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RESEARCH ARTICLE

Gender Inequality and Labor Market Dynamics: Analyzing Short- and Long-Term Trends in Kazakhstan

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Abstract

Gender-based public policy is crucial for ensuring equal opportunities for men and women across all spheres of life. The objective of this study is to analyze gender inequality trends in Kazakhstan from 2013 to 2023 by focusing on key social and economic indicators, such as political representation, educational attainment, labor force participation, and wage disparities. The study employs K-means clustering to group Kazakhstan's regions into clusters based on gender inequality indicators, such as the Gender Inequality Index (GII), wage gap, maternal mortality, and political representation. The data used in this study come from official statistics provided by the Bureau National of Statistics of the Republic of Kazakhstan and international organizations such as the United Nations from 2013 to 2023. The analysis revealed that Cluster 0 had the lowest gender inequality, with a Gender Inequality Index (GII) of 0.34 and a 27% wage gap. Cluster 1, with a GII of 0.37, exhibited higher disparities, particularly in adolescent birth rates and wage gaps (33%). Cluster 2, with the highest inequality (GII of 0.41), also showed a 32.73 maternal mortality rate and a 24% wage gap. These findings underscore the persistent challenges in gender equality, especially in the areas of economic and political participation, despite improvements in educational access. The study's implications are significant, highlighting the need for targeted policies to reduce wage disparities, improve political representation for women, and address maternal health. These insights can guide policymakers in prioritizing gender-focused interventions for sustainable development, thereby contributing to the broader goal of achieving long-term gender equality in Kazakhstan.

Keywords: Gender, Gender Inequality, Wage Gap, Labor Force Participation, Kazakhstan

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1. INTRODUCTION

Gender inequality and unemployment in the labour market is a pressing issue worldwide. It is not only a social equality issue but also directly impacts economic growth, productivity and sustainable development. According to the International Labour Organization (ILO), women earn, on average, 20% less than men for the same job. This gap persists even in developed countries with highly developed economies, such as the United States, Germany and Japan. In some countries, the gender pay gap is exacerbated by women's lack of access to high-paying and leadership positions. Women are likelier to work in less protected and lower-paid sectors, such as health care, education and retail. In fragile economies, such as Latin America, South Asia and Africa, women face higher unemployment rates than men. This is often due to social norms limiting their economic participation. COVID-19 has made the situation worse. Women around the world have faced a high number of layoffs as the pandemic has hit hard the sectors where they are traditionally highly employed (services, tourism, healthcare). Automation and digitalization also create unequal conditions in countries with market economies, such as the US or UK. Women and men are losing jobs in sectors where technology replaces labour, but women are less represented in promising and technology-driven industries such as IT and engineering.

Structural features of the economy, dependence on male-dominated raw materials industries, and insufficient support for women in the labour market are crucial factors in Kazakhstan. The experience of other countries shows that sustainable growth and reduction of inequality are possible only by removing barriers for women, creating new jobs, and ensuring equal access to resources and opportunities (Stoker et al, 2024). The topic of gender inequality and unemployment is not just a problem; it is a challenge that all countries face, regardless of their level of development. For Kazakhstan, this is also an opportunity to adapt the best global practices and reach a new social and economic development level. The current study aims to analyze the trends in the labour market in Kazakhstan by focusing on the immediate impacts of unemployment and wage disparities and the long-term structural drivers of inequality accelerations.

2. LITERATURE REVIEW

An extensive body of knowledge discusses gender inequality in labour markets. The current study has addressed the multidimensional nature and interconnectedness of discussed topics, including the wage gap, economic activity, and labour unemployment. Wage inequality remains a persistent challenge, with studies examining how segmented labour markets and structural barriers limit women's access to higher-paying opportunities (Berik et al., 2009). Patterns of women's labour force participation over time have been explored, particularly how industrialization and economic restructuring influence women's engagement in the workforce. The shifts in gender disparity are often non-linear. Moreover, they are highly context-specific and mirror variations in the structures of the economy, society and cultural habits (Gaddis & Klasen, 2014). In terms of the labour force, unemployment and underemployment have been exclaimed as key drivers of economic inequality (Tilly et al., 2022). On the other hand, there is a correlation between supply and demand in the labour force, which is highly dependent on equitable access to education and skills training to foster workforce adaptability (Aji & Akbardin, 2024). Thus, gender inequality in labour markets is shaped by a complex of structural, demographic, and policy factors.

