ORIGINAL RESEARCH ARTICLE

Comparative analysis of population growth and women employment patterns in agriculture and service sectors: Evidence from China and India

*Zezhen Gong[1][2] * and Chenyu Ma[2]*

School of Accounting, Shandong University of Finance and Economics, JiNan 250220, China[1]; King's College London, Strand London WC2R 2LS, Britain[2]

*For Correspondence: Email: *xiaodongbao123@sohu.com*

Abstract

This study uses a comparative approach to investigate population growth patterns and women employment in two strategic sectors of China and India from 2005 to 2021. Consequently, a descriptive statistic was used to estimate the performance of each of the variables of interest. The results showed that the average mean value of population growth rate in China is 0.52 % while that of India is 1.23%. The mean value of women employed in agriculture in India is higher comparing to the average percentage of women in agriculture in China. Moreover, Chinese service sector accounts for 45.27% of female workforce but its India counterpart engages 21.71% of women working population. This implies that the Chinese service sector engages a significant proportion of the female working population. In the light of this, policymakers in India should prioritise investment in human development of the female population in order to ensure gender balancing in the service sector of the country. Also, the policymakers in India need to embark on a proactive measure in controlling its increasing population in order to ensure that the country's population growth rate does not overshoot the means of sustenance in the country. *(Afr J Reprod Health 2023; 27 [12]: 86-93).*

Keywords: Agriculture, service, employment and women

Cette étude utilise une approche comparative pour étudier les schémas de croissance démographique et l'emploi des femmes chez deux secteurs stratégiques de Chine et de l'Inde de 20 05 à 2021. Par conséquent, une statistique descriptive était Wase pour estimer la performance des variables d'intérêt. Les résultats ont montré que le La valeur moyenne moyenne du taux de croissance démographique en Chine est de 0,52% tandis que celle de l'Inde 1,23%. La valeur moyenne des femmes employées dans l'agriculture de l'Inde est plus élevée pour le pourcentage moyen de femmes en agriculture en Chine. Représente 45,27% de la main-d'œuvre féminine mais Son homologue de l'Inde engage 21,71% de la population professionnelle des femmes. Assurer l'équilibre entre les sexes dans le service hors du comptoir. Mesure proactive de l'ONA dans le contrôle de sa population croissante afin que le taux de taux de taux de population du pays ne dépasse pas les moyens de subsistance dans le pays. *(Afr J Reprod Health 2023; 27 [12]: 86-93).*

Mots-clés: Agriculture, service, emploi et femmes

Introduction

The populations of China and India, the two most populous countries in the world, collectively accounted for approximately 36% of the global population as of 2020, projecting a combined population of between 2,783 to 3,308 million by 2050[1]. However, recent demographic trends and projections indicate significant shifts in these demographic giants. The United Nations predicts that India is on the cusp of surpassing China as the world's most populous country, a transition expected to occur around mid-2023, as China has reached its population size peak and is now experiencing a decline since 2022. This decline is anticipated to continue, ultimately falling below 1 billion by the close of this century, while India is projected to continue its ascent, reaching its population zenith in 2064[2-4]. The dynamic evolution of these two nations' populations not only holds profound implications for global demographics but also exerts substantial pressure on their respective economies. In this context, an essential aspect to consider is the role of women in the workforce, particularly in agriculture and the service sector. Understanding the employment patterns of women in these sectors is crucial, as it reflects not only the changing socio-economic

landscape but also the progress in gender equality, legal frameworks, and institutional support.

China has witnessed a significant transformation, with over 40% of its working population comprising women. This transformation is largely attributed to the socialist revolution, which has led to a substantial improvement in the overall living standards of women in China. Additionally, legal and institutional reforms have been instrumental in promoting gender equality in the Chinese workforce[5]. In contrast, India, despite undergoing structural changes in its economy, has experienced limited diversification in women's employment. Women in India are predominantly engaged in the rural informal sector, making it the primary source of employment for women in the country[6]. This marked disparity in the employment patterns of women in these two countries underscores the need for a comprehensive analysis to better understand and address the factors contributing to these differences.

This research paper aims to provide a detailed and comparative analysis of the population trends in China and India, along with a focused examination of women's employment in the agricultural and service sectors. By presenting descriptive and graphical comparisons, this study intends to shed light on the evolving dynamics and challenges faced by women in the workforce in these two nations. Ultimately, this study seeks to contribute to a deeper understanding of the socio-economic factors shaping women's employment patterns and the broader implications for gender equality and economic development in China and India.

