, mobility and visibility rather than applied as a wholly neutral standard (Bagilhole and Goode 2001; Benschop and Brouns 2003; Castilla and Benard 2010; van den Brink and Benschop 2012). In universities, these processes appear in recruitment networks, publication expectations, access to mentoring, leadership selection and the unequal allocation of teaching, service and care work (Morley 2013; O'Connor 2020).

Gender can enter academic careers at recruitment and promotion. Experiments using otherwise comparable application materials have found differences in how evaluators assess candidates identified as women and men, although the size and direction of bias vary by career stage and setting (Moss-Racusin et al. 2012; Reuben et al. 2014; Steinpreis et al. 1999). Studies of professorial selection show how informal networks, relationship assumptions and local definitions of merit shape who is considered appointable (Nielsen 2016; Rivera 2017; van den Brink and Benschop 2014). Connections can influence promotion decisions, while simply adding women to evaluation committees does not guarantee a change in outcomes (Bagues et al. 2017; Zinovyeva and Bagues 2015). These findings direct attention from the nominal neutrality of a rule to how that rule is interpreted and enforced.

Gendered differences continue after appointment. Faculty workload studies find that women often undertake more service, advising and other tasks that are necessary to universities but weakly rewarded in promotion systems (Babcock et al. 2017; Guarino and Borden 2017; O'Meara et al. 2017; Winslow 2010). Care and parenthood can also alter career continuity, time for research and willingness or ability to remain in demanding academic pathways (Cech and Blair-Loy 2019; Correll et al. 2007; Fox 2005). These processes can accumulate even when formal pay scales and promotion criteria appear gender-neutral.

Research evaluation introduces an additional stratifying mechanism. Empirical work on peer review, publication practices, and authorship has documented systematic gendered disparities in fellowship assessments, access to resource-intensive research environments, patterns of scholarly authorship, and the attribution of credit for collaborative work (Duch et al. 2012; Sarsons et al. 2021; Wennerås and Wold 1997; West et al. 2013). Large-scale bibliometric analyses similarly reveal persistent gender differences in authorship position and in representation within high-impact and highly visible journals (Bendels et al. 2018; Holman et al. 2018; Huang et al. 2020; Larivière et al. 2013). These patterns are consequential because research visibility is routinely converted into career advancement, geographic and institutional mobility, and access to leadership positions.

Research on leadership in higher education reveals a corresponding vertical stratification. The increased participation of women among students and junior academic or administrative staff has not translated into proportional representation at the levels of full professorship, senior management, or institutional leadership (Burkinshaw and White 2017; Morley 2014; Read and Kehm 2016). Positions of leadership are frequently structured by masculinised norms, intensified managerial imperatives, and precarious contractual arrangements, including configurations that resemble the “glass-cliff” phenomenon (Peterson 2016; Teelken and Deem 2013). Empirical evidence from African and Asian higher education systems further demonstrates that organisational cultures, racialised dynamics, national policy frameworks, and familial expectations intersect with gender in context-specific ways that are not adequately accounted for by a singular, Western-centric career model (Mabokela 2003; Mabokela and Mawila 2004; Morley 2006; Morley and Crossouard 2016a, 2016b; Odhiambo 2011; Toni and Moodly 2019).

The problem is therefore not reducible to women’s preferences or qualifications. Research on scientific careers finds continuing differences in career length, seniority and productivity opportunities across fields and countries (Ceci et al. 2014; Holman et al. 2018; Huang et al. 2020). Organisational interventions can help when they change structures, assign responsibility and monitor outcomes, but isolated training or mentoring is less likely to alter the rules governing appointments and rewards (Bilimoria et al. 2008; Drange et al. 2023; Kalev et al. 2006). State-mandated quotas can also have direct and indirect effects when they are backed by enforceable procedures (Forman-Rabinovici et al. 2024). National policy, labour regulation, care infrastructure, academic labour-market structure and institutional autonomy may therefore influence conversion together.

This article uses organisational conversion to describe the system’s capacity to turn gender-balanced participation into gender-balanced academic employment. Conversion is not a claim that every student should become an academic or that aggregate enrolment composition should be reproduced exactly among staff. It is an analytical comparison between two gender structures: relative access to tertiary education and representation within the academic workforce. A negative conversion gap indicates that women’s academic representation is below the benchmark implied by women’s position in tertiary enrolment. A positive gap indicates the reverse.

2.3 Path dependence and national pathways

The conversion process is likely to exhibit path dependence. Academic workforces tend to adjust only gradually, as permanent appointments, promotion hierarchies, and disciplinary structures are characterised by long temporal horizons. An economy may achieve gender parity in tertiary enrolment rapidly through expansion of the student body, while its academic staff composition remains anchored in earlier, more male-dominated cohorts. Conversely, systems with a long-standing history of women's participation in higher education may develop a more gender-balanced academic workforce even when recent changes in enrolment are relatively modest. Moreover, stable social and institutional environments can generate substantial cross-economy variation in gender representation without inducing a strong short-run association between student participation and academic staffing within individual economies. This line of reasoning yields three expectations. First, gender parity is expected to become progressively less frequent as the focus shifts from primary and secondary education to academic employment. Second, gender representation bottlenecks in academic staffing are likely to be both widespread and persistent, even as cumulative female disadvantage diminishes. Third, the relationship between women's tertiary participation and their representation in academic staff positions should be considerably stronger in cross-sectional comparisons between economies than in temporal analyses within a single economy over short and medium time spans. Doctoral attainment may approximate more closely the point of entry into academic careers, but it is expected to display the same limitation if organisational conversion processes remain weak.

