

Key Factors of China's Fast Economic Growth: Dynamics of China's Economic Expansion

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ABSTRACT

According to economist, increasing population growth rate is harmful for environment and causes many other challenges for economic growth and development of a country. In past, China was also facing the problem of high population growth rate. This study investigates the dynamics of China's economic expansion through an examination of key macroeconomic indicators such as population growth rate, trade openness, inflation, labor force participation rate, and gross fixed capital formation. Utilizing time series data from 1990 to 2022 sourced from World Development Indicators (WDI), ARDL model is used to analyze these relationships. Our short-term analysis indicates that labor force participation rate, gross fixed capital formation, inflation, and population growth rate have a positive impact on economic growth, while trade openness exerts a negative influence. In the long term, gross fixed capital formation does not significantly affect economic growth. The positive impact of population growth on economic growth aligns with the SDG target to achieve higher levels of economic productivity through diversification, technological upgrading, and innovation, including through a focus on high-value added and labor-intensive sectors.

Introduction

In recent decades, China's remarkable economic growth has captivated the attention of economists, policymakers, and scholars worldwide. From a predominantly agrarian economy to becoming the world's second-largest economy, China's transformation has been nothing short of remarkable. This study explores the multifaceted drivers and implications of China's economic growth, aiming

to provide insights into the factors contributing to its rapid expansion and the challenges it faces in sustaining this growth trajectory.

Over the past 40 years, China's economic growth story has been defined by historically high rates of increase, averaging over 10% annually (World Bank, 2021). Today, China has become the only country whose economy is unprecedentedly growing, and this shift has dramatically altered the fundamentals of globalization, particularly in trade and investment, as well as geopolitics. However, concerns raised about risks alarming financial systems, growing income disparity, and environmental threats have raised questions about the sustainability and inclusiveness of China's growth model (Naughton, 2018; Zhang and Daly, 2011).

To understand the specific characteristics of China as a country and the means for economic growth, it is crucial to study internal and external factors that contribute to China's economic growth. (Breton, 2008) The country has experienced significant growth due to swift industrialization, urbanization, and shifts in the economic framework with substantial investments in infrastructure, human capital, and technology. The international arena showcases the impact of trade liberalization, foreign direct investment attraction, and participation in Global Value Chains, particularly evident in China according to Baldwin (2008) and Subramanian & Kessler (2013).

Since the beginning of the last decade, China shift from an export-oriented model of growth towards a consumption and innovation-driven growth model has introduced a new set of factors in the country's growth dynamics. Recent policy strategies like the BRI, members, and China's pledges on sustainable development highlight the changes in its position in global economic governance (Kynge, 2019; Xinhua, 2015).

However, as it is evident, China's post-reform economic performance has been remarkable; the country has, however, not avoided a host of problems that threaten sustainable growth. These are the emission of polluted energies which has affected the environment, switching from a commodities and investment-based economy, and budgeting for too much debt and tension between nations (IMF, 2020; World Bank, 2019).

Right in the middle of this investigation is a web of other socio-economic factors such as; labor force, capital accumulation, trade liberalization, inflation, and population growth rate. Therefore, this study seeks to find the relationship between the labor force, fixed capital formation, trade openness, inflation rate, and population growth rate of a given country as the main socio-economic factors.

Thus, one can say that these elements play an extremely crucial role in defining the development of the Chinese economy.

Consequently, available information indicates that the size, skill composition, and efficiency of the workforce have economic growth as some of the main determinants (Kapsos, 2018). Complementing this, Khan & Senhadji (2001) explained that gross capital formation which may be defined as the process of acquiring fixed assets which include machinery and infrastructure is crucial for enhancing productivity and promoting technological development. In addition, China's trade openness has further reinforced its economic growth through easy entry of flow of foreign capital, technology, and markets (Dollar & Wei, 2007). However, other factors such as growth inhibitory elements such as inflationary pressures or date demographic issues highlighted in the population growth rate contain issues for sustainable development (Wei & Zhang, 2020).

While a great deal of work has already been done on each of these individual components, relatively little has been done to study how they operate in combination to influence China's

economic growth patterns. To fill this gap, this study performs an in-depth, extensive multivariate analysis to evaluate the interplays of the labor force and trade openness together with inflation, population growth rates, and gross fixed capital formation as co-factors that drives economic growth of China.

The analysis is anticipated to focus on the primary variables and their interrelationships, as well as their correlation with the overall trends in China's GDP over an extended period spanning several years or decades.

Objective of the Study

The objectives of this study are

- To examine how labor force participation rate, gross fixed capital formation, trade openness, inflation and population growth rate affects the economic growth of China.

Hypothesis of the study

Here the objectives of the study are formulated in the form of a hypothesis that we are going to test in our study

H1: Labor force growth positively influences GDP growth in China.

H2: Gross capital formation has a significant positive impact on China's GDP growth.

H3: Trade openness positively contributes to China's economic growth.

H4: Inflation has negative impact on China's GDP growth.

H5: Population growth rate has negative impact on China's GDP growth.

Significance of Study

This study is an addition to the literature to examine the impact of population growth rate on the economic growth of the subject country because usually high population growth is considered a barrier to economic growth, then how China has achieved high economic growth, and why have other developing countries have not? The overall impact of the population growth rate on economic growth will determine the policy. It will tell us how population growth can be a good factor in economic growth.

Literature Review

Fang and Liu (2021) discovered a favorable relationship between LFPR and economic advancement, indicating that a heightened LFPR could enhance productivity levels and output within the economy by maximizing human resource utilization.

The LFPR's position in the economy is exemplified by Parker and Vissing-Jorgensen (2020) through their demonstration that GDP contractions often result in a numerical decrease in LFPR due to negative cyclical responses to economic conditions and worker discouragement. Conversely, Bertola et al. (2022) found that sustained GDP growth positively impacts LFPR by generating more job opportunities and reducing unemployment rates.