Literature review

Padhi and Sharma[7] examined the shifting patterns of employment and economic development in the Indian workforce during a 40-year period, spanning between 1983 and 2019. The analysis revealed that revenue per labour and cross-sector changes are the main drivers of growth. Filipovi and Ignjatovi[8] analysed the impact of Chinese population strategy on labour market. Population by age and sex in both urban and rural regions, the employment enrollment percentage, and the number of unemployed were the three employment factors utilized in the study. The workforce grew between 2010 and 2020 according to the study;

however, since 2018, the number of unemployed individuals has been rising. The study demonstrated that the population policies and persistent enforcement have increased the percentage of male involvement in the workforce.

Leng and Kang[9] examined the effects of the rule of two children on female workforce and business outcomes in China. According to the evaluation, the two-child policy's expansion did not result in a decline in the percentage of women working, but it did lessen the benefits of employing women for business efficiency. According to the research, businesses that have more female employment rates have fewer expenses, and this cost-effective benefit vanishes when the second-child laws was implemented.

Chaurasia[10] examined the trends in economic progress and demographic change in China and India between 1990 and 2018. Findings from the study showed that while majority of China's economic development between 1990 and 2018 helped raise living standards, a significant amount of India's economic progress was caused by population growth, which had little effect on individual standards of living. Ogbeide-Osaretin and Orhewer[11] investigated the effects of population increase and gender disparity on the economic progress of Nigeria. Results revealed that female postsecondary enrolment and the gender workforce ratio had beneficial substantial impacts on advancement of the Nigerian economic prosperity. Xiao[12] examined the effect of job prospects on demographic clustering. The following was discovered: initially work possibilities generally have a big influence on demographic clustering. The workforce has a major beneficial effect on demographic accumulation, but conventional service employment has little of a consequence. Furthermore, during 2012, the influence of job availability on demographic clustering started to decline. Ma and Zhang[13] assessed the impacts of demographic policies on the labour market in China with specific focus on the effects of the overall number of children and equality on the labour market for Chinese women. The findings indicated that when the overall number of children rises the likelihood that the mother would find employment on a daily basis may drop, and that this adverse effect is stronger for subsequent deliveries than for the initial birth. Golley and

Tyers[14] evaluated the sequence of China's and India's population adjustments and the consequences of different fertility instances. The findings demonstrated that while China's total reliance trend will be relatively stable, the lowering young reliance's beneficial effect to real per capita earnings won't be countered by expanding elderly reliance until far after 2030. The reliance rate in India falls quite precipitously. Yao *et al.*[15] assessed the global economic implications of demographic transition in China. According to the results, population has a significant negative impact on GDP per capita, while savings rate, total factor productivity and degree of industrialization have significant positive impacts on GDP per capita.

Tsen and Furuoka[16] examined the connection between demographic increase and economic development in Asian countries. However, the analysis discovered that for Japan, Korea, and Thailand, there is bidirectional Granger causality between demographic increase and economic expansion. Demographic increase was discovered to be the primary driver of economic expansion in China, Singapore, and the Philippines, not the other way around. Economic expansion was discovered to trigger a rise in population in Hong Kong and Malaysia, rather than the other way around. Overall, the associations between demographic and economic expansion were not clear-cut; demographic transition could be helpful or harmful to economic transition, and economic growth may have an effect on demographic transition. For Taiwan and Indonesia, it showed an absence of Granger causality between demographic and economic transition.

Methods

Data

This study used a comparative approach to investigate population growth patterns and women employment in two strategic sectors of China and India. Data from 2005 to 2021 were used to conduct the comparative analysis. This scope was chosen based on the availability of data that are relevant to the study. The study covers the periods of 1990 and 2020, and the data for this analysis are sourced from the World Development Indicators published by the World Bank[17].

Empirical model

Based on the goals of this study, we specify a baseline model by adapting the frameworks of Aderemi *et al.*[18] and Chaurasia[10] as such, women employment in agriculture and service sectors are incorporated into the model. Therefore, the model is specified as follows;

$$WE_{as} = F(POP) \qquad (1)$$

Where WE_{as} stands for women employment in agricultural and service sectors respectively. And POP denotes population growth patterns.