3. Data and methods

3.1 Data source and analytic sample

The study uses the World Development Indicators extract supplied for this project, last updated on 13 July 2026 (World Bank 2026). Education indicators in the extract are sourced mainly from the UNESCO Institute for Statistics. Country metadata provide World Bank region and income-group classifications. Aggregate entities were removed by retaining only records with a defined region. The resulting source frame contained 217 economies and territories. The term economy is used throughout because the file includes several territories as well as sovereign states.

The main study period is 2000–2022. Later years were excluded because joint coverage across the four core indicators was too sparse for pathway analysis. No values were interpolated. The complete same-year core contains 1,449 economy-year observations from 163 economies, with a median of eight complete years per economy. Coverage rises from 42 economies in 2000 to 80 in 2015, then falls to 73 in 2020, 32 in 2021 and one in 2022. For this reason, the final window is interpreted as a 2020–2022 reporting window rather than a fully observed end-year cross-section. Models that require only tertiary enrolment and academic staffing use larger samples, as reported with each estimate. Descriptive statistics for the study variables are presented in Table 1.

[Insert Table 1 **here]**

Table 1
Descriptive statistics, 2000–2022

Variable	Obs.	Econ.	Mean	SD	Median
Primary enrolment GPI	3,503	200	0.97	0.07	0.99
Secondary enrolment GPI	2,933	198	0.98	0.14	1.00
Tertiary enrolment GPI	2,850	191	1.09	0.33	1.18
Female academic staff (%)	2,083	176	39.42	13.96	41.40
Representation conversion gap (percentage points)	1,966	174	-11.61	9.85	-11.70
Tertiary gross enrolment ratio (%)	2,959	193	39.73	28.43	36.15
Government education expenditure (% GDP)	3,204	199	4.38	1.97	4.19
Female doctoral attainment benchmark (%)	616	125	37.50	11.38	38.65

Note. Statistics use all available economy-years for each variable. The unit of analysis is the economy-year and samples therefore differ across rows.

3.2 Core measures

Primary, secondary and tertiary gender parity indices are the ratios of female to male gross enrolment ratios. Academic staff are reported as the percentage of tertiary academic staff who are women. To place staffing on the same ratio scale, the staff gender parity index is calculated as:

$$GPIstaff = S / (100 - S)$$

where S is the percentage of academic staff who are women. The same 0.97–1.03 parity band is applied at every stage. Staff parity therefore corresponds to a female share of approximately 49.2% to 50.7%.

For percentage-point comparisons and regression interpretation, tertiary GPI is transformed into a parity-implied female participation benchmark:

$$B = 100 \times GPItertiary / (1 + GPItertiary)$$

The expression is a transformation of the relative female and male gross enrolment rates. It is not the observed female share of student headcounts because the two gross enrolment ratios have sex-specific population denominators. It is therefore described as a benchmark, not as enrolment composition. The representation conversion gap is academic staff percentage female minus this benchmark. Negative values indicate lower representation in staffing than in relative tertiary participation.

Contextual covariates are tertiary gross enrolment, government education expenditure as a percentage of gross domestic product, women's share of the labour force, the working-age share of the population and the female-minus-male unemployment-rate gap. These variables represent system scale, public

investment, labour-market participation, demographic structure and gendered labour-market conditions. Continuous predictors are winsorised at the first and ninety-ninth percentiles in the main models; raw-covariate estimates are reported as a sensitivity test.

The doctoral extension uses educational attainment at the doctoral or equivalent level among women and men aged 25 and over. A doctoral gender-balance benchmark is formed as the female attainment rate divided by the sum of female and male attainment rates, multiplied by 100. Like the tertiary measure, it compares sex-specific attainment rates rather than graduate headcounts.

3.3 Pathway classification

Economy-year observations with all four core measures were grouped into five windows: 2000–2004, 2005–2009, 2010–2014, 2015–2019 and 2020–2022. Indicator means were calculated within each economy-window from same-year complete observations. The window profile was then assigned to one of six pathways. Table 2 summarises the pathway definitions and classification rules.

[Insert Table 2 **here]**

Table 2
Parity-to-representation pathway definitions

Pathway	Classification rule	Interpretation
Cumulative female disadvantage	$P < .97; S < .97; T < .97; A < .97$	Male advantage at every observed stage.
Tertiary access lag	P ≥ .97; S ≥ .97; T < .97	Basic education parity has not reached tertiary participation.
Academic representation bottleneck	T ≥ .97; A < .97	Tertiary parity or female advantage, but male advantage in staffing.
Parity aligned	.97 ≤ T ≤ 1.03; .97 ≤ A ≤ 1.03	Tertiary participation and staffing both lie within the parity band.
Female advantage reaches workforce	T > 1.03; A > 1.03	Female advantage appears in both tertiary participation and staffing.
Mixed pathway	All other complete combinations	Non-sequential or cross-stage pattern.

Note. P = primary enrolment GPI; S = secondary enrolment GPI; T = tertiary enrolment GPI; A = academic staff GPI. The conditions for cumulative disadvantage and tertiary access lag are applied before the broader bottleneck rule.

