“Determinants and consequences of gender segregation in the labor market: A comparative analysis of Kazakhstan, Kyrgyzstan, and Uzbekistan”

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ARTICLE INFO	Yeldar Mubarakov, Ilona Bordiyanu, Ayazhan Seriktayeva, Zhassulan Baikenov and Gulnar Sarsembayeva (2025). Determinants and consequences of gender segregation in the labor market: A comparative analysis of Kazakhstan, Kyrgyzstan, and Uzbekistan. *Problems and Perspectives in Management*, *23*(3), 413-426. doi:10.21511/ppm.23(3).2025.30
DOI	http://dx.doi.org/10.21511/ppm.23(3).2025.30
RELEASED ON	Friday, 29 August 2025
RECEIVED ON	Saturday, 24 May 2025
ACCEPTED ON	Thursday, 14 August 2025

JOURNAL	"Problems and Perspectives in Management"
ISSN PRINT	1727-7051
ISSN ONLINE	1812-9358
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
38	5	3

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

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DETERMINANTS AND CONSEQUENCES OF GENDER SEGREGATION IN THE LABOR MARKET: A COMPARATIVE ANALYSIS OF KAZAKHSTAN, KYRGYZSTAN, AND UZBEKISTAN

Abstract

Gender segregation in the labor market remains a pressing socio-economic issue in Central Asian countries, where women still face challenges in accessing high-paying sectors and leadership positions. This study aims to uncover the structural and socio-economic drivers of gender segregation in the labor markets of Kazakhstan, Kyrgyzstan, and Uzbekistan, and their impact on employment equity and economic opportunity. The analysis covers the period from 2015 to 2024. The research uses national statistical data and applies the Index of Dissimilarity (Duncan index), the Gender Gini Index, and the Glass Ceiling Index (GCI). Kazakhstan's Duncan index increased from 0.2965 to 0.32195, and Kyrgyzstan's rose from 0.2859 to 0.3347, indicating rising occupational gender segregation. Uzbekistan, in contrast, showed a modest decrease from 0.3223 to 0.3104. Gini index values dropped most significantly in Kazakhstan (from 11.59 to 8.53), reflecting improved wage equality. Uzbekistan also saw a notable decline (from 24.41 to 19.12), while Kyrgyzstan's progress was slower (from 9.02 to 8.33). GCI trends show persistent barriers: in Kyrgyzstan, the index rose from 0.84 to 1.24, while in Kazakhstan and Uzbekistan it remained below 1.0, peaking at 0.91 and 0.74, respectively. A panel regression (R^2 = 0.6647) identified significant predictors: GDP per capita (β = 16.225), women in leadership (β = –3.85), female unemployment (β = 2.98), and the male-to-female employment ratio (β = 0.68). The strongest factor in reducing the gender pay gap was women's representation in leadership. The results highlight structural inequality and call for targeted policy to ensure inclusive labor market development.

Keywords gender, segregation, employment, inequality, leadership, development, labor, economy

JEL Classification J16, J21, J31

Type of the article: Research Article

Received on: 24th of May, 2025
Accepted on: 14th of August, 2025
Published on: 29th of August, 2025

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Conflict of interest statement:
Author(s) reported no conflict of interest

INTRODUCTION

Gender inequality remains a persistent and complex socio-economic issue in the Central Asian countries of Kazakhstan, Kyrgyzstan, and Uzbekistan. Despite several national strategies and international commitments aimed at promoting gender equality, women in these countries continue to face significant barriers in employment, income, and career advancement. One of the most critical manifestations of this inequality is gender segregation in the labor market, which limits access to high-paying sectors and leadership positions for women (International Labour Organization, 2018).

International reports consistently highlight that gender segregation hinders economic growth by reducing the potential contribution of women to the economy (OECD, n.d.). In Central Asia, this issue is

further exacerbated by cultural norms, demographic disparities, and unequal access to education and resources, especially in rural areas (International Monitoring Mission on Labour Rights in Central Asia, 2024). Data from the OECD and ILO indicate that wage gaps, underrepresentation in decision-making roles, and social restrictions persist across the region. Moreover, women's unpaid labor and societal expectations continue to reinforce their disadvantaged position in the formal labor market (Papuc, 2024).

The persistence of both vertical and horizontal gender segregation points to a deeper structural and institutional problem, rooted in the interaction of socio-economic and cultural factors (Blackburn et al., 2002; Rubery & Fagan, 1995). These issues call for closer academic scrutiny and comprehensive policy responses. In light of these challenges, the current study addresses the broader scientific problem of understanding the nature, causes, and implications of gender segregation in labor markets within the context of post-Soviet Central Asia.

1. LITERATURE REVIEW

Gender segregation in the labor market has been widely documented across various economic systems and is typically categorized into vertical (hierarchical) and horizontal (sectoral) forms. One of the foundational authors in this area is Anker (1998), who provides a comprehensive global overview of sex-based occupational segregation. Bettio et al. (2009) later expanded this idea by analyzing the structural roots and policy responses within the European Union, highlighting the persistence of gendered labor divisions despite ongoing reforms. Similarly, Alkadry and Tower (2006) emphasize how institutional structures contribute to unequal pay, with gender discrimination embedded in public sector systems.

Theoretical frameworks have evolved to capture both individual and institutional determinants of segregation. For example, Blau and Kahn (2003) offer comparative insights into gender pay gaps across industrialized economies, revealing how wage-setting institutions and labor market flexibility influence outcomes. Rubery and Fagan (1995) stress the societal context of segregation, arguing that occupational outcomes are shaped by broader gender norms and policy configurations. Blackburn et al. (2002) provide a sociological perspective, linking segregation to structural inequalities and power relations in employment.

