Crime Pattern Analysis
Group No 13

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Problem Statement

- We aim to analyse hot-spot and cold-spot districts/states in crimes across India for years 2001 to 2010. We have considered following four major types of crimes:
  1. Crimes on SC
  2. Crimes on ST
  3. Crimes on Children
  4. Crimes on Women
- We also aim to back our analysis by finding relation with the census data.

Introduction and Motivation

- Crime pattern analysis plays an important role in construction of policies to overcome crimes committed in a region.
- The crime pattern analysis focuses on detection of hot-spot areas; the areas with high density of crime.
- Studies state that 10% people commit about 50% crimes [1].
- India ranks 65th in crimes with crime index of 44.2 `https://www.numbeo.com/crime/rankings_by_country.jsp`.
- The efficient utilization of resources can overcome crimes in India in a cost effective manner

Dataset Used

- District wise crime data record of India for the year 2001-2014.
- Data has been shared on Open Govt Data Platform India portal under Govt. Open Data License - India
- Census Data for the period 2001 to 2010.
- Census Data released (and owned by) the Registrar General and Census Commissioner of India under the Ministry of Home Affairs, Government of India.

Pre-Processing

Following steps were followed to pre-process the data:

- The missing state/districts crime count were made zero by adding a new entry for that particular year.
- Several district's names were changed with common name if they had any other alias.
- Districts of union territories were combined together as one single district named by the corresponding union territory's name.
- Spelling mistakes in district's name were handled with correct name.
- The number of districts in the crime files were made equal in number for every year(2001-2010) using above mentioned steps.
- Census Data state/district names were made similar to the pre-processed crime files.

Methodology

We define our methodology in four steps:

- **Finding Extremum:** We found top five hotsspots/coldspots districts/states using following two metrics:
  - **Population Normalized(Density)**
  - **ZScore(Volume)**
- **Growth Rate:** We have calculated growth rate for two consecutive years of the extracted hotspot/coldspot districts/states for all crime files.
- **Contribution of sub category crimes:** Each subcategory contribution in percentages.
- **Correlation:** We found correlation of census data with crime files to extract relevant attributes from census data.
- **Inferences:** Here we discuss insights developed by analyzing inference bar plots.

Results and Analysis

Our analysis is centered towards four types of crimes:

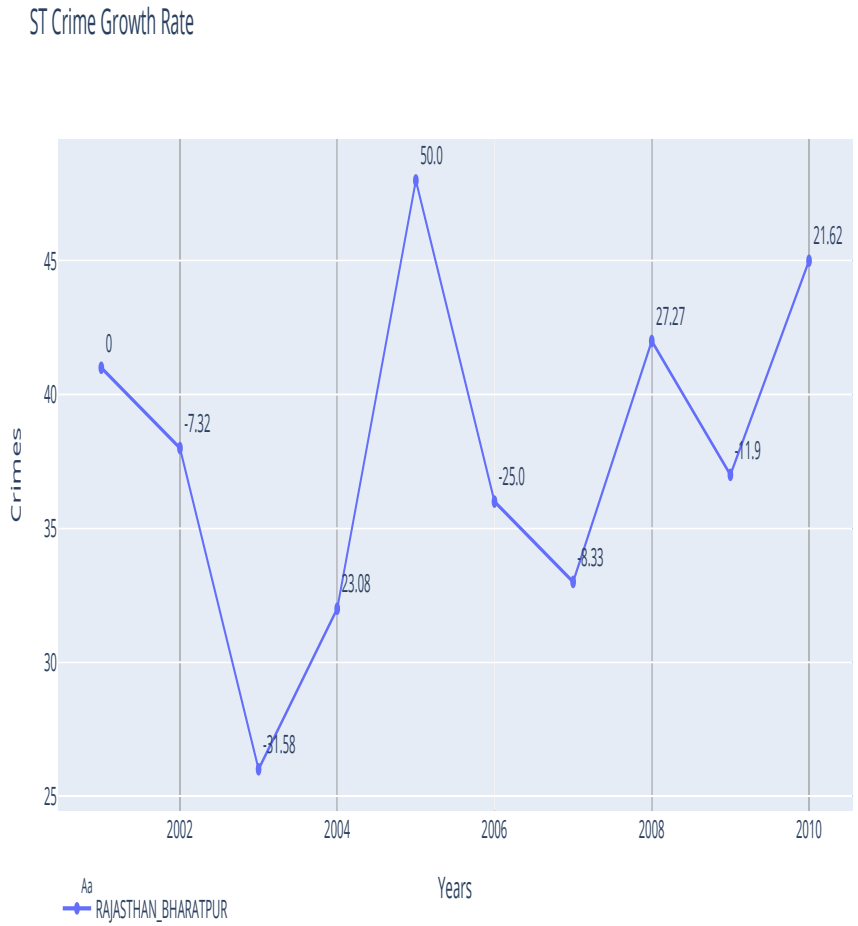
1. Crime against STs
2. Crime against Children
3. Crime against SCs
4. Crime against Women

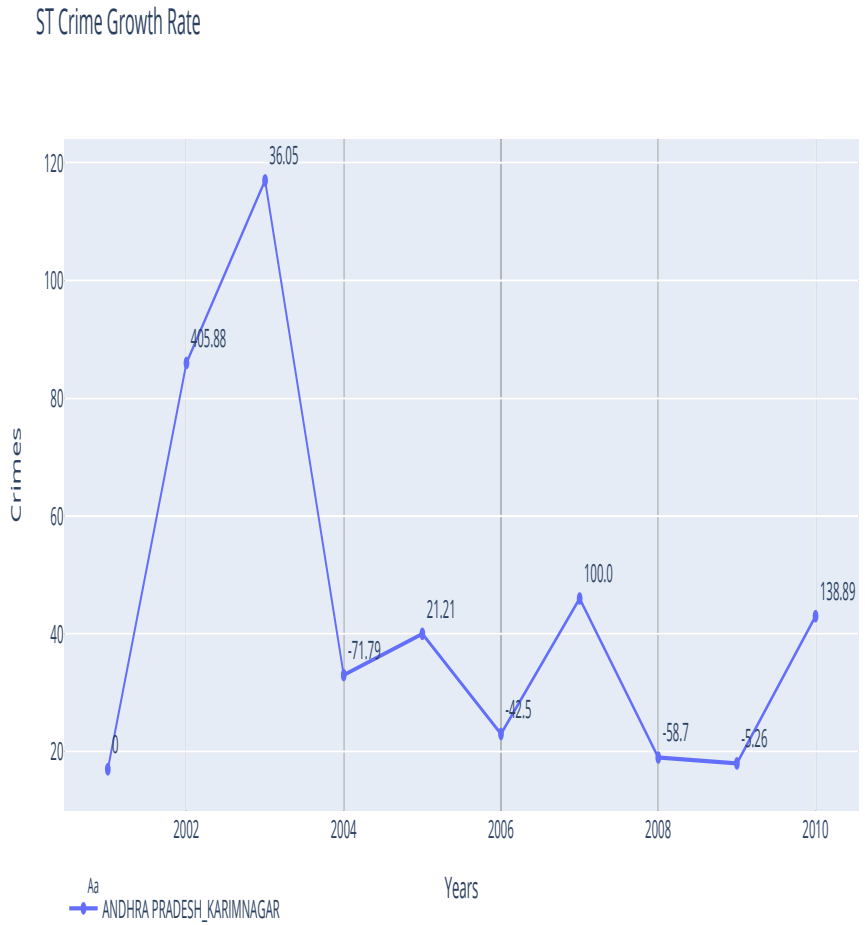
STs

Population			
Districts		**States**	
Top	Low	Top	Low
GWALIOR	JHABUA	RAJASTHAN	WEST BENGAL
BHARATPUR	AMRAVATI	MADHYA PRADESH	ASSAM
TONK	SRIKAKULAM	ANDHRA PRADESH	NAGALAND
KARIMNAGAR	VALSAD	CHHATTISGARH	MEGHALAYA
SIKAR	SUNDARGARH	ODISHA	BIHAR

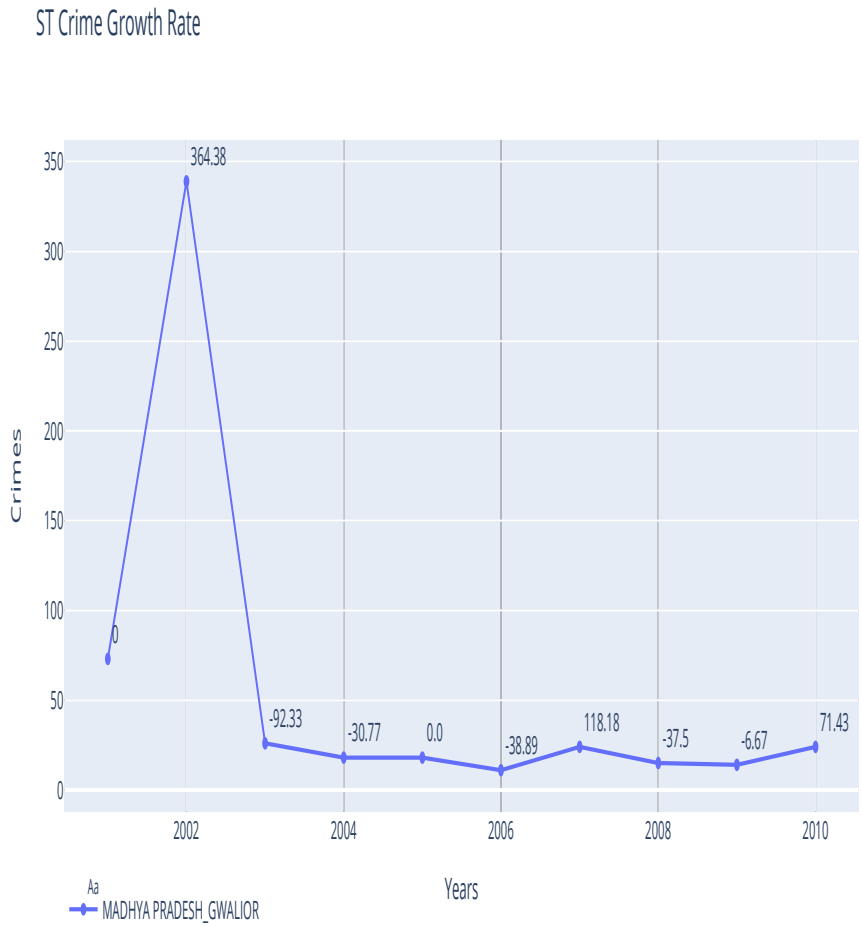
Zscore			
Districts		**States**	
Top	Low	Top	Low
JAIPUR	TAWANG	MADHYA PRADESH	LAKSHADWEEP
NALGONDA	GOPALGANJ	RAJASTHAN	MEGHALAYA
BETUL	NORTH GOA	ANDHRA PRADESH	GOA
MAYURBHANJ	SOUTH GOA	ODISHA	DAMAN & DIU
SEONI	MANDI	CHHATTISGARH	J & K

Growth Rate of STs

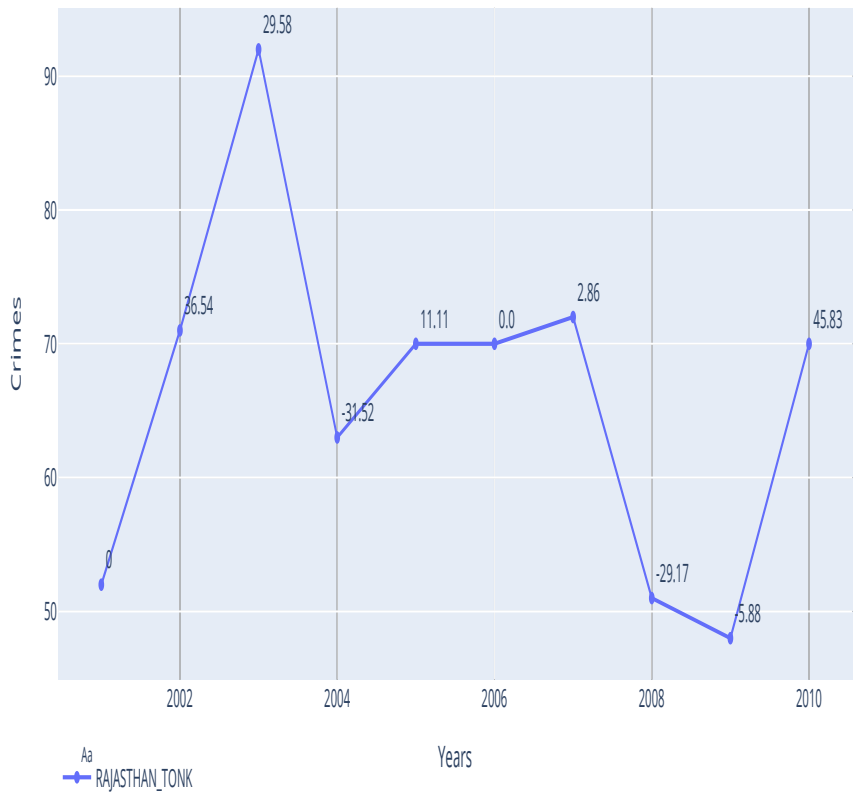





ST Crime Growth Rate
Crimes
Years
RAJASTHAN_SIKAR
0
3.57
-44.83
87.5
-10.0
7.41
-27.59
57.14
8.06
37.14

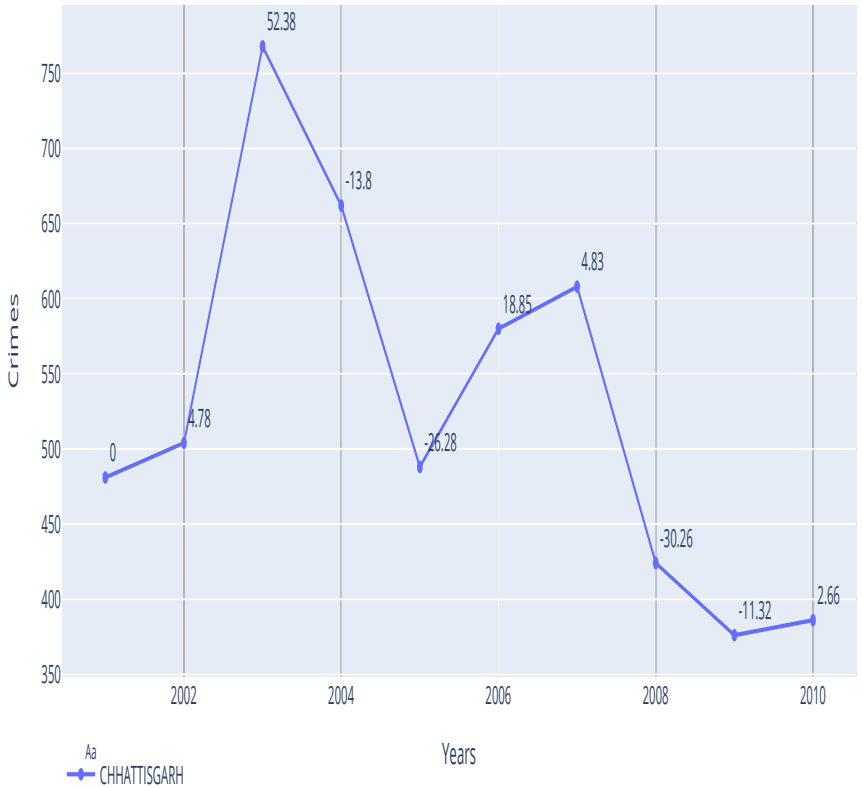

ST Crime Growth Rate
Crimes
Years
MADHYA PRADESH_GWALIOR
0
364.38
-92.33
-30.77
0.0
-38.89
118.18
-37.5
-6.67
71.43