However, to enhance the robustness of the model (1), the following controls variables – GDP, money supply and trade openness were added to the model, because these variables have both direct and indirect influence on employment generation[19,8]. Hence, model (1) is therefore restated as this;

$$WE_{as} = F(POP, GDP, MS, TOP) \qquad (2)$$

In linearising the above model, we introduced double log to both side of the model as follows;

$$LogWE_{ast} = \alpha_i + \alpha_2 POP_t + \alpha_3 LogGDP_t + \alpha_4 LogMS_t + \alpha_5 TOP_t + u_t \qquad (3)$$

Thus, estimating model (3) would provide a comparative analysis for population growth and women employment patterns in agriculture and service sectors in both China and India. As such, the aprori expectation in the study should follows this pattern; $\alpha_2, \alpha_3, \alpha_4$ *and* $\alpha_5 > 0$.

Full meanings of abbreviations and measurement of variables

The operational definitions of the study's variables to drive the investigation of comparative analysis of population growth and women employment patterns in agriculture and service sectors of China and India are provided in Table 1.

Ethical consideration

The data in the WDI were obtained using appropriate ethical procedures and guidelines. Consequently, further ethical issues were minimal. The data were completely anonymized, while the data was already freely available to the general public. Hence, further ethical clearance was not obtained for this study.

Table 1: Description of the variables

Abbreviation	Full Meaning	Operational Definition
WE_{as}	Women employment in agricultural and service sectors respectively.	This is measured as percentage of female employment agricultural and service sectors in total employment.
POP	Population Growth Patterns	Population growth rate.
GDP	Gross Domestic Product.	Gross Domestic Product growth rate
MS	Money Supply	Broad money supply
TOP	Trade Openness	Exports plus imports as percentage of GDP.
u	Error term	

Results

Comparative analysis of population growth and women employment patterns in agriculture and service sector China and India

Figure 1 shows a comparison of the population growth rate of China and India. The chart reveals that India from 2005 to 2021 consistently had a higher population growth rate compared to China. The figure reveals that India had her highest population growth rate in 2005 at close to 1.6%

while China was at about 0.6% in the same year. India's population growth rate experienced a gradual fall through the years till 2020 and in 2021 India's population growth rate rose slightly to over 1% but less than 1.2% from about less than 1% the previous year. China on the other hand experienced an increase in population growth rate in 2011 to over 0.5% but fell in 2013. China is shown to have her least population growth rate in 2020 at a little above 0.2%. Generally, China is shown to have fluctuations in population growth rate from 2005 to 2021.
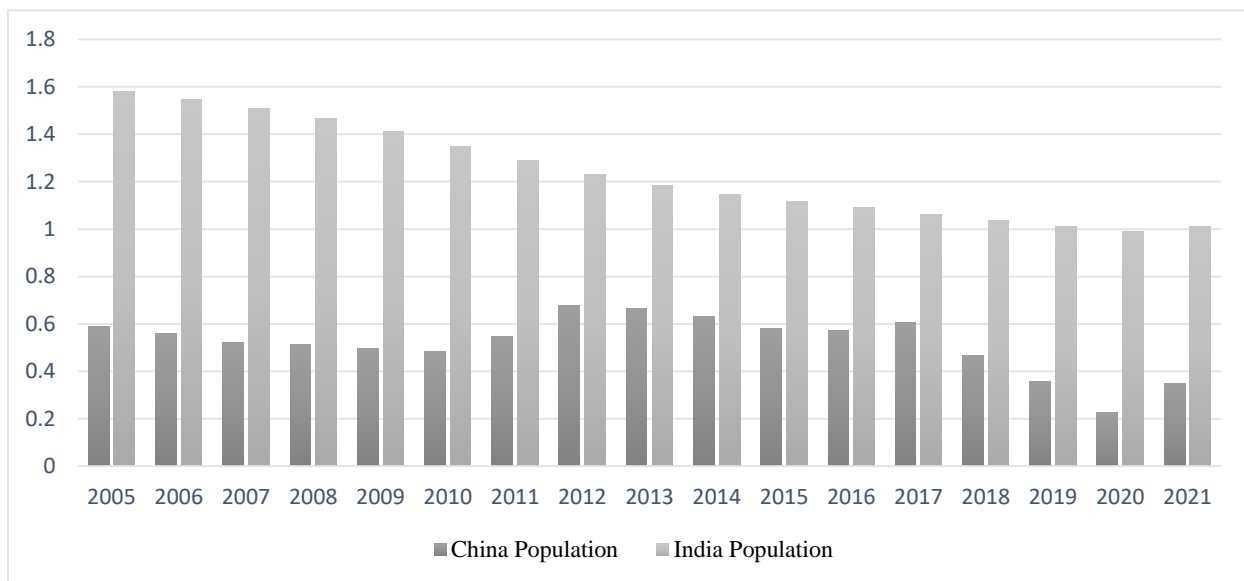

