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Demographic Dynamics and Economic Transformation in Nepal: Exploring the Interplay of Population Growth, Migration, and Development Pathways

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ABSTRACT

This paper analyses the relationship between population change and economic development in Nepal from 1961 to 2021. It verifies that demographic transitions, such as population growth, fertility, and mortality evolution, are an intrinsic characteristic of global development and significantly influence the long-term social and economic trajectory of a nation. The main goals of this research are to analyse Nepal's trends in demographic change, to comment on its trends in economic growth, and to assess the effects of the major demographic indicators—like the working-age population, participation in the Labour force, and dependency ratio—on its economic growth. The research tries to bridge the gap in literature by including analysis for countries with recent data. The analysis utilizes a quantitative approach grounded in secondary data from various international and national sources. A multiple regression model, with Gross Domestic Product (GDP) as the dependent variable, was utilized in an analysis of key demographic independent variables like population growth rate, Labour force participation rate, and net migration. The regression results show that the model in total is extremely explanatory with an R^2 of 0.997 and is significant. This leads to the rejection of the null hypothesis, suggesting an extremely high correlation between economic growth and demographic variables. The indicators reveal positive contributions of the increase in Labour force and population to GDP, while youth population and net migration have negative effects, suggesting high youth dependency and high out-migration may deter economic development. It is concluded that while Nepal's demographic transition offers scope for speeding up economy, the same is threatened in the absence of policy action on education, employment, and social protection.

Keywords: Demographic transition, Economic growth, Gross domestic product, Labour force participation, Net migration and Sustainable development

INTRODUCTION

Population transformation has become the defining characteristic of global development. It is a complex process that is caused by increase in population, declining death rates and fertility, and shifting age structure. These forces largely shape the long-term social, economic, and political destinies of nations. While an expanding population can increase the labour force and drive consumer spending, it can also generate problems such as depletion of resources, unemployment, and pressure on infrastructure (Sukhija, 2021). The comprehension of the intricate interaction between demographic change and economic development becomes highly critical for policy and academic discourse both (Reserve Bank of Australia, 2023).

Nepal has experienced profound demographic transformation in recent decades. Declining fertility, increased life expectancy, and increased internal migration, particularly rural-urban migration, have transformed the nation's population. These all pose opportunities along with challenges. A larger, healthier labour force means the potential of accelerating economic growth, but rapid urbanization and migration put cities under stress on housing, urban amenities, and rudimentary social services. Unless these stresses are removed, they can undermine the benefits of demographic transition and thwart sustainable development.

65.26% of Nepal's population is in the working-age bracket (15–64 years), according to the 2021 Population and Housing Census. Only 7% are aged 65 years and above (Central Bureau of Statistics, 2022). Nepal has experienced a demographic window of opportunity during the past three decades, yet population-aging indicators are becoming more obvious (Paudel, 2018). Census shows a declining number of children (0–14 years) and a consistent rise in the working-age population, which increased, from 56.4% in 1971 to 65.2% in 2021 (Central Bureau of Statistics, 2022). This change points towards a twin reality for Nepal: short-term opportunities for a demographic dividend and long-term implications of an aging society.

The current age structure is a point of reckoning for policy. On the positive side, the increase in the working-age population offers the potential for higher growth, if there is sufficient investment in education, human skill building, and employment generation (Paudel, et al., 2009). On the other hand, the increasing population of the elderly signals a desperate need for comprehensive social protection systems, like health and pension schemes. Whether Nepal succeeds in capturing its demographic dividend or boosts economic and social tensions in the coming decades will rely on how effective it becomes in managing this change.

Demographic transition and economic growth have been thoroughly studied as interconnected ideas, with proof even now remaining inconclusive across differences in data sources, techniques, and geographic locations. Most previous work has focused on East Asia's economies during the period of their high-speed transitions from the 1960s through the 1990s, with limited research done on Nepal or on the later decades (Adhikari & Chapagain, 2019). This shortfall highlights the need for national-level studies based on current demographic and economic information to better comprehend Nepal's experience.

Nepal is a strong candidate for such a query with the scale of its population transformation. The population in 1911, the first census, was 5.6 million and had a growth rate of –0.13% per

annum. The growth in the population then accelerated to a peak of 2.62% in 1981 before dipping to 0.92% in 2021, when the population was 29.16 million (Central Bureau of Statistics, 2022). The fertility has also plummeted sharply, with the Total Fertility Rate (TFR) falling from 6.3 childbearing per woman in the mid-1970s to 2.1 in 2022, reaching replacement level (United Nations Development Programme, 1976; United Nations Population Fund, 2017). Along with falling mortality, these changes have reorganized the age structure, reducing the number of children, expanding the working-age population, and gradually increasing the number of elderly.