ST Crime Growth Rate

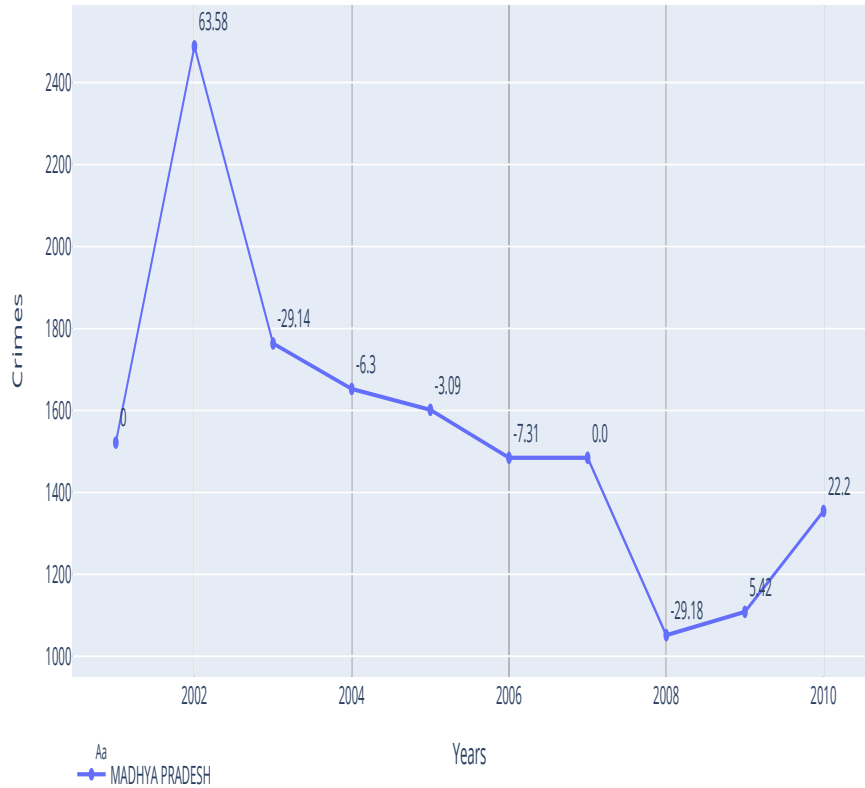


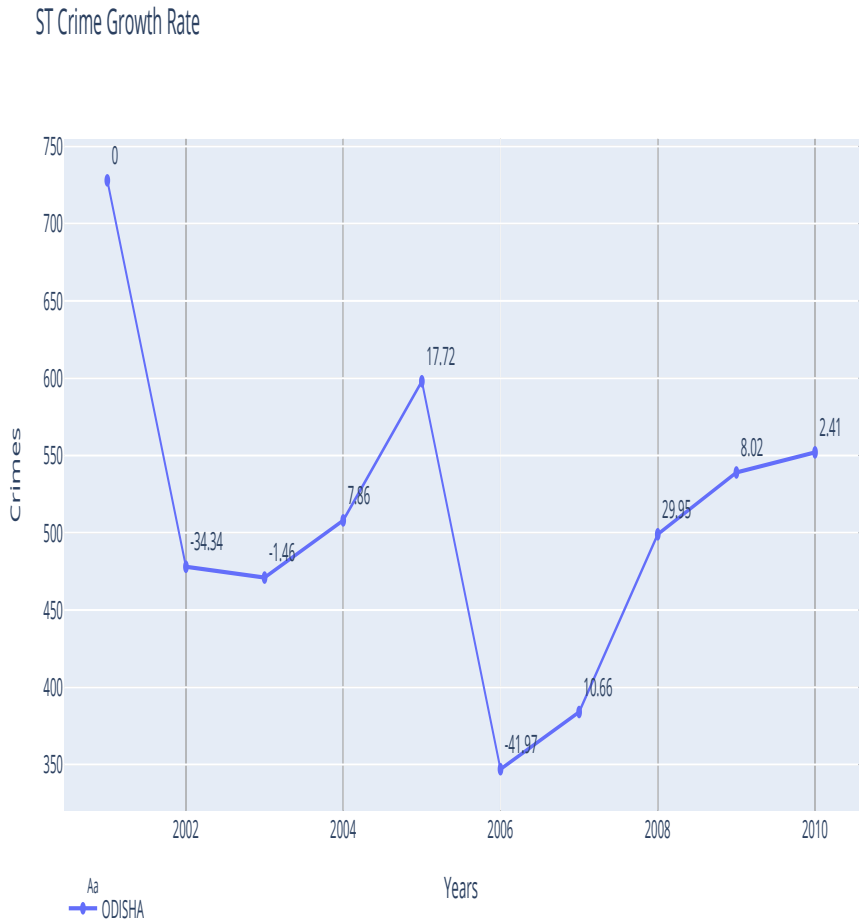
ST Crime Growth Rate

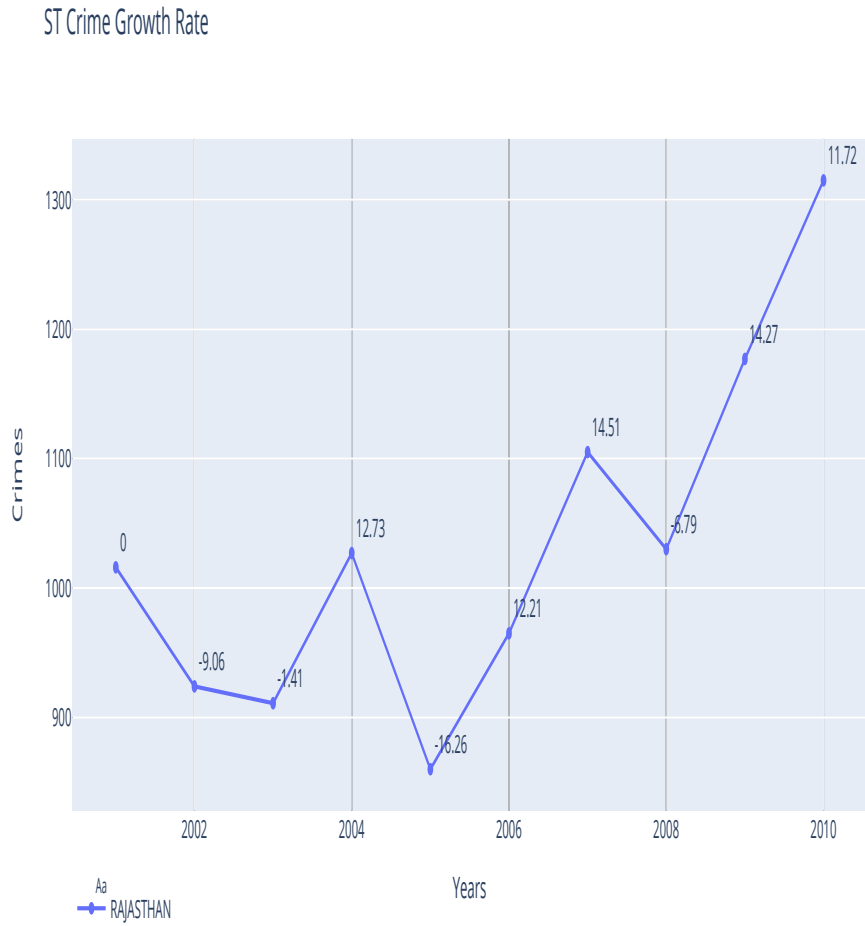
ST Crime Growth Rate



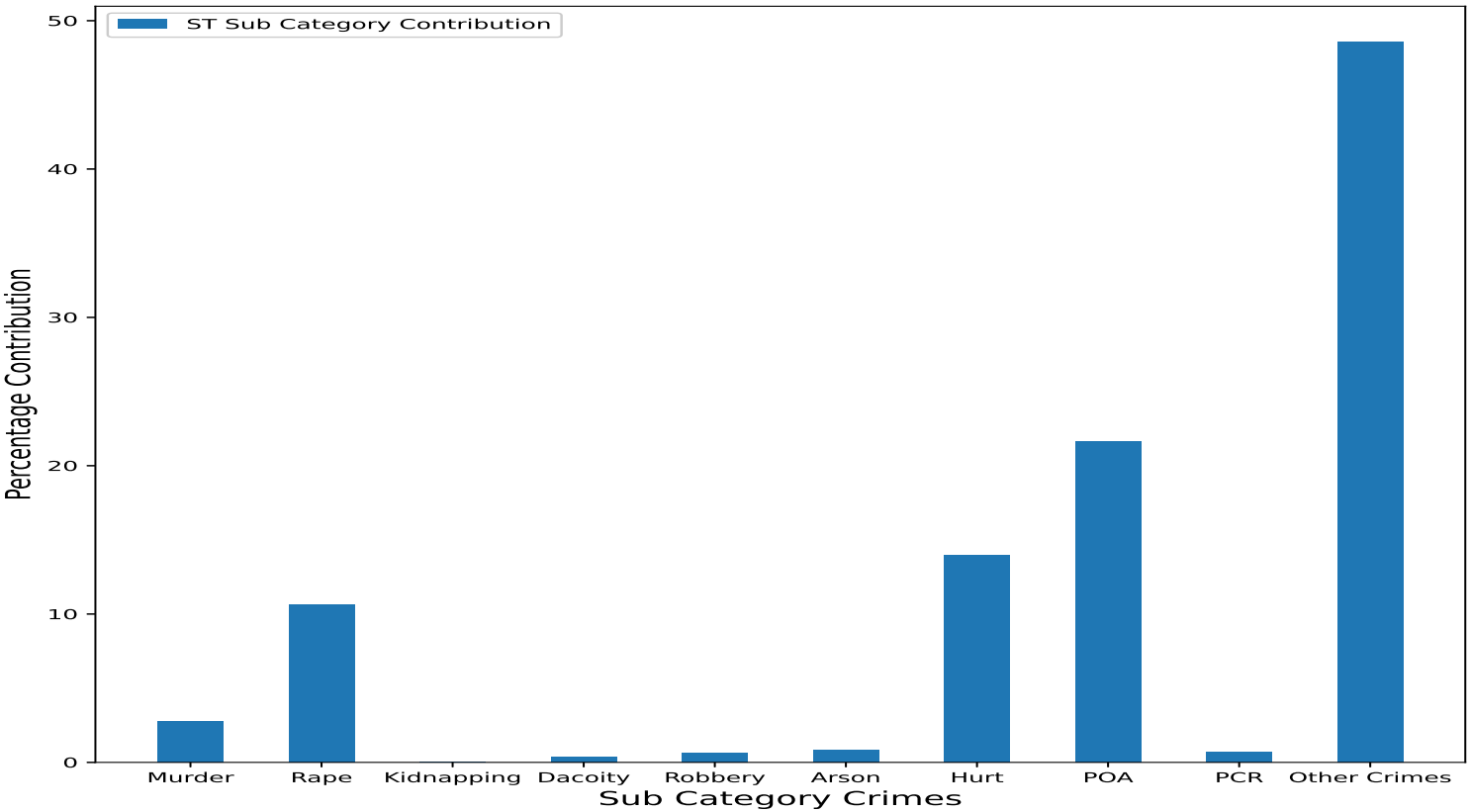
ST Crime Growth Rate



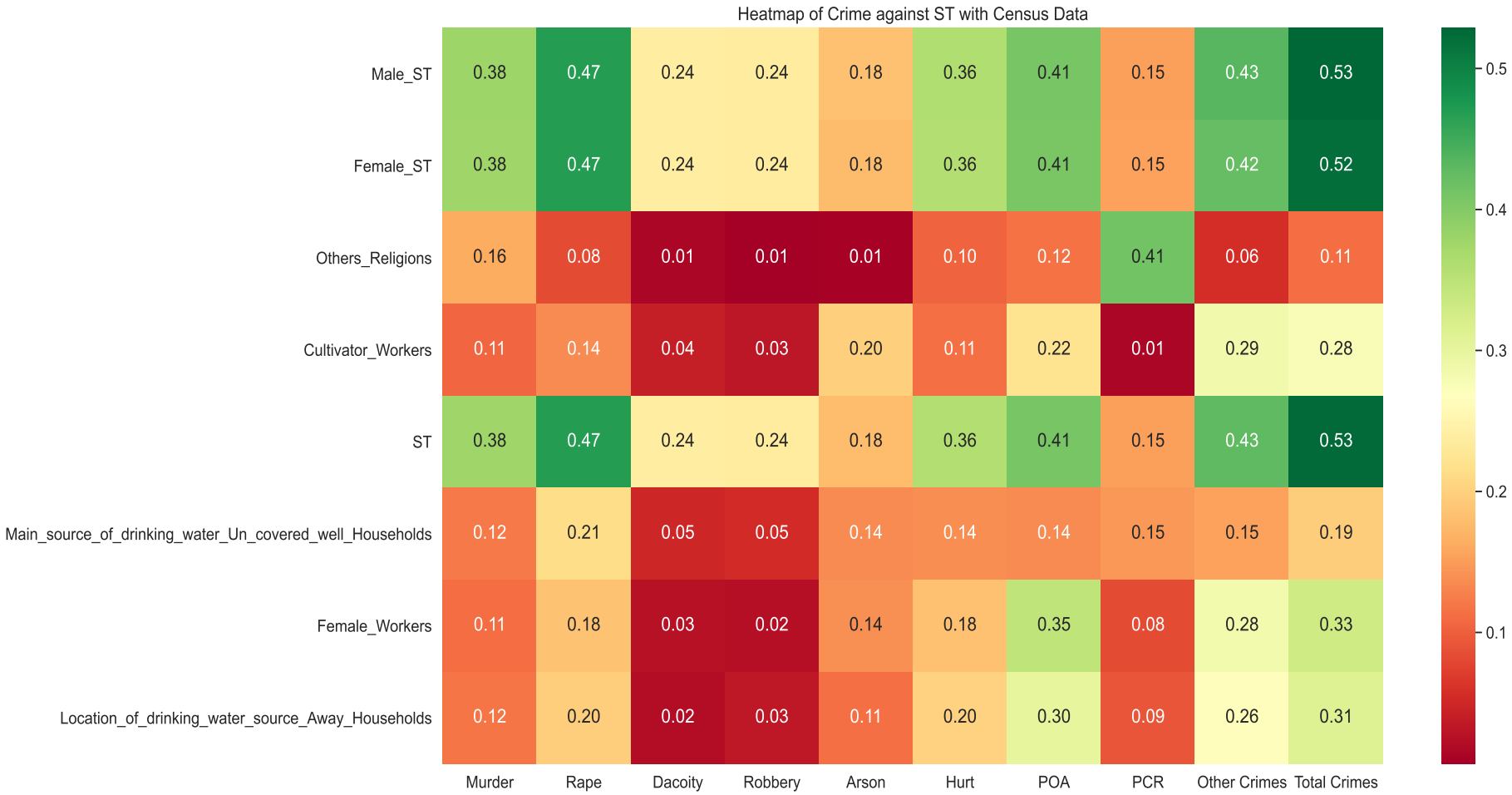

ST Crime Growth Rate
750
700
650
600
550
500
450
400
350
Crimes
0
-34.34
-1.46
7.86
17.72
-41.97
10.66
29.95
8.02
2.41
2002
2004
2006
2008
2010
Years
Aa
ODISHA


ST Crime Growth Rate
1300
1200
1100
1000
900
Crimes
0
-9.06
-1.41
12.73
-16.26
12.21
14.51
-6.79
14.27
11.72
2002
2004
2006
2008
2010
Years
Aa
RAJASTHAN

