ӘЛЕУМЕТТІК-ЭКОНОМИКАЛЫҚ ЖӘНЕ ҚҰҚЫҚ ҒЫЛЫМДАРЫ
СОЦИАЛЬНО-ЭКОНОМИЧЕСКИЕ И ЮРИДИЧЕСКИЕ НАУКИ
SOCIO-ECONOMIC AND LEGAL SCIENCES

CENTRAL ASIAN SCIENTIFIC JOURNAL
ISSN 3135-3061
2026. No. 4 (32), Vol. 2. pp. 140–151
DOI: https://doi.org/10.5281/zenodo.24220161
Journal website: https://cajournal.kz

UDC 378.147

PURSUING THE DEMOGRAPHIC DIVIDEND IN CENTRAL ASIA: FEMALE LABOUR FORCE PARTICIPATION AND POTENTIAL ECONOMIC GROWTH

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Abstract: This article examines how demographic change and female labour force participation could affect economic output in Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Turkmenistan by 2050. Using World Bank demographic and labour data, the study constructs three labour force scenarios and translates their implications into output effects through a Cobb–Douglas production function. The results indicate that demographic expansion is the largest source of projected labour force growth in every country, while higher female participation adds approximately 3,173 participants in Kyrgyzstan and 1.66 million in Uzbekistan. Under the combined scenario, the largest proportional output gain is in Tajikistan (46.16%), while Uzbekistan has the largest absolute gain ($55.335 billion in constant 2015 dollars). These conditional estimates assume productive employment and constant capital and technology; they are not forecasts of actual GDP or causal estimates of reform effects.

Keywords: demographic dividend, Central Asia, female labour force participation, population projections, labour markets, economic growth, Cobb–Douglas model

Introduction

The demographic dividend describes the potential economic benefit arising when the working-age population grows relative to dependent age groups. A change in age structure does not itself guarantee faster growth: its economic effects depend on whether people can obtain productive work and on the availability of education, healthcare and appropriate institutions [1]. East Asian experience has attracted particular attention because demographic change coincided with investments in human capital, employment and economic development [1].

Central Asia provides a setting in which to examine this relationship. Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Turkmenistan have different population structures and labour markets, but all face the challenge of creating opportunities for expanding working-age populations. The population inputs used in this study imply an increase in their combined population aged 15–64 from approximately 52.0 million in 2025 to 71.9 million in 2050 [2]. This increase in absolute size is not identical to an improvement in the age-dependency ratio: a country can have more working-age people while ageing or experiencing a less favourable dependency ratio.

Female labour force participation is an important part of this question. Women who are able and willing to work can contribute to the labour supply, yet participation depends on the availability

of jobs and childcare, education, occupational access and the wider institutional environment. Participation also differs from employment: the labour force includes both employed people and those seeking work. The relationship between participation and output therefore depends on whether additional participants find productive employment.

The aim of this article is to compare the potential contribution of demographic expansion and changing female participation to labour force growth and output in the five Central Asian republics. It asks how much the labour force could expand by 2050 under alternative participation assumptions, and how these differences translate into model-implied output. The analysis combines descriptive evidence on fertility and participation with population projections, recent-trend scenarios and a common production framework. Its results are intended to illustrate conditional possibilities rather than predict the economies' actual paths.

The demographic transition provides a useful way to interpret the changing age structure. When mortality falls while fertility remains relatively high, a large younger cohort emerges. If fertility subsequently declines and that cohort enters working age, the number of working-age people can increase relative to the number of children. As that cohort ages, old-age dependency may in turn rise. The timing and magnitude of these changes differ between countries, and the transition model should be treated as an organising framework rather than a fixed timetable that every society must follow.

An increase in the working-age population may expand an economy's productive capacity, but it also creates demand for education, housing, healthcare and employment. If job creation does not keep pace, an expanding labour supply may instead be accompanied by unemployment, underemployment or outward migration. The relevant policy challenge is therefore not only to expand the number of people available for work, but to support their access to productive and appropriately paid jobs.

The original research identifies several conditions that influence whether the dividend can be realised: education and health, access to employment, gender equality, effective institutions and channels through which savings can support investment. These conditions interact. For example, education can improve opportunities, but a qualification alone does not ensure that a suitable job exists. Similarly, access to employment may depend on affordable childcare, transport, workplace safety and the enforceability of equal-opportunity rules. Such mechanisms help motivate the focus on female participation in this study without assuming that a single policy will determine it.

A demographic dividend can also be examined at more than one level. An increase in total GDP can result from a larger population even if income per person does not increase. A favourable change in the working-age share can contribute to a per-person dividend if employment and productivity conditions allow it. The model below measures the output associated with a change in aggregate labour input while holding other inputs fixed; it does not separately calculate GDP per capita or the contribution of changing dependency ratios. This distinction is especially important when comparing countries with different population growth rates.