Gender wage inequality persists across sectors and regions. Most often as occupational segregation, devaluation of women's work, and between-firm inequality. As a result, women are concentrated in lower-paying roles

and firms, as there are barriers that limit access to leadership and high-wage positions. In some regions, the issue of social perception of women's role significantly affects offered opportunities, and structural reforms, including anti-discrimination policies, wage transparency, and equitable access to leadership opportunities, are required (Mandel & Semyonov, 2014). Firm-level practices, such as wage surpluses disproportionately favouring men, perpetuate disparities (Brynin & Perales, 2016; Brick et al., 2023). In transition economies like Kazakhstan, these patterns are compounded by historical gender norms and discriminatory labour practices, sustaining gaps despite women's high educational attainment (Koskinen & Sandberg, 2018). A widely spread issue, according to McGee et al. (2024), is that women of colour face disadvantages such as lower wages and barriers to career advancement.

Unemployment and underemployment have been consistently identified as key drivers of economic inequality, with distinct impacts on marginalized groups. Women are disproportionately hit by unemployment and precarious employment, and they lack stable and high-quality jobs (Worth, 2016). This is particularly characteristic during economic downturns, where women are the first to lose jobs because they are often concentrated in vulnerable sectors like retail and hospitality (Chesters & Cuervo, 2019). Precarious employment, characterized by temporary or insecure work, compounds these disparities, as seen across European economies, where such employment is increasingly prevalent among younger populations and women (Kretsos & Livanos, 2016). Even more, the effects of accelerating unemployment are not limited to financial instability but also extend its impact on health outcomes, especially for youth promoting precarious job markets (Vancea & Utzet, 2017).

The role of workforce participation in reducing economic inequality has been widely explored in the literature. Increasing women's labour force participation contributes considerably to economic growth, but systemic barriers, including inadequate childcare services, inflexible work environments, and societal norms, continue to impede their full inclusion in the labour market. Macroeconomic factors influence gendered labour market outcomes, and international trade policies can influence gender wage gaps and women labourer force participation (Sauré & Zoabi, 2014). Despite investments in education and skill development including improvement of women's qualifications, there is barely progress in quality employment or increased workforce participation (Klasen et al., 2020). Therefore, current research is focused on the analysis of fluctuations in inequality, focusing on the immediate impacts of unemployment and wage disparities, as well as the compounding effects of changes over time to identify the structural drivers of inequality accelerations. Following hypotheses were developed.

1. Unemployment and gender pay gaps significantly influence short-term changes in overall inequality.

2. Acceleration in unemployment and acceleration in gender pay gaps drive long-term systemic changes in inequality.

3. METHODOLOGY

The conducted literature review allowed to develop the methodology in to explore gender disparity indicators using first and second derivatives for trends and patterns over time analysis. The data was collected from the Bureau of National Statistics and covered the period from 2014 to 2023, includes normalized economic indicators such as wage disparities, unemployment rates, and labor force participation. Data cleaning was conducted by excluding highly correlated predictors identified through correlation matrices and retaining only statistically significant predictors determined via preliminary regression analyses to ensure model reliability.

The first derivative was calculated to represent the rate of change in each indicator

on a year-over-year basis, following the formula (1):

$$\left(\Delta X = X(t+1) - X(t)\right) \quad (1)$$

Specifically, the first derivative was employed to quantify incremental changes, offering insights into whether trends are improving or worsening. The second derivative was calculated according to the following formula:

$$\left(\Delta^2 X = \Delta X(t+1) - \Delta X(t)\right) \quad (2)$$

The second derivative assessed the acceleration or deceleration of these changes, indicating whether the trends are stabilizing, intensifying, or reversing over time.