The categories distinguish early educational disadvantage from failure at the transition into academic employment. Cumulative female disadvantage requires male advantage at all four stages. Tertiary

access lag captures systems where primary and secondary parity has not yet reached tertiary education. Academic representation bottleneck identifies tertiary parity or female advantage combined with male advantage among academic staff. Parity aligned requires both tertiary participation and staffing to lie inside the parity band. Female advantage reaches workforce requires female advantage at both stages. All remaining combinations are mixed.

3.4 Analytical strategy

The analysis proceeds in four stages. First, unweighted descriptive statistics and median values are used to map the education-to-workforce trajectory. Each economy is assigned equal weight; consequently, these statistics characterise the average reporting economy rather than the global population distribution. Second, pathway distributions are estimated for each observation window. Adjacent-period transition matrices are constructed only for economies with complete data in both windows. These matrices characterise patterns of persistence and mobility across states and are not interpreted as causal transition probabilities. Third, country-level medians for 2018–2022 are computed using only those years in which both the tertiary GPI and the share of female academic staff are jointly observed. The use of medians mitigates the influence of abrupt, single-year reporting fluctuations. This subsample of 123 economies underpins the most recent paired comparison, the regional and income-group summaries, and the access-to-representation scatterplot.

Fourth, ordinary least-squares panel models estimate the association between the tertiary participation benchmark and female academic staff. Standard errors are clustered by economy. A pooled contextual model includes year, region and income-group indicators plus all covariates. An economy-means model estimates the between-system relationship. A two-way fixed-effects model includes economy and year indicators and therefore estimates whether deviations from an economy's usual tertiary gender balance are associated with deviations from its usual female staff share. A five-year-lag model links tertiary participation and total tertiary enrolment in year t minus five to staffing in year t. A lean fixed-effects model drops covariates with weaker coverage. Doctoral models repeat the pooled and fixed-effects contrast. Finally, raw-covariate and trimmed-outcome models test sensitivity to winsorisation and extreme staff shares. A complete summary of the regression specifications is provided in Appendix Table C1.

The models are associational. The data do not identify reforms, hiring cohorts or exogenous changes sufficient for causal inference. Statistical significance is evaluated with two-sided tests and 95% confidence intervals, but substantive contrasts and interval width receive greater attention than threshold decisions.

3.5 Ethics and reproducibility

The analysis uses public, aggregate national statistics and contains no individual or identifiable human-subject data. Formal human-participant ethics review was therefore not required. Indicator codes, transformations and analytical uses are reported in Appendix Table A1. The source file and analysis code can be archived with the submitted paper.

4. Results

4.1 Parity advances faster than academic representation

Figure 1 shows a clear separation between educational access and academic staffing. Median primary and secondary GPIs remain close to 1.00 throughout the study period. Median tertiary GPI is already 1.13 in 2000–2004 and rises to 1.23 in 2020–2022, indicating a growing female advantage among the economies with complete data. Academic staff GPI also improves, from 0.57 to 0.85, but remains below the parity threshold in every window.

The right panel shows that the representation conversion gap remains negative in every income group and period. The median gap narrows most clearly among high- and upper-middle-income economies. The low-income series is volatile and is based on fewer reporting economies; it should not be read as a stable trend. Its large negative value in 2020–2022 nevertheless illustrates a different stage of the pathway, where limited tertiary access and very low staff representation often coexist.

Figure 2 presents the most recent paired comparison and reinforces the overall result. Across 123 economies with jointly observed data in 2018–2022, median tertiary GPI is 1.21, the median parity-implied participation benchmark is 54.9%, and the median female academic staff share is 45.8%. The median conversion gap is minus 9.8 percentage points. In 107 economies, 87.0%, the staff share is below the benchmark. Sixty economies, 48.8%, meet the stricter bottleneck definition of tertiary parity or female advantage together with male advantage among academic staff.

The scatterplot also shows heterogeneity around the dominant pattern. A small group has more women among academic staff than its relative tertiary participation would suggest. Most economies, however, lie below the equality line. Income-group medians in Table 3 clarify why bottleneck prevalence cannot be interpreted alone. Low-income economies have the lowest bottleneck share, 11.1%, because most have not reached tertiary parity. Their median tertiary GPI is 0.59 and median female staff share is 13.4%. In contrast, high-income economies have a median tertiary GPI of 1.28, a median female staff share of 46.6%, and a bottleneck share of 60.8%. Upper-middle-income systems come closest to conversion, with a median gap of minus 6.6 points.

Table 3
Latest paired medians by income group, 2018–2022

Income group	N	Tertiary GPI	Female staff (%)	Conversion gap (pp)	Bottleneck (%)
Low income	9	0.59	13.4	-23.6	11.1
Lower middle income	22	1.01	29.9	-13.2	36.4
Upper middle income	41	1.27	48.9	-6.6	48.8
High income	51	1.28	46.6	-9.5	60.8

Note. Values are medians of economy-level medians calculated from jointly observed tertiary GPI and female academic staff during 2018–2022. Bottleneck means tertiary GPI ≥ 0.97 and academic staff GPI < 0.97.

Regional medians show the same distinction. The Middle East and North Africa combines a median tertiary GPI of 1.31 with only 34.6% female academic staff and a median conversion gap of minus 18.1 points. Sub-Saharan Africa has a lower median tertiary GPI, 0.80, and 23.1% female staff, reflecting a pathway that often begins before tertiary education. Europe and Central Asia is closer to workforce balance, with 48.4% female staff, but still records a negative median gap because women's tertiary advantage is larger. These are descriptive regional contrasts and do not isolate institutional causes.