Figure 1: Annual population growth rate (%) in China and India from 2005 to 2021

Figure 2 is a chart of the women employment in agriculture in both China and India. The chart shows that India has a high amount of her employed women in the agricultural sector. In 2005, India had her highest number of employed women into agriculture and the least number in

2019. The chart shows that in 2005, India had 70% of her employed women were employed in agriculture. The percentage gradually reduced till 2019 where it was about 54% and slightly increased to about 55% in 2020 and about the same in 2021. China just like India had her highest
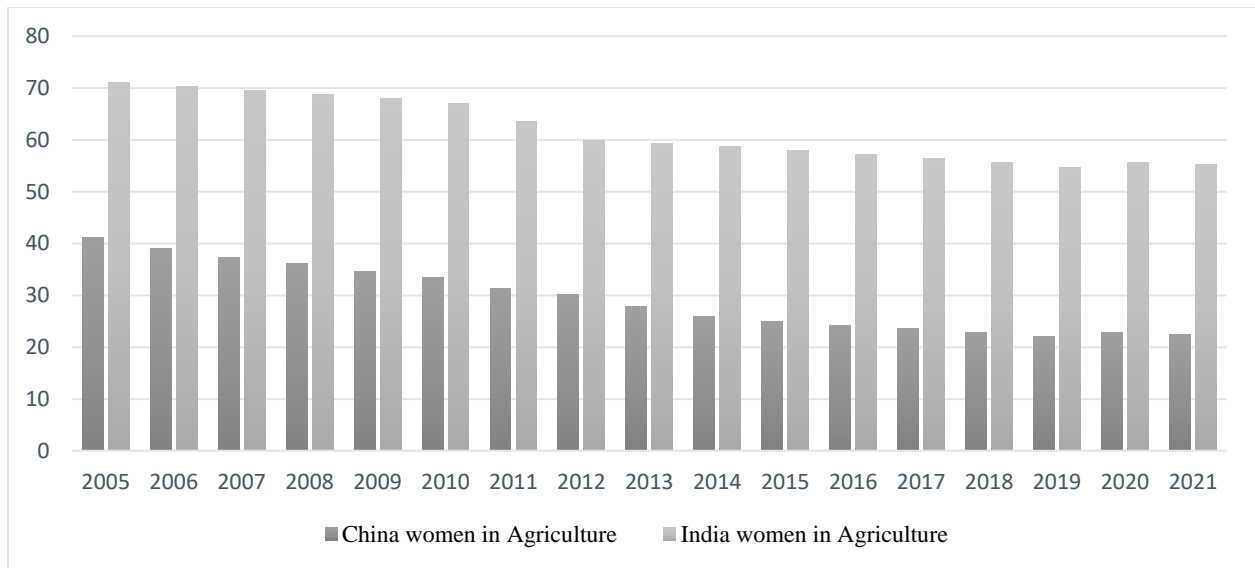
Figure 2: Percentage of women employment in agriculture in China and India from 2005 to 2021
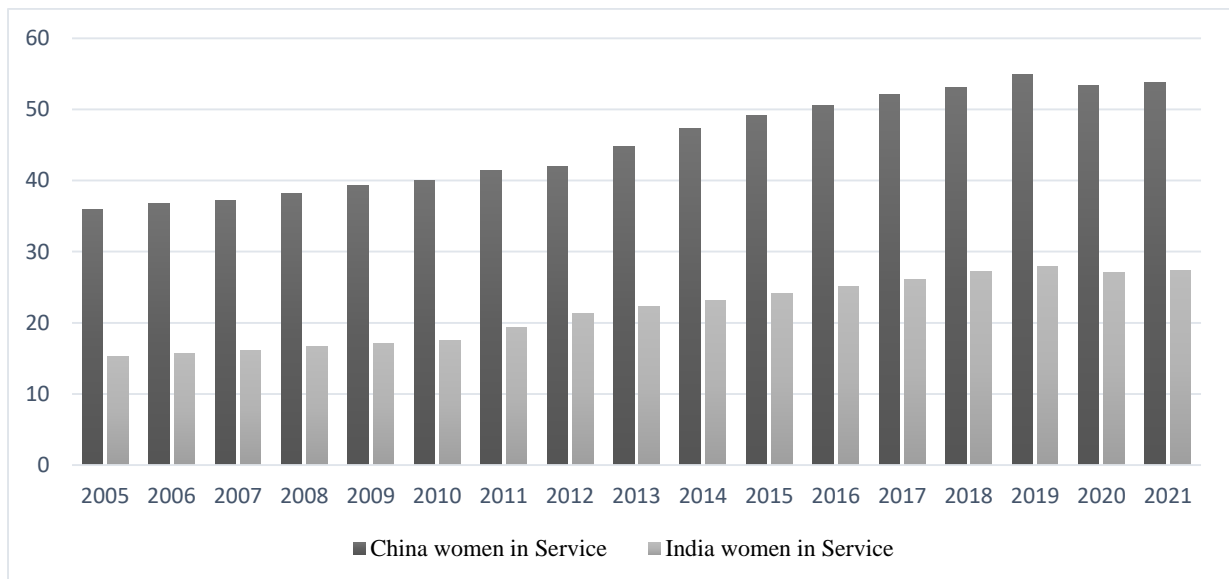