Linear regression models were employed to analyze both the first and second derivatives of integral measures, particularly SC_OII (first derivative) and AC_OII (second derivative). Independent variables included SC_GEP (gender earnings gap), SC_PW (participation in the workforce), SC_UN (unemployment rates), and SC_UP (underemployment rates), which represent key components of gender disparities. The analysis included coefficient of determination (R^2) and p-values of individual predictors. Diagnostic tests, including the Durbin-Watson test for autocorrelation and Variance Inflation Factor (VIF) for multicollinearity, were conducted. The regression model for SC_OII followed the equation:

$$\mathrm{SC_{OII}} = \beta_0 + \beta_1 SC_{GEP} + \beta_2 SC_{UN} + \epsilon \quad (3)$$

where $\beta_1$1and β_2 are the coefficients of SC_GEP and SC_UN, respectively, and ϵ is the error term. Similarly, the regression model for AC_OII accounted for second-order dynamics with the equation:

$$\mathrm{AC_{OII}} = \beta_0 + \beta_1 AC_{GEP} + \beta_2 AC_{UN} + \epsilon \quad (4)$$

The model captured the acceleration of changes in integral measures.

A methodology with first—and second-order derivatives, correlation, and regression analysis will allow us to better understand how short-term changes and long-term accelerations affect inequality.

Identify dynamics over time: how key economic indicators change year after year (first derivative) and how structural changes accumulate (second derivative), which gives a holistic view of short-term and long-term processes.

Assess the relationships between indicators: Correlation analysis will help us determine which factors – unemployment, the gender gap or others – are most closely associated with inequality, excluding less significant variables to simplify the models.

Quantify the impact of factors: Regression analysis can accurately measure how much each factor (for example, unemployment or the gender gap) affects the level of inequality.

This integrated approach is better because it allows us to describe the situation and explain its causes, which makes the conclusions more justified.

4. ANALYSIS AND RESULTS

The analysis of gender inequality in labor market included three key stages: an examination of the derivatives, a correlation analysis based on a heatmap, and a regression analysis. The first stage involves analyzing the first and second derivatives of gender disparity indicators to identify trends and acceleration patterns over time. The second stage focused on the relationships among variables for both hypotheses. The correlation analysis was used to identify key predictors and address multicollinearity by excluding highly correlated variables. Finally, the regression analysis results, reveal the influence of significant predictors on the dependent variables, highlighting the role of earnings gaps and unemployment rates as primary drivers of both year-over-year changes and accelerations in gender disparities.

Our analysis showed that during the observed period, the labour market in Kazakhstan experienced differentiated negative economic conditions shifts faced by men and women. Gender wage equality, as captured by the first derivative, highlights significant instability. In 2020, the situation for women had a brief improvement in wage gaps (0.145), primarily due to the potential driven by short-term policies or conditions, which converted the period for pandemic-related economic support. However, this progress was not sustained, with a sharp decline by 2023 (-0.193), suggesting that underlying structural barriers to economic independence remained unaddressed. Thus, it resulted in financial insecurity and limited access to stable employment for women.

Economic activity results showed relatively modest year-over-year changes overall. Again, a favourable short-term period was observed during the pandemic in 2019 (0.189). However, these changes were insufficient to address underlying disparities in job accessibility. On top of existing challenges, women faced additional sectoral segregation, unequal hiring practices, and a heavier burden of unpaid care work. For vulnerable groups, including rural populations, these systemic obstacles meant limited employment opportunities and increased reliance on informal or less secure jobs.

The radar charts represent the results for both derivatives in Figure 1.

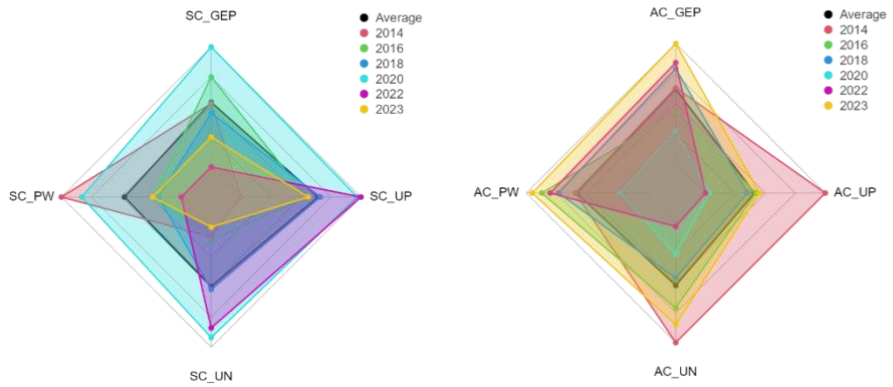

FIGURE 1. Changes and Acceleration Trends Across Economic Indicators, 2014–2023

Note: compiled by authors based on data from the Bureau of National Statistics (2023)