Several studies explore how segregation affects labor market outcomes such as underemployment, involuntary part-time work, and subjective well-being. Barrett and Doiron (2001) find that women disproportionately work part-time due to constraints rather than choice, while Green and Livanos (2015) associate underemployment with gendered job characteristics. Kjeldstad and Nymoen (2012a, 2012b) extend this analysis to Norway, demonstrating how gender interacts with employment contracts to produce differentiated experiences of job insecurity. In the UK, Kamerāde and Richardson (2017) link underemployment and segregation to lower life satisfaction among women. Tam (2010) further disaggregates the under- and overemployed populations in the UK, showing that gender plays a significant role in job mismatch and work-hour dissatisfaction. Similarly, Parasnis (2006) provides an in-depth analysis of labor market segregation in Australia, demonstrating that sectoral and occupational divisions remain entrenched despite economic modernization.

From a global comparative perspective, Borrowman and Klasen (2020) identify education, fertility rates, and trade liberalization as key drivers of occupational segregation in developing countries. Gedikli (2020) focuses on Turkey and highlights the role of motherhood and sectoral composition in reinforcing horizontal and vertical segregation. Rodgers and Zveglich (2004) document similar trends in East Asia, showing how structural and policy changes interact with traditional gender roles to affect labor allocation.

Regionally, Khitarishvili (2018) examines gender pay gaps in post-Soviet countries, attributing persistent inequality to both transitional shocks and institutional legacies. In the Kyrgyz Republic, Fachrieva (2017) explores labor market asymmetries and finds that despite increasing female education, traditional gender roles continue to restrict

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women's occupational mobility. Bo'ranova (2025) provides recent insights into Uzbekistan, where legal reforms and gender-targeted programs have aimed to improve women's labor market outcomes but face significant implementation challenges.

Quantitative approaches also play a central role in measuring and interpreting segregation. Farris (2010) revisits the Gini index and its application to labor inequality, while Leijon et al. (2005) investigated how physical work environments are shaped by gender-based occupational clustering. Valletta et al. (2018) study the cyclical nature of involuntary part-time work and its gendered impact, noting the persistent vulnerability of women in recessionary periods. Passinhas and Araújo (2021) propose a computational approach using bit-string models to simulate segregation patterns in labor markets, providing a novel methodological contribution.

In Latin America, Bando (2019) examines gender equality policies and their effectiveness. Bando (2019) emphasizes evidence-based policymaking to address structural barriers. Gedikli (2020) and Cattani and Rizza (2024) link occupational segregation to adverse mental health effects among female professionals, underscoring the broader social costs of persistent inequality.

Studies on masculinity and men's experience in feminized sectors further complicate the picture. Lupton (2006) and Simpson (2004) analyze how men entering female-dominated jobs encounter both stigma and privilege, often receiving better pay and faster promotion. Torre (2018) echoes this in her exploration of "stopgappers" – men who temporarily take on feminized roles yet exit more easily into better-paid, male-dominated fields.

Other studies explore youth and educational mismatches. Acosta-Ballesteros et al. (2018) emphasize how education specialization affects employment and underemployment in Spain, while Martin and Barnard (2013) explore the lived experience of women in male-dominated sectors. Alkadry and Tower (2006) further argue that institutional reform is necessary to combat embedded pay discrimination in the public sector.

Some studies also shed light on gendered labor patterns in emerging sectors. Marco-Serrano et al. (2014) discuss how the creative industries can promote inclusive growth, though they caution that gender segmentation persists even in innovative sectors. Patston et al. (2021) contribute from an education policy angle, calling for creative pedagogical reforms that challenge occupational stereotypes early in life.

Finally, multiple reports and indices underscore these academic findings. The ILO (2019) and the World Economic Forum (2023) both confirm the global scope of gender-based inequality, particularly in wages and senior leadership representation. OECD (n.d.) data similarly confirm that cultural and institutional factors perpetuate inequality, particularly in rural and traditional communities.

In summary, the literature review reveals that gender segregation is a multifaceted phenomenon influenced by cultural, institutional, economic, and individual-level factors. While some progress has been made, particularly through targeted policy initiatives and educational reforms, the evidence indicates that structural barriers continue to reproduce inequality. In the context of Central Asia, there remains a need for more systematic, comparative, and context-sensitive analyses to inform effective policy responses.

Numerous studies have examined gender segregation in labor markets across various national contexts; however, there is a noticeable gap in comparative, region-specific analyses of post-Soviet Central Asia. This study, therefore, seeks to investigate the structural and socio-economic factors that shape gender segregation in the labor markets of Kazakhstan, Kyrgyzstan, and Uzbekistan, with particular attention to its implications for employment opportunities, wage disparities, and career progression.

To address this aim, the following hypotheses are proposed and tested:

H1: In Kazakhstan, Kyrgyzstan, and Uzbekistan, many women are employed in low-paid jobs and occupy less prestigious positions than men.

H2: Jobs and fields where women are predominantly employed are concentrated in the service sector, which contributes to their financial instability.

2. METHOD

This study employs a comparative, mixed-methods design to explore the determinants and consequences of gender segregation in the labor markets of Kazakhstan, Kyrgyzstan, and Uzbekistan between 2015 and 2024. This period was selected due to its alignment with the implementation of the Sustainable Development Goals (SDGs), particularly Goal 5 on gender equality.

Data for GDP per capita were obtained from the World Bank's World Development Indicators database. Gender pay gap data, employment ratios, female unemployment, and the share of women in leadership were drawn from the labor force surveys and national yearbooks of the three countries.