Materials and methods

The study uses World Bank World Development Indicators for population, fertility, labour force participation and real GDP, together with the World Bank's population estimates and projections [2–6]. Working age is defined as 15–64. The participation rates used in the calculations are the country-specific values reported in the underlying research. Where indicators are based on modelled International Labour Organization estimates, they should be interpreted as estimates rather than direct counts of every worker. Population and participation series may also be revised, so the results reproduce the inputs in the original study rather than a newly downloaded dataset.

The 2025 baseline combines the working-age population by sex with the corresponding male and female participation rates. Female rates use the unrounded observations in the original paper's embedded historical chart; the male rates retain the published inputs. For each country, the labour force is calculated as:

$$L = (m/100) \times M + (f/100) \times F \quad (1)$$

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Here L denotes the total labour force; M and F are the male and female populations aged 15–64; and m and f are the respective participation rates in percent. The calculation applies the same identity to 2025 and to each 2050 scenario. Because the populations and rates are rounded in the source tables, recalculations from displayed values may differ slightly from the underlying results.

Three 2050 scenarios separate the components of change. The demographic-only scenario applies the observed 2025 participation rates to the projected 2050 population. It shows the change associated with population growth when participation rates are held fixed. The status-quo scenario keeps female participation at its 2025 value but uses the historical mean of male participation in 2050. The reform-based scenario combines that male assumption with a female participation rate extrapolated from a recent, policy-calibrated trend. All three are compared with the same 2025 baseline.

The male participation parameter is the published, two-decimal mean of the four benchmark observations reported for 2010, 2015, 2020 and 2025. It is not the average of every annual observation in that period. The original study uses the observed 2025 rate for the baseline and the four-observation mean at the 2050 endpoint. This creates a distinct male adjustment between the demographic-only and status-quo scenarios. In Uzbekistan the mean lies below the observed 2025 rate, producing a negative adjustment; in the other countries the adjustment is positive and comparatively small. This is an assumption for comparison, not a prediction of male participation.

Female rates in the reform-based scenario are derived by extending country-specific linear trends to 2050. To select the start of the estimation period, the original study classifies relevant policies according to their scale and directness, assigns scores of one to three, and compares three-year windows of policy activity. It identifies 2021 as the candidate breakpoint for Kazakhstan, Kyrgyzstan and Tajikistan; 2017 for Uzbekistan; and 2019 for Turkmenistan. The regression is refitted using the original historical observations from the selected year through 2025, including unrounded 2025 values; full-precision coefficients are used to project 2050. The selected period is associated with policy activity, but the method does not identify a causal effect of individual reforms.

The reform-based results depend strongly on continuing a recent linear trend for 25 years. The original study reports particularly weak fits for Kazakhstan, Kyrgyzstan and Turkmenistan, making their extrapolations especially uncertain. A high within-sample fit, where present, does not establish that a trend will continue or that reform caused it. Short post-breakpoint periods also restrict the evidence available for assessing a long-term trajectory. The policy score involves judgement, and the timing or announcement of a reform does not establish its implementation or effectiveness.

To translate labour force changes into output, the study adopts a Cobb–Douglas production function, following the labour and capital structure of the Solow model [7]:

$$Y = K^{\alpha}(AL)^{1-\alpha} \quad (2)$$

Y is output, K is physical capital, A is labour-augmenting technology and L is labour input. The analysis sets α equal to one third, so the labour elasticity is two thirds. Capital and technology are held constant for the comparison. The resulting exact proportional change in output between the baseline and a scenario is:

$$\Delta Y / Y_0 = (L_1 / L_0)^{2/3} - 1 \quad (3)$$

The percentage effect is applied to 2025 GDP in constant 2015 US dollars to obtain an illustrative monetary equivalent [5]. This procedure holds other determinants of output at their baseline levels. It does not estimate actual 2050 GDP, annual growth, the economy-wide consequences of changing capital accumulation, or the effect of demographic change per person. The results should therefore be understood as conditional labour-input effects, not a full estimate of a welfare-adjusted demographic dividend.

The framework assumes that additional labour force participants obtain productive employment and contribute equally to labour input. It does not distinguish hours worked, skills, unemployment, migration, occupational differences or informal work. These simplifications make

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comparison possible but are consequential: higher participation need not translate one-for-one into higher employment or equally productive work. An increase in aggregate output also does not necessarily imply an increase in output per person or household welfare.

The decomposition follows directly from the ordering of the three scenarios. Let L_0 denote the 2025 labour force, L^D the demographic-only value, L^s the status-quo value and L^R the reform-based value. The demographic, male-participation and female-participation components add to the total change as follows:

$$L^R - L_0 = (L^D - L_0) + (L^s - L^D) + (L^R - L^s) \quad (4)$$

For Kazakhstan, the recalculated demographic, male and female components are approximately 2,656,344, 22,172 and 330,392 people, respectively, giving a combined increase of 3,008,908. In Uzbekistan, the male adjustment is negative: approximately 6,105,551 − 338,069 + 1,659,004 equals 7,426,486. These identities help prevent the female component from being confused with the full demographic gain. The use of rounded displayed figures can produce a one-person discrepancy in some countries.