Demographic shifts and aging populations, as highlighted by Chen and Imam (2018), serve as moderating factors, potentially leading to a negative correlation between older workers' proportion increase, LFPR reduction, and restricted GDP growth.

Estevão and Sá (2023) demonstrated how automation influences the LFPR-GDP dynamic: while automation may initially lower LFPR by displacing workers and reducing employment, it could enhance productivity and GDP growth in the long term, thus creating new job prospects and raising LFPR again.

Choudhary et al. (2021) emphasized that the impact of LFPR on GDP varies based on economic development levels, labor market structures, and industrial distributions using cross-country panel data on working-age population, labor force participation rate, and GDP. Emerging markets exhibited notably positive effects of increased LFPR on GDP through employing female and youth labor.

Liang and Wang (2022) examined sector-level data in China indicating a stronger association between high-tech/service sector LFPR and GDP growth compared to traditional manufacturing sectors, underscoring the significance of sectoral shifts in the LFPR-GDP relationship. This is the result of a discussion on China's LFPR/GDP which has raised alarm over demographic transition in an aging world with fewer people to work will necessarily lead to much lower GDP growth than it once did as have been made by Cai and Wang (2023) about china faces decline lfp due more gentle business environment creating headwinds for Growth Prospects.

Within a nation, disparities across regions can be very large and noticeable in China where capital formation inequalities among its component provinces lead to significant regional GDP variations stemming from deflected GFCF. There will be a strength in the GDP growth if we had advocated for policies leading to increase Gross Fixed Capital Formation (GFCF).

In an analysis of Gross Fixed Capital Formation (GFCF) and fiscal/monetary policies run by The International Monetary Fund, it stated that in emerging markets favorable fiscal policy concessions together with weak monetary stance propped up GFCF funding contributing into GDP.

The importance of distinguishing between public and private investments in capital formation was emphasized. According to Warner, Public, and McDonough (2023), both types of investments are crucial, with a particular emphasis on public investment that facilitates infrastructure development to enhance the private sector's contribution to GDP growth. Sustainable GFCF investments are increasingly recognized for their long-term profitability.

Stern and Zenghelis (2023) underscored in their research the significance of green investments within capital formation, advocating for sustainable infrastructure projects as contributors to more stable economic growth manifested in GDP. Capital investments aimed at enhancing productivity levels are essential for fostering GDP growth.

The World Bank report (2023) stresses the critical role of infrastructure investments in developing countries for economic progress and GDP expansion.

Creating a conducive environment for private GFCF investment is vital. The OECD article (2022) explores diverse strategies that governments can employ to incentivize private-sector investments through tax breaks, regulatory modifications, and collaborations between the public and private sectors. China's rapid economic growth during the early 2000s was attributed to substantial infrastructure investments; however, this led to overinvestment and inefficiencies, resulting in a decline in the marginal productivity of new capital ventures (Krugman, 2013).

The Chinese economy is characterized by low labor productivity despite increased capital injections, with output growth primarily dependent on labor inputs rather than technological advancements or productivity enhancements (Gallagher, 2014).

Direct state intervention by China's government through state-owned enterprises has led to capital misallocation towards unprofitable or inefficient projects (Dewatripont & Maskin, 2005). China's heavy reliance on exports makes its economy vulnerable to global economic fluctuations and trade policies. Domestic investment faces challenges in significantly influencing economic growth due to its reliance on external factors. China's economy is currently undergoing significant changes, shifting from manufacturing to services and prioritizing high-tech industries, potentially reducing the importance of Gross Fixed Capital Formation (GFCF) as a primary economic driver. However, research has been suggesting that infrastructure and manufacturing sector investments have more immediate impact on GDP as compared to any other sector especially highlighting the multiplier effect of infrastructure projects over economic growth.

Measures such as simplification of access bureaucratic procedures, tax benefits or support to PPPs) are identified as crucial to encourage private investment in GFCF. The idea behind GDP, however, is that certain aggregate of economic activities contributes to efficiency and prosperity in an economy; therefore active trade leads to higher performance for a country since it enhances competition between economies*ending not only improve productivity but also commercial accessibility. The impacts of trade openness on GDP are sector and region specific within a country, where manufacturing/ services mainly gain but agricultural regions may sound occur with threat from external competition.

As a result of trade openness, foreign direct investment (FDI) can be lured that may possibly then allow capital accumulation and development. Open trade policies leads countries to be like magnets for FDI which in turn can support GDP growth directly via increaseing the capital stock and,# creating new jobs etc.. International trade allows countries to access foreign markets, increasing the potential of increased profits and GDP through proper utilization of economies of scale. While trade liberalization may raise national GDP, it can also fuel income inequality.

In a paper with the Journal of Globalization and Development, Rodrik (2012) finds that global trade benefits accrue more to skilled workers and owners of capital than unskilled labor.

The Economic Journal also published another research by Frankel and Rose, advancing the notion that intellect might render an economy be buffeted potentially disrupting domestic economies as well as GDP growth easier to global fluctuations in economic environment due largely associated with trade openness.

Furthermore, the International Monetary Fund has suggested that policymakers should favour those trade policies which focus protection on particular sensitive industries while also advocating for openness. Public investment in education, infrastructure and technology to support national industries is crucial for international competitiveness. World Bank, () trade liberalization is essential to sustain GDP growth, more policies are needed.

Several studies have directly linked the level of trade liberalization in China with economic growth rates. Trade openness interprets into additional gains in the GDP of China, according to Chen and Li that were caused by productivity growth (particularly technical progress) which was achieved due to technological innovation and FDI. Huang et al., (2019), also show that the inflow of a large amount of FDIs by which China has attracted considerable amounts owing to advanced technology and management practices through being trade openness as concerning FDI and Economic Growth. 's research.

