

## **"Macroeconomics Assignment I"**

Ashutosh,

231270009, M.Sc. Economic Sciences

Manan Arora,

231270015, M.Sc. Economic Sciences

Sajjad Khan,

231270022, M.Sc. Economic Sciences

Abhishek Kumar,

231270001, M.Sc. Economic Sciences

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*ANSWER 1)*

a) GNP at market price = GNP at factor cost + indirect tax - subsidies

$$= 124601 + 16345 - 2322$$

$$= 138624$$

b) NNP at market price = GNP at market price - depreciation

$$138624 - 8062$$

$$= 130562$$

c) NDP at market price = NNP at market price - NFIA

$$= 130562 - 320$$

$$= 130242$$

d) NDP at factor cost = NDP at market price - indirect tax + subsidy

$$= 130242 - 16345 + 2322$$

$$= 116219$$

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*ANSWER 2)*

A. NNP at market price = NDP at market price + NFIA

$$= 83686 + (-233)$$

$$= 83453$$

B GNP at market price = NNP at market price + depreciation

$$83453 + 4957$$

$$= 88410$$

C GNP at factor cost = GNP at market price - indirect tax + subsidy

$$88410 - 9689 + 1772$$

$$= 80493$$

D. NDP at factor cost = GNP at factor cost -- depreciation + NFIA

$$80493 - 4957 + (-233)$$

$$= 75769$$

ANSWER 3)

A. Depreciation = GNP at factor price -- NNP at factor price

$$98000 - 94000 = 4000$$

B. Net factor income from abroad = NNP at market price -- NDP at market price

$$99000 - 101422 = -2422$$

C. Subsidy = GNP at factor price -- GNP at market price + indirect tax

$$98000 - 103000 + 14000$$

$$= 9000$$

D. NDP at factor cost = NDP at market price -- indirect tax + subsidy

$$= 101422 - 14000 + 9000$$

$$= 96422$$

E.. National income = net national income at factor price

= NDP at factor price + NFIA

$$96422 + (-2422)$$

$$= 94000$$

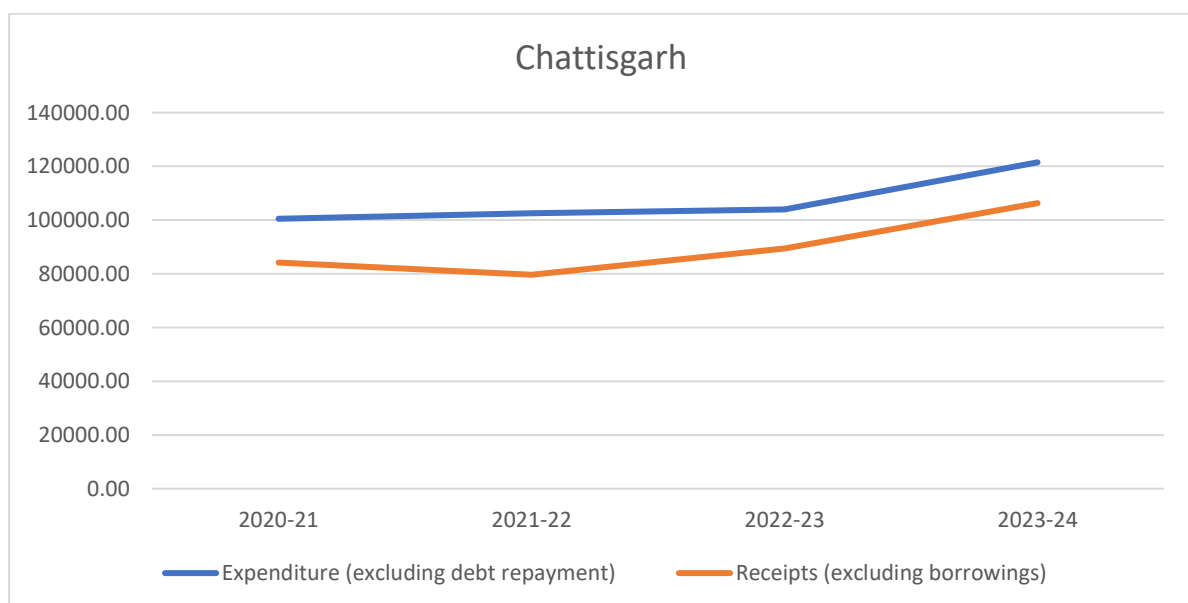
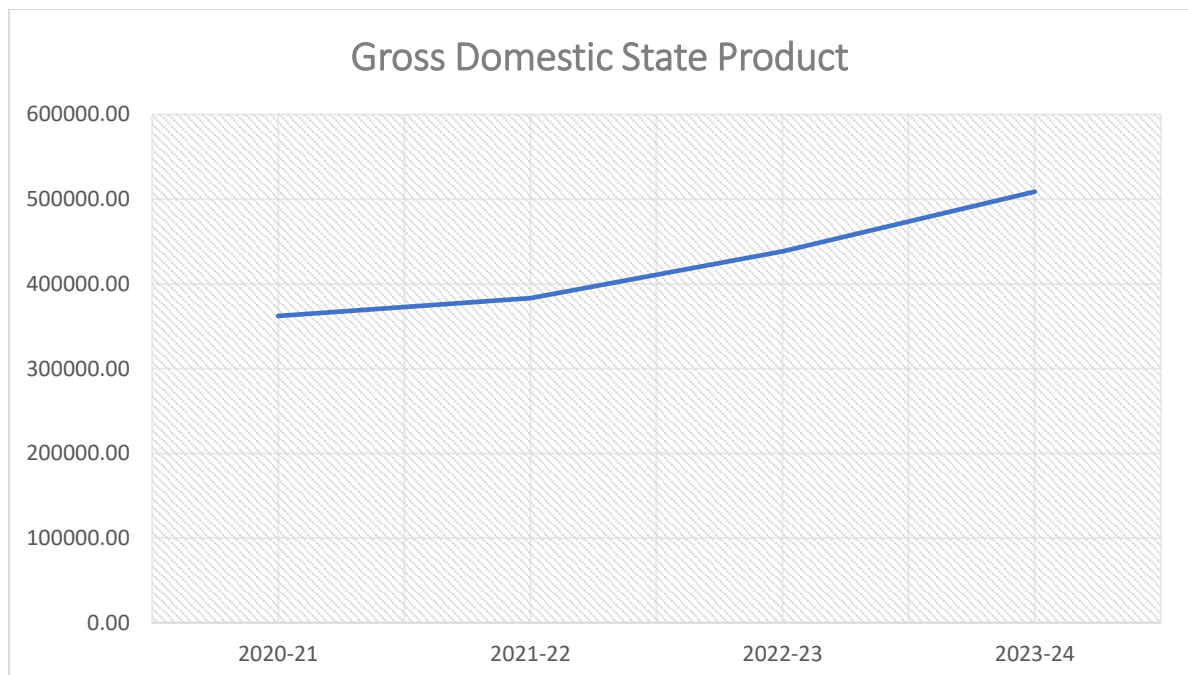
ANSWER 4)

**Please refer to the Excel file attached for all the analysis in this question.**

We analyse the performance of the 4 states based on their macro-economic performance and measured their performance based on empirical data about these states as well as Fiscal rules and FRBM act 2003.

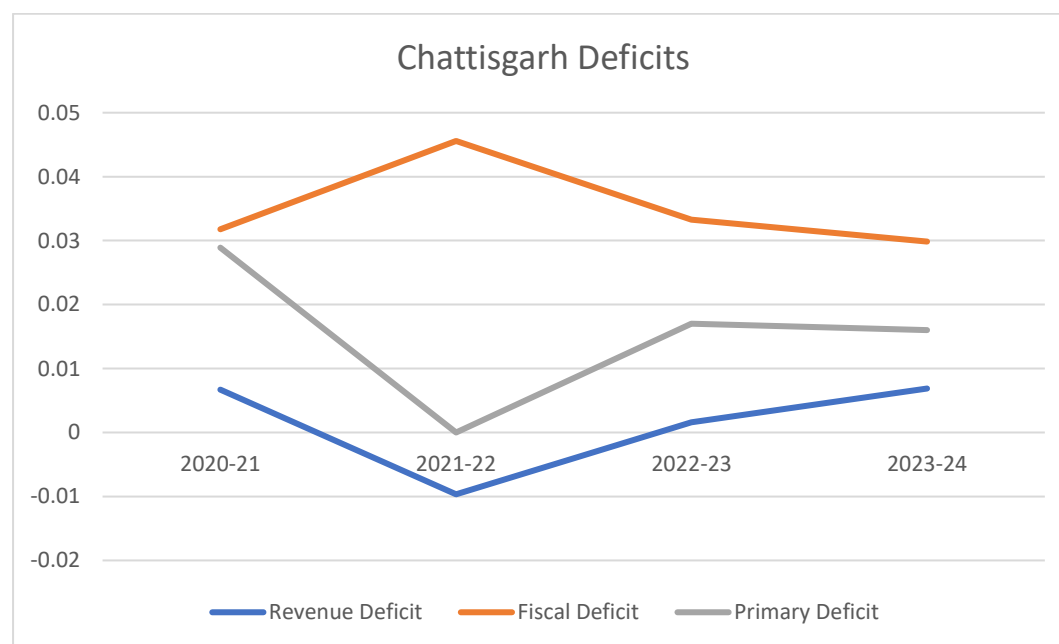
**a) Chhattisgarh:**

Chhattisgarh gross state domestic product has improved over the years with an annual CAGR of 4% year on year from 362214.00 to 509000.00 in 2023-24 (estimated).