The output calculations use the same ordering, but the size of an effect depends on the reference point. A difference in the two 2050 output levels may be expressed relative to the 2025 baseline or relative to status-quo output. These percentages have different denominators. To avoid conflating them, the results table reports each scenario's percentage change relative to 2025 and reports the difference between their monetary output levels separately. The difference in percentage points between the two reported baseline-relative growth figures should not be labelled as a percentage increase over the status-quo level.

The 2050 female participation inputs are conditional trend extensions, not policy targets. The policy-intensity procedure selected candidate periods by scoring identified reforms from one to three and summing their scores across three-year windows. A window needed activity in at least two of the three years. Where overlapping windows tied, the underlying study considered the first year of the relevant activity and the nature of the reforms. These rules make the selection more explicit, but choices about which policies to include and how to score them remain judgement calls. A formal structural-break test or an evaluation of individual policies would require additional analysis.

The distinction between the labour force and labour input also matters for interpretation. Participation includes unemployed jobseekers, while the production function requires productive labour input. The scenario therefore applies an additional full-absorption assumption: any extra participant contributes to output as though employed. If only some additional participants find work, or if their hours differ, the output effect would be smaller than the estimate implied by an equal-unit assumption, all else equal. Conversely, the present framework does not capture effects that could arise through changes in investment or productivity.

For a selected country, the post-breakpoint regression can be written as follows, where f is the female participation rate, t is the calendar year, a is the intercept, b is the estimated annual change in percentage points and ε is the residual:

$$f_t = a + bt + \varepsilon_t \quad (5)$$

The projected 2050 rate is obtained by evaluating the fitted line at t = 2050, conditional on continuation of the recent trend. The policy-window score is calculated by summing the annual policy scores S over three consecutive years:

$$W_t = S_t + S_{t+1} + S_{t+2} \quad (6)$$

The annual score sums the researcher-assigned scores for included policies in that year. W identifies a concentration of policy activity; it is not an estimate of policy effectiveness.

Results and discussion

The demographic inputs in Table 1 point to growth in the working-age population in all five countries. Uzbekistan has the largest absolute increase, while Tajikistan has the largest proportional increase in both the male and female working-age populations. Kazakhstan's projected growth is smaller in percentage terms, despite a substantial increase in the absolute number of working-age

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people. The estimates are conditional on the assumptions of the underlying population projections, including fertility, mortality and migration.

Table 1 – Working-age population by sex in 2025 and 2050, millions

Country	Male 2025	Male 2050	Female 2025	Female 2050
Kazakhstan	6.361	8.212	6.533	8.118
Uzbekistan	11.748	16.736	11.462	16.131
Kyrgyzstan	2.247	3.146	2.315	3.148
Tajikistan	3.150	5.017	3.329	5.044
Turkmenistan	2.394	3.206	2.480	3.183

Figure 1 compares working-age population in 2025 and 2050. In the figures, KAZ, UZB, KYR, TAJ and TUR denote Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Turkmenistan, respectively.

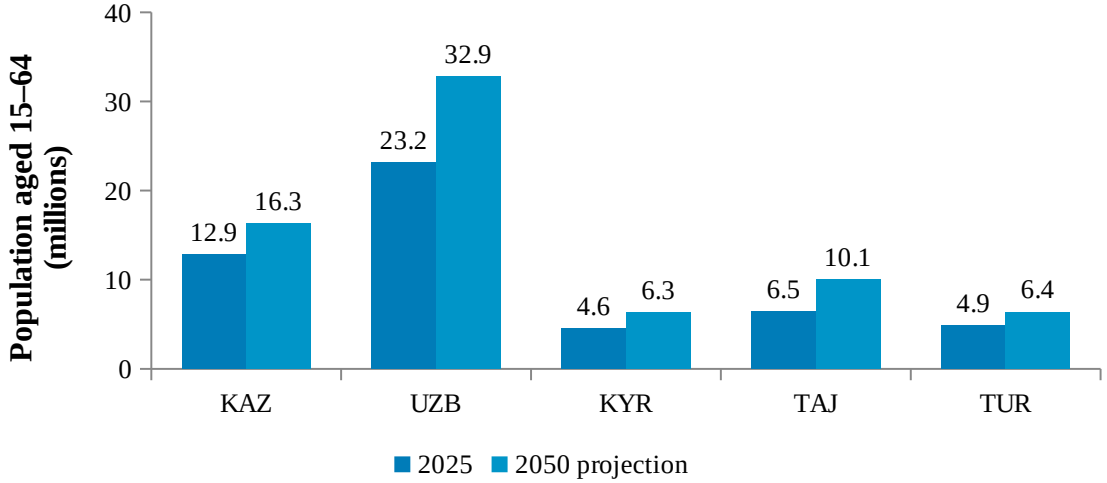


Figure 1 - Working-age population in 2025 and projected 2050

The scale of population growth should be considered alongside age structure. In the underlying research, Tajikistan's total dependency ratio falls from 66.5 to 54.8 dependants per 100 working-age people between 2025 and 2050, whereas Kazakhstan's rises from 61.7 to 62.5. Kazakhstan's old-age dependency ratio increases from 14.6 to 22.4. Thus the economic challenge is not identical across the region: countries with younger populations face the immediate task of creating jobs, while ageing also increases the importance of productivity and the sustainability of support for older people. These are scenario inputs, not guarantees of future demographic outcomes.