The analysis from Li and Zhang also suggests that trade openness has enabled structural transformation in China, boosting productivity by moving resources (especially labour) away from agriculture to come down manufacturing and services activities generating GDP growth across sectors. Their data from 1990 to 2020 implies a positive relationship between openness with productivity improvements in many other sectors.

While trade openness has a positive impact on GDP (Wang and Yu 2019), regional disparities remain in China. Their study looked at the uneven impact of trade openness on various regions. The coastal areas improved their economic picture more than the hinterland because these were better connected by infrastructure and seaports. In order to thoroughly examine the heterogeneous impact of trade openness, this study conducted a spatial econometric analysis based on regional GDP data from 2000 to 2017.

Trade agreements like the Belt and Road Initiative (BRI) have impacted too quickly for us to know, with as much confidence as we might hope when it comes to relationship between openness and GDP. Zhang and Zhou (2022) measured the impact of policies like BRI to China economic growth. The paper showed that other countries too were benefitting from these policies due to increased trade as well as improved regional economic integration and found it a driver of GDP growth. Through both qualitative analysis and econometric modeling, they examined how well the BRI actually did.

The current academic literature suggests that the linkage between inflation and GDP growth is nonlinear. Somewhat less positive, Khan and Senhadji (2020) find an optimal band of low to moderate inflation rates which support growth but further that a transition from negative to slightly positive inflation does not necessarily stimulate it. These thresholds were 7-10% in developing countries and 2-3% in developed nations as determined by a panel data analysis including evidence from all the world's economies (1980 -2015) via Lancet.

Inflation affects GDP growth differently depending on the context and scenario. Bittencourt et al. In Brazil, Russia, India and China outcomes differ Esmamipur et al. (2021). In Brazil and Russia, real GDP growth was found to be more sensitive to higher inflation rates than in China or India where instead it is lower rate of inflation that makes economy grow. This analysis of data from 1990-2019 further underlined the importance of country-specific factors.

In his study (2022) Mishkin emphasised that central banks must strike a balance between controlling inflation and still meeting growth objectives as efficiently. However, while banging the inflation control drum it has noted that too obsessive an approach could retard growth in emerging markets and a softer touch towards monetary policy -- within limits- would be more successful at boosting economic activity. MethodsQuantitative research methods and cross-national systematic reviews conducted between 2000 to 2020 were included in this paper.

Different categories in the economy are influenced distinctively by swelling. For example, a study of manufacturing and services in India by Ghosh-Gupta (2020) showed higher prices increases have positive effects on firm as it increase demand but at the same time increased costs put production off because they are dependent on economic models to analyze.

Researchers Zhang and Wu (2020) conducted a study "An Empirical Study on the Inflation- GDP Coefficient in China with non-linearity using Deep Regression Models", to divide inflation on Chinese GDP growth through deep regression models. They have found that up to a certain point, more than moderate inflation is good for growth; the rate below which this stops being true or becomes statistically insignificant (wherever signalling ends) has been at $\geq 8\%$ per year. By

examining data from 1995 to 2018, they discovered that one of the requirements for sustaining GDP growth in China is a rate of inflation kept at moderate levels.

Liu and Li (2019) also analyzed the inflation in China to examine how its trend affects GDP growth, with GARCH type of volatility models.

This paper focuses to analyze the relationship between an aging population and GDP growth in China. A recent study by Xu et al. Chang (2020) studied the impact of demographic aging on Chinese economic development; he found that an ageing population impacts these items and other things which may decelerate GDP growth. Using demographic and economic data from 2000 to 2019, the authors studied how pop dynamics related to econ growth.

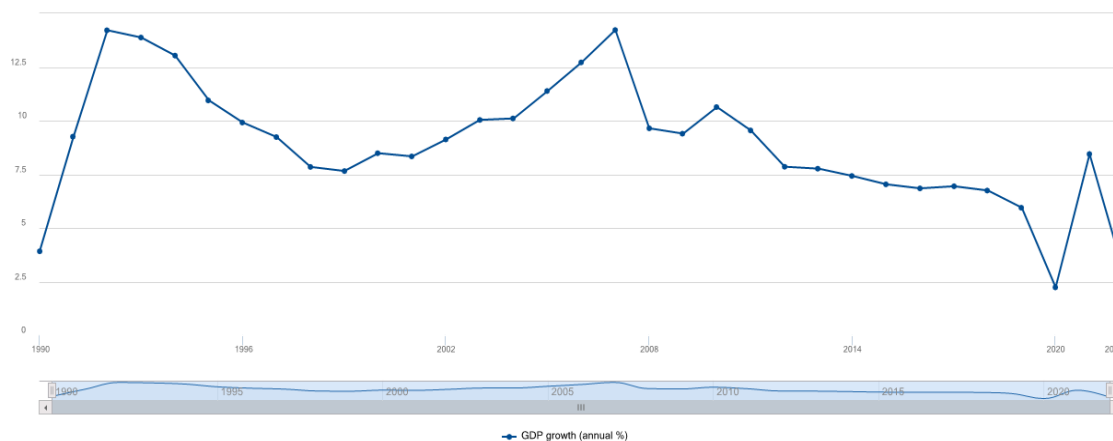
Second, the analysis of Li and Wei (2018) explained how changes in population will lead to a further decline in labor supply that is expected to affect employment rates and consequently influence industry competitiveness followed by GDP growth lines due to an increase workforce shortage leading higher wages. To understand their endogenous impacts on economic performance, time-series data from 2005 to 2017 were analysed in this study.

