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Forecasting India's Gdp Using Arima: Factors Contributing To India's Growth

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Abstract:
India is poised to reach the ambitious target of becoming a USD 5 trillion economy by 2027 and become the third largest economy of the world by 2032. This trajectory is fuelled by a youthful population, a burgeoning middle class, and robust digital infrastructure. Indian Prime Minister, Narendra Modi, has built his global image with political astuteness, emphasising multilateralism and the rule of law. However, in a world, where nationalism, egotism and authoritarianism are on the rise, India faces a challenging task as a global leader in maintaining world peace, contain global wars and coax others countries to play by the book. India may need to recalibrate its foreign policy in order to align its global political ambitions with its growing economic targets. This paper looks at the factors that have contributed to India's economic growth and its growing international stature. ARIMA (Auto-Regressive Integrated Moving Average) technique has been applied to forecast the GDP growth rates of India until 2035. India is projected to reach a GDP of USD 7 trillion during this period. The paper concludes that with economic growth, India is also likely to increase its influence as a global leader.

Keywords: India, GDP, Economic-Growth, Political-Leadership, Foreign-Policy
JEL Classification: C22, C53, E27

1. Introduction

Indian Sensex touched an all-time high to close at 72,038.43 points on 27th December 2023, mirroring the trend witnessed in the global markets. With this, India's total market capitalization amounts to USD 4.3 trillion (ET Bureau, 2023). The domestic retail investor has overtaken the foreign portfolio investors as the largest public participants in the Indian equity markets (Singh, et.al., 2023). The markets remain bullish, the confidence of domestic investor is buoyant and India seems to tick all the right boxes.

The Indian economic transformation reflected in the equity markets has been a steady growth story. It's not just the equity markets that have shown promising growth in India. There is something to cheer about in overall economic indicators over this period. The decline in poverty ratio, increase in literacy rates, an improvement in life expectancy, and even an increase in per capita ratio, the India story has considerably improved. Many academics have argued that human-development indicators still indicate that India has underperformed in most of these parameters. However, underperformance cannot be synonymous with non-performance (Debroy, 2004).

India's outreach to other countries to engage in bi-lateral and multi-lateral discussions on trade and development and other forms of cooperation are a sign of its commitment to be a global player. Its discussions with UK, EU and other nations in finalizing an FTA (Free Trade Agreement) are a step in this direction (Agarwal, 2023).

2. The India Growth Story

Post liberalization, India has experienced encouraging growth. There are many factors that have shaped India's growth story.

2.1 Consumption Driven Growth

With a growing middle class, India has been dubbed as a consumption market. The trade liberalization of 1991 provided greater market access for foreign producers to tap the large Indian market. The economic reforms injected an adrenaline rush around the world, with producers from across the globe, eyeing for the Indian market. The Indian consumer, who was bereft of choice until now, was suddenly spoilt for choice.

In 1983, Maruti Suzuki introduced the common man's car. The middle-class Indian consumer was given the choice of owning a car, but the car was available only in four colors. It was as if the size of the rainbow had been reduced for the Indian consumer. Such was the effect of a socialist, planned economy.

The big change from a quasi-planned economy to a more open, liberalized economy gave way to opening of markets and unleashing consumer products in the Indian retail market. With a growing, aspiring middle-class, the Indian consumption market has expanded rapidly. Domestic consumption has increased demand for various goods and services. The huge consumption base of Indian population's bottom half remains the biggest growth driver (Subbarao, 2024).

The productivity growth in nontradeable consumer services such as retail, hospitality sector especially restaurants and real estate (primarily residential) has been an important driver of structural transformation and rising living standards of the people of India (Fan, et al., 2023). In response to the critics of consumption driven growth, Mishra (2011) has analysed the causal relationship between consumption expenditure and economic growth of India employing the Vector Error Correction Model (VECM). The results of the analysis show a uni-directional causal relationship from consumption expenditure to real GDP in the long run.

Hence, the confidence in consumption driven growth continues to play a vital role in propelling economic growth in India.

2.2 The Demographic Advantage

India has caught the attention of the world for its demography. India, as a single country, has the largest population in the world, having overtaken China. According to the United Nations Population Fund, the working population (between the age group 15-64) of India is a whopping 68 per cent[1]. Irrespective of the size of the population, the large workforce, called as a 'bulge' by Chandrasekhar, et al. (2006) is an inherent advantage, which the authors have referred to as the 'demographic dividend'. This large segment of young working population is the primary productive human resource directly linked to the Indian growth (Goswami, et al., 2010; Shukla, 2010).

Increasing participation of the women in the workforce has also been a key driver of economic growth in India. Women empowerment and entrepreneurship leads to shared prosperity and a more dynamic and sustainable growth (Ghani, et al., 2013). With the availability of basic amenities like access to clean water, electricity and gas-connections, rural women, who used to spend considerable time in organizing household chores (in the absence of these basic amenities), are now able to partake in economic activities such as handicrafts, poultry farming etc. Alongwith the youth, added women participation to the working population of India is making a strong impulse for economic growth.

Demographics adds to the speed and nature of economic growth. Bloom (2011) has concluded that India's demographic dividend will open new economic opportunities for India. Policy reforms in order to educate the youth, develop their skills and promotion of entrepreneurship will empower the workforce and increase productivity in India (James, 2011).

The theory that demographic transition of India fuels its economic growth is well established (Ghosh, 2016; Kumar, 2014; Aiyar & Mody, 2011; Ladusingh & Narayana, 2011; Bloom et al., 2010; James, 2008). The increased discourse regarding

[1] https://www.unfpa.org/swp2023/8-billion-strong

India reaping the benefits of its demographic dividend contains some merit (Joe, et al., 2018). The share of expanded workforce is reflected in the net growth of India. Hence, the Indian economic growth significantly benefits from this demographic advantage.

2.3 Digitalisation and Financial Inclusion

India boasts of a strong Information Technology (IT) sector. IT has brought in progressive changes to the economic, social and personal life of Indians. This digital advantage has been utilized by the government as a key policy strategy (Maiti, et al., 2020). Exposure to IT enhances efficiency and productivity, saves time, alleviates challenges, eliminates information distortions and improves communication (Oulton, 2012; Castellacci & Tveito, 2018). Consequently, the adoption of IT has yielded positive impacts on economic outcomes such as capital formation, exports and government accounts. Eliminating physical barriers, IT has enabled financial inclusion by providing relatively easy access to financial services.

According to the Information and Broadcasting Ministry, Government of India, there are 1.2 billion mobile phone users in India, which include 600 million smart phone users (Anand, 2022). More and more Indians are using mobile phones not just for entertainment, but have now access to information and are able to take benefit of the digital services offered by government and private players alike.