Fertility and participation present another important contrast. In the original study's 1990–2025 comparison, total fertility declined alongside female participation in Kyrgyzstan, Tajikistan and Turkmenistan. Uzbekistan recorded a decline in fertility together with a rise in female participation, while Kazakhstan saw small increases in both. This descriptive comparison challenges the assumption that lower fertility automatically leads to higher female labour force participation. It does not identify why the two indicators moved as they did, nor establish a causal relationship between them. Differences in data coverage, the definition of participation and other economic changes matter when comparing countries.

The findings nevertheless suggest a practical distinction between having fewer children and having access to a suitable job. The availability and affordability of childcare, safe transport, skills, formal employment and protection against discrimination may shape whether women can enter or remain in paid work; evidence on care provision in Kyrgyzstan illustrates one of these mechanisms [8]. Informal activity and unpaid care also complicate comparisons of measured labour force participation. Improving women's opportunities requires attention to the quality and conditions of work as well as the headline participation rate.

Table 2 presents the participation assumptions used in the scenarios. The largest projected increases in female participation are in Uzbekistan and Tajikistan. Kazakhstan begins with the

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highest female rate in the dataset, while Tajikistan begins with the lowest. The differing baselines and projections mean that the same change in the size of the working-age population does not produce the same change in the labour force in every country.

Table 2 – Labour force participation inputs, percentage

Country	Male 2025	Male 2050	Female 2025	Female 2050
Kazakhstan	80.70	80.97	73.348	77.418
Uzbekistan	79.55	77.53	45.782	56.066
Kyrgyzstan	74.79	75.35	47.765	47.866
Tajikistan	58.54	58.58	23.223	33.419
Turkmenistan	48.32	48.76	41.455	44.637

Figure 2 illustrates the baseline female rates and the recent-trend scenario for 2050.

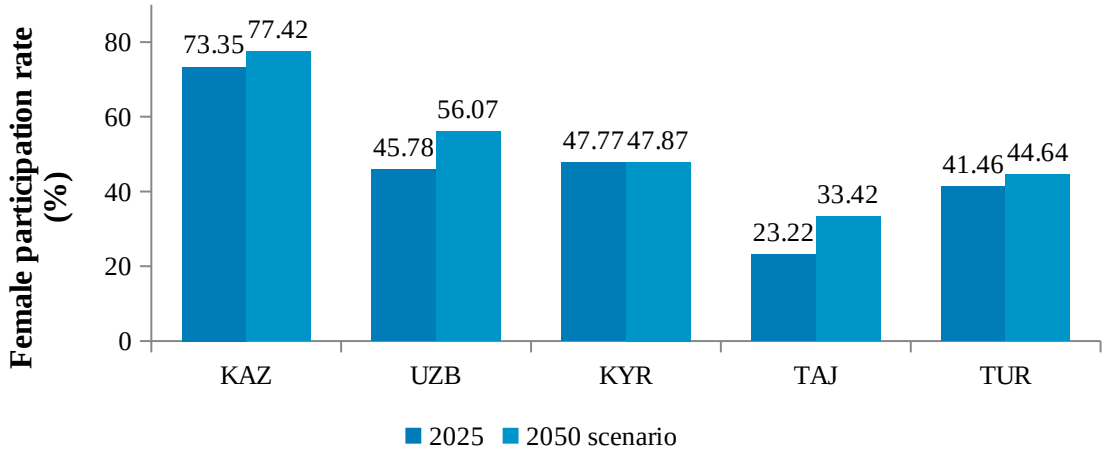


Figure 2 - Female labour force participation in 2025 and the 2050 scenario

The difference between the reform-based and status-quo labour forces isolates the effect of applying the higher projected female participation rate to the 2050 female working-age population. As Table 3 shows, this difference ranges from approximately 3,173 in Kyrgyzstan to 1.66 million in Uzbekistan. The latter figure reflects both the projected change in the participation rate and Uzbekistan's large female working-age population. Tajikistan has the second-largest additional female labour supply under the scenario, at approximately 514,000.