Figure 3: Percentage of women employment in service sector in China and India from 2005 to 2021

women employment in agriculture in 2005 at a little above 40%. This numbers fell gradually till 2019 when it stood at a little above 22% with a less than 1% increase in 2020 and less than 1% decrease in 2021. In the figure, India engaged a greater number of her female workforce in agriculture than China.

Figure 3 is a chart showing the percentage of women employment in service in China and India from 2005 to 2021. The diagram reveals that China over the years had a higher percentage of women employment in service than India. China

had her highest percentage of women employment in service in 2019 at about 55%. The numbers grew gradually from about 35% in 2005 to 55% in 2019 and fell slightly in 2020 with a slight raise in 2021 to about 53%. China had her least percentage of women employment in service in 2005 which was about 15%. The percentage value gradually increased till 2019 resting at about 27% with a very little fall in 2020 followed by an increase 2021. It is important to note that China`s service sector gives more opportunities for women forks than agricultural sector.

Table 1: Descriptive statistics of population growth rate in China and India

China		India	
Mean	0.520016	Mean	1.237278
Median	0.546458	Median	1.182904
Maximum	0.678345	Maximum	1.579709
Minimum	0.225948	Minimum	0.989414
Std. Dev.	0.119059	Std. Dev.	0.203522
Skewness	-0.965557	Skewness	0.393324
Kurtosis	3.440662	Kurtosis	1.705917
Observations	17	Observations	17

Source: Authors' computation (2023)

Table 2: Descriptive statistics of women employment in agricultural sector in China and India

China		India	
Mean	29.41588	Mean	61.68654
Median	27.88000	Median	59.36000
Maximum	41.20000	Maximum	71.05000
Minimum	22.01000	Minimum	54.69000
Std. Dev.	6.477434	Std. Dev.	6.089039
Skewness	0.414977	Skewness	0.371427
Kurtosis	1.746311	Kurtosis	1.479750
Observations	17	Observations	17

Source: Authors' computation (2023)

Table 1 shows the descriptive analysis of population growth rate of China and India. The average population growth rate of India is shown to be higher than that of China at 1.23 and 0.52 respectively. The median value of China is 0.55 which lower than that of India at 1.18. The maximum population growth rate for China was 0.678 showing that from 2005 to 2021 China's rates of population growth were less than 1.00 each year. India, however, has a maximum population growth rate of 1.57.