4.2 The academic representation bottleneck remains the modal pathway

Table 4 and Fig. 3 show the distribution of pathway configurations. Cumulative female disadvantage falls from 25.3% of complete economy-windows in 2000–2004 to 1.2% in 2020–2022. This is substantial progress. The share in which female advantage reaches the academic workforce more than doubles, from 12.6% to 27.2%. Tertiary access lag becomes somewhat more common in the latest windows, partly because progress at primary and secondary levels exposes the next transition point.

Table 4
Distribution of parity-to-representation pathways by period

Pathway	2000–04	2005–09	2010–14	2015–19	2020–22
Cumulative female disadvantage	24 (25.3)	19 (20.9)	14 (12.0)	8 (7.6)	1 (1.2)
Tertiary access lag	5 (5.3)	4 (4.4)	9 (7.7)	11 (10.5)	8 (9.9)
Academic representation bottleneck	46 (48.4)	47 (51.6)	56 (47.9)	54 (51.4)	43 (53.1)
Parity aligned	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Female advantage reaches workforce	12 (12.6)	12 (13.2)	20 (17.1)	25 (23.8)	22 (27.2)
Mixed pathway	8 (8.4)	9 (9.9)	18 (15.4)	7 (6.7)	7 (8.6)

Note. Cells report count (percentage) among economies with at least one same-year complete observation in the period. Period totals are 95, 91, 117, 105 and 81, respectively.

The academic representation bottleneck changes very little. It accounts for 48.4% of complete cases in 2000–2004, varies between 47.9% and 51.6% in the next three windows, and reaches 53.1% in 2020–2022. The decline of early educational disadvantage has therefore not produced a corresponding decline in the most common later-stage bottleneck.

As shown in Appendix Table B1, these configurations are highly persistent. Across 305 adjacent-window transitions from 121 economies, 86.4% of observations beginning in an academic representation bottleneck remain there in the next period. Only 4.9% move directly to female advantage reaching the workforce. Cumulative female disadvantage persists in 72.2% of transitions, while 11.1% move to the academic bottleneck, a form of progress in access that still stops before staffing parity. Tertiary access lag persists in 70.8% of cases, and female advantage reaching the workforce is the most stable configuration at 96.1%. Mixed pathways are more mobile, but only 28.1% move to female advantage reaching the workforce.

4.3 A strong between-economy association but little within-economy conversion

Table 5 reports the focal coefficients. The unit is the percentage-point change in female academic staff associated with a ten-point increase in the parity-implied tertiary participation benchmark. The pooled contextual estimate is 10.03 points, with a 95% confidence interval from 8.37 to 11.68. The economy-means estimate is 10.70 points, with an interval from 8.17 to 13.23. Economies where women have a stronger relative position in tertiary enrolment therefore tend to have substantially more women among academic staff.

Table 5
Gender-balance benchmarks and female academic staff

Model	Focal predictor	b (clustered SE)	95% CI	p	N	Econ
M1 Pooled contextual	Tertiary benchmark	10.03 (0.84)	[8.37, 11.68]	< .001	1,488	146
M2 Economy means	Tertiary benchmark	10.70 (1.28)	[8.17, 13.23]	< .001	153	153
M3 Economy + year FE	Tertiary benchmark	0.65 (1.06)	[-1.46, 2.75]	.545	1,488	146
M4 Five-year lag FE	Tertiary benchmark, lag 5	0.62 (0.52)	[-0.42, 1.66]	.240	1,063	124
M5 Lean FE	Tertiary benchmark	0.28 (0.77)	[-1.24, 1.79]	.719	1,966	174
M6 Doctoral pooled	Doctoral benchmark	2.33 (0.67)	[1.00, 3.67]	< .001	418	89
M6 Doctoral pooled	Tertiary benchmark	7.41 (1.50)	[4.43, 10.38]	< .001	418	89
M7 Doctoral FE	Doctoral benchmark	0.10 (0.26)	[-0.42, 0.63]	.698	418	89
M7 Doctoral FE	Tertiary benchmark	-2.01 (2.53)	[-7.05, 3.02]	.429	418	89
M8 Raw-covariate FE	Tertiary benchmark	0.58 (1.00)	[-1.40, 2.56]	.561	1,488	146
M9 Trimmed-outcome FE	Tertiary benchmark	-0.36 (0.64)	[-1.62, 0.90]	.577	1,944	173

Note. The outcome is female academic staff (%). Coefficients give the percentage-point difference associated with a ten-point increase in the stated benchmark. M1 includes year, region, income group and all covariates. M2 uses economy means. M3, M4, M8 and M9 include economy and year fixed effects plus the full control set, except M9 uses the lean control set and retains staff shares from 5% to 80%. M5 includes economy and year fixed effects plus total tertiary enrolment. M6 and M7 include both tertiary and doctoral benchmarks, so each appears on a separate row. Standard errors are clustered by economy.