Table 3 – Components of labour force change between 2025 and 2050

Country	Demographic change	Male adjustment	Additional female participation	Total change
Kazakhstan	2,656,344	22,172	330,392	3,008,908
Uzbekistan	6,105,551	−338,069	1,659,004	7,426,486
Kyrgyzstan	1,070,376	17,619	3,173	1,091,168
Tajikistan	1,491,253	2,007	514,316	2,007,575
Turkmenistan	683,622	14,105	101,288	799,015

Figure 3 compares all three components in Table 3; the male adjustment is negative in Uzbekistan.

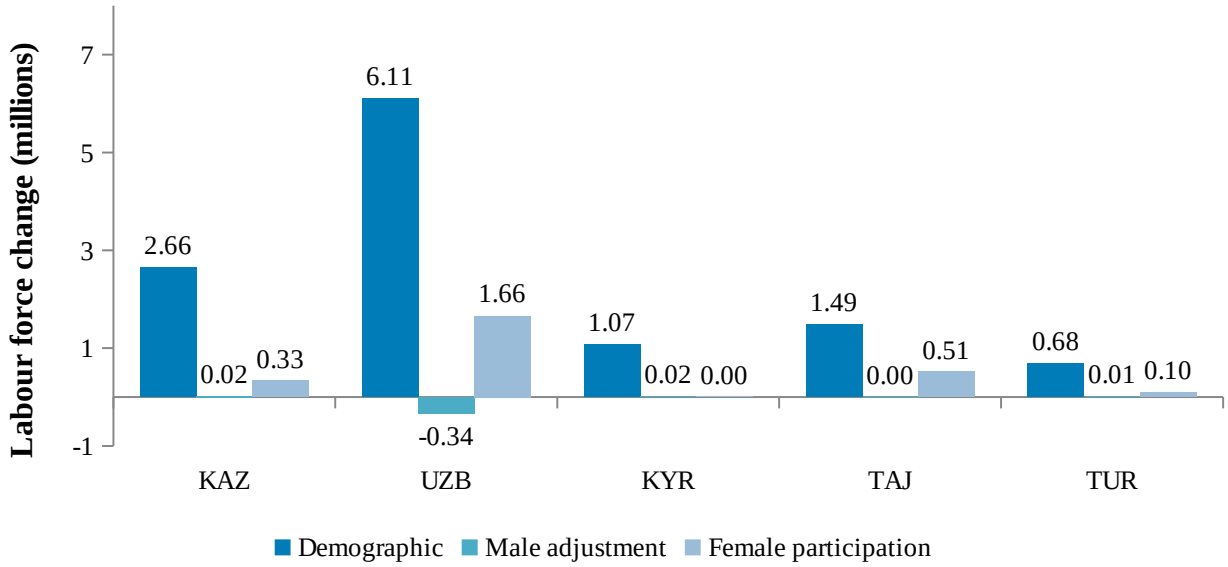


Figure 3 - Components of projected labour force change

Demographic expansion is the largest of these three components in each country. In Uzbekistan it contributes approximately 6.11 million people to the projected labour force, compared with an additional 1.66 million associated with the female participation assumption. In Tajikistan the respective figures are approximately 1.49 million and 0.51 million. Across the five countries, female participation is therefore an additional source of potential labour supply, while population change is the principal driver in these particular scenarios.

The male adjustment is much smaller than the demographic component in every country. Uzbekistan is the only case in which it is negative, because the 2050 historical-mean assumption is below the 2025 male rate. This result is built into the scenario design and should not be read as independent evidence that participation will fall. Similarly, the positive female contribution in each country reflects the projected rates in Table 2; different assumptions about future participation would yield different estimates.

The combined reform-based labour force grows by 30.32% in Kazakhstan, 50.89% in Uzbekistan, 39.16% in Kyrgyzstan, 76.71% in Tajikistan and 36.57% in Turkmenistan relative to 2025. Tajikistan therefore has the largest proportional expansion despite a smaller absolute gain than Uzbekistan. These figures concern labour supply and not necessarily employment. Absorbing additional participants would require sufficient job creation and effective matching between workers and employers.

Table 4 converts the labour scenarios into output effects. In the status-quo scenario, the largest proportional increase is in Tajikistan at 35.12%, followed by Uzbekistan at 24.86%. Under the reform-based scenario, the corresponding effects rise to 46.16% and 31.55%. Across the region, the combined scenario produces a larger effect than the status-quo scenario because all projected female participation rates exceed their 2025 values.

Table 4 – Conditional labour-driven output effects by 2050

Country	Status quo, %	Reform-based, %	Total gain, $bn	Extra gain, $bn
Kazakhstan	17.27	19.31	50.272	5.313
Uzbekistan	24.86	31.55	55.335	11.738
Kyrgyzstan	24.58	24.65	2.815	0.008
Tajikistan	35.12	46.16	7.931	1.898
Turkmenistan	20.29	23.09	15.141	1.837

Figure 4 compares the output effects of the two 2050 scenarios, both measured against the same 2025 baseline.