Another important demographic determinant of GDP is population density or urbanization, which through changes in consumption patterns and essential goods will also shape demand Shahzadi, Sheikh, Sadiq, & Rahman, (2023), Qureshi, Zaman, Rahman, Shahzadi, (2022), Hafiza, Manzoor, Fatima, Sheikh, Rahman, Qureshi, (2022), Shahid, Muhammed, Abbasi, Gurmani, & Rahman, (2022), Zulfiqar, Ansar, Ali, Hassan, Bilal, & Rahman, (2022), Zulfiqar, Ansar, Ali, Hassan, Bilal, & Rahman, (2022). Wang and Wu (2021) analyzed the influence of urbanization MAENs on CHS. They found that with fast urbanization comes more consumption and investment, which then drives up the economy. Analysis Population growth-GDP growth using fixed-effects techniques, the research examined whether population had any effect on GDP in recent years (2000-2020) within an urbanization context. Zhang and Li (2023) also addressed the issue in planning, arguing that demographic policies going so far to relax one-child policy or to provide fertility incentives are likely conducive for Chinese economic growth. According to their research, targeted demographic policies can counter the negative impact of population growth on GDP by stimulating labor and consumer markets. They assessed the effectiveness of these policies by doing qualitative examination on some policy documents together with quantitative analysis using demographic and economic indicators.

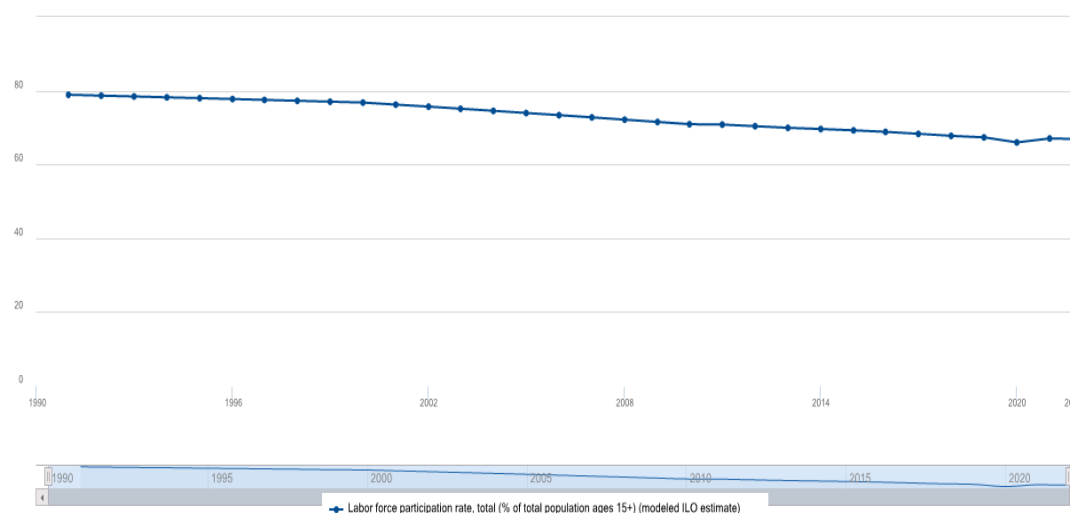
The concept of demographic distribution and the economic advantages derived from better planning for age across populations is further examined in the literature. According to Bloom et al. proposed a light Kaluscki (2017) whose growth PGDP is associated with these evolutions of populations following important demographic transitions including fertility reduction and increase in the working-age population. This is largely because of improved labor productivity and savings, as identified by Bloom et al. 's (2017) findings. Population in conjunction with human capital formation and also productivity growth always has an impact on economic dynamics. Acemoglu and Restrepo (2020) look at not only how population growth is combined with education but also on technological change Zahra, Nasir, Rahman, & Idress, (2023), Chaudhary, Nasir, Rahman, & Sheikh, (2023). Shahid, Ghaffar, Rahman, Ali, Baig, & Idrees, (2022), Hafiza, Rahman, Sadiq, Manzoor, Shoukat, & Ali, (2023), Dawood, Rahman, Majeed, Umair., & Idrees. (2023). The translate it into the expansion of GDP that results from human capital accumulation in combination with education and skills development plus population growth. The analysis by Viard and Lichtman is that countries we might term moderate in their population increase along with good human capital management lead to faster per capita GDP growth.

Overview of variables

China economic development has been measured by GDP growth rate over the years, especially in recent decades. Since China adopted economic reforms in the early 1970s till present day its economy is being on an upward trajectory. Fully dominated by agriculture from many years, but now it has become one of staunchest industrial and manufacturing powerhouse globally. The GDP value is shown on Y axis of the graph, and X-axis shows years or time series for China's GDP.



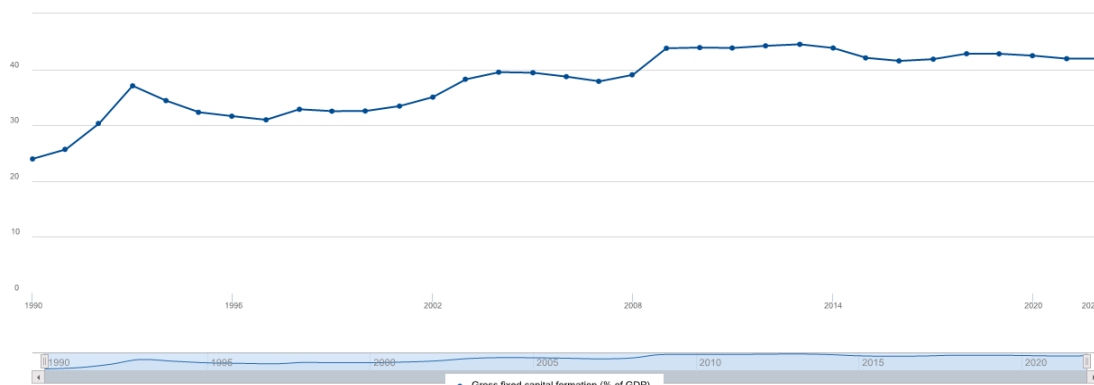
Country : China
Source: World Development Indicators
Created on: 03/21/2024