Unemployment trends showed negative changes, and by 2022, the deceleration in unemployment (-0.450) pointed to systemic issues that disproportionately affected women, who are often more vulnerable to labour market shocks. The results showed prolonged periods of unemployment restricted by financial strain and strong dependence on informal support systems. Although positive acceleration was observed in 2021 (0.182), which mainly explained that job creation efforts may have temporarily alleviated some of the pressures, it failed to provide long-term stability.

Income stagnation or reduction was a persistent issue, particularly for women, whose earning potential remained constrained by structural inequities in the labour market. Observed conditions in the labour market, especially for families relying on dual incomes, were highly vulnerable. The stress was mostly due to restricted opportunities to meet basic needs (including access to quality healthcare and education and financial resilience) because

of inconsistent employment opportunities and the wage gap.

Overall, the analysis showed that long-term reforms to stabilize income levels and promote inclusive economic growth were difficult to achieve in Kazakhstan. Women faced economic instability and structural inequities, with limited opportunities for upward mobility, constrained financial security, and reliance on informal safety nets.

In Figure 2, there are presented results for correlation analysis.

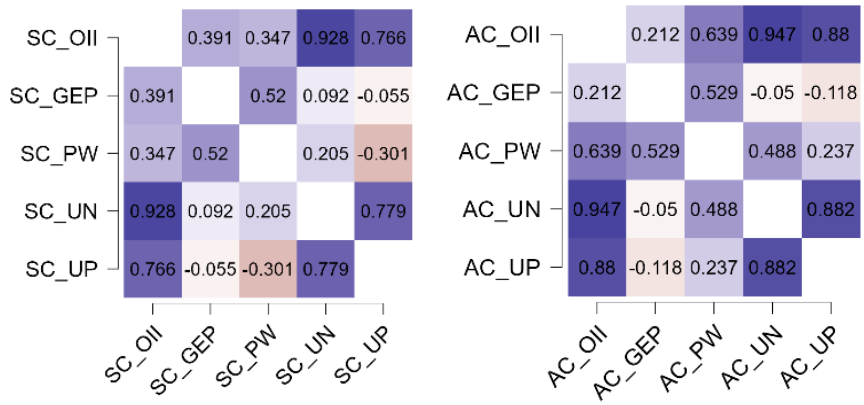

FIGURE 2. Mapping Interconnections: correlation dynamics across economic indicators

Note: compiled by authors based on calculations

The heat maps showed the relationships between dependent and independent variables. The analysis was done to exclude multicollinearity in further analysis. In the first hypothesis, the dependent variable (SC_OII) strongly correlated with dependent variables (SC_UN and SC_UP), emphasizing the significant influence of unemployment and underutilized labour on societal outcomes. In other words, the participation of women and men in the labour market was disproportionately shaped. However, SC_GEP showed weaker correlations with SC_OII (0.391), indicating that while gender pay disparities are important, they play a secondary role in driving overall inequality compared to unemployment-related factors.

In the second hypothesis, the dependent variable (AC_OII) maintained strong correlations with independent variables (AC_UN and AC_UP) above 0,8. This showed the central role of employment-related dynamics in shaping long-term systemic changes. For women, the consistent influence of unemployment acceleration (AC_UN) highlights the structural vulnerabilities they face in accessing stable and equitable employment. Interestingly, AC_GEP demonstrates a weaker relationship with AC_OII (0.212), reflecting how wage inequality, while persistent, contributed less to systemic inequality accelerations during the observed period compared to the broader challenges posed by unemployment and underemployment.