Contribution of sub category in ST crimes

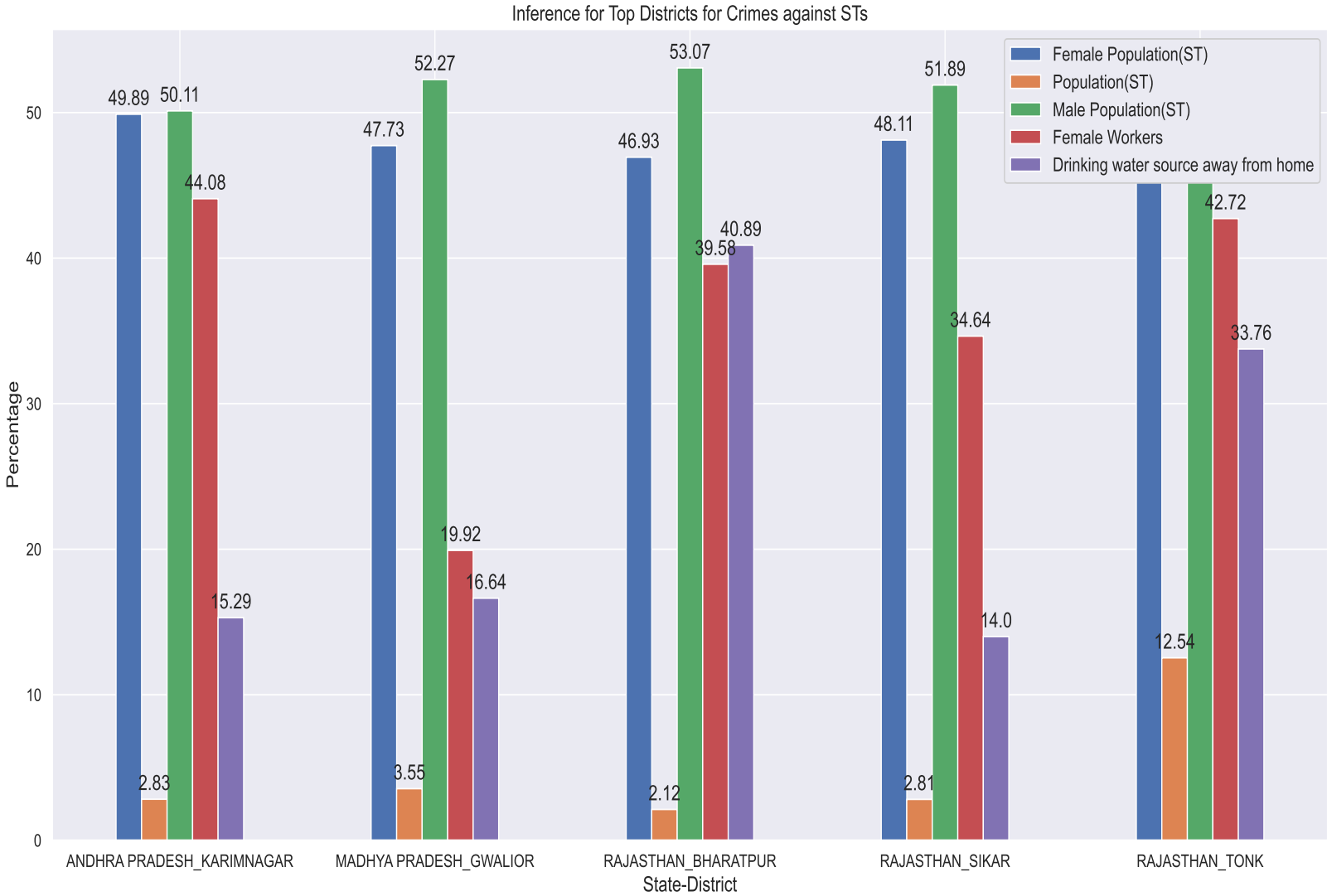


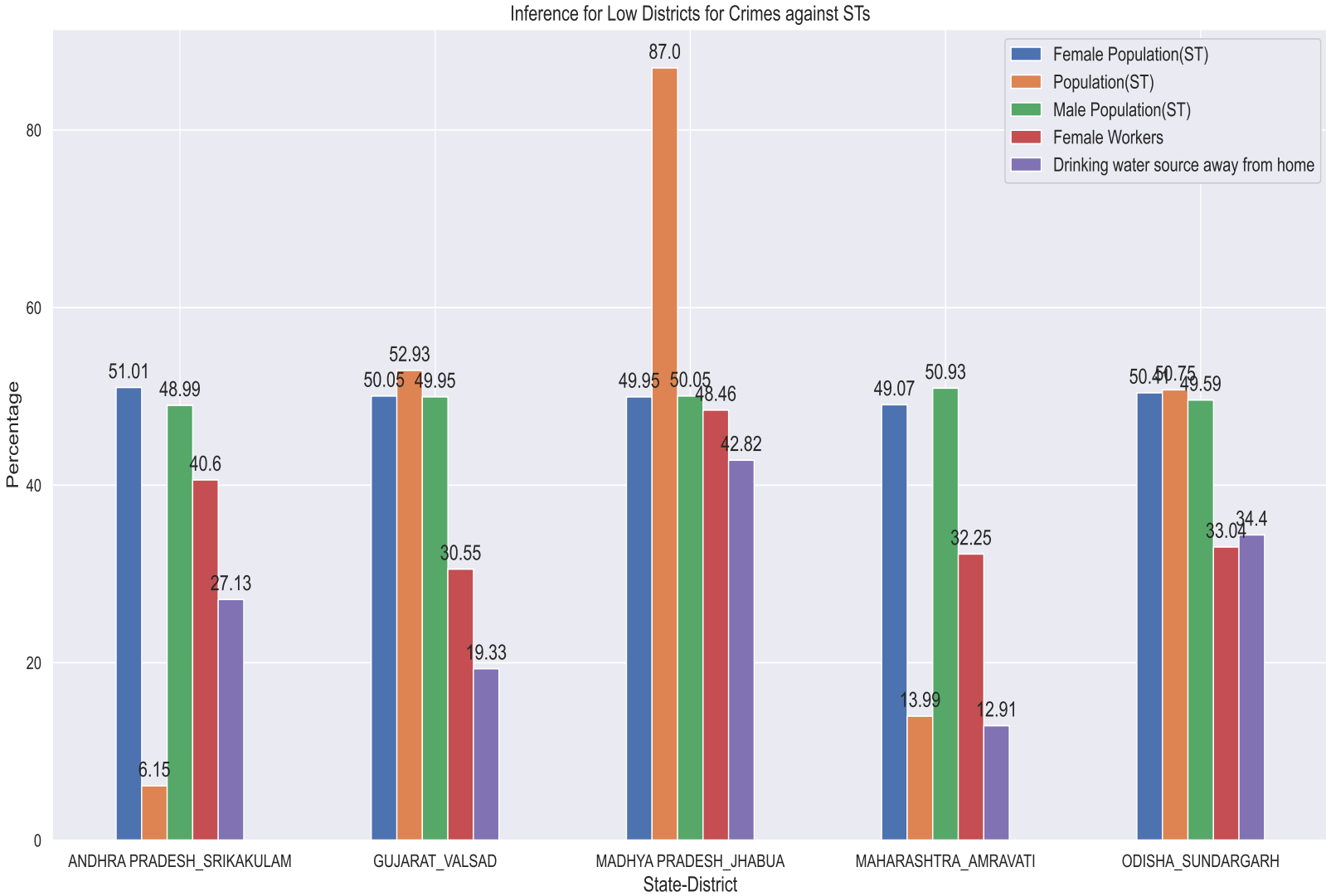
Inference

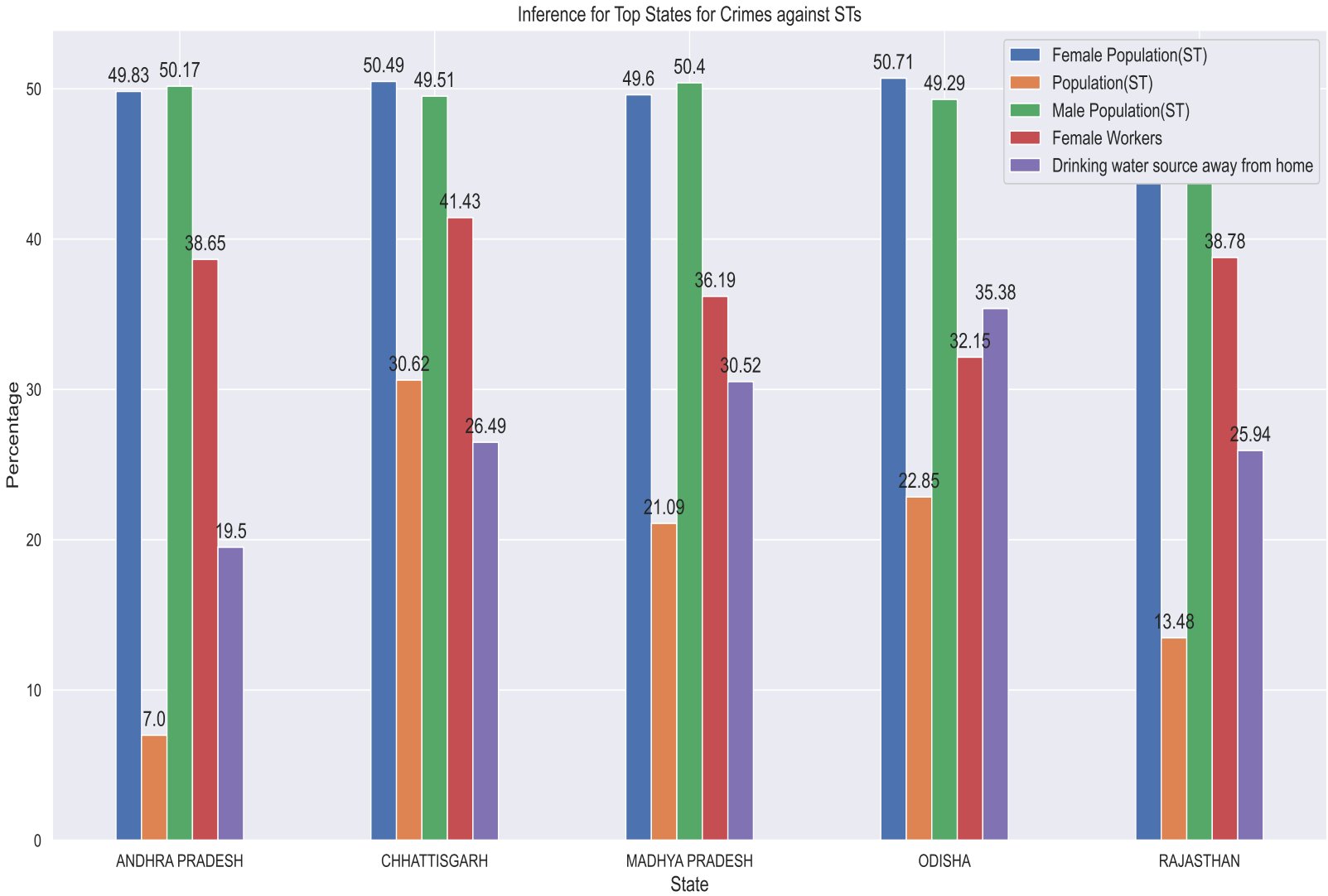

Heatmap of Crime against ST with Census Data
Male_ST 0.38 0.47 0.24 0.24 0.18 0.36 0.41 0.15 0.43 0.53
Female_ST 0.38 0.47 0.24 0.24 0.18 0.36 0.41 0.15 0.42 0.52
Others_Religions 0.16 0.08 0.01 0.01 0.01 0.10 0.12 0.41 0.06 0.11
Cultivator_Workers 0.11 0.14 0.04 0.03 0.20 0.11 0.22 0.01 0.29 0.28
ST 0.38 0.47 0.24 0.24 0.18 0.36 0.41 0.15 0.43 0.53
Main_source_of_drinking_water_Un_covered_well_Households 0.12 0.21 0.05 0.05 0.14 0.14 0.14 0.15 0.15 0.19
Female_Workers 0.11 0.18 0.03 0.02 0.14 0.18 0.35 0.08 0.28 0.33
Location_of_drinking_water_source_Away_Households 0.12 0.20 0.02 0.03 0.11 0.20 0.30 0.09 0.26 0.31
Murder Rape Dacoity Robbery Arson Hurt POA PCR Other Crimes Total Crimes
0.5
0.4
0.3
0.2
0.1

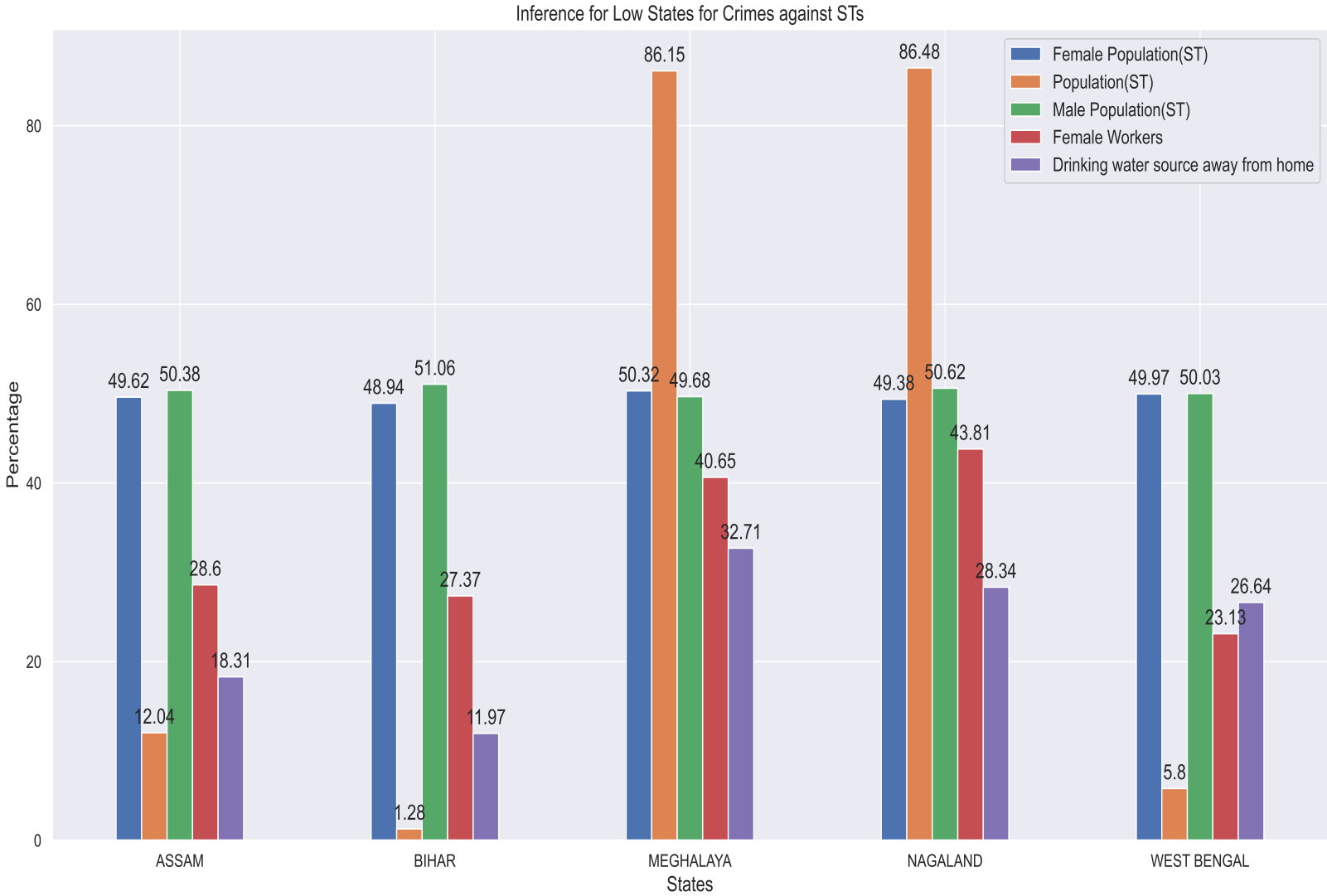
The attributes extracted from the heatmap are :

- No latrine facility within the premises.
- Cultivator Workers.
- Below Primary Education roof
- Bathing facility enclosure without roof.
- Illiterate.


Inference for Top Districts for Crimes against STs
Female Population(ST)
Population(ST)
Male Population(ST)
Female Workers
Drinking water source away from home
Percentage
0
10
20
30
40
50
49.89
50.11
44.08
15.29
2.83
47.73
52.27
19.92
16.64
3.55
46.93
53.07
39.58
40.89
2.12
48.11
51.89
34.64
14.0
2.81
42.72
33.76
12.54
ANDHRA PRADESH_KARIMNAGAR
MADHYA PRADESH_GWALIOR
RAJASTHAN_BHARATPUR
RAJASTHAN_SIKAR
RAJASTHAN_TONK
State-District


Inference for Low Districts for Crimes against STs
Female Population(ST)
Population(ST)
Male Population(ST)
Female Workers
Drinking water source away from home
Percentage
0
20
40
60
80
51.01
6.15
48.99
40.6
27.13
50.05
52.93
49.95
30.55
19.33
49.95
87.0
50.05
48.46
42.82
49.07
13.99
50.93
32.25
12.91
50.41
50.75
49.59
33.04
34.4
ANDHRA PRADESH_SRIKAKULAM
GUJARAT_VALSAD
MADHYA PRADESH_JHABUA
MAHARASHTRA_AMRAVATI
ODISHA_SUNDARGARH
State-District


Inference for Top States for Crimes against STs
Female Population(ST)
Population(ST)
Male Population(ST)
Female Workers
Drinking water source away from home
Percentage
State
ANDHRA PRADESH
CHHATTISGARH
MADHYA PRADESH
ODISHA
RAJASTHAN
0
10
20
30
40
50
49.83
7.0
50.17
38.65
19.5
50.49
30.62
49.51
41.43
26.49
49.6
21.09
50.4
36.19
30.52
50.71
22.85
49.29
32.15
35.38
13.48
38.78
25.94


Inference for Low States for Crimes against STs
Female Population(ST)
Population(ST)
Male Population(ST)
Female Workers
Drinking water source away from home
Percentage
0
20
40
60
80
49.62
12.04
50.38
28.6
18.31
48.94
1.28
51.06
27.37
11.97
50.32
86.15
49.68
40.65
32.71
49.38
86.48
50.62
43.81
28.34
49.97
5.8
50.03
23.13
26.64
ASSAM
BIHAR
MEGHALAYA
NAGALAND
WEST BENGAL
States

Inferences drawn from the plots are:

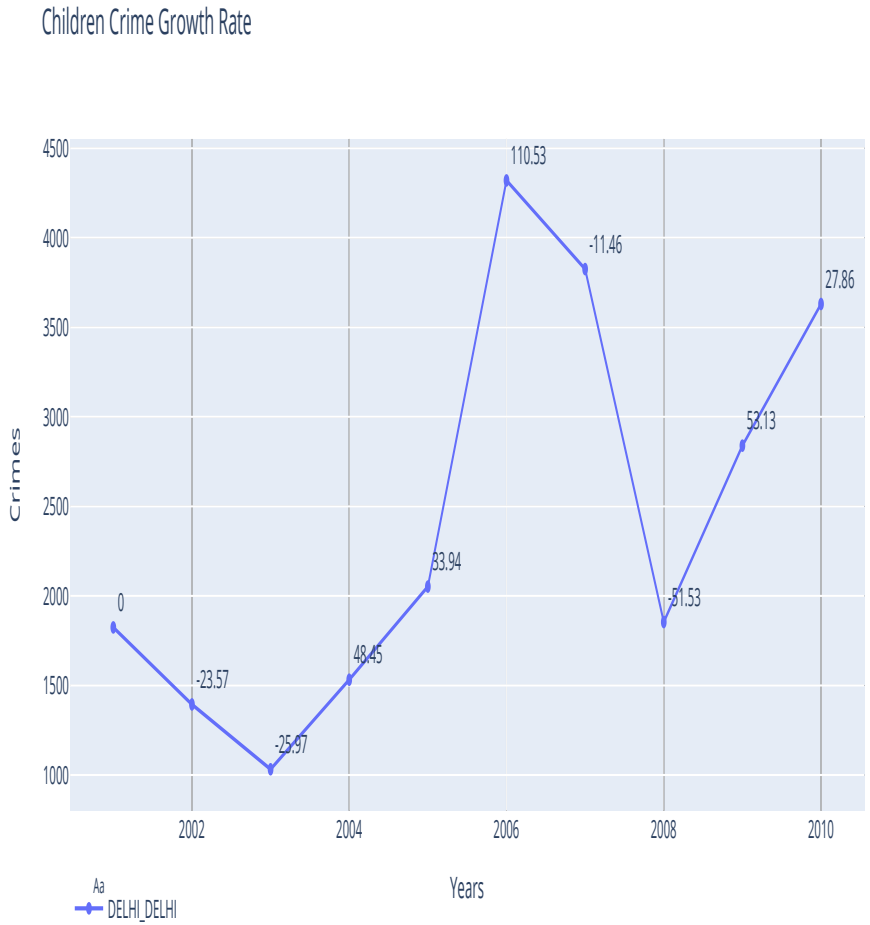
- Comparative look at plots of cold-spot and hot-spot district shows that districts with more ST population have less crimes than districts with less ST population.
- hot-spot districts/states have more male ST population than cold-spot districts.
- Majorly hot-spot districts have high female workers than the cold-spot districts.