Country : China
Source: World Development Indicators
Created on: 03/21/2024

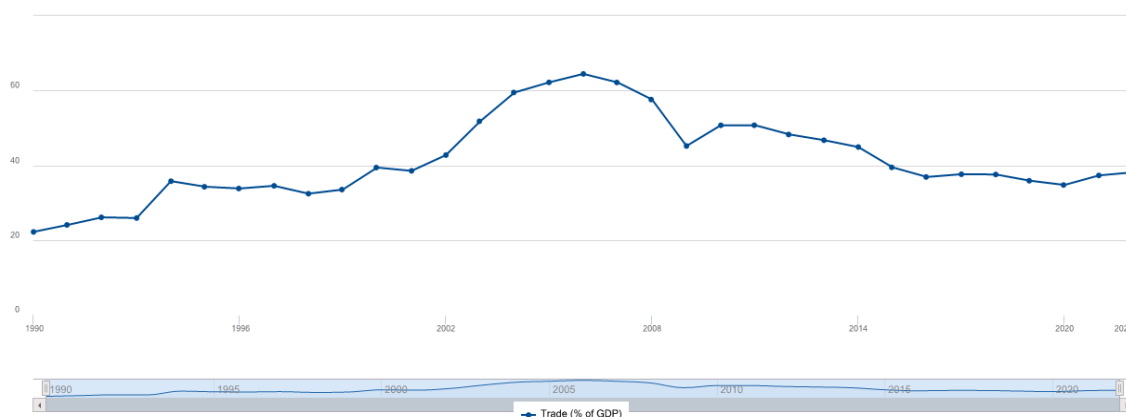
Another sign that can help to assess China's economic growth is the labor force participation rate or LFPR. A time series graph displaying the labor force participation rate in china is shown below. On the Y axis, the labor force participation rate is plotted against time or number of years on the X axis. Substantial economic expansion has been experienced by China over the last 20 years, as a

result of GFCF. This has been driven by extensive spending on new manufacturing facilities (infrastructure), among other things, geared to supporting urbanization which is a consequence of rapid industrialization that has necessitated the development of real estate. The value of gross fixed capital formation (GFCF) is plotted against years (time) realized on the X-axis and construction in China's GFCF is shown across this length.



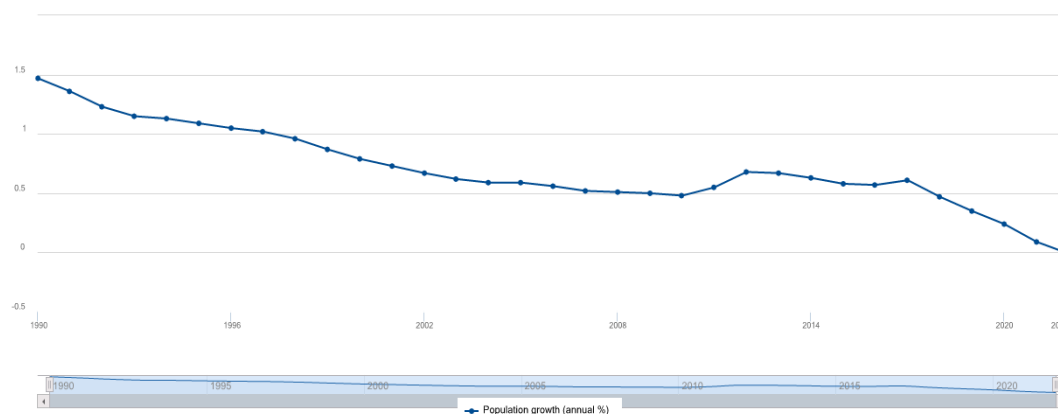
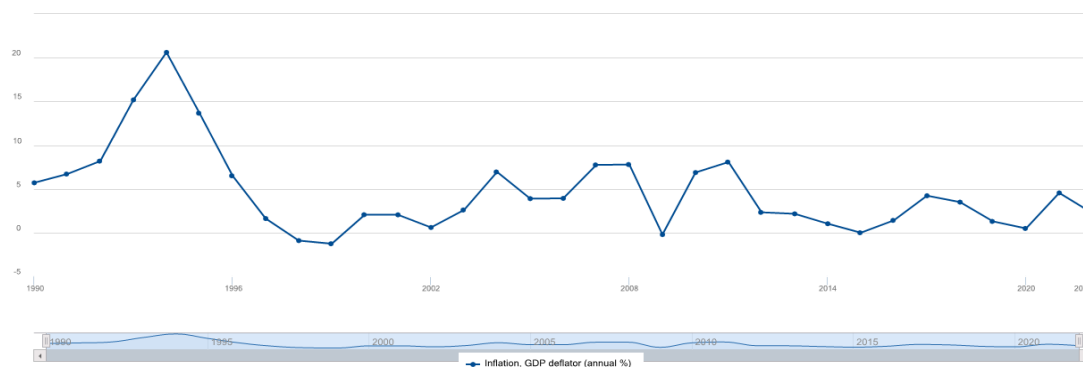
Country : China
Source: World Development Indicators
Created on: 03/21/2024

China's trade and economic growth have been tightly correlated, with trade being a key factor in the nation's rapid economic growth. China's trade is plotted against time on the graph below. Trade value is plotted on the Y-axis, and the number of years or time is plotted on the X-axis.



Country : China
Source: World Development Indicators
Created on: 03/21/2024

The graph below illustrates the inflation rate in China over time. The number of years or time is plotted on the X-axis, while the inflation value is plotted on the Y-axis.



The population growth rate value is plotted on the Y-axis, and the number of years or time is plotted on the X-axis.

Data and methodology

Data

Sufficient data is essential for empirical analysis and research validity. This study utilizes time series data spanning from 1990 to 2022, sourced from a single origin and presented as percentages.