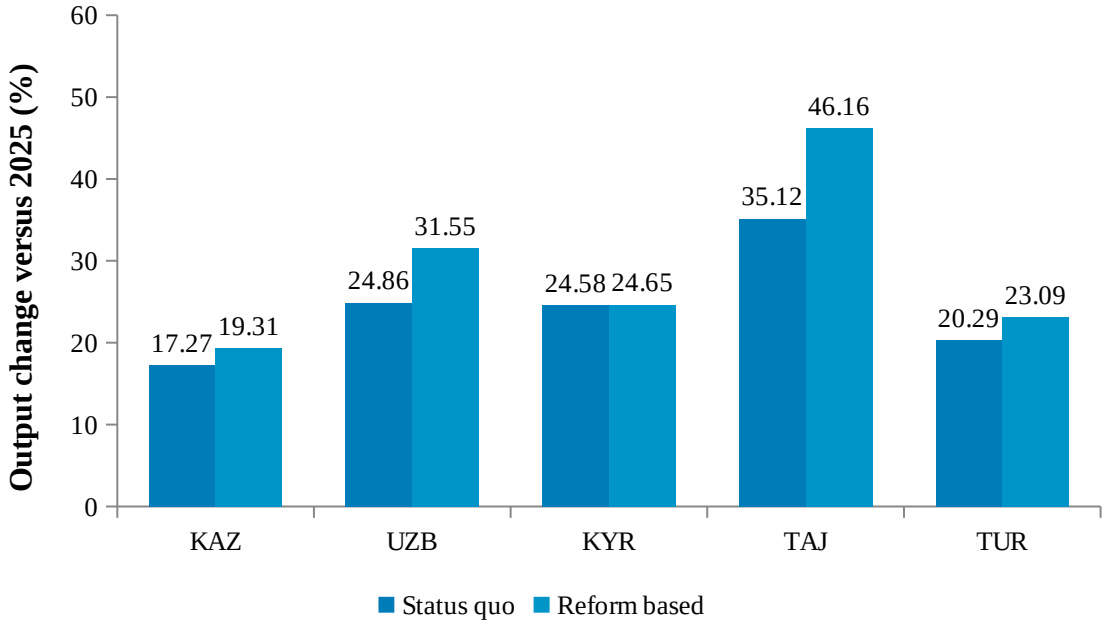


Figure 4 - Model-implied output change in the two 2050 scenarios

The size of an output gain depends on the measure chosen. Uzbekistan has the largest total monetary gain, $55.335 billion, followed by Kazakhstan at $50.272 billion. These totals include the contribution of demographic change and the male adjustment as well as the female participation scenario. They are not estimates of the effect of female participation alone. The additional output difference between the reform-based and status-quo scenarios is $11.738 billion in Uzbekistan and $5.313 billion in Kazakhstan, using the recalculated unrounded scenarios.

Tajikistan has the largest proportional gain, even though its total monetary gain is smaller than those of Uzbekistan and Kazakhstan. Its projected labour force expands rapidly relative to its own baseline, but its 2025 GDP baseline is also smaller. Comparing percentages is therefore useful for examining the relative size of an effect, while comparing monetary amounts highlights the scale of the effect measured in constant dollars. Neither measure alone captures every dimension of the dividend.

The original research also considers the total output gain divided by the increase in labour force participants. The recalculated ratio is highest in Turkmenistan and Kazakhstan, at approximately $18,950 and $16,708 per additional participant, respectively. It is influenced by baseline GDP, the size of the labour force and the non-linear production function. It should not be interpreted as the wage, productivity or individual contribution of an additional worker, nor as evidence that one country's workers are inherently more productive than another's.

The results support three policy implications. First, employment opportunities are essential if a growing working-age population is to translate into higher output. Education and training can help workers access opportunities, but their value also depends on the availability of jobs that use those skills. Second, policies addressing barriers to women's work can complement demographic expansion; childcare, occupational access, fair treatment and employment protection are plausible areas for consideration. Third, policy design should reflect differences between countries rather than assume a common regional trajectory. In each case, implementation and evaluation matter as much as the adoption of a formal policy.

These implications should be separated from causal conclusions. The regressions extend patterns observed after selected policy dates; they do not compare treated and untreated groups or isolate policy effects from other developments. The model also holds capital and technology fixed even though both may change substantially over 25 years. It assumes productive employment for additional participants and does not model the cost of job creation, changes in wages, migration or differences in hours. Because population projections and labour data are uncertain, the numerical

results should be tested against alternative demographic and participation scenarios before being used for policy decisions.

The structure of female employment provides a further perspective on these scenarios. The original paper contrasts agriculture, industry, services and knowledge-intensive activities, while recognising that measured sectoral categories can conceal informal and unpaid work. Participation rates show whether women are in the labour force; they do not show whether jobs are secure, how many hours are worked, or whether earnings and opportunities are comparable across occupations. For that reason, the participation projections and the sectoral analysis answer complementary questions.