A comparative, mixed-methods approach was adopted, consisting of two main stages:

- Descriptive Analysis – Key employment indicators were examined, including the share of women in various economic sectors, their representation in managerial positions, and gender-based wage differentials.
- Quantitative Analysis – Gender segregation was assessed using standard indices, such as the Duncan dissimilarity index, the Gini coefficient, and the glass ceiling index, to measure both horizontal and vertical dimensions of segregation.

The analysis covered the period 2015–2024 and drew on official statistics from national data sources, including the National Bureau of Statistics of Kazakhstan, the National Statistical Committee of the Kyrgyz Republic, and the Agency for Statistics under the President of the Republic of Uzbekistan.

The statistical analysis was carried out using the R programming language in the integrated development environment RStudio. The following packages were used: for data processing and transformation – readxl, dplyr; for visualisations – ggplot2; for calculating the Gini index – ineq; for regression analysis – car, lmtest, broom; and for preparing tables and graphs – tidyr, reshape2.

The oldest and most commonly used is the Duncan (ID) index. The general formula for calculating the Duncan (ID) index is as follows (1):

$$ID = \frac{1}{2}\sum_i \left| \frac{F_i}{F} - \frac{M_i}{M} \right|, \quad (1)$$

where F_i and M_i are the number of women and men working in the profession; F and M are the total number of women and men working in the economy. i varies from 1 to the number corresponding to the number of professions (industries) in the economy.

The most common explanation for the Duncan index is that it reflects the proportion of men or women who need to change their profession or industry to achieve an even distribution of women and men between occupations.

The dissimilarity index for Kazakhstan, Kyrgyzstan, and Uzbekistan is shown in Table 1, covering the period between 2015 and 2024.

Table 1. Index of dissimilarity

Year	Index of dissimilarity (Kazakhstan)	Index of dissimilarity (Kyrgyzstan)	Index of dissimilarity (Uzbekistan)
2015	0.2965	0.2859	0.3223
2016	0.3188	0.2934	0.3043
2017	0.3041	0.2926	0.3070
2018	0.2992	0.2952	0.2953
2019	0.3046	0.3023	0.2637
2020	0.298	0.3063	0.2719
2021	0.2907	0.3398	0.2612
2022	0.3013	0.3232	0.2585
2023	0.30997	0.3349	0.2641
2024	0.32195	0.3347	0.3104

Sometimes, the traditional income inequality indicator, the Gini coefficient (G), is used to estimate gender distribution by industry and occupation (Mehta & Strough, 2010).

The Gini coefficient is a statistical indicator of the degree of stratification of a particular country or region for this entity, used to estimate economic inequality. The Gini coefficient can vary from 0 to 1. The more its value deviates from zero and approaches one, the more income is concentrated in the hands of individual population groups (Farris, 2010).

Gini coefficients are often used to measure income inequality, but can also assess gender inequality in

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occupations. The Gini coefficient can be viewed graphically or algebraically. The Gini coefficient is calculated in this study as

$$G = 1 - 2\sum_{i=1}^{n} x_i \text{cum} \cdot y_i + \sum_{i=1}^{n} x_i y_i, \quad (2)$$

where x_i is the proportion of the i-th group in the population

$$\left(i = \overline{1,n};\ \sum_{i=1}^{n} x_i = 1 \right),$$

y_i is the proportion of the i-th group in the income volume (the proportion of the i-th group in the population)

$$\left(\sum_{i=1}^{n} y_i = 1 \right),$$

cum y_i is the total proportion of the income (i-th and preceding population).

If G is near zero, the division between countries' citizens is almost even. The Gini indices are shown in Table 2.

Table 2. Gini coefficient

Year	Gini (Kazakhstan)	Gini (Kyrgyzstan)	Gini (Uzbekistan)
2015	11.59	9.02	24.41
2016	11.95	7.53	24.33
2017	10.95	7.45	24.19
2018	11.17	8.42	24.11
2019	11.84	8.98	21.94
2020	11.12	7.27	23.14
2021	8.62	7.41	22.45
2022	7.53	7.51	23.46
2023	8.4	6.08	24.32
2024	8.53	8.33	19.12

Vertical gender segregation is a type of inequality in which men and women occupy different positions in the hierarchical structure of professions, organizations, or industries. This type of segregation is manifested in women's limited access to higher and more prestigious positions than men despite equal educational and professional qualifications. Main features include the gap in leadership positions and the glass ceiling. The quantitative analysis of vertical gender segregation involves statistical and analytical methods to measure inequality between men and women in occupational hierarchies. This analysis determines the extent of women's limited access to leadership positions regardless of their numbers or competencies.

The primary method of quantitative analysis is the glass ceiling index. This index is calculated as the share of women in management positions in the overall share of women in employment. The index is studied in Kazakhstan, Kyrgyzstan, and Uzbekistan. The index of the glass ceiling includes:

- Assessment of the level of gender inequality in the labor market.
- Comparison between industries and regions.
- Proposals to remove barriers to women's career growth.

The calculation formula is

$$GCI = \frac{Proportion\ of\ women\ in\ senior\ position}{Share\ of\ employed\ women}, \quad (3)$$

where *GCI* is the glass ceiling index. *GCI* women are more likely to take up leadership positions. If *GCI* < 1, that is a glass ceiling. The lower the index is, the stronger the resistance. The calculation results are presented in Table 3.