Aadhaar initiative along-with the mobile number has made it possible to expand the scope, size and type of services offered by the government, digitally. Aadhaar, a unique 12-digit ID issued to all citizens, was a mammoth task covering over a billion people in order to take their fingerprints and scan their iris'. Aadhaar works seamlessly with the registered mobile number of the individual and brings in efficiency in governance services.

The National Mission on Financial Inclusion (also referred to as the PMJDY-Pradhan Mantri Jan-Dhan Yojana), started in August 2014, already has crossed 500 million low-cost accounts. Almost 56 per cent of these accounts belonging to women and more than 67 per cent of these accounts have been opened in rural and semi-urban areas. The accounts have proved extremely useful in getting the benefits of government schemes to the ultimate beneficiary. The beneficiaries are able to receive Direct Benefit Transfer (DBT) into their accounts, thereby plugging leakages in the system. The account holders of these accounts enjoy other benefits too, like the option of having a free debit card, overdraft facility up-to a maximum of Rs. 10,000 and even an accident insurance coverage of Rs. 2,00,000 (ET BFSI, 2023).

The digital financial transactions made easy through the Mobile coupled with Adhaar and opening of zero-balance bank accounts called Jan-Dhan accounts have come to be called as JAM (Jan-Dhan-Adhaar-Mobile) trinity. The magic of JAM enables low-income households to enhance their livelihoods, propelling India towards a middle-income trajectory characterized by widely shared prosperity (Subbarao, 2023). Access to government welfare schemes has improved due to e-payments and JAM (Singh & Singh, 2024).

The UPI (Unified Payments Interface) is another digital platform which connects banks and their account holders through their mobile numbers (Rakesh, et al., 2018). Payments are seamlessly transferred to other individuals or businesses making transactions easier and simpler without the use of either physical money or even credit cards. As one of the most successful initiatives, the Indian UPI transactions in volume have crossed the trillion-dollar mark in 2022, appealing countries like Japan, South Korea and France to adopt India's UPI (Saha & Mathew, 2022).

The Ayushman Bharat Digital Mission, the healthcare app, aims to integrate health infrastructure including personal health records (Ram, 2023). This initiative aims to enhance the availability, accessibility, affordability and acceptance of healthcare by leveraging Digital Public Goods across various components. Its mission is to cultivate a comprehensive, inclusive and seamlessly integrated national digital health eco-system (Sharma, et al., 2023). The Open Network Digital Commerce (ONDC) is being developed to create an inclusive ecosystem for India's e-commerce landscape. It's a platform that aims to create new opportunities, curb digital monopolies and help MSME's and small traders to use online platforms (Business Standard, 2024)

Numerous other digital services are available and many more are being developed. The digital transformation of India has brought in efficiency, reduced transaction costs and promoted growth.

2.4 The Structural Reforms

Structural reforms have played a crucial role in the Indian growth story. Policy-led changes, incentives and other steps taken by India have improved efficiency of the economy. The Indian liberalization of 1991 introduced a major shift to the underlying structure of Indian economy. Reducing tariff barriers and opening borders to foreign investors was instrumental in connecting India to a global economy. Thereafter, a number of reforms such as privatization of state-owned enterprises, deregulation of the financial sector led India towards a market-based economy. These reforms were undertaken to make the Indian economy more efficient and competitive. Since then, reforms to simplify tax regime through the implementation of the goods and services tax (GST), the introduction of the Insolvency and Bankruptcy Code (IBC), to resolve the insolvency of businesses and improve the credit environment for business in India. More recently, the Production Linked Incentive (PLI) scheme is to encourage manufacturing industry in India by providing incentives and thereby create jobs. Similarly, National Monetization Pipeline (NMP) aims to inject funds into government coffers which are then utilized for development of infrastructure and other vital projects. The Hydrogen Energy Mission aims to reduce India's dependence on fossil fuels and establish India as a front-runner in hydrogen energy. The National Education Policy (NEP) is redrafting the education policy to bring it par to global standards (Testbook, 2023).

These structural changes have played a vital role in development of infrastructure, reduce poverty, attract investments, increase competition as well as to bring efficiency in governance. All these initiatives have started reflecting in Indian economic growth.

3 India at the International Stage

3.1 India's Mature Democracy

At the time of Indian independence, the west was certain that Indian democracy would collapse and India would soon be fragmented into smaller units of governance (Nayak, 2014). With all the challenges and hardships faced by Indian politicians, since independence, Indian democracy survived and has deepened overtime. While democratice freedom may lead to economic freedom, the opposite may not necessarily be true. The classical liberal assertion that economic freedom would naturally pave the way for political freedom, particularly in countries like China, where Western investment aimed to catalyse citizens' demand for political liberties, has proved flawed. In contrast, Indian democracy has stood the test of time. And it has been acknowledged that a democratic India remains better than an autocratic China (Agarwal, et al., 2021).

Elsewhere, in the United States (US), often hailed as the epitome of democracy, the assault on Capitol Hill by supporters of the Republican party stands as a stark blemish on democratic principles. Heine (2021) called the incident of 6th January 2021 as 'The American Kristallnacht' and has termed the event within the broader crisis of Western democracies and the rise of populism. While there is erosion of democracy in various countries of the world, democracy in most of the developing world continues to flourish. The policy literature available habitually implies the ownership of democracy by Western nations (Jaishankar, 2019), without understanding the nuances and functioning of democracy across different nations.

In contrast, despite its imperfections, India has consistently upheld and respected democracy, preserving its democratic traditions. Indian democracy has deepened and matured over the years. India also remains committed to a rule based international global order. Moreover, as a democratic country, India continues to play a vital role in preserving peace and stability, generate sustainable and equitable global solutions and share experiences of governance.

3.2 India's Leadership Role during COVID-19

Dubbed as the 'pharmacy of the world', India was a pioneer in developing the covid vaccine. India showed its magnanimity by supplying its vaccine to the world, its neighbours and its citizens (Pattnaik, 2021). India's leadership role during Covid-19 was on full display when it decided to follow the 'Neighbourhood First' policy (Trofimov & Bellman, 2021; Pasricha, 2021) to deliver its vaccine to its neighbours (Singh et al., 2023). In addition to supplying vaccines, India sent medical equipment, masks and other essential supplies to countries around the world. India's vaccine diplomacy (Lisk & Šehović, 2020), while appreciated by most countries, also ruffled feathers in a few others.

Amid the suspension of air travel, India took pro-active steps to evacuate citizens from neighbouring countries, who were stranded across the globe, ensuring their safe return home. This initiative exemplifies India's commitment to the foreign policy principle of "one world, one family" (Mahapatra, 2016).