Therefore, certain variables, such as SC_PW and AC_PW (workforce participation indicators), were excluded due to their weaker correlations with societal outcomes. While workforce participation remains essential for economic inclusion, its immediate impact on overall inequality during this period was overshadowed by more pressing issues like unemployment and income disparities. The results supported the analyzed dynamics of employment indicators and the impact of systemic barriers, such as unequal hiring practices and gendered expectations, diminishing their impact on aggregate outcomes on women's economic activity. The

economy of Kazakhstan relies on sectors such as oil and mining, explaining favourable opportunities for men. Women are often observed in precarious or informal employment. Consequently, unemployment and existing labour potential became the most influential factors.

By focusing on these high-impact variables, the analysis sharpens its lens on the root causes of inequality. The regression analysis demonstrated a strong explanatory power for both models (Table 1).

TABLE 1. Structural inequalities and labor market dynamics

Model	R	R^2
1 (SC_OII)	0.977	0.955
2 (AC_OII)	0.982	0.963

Note: compiled by authors based on calculations

The regression results closely reflect the trends observed in the earlier figures, reinforcing the analysis's consistency and the selected variables' reliability. The regression analysis results for both models confirmed the role of gender pay equality (SC_GEP), unemployment (SC_UN), and their long-term dynamics (AC_GEP and AC_UN) due to their high explanatory power (R^2 exceeding 95%). The selected indicators strongly influenced labour market outcomes during the observed period.

The analysis captures a period characterised by fluctuations in gender pay equality and workforce participation, as illustrated in the derivatives and visualised earlier. The strong correlations between unemployment variables and overall inequality, revealed in heat maps, supported that labour market inefficiencies and structural barriers were central causes shaping economic dynamics in the labour market. Interestingly, gender pay gaps, while significant, played a less dominant role in shaping the labour market but still played a meaningful role in increasing disparities.

To sum up, regression analysis results showed that unemployment-related indicators (SC_UN and AC_UN) had the most substantial and consistent impact in terms of inequality. Persistent unemployment worsened systemic disparities and limited economic mobility, predominantly for women. Ultimately, restricted access to well-paying jobs and long-term financial insecurity made it difficult for women to improve their economic stability, but further widened gender inequalities. Even though workforce participation metrics revealed weaker impacts, the results confirmed unequal opportunities for women in the labour market. The analysis allowed us to paint a picture of an economy grappling with deep-seated inefficiencies. Thus, systematic issues in unemployment and gender pay inequality stagnated economic growth and worsened social inequalities. The labour market was defined in two ways, but it was characterized as instability, inequity, and barriers to career promotion for women.

Coefficient results are presented in Table 2.

TABLE 2. Dominant role of unemployment in short- and long-term inequality trend

	Predictor	Estimate	SE	t	p
1 (SC_OII)	Intercept	-0.00178	0.0102	-0.175	0.866
	SC_GEP	0.34652	0.0908	3.818	0.007
	SC_UN	0.53141	0.0477	11.141	<.001
2 (AC_OII)	Intercept	0.00225	0.0127	0.177	0.864
	AC_GEP	0.38657	0.1075	3.597	0.009
	AC_UN	0.53875	0.0406	13.267	<.001

Note: compiled by authors based on calculations

The regression analysis of coefficients showed a consistent pattern across both models. The SC_UN and AC_UN indicators were identified as the strongest predictors of economic inequality, supporting that unemployment is central in driving short-term changes and long-term systemic shifts within the labour market. There was a direct and significant impact on inequality by SC_UN, while the influence on gender pay gaps showed gradual shifts. The indicator SC_GEP showed an insignificant impact. Therefore, unemployment is identified as a fundamental factor affecting economic conditions in the labour market, while the gender pay gap has an insignificant role.

According to the results, unemployment, which is the dominant role of AC_UN in the second model, also stresses long-term structural inequalities. Accelerating unemployment created compounding effects, further marginalizing vulnerable groups and deepening cycles of exclusion.

The findings support that woman have long experienced barriers in the access to stable and equitable employment, and for younger workers, whose entry into the labor market was likely delayed or destabilized during periods of economic disruption.

The significance of unemployment variables in both models pointed to challenges beyond mere job access. The results showed growing instability in the labour market, especially for women. For both models, SC_UN and AC_UN, the results reflect the widespread financial insecurity and reduced economic confidence of many households. For women, these systemic inequalities translated into limited opportunities for career advancement and persistent vulnerability to economic shocks. As unemployment rates fluctuated and accelerated, the informal income system was the central source of income for individuals and families. The gap is widening, and financial insecurity is worsening between those with access to stable employment and those left behind.