The relationship largely disappears within economies. In the model with economy and year fixed effects, the coefficient is 0.65 points and is not statistically distinguishable from zero, p = .545. The interval, minus 1.46 to 2.75, rules out a short-run effect remotely as large as the between-economy association. The five-year-lag estimate is 0.62 points, p = .240, and the larger-sample lean fixed-effects estimate is 0.28 points, p = .719. Raw covariates produce 0.58 points, p = .561, while removing staff shares below 5% and above 80% produces minus 0.36 points, p = .577. The conclusion is therefore not dependent on covariate tails, outcome outliers or a single control set.

This contrast does not mean that women's tertiary education is irrelevant to academic employment. Tertiary participation defines the potential pool and is strongly ordered across national systems. It means that movements in the aggregate pool, within the temporal resolution of these data, do not mechanically change the staff stock. Stable institutional and social conditions account for most of the cross-system alignment.

4.4 Doctoral attainment narrows but does not remove the conversion problem

The doctoral extension contains 418 economy-years from 89 economies. In the pooled model, a ten-point higher female doctoral-attainment benchmark is associated with 2.33 percentage points more female academic staff, with a 95% interval from 1.00 to 3.67, net of tertiary participation, total tertiary enrolment, year, region and income group. Tertiary participation remains independently associated with staffing in this restricted sample.

Once economy and year fixed effects are added, the doctoral coefficient falls to 0.10 points, $p = .698$. The tertiary coefficient is also small and statistically uncertain. Moving the educational comparison closer to the formal qualification for academic work therefore does not generate a reliable within-economy relationship. The result is consistent with a slow-moving staff stock and with institutional filters between qualification, recruitment, retention and promotion.

5. Discussion

This study began with an apparent paradox: women have reached or exceeded tertiary enrolment parity in many systems, yet academic workforces remain less balanced. The global pathway analysis shows that the paradox is not an isolated mismatch. It is a stable system configuration. Early educational disadvantage has receded among reporting economies, and the number of systems where female advantage reaches the workforce has grown. Even so, the academic representation bottleneck remains the modal pathway in every period and has an 86% adjacent-period persistence rate.

The central empirical contribution is the separation of between-economy and within-economy relationships. Cross-sectionally, tertiary gender balance is a powerful marker of women's academic representation. Long-run differences in social norms, labour markets, public policy and higher education institutions plausibly shape both. Within an economy, however, a rise in women's relative tertiary participation has little detectable relationship with the female staff share, either contemporaneously or five years later. The evidence therefore favours a conversion account over an automatic pipeline account.

Three mechanisms can produce this pattern. First, enrolment is a flow while employment is a stock. Academic workforces turn over slowly, and a five-year lag may still be too short for student cohorts to complete postgraduate training and enter stable posts. Parenthood, care and discontinuous employment can lengthen this transition or draw qualified people away from academic careers (Cech and Blair-Loy

2019; Correll et al. 2007; Fox 2005). Second, the candidate pool is segmented by discipline. Aggregate female advantage can be concentrated in fields with fewer academic posts or different career structures, while male-dominated fields retain greater resources and employment opportunities (Charles and Bradley 2002, 2009; Duch et al. 2012). Third, organisational processes mediate movement from qualification to employment. Recruitment networks, temporary contracts, promotion, workload, mobility demands and definitions of excellence can produce cumulative differences even when formal access is equal (Acker 1990; Benschop and Brouns 2003; Nielsen 2016; O'Meara et al. 2017; van den Brink and Benschop 2012, 2014).

The doctoral results are important in this respect. If the mismatch were mainly caused by comparing students with a workforce that requires advanced qualifications, doctoral gender balance should show a clearer within-economy relationship. It does not. Coverage is more limited and the attainment indicator is imperfect, so the null estimate is not decisive. It nevertheless points beyond the size of the qualified pool toward the institutions governing academic careers.

The pathway typology also reveals developmental heterogeneity. A low bottleneck rate is not necessarily a sign of equality. Low-income economies often have male advantage at tertiary level and very low female staff shares, so their constraint begins earlier. High-income economies have high bottleneck prevalence because women's tertiary advantage has not been matched by staffing parity. Upper-middle-income systems more often show female advantage reaching the workforce. The appropriate policy diagnosis therefore depends on where the pathway breaks. Research from Kenya, South Africa, Ghana and South Asia similarly cautions that access, appointment and leadership barriers take different forms across institutional and national contexts (Mabokela 2003; Mabokela and Mawila 2004; Morley and Crossouard 2016a, 2016b; Odhiambo 2011; Toni and Moodly 2019).

These results add a global systems perspective to research on the leaky pipeline and women's academic careers. Bibliometric studies show slow and uneven change in scientific authorship, recognition and seniority (Bendels et al. 2018; Holman et al. 2018; Huang et al. 2020; Larivière et al. 2013; Sarsons et al. 2021; West et al. 2013). Institutional studies identify gendered evaluation, workload and leadership practices (Aiston and Yang 2017; Guarino and Borden 2017; Islam et al. 2023; Morley 2013, 2014; Peterson 2016). Policy studies find that effective change depends on the design and enforcement of organisational interventions, not the mere existence of equality commitments (Bilimoria et al. 2008; Drange et al. 2023; Forman-Rabinovici et al. 2024; Kalev et al. 2006). The present study connects those mechanisms to a long-run global pattern: access parity changes the conditions of possibility, but the academic organisation determines conversion.