S no.	Variable Name	Period	Data Source
1	GDP	1990-2022	WDI
2	Labor Force Participation Rate	1990-2022	WDI
3	Gross Fixed Capital Formation	1990-2022	WDI
4	Trade	1990-2022	WDI
5	Inflation	1990-2022	WDI
6	Population Growth Rate	1990-2022	WDI

Econometric Model

To attain the required result following model has been proposed.

$$GDP = f(lf, GFC, trade, inf, per)$$

For the above equation, the econometric model can be written as follows:

$$GDP = \beta_0 + \beta_1 LF + \beta_2 GFC + \beta_3 Trade + \beta_4 INF + \beta_5 PGR + \mu$$

Where the Dependent variable is,

The economic growth of China and GDP is used as a proxy for economic growth

GDP (annual%)= Gross Domestic Product

While Independent variables are:

INF= Inflation, GDP deflator (annual%)

PGR=Population Growth Rate (% GDP)

GFC= Gross Fixed Capital Formation (% GDP)

Trade= Trade (% GDP)

LF = Labor Force Participation Rate (% GDP)

α = Coefficient of variables

μ = Error term

All variables are converted into log form. The Logarithmic of all variables is determined as follows

$$\ln GDP = \beta_0 + \beta_1 \ln(LF) + \beta_2 \ln(GFC) + \beta_3 \ln(Trade) + \beta_4 \ln(INF) + \beta_5 \ln(PGR) + \mu$$

The subsequent model is calculated to utilize a bound test methodology.

$$\Delta GDP_t = \beta_0 + \beta_1 GDP_{t-1} + \beta_2 lf_{t-1} + \beta_3 gfc_{t-1} + \beta_4 trade_{t-1} + \beta_5 inf_{t-1} + \beta_6 pgr_{t-1} + \sum \delta_1 \Delta GDP_{t-i} + \sum \delta_2 \Delta lf_{t-i} + \sum \delta_3 \Delta gfc_{t-i} + \sum \delta_4 \Delta trade_{t-i} + \sum \delta_5 \Delta inf_{t-i} + \sum \delta_6 \Delta pgr_{t-i} + \mu_t \quad (1)$$

α_1 = long run multipliers

δ_1 = short-run dynamics

The most suitable lag order for the model is determined using the Akaike information criteria. The following null and alternative hypotheses are specified for testing:

$$H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$$

$$H_1: \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq 0$$

When the F-statistic's calculated value surpasses the upper limit, H_0 is invalidated, indicating a long-term relationship. Conversely, if the computed F-statistic value falls below this threshold, it

suggests otherwise. The subsequent phase involves executing equation (2) to determine the long-run parameters of the dynamic model.

$$GDP_t = \theta_0 + \theta_1 lf_t + \theta_2 gfc_t + \theta_3 tradet + \theta_4 inf_t + \theta_5 pgr_t + \mu_t \quad (2)$$

The long-run coefficients can be estimated using the unrestricted Error Correction Model in equation (2).

$$\theta_0 = -\alpha_0/\alpha_1, \theta_1 = -\alpha_2/\alpha_1, \theta_2 = -\alpha_3/\alpha_1,$$

$$\theta_3 = -\alpha_4/\alpha_1, \theta_4 = -\alpha_5/\alpha_1 \text{ and } \theta_5 = -\alpha_6/\alpha_1$$

An unbounded Error Correction Model (ECM) is employed to determine a short-term estimate of the model. The equation is then specified as follows:

$$\Delta GDP_t = c + \sum \gamma_1 \Delta GDP_{t-i} + \sum \gamma_2 \Delta lf_{t-i} + \sum \gamma_3 \Delta gfc_{t-i} + \sum \gamma_4 \Delta tradet_{t-i} + \sum \gamma_5 \Delta inf_{t-i} + \sum \gamma_6 \Delta pgr_{t-i} + \psi ECT_{t-i} + \varepsilon_t \quad (3)$$

Where,

$$ECT_{t-i} = GDP_{t-i} - \theta_0 - \theta_1 lf_{t-i} - \theta_2 gfc_{t-i} - \theta_3 tradet_{t-i} - \theta_4 inf_{t-i} - \theta_5 pgr_{t-i} \quad (4)$$

Methodology

The research utilizes the ARDL estimation technique, which is an econometric model for examining both long and short-term relationships among various time series variables. In this model, the AR component reflects past values of the dependent variable, capturing short-term dynamics. The distributed Lag Component accounts for past values of explanatory variables, representing their lagged effects on the dependent variable (Pesaran et al., 2001). GDP serves as a proxy for China's economic growth and is treated as the dependent variable, while labor force participation rate (lf), gross fixed capital formation (GFC), trade, inflation (inf), and population growth rate (pgr) are considered independent variables. Augmented Dickey Fuller (ADF) unit root tests are employed to determine the highest order of integration.

Results and Estimations

Unit root test

The primary objective of conducting a unit root test is to assess whether the variables exhibit stationary values.

Variables	ADF	Critical Values			Conclusion
		1%	5%	10%	
GDP	-5.332605	-4.296729	-3.568379	-3.218382	I(1)
Labor Force Participation Rate	-6.491518	-4.284580	-3.562882	-3.215267	I(1)
Gross Fixed Capital Formation	-4.940283	-4.296729	-3.568379	-3.218382	I(1)
Trade	-5.231172	-4.284580	-3.562882	-3.215267	I(1)
Inflation	-4.808045	-4.296729	-3.568379	3.218382	I(1)
Population Growth Rate	-4.4682855	-4.394309	-3.612199	-3.243079	I(0)

(Calculations are conducted in Eviews)

For all these variables, the ADF statistic is more negative than the critical values at all significance levels (1%, 5%, and 10%). Therefore, we reject the null hypothesis of a unit root for these variables at all significance levels. The conclusion is that these series are integrated of order 1 I(1), indicating they are non-stationary but become stationary after differencing once. For the Population Growth Rate variable, the ADF statistic is less negative than the critical values at all significance levels (1%, 5%, and 10%). Therefore, we fail to reject the null hypothesis of a unit root for this variable at all significance levels. The conclusion is that the series is integrated of order 0 I(0), indicating it is stationary without differencing.