Coming to the deficits we see an a balanced revenue surplus for the state from 2020-2023 , with estimated in 2023 accounting for revenue surplus being 1% of the GSDP, an improvement with the standards of FRBM Act 2003 which prescribes a 0 revenue Deficit. Chhattisgarh has managed to bring back its fiscal deficit from 5% in 2021 to 2.99% 2023-24(estimated) meeting the FRBM 2003 target of 3% of GSDP. The state has done well in systematically decreasing its primary deficit from 2.89% of GSDP in 2020-21 to 1.60% of 2023-24 (estimated).

Year	Revenue Surplus	Fiscal Deficit	Primary Deficit
2020-21	0.67%	0.0318	2.89%
2021-22	-0.97%	0.0456	0.00%
2022-23	0.16%	0.0333	1.70%
2023-24	0.69%	0.0299	1.60%

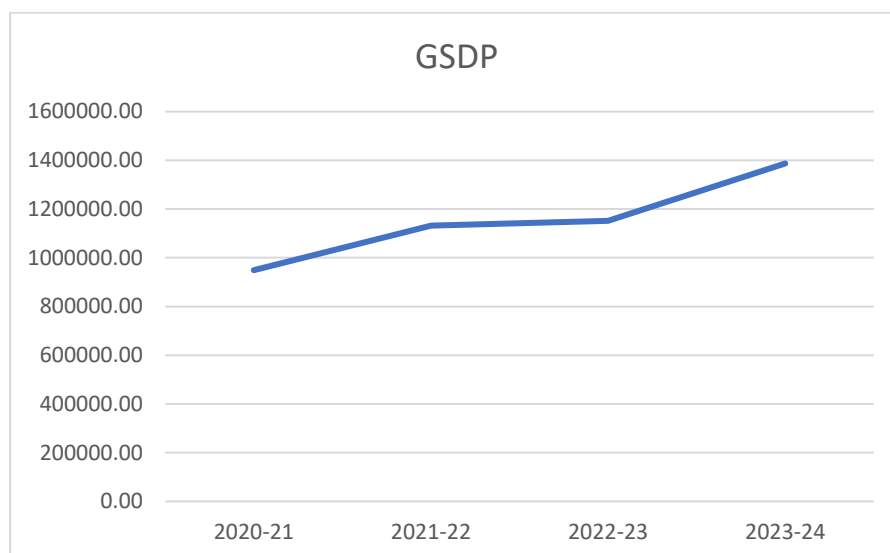


### Debt to GSDP Ratio:

The debt to GSDP ratio stands at 23.8, which is above the FRBM threshold of 20% which is one of the lowest among all states particularly due to increased infrastructure development, social welfare programs and public welfare programs.

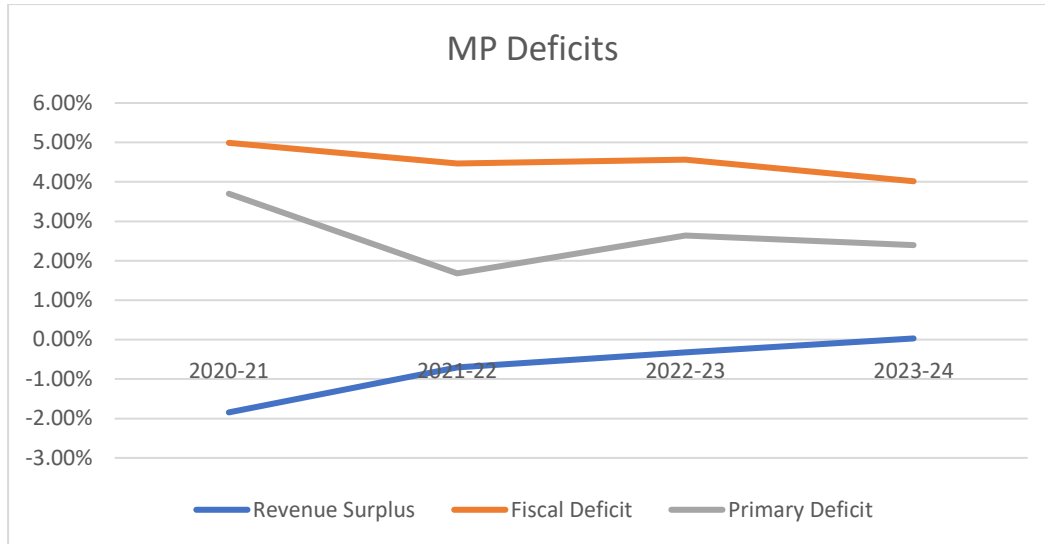
**b) Madhya Pradesh:**

Madhya Pradesh experienced a spike from 2020-21, a flat growth relatively flat period during 2021-23 and is projected to have a 17% GSDP growth in 2023.



MP's has shown significant results in cutting down its deficits. The revenue budget has experienced significant improvements in its revenue deficit post COVID with current figures indicating a revenue surplus of 0.3% of GSDP. The fiscal deficit is brought down from 4.99% to 4.02% however it is still above the prescribed threshold of 3% of FRBM Act. The primary deficit has reduced from 3.7% to 2.4% indicating good signs for the economy.

Year	Revenue Surplus	Fiscal Deficit	Primary Deficit
2020-21	-1.85%	4.99%	3.70%
2021-22	-0.70%	4.47%	1.68%
2022-23	-0.32%	4.56%	2.64%
2023-24	0.03%	4.02%	2.40%

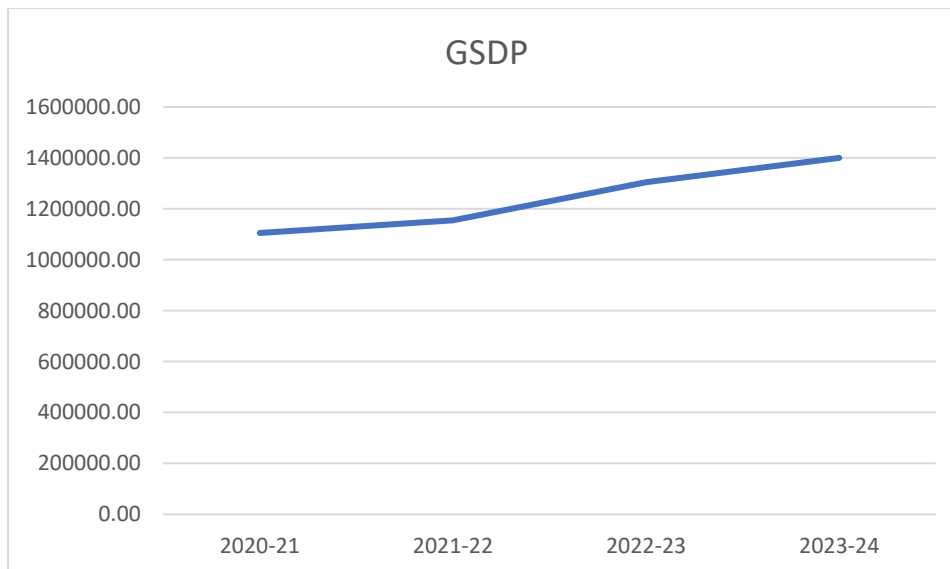


### Debt to GSDP Ratio:

The debt to GSDP ratio stands at 30.4%, which is above the FRBM threshold of 20% along with COVID 19 and MP spends about 90% on revenue accounts.