6. Implications for policy and institutional management

The first implication is diagnostic. Governments and universities should monitor connected stages rather than celebrate a single parity indicator. A useful dashboard would report tertiary enrolment, doctoral participation, entry-level academic appointments, contract type, retention, promotion, senior

rank and leadership by gender and field. Aiston and Yang's (2017) warning about absent data remains relevant. Aggregate staff shares can reveal a bottleneck, but they cannot locate the precise organisational point where it occurs.

Second, interventions should match the pathway. Where cumulative female disadvantage persists, the priority remains educational access, completion and transition into tertiary study. Where tertiary access lag dominates, finance, admissions and field-specific participation require attention. Where the academic representation bottleneck dominates, another expansion of female enrolment is unlikely to be enough. Institutions need transparent recruitment, monitored shortlists, equitable starting conditions, structured mentoring and sponsorship, fair workload allocation, predictable promotion criteria, care-compatible employment and accountability for outcomes. Evidence on national quotas and organisational programmes suggests that bundled, enforceable measures with assigned responsibility are more promising than isolated training or mentoring (Bilimoria et al. 2008; Drange et al. 2023; Forman-Rabinovici et al. 2024; Kalev et al. 2006). Recruitment reform should also address the informal networks and relationship assumptions through which apparently neutral processes can reproduce unequal outcomes (Rivera 2017; van den Brink and Benschop 2014).

Third, policy horizons should reflect workforce stocks. Annual targets may encourage symbolic compliance or unstable hiring. Cohort-based measures can track whether women are recruited, retained and promoted at rates consistent with the qualified pool over ten or more years. The persistent between-economy differences also support comparative institutional learning. Systems that convert women's participation into workforce representation may offer lessons about employment structures, public-sector careers and care support, but policy transfer should account for national context rather than assume a universal model.

7. Limitations and future research

This study is subject to three principal limitations. First, data coverage is uneven across countries and declines in the most recent years, with particularly sparse information for low-income economies. The use of period medians attenuates annual volatility but cannot eliminate selection arising from reporting practices. The empirical patterns therefore characterise the subset of economies with available data rather than yielding population-weighted global estimates.

Second, the indicators necessarily reduce complex educational and labour-market processes to simplified metrics. Academic staffing data aggregate across ranks, disciplines, contract types and institutional contexts. As a result, aggregate gender parity in staffing may coexist with substantial underrepresentation of women in senior, secure or high-influence positions. The construct of "power" should therefore be understood as a conceptual approximation, rather than a direct empirical measure of formal authority or decision-making capacity. Similarly, enrolment parity is defined in terms of sex-specific participation rates rather than the proportional representation of women and men among enrolled students, and threshold-based category assignments remain sensitive to observations near cut-

points. Data on doctoral attainment do not allow for the identification of recent graduates, fields of specialisation, migration trajectories or subsequent entry into academic employment.

Third, the five-year lag structure does not capture complete academic career trajectories, and the estimated relationships remain associational rather than causal. While fixed-effects specifications mitigate some forms of confounding, they cannot fully address policy endogeneity, measurement error or unobserved time-varying influences. Future research should exploit linked individual-level cohort data and quasi-experimental policy reforms to analyse transitions from tertiary education into academic careers. It should also incorporate information on academic rank, leadership roles, remuneration, contract security, and the intersections of gender with social class, ethnicity, disability and nationality (Unterhalter 2025).

8. Conclusion

The global expansion of women's educational attainment has substantially altered the composition of the academic talent pool, but it has not, in itself, transformed the structure and practices of the academy. Between 2000 and 2022, cumulative female educational disadvantage declined markedly among economies with available data, and an increasing number of systems translated women's educational gains into a female advantage within their academic labour force. Nevertheless, the "representation bottleneck" in academic employment remained both the most prevalent and one of the most persistent pathways.

The contrast between strong cross-system alignment and weak within-system conversion constitutes the core empirical finding of this paper. Economies that exhibit more gender-balanced participation at the tertiary level tend, on average, to employ higher proportions of women in academic positions. However, an individual economy's progress toward enrolment parity does not, in isolation, reliably predict short-term changes in the gender composition of its academic workforce. Parity in educational participation provides the necessary conditions for change-expanding the pool of qualified women-but the translation of this potential into substantive power depends on institutional arrangements that govern the recruitment, retention, promotion and recognition of academic labour.

Declarations

Declarations

Ethics approval:

Not applicable. This study uses publicly available aggregate data and contains no individual-level records.

Competing interests:

Authors confirm no competing interest exist.

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Author Contribution

Conceptualization: JKGAB, AKD, DO Methodology: JKGAB, AKD, DO, EAN, DAA, PBO Investigation: JKGAB, AKD, DO,PBO Data Curation: EAN, DAN, PBO. Formal Analysis: JKGAB, AKD, DO, EAN Validation: JKGAB, AKD, DO Writing – Original Draft: JKGAB Writing – Review & Editing: JKGAB, AKD, DO, EAN, DAA, PBO.

Data Availability

The source indicators are publicly available from the World Bank's World Development Indicators database at https://databank.worldbank.org/source/world-development-indicators.