Results of the ARDL model

An ARDL model is suitable when all variables exhibit stationarity at different levels, encompassing both the level and first difference of variables. The subsequent results presented in the tables below have been computed using Eviews software. The outcomes are derived from a formula involving various logged variables such as GDP, labor force, government final consumption, trade, inflation rate, population growth rate, and lagged values of these variables. Initially, data was sourced from the World Development Indicator for analysis in Eviews to generate the results discussed further below.

Table 2 shows the results of the ARDL model.

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNGDP(-1)	0.343199	0.215498	1.592587	0.1287
LNGDP(-2)	-0.326701	0.138791	-2.353906	0.0301
LNLF	33.72175	6.433441	5.241635	0.0001
LNLF(-1)	-54.93464	12.46233	-4.408056	0.0003
LNLF(-2)	21.63705	9.767857	2.215128	0.0399
LNGFC	-0.326959	0.724822	-0.451089	0.6573
LNGFC(-1)	0.598514	1.132987	0.528262	0.6038
LNGFC(-2)	-0.963779	0.703466	-1.370043	0.1875
LNTRADE	0.298058	0.373438	0.798145	0.4352
LNTRADE(-1)	0.113886	0.501705	0.226998	0.8230
LNTRADE(-2)	0.365073	0.256091	1.425558	0.1711
LNINF	0.108797	0.043561	2.497595	0.0224
LNPGR	0.291204	0.064619	4.506466	0.0003
R-squared	0.944198	F-statistic		25.38067
Adjusted R-squared	0.906996	Prob(F-statistic)		0.000000
Durbin-Watson stat	2.205468			

Overall, the model appears to explain a significant portion of the variance in the dependent variable, as indicated by the high R-squared value. However, not all independent variables are statistically significant predictors of the dependent variable. Gross fixed capital formation, trade, and their lags do not appear to have a statistically significant impact on the dependent variable. Labor force, inflation, and population growth rate, along with their lags, show statistically significant relationships with the dependent variable.

Now we will use the Wald test to check the long-run relationship between variables.

Bounds test Analysis

To check whether there exists a long-term relationship between variables or not we will use the Bounds Test approach. Table 3 gives the result of the Bounds test analysis. As the result shows F-statistics value is greater than both the lower and upper bound which is I(0) and I(1). It indicates the presence of a long-run relationship among the variables. In this case, the null hypothesis of no co-integration is rejected.

Bounds test critical values

Test Statistic			Value			
F-statistic			5.872352			
t-statistic			-4.568639			
	10%		5%		1%	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F-Statistic						
30	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
35	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
Asymptotic	1.810	2.930	2.140	3.340	2.820	4.210
t-Statistic						
Asymptotic	-1.620	-3.490	-1.950	-3.830	-2.580	-4.440

* I(0) and I(1) are respectively the stationary and non-stationary bounds.

(Calculations are conducted in Eviews)

Long Run Analysis

Table 4 shows the results of the long-run analysis of the ARDL model.

Variables	Coefficient	Std.Error	t-Statistics	Prob.
lnLF	3.218014	1.31	2.46	0.024
lnGfC	0.3122879	0.4492082	0.70	0.495
lnTrade	0.5564309	0.1230352	4.52	0.000
lnINF	0.11077	0.029771	3.72	0.001
lnPGR	0.2265788	0.0615568	3.68	0.002

In the long run, Trade, Inflation, and Population Growth Rate have statistically significant positive effects on the dependent variable, with Trade being the most significant predictor. However, the Labor Force is the only variable that is statistically significant at the 5% level, indicating its moderate impact on the dependent variable in the long run. Gross Fixed Capital Formation does not appear to have a statistically significant impact on the dependent variable in the long run, as its coefficient is not statistically significant at conventional levels. The study aligned with previous studies Ilyas, Banaras, Javaid, & Rahman, (2023), Ali, Rahman, & Anser, (2020), Rahman, Bakar, & Idrees, (2019), Rahman, & Bakar, (2019), Rahman, & Bakar, 2019), Rahman, & Bakar, (2018), Shafique, Sadiq, & Idrees, (2023), Ullah, Rehman, Raman, 2023; Usman, Rahman, Ullah, Rehman, Raman, 2023; Khan, Rahman, Fiaz. 2023.

Short Run Analysis

The findings of the short-term analysis are presented in Table 5, where the error correction model (ECM) is employed to examine the short-term correlation.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
E(-1)	-0.983501	0.146577	-6.709796	0.0000
D(LNGDP(-1))	0.326701	0.109455	2.984792	0.0066
D(LNLF)	33.72175	3.713853	9.079990	0.0000
D(LNLF(-1))	-21.63705	4.787503	-4.519486	0.0002
D(LNGFC)	-0.326959	0.510928	-0.639933	0.5285
D(LNGFC(-1))	0.963779	0.521244	1.848998	0.0774
D(LNTRADE)	0.298058	0.275412	1.082225	0.2904
D(LNTRADE(-1))	-0.365073	0.206302	-1.769605	0.0901
R-squared	0.939660	F-statistic		51.16745
Adjusted R-squared	0.921295	Prob(F-statistic)		0.000000
Durbin-Watson stat	2.205468			

(All Calculations are conducted in Eviews)

The value of ECT (error correction term) is -98.3%, which suggests that deviations from the long-run equilibrium are being corrected in the short run. In the short run, the lagged error term, as well as the first difference in the labor force, have statistically significant effects on the dependent variable. These finding bring into line with Shafique, Rahman, Khizar, Zulfiqar, (2021), Bilal, Shah, Rahman, Jehangir, (2022), Rahman, Ali, Idrees, Ali, & Zulfiqar, (2022), Khan, Afridi, Shad, Rahman, (2022), Li, Bai, Yu, Meo, Anees, &. Rahman, (2022), Khan, Afridi, Shad, Rahman, (2022), Rahman, Chaudhry, Meo, Sheikh, & Idrees, (2021), Sarwar, Ali, Bhatti, & Rahman, (2021), Younas, Idrees, & Rahman, (2021), Hassan, Sheikh, & Rahman, (2022), Zhu, Fang, Rahman, & Khan, (2021), Ali, Rahman, & Anser,. (2020). However, the first differences of gross fixed capital formation and trade, along with their lags, have statistically significant effects on the dependent variable at a 10% confidence interval in the short run. The model overall provides a good fit to the data, as indicated by the high R-squared and significant F-statistic.