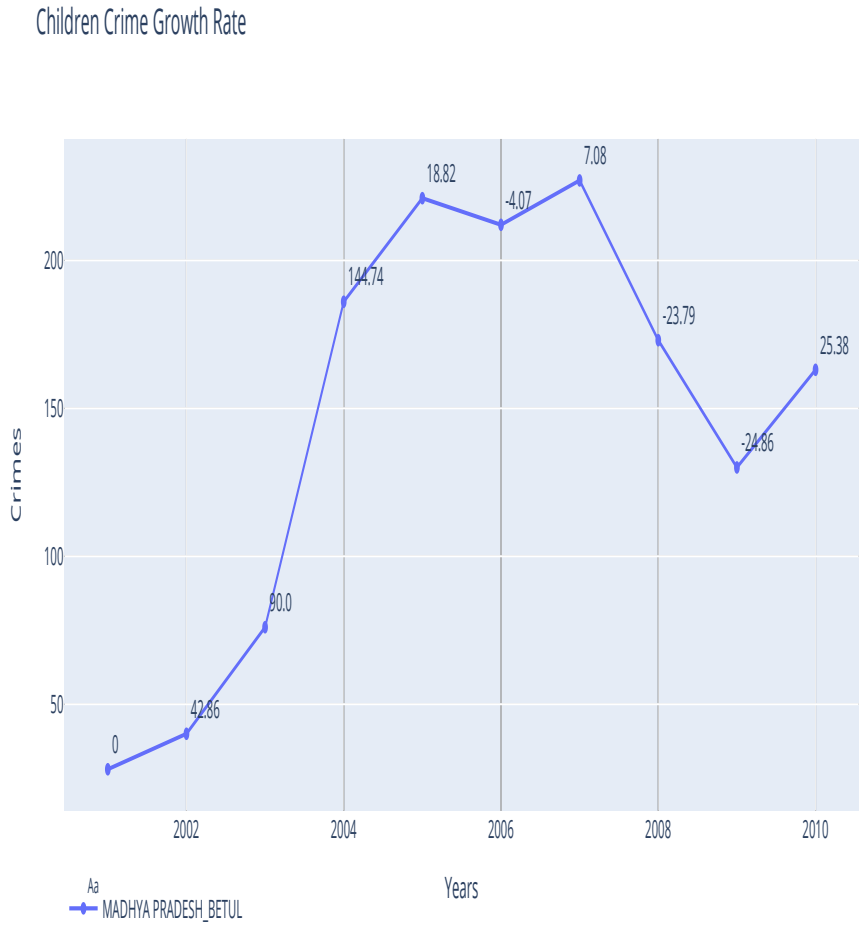
Children

Population			
Districts		**States**	
Top	Low	Top	Low
DELHI	RAIGARH	MADHYA PRADESH	BIHAR
INDORE	CHITTOOR	DELHI	WEST BENGAL
KHANDWA	AMRELI	CHHATISGARH	TAMIL NADU
BETUL	CHENNAI	UTTAR PRADESH	KERLA
RAJGARH	SHIVPURI	MAHARASHTRA	KARNATAKA

Zscore			
Districts		**States**	
Top	Low	Top	Low
DELHI	KAMENG WEST	MADHYA PRADESH	LAKSHADWEEP
PUNE	TAWANG	MAHARASHTRA	DAMAN & DIU
MUMBAI	KAITHAL	UTTAR PRADESH	NAGALAND
INDORE	JAMMU	DELHI	D & N HAVELI
NAGPUR	KARGIL	ANDHRA PRADESH	PUDUCHERRY

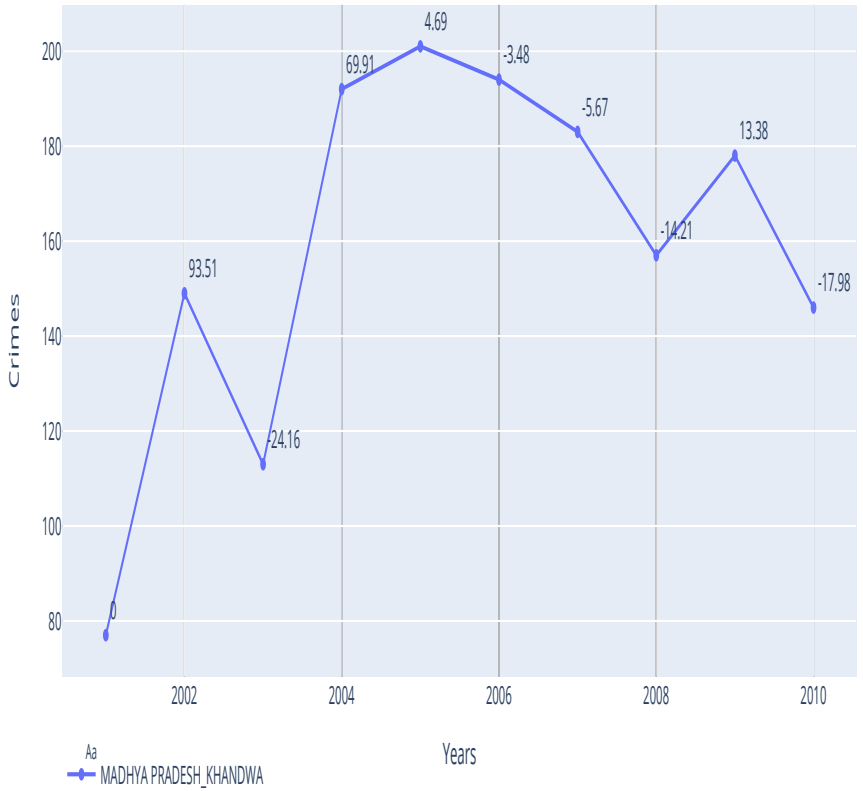
Growth Rate of Children

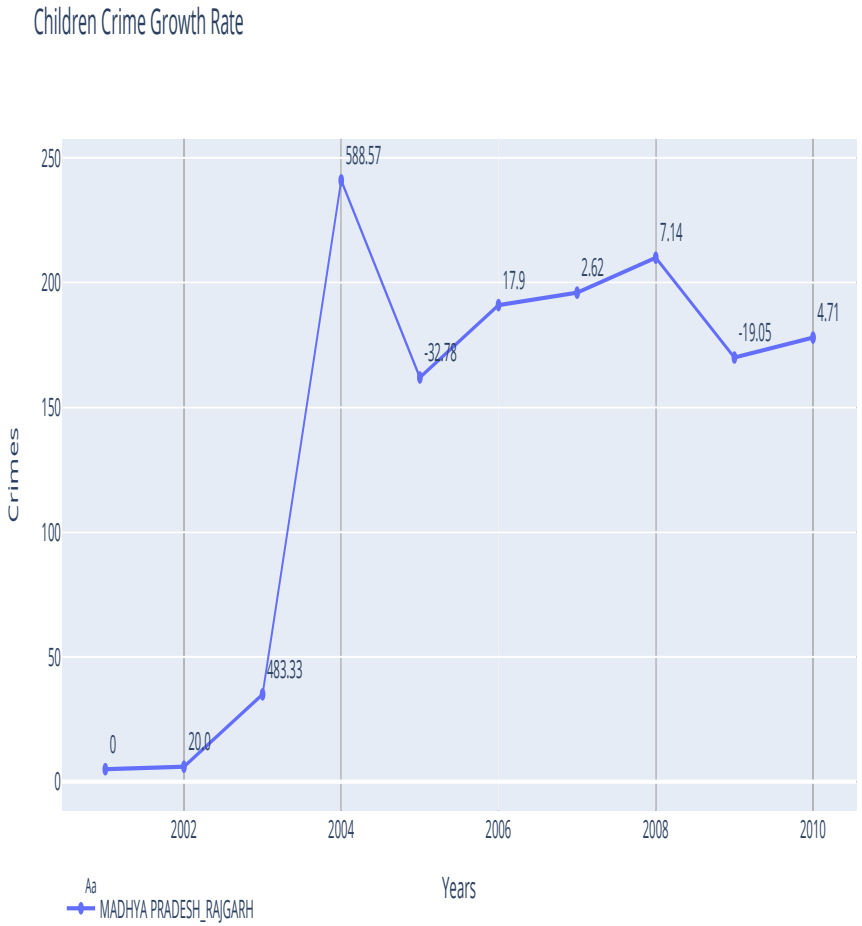


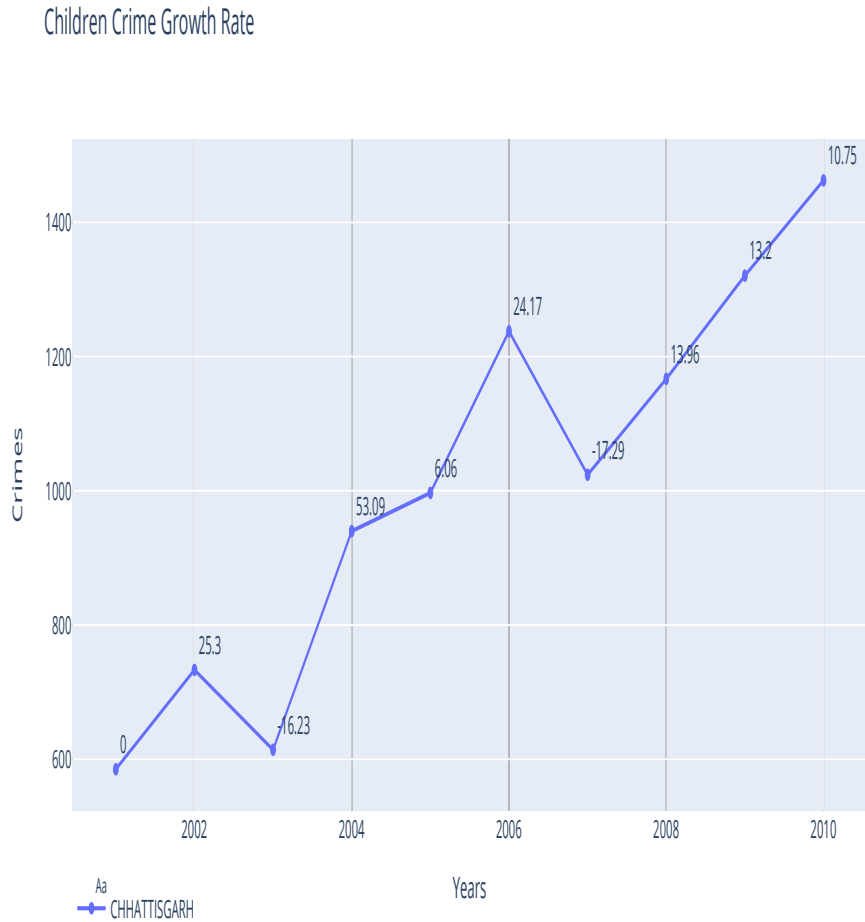


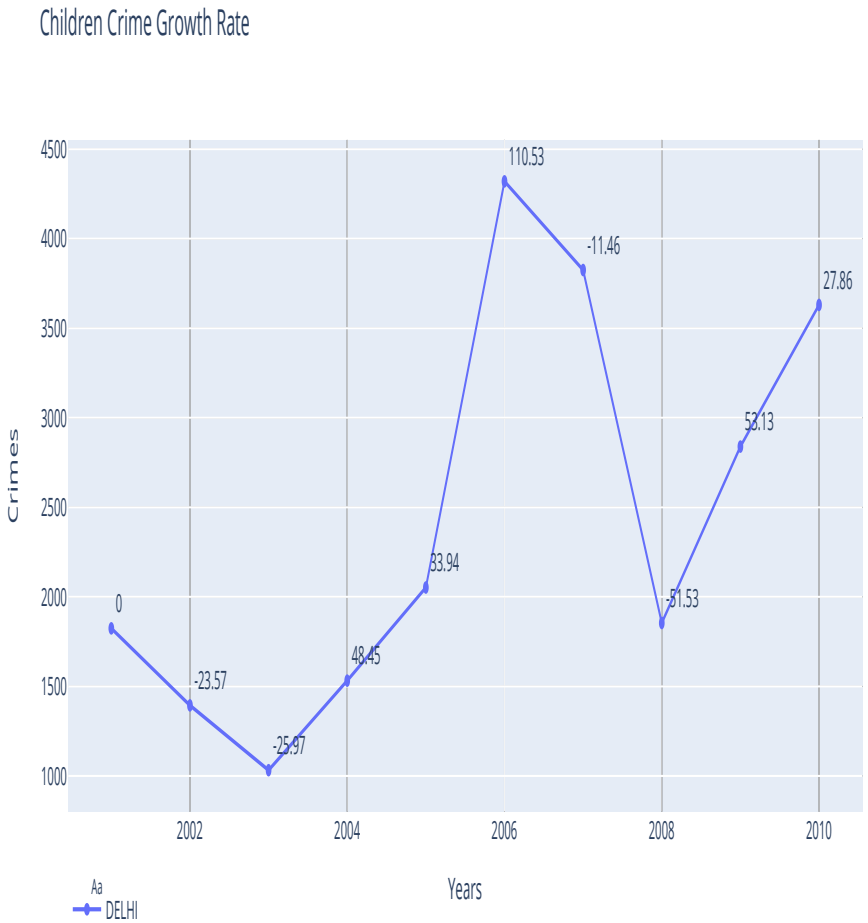
Children Crime Growth Rate

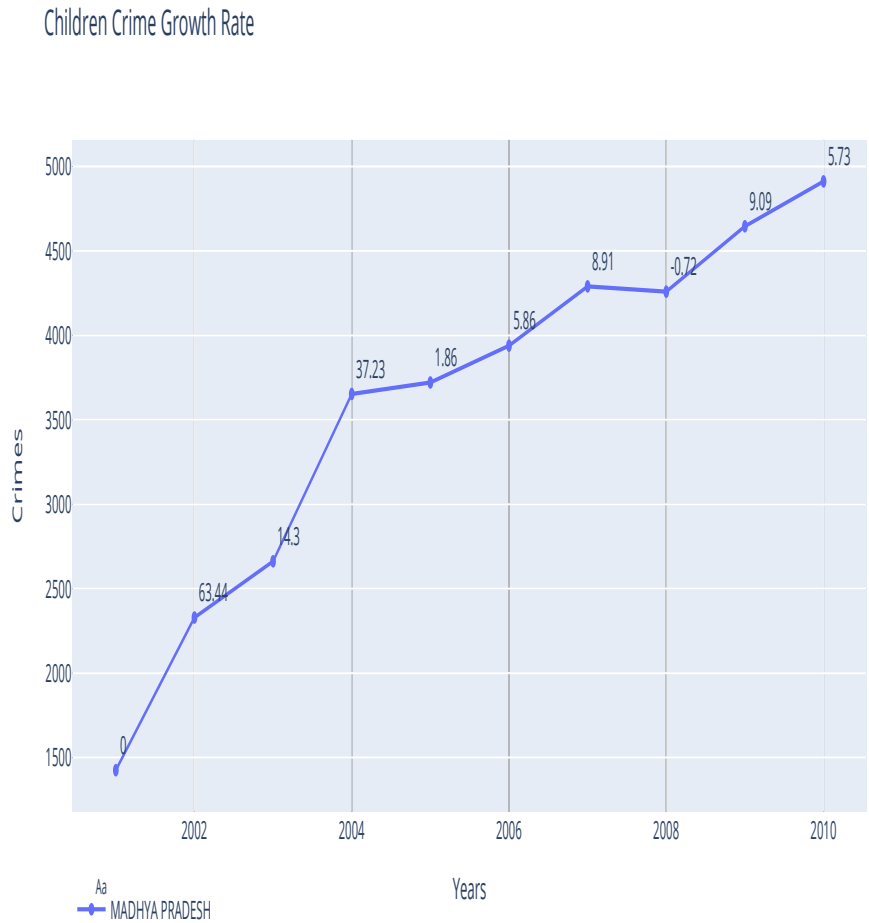
Children Crime Growth Rate

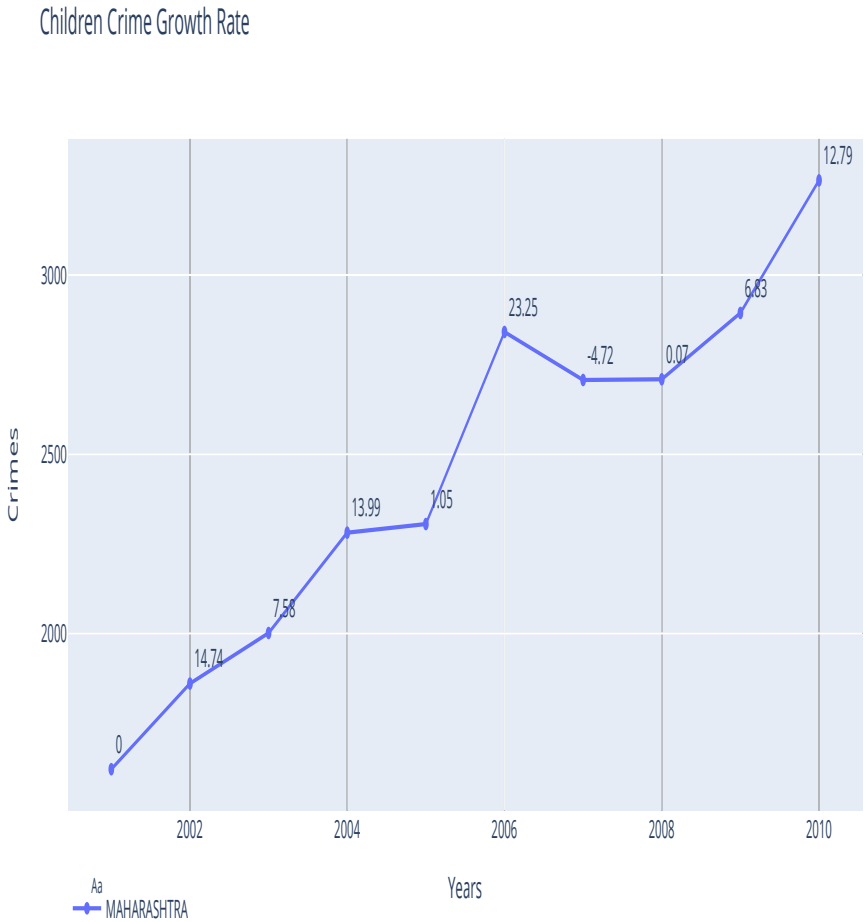



Children Crime Growth Rate
Crimes
Years
Aa
MADHYA PRADESH_RAJGARH
0
20.0
483.33
588.57
-32.78
17.9
2.62
7.14
-19.05
4.71


Children Crime Growth Rate
Crimes
Years
Aa
CHHATTISGARH
0
25.3
-16.23
53.09
6.06
24.17
-17.29
13.96
13.2
10.75