India garnered international acclaim for its effective measures in combating COVID-19, thereby enhancing its global reputation and respect. This success bolstered India's standing on the world stage and underscored its commitment to global solidarity.

3.3 India's Strategic Autonomy

The conflict between Russia and Ukraine has solidified the rifts between the US, Europe and the UK on one side pitted against Russia on the other (Siddi, 2022). Over the past two years, there has been a noticeable realignment of alliances, with China's 'no-limits' friendship to Russia (Wertsch, 2023), signalling a growing resentment against the dominance of the United States and its allies. The recent development of North Korea reaching out to Russia, represented by Kim Jong Un's visit to Moscow in September 2023 further underscores this trend.

India has adopted a distinctive neutrality towards Russia and has refrained from publicly condemning the invasion of Ukraine by Russia. This has irked the western nations, who are dismayed with India (Tellis, 2022). Germany, in particular, was extremely disturbed and expressed its anxiety over India not condemning Russia (Agarwal & Hussain, 2023). India stood firm in its decision based on its motto of maintaining 'strategic autonomy". Inspite of the growing 'strategic proximity' with the US, Thakkar (2024) argues that the two Indian concepts of strategic autonomy and strategic proximity need to be understood by the world at large and the two concepts will continue to co-exist.

India retains its independent stand on not just domestic issues but pressing international matters. The opinion about India's strategic autonomy might be divided, however, India has always maintained a balance in its equation with the world.

3.4 India's G20 Presidency

The G20, which consists of 19 individual countries and the European Union (EU), has developed into a key platform for international cooperation and policy alignment (Breslin, 2020). It plays an essential role in influencing global governance and addressing worldwide challenges (Ali & Kamraju, 2023). While, the forum primarily addresses economic collaboration (Mazouz, 2021), its influence extends to other crucial areas, including financial crises, climate change, sustainable development, and trade (Kirton & Kokotsis, 2021).

India took over the G20 Presidency from Indonesia on December 1, 2022. India's presidency was characterized by adept leadership, strategic vision and diplomatic finesse. Shaping the agenda and fostering consensus are key tasks of the presidency (Zacher & Koehane, 2017) and India reinforced its adroitness in navigating complex geopolitical issues. As a responsible global player, India emphasized the importance of climate change and sustainable development. Its commitment to inclusivity was on display as it invited African Union became a permanent member of the G20 in 2023.

India's ability to unite differing perspectives has enhanced its soft power and positioned it to play a key role in shaping the global order. During its 2023, G20 presidency, India exerted influence that reached beyond the G20 itself, making a notable impact on international relations and geo-politics. Throughout this period, India's leadership not only steered the G20's priorities but also broadened its influence in critical global areas, thereby elevating its global standing and influence

The transformation of India seen in the last few years is noteworthy. This transformation is witnessed both at the domestic front as well as in international affairs. The policy-led changes have propelled India as a leading global power. The empirical analysis in the next section delves on India's GDP forecast to corroborate and compliment India's growing global stature.

4 Research Methodology

The empirical analysis uses the time-series data from World Bank for the period 1973-2022. All tables, graphs and figures are derived using Worldbank data and the analysis has been done with the help of Eviews 12 software, unless otherwise

mentioned. The top 5 economies of the world in 2022, which include the People's Republic of China (CN), Germany (DE), India (IN), Japan, (JP) and the United States (US), have been studied. The ARIMA (Autoregressive Integrated Moving Average) model by Box and Jenkins (1976) is applied on the historical data of univariate time series for each of the countries. The analysis estimates the values of p and q in the ARIMA model after examining the autocorrelation function (ACF) and partial autocorrelation function (PACF) in the time series.

The steps involved in forecasting in time-series using ARIMA are identification, parameter estimation, diagnostic checks and forecasting. The general functional form of ARIMA (p,d,q) model is:

$\phi_p(B)\,\Delta^d Y_t = c + \theta_q(B)\,a_t$

where:

Y : denotes the GDP

B : is the Lag Operator

a : is the Error term ($Y - \hat{Y}$), where $\hat{Y}$ is the estimated value of Y

t : is the time subscript

$\phi_p(B)$: non-seasonal Auto Regressive (AR)

Δ^d : non-seasonal difference

$\theta_q(B)$: non-seasonal Moving Average (MA)

ϕ and θ : parameters to be estimated

Since the introduction of the ARIMA Model by Box and Jenkins (BJ), academics have discussed the advantages of using this approach as an indispensable tool of statistical modelling of time series (Kirchgässner, et al., 2013; Chatfield, 2013). Similarly, Frain (1992) in his lecture notes on univariate time series analysis has emphasized on the intuition and the theory of the BJ methodology. Young (1977) used the BJ approach and compared it with econometric modelling and found the BJ approach to be useful in forecasting.

A comparison of time series forecasts to preliminary milk price estimates was conducted, in which Klugh & Markham (1985) observed that Box-Jenkins time series models outperformed the preliminary milk price estimation proceduare in five states of the US. Marcek (1998) used this methodology to forecast stock prices of 1997 using ARIMA (2,1,1) as the model of best fit.

Adopting the BJ approach, ARIMA model is a high precision and effective method to forecast GDP time series as the error between actual and predicted values is small when forecasting (Wang & Wang, 2011; Wei, et al., 2010).

For India, forecasting for a time period of 60 years, the GDP growth rate shows steady growth (Maity & Chatterjee, 2012). Forecasting results to calculate the per capita GDP of five regions of Sweden for the years 1993-2009 have been computed using three models, namely, ARIMA, VAR and AR(1) (Zhang, 2013). All three models show similar outcomes for forecasting in the short run, however, AR(1) Autoregressive first order is the most suitable to forecast the per capita GDP of five regions of Sweden. In another study, Shahini and Haderi (2013) have also employed two models, namely, ARIMA and VAR to forecast GDP for Albania for the period 2003-2013. The results show VAR to be more apt for GDP forecasting as compared with ARIMA model.

Zakai (2014) has used ARIMA (1,1,0) to forecast GDP of Pakistan using quarterly data from 1953-2012 to show the rate of growth of GDP from 2013-2025. Modeling and forecasting real GDP rate in Greece, Dritsaki (2015) employs the BJ approach for the period 1980-2013. Using ARIMA (1,1,1) to forecast real GDP for 2015-2017 the results show a steady increase in GDP of Greece.

The quarterly agricultural GDP of Kenya for the period 2000-2014, using BJ seasonal ARIMA, shows that the SARIMA (1,0,0) (1,1,0) was the model of best fit to describe the agricultural GDP of Kenyan economy (Musundi, et al., 2016).