Table 3. Glass ceiling index

Year	GCI (Kazakhstan)	GCI (Kyrgyzstan)	GCI (Uzbekistan)
2015	0.72	0.84	0.59
2016	0.77	0.88	0.60
2017	0.78	0.87	0.59
2018	0.77	0.87	0.59
2019	0.85	0.99	0.65
2020	0.89	1.07	0.64
2021	0.85	1.24	0.64
2022	0.81	1.11	0.67
2023	0.85	1.22	0.68
2024	0.86	1.24	0.74

Panel regression is used to verify the validity of hypothesis 2. Panel regression can improve the accuracy of the estimate, that is, reduce the variance of the estimate, and make the regression more reliable. It allows us to consider both temporary changes and differences between countries, making the methodology more reliable compared to traditional cross or temporal elections.

Panel regression for three states (Kazakhstan, Uzbekistan, and Kyrgyzstan) analyzes gross domestic product per capita in 2015–2024, percentage of women in managerial positions, the ratio of employed men and employed women (in the area of services for living and food), and gender level in the data.

Random effects model is

$$\begin{aligned} &Gender\_pay\_gap_{it} \\ &= \beta_0 + \beta_1 \log\_GDP\_per\_capital_{it} \\ &+ \beta_2 Women\_in\_leadership_{it} \\ &+ \beta_3 Female\_unemployment\_rate_{it} \\ &+ \beta_4 Ratio\_M\_F\_employment_{it} \\ &+ \mu_i + \varepsilon_{it}, \end{aligned} \quad (4)$$

where i is country index; t is year; μ_i is random effect; ε_{it} is random error.

Based on statistical data, a regression equation was constructed in RStudio (Figure 4). Panel data were loaded, and a linear model was built. The dependent variable is the gender pay gap. The independent variables are the logarithm of GDP per capita, the share of women in managerial positions, the female unemployment rate, and the male-to-female employment ratio.

The Duncan, Gini, and Glass Ceiling indices are mainly used to measure gender segregation. However, the methodology is flexible and can be adapted to other indices, such as Carmichael and McLachlan. This flexibility provides reliable future testing and cross-checking with alternative labor market segregation measures.

After all, our counterfactual demonstration was designed to reflect on how changes in labor attitudes can affect gender segregation. This reconstruction showed that closing the learning and training gaps can significantly reduce isolation, and this conclusion is consistent with past considerations in comparative conditions.

The methodological rigor applied in this study ensures that its results will provide a solid basis for policy recommendations aimed at reducing gender segregation in labor markets in Central Asia.

3. RESULTS

This paper presents the results of the empirical analysis of gender segregation in the labor markets of Kazakhstan, Kyrgyzstan, and Uzbekistan over the period 2015–2024. The findings are based on quantitative indicators that reflect horizontal and vertical segregation as well as income inequality between men and women. The analysis also includes the results of a panel regression model used to test the hypotheses formulated in the study.

A comparison of the Duncan dissimilarity index indicators for three countries to identify common trends and differences can be seen in Figure 1.

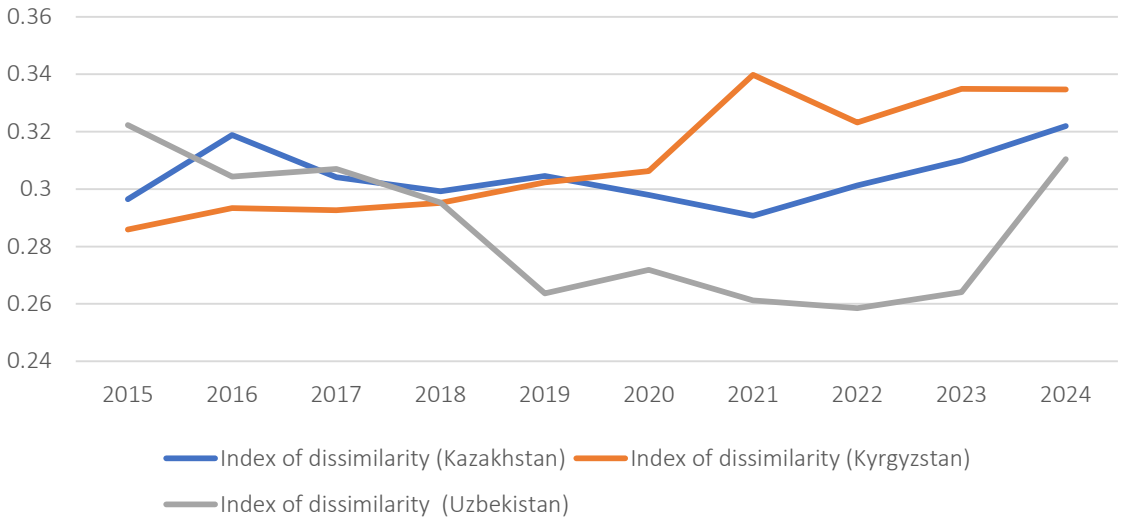

Figure 1. Duncan index for Central Asian countries

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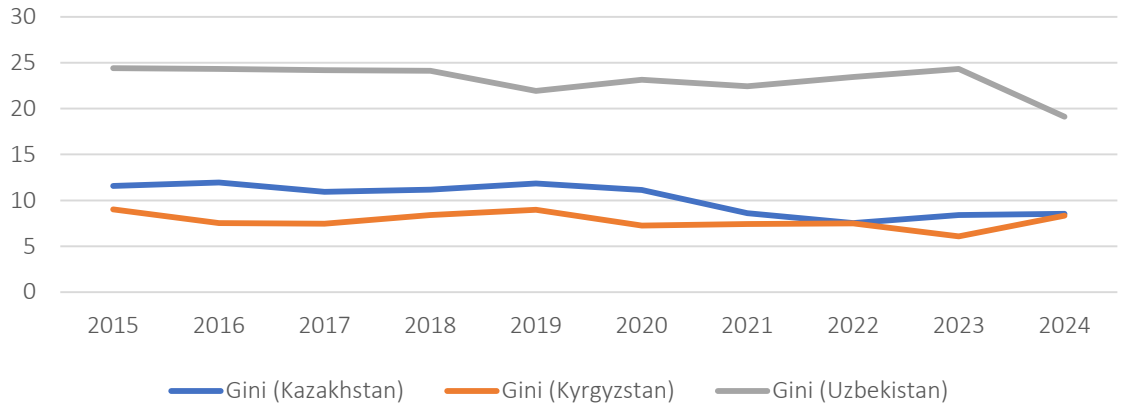