Overall, these results reflect a labour market struggling to deliver equity and stability, with unemployment as a structural driver of inequality. Short-term changes in inequality are mainly explained by fluctuations in the unemployment rate, and the influence of the gender factor remains, but less pronounced. Long-term changes in inequality are mainly explained by acceleration of unemployment had the greatest impact on long-term changes in inequality. Acceleration of the gender pay gap also had an impact, but to a lesser extent.

Further, in Table 3 there are assumptions check results.

TABLE 3. Validation of regression models: statistical assumptions

Model	Durbin–Watson Test for Autocorrelation			Collinearity Statistics		
	Autocorrelation	DW Statistic	p		VIF	Tolerance
1 (SC_OII)	-0.210	1.90	0.916	SC_GEP	1.01	0.991
				SC_UN	1.01	0.991
2 (AC_OII)	-0.358	2.39	0.490	AC_GEP	1.00	0.997
				AC_UN	1.00	0.997

Note: compiled by authors based on calculations

The results of the assumption check in Table 3 confirm the reliability and robustness of the selected indicators for the analysis in the current research. The results ensure the accuracy of findings presented in the regression and correlation results and reflect labour market dynamics in Kazakhstan. The Durbin–Watson test for autocorrelation shows no significant evidence of serial correlation in the residuals for both models. For SC_OII, the Durbin–Watson statistic of 1.90 indicates that residuals are independently distributed

(p=0.916), while for AC_OII, the statistic of 2.39 further reinforces the absence of autocorrelation (p=0.490). These results ensure that the relationships captured by the models are free from temporal bias, reflecting genuine patterns in the data.

Collinearity statistics confirm the predictors' independence, with VIF values near 1 and tolerance values close to their maximum of 1 for all variables. This indicates that key predictors—such as SC_GEP, SC_UN, AC_GEP, and AC_UN—each contribute unique explanatory power to the models without redundancy. The lack of multicollinearity is essential for isolating the distinct effects of gender pay disparities and unemployment dynamics on overall inequality. These assumption checks (based on Durbin–Watson and Collinearity tests) validate the accuracy of the hypotheses and support the accuracy of the findings. The results highlight unemployment, particularly SC_UN and AC_UN, as critical factors influencing inequality. The models provide a reliable lens through which to understand the interplay of gender and labor market dynamics in Kazakhstan.

5. CONCLUSIONS

The objective was to study the dynamics of inequality in Kazakhstan's labour market, emphasising short-term changes caused by unemployment, the gender pay gap and long-term structural factors contributing to the acceleration of inequality. The objectve of current research was to reveal the main factors influencing inequality and recommend developing more inclusive economic policies. Short-term hypothesis was partly confirmed.

Unemployment and the gender pay gap significantly affect short-term changes in the overall level of inequality. Unemployment was the main factor in short-term changes, while the effect of the gender pay gap was less significant.

The long-term hypothesis was fully confirmed. *The acceleration of unemployment and the gender pay gap are key drivers of long-term structural changes in inequality*. Results confirmed that structural problems in the labour market related to unemployment are the primary source of long-term inequalities.

The results showed that unemployment is the main driver of inequality. It strongly influences both short-term changes (where the situation changes from year to year) and long-term trends (where the effect is cumulative). The level and acceleration of unemployment play a more significant role than the gender pay gap. The gender pay gap was also important, but its impact was weaker. It increased inequality but was not as “systemically important” as unemployment. So, women's wage problems were more a part of the overall crisis than its primary cause. Finding stable work was difficult. Women were more likely to be unemployed or to have to accept low-paid positions. The acceleration of unemployment led to more people dropping out of the labour force, which created long-term problems: less income, more debt, and dependence on family or state assistance. Families, especially those with dual incomes, were vulnerable as earnings became unstable and expenses remained high. Under conditions of economic instability, the main problem was unemployment, which not only made it difficult to find work but also exacerbated the gap between rich and poor. Women mainly suffered because they earned less and had difficulty finding stable jobs. The economy as a whole did not provide equal opportunities, which is why many had no chance of breaking out of poverty.

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