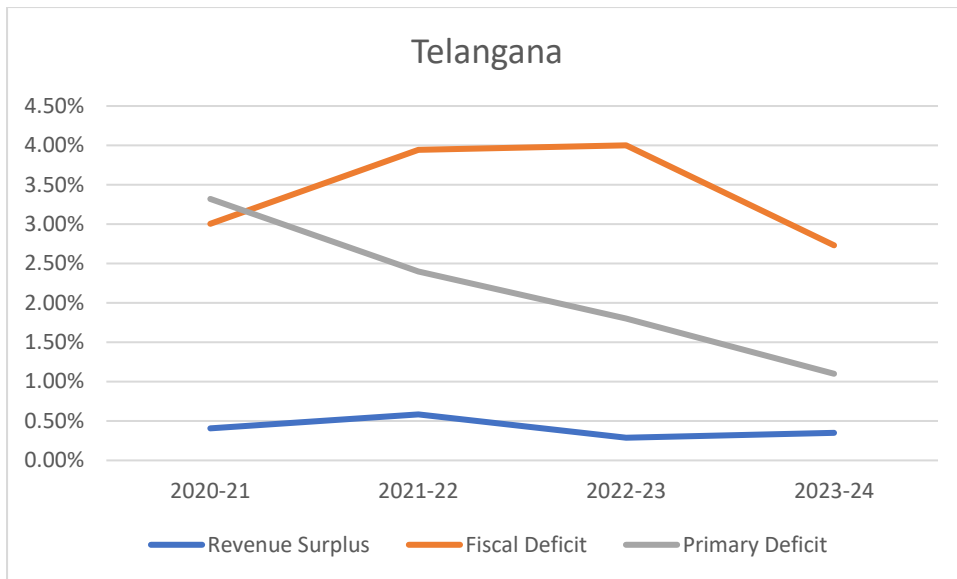
### c) Telangana:

Telangana has experienced an average year on year GSDP growth of 8% with estimates of 14 lakh crores in 2023-24.



Telangana has maintained a revenue surplus for the past 3 years with the recent estimates accounting for 0.35% of GSDP. Fiscal Deficit has been reduced from 3% in 2020-21 to 2.73% (estimates) in 2023-24 which is in limits with the FRBM Act. The primary deficit has reduced considerably from 3.32% in 2020-21 to 1.10%. Telangana has performed better than other states in maintaining deficits.



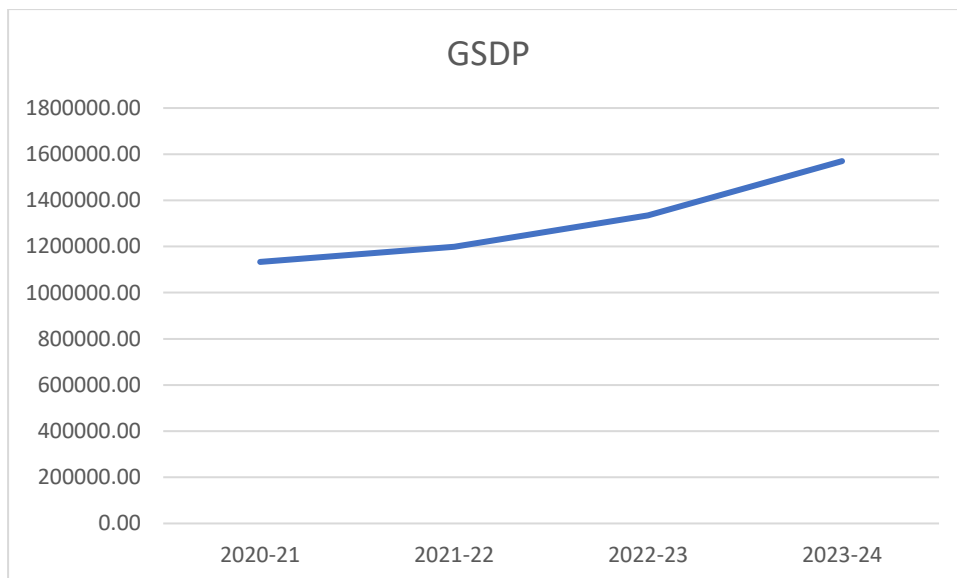


#### Debt to GSDP Ratio:

The debt to GSDP ratio stands same as Chhattisgarh at 23.8%, the main reasons for this are populist spending under political pressures by Telangana leaders. which is above the FRBM threshold of 20%

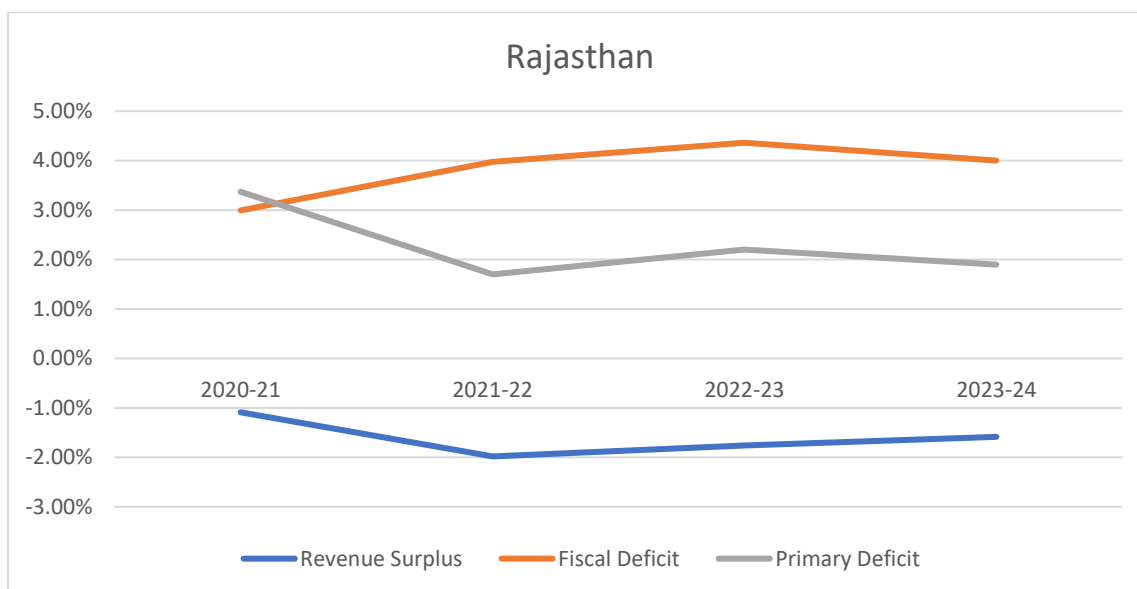
#### d) Rajasthan:

Rajasthan has an estimated GSDP 15.7 lakh crore with an average YoY growth of 12% for the past 3 years showing positive signs post covid recovery.



Rajasthan has the worst performing indicators out of all states mentioned. The revenue deficit was as high as 1.59% in 2023-24. The Fiscal Deficit is estimated at 4% of GSDP which is above the mark of FRBM Act. However the state has done well to reduce primary deficit from 3.37% to 1.90% in 2023-24.

Year	Revenue Surplus	Fiscal Deficit	Primary Deficit
2020-21	-1.09%	2.99%	3.37%
2021-22	-1.98%	3.98%	1.70%
2022-23	-1.76%	4.36%	2.20%
2023-24	-1.59%	4.00%	1.90%



### Debt to GSDP Ratio:

The debt to GSDP ratio stands at 36.8%, which is above the FRBM threshold of 20% worse than Chhattisgarh and Telangana. Main reasons account for high revenue spending to capital outlay ratios.

### REFERENCES:

- 1) PRS Legislative Research, ([www.prsindia.org](http://www.prsindia.org))
- 2) Macro Economic Parameter Analysis  
([https://docs.google.com/spreadsheets/d/1vqNnowVFeIRWdLAUHMj\\_V-a8KEKM\\_N8S/edit?usp=sharing&ouid=111264013720999294006&rtpof=true&sd=true](https://docs.google.com/spreadsheets/d/1vqNnowVFeIRWdLAUHMj_V-a8KEKM_N8S/edit?usp=sharing&ouid=111264013720999294006&rtpof=true&sd=true))

ANSWER 5):

The following table and graphs display the potential output gaps for different states from the year 2004 to 2022.

### CHATTISGARH:

#### Insights:

We observe that the cyclical component moves along with the national cyclical component. Chhattisgarh a drastic dip in GSDP in 2009-10 owing to bad year of bad drought in the state. The state lost up along with Jharkhand and Odisha lost up to 400 million. The period of 2008-2011 was also recovering Global Financial Crisis, owing to weak demand the raw material industry suffered in Chhattisgarh owing to weak global demand. Persistent Inflation and high energy prices further complemented to this situation. The 2020 – 2022 negative output gap is owing to novel Coronavirus Pandemic.