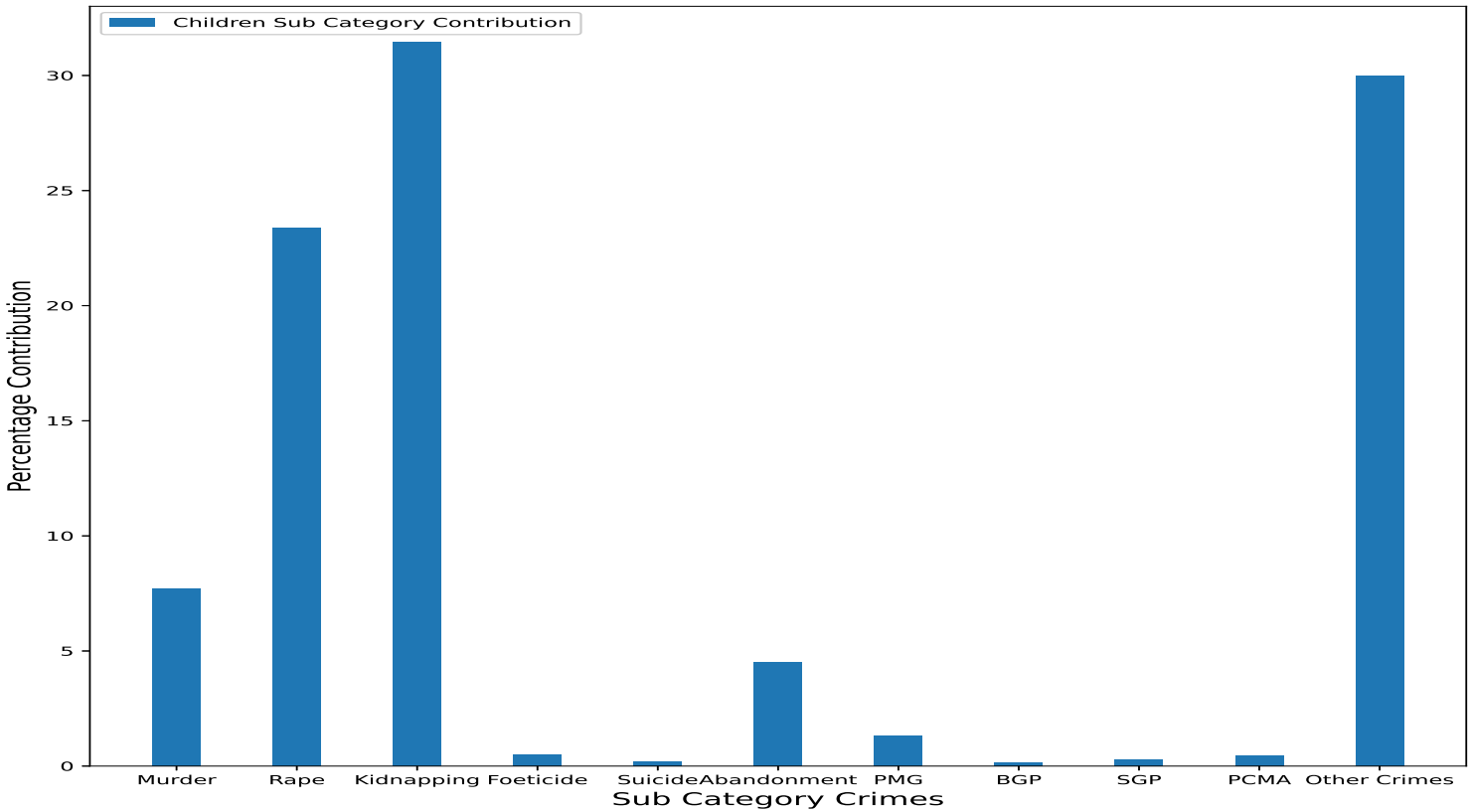

Children Crime Growth Rate
Crimes
Years
Aa
DELHI
0
-23.57
-25.97
48.45
83.94
110.53
-11.46
-51.53
53.13
27.86


Children Crime Growth Rate
Crimes
Years
Aa
MADHYA PRADESH
0
63.44
14.3
37.23
1.86
5.86
8.91
-0.72
9.09
5.73

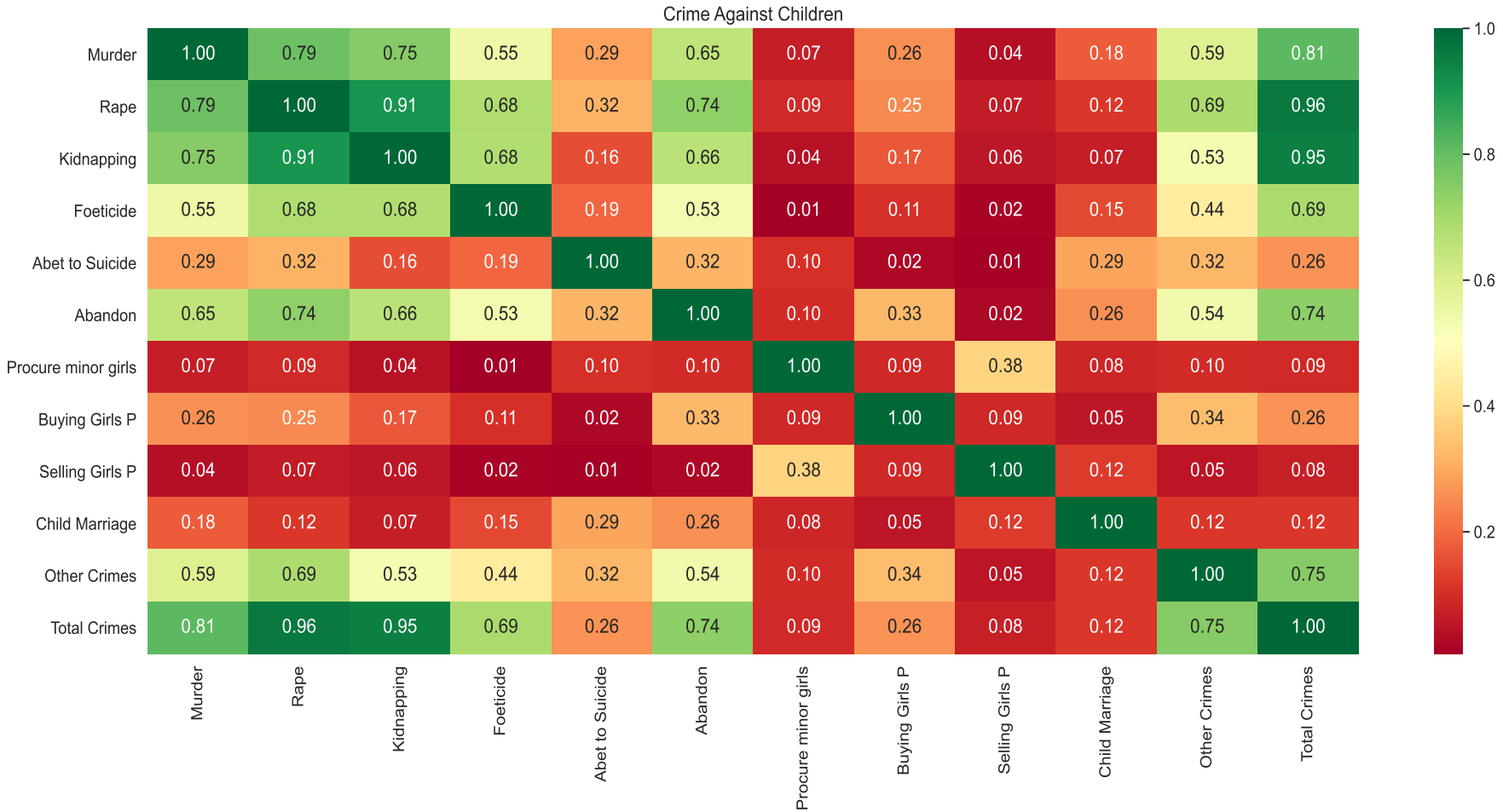

Children Crime Growth Rate
Crimes
3000
2500
2000
0
14.74
7.58
13.99
1.05
23.25
-4.72
0.07
6.83
12.79
2002
2004
2006
2008
2010
Years
Aa
MAHARASHTRA


Children Crime Growth Rate
Crimes
4000
3500
3000
2500
2000
0
-50.77
-6.79
12.87
-6.25
-1.89
27.22
81.41
-24.35
-24.41
2002
2004
2006
2008
2010
Years
Aa
UTTAR PRADESH

Contribution of sub category in Children crimes

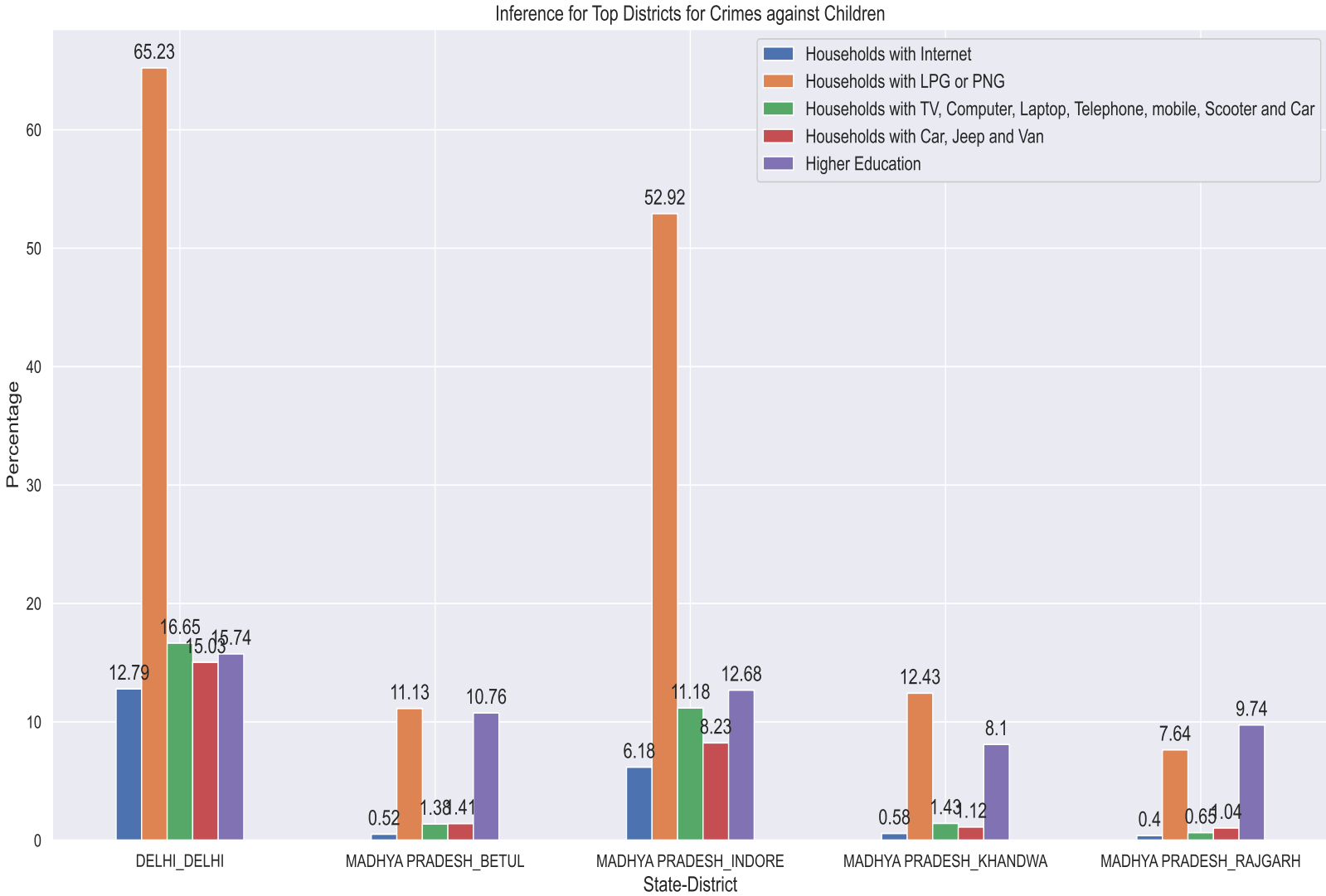


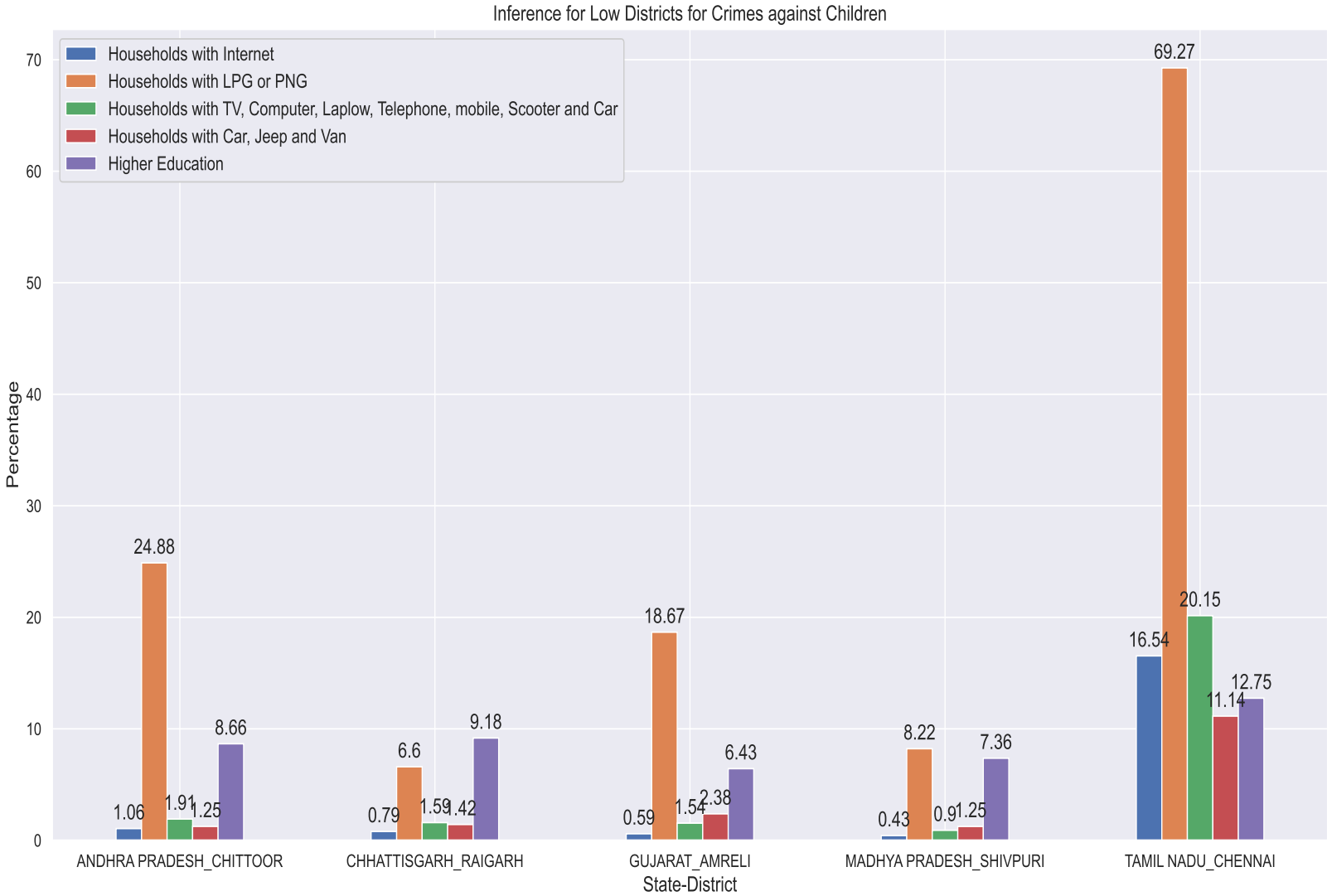
Inference

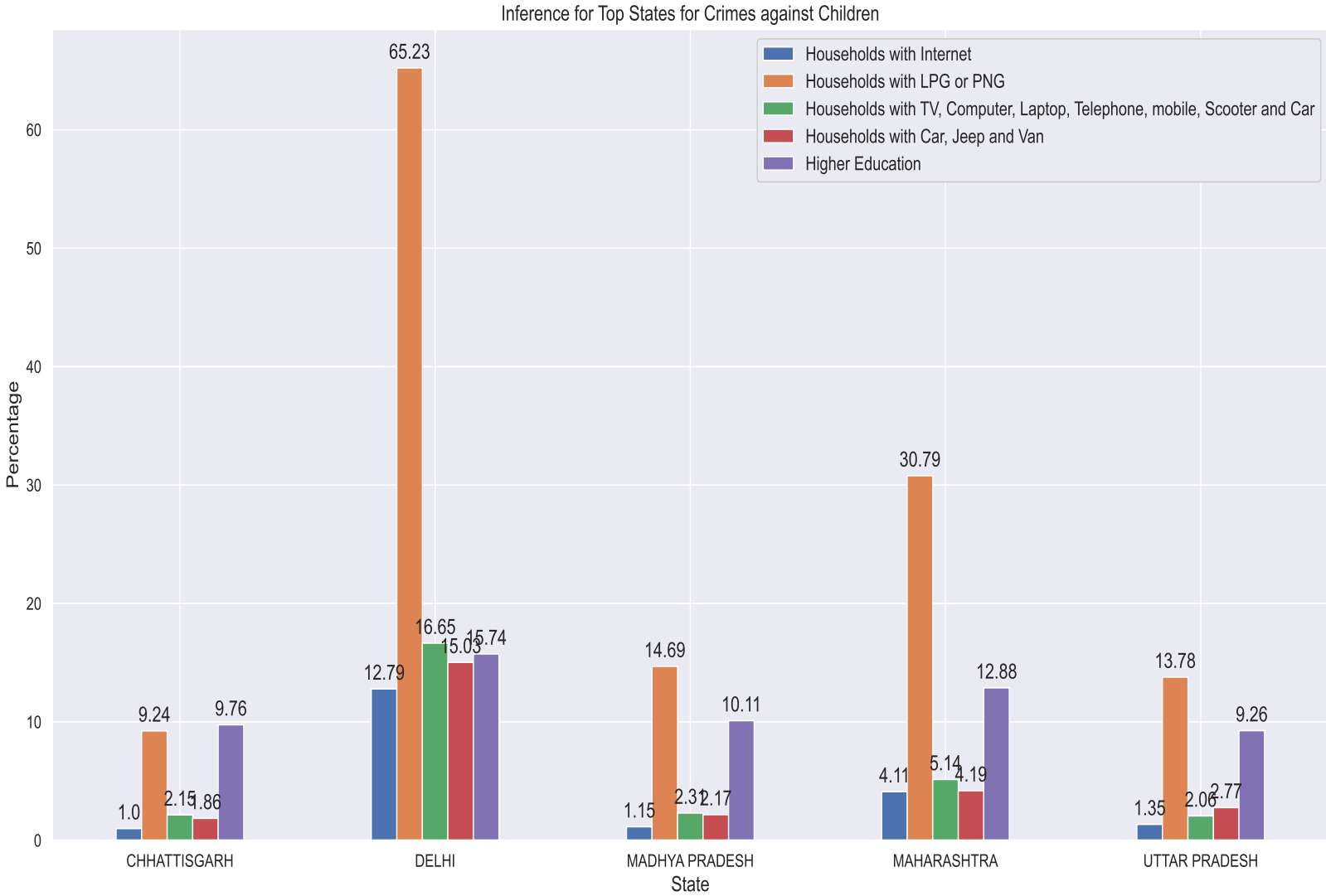

Crime Against Children
Murder 1.00 0.79 0.75 0.55 0.29 0.65 0.07 0.26 0.04 0.18 0.59 0.81
Rape 0.79 1.00 0.91 0.68 0.32 0.74 0.09 0.25 0.07 0.12 0.69 0.96
Kidnapping 0.75 0.91 1.00 0.68 0.16 0.66 0.04 0.17 0.06 0.07 0.53 0.95
Foeticide 0.55 0.68 0.68 1.00 0.19 0.53 0.01 0.11 0.02 0.15 0.44 0.69
Abet to Suicide 0.29 0.32 0.16 0.19 1.00 0.32 0.10 0.02 0.01 0.29 0.32 0.26
Abandon 0.65 0.74 0.66 0.53 0.32 1.00 0.10 0.33 0.02 0.26 0.54 0.74
Procure minor girls 0.07 0.09 0.04 0.01 0.10 0.10 1.00 0.09 0.38 0.08 0.10 0.09
Buying Girls P 0.26 0.25 0.17 0.11 0.02 0.33 0.09 1.00 0.09 0.05 0.34 0.26
Selling Girls P 0.04 0.07 0.06 0.02 0.01 0.02 0.38 0.09 1.00 0.12 0.05 0.08
Child Marriage 0.18 0.12 0.07 0.15 0.29 0.26 0.08 0.05 0.12 1.00 0.12 0.12
Other Crimes 0.59 0.69 0.53 0.44 0.32 0.54 0.10 0.34 0.05 0.12 1.00 0.75
Total Crimes 0.81 0.96 0.95 0.69 0.26 0.74 0.09 0.26 0.08 0.12 0.75 1.00
Murder
Rape
Kidnapping
Foeticide
Abet to Suicide
Abandon
Procure minor girls
Buying Girls P
Selling Girls P
Child Marriage
Other Crimes
Total Crimes
1.0
0.8
0.6
0.4
0.2