These changes have broader implications for development. Nepal is currently experiencing a demographic dividend, in which 65.26% of the population belongs to the working age (15–64 years), but this opportunity window of about 55 years (1992–2047) is finite (Paudel, 2018). As the working-age population ages, the country will begin to suffer from the issues of aging population, including burden on healthcare, pensions, and social protection systems. Despite the crude death rate having decreased from 21 per 1,000 in 1971 to 8 per 1,000 in 2021, rising life expectancy has accentuated the burden of disease on non-communicable and degenerative illnesses, which requires enhanced adaptability of the healthcare system to chronic conditions (Central Bureau of Statistics, 2022).

Simultaneously, worldwide migration has dramatically influenced Nepal's demographic and economic landscape. More than 2.19 million Nepali citizens were abroad relative to fewer than 140,000 foreign citizens residing within the country at the time of the 2021 census (Central Bureau of Statistics, 2022). These negative net migrations have led to shortages of Labour, drained human capital, and increased reliance on remittances and have altered age-sex patterns in many rural communities. Despite these demographic shifts, Nepal’s economic growth has remained modest, averaging only 3–4% annually over the past decade. The persistence of modest growth suggests that the demographic dividend remains underutilized. Without timely and targeted policies in employment generation, education, health, and migration management, Nepal risks missing this critical opportunity and facing heightened demographic and economic pressures in the decades ahead (Gautam & Shrestha, 2020).

OBJECTIVES

This study has three broad objectives. First, the study shall examine the trends of demographic change through observation of fertility, mortality, and population growth patterns spanning several decades. This provides the background in history to the analysis. Next, it will analyse Nepal's macroeconomic performance during the period in question through the analysis of its economic growth trend. Finally, the study seeks to ascertain the influence of the principal demographic drivers.

METHODS

The study adopts a quantitative approach, relying on secondary data from various national and international databases from 1961 to 2021. The dependent variable in this case is Gross Domestic Product (GDP), given that it's the primary indicator of economic growth. Demographic variables are the independent variables, and they range from population growth

rate to economically active population (15–49), to aging population (65+), youth population (0–14), dependency ratio, Labour force participation rate, and net migration. These diverse variables allow a comprehensive examination of the relationship between demographic change and economic performance in their numerous facets.

This trend was best observed in the example of East Asian economies like South Korea and Taiwan when they went through a spectacular economic shift between the 1960s and 1990s. Studies carried out during this period, such as those by the Asian Development Bank, have proven that a higher, healthy, and educated workforce can drive productivity, savings, and investment towards GDP growth of a nation (Paudel et al., 2009).

While this paradigm has been universally accepted, recent research has highlighted that the dividend is not inherent and requires positive policy intervention. As an example, Adhikari and Chapagain (2019) assume that without strategic investment in human capital per se, quality education, skills formation, and job creation the demographic dividend would rapidly turn into a demographic burden, leading to surplus youth unemployment and societal unrest. This underscores the importance of a more nuanced approach depending on country-specific contexts.

In Nepal's case, research on this topic is relatively in its early stages. Gautam and Shrestha (2020) have built a supportive association between demographic transition and economic development in Nepal, with the major emphasis being on the role played by an enormous working-age population.

Regression Model

This paper employed the model specified as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \varepsilon$$

Where, Y represents Total GDP;

β_0: The constant term; X_1: Population growth rate

X_2: Economically active population (15-49); X_3: Aging population (Population ages 65 and above)

X_4: youth population (0-14); X_5: Dependency Ratio

X_6: Labour force participation rate; X_7: Net migration; ε: Error term

The above model shows how the statistical analysis of the study was conducted. The error term (ε) is applied to represent variables outside the model, if they follow a normal distribution and have a mean of zero. The parameters of the model were estimated using the least squares method, and it was conducted with SPSS software. Finally, statistical significance was verified to test the hypothesis of the study and to interpret the regression output.

Before employing this statistical tool, the study has explored regarding Demographic and Economic Trends in Nepal as per the following guidelines:

Demographic and Economic Trends in Nepal

Nepal's demographic transition, both from high to low fertility and mortality, has been the main force behind its socio-economic dynamics. This transition is explored between 1961 and 2021, using a range of demographic indicators in trying to account for its trend and consequence for the economy.

Theoretical consideration is drawn on the demographic dividend theory, according to which an increasing working-age population has the potential to contribute to economic growth.