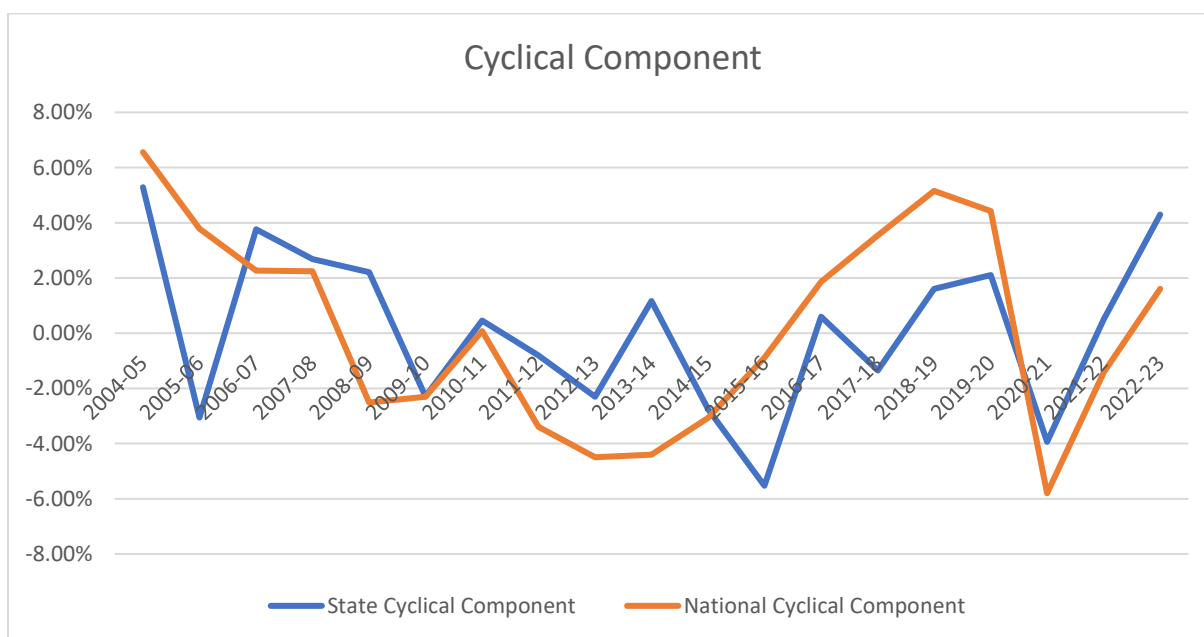
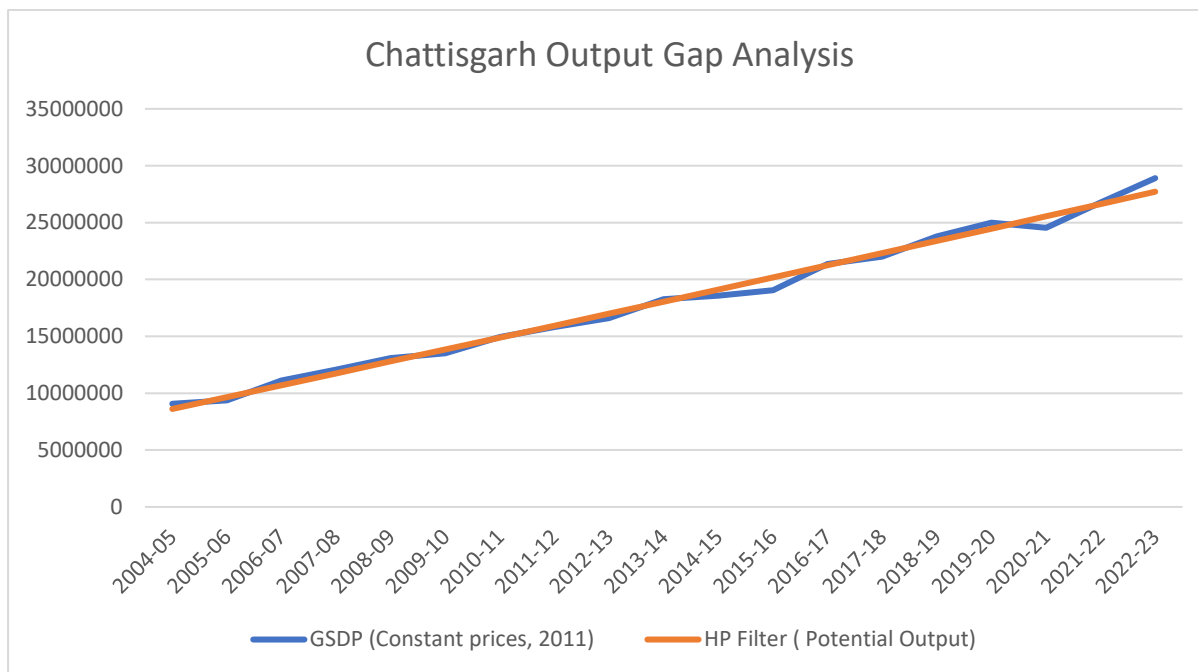
#### Policy Inferences:

The state follows a countercyclical policy

Chhattisgarh expenditure was estimated at Rs 1,02,483 crore, a 6% annual increase over the actual expenditure in 2019-20 owing to the coronavirus pandemic. The health and family expenditure increased by a margin of 12% from 2019-20. In 2020-21, fiscal deficit is estimated to increase to 6.52% of GSDP. However we observe that taxes have increased, total own tax revenue of Chhattisgarh has increased at an annual increase of 8% over the actual tax revenue in 2019-20.

Years	GSDP (Constant prices, 2011)	GSDP (Current Prices)	HP Filter ( Potential Output)	Output Gap	Cyclical Component
2004-05	9070653.589	4786229	8615170.29	455483.30	5.29%
2005-06	9363540.569	5338110	9658535.51	-294994.95	-3.05%
2006-07	11105269.1	6687489	10702185.42	403083.68	3.77%
2007-08	12061491.22	8025511	11746220.30	315270.92	2.68%
2008-09	13073190.26	9697218	12790992.40	282197.86	2.21%
2009-10	13520543.88	9936426	13837050.99	-316507.11	-2.29%
2010-11	14953344.83	11941976	14885121.73	68223.10	0.46%
2011-12	15807382	15807382	15935732.44	-128350.44	-0.81%
2012-13	16597740	17751133	16989453.60	-391713.60	-2.31%
2013-14	18257945	20683318	18046775.46	211169.54	1.17%
2014-15	18581344	22111811	19107943.45	-526599.45	-2.76%
2015-16	19058377	22516299	20173335.00	- 1114958.00	-5.53%
2016-17	21370478	26280175	21242998.38	127479.62	0.60%
2017-18	22013569	28228344	22316285.05	-302716.05	-1.36%
2018-19	23769490	31810113	23392626.11	376863.89	1.61%
2019-20	24987503	34495535	24471263.48	516239.52	2.11%

<b>2020-21</b>	24545166	35026983	25551674.62	- 1006508.62	-3.94%
<b>2021-22</b>	26768129	40641671	26633659.64	134469.36	0.50%
<b>2022-23</b>	28908257	45760852	27716389.58	1191867.42	4.30%



## Telangana:

### Insights:

(Andhra Scenario) Telangana's output gap is in synchronisation with the national output. the state output gap was negative during 2008 to 2014. The reasons can be attributed to revenue

receipts which fell from 14.84% during 2007-08 to 12.95% in 2013-14, substantial increase in debt and non debt components, tax revenue decline from 2008-10 and increased dependence on borrowings for the plan where all reasons for downfall of the state. The 2021-2022 decline corresponds to the coronavirus pandemic.