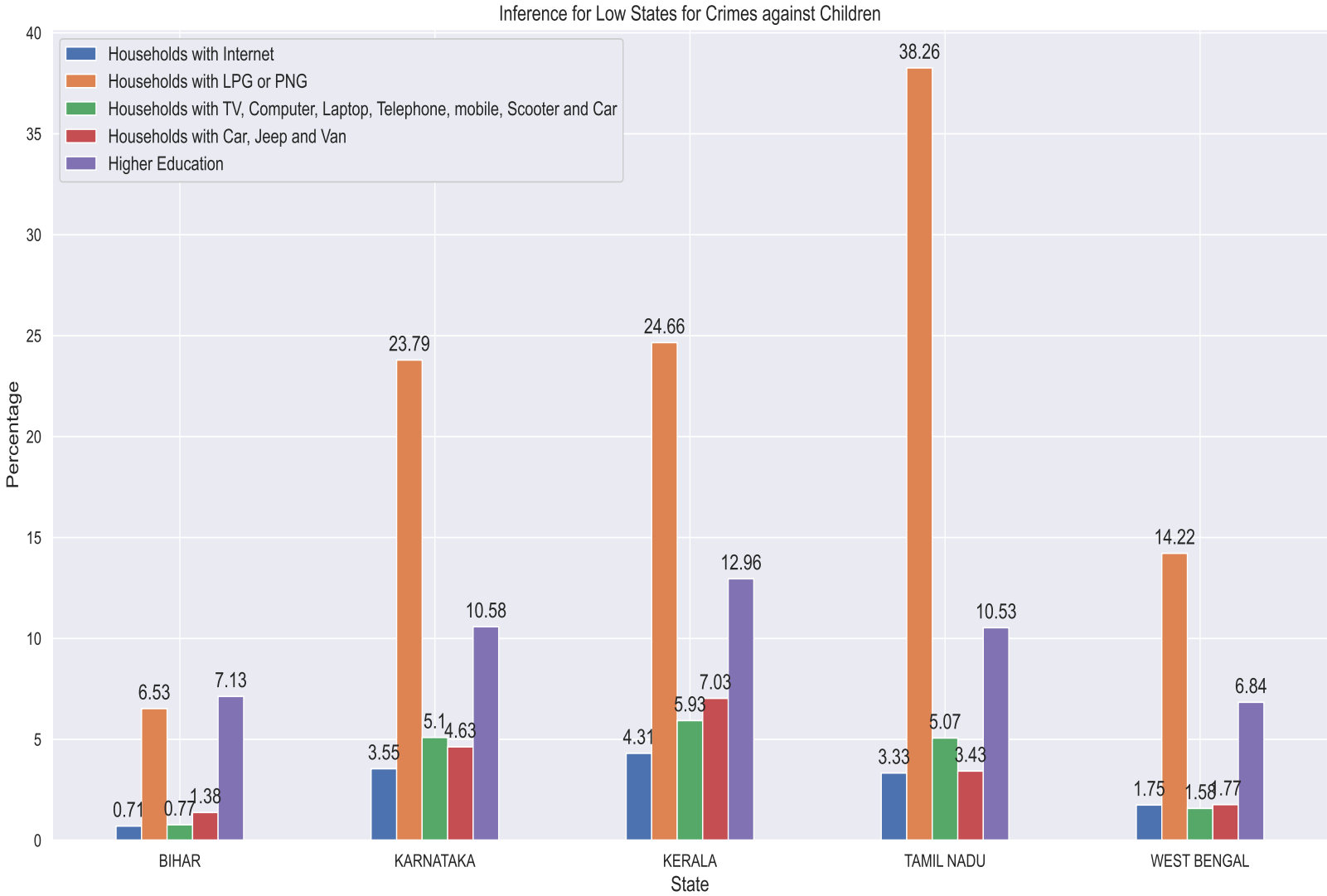
The attributes extracted from the heatmap are :

- Households with Internet.
- Households with LPG or PNG
- Households with TV, Computer, Laptop, Telephone, mobile, Scooter and Car.
- Households with Car, Jeep and Van.
- Higher Education.


Inference for Top Districts for Crimes against Children
Households with Internet
Households with LPG or PNG
Households with TV, Computer, Laptop, Telephone, mobile, Scooter and Car
Households with Car, Jeep and Van
Higher Education
Percentage
0
10
20
30
40
50
60
65.23
52.92
12.79
16.65
15.03
15.74
11.13
10.76
0.52
1.38
1.41
6.18
11.18
8.23
12.68
12.43
0.58
1.43
1.12
8.1
7.64
0.4
0.65
1.04
9.74
DELHI_DELHI
MADHYA PRADESH_BETUL
MADHYA PRADESH_INDORE
MADHYA PRADESH_KHANDWA
MADHYA PRADESH_RAJGARH
State-District


Inference for Low Districts for Crimes against Children
Households with Internet
Households with LPG or PNG
Households with TV, Computer, Laplow, Telephone, mobile, Scooter and Car
Households with Car, Jeep and Van
Higher Education
Percentage
State-District
ANDHRA PRADESH_CHITTOOR
CHHATTISGARH_RAIGARH
GUJARAT_AMRELI
MADHYA PRADESH_SHIVPURI
TAMIL NADU_CHENNAI
1.06
24.88
1.91
1.25
8.66
0.79
6.6
1.59
1.42
9.18
0.59
18.67
1.54
2.38
6.43
0.43
8.22
0.91
1.25
7.36
16.54
69.27
20.15
11.14
12.75


Inference for Top States for Crimes against Children
Households with Internet
Households with LPG or PNG
Households with TV, Computer, Laptop, Telephone, mobile, Scooter and Car
Households with Car, Jeep and Van
Higher Education
Percentage
State
CHHATTISGARH
DELHI
MADHYA PRADESH
MAHARASHTRA
UTTAR PRADESH
1.0
9.24
2.15
1.86
9.76
12.79
65.23
16.65
15.03
15.74
1.15
14.69
2.31
2.17
10.11
4.11
30.79
5.14
4.19
12.88
1.35
13.78
2.06
2.77
9.26


Inference for Low States for Crimes against Children
Households with Internet
Households with LPG or PNG
Households with TV, Computer, Laptop, Telephone, mobile, Scooter and Car
Households with Car, Jeep and Van
Higher Education
Percentage
State
BIHAR
KARNATAKA
KERALA
TAMIL NADU
WEST BENGAL
0.71
6.53
0.77
1.38
7.13
3.55
23.79
5.1
4.63
10.58
4.31
24.66
5.93
7.03
12.96
3.33
38.26
5.07
3.43
10.53
1.75
14.22
1.58
1.77
6.84

Inferences drawn from the plots are:

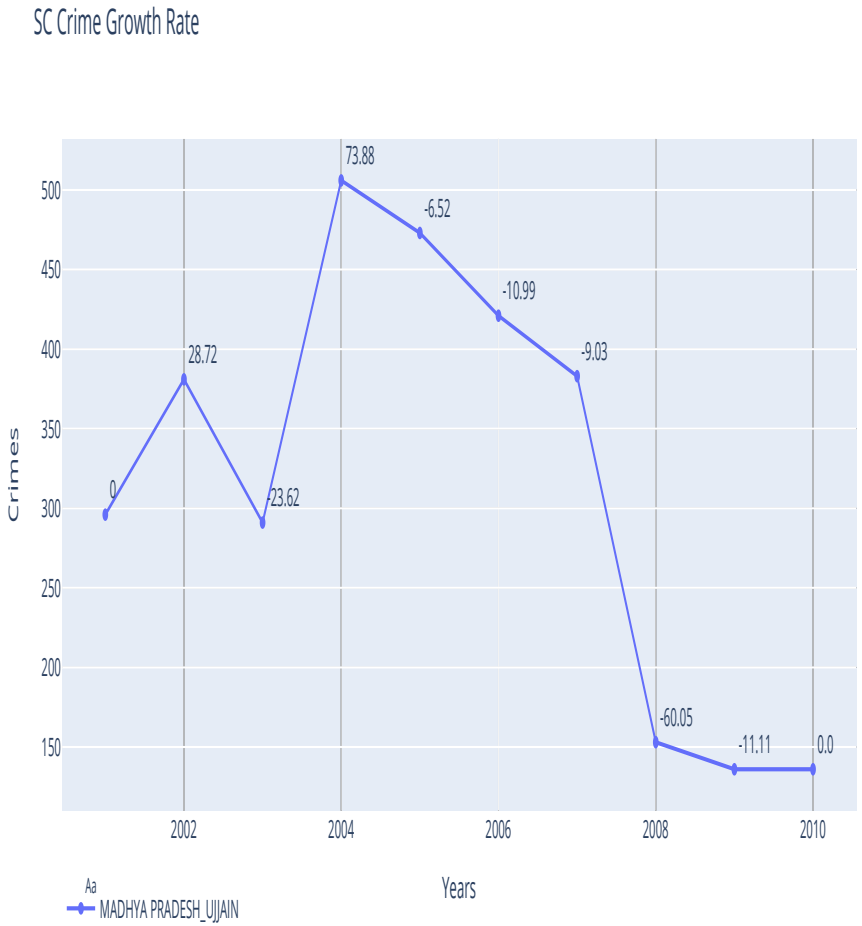
- Delhi and Indore are the top hot-spot districts in case of crimes against children and the census data attributes like households with LPG or PNG are also high.
- However, there is exception in case of Betul, Khandwa and Rajgarh which are also in the hot-spot district but the attributes of census data like households with LPG or PNG, households with Internet are quite less.
- There is only one attribute that is Higher Education which can be accounted for majority of crimes as it is somewhat constant in all districts.

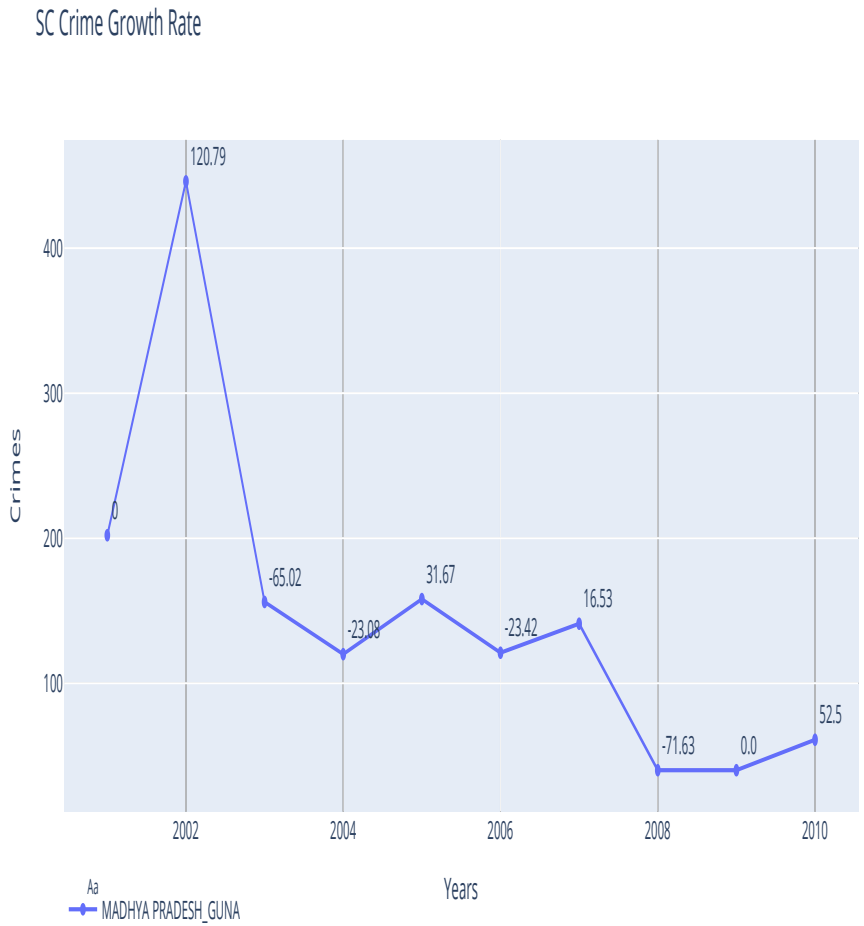
SCs

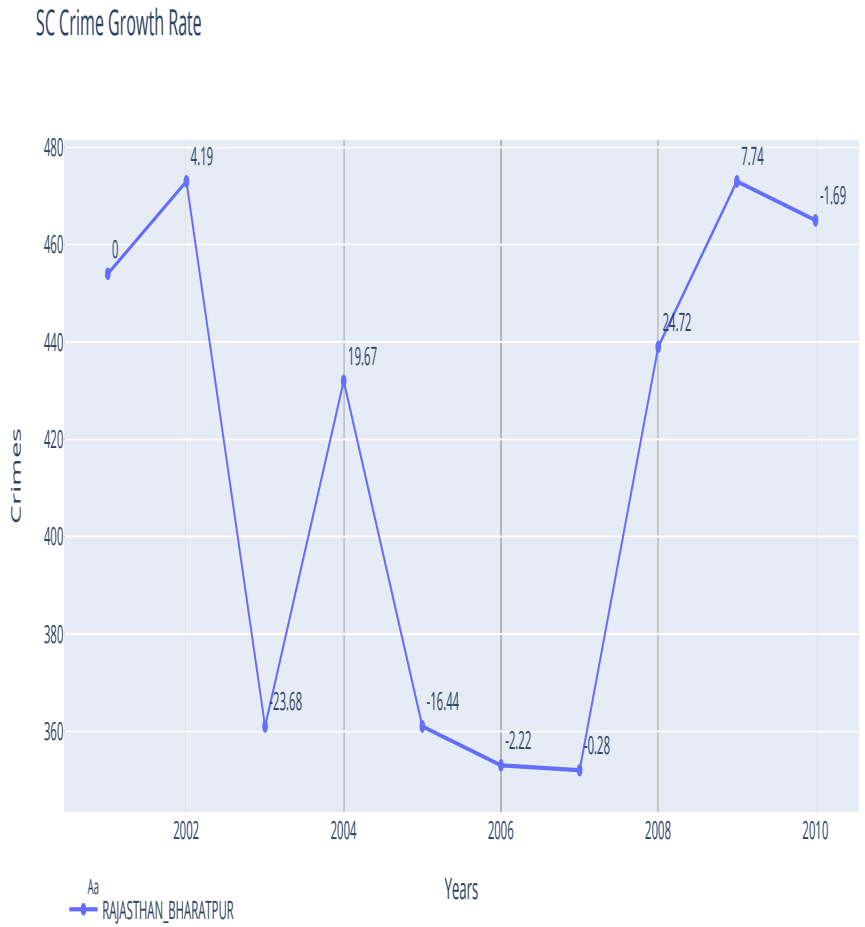
Population			
Districts		**States**	
Top	Low	Top	Low
BHARATPUR	KAUSHAMBI	M.P	MAHARASHTRA
UJJAIN	ADILABAD	RAJASTHAN	WEST BENGAL
GUNA	PUNE	A.P	PUNJAB
DEWAS	DAVANAGERE	U.P	HARYANA
DHOLPUR	AMBEDKAR NAGAR	BIHAR	JHARKHAND