The mean value of women employed in agriculture in India between 2005 and 2021 is very high compared to the average percentage of women in agriculture in China between the same years. In the table 2 above, the mean value for China's women employment in agriculture is approximately 29% while that of India is approximately 61%. The median value for China is 27.88 while that of India is 59.36. China's maximum percentage of women employment in agriculture is shown to be 41.20% and India's maximum is 71.05%. The minimum value of women employment in agriculture in China and India are 22.01% and 54.69%. These all reveal that between 2005 and 2021, less than 50% of the women employment in China were employed in the Agricultural sector while in India at no period was women employment in agriculture less than 50% of women employment. Furthermore, the standard deviation values for China and India both reveal that the data are not very dispersed from the mean. The standard deviation values for China and India are 6.47 and 6.089, respectively. Both China and India are positively skewed and they are also both platykurtic.

Table 3 reveals the descriptive result of women employment in service in China and India. The average women employment in China and India are shown to be 45.27% and 21.71% respectively. The median values for China and India are 44.80% and 22.21% respectively. The maximum values and minimum values are shown as 54.92 and 35.85 for China and 27.96 and 15.30 for India. These show that China from the year 2005 to 2021 consistently had a higher amount of women employment in service than India which is the opposite of women employment in agriculture. The standard deviation value for India reveals that the values are of women employment in service are dispersed closely to the mean value compared to that of China. The data for India is shown to negatively skewed at approximately -0.061 while that of China is positively skewed at about 0.051. The Kurtosis

Table 3: Descriptive statistics of women employment in service sector in China and India

China		India	
Mean	45.27660	Mean	21.71660
Median	44.80000	Median	22.21000
Maximum	54.92000	Maximum	27.96000
Minimum	35.85000	Minimum	15.30000
Std. Dev.	6.847536	Std. Dev.	4.682390
Skewness	0.051483	Skewness	-0.061617
Kurtosis	1.428242	Kurtosis	1.438493
Observations	17	Observations	17

Source: Authors' computation (2023)

values for both India and China at 1.42 and 1.43 irrespectively are less than 3 revealing that the data of women employment in service for both countries are platykurtic.

Discussion

Discussing these findings within the context of the research question and objective of this study, it could be deduced that from 2005 to 2021, the average mean value of population growth rate in China is 0.52 % while that of India is 1.23%. This implies that in the past 17 years, India's population growth rate is greater than the average population growth rate in Asia which is 0.55%. This shows that India is one of the countries in Asia with the fastest growing population. The implication of this is that if the policymakers in India refuses to control this population growth, in less than a decade, the country`s population will be the largest population in the globe. It is pertinent to stress that one of the reasons why population growth rate is relatively low in China could be attributed to the one child glory policy implemented in the past decades in the country. In the light of this, it is expedient of the policymakers in India to embark on a proactive measure in controlling its increasing population in order to ensure that the country's population growth rate does not overshoot the means of sustenance in the country.

Consequently, the mean value of women employed in agriculture in India between 2005 and 2021 is very higher comparing to the average percentage of women in agriculture in China between the same years. It is deduced that in the past 17 years, Indian agricultural sector has approximately engaged 61% of the country's women workforce. In contrast to situation report of China, in agricultural sector employed

approximately 29% of the female workforce in the country within the same periods. However, it could be deduced that both the countries engage some reasonable proportion of their female workforce in the agricultural sector. This implies that China and India employed substantial number of female workforces in the primary production unit of the economy. Whereas, it is instructive to stress that in global context, India engages more proportion of women forks in agriculture than 52% recorded in SSA, 59% in South Asia, 20% in East Asia and Pacific region, 16% in the Middle East and North Africa. This is an indication that the majority of women in India are largely depending on agricultural sector for productive engagement. It is worth to note that the reason for this outcome might be related to lack of investment in Indian women higher education and critical skills that are required in the service sector of the economy. This is a wakeup call for the country`s policymakers to prioritise investment in human development of the female population in order to ensure gender balancing in the service sector of the country.

Moreover, Chinese service sector accounts for 45.27% of female workforce but its India counterpart engages 21.71% of women working population. This implies that the Chinese service sector engages a significant proportion of the female working population. This is an indication that Chinese labour market has been transformed from agrarian economy to the service-oriented economy, in which its female working population is a very active player.

Strengths and limitations

A comparative analysis of population growth and women employment patterns in agriculture and service sectors possesses a high level of novelty in

the body of knowledge, and this could serve as the strength of this study. In the same vein, this study has a clearly stated research question, and comprehensive descriptive methods of analysis, which would make the contents of the study to be easily understood by both experts and laymen. This study is limited and serves as a future direction for other researchers. The study focused on only two largest countries in Asia. Further studies could be carried out on other Asian countries and African countries, especially those countries with rapid population growth.