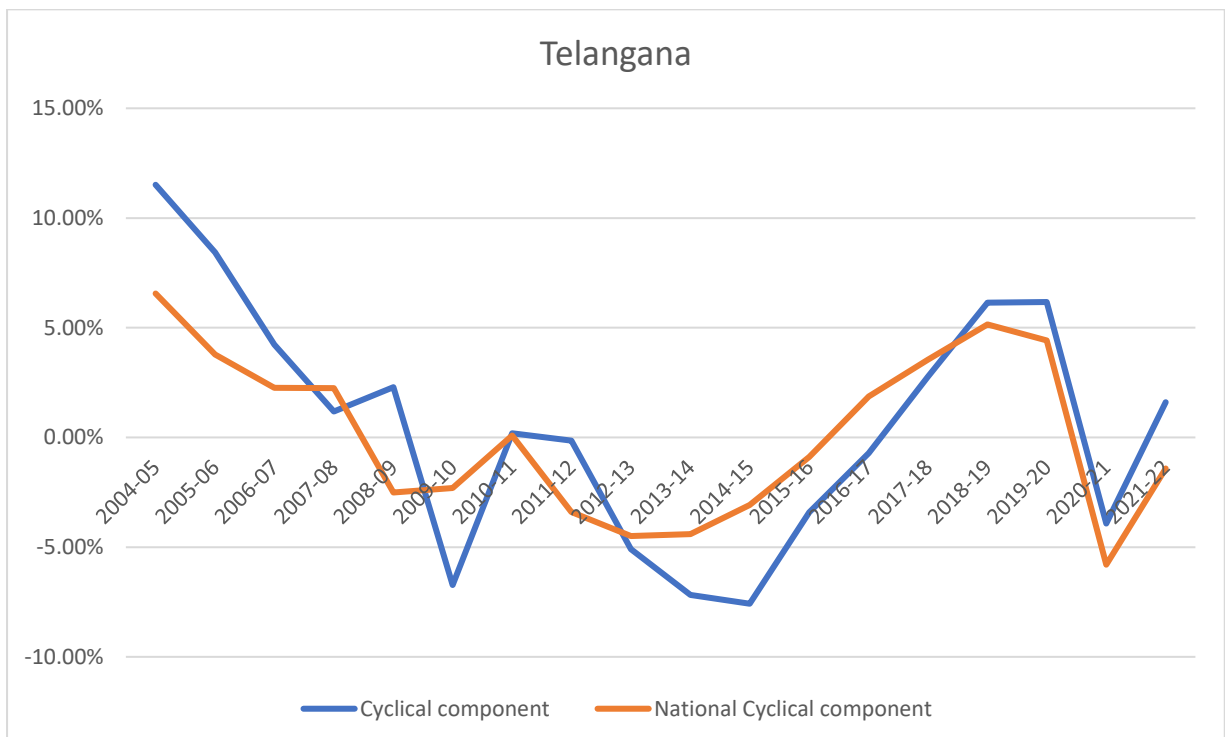
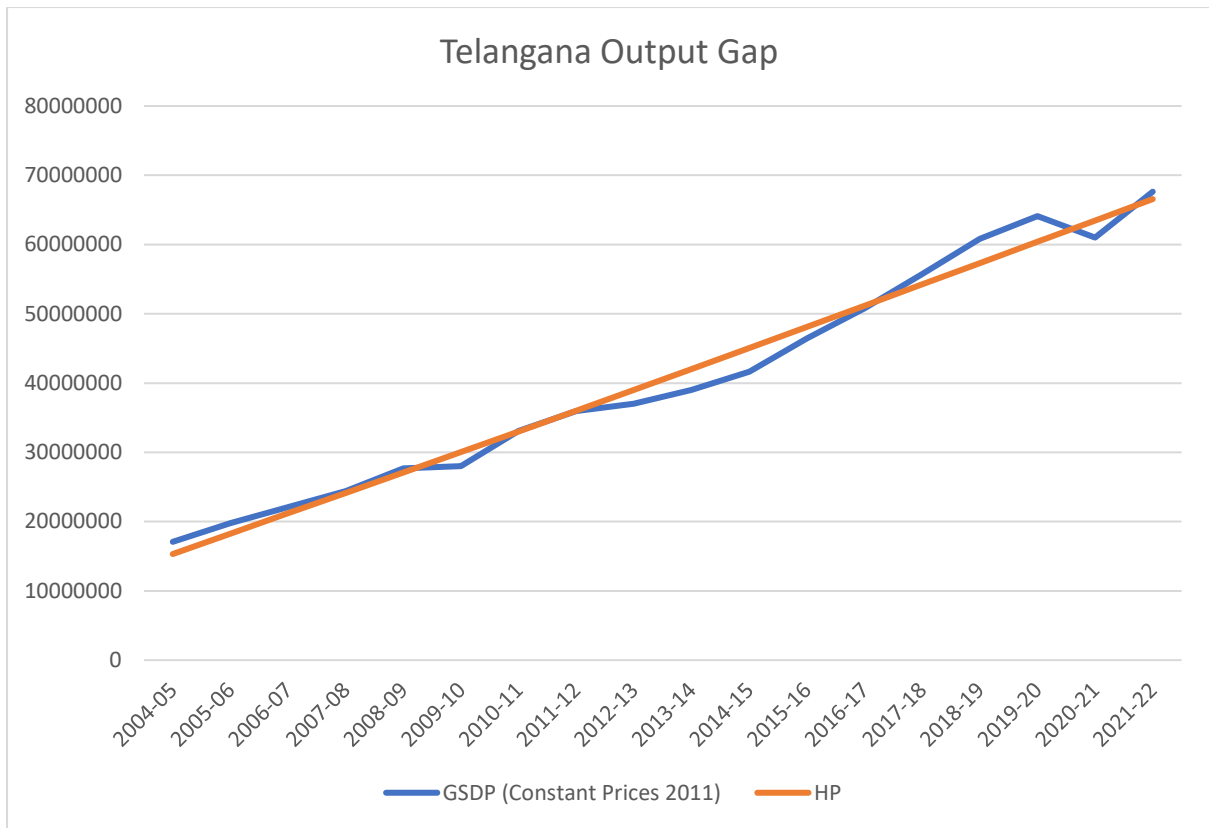
### **Policy Inferences:**

#### **The state follows a counter cyclic policy.**

Total expenditure for 2021-22 had an annual increase of 13% over the actual expenditure in 2019-20. The fiscal deficit has increased from 3.29% in 2019-20 to 5.06% in 2020-21.

Majority of expenditure has been allocated to housing ,urban development and family and health sector. The government of Telangana provided a waiver of loans up to 1 lakh rupees. The government came out with various healthcare and stimulus packages to revive the economy.

<b>Year</b>	<b>GSDP (Constant Prices 2011)</b>	<b>HP</b>	<b>Cyclical component</b>	<b>National Cyclical component</b>
<b>2004-05</b>	17081409.99	15317734.90	11.51%	6.56%
<b>2005-06</b>	19794620.1	18256454.32	8.43%	3.78%
<b>2006-07</b>	22094370.79	21196276.03	4.24%	2.27%
<b>2007-08</b>	24425383.93	24139263.69	1.19%	2.24%
<b>2008-09</b>	27707742.88	27088042.26	2.29%	-2.51%
<b>2009-10</b>	28025853.9	30045415.52	-6.72%	-2.30%
<b>2010-11</b>	33079006.57	33014574.57	0.20%	0.08%
<b>2011-12</b>	35943411	35997448.28	-0.15%	-3.39%
<b>2012-13</b>	37011312	38996005.79	-5.09%	-4.50%
<b>2013-14</b>	38995678	42012182.48	-7.18%	-4.41%
<b>2014-15</b>	41633207	45046673.27	-7.58%	-3.07%
<b>2015-16</b>	46454244	48098287.79	-3.42%	-0.89%
<b>2016-17</b>	50794610	51163702.24	-0.72%	1.86%
<b>2017-18</b>	55740976	54238565.30	2.77%	3.54%
<b>2018-19</b>	60840139	57318294.95	6.14%	5.15%
<b>2019-20</b>	64124429	60399248.20	6.17%	4.43%
<b>2020-21</b>	60992733	63479983.20	-3.92%	-5.80%
<b>2021-22</b>	67630412	66561386.35	1.61%	-1.42%