Figure 2. Gini index of the Central Asian countries

Figure 1 illustrates the evolution of the index for each country. In Kazakhstan, the index ranged from 0.2965 in 2015 to 0.32195 in 2024. Although there was a slight decline in the mid-period (2019–2021), it gradually increased again by the end of the observation period. In Kyrgyzstan, the index showed a steady upward trend, increasing from 0.2859 to 0.3347, with the highest value observed in 2021 (0.3400). This indicates a growing disparity in occupational gender distribution. Uzbekistan displayed more volatile dynamics: the index initially declined sharply, reaching its lowest point (0.2585) in 2022, but increased again to 0.3104 in 2024. These data confirm that horizontal segregation remains widespread in all three countries, with Kyrgyzstan exhibiting the highest levels by the end of the period.

To assess gender-based income inequality, the study used the Gini index (Figure 2).

Figure 2 shows that Kazakhstan experienced a significant decrease in the Gini coefficient from 0.1159 in 2015 to 0.0853 in 2024, a reduction of 26.4%. Kyrgyzstan showed a more modest improvement, with the index decreasing from 0.0902 to 0.0833 (7.6%). Although Uzbekistan also demonstrated a reduction in inequality, from 0.2441 to 0.1912 (21.7%), the Gini coefficient remains substantially higher than in the other two countries, indicating persistent wage disparities between genders. These findings suggest that while all three countries made some progress in reducing income inequality, the improvements have not been sufficient to eliminate systemic gender-based pay gaps.

Vertical segregation was assessed using the glass ceiling index (GCI), which compares the proportion of women in leadership positions to their overall employment rate (Figure 3).

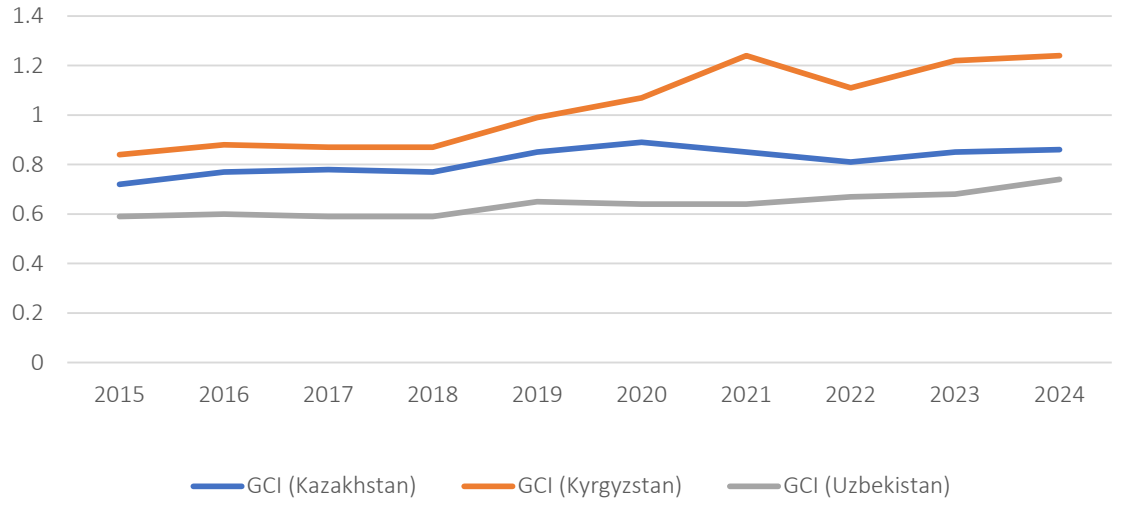

Figure 3. Glass ceiling index of the Central Asian countries

Figure 3 shows that in Kazakhstan, the GCI increased from 0.72 to 0.86 over the study period, indicating gradual but incomplete progress in promoting women to senior positions. In Kyrgyzstan, the index surpassed 1.0 in 2020 and reached 1.24 by 2024, suggesting that women are increasingly represented in leadership relative to their overall employment. This may be due to targeted policies or greater institutional support for gender equality. Uzbekistan, however, remained below 1.0 throughout the entire period, rising from 0.59 to only 0.74, which points to continued barriers to women's advancement in professional hierarchies.

To test the second hypothesis concerning the economic vulnerability of women in female-dominated sectors, a panel regression model with random effects was applied. The dependent variable was the gender pay gap, while the independent variables included GDP per capita (in logarithmic form), the percentage of women in leadership positions, the female unemployment rate, and the male-to-female employment ratio in the service sector. The regression results are presented in equation (5):

$$\begin{aligned} Gender\_pay\_gap_{it} &= -14.483 \\ &+16.225 \cdot \log\_GDP\_per\_capital_{it} \\ &-3.85 \cdot Women\_in\_leadership_{it} \\ &+2.98 \cdot Female\_unemployment\_rate_{it} \\ &+0.68 \cdot Ratio\_M\_F\_employment_{it}. \end{aligned} \quad (5)$$

The regression results led to such conclusions. To ensure the robustness of the regression model, standard diagnostic plots were generated (Figure 4). These plots are essential for validating the assumptions of linear regression and assessing the quality of the model fit.