ARIMA (2,4,2) is shown to be effective to forecast Chinese GDP on the annual GDP data of China from 1978-2014 (Yang, et al., 2016). In the case of Bangladesh, BJ methodology has been applied and found that ARIMA (1,2,1) model is the best fit with forecast showing a steady growth of Bangladesh GDP (Miah, et al., 2019; Salahuddin & Tanzim, 2021). ARIMA (0,1,2) model is the best fit model for forecasting GDP movements in Nepal (Rana, 2019). Jeyarajah (2022) has applied the BJ approach for modelling and forecasting GDP in Sri Lanka using ARIMA (1,1,1). The forecast period 2022-2030 shows a steady growth of GDP of Sri Lanka during the predicted period.

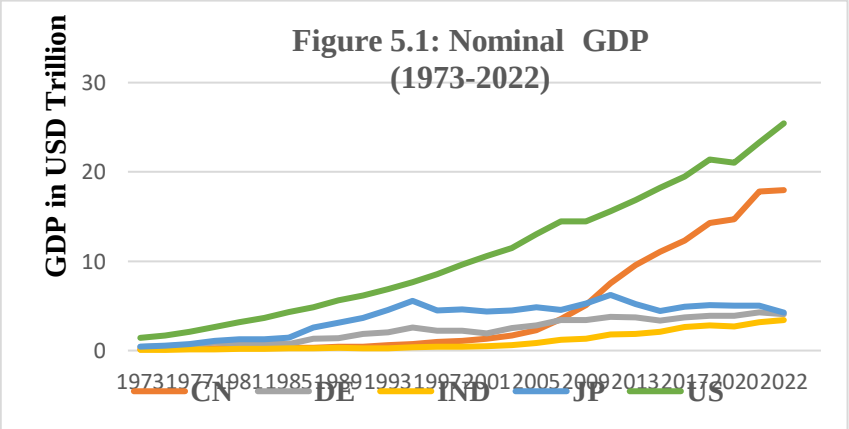
5 Forecasting Results: India's GDP from 2023-2035

5.1 Descriptive Statistics

Figure 5.1 shows the GDP of the five countries for the last 50 years shows a steady growth for the United States, which has reached a GDP of USD 25.44 trillion in 2022. During the period from 1973-2022, the US has experienced a decline of its GDP in 2009 when it fell from USD 14.77 trillion in 2008 to USD 14.48 trillion and again in 2020, when it fell from USD 21.38 trillion in 2019 to USD 21.06 trillion in 2020. These two drops can be attributed to the American Subprime Mortgage Crisis which led to the global financial crisis of 2007-2008 and the extra-ordinary COVID-19 situation in 2020.

China had a GDP of USD 138 billion in 1973, whereas India in the same year recorded a GDP of USD 85 billion. China reached its first trillion in the year 1998 and continued on its upward trajectory after 1998. A sharp upward trajectory is seen from the year 2004, when its GDP was at USD 1.95 trillion. From below USD 2 trillion in 2004, China has touched a GDP of USD 17.96 trillion in 2022, an addition of more than USD 16 trillion during the period 2004-2022. It added more than USD 3 trillion from 2020 to 2021, when its GDP was USD 14.69 trillion in 2020, the GDP in 2021 was USD 17.82 trillion. However, in 2022, China shows a modest growth recording a GDP of USD 17.96 trillion.

In 1973, Japan had a GDP of USD 441billion and its GDP remained below USD 2 trillion till 1985 having GDP of USD 1.43 trillion. In the next 10 years, Japan reached a peak



Source: Authors own

with a GDP of USD 5.55 trillion in 1995. Its GDP remained below USD 6 trillion till 2010, having a GDP of USD 5.75 trillion in 2010. Japan's economy touched its second and highest peak in 2012 with a GDP of USD 6.27 trillion, after which its GDP has declined and was recorded at USD 4.23 trillion in 2022.

German economy showed similar traits as those of the Japanese economy with the absence of fluctuations experienced by the Japanese economy during the period 1973-2022. Germany had a GDP of USD 398 billion in 1973 and reaching a USD 1.05 trillion in 1986. Unlike Japan, German economy has not crossed the USD 5 trillion mark and continues to remain at USD 4.08 trillion in 2022.

Indian economy was similar to its Asian counterpart, China, in 1973 having a GDP of USD 85 billion. India reached its first trillion in 2007 (60 years after independence) with a GDP of USD 1.22 trillion. The next trillion was in 2014 when India's GDP was recorded at USD 2.04 trillion. The next seven years again added another trillion to India's GDP with a USD 3.15 trillion in 2021. While China added USD 16 trillion from 2004 to 2021, India could add only USD 2 trillion to reach a GDP of USD 3.42 trillion in 2022.

Table 5.1: Descriptive Statistics

	CN	DE	IN	JP	US
Mean	3.8623	2.2479	0.9210	3.6404	10.1302
Median	0.9953	2.2000	0.4186	4.4687	8.8202
Maximum	17.9632	4.2785	3.4166	6.2724	25.4397
Minimum	0.1385	0.3984	0.0855	0.4415	1.4254
Std. Dev.	5.2819	1.2288	0.9614	1.7884	6.6711
Skewness	1.3669	0.0108	1.1421	-0.6089	0.4785
Kurtosis	3.5199	1.6334	2.9581	1.8960	2.1127
Jarque-Bera	16.1330	3.8917	10.8728	5.6289	3.5485
Probability	0.0003	0.1429	0.0044	0.0599	0.1696
Sum	193.1144	112.3958	46.0501	182.0194	506.5100
Sum Sq. Dev.	1367.0380	73.9925	45.2944	156.7160	2180.7030
Observations	50	50	50	50	50

Source: Authors own

From Table 5.1, it is clear that the average values of GDP for the period studied for the US is highest at USD 10.13 trillion, followed by China at USD 3.86 trillion. Japan has an average value of GDP of USD 3.64 trillion with Germany on the fourth position with a value of USD 2.25 trillion. India has the lowest average value of GDP at USD 0.92 trillion. The average value of GDP for India has not reached USD 1 trillion.

5.2 Stationarity Test

The Augmented Dicky Fuller (ADF) method was used to check the stationarity of the data for all the five selected countries. The data was non-stationary at nominal value of GDP. Therefore, the first order transformation of natural logarithm of GDP has been employed to make the series stationary for all countries, except China, which is integrated at second order.

5.3 ARIMA Modelling

5.3.1 ARIMA Modelling for India

On the basis of ACF and PACF analysis, the identification of the values of parameters p and q have been undertaken after experimenting with different lags of the moving average (MA) and autoregressive (AR) processes. The lags have been arrived after checking the criteria for best model selection based on maximum Log Likelihood, and minimum values of Akaike's Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC).