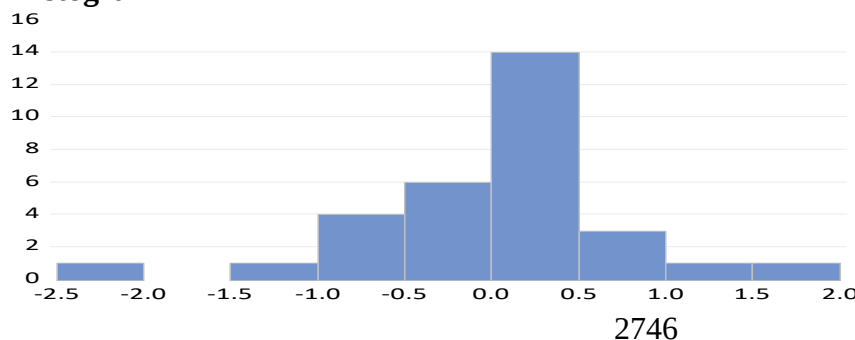
Serial Correlation LM Test

The outcomes of the serial correlation LM test indicate that there are no issues with autocorrelation, as the probability value exceeds 0.05, resulting in the null hypothesis being accepted. Therefore, autocorrelation is not a concern.

F-statistic	1.064018	Prob. F(2,16)	0.3683
Obs*R-squared	3.639065	Prob. Chi-Square(2)	0.1621

(Calculations are conducted in Eviews)

Histogram



Series: Residuals	
Sample 1992 2022	
Observations 31	
Mean	5.10e-06
Median	0.142944
Maximum	1.607793
Minimum	-2.306649
Std. Dev.	0.732822
Skewness	-0.948275
Kurtosis	5.136182
Jarque-Bera	10.54023
Probability	0.005143

Conclusion and Policy Recommendations

Conclusion

This research provides a comprehensive analysis of the economic growth trends in China, with a focus on various factors such as labor force participation rate, gross fixed capital formation, trade openness, inflation, and population growth rate. The objective was to deepen insights into the intricate relationships and impacts on economic development in one of the world's largest and most rapidly evolving economies using an ARDL model. The positive correlation between population growth and economic progress aligns with the Sustainable Development Goals (SDG) target of enhancing economic productivity through diversification, technological advancement, and innovation, particularly in high-value-added and labor-intensive sectors. Emphasizing full and productive employment for all individuals supports SDG 8 objectives. Facilitating greater workforce participation plays a vital role in boosting the economy. In the short term, construction activities provide an immediate injection of funds into an economy through gross fixed capital formation. This aligns with the objectives outlined by the Sustainable Development Goals (SDGs) to enhance global efficiency and environmental sustainability. Maintaining controlled inflation is conducive to growth, supporting broader economic strategies for sustainable development as per the SDGs (UNCTAD 2018:14), which emphasize the importance of stabilizing expectations regarding economic and employment outcomes. On the other hand, trade liberalization can pose challenges to short-term growth, entail medium-term adjustment costs, and thus requires effective management of global economic and international trade frameworks to promote sustainable economic development and fair trading policies for market access in line with the SDGs. While fixed capital formation plays a vital role in boosting the Chinese economy, its overall impact remains limited. These observations resonate with prior research conducted by Krugman (2013), Gallagher (2014), Devatripont & Maskin (2005), Lardy (2014), and Zhang & He (2017). The notion that total capital formation may not significantly influence long-term economic growth underscores the importance of implementing sustainable and well-structured economic policies aligned with the SDGs to foster sustainable economic development through investments in resilient infrastructure, innovation, and sustainable practices.

Policy Recommendations

Several policies can be derived from the results of the study. These are:

- Policies that support innovation and the adoption of new technologies, facilitate bureaucratic processes, and promote both domestic and foreign investment, can promote capital formation and productivity growth.
- The benefits of trade for economic expansion highlight how crucial it is to keep trade open and liberalized.
- Although inflation has shown a significant positive impact on economic growth in the long run, smart monetary policy is needed to keep inflation in check.
- China's integration into the global economy can be enhanced and economic growth can be driven through increased exports and imports through continued efforts to promote international trade, negotiate favorable trade agreements, and reduce trade barriers.
- To preserve price stability and promote sustainable economic growth, the central bank should keep an eye on inflationary pressures and take the necessary monetary policy actions.

- The population growth rate demonstrated a noteworthy positive correlation with economic growth, underscoring the pivotal role of demographic considerations in propelling economic advancement.
- By fostering gender equality, family planning, and investments in healthcare and education, policies can successfully manage population dynamics and capitalize on the demographic dividend to drive economic growth.
- Because the variables have a long-term link and the error correction period is significant, policymakers should approach economic planning holistically.
- In the face of regional and global difficulties, long-term development policies that tackle structural changes, technological innovation, environmental sustainability, and social inclusion can guarantee balanced and inclusive growth.

In summary, China's economic growth trajectory and progress toward its development goals depend on an integrated policy framework that takes into account the interplay of labor market dynamics, investment, trade openness, price stability, demographic trends, and long-term planning.

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