The Residuals vs Fitted plot shows a relatively random scatter of residuals around the zero line, which suggests that the linearity assumption holds. While the red trend line is slightly curved, the deviation is minor and does not indicate a strong non-linear relationship.

The Normal Q-Q plot demonstrates that the residuals closely follow a straight line, indicating that they are approximately normally distributed.

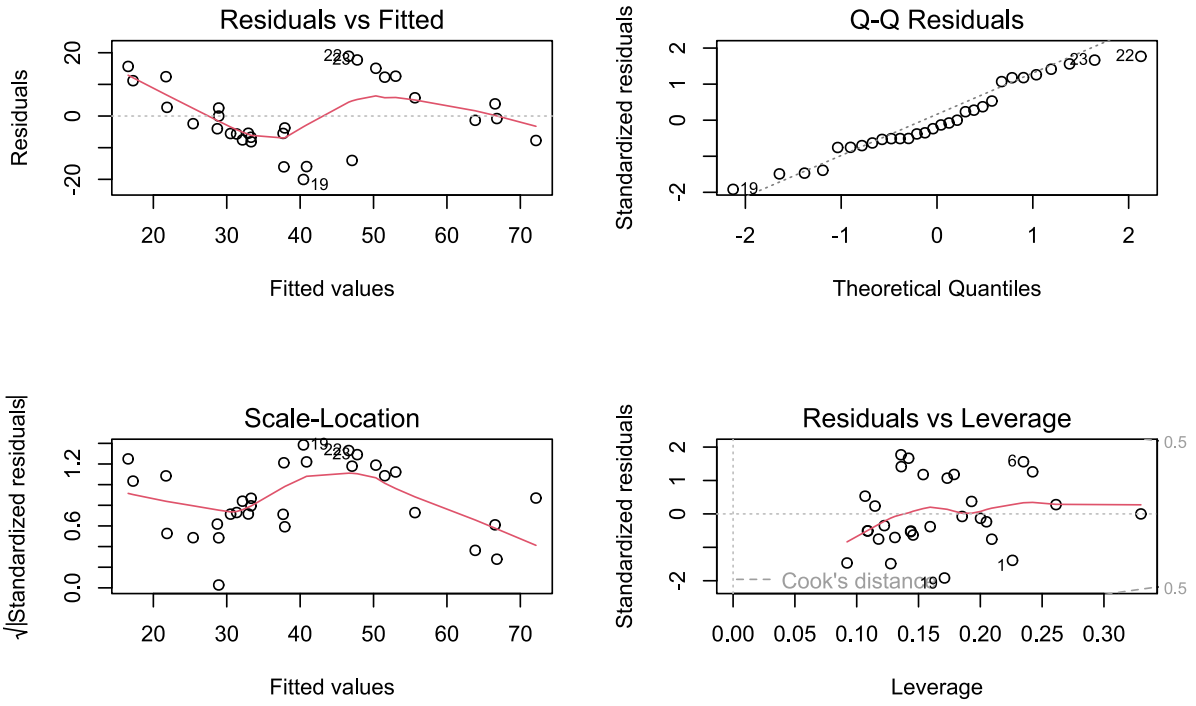

Figure 4. Standard diagnostic plots for model evaluation

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This supports the validity of statistical inferences drawn from the model, such as *p*-values.

The Scale-Location plot shows that the variance of residuals is fairly constant across different levels of fitted values, although slight heteroskedasticity is present. Given its mild nature, it does not substantially affect model reliability but may be addressed in further refinements.

The Residuals vs Leverage plot shows no overly influential observations, confirming that no single data point disproportionately affects the model's results. Most values lie within the Cook's distance threshold, indicating the stability and reliability of the regression.

Overall, these diagnostics confirm that the regression model used in this study is statistically valid, meets key assumptions, and produces reliable estimates for assessing the determinants of the gender pay gap in Central Asian countries.

The results of the panel regression model, visualized in Figure 5 through coefficient plots with 95% confidence intervals, highlight the statistical significance and direction of the relationships between the selected variables and the gender pay gap.

The coefficient for log GDP per capita ($\beta_1 = 16.225$, $p = 0.0001$) indicates a strong positive association: as GDP per capita increases, so does the gender pay gap. This is likely due to economic growth concentrating in sectors that are traditionally male-dominated and better paid. The 95% confidence interval for this coefficient ranges from 9.0993 to 23.351, confirming the robustness of this effect.

In contrast, the coefficient for the share of women in managerial positions ($\beta_2 = -3.85$, $p = 0.0007$) is negative, implying that greater female representation in leadership roles is associated with a narrowing of the wage gap. This suggests that women's participation in decision-making positions can contribute to financial equity. The confidence interval for this effect is [–5.8931, –1.8017], which does not cross zero and further confirms the statistical significance of the relationship.