In the original research, the share of female employment in agriculture falls substantially in Kazakhstan and Uzbekistan over the period considered, while agriculture remains a more prominent source of female employment in Tajikistan [9]. These descriptive patterns suggest that the ability to move into different activities, as well as the productivity of work within existing sectors, matters for the economic value of labour force growth. The figures do not establish that moving out of agriculture automatically raises the earnings of every worker, nor that all service-sector work is highly productive.

The distinction is relevant for policy design. Training for digital and professional occupations can create opportunities only where workers have access to the necessary infrastructure and employers or markets. Support for rural enterprise can address different constraints from those faced in urban professional services. Similarly, a reform that removes a formal occupational restriction may expand legal access while leaving barriers in recruitment, training or working conditions. Evaluating an intervention requires evidence on implementation and outcomes, not just the date on which a law or programme was introduced.

The original paper also considers the role of unpaid work and childcare. A reduction in the number of children per woman may alter household responsibilities, but care demands do not disappear automatically. The availability, cost, quality and opening hours of care services may affect whether paid employment is feasible. The distribution of responsibilities within households, the accessibility of transport and the predictability of working hours may also matter. These are plausible mechanisms to investigate, rather than causes established by this study’s descriptive correlations.

The five national cases illustrate why the same headline concept can have different policy meanings. Kazakhstan enters the comparison with the highest female participation rate reported in the study and the lowest proportional labour force expansion under the combined scenario. Its projected total increase of approximately 3.01 million participants remains substantial, but its rising old-age dependency ratio suggests that the composition of spending and the balance between workers and dependants will also change. Sustaining output as the population ages requires attention to productivity and employment conditions across the life course, in addition to the number of participants. The estimated $5.313 billion difference between its two 2050 output scenarios is a model calculation rather than a forecast of a return on a particular reform.

Uzbekistan combines the largest working-age population in the dataset with the largest absolute demographic increment to the labour force. Its projected female participation rate increases from 45.782% to approximately 56.066%, and the resulting difference between the two 2050 participation scenarios is approximately 1.66 million people. Because this scenario uses a recent trend fitted from 2017 to 2025, its result depends on the direction observed during those years persisting much longer. The World Bank’s country gender assessment also identifies persistent constraints on women’s labour-market opportunities in Uzbekistan [10]. The policy-relevant question is not simply whether a participation rate rises, but whether women can enter work with adequate pay, security and opportunities for advancement. The projection does not determine which policies would achieve this outcome.

Kyrgyzstan’s combined labour force increases by approximately 1.09 million in the recalculation, most of which is associated with demographic change. Its female participation assumption rises from 47.765% to approximately 47.866%, generating the smallest additional

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female component among the five scenarios. This does not imply that reforms are unimportant or that the maximum possible effect is small. It indicates that the specific trend extrapolated in the study changes the participation rate only modestly. Alternative policy and labour market paths could produce different outcomes, and a weak trend fit makes the particular 2050 estimate uncertain.

Tajikistan has the largest projected proportional increase in the labour force and the highest proportional output effect, but it also begins with the lowest female participation rate in the analysis. The scenario raises that rate from 23.223% to approximately 33.419%. The projected 514,316 additional female participants relative to the status quo are meaningful in relation to the baseline, yet the resulting rate remains substantially below those of several neighbours. The World Bank's country gender assessment discusses barriers to better employment and women's control of economic assets [11]. A large proportionate output effect should not be confused with an equal distribution of its benefits, or with a projection that every new labour force participant will find suitable employment.

Turkmenistan's projected demographic component is approximately 684,000 participants, compared with around 101,000 associated with the female participation assumption. Its output gain per additional participant is the highest in the study, but this ratio derives from the model's baseline GDP and labour force values as well as the size of the projected expansion. It cannot reveal the quality of jobs, the distribution of income or the productivity of individual workers. The country's gender equality action plan provides policy context, but the existence of a plan does not establish its implementation or impact [12]. Moreover, the underlying data and the effectiveness of implementation deserve careful assessment when drawing policy conclusions.

The policy context also includes Kazakhstan's women's entrepreneurship centres [13] and Kyrgyzstan's gender-equality strategy and action plan [14]. These examples document selected initiatives rather than the full policy inventory used for breakpoint scoring; they do not independently validate the scores or the assumed participation trajectories.

The historical comparison in Table 5 summarises the direction and scale of the fertility and participation changes discussed above. The figures are percentage changes in the indicator values, not changes in percentage points. They describe the endpoints used in the original research and should not be interpreted as an estimate of a causal relationship.

Table 5 – Changes in fertility and female participation, 1990–2025

Country	Fertility rate change, %	Female participation change, %
Kazakhstan	+7.4	+2.7
Uzbekistan	−8.1	+11.4
Kyrgyzstan	−23.5	−9.0
Tajikistan	−37.5	−50.8
Turkmenistan	−31.6	−11.3

The original study also compares changes in the age structure through the dependency ratios in Table 6. These values complement the absolute population projections in Table 1.