Table 5.3.1: Parameter Estimates of ARIMA Model for India

Variable	Coefficient	Std. Error	t-Statistic	p-value

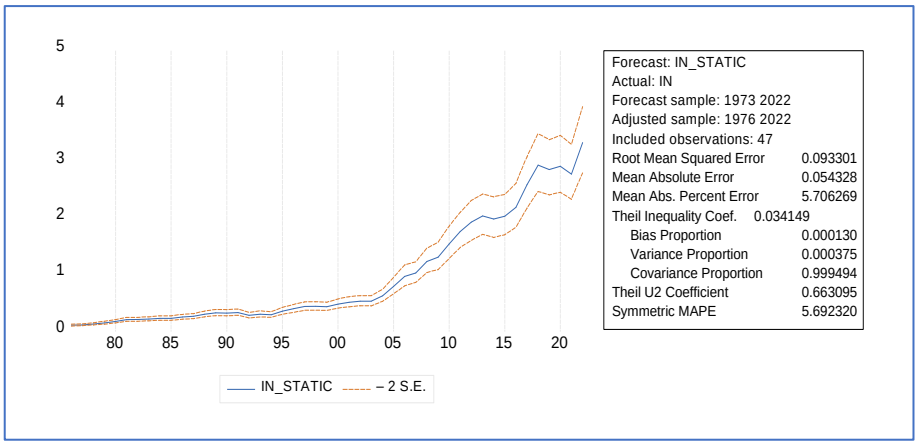
AR (2)	-0.5440	0.2251	-2.4166	0.0199
MA (2)	0.8448	0.2765	3.0554	0.0038
MA (3)	0.3434	0.1635	2.0998	0.0415
Constant	0.0760	0.0163	4.6674	0.0000

Source: Authors own

The ARIMA Model has been applied to forecast the GDP values for India for the period 2023-2035. From Table 5.3.1, it is evident that the non-seasonal AR(2), non-seasonal MA(2) and non-seasonal MA(3) are significant as the p-value is less than 5 per cent. Differencing of order one was adequate for a stationary series. The ARIMA (p,d,q) for India is (,2,1,(,2,3)). The unit root test indicates Autoregressive Moving Average (ARMA) model is stationary and invertible. The residual ACF as suggested by Ljung-Box (Q) (1978) was used for checking of white noise. The values of Q-Statistics probabilities for ARMA terms have been checked and are higher than 5 per cent significance level.

Figure 5.3.1 plots the static estimated values of India's GDP taking the adjusted sample from 1976-2022, which are derived from the results of the ARIMA model. The Mean Absolute Percent Error (MAPE) is 5.706, indicating a highly accurate forecast.

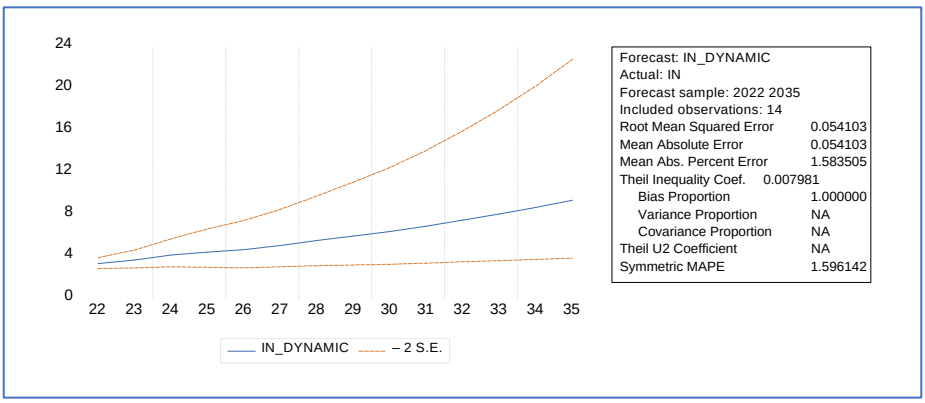
Figure 5.3.1: Estimated values of India's GDP - Static



Source: Authors own

Figure 5.3.2 plots the dynamic forecasted values of India's GDP for the period 2022-2035, which are derived from the static estimates of India's GDP. India's GDP is projected to follow a stable growth trajectory in the forecasted period.

Figure 5.3.2: Forecasted values of India's GDP – Dynamic



Source: Authors own

Table 5.3.2 gives the ARIMA (p,d,q) values for estimating the GDP of the selected countries. The MAPE values for all the countries are also shown, indicating the fitness of the model to be highly accurate. Structural break has been identified in the year 1996 in the case of Japan (collapse of the asset price bubble) and for the US in the year 1986 (triggered due to a sharp drop in world oil prices). Dynamic regressors have been introduced to incorporate the impact of drift in the series for both these countries.

Table 5.3.2: ARIMA Model of Best Fit			
Country	**ARIMA (p,d,q)**	**MAPE**	**MAPE ≦ 10**
China	**((,2),2,1)**	**7.52**	Highly Accurate
Germany	**((,4),1,1)**	**7.68**	Highly Accurate
India	**((,2),1,(,2,3))**	**5.71**	Highly Accurate
Japan	**(0,1,(,3,4))**	**6.25**	Highly Accurate
US	**((,2),1,(,2))**	**5.418**	Highly Accurate

Source: Authors own

Table 5.3.3, gives the forecasted GDP values for top five countries for the priod 2023-2035. GDP of India is projected to cross USD 7 trillion in 2032. While it is forecasted that the GDP of India will be USD 9.4 trillion by 2035. India is forecasted to become the fourth largest economy by 2026, overtaking Japan.