The coefficient for the female unemployment rate ($\beta_3 = 2.98$, $p = 0.0006$) reveals that as female un-

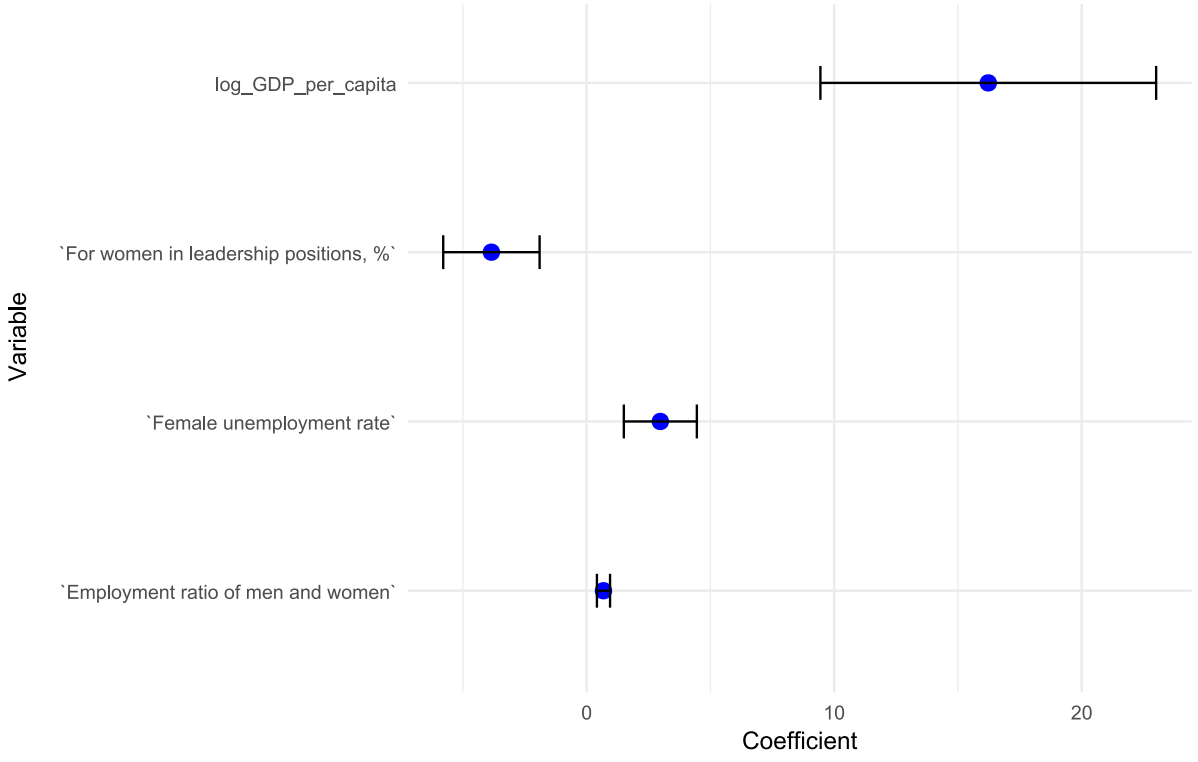

Figure 5. Standard diagnostic plots for model evaluation

employment increases, so does the gender pay gap, suggesting increased economic vulnerability for women who struggle to access stable employment. The corresponding 95% confidence interval [1.4272, 4.5269] supports this interpretation.

Lastly, the coefficient for the male-to-female employment ratio in the service sector ($\beta_4 = 0.68$, $p = 0.0000$) indicates a significant positive relationship with the gender pay gap. The confidence interval [0.4013, 0.9592] confirms that a higher disparity in employment rates between men and women correlates with greater wage inequality. This likely reflects sectoral segregation, where women are overrepresented in lower-paying jobs.

All model variables demonstrated statistically significant effects with p-values well below 0.01, confirming the robustness of the model and supporting the second hypothesis: women concentrated in service-sector jobs face higher risks of economic instability and a wider pay gap.

4. DISCUSSION

The findings of this study provide a multifaceted picture of gender segregation in the labor markets of Kazakhstan, Kyrgyzstan, and Uzbekistan, confirming the persistence of both horizontal and vertical inequality. The results support both proposed hypotheses and offer new insights into the structural and socio-economic factors that influence gender disparities in employment and wages across Central Asia.

The dynamics of the Duncan index, which measures horizontal segregation, revealed notable differences across countries. Kyrgyzstan showed the most consistent decline in the index over time, suggesting that national policies and targeted donor programs may be effectively encouraging female participation in a wider range of occupational sectors. This trend may also reflect comparatively greater openness to gender equality in Kyrgyz society or better institutional implementation of labor reforms.

Kazakhstan's Duncan index showed fluctuations: while the mid-period saw a decline, the later increase signals that the initial progress may not have been institutionalized. This could indicate that gender diversification in the workforce was driven more by short-term programs or labor demand shifts than by deep structural change. The Kazakh experience highlights the need for sustained and systemic efforts, including policy continuity and monitoring mechanisms, to reduce horizontal segregation permanently.

Uzbekistan exhibited the highest volatility in the Duncan index, suggesting that gender representation across sectors is highly sensitive to economic and institutional fluctuations. These could include industrial restructuring, privatization, or informal hiring practices that disproportionately affect women. This pattern emphasizes the importance of long-term, coordinated strategies for inclusive labor development and female empowerment, especially in transitional economies.

The Gini index, adapted here to measure gender-based economic inequality, consistently declined in all three countries over the analyzed period, reflecting improvements in income distribution. However, the rate and magnitude of this decline varied significantly. Kazakhstan showed the sharpest drop (by 26.4%), which may be attributed to its more diversified economy, better access to education, and targeted wage reforms. Nonetheless, wage gaps persist, particularly in higher-paying industries where women remain underrepresented.

Kyrgyzstan's Gini index declined more modestly (7.6%), which may reflect the structural characteristics of its economy, such as higher informal employment and dependency on remittances. These sectors often lack formal pay equality mechanisms and are harder to regulate, placing women at a disadvantage. Uzbekistan also saw a decrease (21.7%), but its Gini index remained the highest among the three, indicating enduring structural inequalities and limited access to high-income jobs for women, particularly in rural and conservative regions.