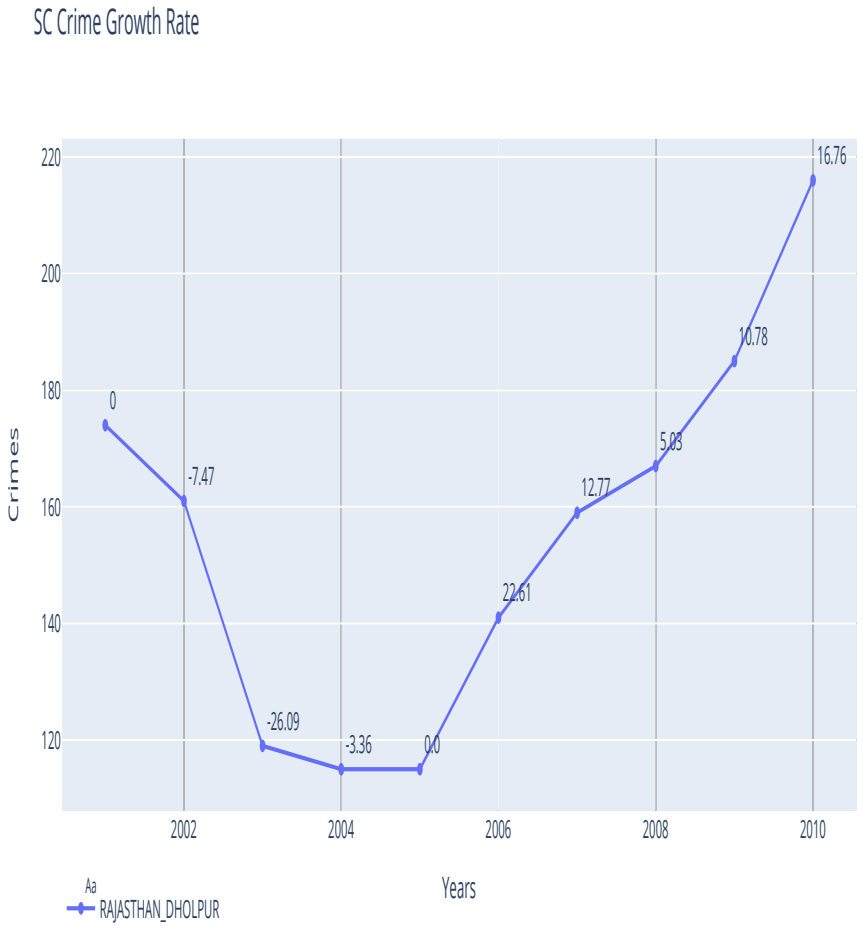
Zscore			
Districts		**States**	
Top	Low	Top	Low
BHARATPUR	NALBARI	UTTAR PRADESH	MIZORAM
UJJAIN	NARAYANPUR	RAJASTHAN	DAMAN & DIU
KANPUR	JAMMU	MADHYA PRADESH	D & N HAVELI
SITAPUR	RAJOURI	ANDHRA PRADESH	CHANDIGARH
GANGANAGAR	RAMBAN	BIHAR	GOA

Growth Rate of SCs



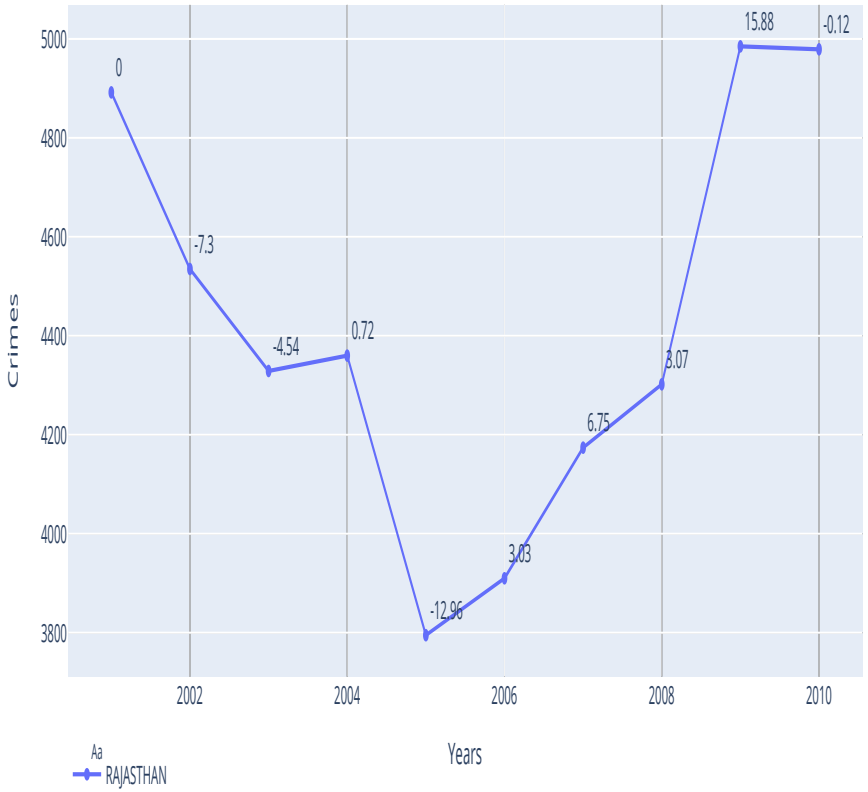

SC Crime Growth Rate
120.79
0
-65.02
-23.08
31.67
-23.42
16.53
-71.63
0.0
52.5
400
300
200
100
Crimes
2002
2004
2006
2008
2010
Years
Aa
MADHYA PRADESH_GUNA


SC Crime Growth Rate
4.19
0
-23.68
19.67
-16.44
-2.22
-0.28
24.72
7.74
-1.69
480
460
440
420
400
380
360
Crimes
2002
2004
2006
2008
2010
Years
Aa
RAJASTHAN_BHARATPUR

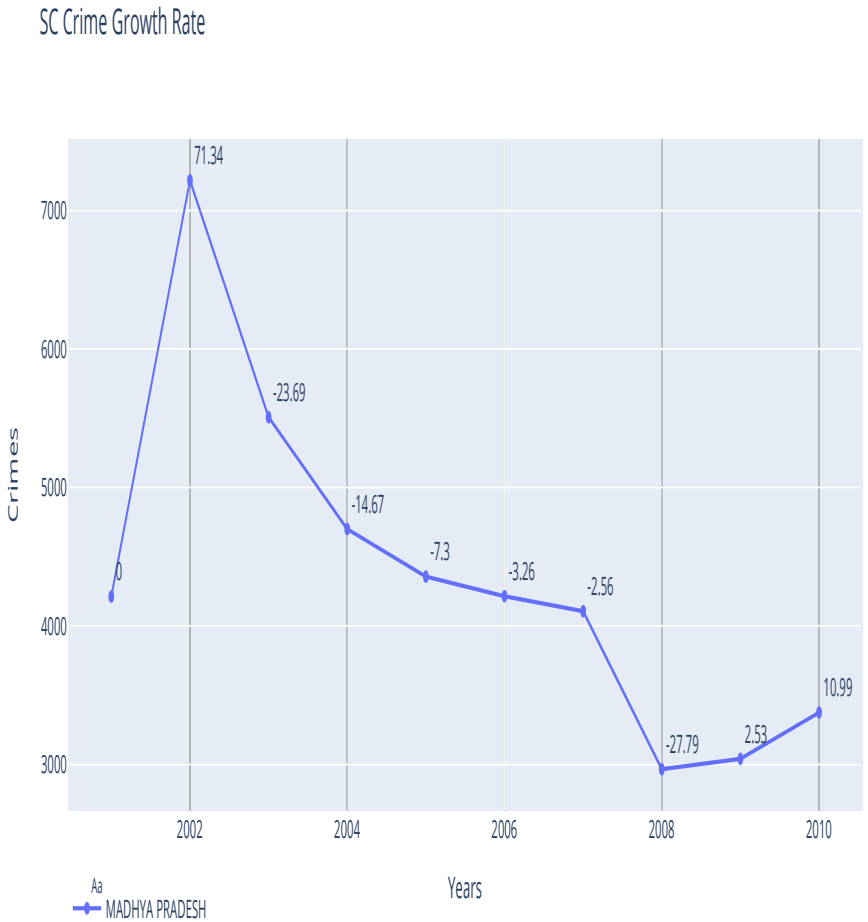

SC Crime Growth Rate
220
200
180
160
140
120
Crimes
0
-7.47
-26.09
-3.36
0.0
22.61
12.77
5.03
10.78
16.76
2002
2004
2006
2008
2010
Years
Aa
RAJASTHAN_DHOLPUR

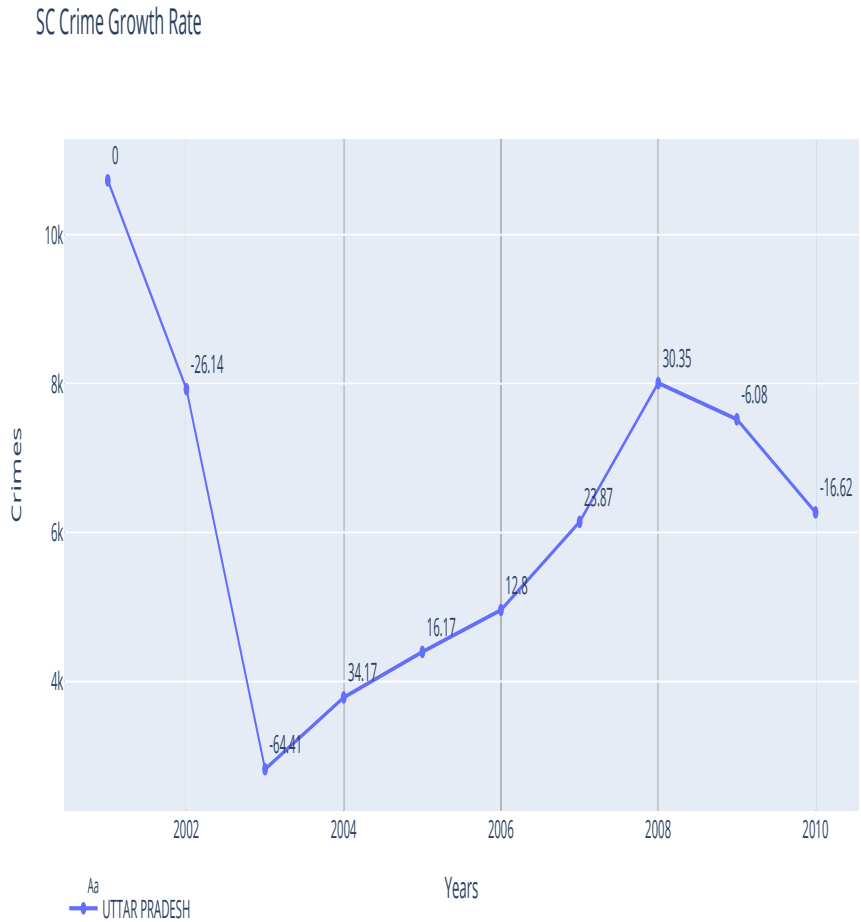

SC Crime Growth Rate
4600
4400
4200
4000
3800
3600
3400
3200
3000
Crimes
0
15.41
5.14
-8.54
-4.24
24.83
-13.06
18.18
12.66
-4.06
2002
2004
2006
2008
2010
Years
Aa
ANDHRA PRADESH

SC Crime Growth Rate

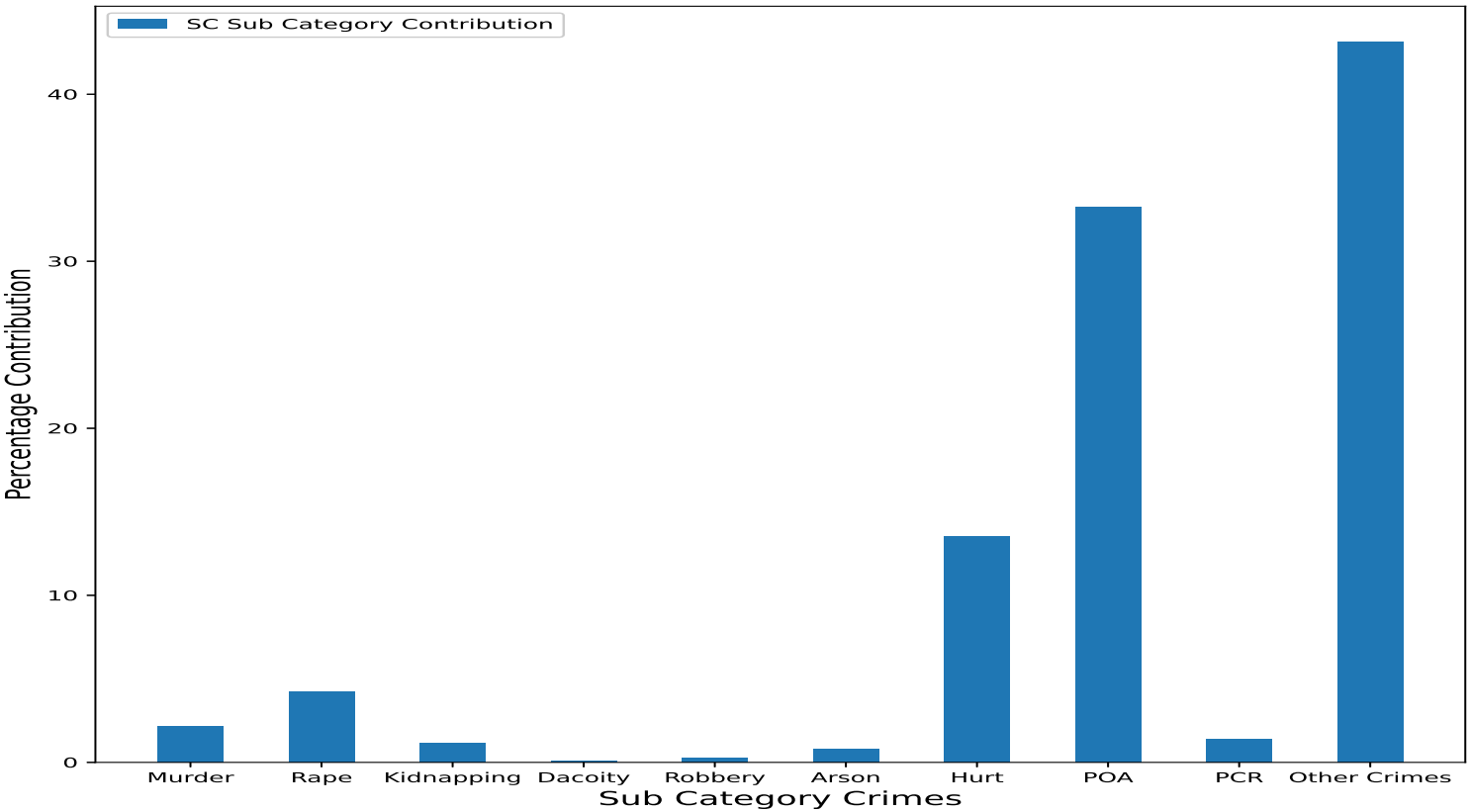


SC Crime Growth Rate

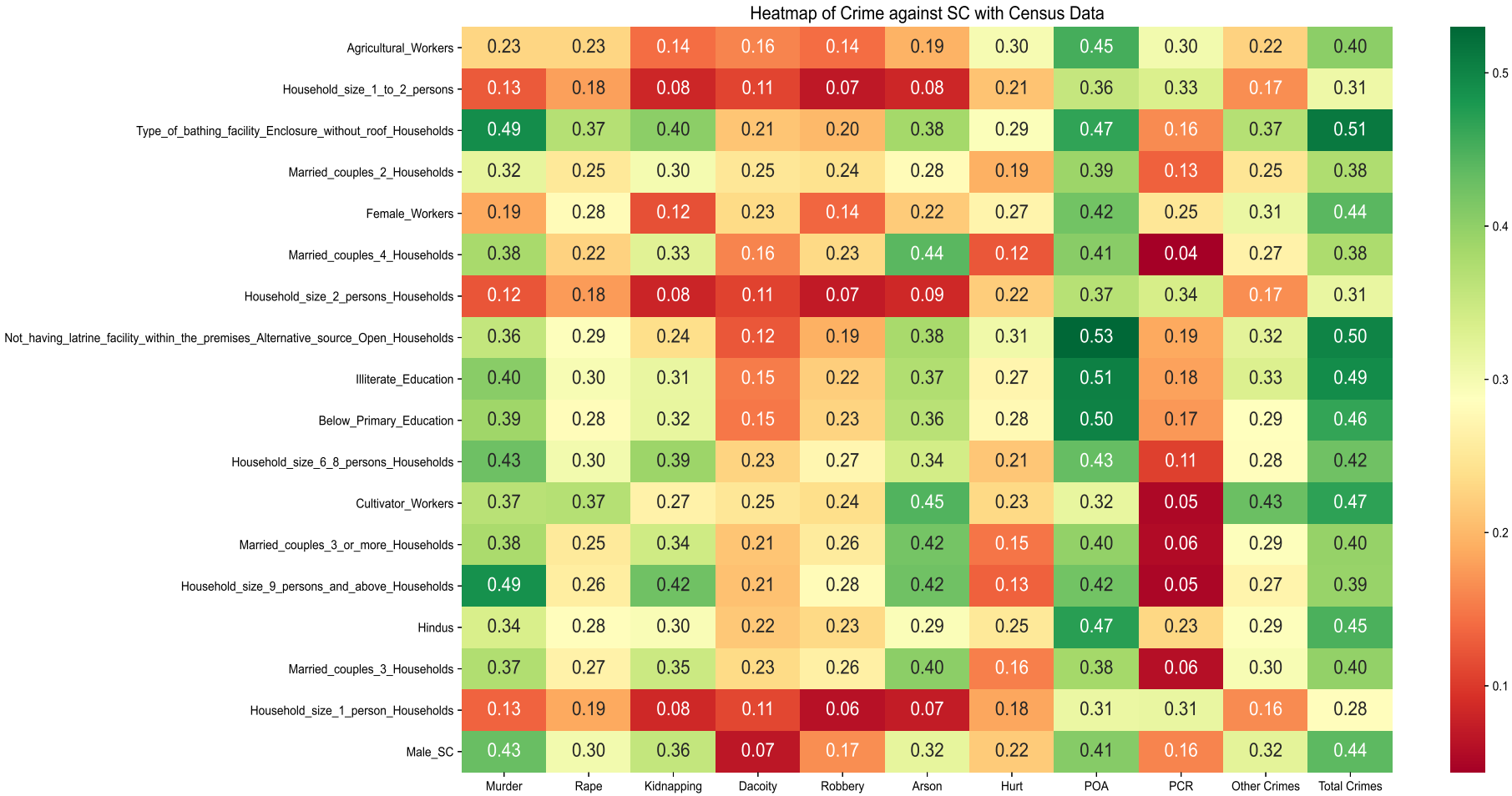

SC Crime Growth Rate
Crimes
Years
Aa
MADHYA PRADESH
7000
6000
5000
4000
3000
2002
2004
2006
2008
2010
71.34
-23.69
-14.67
-7.3
-3.26
-2.56
-27.79
2.53
10.99
0