**Madhya Pradesh:**

### Insights:

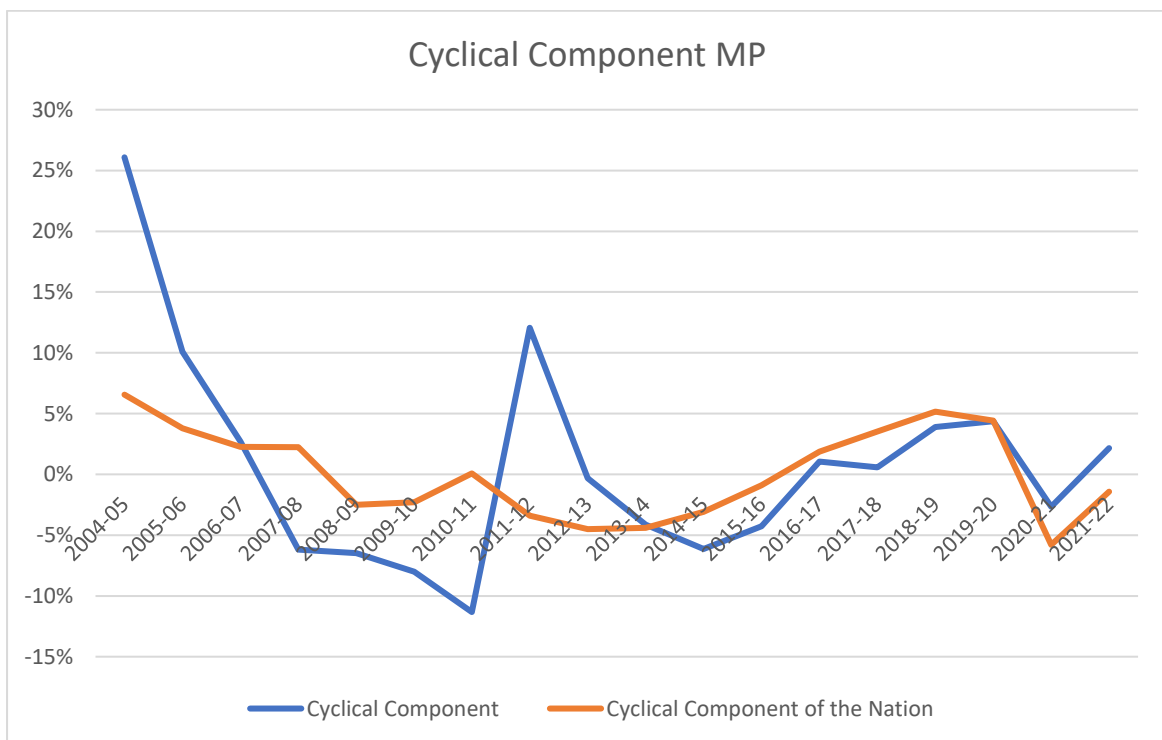
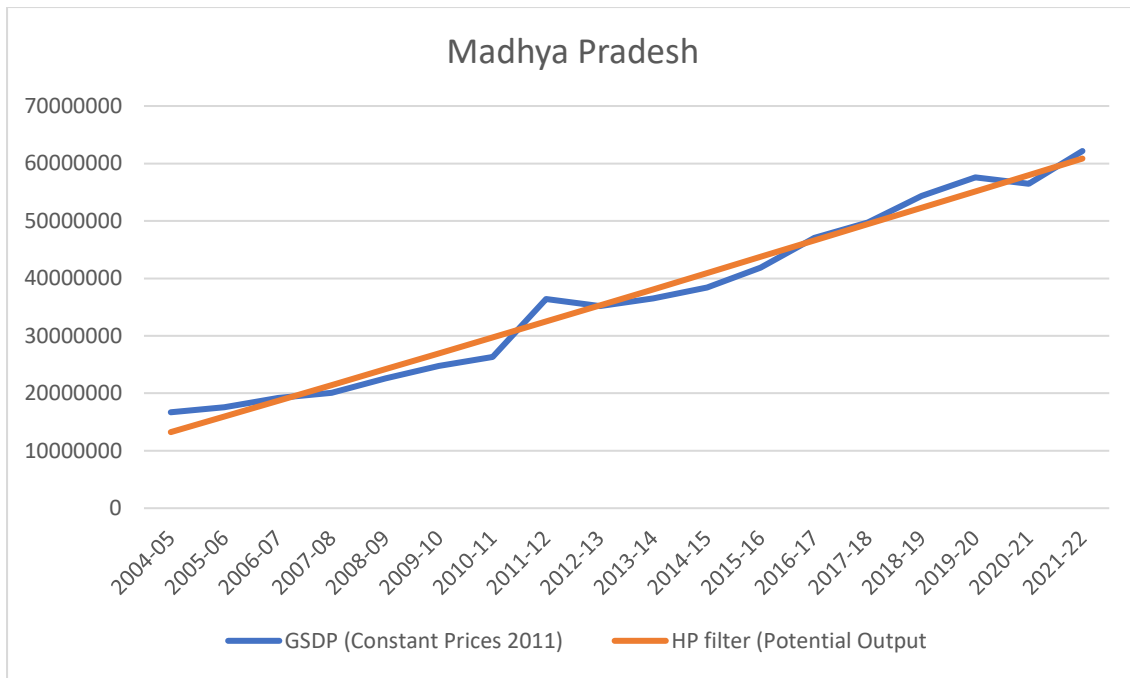
MP follows a pattern in lines with the output gaps of India owing to Global Financial Crisis, rising subsidies and pensions in the period 2008-2011. However it was observed that MP was quick in recovery from COVID 19 with negative output gap only in one year.

### Policy inferences:

The state follows a countercyclical policy.

The fiscal deficit in 2021-22 stood at 3.6% which increased to 4% in 2022-23. The Total expenditure increased from by 12% to counter the COVID-19 in 2021-22. Allocation towards water supply and sanitation had the highest annual increase of 54% over 2019-20, followed by health and family welfare (10%), and education, sports, arts and culture (10%).

Year	GSDP (Constant Prices 2011)	GSDP (Current Prices)	HP filter (Potential Output	Cyclical Component	Cyclical Component of the Nation
2004-05	16696907	11292689	13242801.68	26%	7%
2005-06	17582944	12427599	15970601.99	10%	4%
2006-07	19205907	14457681	18700561.12	3%	2%
2007-08	20106289	16147939	21435845.6	-6%	2%
2008-09	22613992	19727620	24179937.79	-6%	-3%
2009-10	24775334	22755664	26935489.09	-8%	-2%
2010-11	26339573	26339573	29704172.19	-11%	0%
2011-12	36404788	36404788	32486309.66	12%	-3%
2012-13	35168262	41231300	35280121.23	0%	-4%
2013-14	36513394	46504121	38086275.64	-4%	-4%
2014-15	38394448	51256405	40905371.75	-6%	-3%
2015-16	41873574	56199361	43737025.36	-4%	-1%
2016-17	47066916	63488640	46579282.92	1%	2%
2017-18	49710165	70158826	49429026.26	1%	4%
2018-19	54323489	78828558	52283441.96	4%	5%
2019-20	57555384	82437420	55139892.3	4%	4%
2020-21	56451437	79957111	57997014.62	-3%	-6%
2021-22	62165324	90199783	60854955.92	2%	-1%



## Rajasthan:

### Insights:

Rajasthan cyclical component poses and interesting view, during 2008-2010 when national output gap was negative. Rajasthan had a positive output gap with average growth of 9.12%. The growth is primarily attributed to agricultural growth during the same period. The economy managed the pandemic well and made a quick recovery.