Nepal's Demographic History

- Pre-transition Stage (Before 1961): This was the time when birth and death rates were high, and thus there was less population growth. Low standards of healthcare, high infant mortality, and poor sanitation had led to low life expectancy.
- Early Transition Stage (1961–1981): It was a period of rapid population growth with decreasing death rates but still high birth rates. Improvements in public health and treatment lowered mortality.
- Late Transition Stage (1981–2021): In this phase, birth and death rates both declined further. The crude death rate (CDR) came down significantly from 36.7 deaths per 1,000 in 1954 to 6.7 in 2021 (Central Bureau of Statistics, 2022). The decline in the total fertility rate (TFR) was even more pronounced, declining from 6.3 in 1976 to 2.1 (replacement level) in 2022 (United Nations Population Fund, 2017). This was prompted by increasing access to family planning, increased education among women, and changing socio-economic norms. The adjustment resulted in the deceleration of population growth, from the peak of 2.62% in 1981 to 0.9% in 2021 (Central Bureau of Statistics, 2022).

Migration Trends

While the internal migration does not affect the overall population of a country, international migration has emerged as a significant demographic force on Nepal. The study reports the rising and persistent out-migration for work overseas and educational purposes. Over 2.19 million Nepali nationals are living abroad, as counted during the 2021 census (Central Bureau of Statistics, 2022).

The rate of absentee population has shown a steady increase, from as low as 2.7% in 1981 to 7.5% in 2021. It has two economic effects. In the first place, it has caused a dramatic surge in remittances, now the linchpin of the national economy, supporting incomes domestically and helping to alleviate poverty. On the other hand, it has resulted in internal labour deficits in a few industries and a depletion of human capital, which can hinder economic growth in the future.

Trend in Economic Growth

The study graphs GDP and key demographic indicators' correlation from 1961 to 2021. The trend is one of steady growth in GDP per working population, with an appreciably greater increase after 2001. This points to greater economic productivity and rising inputs by the workforce.

Concurrently, the percentage of working-age population (15-64 years) also fell between 1961 and 1991 before the trend was reversed. From 2001 onwards, there has been a dramatic rise in the percentage of working-age population to 65.26% of the total population in 2021. This concurrent rise in both GDP per working population as well as working-age population proportion shows Nepal is experiencing a demographic dividend.

Economic Impacts of Demographic Changes

The economic implications of Nepal's demographic transition are enormous, both as opportunities and burdens. The most crucial indicator here is the dependency ratio, which is the ratio of dependents (youth under 15 years and old persons over 64 years) to the working-age population. A falling dependency ratio signals a "demographic window of opportunity," as more of the population is available to enter the Labour force and contribute to economic activity.

Nepal has approached this window with its enormous working-age group, which holds a vast potential for rapid economic growth. However, this potential is not guaranteed and must be addressed through strategic policy intervention. The report highlights that challenges like rising emigration, internal employment generation limitations, and underinvestment in education and health infrastructure may limit Nepal from reaping the most out of this demographic dividend. The economic ramifications, therefore, depend upon the effectiveness with which the country can convert this population potential into actualized economic benefits, a quest that will determine its developmental trajectory over the forthcoming decades.

All these demographic and economic trends invited further investigation using the multiple regression model of GDP. Its findings are given in Table 1.

Table 1: Multiple linear regression of gross domestic product

Variable	Coefficient	P-value	Interpretation
Intercept (β_1)	-0.0060	0.302	Not significant.
X□: Pop. Growth Rate	1.5043	0.070	An 1% increase raises GDP by $1.50B (marginally significant).
X□: Working-age Pop.	0.3200	0.242	Positive impact, but not statistically significant.
X□: Aging Pop.	0.7879	0.828	Minimal and non-significant.
X□: Youth Pop.	-0.8581	0.258	Negative impact—potentially due to economic dependency.
X□: Dependency Ratio	0.1951	0.498	Weak, not significant.
X□: Labour Force Participation	0.1705	0.344	Positive influence on GDP.
X□: Net Migration	-0.5795	0.595	Negative but not significant—may reflect brain drain.

Model Fit

- R-squared: 0.997 – Excellent fit (99.7% of the variation in GDP is explained).
- Adjusted R^2: 0.993 – Very strong even after adjusting for predictors.
- F-statistic: 241.4 ($P = 0.0000476$) – Model is statistically significant.
- Multicollinearity Warning: Condition number is very high (1.51e+19), indicating possible collinearity between demographic variables (especially since all are derived from population structure).