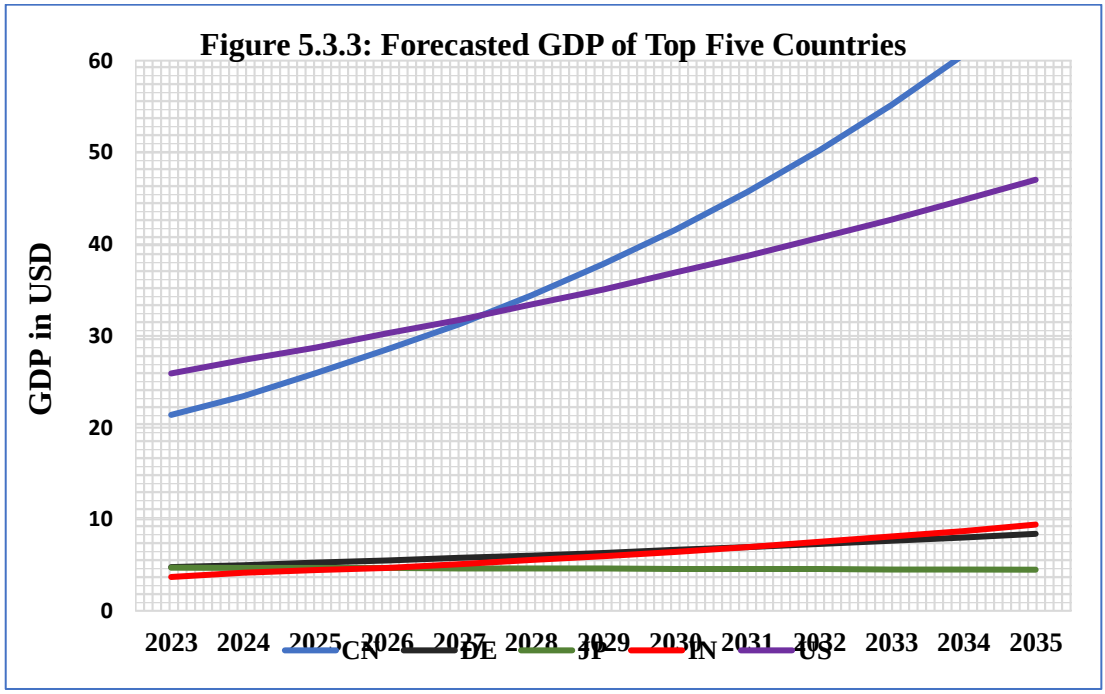
Table 5.3.3: Forecasted GDP Values (in USD trillion)					
Year	**CN**	**DE**	**IN**	**JP**	**US**
2023	21.3704	4.7721	**3.6923**	4.7074	25.8897
2024	23.3887	4.9700	**4.1709**	4.6951	27.3467
2025	25.8927	5.2424	**4.4577**	4.6772	28.6897
2026	28.5030	5.5119	**4.6914**	4.6579	30.2598
2027	31.2800	5.7696	**5.0883**	4.6388	31.7394
2028	34.3771	6.0416	**5.5653**	4.6197	33.4366
2029	37.8094	6.3371	**5.9880**	4.6007	35.0657
2030	41.5663	6.6442	**6.4136**	4.5818	36.9048
2031	45.6850	6.9621	**6.9308**	4.5629	38.6977
2032	50.2147	7.2955	**7.5085**	4.5441	40.6950
2033	55.1944	7.6466	**8.0949**	4.5254	42.6675
2034	60.6635	8.0142	**8.7153**	4.5068	44.8407
2035	66.6708	8.3988	**9.4081**	4.4883	47.0099

Source: Authors own

In 2032, India is projected to be the third largest economy with a USD of 7.51 trillion overtaking Germany, which is projected to have a GDP of USD 7.29 trillion.

China is projected to overtake the United States in 2028 with a forecasted GDP of USD 34.37 trillion. And maintaining the top position thereafter until 2035 with a GDP of USD 66.67 trillion.

Figure 5.3.3 plots the forecasted GDP of top five countries namely, Peoples Republic of China (CN), Federal Republic of Germany (DE), India (IN), Japan (JP) and the United States (US) on a graph.



Source: Authors own

6 Challenges in the future

The projections have an inherent problem. They cannot anticipate the events of the future such as COVID-19, or the housing collapse of 2008-09. Such 'Black Swan' events tend to derail the best of forecasts.

6.1 Geo-Political External Threats

The world seems to be facing an elevated risk of geopolitical conflicts. There are indications of sluggish growth and fiscal pressures in the global economy that could affect India's growth ambitions too. The global supply chains have come under tremendous stress. Supply chain shortages affect all aspects of global markets. More so, the current situation in the Red Sea threatens to increase transportation costs and issues of safety and security. These may trigger inflation.

India can ill-afford to get embroiled in any conflict directly. The persistent threats from Chinese aggression have to be tactfully managed. The tense situation in the South-China Sea have raised global concerns. An escalation of conflict will force India to divert its resources to protect and safeguard its own sovereignty. For India, these challenges are as much a concern as they may derail India's target to become a USD 7 trillion economy.

The current state of affairs in the US elections, the ongoing Russia-Ukraine conflict, rising tensions in the Korean peninsula, increasing US-China trade disputes and the expanding influence of Gulf countries signal a shift in the global status quo. Any unexpected deviation or an unforeseen event could present serious threats to the Indian aspirations.

6.2 Domestic Risks

For India, the ecstatic mood and the positive market sentiment is based on the assumption that the current BJP government will be voted back to power with a thumping majority in the 2024 general elections. A result that goes against this expectation may adversely affect the markets bringing in significant market correction.

The consumption economy can only grow if the income levels also rise. Therefore, it will be a challenging task for the government of India to ensure that the people can increase their incomes in order to boost consumption. The right kind of policies to ensure economic growth will also come from an ever-increasing capacity of Indians to spend.

Similarly, the policy makers need to ensure that there are enough jobs to absorb the youth and the women workforce. While a large working population is an asset for any economy, it is equally imperative that this large segment of population is absorbed in productive work.

7 Conclusion

India, which is currently the fifth largest economy of the world, is expected to take-over Japan to become the fouth largest economy by the year 2026. At the same time, India is expected to supersede Germany by the year 2032 and will become the third largest economy of the world. In the current analysis, it is observed that China will the largest economy of the world, surpassing the United States of America by the year 2028. The gap between China and the US economy is expected to widen in the years to come.

Given the optimistic growth of the Indian economy, it is but natural that India's external relations are bound to be impacted too. India's foreign policy has witnessed a marked intensification in recent years. Emphasizing the projection of an Indian identity and engagement with the global community, India has transitioned from being inward-focussed to outward-oriented, actively seeking to assert its influence on the world stage.

Furthermore, the traditional understanding of a "Superpower" is evolving in tandem with the global geopolitical landscape. As the world moves from a unipolar to a more multipolar paradigm, the concept extends beyond mere economic and military might. This shift suggests that the era of a single dominant superpower may be waning. In this new multipolar context, factors like technological innovation, soft power and global leadership on issues such as climate change and humanitarian crisis are assuming greater significance. Additionally, geo-political competition is being supplanted by geo-economic competition, where nations vie for economic dominance rather than just territorial control.

India's remarkable economic growth over the past few decades, along with its demographic dividend of a youthful population and expanding workforce, presents opportunities for sustained progress and innovation. Moreover, India has actively pursued international diplomacy and forged strategic partnerships to bolster global influence.

India's potential as a superpower, hinges on addressing challenges such as poverty, sustained infrastructure development, administrative efficiency and policy reforms in critical sectors like education and healthcare, governance and security. By leveraging its strengthes and mitigating weaknesses, India can elevate its global stature.

While the journey towards superpower status requires sustained effort, strategic vision and adaptability to evolving international dynamics, India's burgeoning USD 7 trillion economy positions it favourably in the inter-connected global arena.