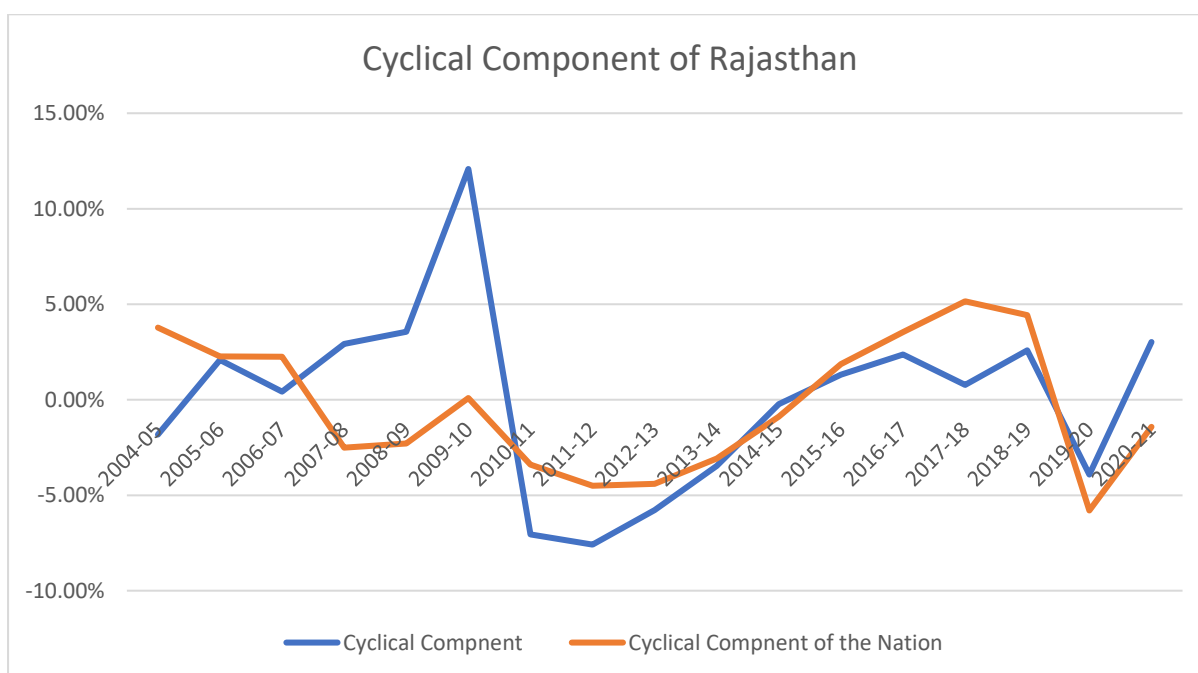
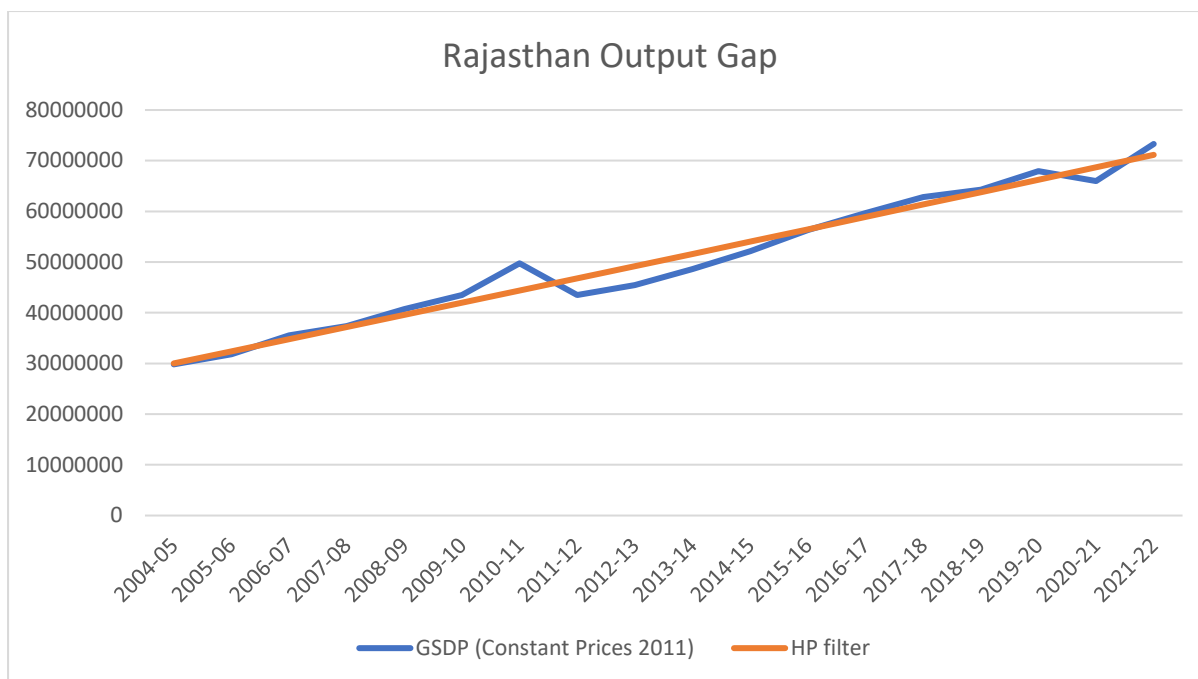


### Policy Inferences:

Rajasthan follows a counter cyclic policy, increasing expenditure during the period of negative output gaps and reducing exp. and increasing taxes during positive output gaps.

The total expenditure for 2021-22 was an annual increase of 8% over the total expenditure in 2019-20. The revenue deficit was estimated 4.36% of GSDP. The fiscal deficit is expected to be 6.12% of GSDP. The taxes were reduced ,stamp duty from 6% to 4% for flats up to Rs 50 lakh, reduction in mandi fee, farmer welfare fee, exemption in stamp duty, tax on motor vehicles.

Year	GSDP (Constant Prices 2011)	HP filter	Cyclical Component	Cyclical Component of the Nation
2004-05	29825568.93	30012961.2	-0.62%	7%
2005-06	31819294.58	32409603.56	-1.82%	4%
2006-07	35532432.35	34806128.79	2.09%	2%
2007-08	37360072.37	37202050.84	0.42%	2%
2008-09	40754613.2	39597337.58	2.92%	-3%
2009-10	43483667.47	41992055.65	3.55%	-2%
2010-11	49748942.93	44386995	12.08%	0%
2011-12	43483664	46783877.81	-7.05%	-3%
2012-13	45456434	49187777.5	-7.59%	-4%
2013-14	48623018	51601704.84	-5.77%	-4%
2014-15	52150893	54026338.52	-3.47%	-3%
2015-16	56333953	56460495.56	-0.22%	-1%
2016-17	59674551	58901820.81	1.31%	2%
2017-18	62802002	61347880.03	2.37%	4%
2018-19	64292850	63796721.96	0.78%	5%
2019-20	67956352	66247304.13	2.58%	4%
2020-21	66011779	68698894.18	-3.91%	-6%
2021-22	73301688	71151827.89	3.02%	-1%



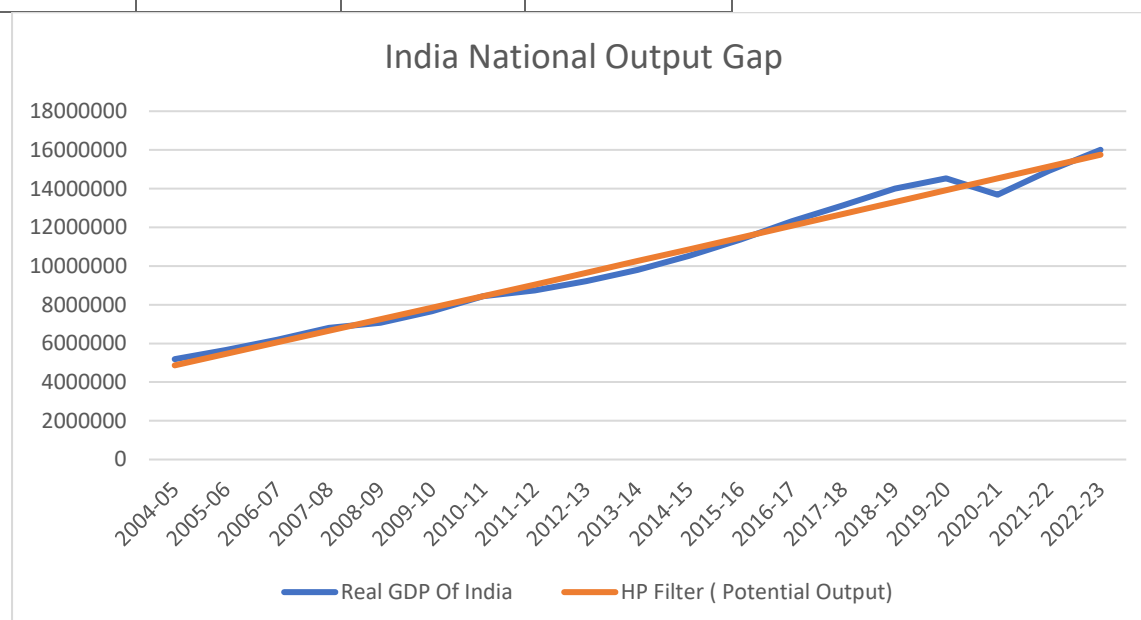
## NATIONAL OUTPUT GAP:

### Insights:

India experienced a deaccelerating growth during 2008-2012. All industries had slower development in 2008–09, with the exception of mining and quarrying and communal, social, and personal services. The growth in agriculture deaccelerated to 1.6% in 2008-2009. due to a fall in the production of non-food crops including oilseeds, cotton, sugarcane and jute.

Centre worked on introducing various stimulus packages to in order to achieve a quick recovery for the same.

Years	Real GDP Of India	HP Filter ( Potential Output)	Cyclical Component
2004-05	5185715.064	4866539.46	6.56%
2005-06	5667202.585	5460674.05	3.78%
2006-07	6192210.236	6055008.12	2.27%
2007-08	6799131.074	6649870.24	2.24%
2008-09	7063682.344	7245674.73	-2.51%
2009-10	7662667.535	7842929.19	-2.30%
2010-11	8448854.388	8442027.48	0.08%
2011-12	87,36,329	9043250.79	-3.39%
2012-13	92,13,017	9646884.59	-4.50%
2013-14	98,01,370	10253022.5	-4.41%
2014-15	1,05,27,674	10861487	-3.07%
2015-16	1,13,69,493	11471818.3	-0.89%
2016-17	1,23,08,193	12083348	1.86%
2017-18	1,31,44,582	12695343.5	3.54%
2018-19	1,39,92,914	13307213.1	5.15%
2019-20	1,45,34,641	13918645.7	4.43%
2020-21	1,36,87,118	14529758.7	-5.80%
2021-22	1,49,25,840	15141054.6	-1.42%
2022-23	1,60,06,425	15752509.2	1.61%



ANSWER 6);