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Figures

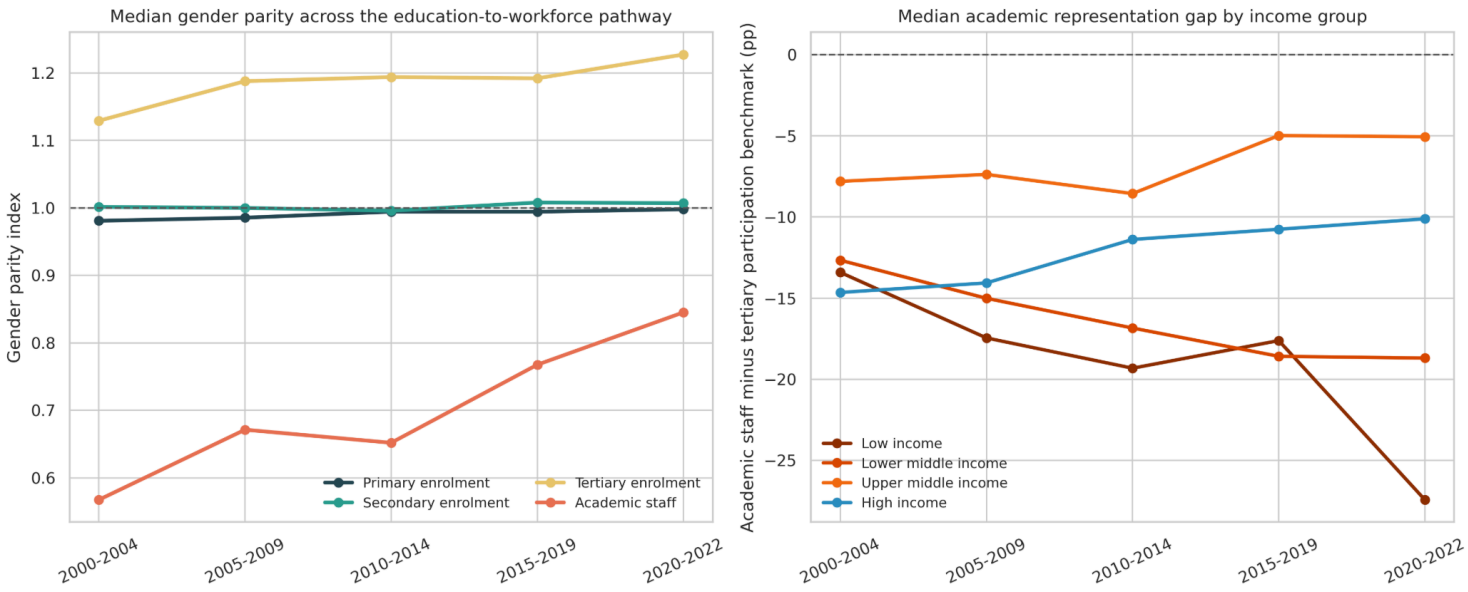


Figure 1

Gender parity and the academic representation gap across five periods

Note. Left panel shows unweighted medians of economy-window means from same-year complete observations. Right panel shows the median female academic staff share minus the parity-implied tertiary participation benchmark. Samples vary by period and income group.