References

1. Agarwal, A. (2023). India and UK: Impact of Growth-Trade Relationship. Arthavaan, 6(1), 1-8
2. Agarwal, S. K., Hussain, T., & Agarwal, A. (2021). India EU Relations: Stranded on High Seas. Indian Journal of Economics and Business, 20(1), 893-906.
3. Agarwal, S. K., & Hussain, T. (2023). Indo-German relationship: Expanding India's Influence at the Global Stage. Journal of Informatics Education and Research, 3(2), 808-823.
4. Aiyar, S., & Mody, A. (2011). The demographic dividend: evidence from the Indian States, IMF Working Paper, no. 11/38. New York, International Monetary Fund. Retrieved from www.imf.org/external/ pubs/ft/wp/2011/wp1138.pdf
5. Ali, M. A., & Kamraju, M. (2023). The G20 Presidency of India in 2023: Achievements, Challenges, and Implications. International Journal of Business and Management Research, Vol.11 (4), 100-107.
6. Anand, S. (2022, November 16). India has over 1.2 bn mobile phone users: I&B ministry | Mint. Mint. https://www.livemint.com/technology/gadgets/india-has-over-1-2-bn-mobile-phone-users-i-b-ministry-11668610623295.html#
7. Bloom, D. E., Canning, D., & Fink, G. (2010). Implications of population ageing for economic growth. Oxford Review of Economic Policy, 26(4), 583–612.

8. Bloom, D. E. (2011). Population dynamics in India and implications for economic growth. PGDA Working Paper 65, Harvard School of Public Health, Harvard University, Boston, MA.
9. Box, G. E., & Jenkins, G. M. (1976). Time series analysis forecasting and control-rev. Holden Day, San Franscisco : p 575.
10. Breslin, S. (2020). G20 Membership and Its Implications for Global Governance. G20 Insights. Retrieved from https://www.g20-insights.org
11. Business Standard. (2024, March 02). What is ONDC, Open Network for Digital Commerce Features. Business Standard. www.business-standard.com. https://www.business-standard.com/about/what-is-ondc
12. Castellacci, F., & Tveito, V. (2018). Internet use and well-being: A survey and a theoretical framework. Research Policy, 47(1) 308–325.
13. Chandrasekhar, C. P., Ghosh, J., & Roychowdhury, A. (2006). The 'demographic dividend' and young India's economic future. Economic and Political Weekly, Vol. 41, No. 49 (Dec. 9-15, 2006), pp. 5055-5064
14. Chatfield, C. (2013). The analysis of time series: theory and practice. Springer.
15. Debroy, B. (2004). The Indian economy in 2040. Futures, 36(6-7), 693-702.
16. Dritsaki, C. (2015). Forecasting real GDP rate through econometric models: an empirical study from Greece. Journal of International Business and Economics, 3(1), 13-19.
17. ET BFSI, (2023, August 27). Jan Dhan accounts cross 50 crore-mark in less than 9 years: Govt. The Economic Times. https://bfsi.economictimes.indiatimes.com/news/industry/jan-dhan-accounts-cross-50-crore-mark-in-less-than-9-years-govt/103099622
18. ET Bureau. (2023, December 28). Sensex@72K: Bulls turn up the heat in December. The Economic Times. https://economictimes.indiatimes.com/markets/stocks/news/sensex72k-bulls-turn-up-the-heat-in-december/articleshow/106333694.cms#
19. Fan, T., Peters, M., & Zilibotti, F. (2023). Growing Like India—the Unequal Effects of Service-Led Growth. Econometrica, 91(4), 1457-1494.
20. Frain, J. (1992). Lecture notes on univariate time series analysis and box jenkins forecasting. Economic Analysis, Research and Publications, 189-194.
21. Ghani, E., Kerr, W. R., & O'Connell, S. D. (2013). Promoting women's economic participation in India. Economic Premise, Poverty Reduction and Economic Management Network (PREM), The World Bank, 75524, Feb. 2013, No.107
22. Ghosh, S. (2016). Estimating the demographic dividend: Evidence from Indian states. Journal of Population Ageing, 9(3), 249–262.
23. Goswami, J., Baruah, P., & Shukla, R. (2010). Dynamics of Youth Population–Impact of Education Expenditure. Working Paper Series-National Council for Applied Economic Research, (102).
24. Heine, J. (2021). The Attack on the US Capitol: An American Kristallnacht. Protest, 1(1), 126-141.
25. Jaishankar, D. (2019). Deepening democracy through diversity: Improving cooperation with India and non-Western democracies. Policy Brief: Democracy & Disorder, Foreign Policy at Brookings, pp. 1-9
26. James, K. S. (2008). Glorifying Malthus: Current debate on ‘demographic dividend’ in India. Economic and Political Weekly, 43(25), 63–69.
27. James, K. S. (2011). India’s demographic change: opportunities and Challenges. Science, 333(6042), 576-580.
28. Jeyarajah, S.(2022). Modeling and Forecasting Using ARIMA: An Empirical Study of GDP in Sri Lanka. International Journal of Research Publications. 105(1), 502-509
29. Joe, W., Kumar, A., & Rajpal, S. (2018). Swimming against the tide: economic growth and demographic dividend in India. Asian Population Studies, 14(2), 211-227.
30. Kirchgässner, G., Wolters, J., Hassler, U. (2013) Univariate Stationary Processes. Introduction to Modern Time Series Analysis, Springer, Berlin, Heidelberg, 27-93. https://doi.org/10.1007/978-3-642-33436-8_2
31. Kirton, J., & Kokotsis, E. (2021). The G20 Governance Report 2020. G20 Insights. Retrieved from https://www.g20-insights.org
32. Klugh, B.F., & Markham, J. (1985). A comparison of Box-Jenkins time series forecasts to preliminary milk price estimates (SRS staff report number, 85-14). United States Department of Agriculture.
33. Kumar, U. (2014). India’s demographic transition: Boon or bane? Asia & the Pacific Policy Studies, 1(1), 186–203.