Conclusion

This study therefore concludes that despite the fact that China is the most populous country in the globe, India population growth rate is bigger than that of China in the past nearly two decades. Also, agricultural sector is the mainstay of livelihood for the majority of women working population in India. Whereas, service sector provides a productive employment for the majority of women work force in China.

Contribution of authors

Zezhen Gong conceived and designed the study, wrote the introduction, collected and analysed the data
Chenyu Ma reviewed empirical studies, designed the methodology and edited the paper.

References

1. Mottaleb KA, Kruseman G, Frija A, Sonder K and Lopez-Ridaura S. Projecting wheat demand in China and India for 2030 and 2050: Implications for food security. *Frontiers in Nutrition*, 2023; 9, 1077443.
2. Gupte PR. India: The emergency and the politics of mass sterilization. *Education about Asia*, 2017; 22(3), 40-44.
3. Alderman H, Nguyen PH, Tran LM and Menon P. Trends and geographic variability in gender inequalities in child mortality and stunting in India, 2006–2016. *Maternal and Child Nutrition*, 2021; 17(3), e13179.
4. Hertog S, Gerland P and Wilmoth J. India overtakes China as the world's most populous country 2023.
5. Yang J. Women in China moving forward: Progress, challenges and reflections. *Social Inclusion*, 2020; 8(2), 23-35.
6. Abraham DM and Kumar BDP. Defeminization of the labor market in the liberalized period: A study of recent changes in employment structure in India.

7. Padhi B and Sharma H. Changing contours of growth and employment in the Indian labour market: A sectoral decomposition approach. *Structural change and economic dynamics*, 2023; 67; 220-233.
8. Filipović S and Ignjatović J. The effects of Chinese population policy on the labour market. *Stanovnistvo*. 2022; 61. 3-3. 10.2298/STNV220609003F.
9. Leng A and Kang F. Impact of two-child policy on female employment and corporate performance: Empirical evidence from Chinese listed companies from 2010 to 2020. *Humanities and Social Sciences Communications*, 2022; 9, 451. https://doi.org/10.1057/s41599 022-01472-2
10. Chaurasia AR. Economic growth and population transition in China and India 1990 2018. *China Population and Development Studies* 2021; 4 (3), 229-261.
11. Ogbeide-Osaretin EN and Orhewere B. Population Growth, Gender Inequality and Economic Development in Nigeria. Izvestiya, *Varna University of Economics*, 2020; 1, 47-64.
12. Xiao XinJuan. Employment Opportunities and Population Agglomeration: A Study Based on a Sub-Industry Perspective. *References Open Journal of Social Science*, 2020, 8(3).
13. Ma X and Zhang J. Population Policy and its Influences on Female Labor Supply: Evidence from China. *Asian Development Policy Review*, 2019; 7(4), 261–276. https://doi.org/10.18488/journal.107.2019.74.261.276
14. Golley J and Tyers R. Contrasting giants: demographic change and economic performance in China and India. *Procedia-Social and Behavioral Sciences,* 2013, 77, 353-383.
15. Yao W, Kinugasa T and Hamori S. An empirical analysis of the relationship between economic development and population growth in China. *Applied Economics*, 2013; 45 (33), 4651-4661.
16. Tsen WH and Furuoka F. The relationship between population and economic growth in Asian economies. ASEAN Economic Bulletin, 2005, 314-330.
17. World Bank. World Development Indicators. Retrieved From https://databank.wprldbank.org/source/world-development-indicators, 2023.
18. Aderemi TA, Wahid DO, Ayodeji GB, Hassan CO, Osabohien R and Azuh DE. Role of agriculture in poverty reduction in Nigeria: An implication for sustainable development goals (SDGs). *African Journal of Business and Economic Research (AJBER), Special Edition: Perspectives on Demographic Dividend, and Economic Growth for Sustainable Development*, 2021, 267-280.
19. Aderemi TA, Omitogun O and Osisanwo BG. Effect of FDI inflows on employment generation in selected ECOWAS countries: Heterogeneous panel analysis. *Central Bank of Nigeria Journal of Applied Statistics*, 2022; 13(1), 241-263.