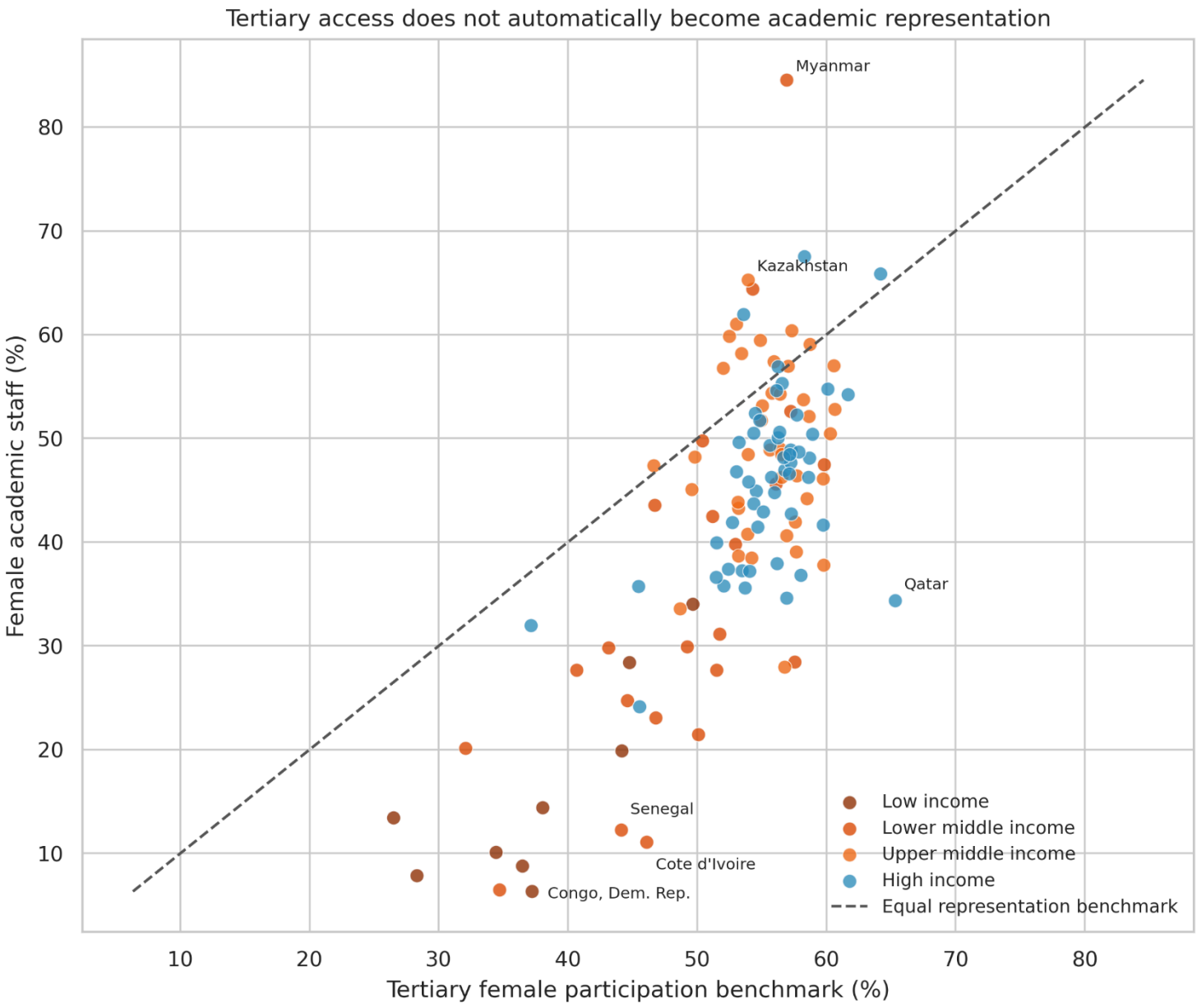


Figure 2

Tertiary participation and women's academic representation, 2018–2022

Note. Each point is an economy-level median from jointly observed years in 2018–2022 (N = 123). The diagonal is the equal-representation benchmark. The horizontal measure is derived from relative female and male gross enrolment rates and is not a student headcount share.

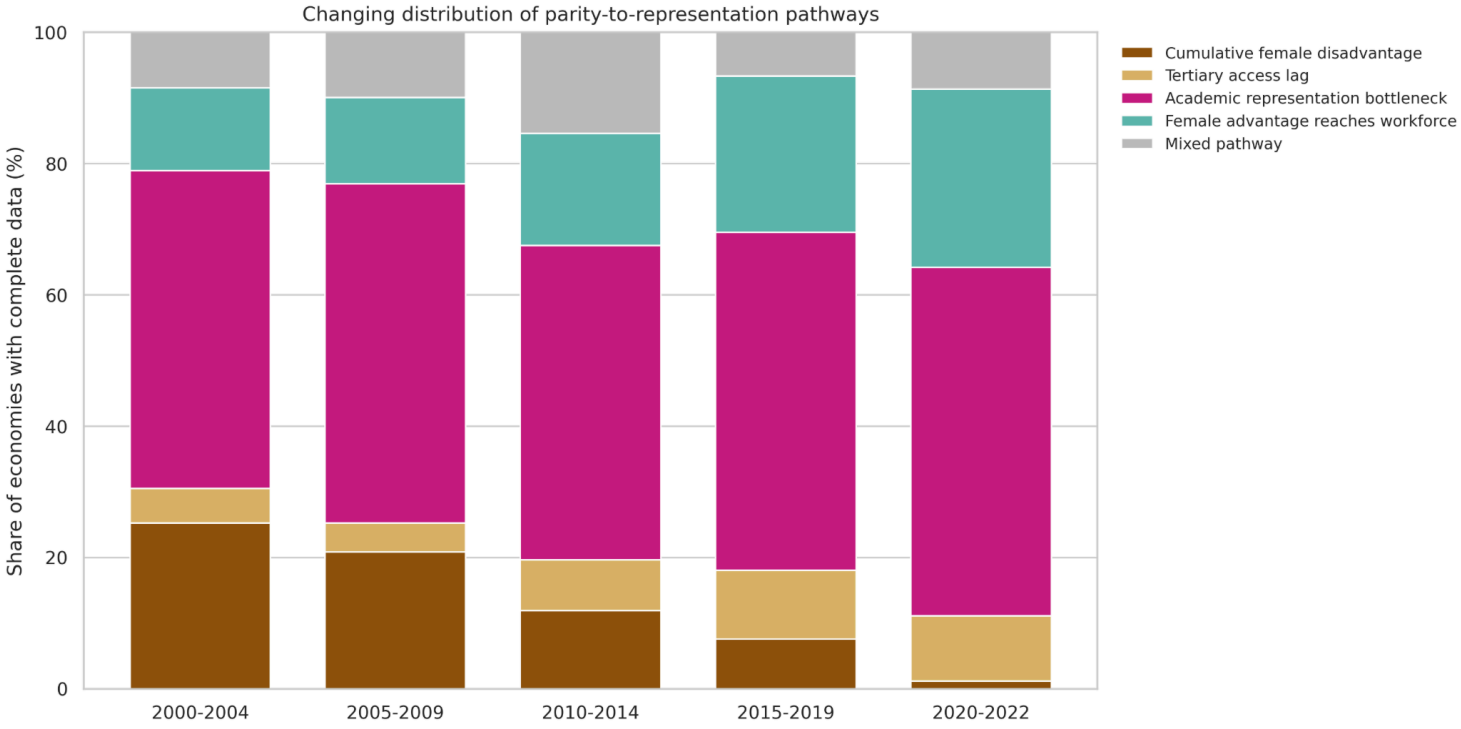


Figure 3

Changing distribution of parity-to-representation pathways

Note. Bars report shares among economies with same-year complete core observations in each period. The academic representation bottleneck is the modal pathway in every period.

Supplementary Files

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