34. Ladusingh, L., & Narayana, M. R. (2011). Demographic dividends for India: Evidence and implications based on National Transfer Accounts. ADB Economics Working Paper Series No. 292, Manila, Asian Development Bank.
35. Lisk, F & Šehović, A. B. (2020) Rethinking global health governance in a changing world order for achieving sustainable development: the role and potential of the 'Rising Powers'. Fudan Journal of the Humanities and Social Sciences 13(1), 45–65.
36. Mahapatra DA (2016) From a latent to a 'strong' soft power? The evolution of India's cultural diplomacy. Palgrave Communications 2(1), 1–11.
37. Maiti, D., Castellacci, F., & Melchior, A. (2020). Digitalisation and development: Issues for India and beyond (pp. 3-29). Springer.
38. Maity, B., & Chatterjee, B. (2012). Forecasting GDP growth rates of India: An empirical study. International Journal of Economics and Management Sciences, 1(9), 52-58.
39. Marcek, M. (1998). Economic time series forecasting: Box-Jenkins methodology and Ssgnal processing approach (Working paper). Opava: The Silesian University, Institute of computer science.
40. Mazouz, S. (2021). A Concise Overview of G20: From its Origins to its 2020 Presidency. Global Policy Journal. Retrieved from https://www.globalpolicyjournal.com
41. Miah, M. M., Tabassum, M., & Rana, M. S. (2019). Modelling and forecasting of GDP in Bangladesh: An ARIMA approach. Journal of Mechanics of Continua and Mathematical Science, 14(3), 150-166.
42. Mishra, P. K. (2011). Dynamics of the relationship between real consumption expenditure and economic growth in India. indian Journal of Economics & Business, 10(4), 553-563.
43. Musundi, S. W., M'mukiira, P. M., & Mungai, F. (2016). Modeling and forecasting Kenyan GDP using autoregressive integrated moving average (ARIMA) models. Science Journal of Applied Mathematics and Statistics, 4(2), 64-73. https://doi.org/10.11648/j.sjams.20160402.18
44. Nayak, A. K. (2014). Democracy And Development In India. World Affairs: The Journal of International Issues, 18(4), 40-69.
45. Oulton, N. (2012). Long term implications of the ICT revolution: Applying the lessons of growth theory and growth accounting. Economic Modelling, 29(5), 1722-1736.
46. Pasricha, A. (2021, January 24) India launches 'Neighborly Vaccine Diplomacy'. Voice of America. Retreived from https://www.voanews.com/covid-19-pandemic/india-launches-neighborly-vaccine-diplomacy.
47. Pattanaik, S. S. (2021) COVID-19 pandemic and India's regional diplomacy. South Asian Survey28(1): 92–110.
48. Rakesh, N., Kumar, K. S., & Kumar, S. S. (2018). UPI-The Growth of Cashless Economy in India. Arabian Journal of Business and Management Review (Oman Chapter), 36-40.
49. Ram, T. S. (2023). Ayush grid: Digital health platform. International Journal of Ayurveda Research, 4(2), 61-69.
50. Rana, S. B. (2019). Forecasting GDP Movements in Nepal Using Autoregressive Integrated Moving Average (ARIMA) Modelling Process. Journal of Business and Social Sciences Research, 4(2), 1-20
51. Saha, V., & Mathew, S. G. (2022, December 15). Why do we need a digital rupee in the age of UPI?. Business World. https://www.businessworld.in/article/Why-Do-We-Need-A-Digital-Rupee-In-The-Age-Of-UPI-/15-12-2022-458008/
52. Salahuddin, K., & Tanzim, N. (2021). Forecasting GDP of Bangladesh Using ARIMA Model. International Journal of Business and Management, 16(6), 56-65.
53. Shahini, L., & Haderi, S. (2013). Short Term Albanian GDP Gorecast: One Quarter to One Year Ahead.. European Scientific Journal, 9(34).
54. Sharma, R. S., Rohatgi, A., Jain, S., & Singh, D. (2023). The Ayushman Bharat Digital Mission (ABDM): making of India's Digital Health Story. CSI Transactions on ICT, 11(1), 3-9.
55. Shukla, R. K. (2010). Indian Youth: Demographics and Readership: Results from the National Youth Readership Survey. National Book Trust, India.
56. Siddi, M. (2022). The partnership that failed: EU-Russia relations and the war in Ukraine. Journal of European Integration, 44(6), 893-898.
57. Singh, B., Singh, S., Singh, B., & Chattu, V. K. (2023). India's neighbourhood vaccine diplomacy during COVID-19 pandemic: humanitarian and geopolitical perspectives. Journal of Asian and African Studies, 58(6), 1021-1037.

58. Singh, J., & Singh, M. (2024). Accelerating Financial Inclusion of the Urban Poor: Role of Innovative e-Payment Systems and JAM Trinity in Alleviating Poverty in India. Global Business Review, 0(0). https://doi.org/10.1177/09721509231222609
59. Singh, S., Khemka, M. & APAC, I. O. (2023). India: why it will be a USD 7 trillion economy by 2030.
60. Subbarao, D. (2023). Digital technologies: holy grail in India's quest for financial inclusion?. RSIS Commentaries, 102-23.
61. Subbarao, D. (2024, January 30). Budgets' job not done: Jobs. Times of India Blog. Retrieved from https://timesofindia.indiatimes.com
62. Tellis, A. J. (2022). 'What is in our Interest': India and the Ukraine War. Carnegie Endowment, April, 25.
63. Testbook. (2023, August 10). Structural reforms in India: latest reforms and their impact. Testbook. Retreived from https://testbook.com/static-gk/structural-reforms-in-india
64. Thakkar, C. (2024). Russia-Ukraine War, India, and US grand strategy: punishing or leveraging neutrality?. Policy Studies, 1-19.
65. Trofimov, B. (2021) In COVID-19 diplomacy, India emerges as a vaccine superpower. Available at: https://www.wsj.com/articles/covid-19-vaccines-are-becoming-important-diplomatic-currency-11613152854
66. Wang, Z. & Wang, H. (2011). GDP Prediction of China Based on ARIMA Model. Journal of Foreign Economic and Trade, 210(12).
67. Wei, N., Bian, K. J. & Yuan, Z. F. (2010). Analyze and Forecast the GDP of Shaanxi Province Based on the ARIMA Model. Journal of Asian Agricultural Research, 2(1), 34-41.
68. Wertsch, J. V. (2023, October 20). Possible limits to Putin and Xi's No-Limits friendship. Wilson Center. https://www.wilsoncenter.org/blog-post/possible-limits-putin-and-xis-no-limits-friendship
69. Yang, B., Li, C.G., Li, M., Pan, K. and Wang, D. (2016) Application of ARIMA Model in the Prediction of the Gross Domestic Product. Advances in Intelligent Systems Research, 130, 1258-1262. https://doi.org/10.2991/mcei-16.2016.257
70. Young, W. L. (1977). The Box-Jenkins approach to time series analysis and forecasting: principles and applications. RAIRO-Operations Research-Recherche Opérationnelle, 11(2), 129-143.
71. Zacher, M. W., & Keohane, R. O. (2017). The United Nations in World Politics. Cambridge University Press.
72. Zakai, M. (2014). A time series modeling on GDP of Pakistan. Journal of Contemporary Issues in Business Research, 3(4), 200-210.
73. Zhang, H., & Rudholm, N. (2013). Modeling and forecasting regional GDP in Sweden using autoregressive models. Dalama University.