The Glass Ceiling Index (GCI) highlights the vertical segregation in the region, i.e., the underrepresentation of women in senior and lead-

http://dx.doi.org/10.21511/ppm.23(3).2025.30

ership positions. Kyrgyzstan's GCI exceeding 1.0 since 2020 indicates a potential reversal of the glass ceiling effect, though this paradoxically may reflect women's concentration in administrative roles in sectors with limited career advancement. It is also possible that the high GCI results from a relatively low share of employed women overall, skewing the ratio.

Kazakhstan's GCI remained below 1.0 (ranging from 0.72 to 0.89), indicating that men still hold a disproportionate share of top-level positions. This finding underscores the need for gender-sensitive promotion policies, mentorship programs, and anti-discrimination laws. In Uzbekistan, the GCI rose modestly from 0.59 to 0.74, which suggests some improvement, but vertical segregation remains entrenched.

The panel regression analysis further reinforced these findings and confirmed the second hypothesis: women predominantly employed in lower-paid service sectors are more likely to experience financial instability and a persistent wage gap. The statistically significant positive coefficient for GDP per capita (β_1 = 16.225; 95% CI: [9.0993, 23.351]) suggests that as economies grow, income disparities may also widen, likely due to expansion in high-wage, male-dominated sectors. This result echoes findings from Rubery and Fagan (1995), who showed that economic development alone does not ensure equitable labor market outcomes.

The negative coefficient for women in leadership (β_2 = –3.85; 95% CI: [–5.8931, –1.8017]) confirms that greater female representation in management reduces the gender pay gap; this result aligns with global evidence on the benefits of gender diversity in leadership. Similarly, the positive effects of female unemployment (β_3 = 2.98; 95% CI: [1.4272, 4.5269]) and the employment ratio between men and women (β_4 = 0.68; 95% CI: [0.4013, 0.9592]) demonstrate that unequal participation in the workforce perpetuates financial inequality, reinforcing the segmentation of women into lower-wage sectors.

These results confirm the first hypothesis: women in Kazakhstan, Kyrgyzstan, and Uzbekistan are overrepresented in low-paying jobs and underrepresented in leadership roles, contributing to persistent income gaps and structural inequality.

These findings are consistent with the international literature. Borrowman and Klasen (2020) found that education, fertility rates, and trade liberalization significantly shape gender segregation in developing countries. The Central Asian context supports this claim, particularly as increasing female educational attainment has not fully translated into labor market equality, due to prevailing traditional norms and structural rigidities.

Furthermore, the results also echo Kamerāde and Richardson (2017), who demonstrated that gender segregation and underemployment correlate strongly with reduced subjective well-being. The overconcentration of women in informal and service sectors across the region likely affects not only economic outcomes but also mental health, job satisfaction, and long-term life trajectories.

Comparing these findings to international literature, the results align with Blackburn et al. (2002), who distinguish between horizontal and vertical segregation and underscore the need for separate but integrated policy approaches. While economic indicators may improve, cultural attitudes, institutional barriers, and social norms continue to shape women's labor market outcomes. In all three countries, legal frameworks and policy declarations often contrast with on-the-ground realities, including informal recruitment practices, lack of childcare infrastructure, and social expectations around unpaid care work.

In summary, the study highlights the multidimensional nature of gender segregation in Central Asia. Reducing both horizontal and vertical segregation requires not only economic development but also political will, structural reforms, social dialogue, and investment in inclusive institutions. Future research should further examine intersectional variables, such as rural vs. urban location, age, and education, to design more tailored and effective policy interventions.

CONCLUSION

The primary aim of this study was to identify and analyze the key determinants of gender segregation in the labor markets of Kazakhstan, Kyrgyzstan, and Uzbekistan. By uncovering the mechanisms behind occupational inequality, this paper contributes to a deeper understanding of the socio-economic barriers faced by women and offers evidence-based insights for regional policy interventions. Using a combination of descriptive analysis, segregation indices, and panel regression, the analysis explored the structural inequalities that persist in employment opportunities and income distribution between men and women.

The findings confirm that both horizontal and vertical gender segregation remain significant challenges across all three countries. Women continue to be overrepresented in low-paid service sectors and underrepresented in leadership positions, despite differing levels of economic development and national policy frameworks. The Duncan and Gini indices highlighted persistent occupational and wage disparities, while the Glass Ceiling Index revealed limited female access to decision-making roles. The results from panel regression further supported the hypothesis that gender-based job concentration contributes to financial instability and income inequality.

Based on these results, several conclusions can be drawn. First, policy efforts aimed solely at economic growth are insufficient to address gender inequality without targeted interventions. Second, increasing female participation in leadership and reducing occupational stereotypes are essential to narrowing the gender pay gap. Third, institutional and cultural reforms are required to achieve lasting progress, particularly in Uzbekistan, where traditional norms continue to hinder change.

Future research should investigate the long-term impacts of digitalization, remote work, and labor market flexibility on gender segregation. It would also be valuable to analyze regional and rural-urban disparities, as well as intersectional dimensions such as education level, age, and family status. Comparative studies involving other post-Soviet or developing countries could further enrich understanding and support evidence-based policymaking.

By addressing both structural and cultural barriers, Central Asian countries can move toward more equitable and inclusive labor markets, contributing to broader goals of social justice and sustainable economic development.

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http://dx.doi.org/10.21511/ppm.23(3).2025.30

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