India Database:						
Year	US(Et $\pi$ it+1)	yt <sup>d</sup>	yt <sup>g</sup>	$\pi$ it-1	$\pi$ t <sup>oil</sup>	
whole period 1994 Q1-2017Q4	0.117	0.0532	0.0462	0.129	0.09095	
<b>pre crisis 1994Q1-2008Q2</b>	0.111	0.0641	0.0524	0.136	0.0943	
<b>post crisis 2008Q3-2017Q4</b>	0.124	0.0423	0.0401	0.122	0.0876	

US Database:						
Year	US(Et $\pi$ it+1)	yt <sup>d</sup>	yt <sup>g</sup>	$\pi$ it-1	$\pi$ t <sup>oil</sup>	
whole period 1994Q1-2017Q4	0.127	0.0372	0.0624	0.573	0.146	
<b>pre crisis 1994Q1-2008Q2</b>	0.145	0.0307	0.121	0.566	0.00241	
<b>pre crisis 2 2000Q1-2008Q2</b>	0.152	0.0523	0.113	0.441	0.123	
<b>post crisis 2008Q3-2017Q4</b>	0.252	0.0342	0.0776	0.415	0.0176	

We estimate our benchmark regression separately for India and US (Tables 1 and 2, respectively). We Show the main coefficient estimates for US for four time periods:

- (1) For the full sample period (1994Q1-2017Q4); (2) for the pre crisis period (1994Q1-2008Q2); (3) for the post-crisis period including the Crisis quarters (2008Q3-2017Q4); and (4) for the post-crisis period Excluding the crisis quarters (2009Q3-2017Q4).

In addition, for India we also show the estimates for the pre-crisis period Which excludes the emerging markets crises in the 1990s(2000Q1-2008Q2). For USA we find that the global output gap affects inflation positively and significantly in most time periods (Table 2) . This is the case in the whole sample period of 1994–2017 (Column 1), and in Both post-crisis periods (Columns 3 and 4). Yet, we do not find any significant global output gap effect for the pre-crisis period in this benchmark specification (Column 2). But as shown below, the global output Gap effect is significant also in the pre-crisis period when using domestic output gap specification. Overall, whenever statistically significant, the coefficient on the global output gap is larger than the coefficient on the domestic output gap.

For India, the global output gap affects inflation positively and significantly in all time periods, except in the post-crisis period Which excludes the financial crisis quarters (see Table 1). Furthermore, the global output gap coefficients reported in Columns 1–3 are consistently larger than the ones on the domestic output gap. Interestingly, the effect of the global output gap in india shows a similar Pattern as that of the domestic output gap in USA i.e it declines after the financial crisis

## b) Taylor's Rule Table 1 and 2 Explanation

Estimates of the aggregate supply function **Intrinsic persistence ( $\beta_1$ )** increased from 0.57 to 0.59 which is in contrast with the data as per WPI because CPI have more weightage to food and in past years WPI and CPI have shown divergence because Food inflation has increased significantly.

**Extrinsic persistence ( $\beta_3$ )** is also significant but quite smaller as compared to intrinsic persistence, size of extrinsic persistence decreased when post crisis period is included as against an increase with WPI. This shows that there is a weaker relationship between output gap and CPI inflation as compared to relationship between output gap and WPI inflation.

The estimated **sacrifice ratio** has increased from 2.7 in Pre crisis level to 3.4 overall (pre plus post crisis). This suggest flattening of aggregate supply curve, This increase in sacrifice ratio is due to reduced economic flexibility, combination of uncertainty during economic crisis.

**Inflation persistence ( $\pi_e$ )** due to expectations it has increased after inclusion of post crisis period but magnitude is lesser as compared to WPI because CPI inflation was not targeted by monetary policy of RBI until 2013.

Exchange rate coefficient ( $\beta_4$ ) decreases in post crisis period due to decline in exchange rate pass-through to domestic inflation in post crisis period.

The **Persistence in output gap ( $\delta_1$ )** have increased from 0.61 in pre crisis period to 0.7 in the combined period this implies slower convergence of actual output to its potential following the shock due to crisis.

**Transmission lag (rr)** of real policy rate to aggregate demand have shortened from pre-Crisis to post crisis.

**Global output growth ( $\delta_3$  OECD\_  $G_t$ )** has Increased from 0.1 in pre crisis period to 0.14 the full sample period. This indicates that global recovery is now more important than before for revival of domestic economy .

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## c) Summary-Transmission Mechanism of Monetary Policy in India

This paper gives in-depth analysis of the transmission mechanism of monetary policy in India, and focus on the differences between emerging economies and developed countries. It explores a different aspect of monetary policy transmission.

The study uses Vector Autoregression (VAR) models to analyze three transmission channels: The bank Lending channel, Asset Price Channel, and Exchange Rate Channel.

**Bank Lending Channel-** This focuses on importance of the bank lending channel in India's monetary transmission. The Indian economy relies heavily on bank financing or loans, Monetary policy tightening affects both the supply of deposits and credit, leading to a larger impact on GDP.

Asset Price Channel-The Asset Price Channel is not significant in India's monetary transmission. Though the growth in market capitalization is significant but the impact of asset prices on GDP is small comparatively.

Exchange Rate Channel- The central bank plays important role by stabilizing the exchange rate. However, the exchange rate channel is not a primary driver of monetary policy. India's monetary transmission mechanisms is unique its important to consider external constraints and specific economic parameters when analyzing the effects of monetary policy Transmission in India.

It shows results of a benchmark model that examines the dynamic responses of GDP, prices, and overnight call money rate to a positive one standard deviation overnight call money rate shock. The model finds that a tightening of monetary policy corresponding to a rise of 1.5% in the overnight call money rate leads to significant changes in GDP and prices.

It also discusses the challenges of modeling monetary transmission mechanisms in emerging economies. Using too many lags may create the degrees of freedom problem, and cites several studies that have used two lags in quarterly estimations of monetary transmission mechanisms in various countries.

The existence of external constraints on monetary policy in emerging economies requires a model specification different from that of developed countries. The section also notes that the responses of GDP to a positive overnight call money rate shock are statistically significant in the bank lending channel, and that GDP shows similar responses to a positive monetary policy shock in the asset price and exchange rate channels. These estimates suggest the robustness of the empirical results and validate the importance of the bank lending channel in India.

Provides a comprehensive transmission mechanism of monetary policy in India, the existence of external constraints on monetary policy in emerging economies requires a model specification different from that of developed countries.

Market capitalization of listed companies in India is lower as compared to developed countries which implies that capital markets in India are not developed sufficiently. Central banks in emerging economies stabilize exchange rates though they deny it. Massive interventions by RBI in foreign exchange market to stabilize the exchange rate weaken the exchange rate channel.

India's monetary policy is constrained by the Fed's monetary policy, therefore Indian monetary policy requires the inclusion of the federal funds rate in the information set of RBI.

### VAR Analysis Significance

VAR models allow researchers to capture the interrelationships among multiple economic variables simultaneously. In the context of monetary policy transmission, various factors such as interest rates, credit, prices, and exchange rates interact with each other. VAR models enable the study of these intricate interactions.

**Lagged Effects:** VAR models incorporate lagged values of variables, which is essential in monetary policy analysis. The impact of a change in monetary policy may not be immediate, and VAR models allow researchers to capture how shocks propagate over time.

**Endogeneity:** VAR models handle endogeneity well. Economic variables often influence each other, and it's crucial to account for this mutual influence when studying the effects of monetary policy. VAR models endogenize variables, which means they consider how changes in one variable affect others and vice versa.

**Identification:** In this research, the paper mentions imposing restrictions on contemporaneous effects of endogenous variables to achieve exact identification. Identification is crucial in VAR modelling because it helps researchers determine the causal relationships between variables, such as how monetary policy shocks affect GDP, prices, and other economic indicators.

**Response Analysis:** VAR models enable researchers to examine how different variables respond to shocks. For example, in the research paper, It is discussed how GDP, prices, and interest rates respond to an unanticipated monetary policy tightening, which helps in providing insights into the transmission mechanisms.

**Exogeneity:** VAR models can be used for both exogenous and endogenous variables. This is important when studying the effects of external factors (exogenous variables like foreign interest rates or global commodity prices) on the domestic economy, as is done in this research.

**Counterfactual Analysis:** VAR models also allow for counterfactual analysis. By manipulating the model, researchers can assess how different policies or shocks might have

affected the economy differently. This can help policymakers understand the potential outcomes of different policy choices.

**Robustness Testing:** VAR models allow for various diagnostic tests to ensure model adequacy and robustness of results. Researchers can check for things like autocorrelation, heteroscedasticity, and stability of parameters.

In summary, VAR models are valuable tools for studying the transmission of monetary policy and assessing the impacts of various shocks in a multivariate economic context. They provide a structured framework to analyse complex interactions, capture time dynamics, and identify causal relationships, making them a suitable choice for the research discussed.

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