Analysis and Hypothesis Testing

The study uses both descriptive statistics and regression analysis. Descriptive analysis graphs the trends in the principal demographic variables and GDP over the 60 years. A multiple regression model using the Ordinary Least Squares (OLS) method estimates the effect of the principal independent demographic variables on GDP for the main analysis.

The study makes a hypothesis which is obvious to all:

- Null Hypothesis (H0): Demographic factors and the economic growth of Nepal have no relationship.
- Alternative Hypothesis (H1): There is a relationship between demographic factors and the economic growth of Nepal.

The statistical significance of the full regression model is tested using an F-test. The findings indicate a strongly significant F-statistic value of 241.41 with p-value 0.0000476, much lower than the 0.05 significance level. This leads to the rejection of the null hypothesis and the presence of a strong relationship.

RESULT AND DISCUSSION

The regression analysis has a high explanatory power with an R2 coefficient of 0.997, indicating that the demographic variables account for over 99% of the variation in GDP. The analysis shows that the overall model is significant statistically, while specific variables have different effects. Specifically, population growth and working-age population have a positive effect on GDP. On the other hand, net migration and youth population have negative effects, reflecting that high youth dependency and significant "brain drain" due to emigration can hinder economic progress. It is mentioned that the research refers to the reality that Nepal's current demographic structure offers a window of opportunity but not efficiently utilizing it due to ongoing challenges. Findings and Discussion

The individual variables were not significant at the 5% level, but the general model makes a strong connection. Specifically, population growth rate (P = 0.070) and labour force participation rate (P = 0.344) reported positive coefficients, implying their contribution towards economic growth (Table 1). Conversely, the youth population and net migration reported negative coefficients, reflecting the potential dampening effect due to high youth dependency and out-migration-induced "brain drain" (Amin et al., 2017).

These findings agree with cross-country literature, such as Bloom and Williamson (1998) on East Asian economies and Bloom, Canning, and Sevilla (2003) on human capital utilization to achieve a demographic dividend. For the South Asian region, this study aligns with Ahmad and Shah (2021), which established that there is a reverse relationship between dependency ratios and economic growth. Kunwar et al. (2023) and Lakshmana (2014) also corroborate the findings, showing the positive correlation between the working population and economic growth in Nepal and India, respectively. The study also reaffirms new threats of aging population, as exemplified by concerns raised by Fernandes et al. (2023).

CONCLUSION

The research concludes that Nepal went through a sharp demographic transition, moving from a high-mortality, high-fertility regime to a low-fertility, declining mortality regime. The Total Fertility Rate (TFR) reduced sharply from 6.3 in 1976 to 2.1 in 2022, while the Crude Death Rate (CDR) fell from 36.7 in 1954 to 6.7 in 2021. This has created a drastic shift in the age structure where the working-age group now holds over 65% of the total, creating a "demographic dividend." However, the rise in the population of aged people (7% in 2021) marks the commencement of demographic aging and creates future issues.

The regression, which has an R^2 of 0.997 and significant F-statistic, confirms that population variables in aggregate have a significant effect on GDP. While some of the individual variables, like youth dependency and out-migration, had a negative correlation with the

economy, the relationship is evident when variables are aggregated. Keeping this in view, the paper presents a few broad recommendations:

- Reaping the Demographic Dividend: Nepal must invest in job creation, vocational training, and entrepreneurship to reap its growing workforce. Brain drain protection and reintegration of skilled returnee migrants are also necessary.
- Aging Society Readiness: Strategic planning in developing social security institutions like pensions and geriatric care is necessary to accommodate the growing aging population.
- Improve Migration Management: The government needs to set up bilateral agreements to protect migrant workers and introduce skill-matching programs.
- Fostering Balanced Population Growth: Improved access to reproductive health services and rural infrastructure investment can relieve urbanization and out-migration pressures.

Overall, Nepal's population transformation provides a significant opportunity for development. However, this is not inevitable and requires certain, forward-looking policies that link population trends to sustainable economic progress.

The policy implications of This paper's findings are important for policymakers in Nepal. Having access to a demographic dividend, a large population of working age, provides a window of opportunity to maintain rapid economic growth. For this, the government must give priority to policies promoting employment generation, technical education, and entrepreneurship for making this workforce productive.

Conversely, the study stresses a demographic issue in the form of an aging population and out-migration. It indicates the need for futuristic policies to enhance pension plans, enhance care for the elderly, and more effectively manage migration so that there is not a huge human capital loss. Without these coordinated measures, Nepal will be losing its window of opportunity and will face economic stagnation.

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