Table 6 – Total and old-age dependency ratios in 2025 and projected 2050

Country	Total 2025	Total 2050	Old age 2025	Old age 2050
Kazakhstan	61.7	62.5	14.6	22.4
Uzbekistan	59.6	58.9	9.7	16.5
Kyrgyzstan	61.0	53.8	9.6	15.5
Tajikistan	66.5	54.8	6.8	12.1
Turkmenistan	56.3	50.9	7.5	16.3

The total dependency ratio compares people aged 0–14 and 65 or over with the population aged 15–64. It is an age-based measure rather than a direct count of economically dependent people: some adults of working age are not employed, while some people aged 65 or over work. A lower ratio therefore creates a potentially favourable age structure but does not, by itself, establish that fiscal burdens will fall or output per person will rise.

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Tajikistan has the largest projected decline in the total ratio, from 66.5 to 54.8 dependants per 100 working-age people. Kyrgyzstan's ratio falls from 61.0 to 53.8, and Turkmenistan's from 56.3 to 50.9. Uzbekistan's decline is smaller, from 59.6 to 58.9. Kazakhstan differs because its total ratio rises slightly, from 61.7 to 62.5, even though its working-age population increases in absolute terms. The comparison demonstrates why the number of potential workers and their share of the population must be examined separately.

The composition of dependency changes even where the total ratio falls. All five old-age ratios increase in the original projections. For example, Kazakhstan's rises from 14.6 to 22.4 and Uzbekistan's from 9.7 to 16.5. Rising old-age dependency may increase demand for pensions, healthcare and long-term care, though the actual fiscal effect depends on employment, health, benefit design and productivity. The ratio is not itself a forecast of pension costs.

The distinction also affects the interpretation of the population and output figures. In the model, additional labour contributes to aggregate output under the stated assumptions; the model does not subtract the cost of supporting a larger population. A comprehensive assessment of living standards would require population denominators, employment rates and fiscal outcomes as well as GDP. A country can therefore lead the comparison by total output gain without necessarily recording the strongest gain in income per person.

Migration adds another layer of uncertainty. Population projections incorporate assumptions about the number and characteristics of people moving across borders. If migration differs from those assumptions, both the number of residents in working age and the size and composition of the labour force may change. Migration can also affect households through remittances and unpaid work, but these channels are not separately modelled here. Further work should compare high- and low-migration cases rather than interpret a single population path as certain.

Conclusion

The recalculation indicates that demographic expansion is the largest labour-force component in all five countries. The demographic-only increases are 2,656,344 participants in Kazakhstan, 6,105,551 in Uzbekistan, 1,070,376 in Kyrgyzstan, 1,491,253 in Tajikistan and 683,622 in Turkmenistan. Including both participation adjustments produces total increases of 30.32%, 50.89%, 39.16%, 76.71% and 36.57%, respectively, relative to 2025. Tajikistan records the largest proportional expansion, whereas Uzbekistan records the largest absolute increase, approximately 7.43 million participants.

Relative to the 2050 status-quo scenario, the female participation assumptions add approximately 330,392 potential participants in Kazakhstan, 1,659,004 in Uzbekistan, 3,173 in Kyrgyzstan, 514,316 in Tajikistan and 101,288 in Turkmenistan. These are scenario differences in labour supply, not causal estimates of policy effects. Kyrgyzstan's refitted trend has particularly weak explanatory power and its 2050 extrapolation is highly uncertain. The historical comparison also shows simultaneous declines in fertility and female participation in Kyrgyzstan, Tajikistan and Turkmenistan, while Uzbekistan records a fertility decline and a participation increase.

Under the Cobb–Douglas specification, combined-scenario output is 19.31% above the 2025 baseline in Kazakhstan, 31.55% in Uzbekistan, 24.65% in Kyrgyzstan, 46.16% in Tajikistan and 23.09% in Turkmenistan. The corresponding total gains are $50.272 billion, $55.335 billion, $2.815 billion, $7.931 billion and $15.141 billion, respectively, in constant 2015 US dollars. These include demographic change and both participation adjustments. Compared with the status-quo scenario, the additional female-participation differences are $11.738 billion in Uzbekistan and $1.898 billion in Tajikistan; neither is the total demographic and participation gain.

The demographic pressures also differ: Tajikistan's total dependency ratio declines from 66.5 to 54.8 per 100 working-age people, whereas Kazakhstan's increases from 61.7 to 62.5 and its old-age ratio rises from 14.6 to 22.4. The output calculations hold capital and technology constant, apply a labour elasticity of two thirds and assume productive employment for additional participants. They are conditional cumulative comparisons, not forecasts of actual GDP, GDP per capita or welfare, and the policy-calibrated trends do not establish causation. Sensitivity tests and evidence on employment, hours and implementation are required to assess robustness.

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