SC Crime Growth Rate
Crimes
Years
Aa
UTTAR PRADESH
10k
8k
6k
4k
2002
2004
2006
2008
2010
0
-26.14
-64.41
34.17
16.17
12.8
23.87
30.35
-6.08
-16.62

Contribution of sub category in SC crimes

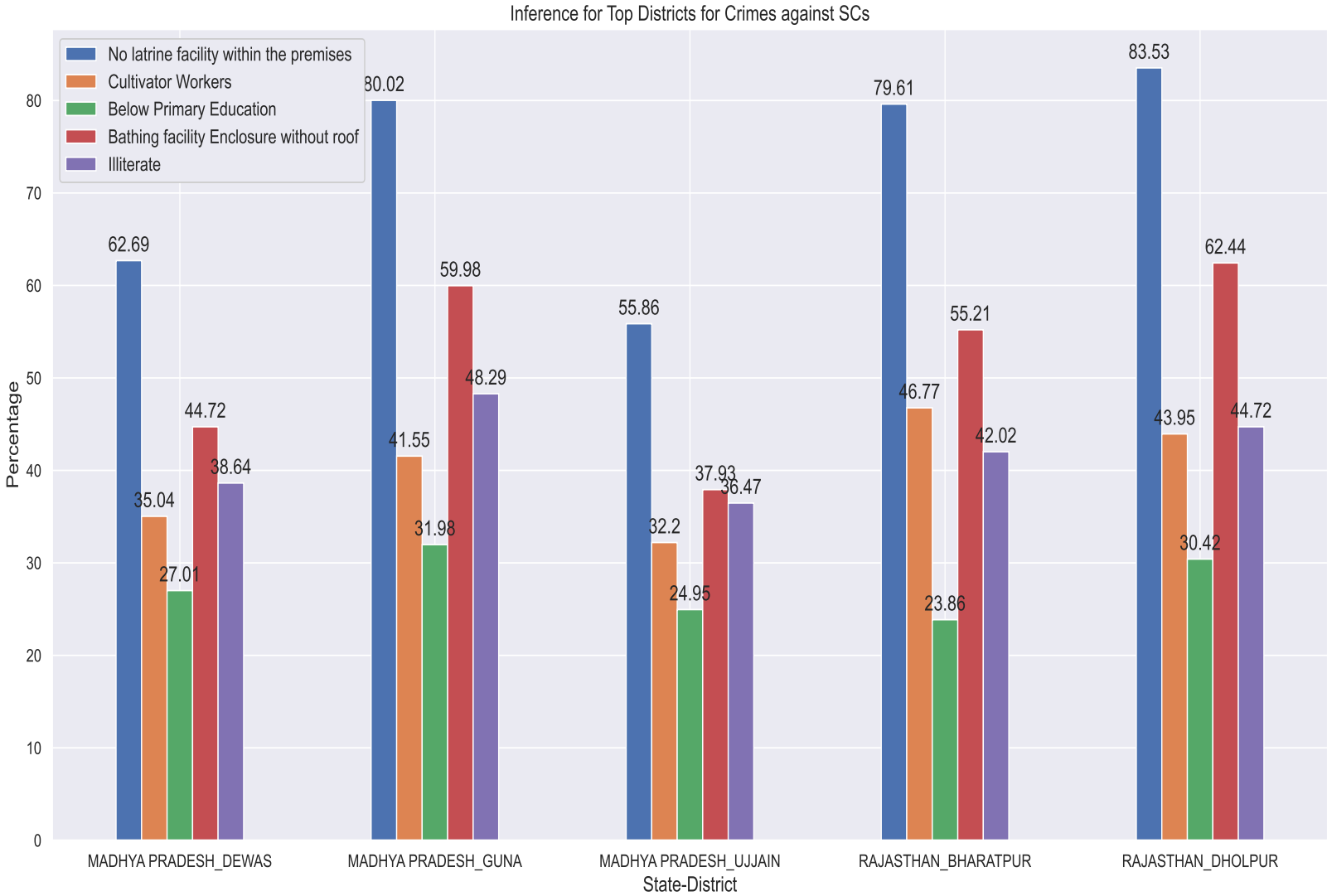


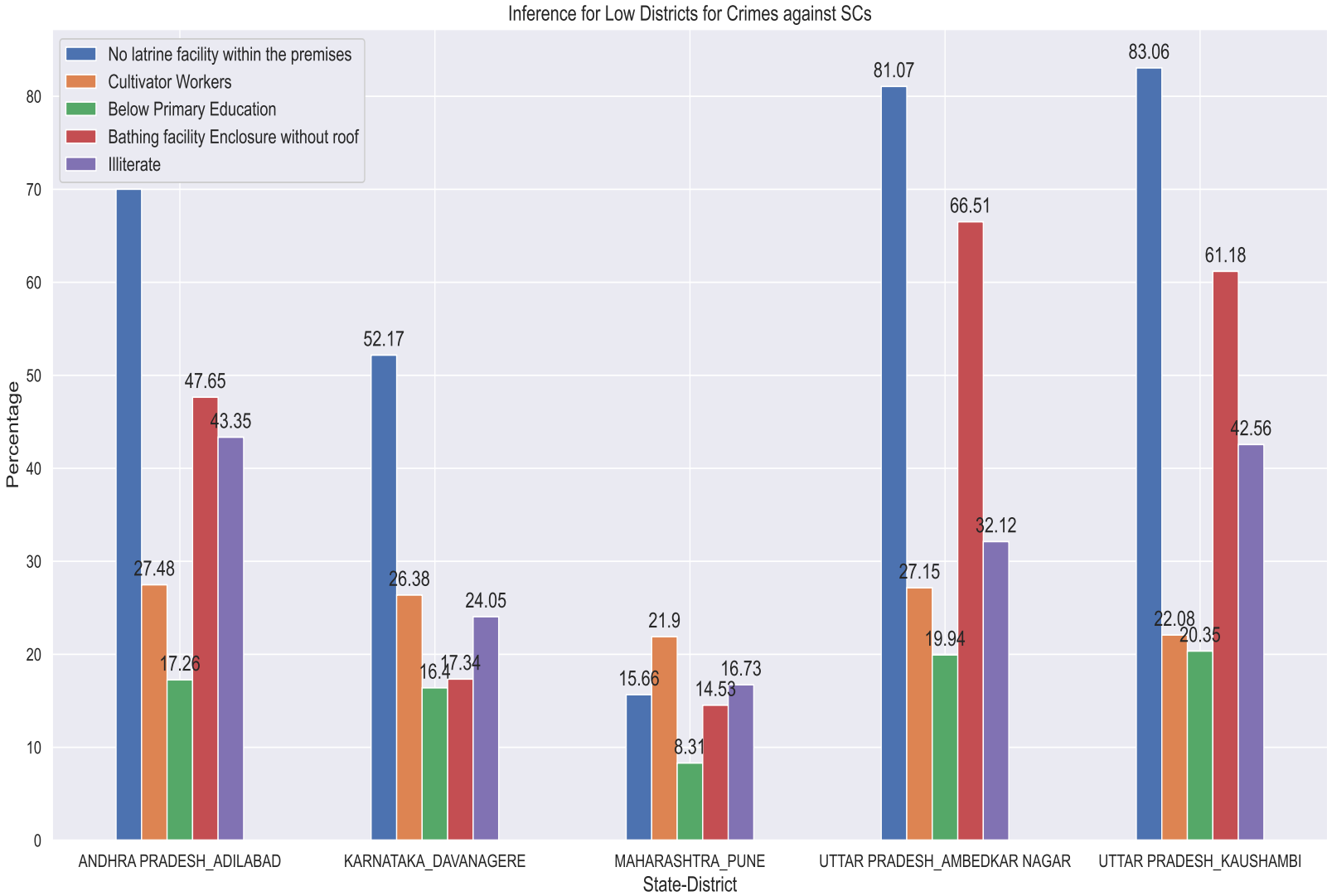
Inference

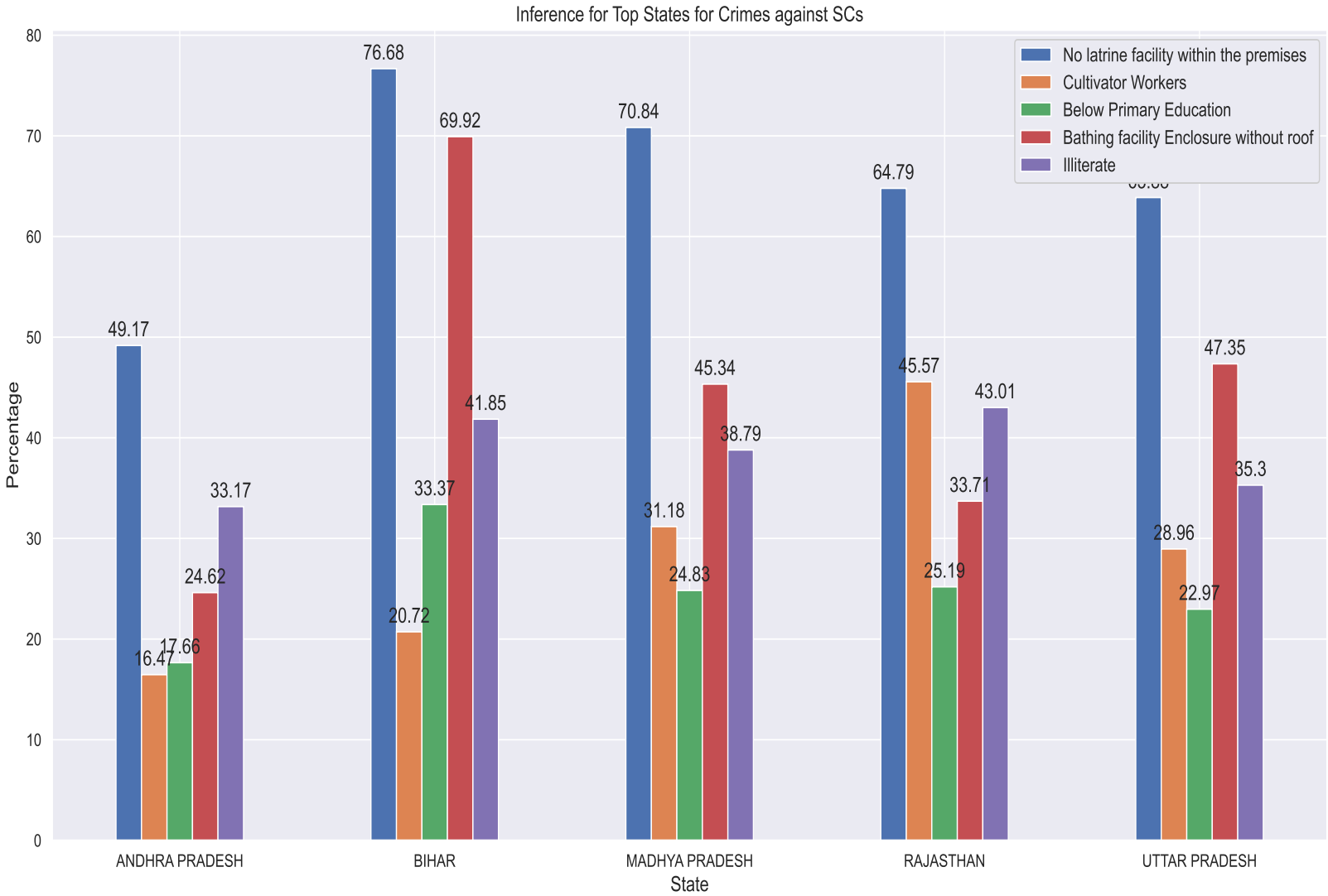

Heatmap of Crime against SC with Census Data
Agricultural_Workers 0.23 0.23 0.14 0.16 0.14 0.19 0.30 0.45 0.30 0.22 0.40
Household_size_1_to_2_persons 0.13 0.18 0.08 0.11 0.07 0.08 0.21 0.36 0.33 0.17 0.31
Type_of_bathing_facility_Enclosure_without_roof_Households 0.49 0.37 0.40 0.21 0.20 0.38 0.29 0.47 0.16 0.37 0.51
Married_couples_2_Households 0.32 0.25 0.30 0.25 0.24 0.28 0.19 0.39 0.13 0.25 0.38
Female_Workers 0.19 0.28 0.12 0.23 0.14 0.22 0.27 0.42 0.25 0.31 0.44
Married_couples_4_Households 0.38 0.22 0.33 0.16 0.23 0.44 0.12 0.41 0.04 0.27 0.38
Household_size_2_persons_Households 0.12 0.18 0.08 0.11 0.07 0.09 0.22 0.37 0.34 0.17 0.31
Not_having_latrine_facility_within_the_premises_Alternative_source_Open_Households 0.36 0.29 0.24 0.12 0.19 0.38 0.31 0.53 0.19 0.32 0.50
Illiterate_Education 0.40 0.30 0.31 0.15 0.22 0.37 0.27 0.51 0.18 0.33 0.49
Below_Primary_Education 0.39 0.28 0.32 0.15 0.23 0.36 0.28 0.50 0.17 0.29 0.46
Household_size_6_8_persons_Households 0.43 0.30 0.39 0.23 0.27 0.34 0.21 0.43 0.11 0.28 0.42
Cultivator_Workers 0.37 0.37 0.27 0.25 0.24 0.45 0.23 0.32 0.05 0.43 0.47
Married_couples_3_or_more_Households 0.38 0.25 0.34 0.21 0.26 0.42 0.15 0.40 0.06 0.29 0.40
Household_size_9_persons_and_above_Households 0.49 0.26 0.42 0.21 0.28 0.42 0.13 0.42 0.05 0.27 0.39
Hindus 0.34 0.28 0.30 0.22 0.23 0.29 0.25 0.47 0.23 0.29 0.45
Married_couples_3_Households 0.37 0.27 0.35 0.23 0.26 0.40 0.16 0.38 0.06 0.30 0.40
Household_size_1_person_Households 0.13 0.19 0.08 0.11 0.06 0.07 0.18 0.31 0.31 0.16 0.28
Male_SC 0.43 0.30 0.36 0.07 0.17 0.32 0.22 0.41 0.16 0.32 0.44
Murder Rape Kidnapping Dacoity Robbery Arson Hurt POA PCR Other Crimes Total Crimes
0.5
0.4
0.3
0.2
0.1

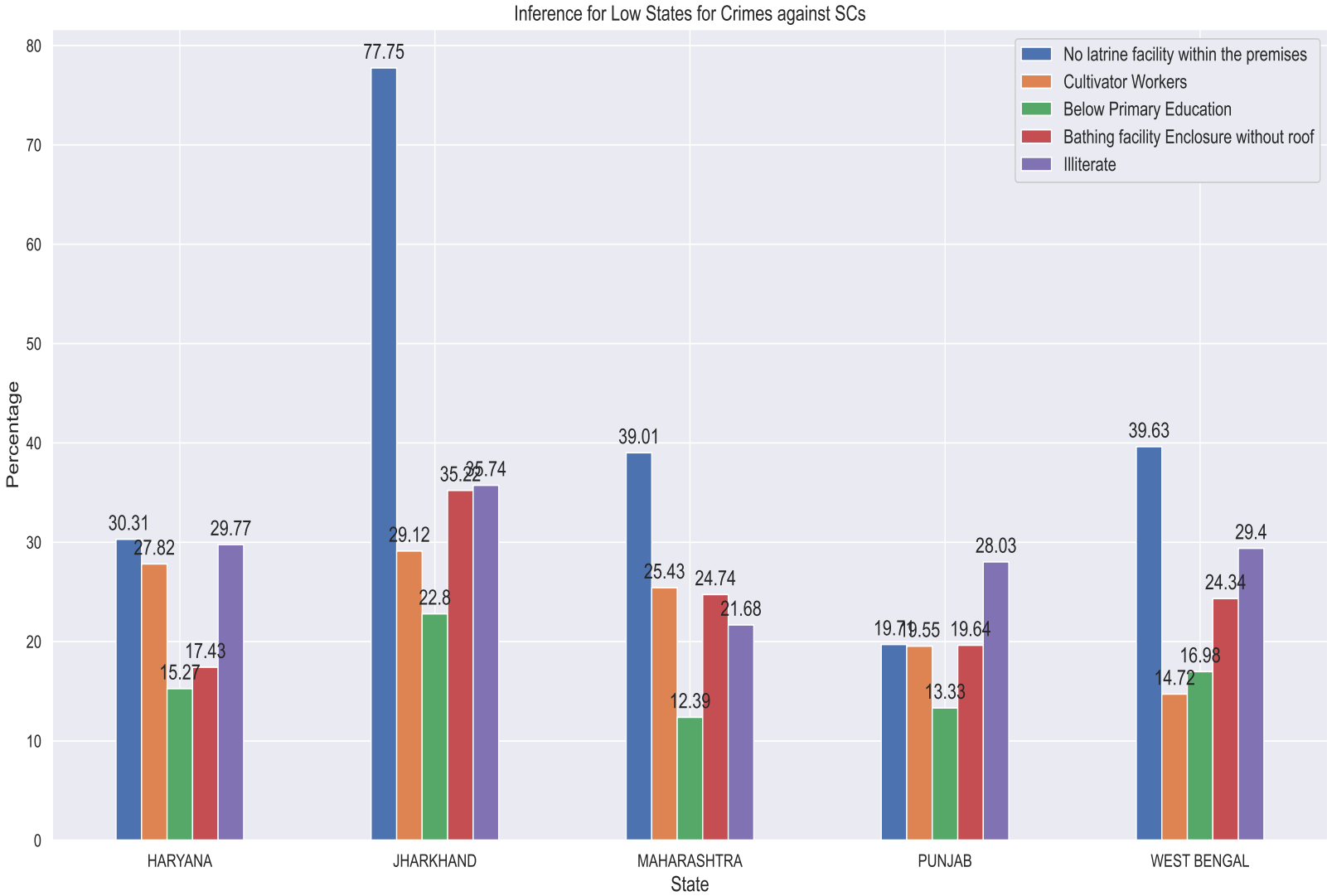
The attributes extracted from the heatmap are :

- No latrine facility within the premises.
- Cultivator Workers.
- Below Primary Education roof
- Bathing facility enclosure without roof.
- Illiterate.


Inference for Top Districts for Crimes against SCs
No latrine facility within the premises
Cultivator Workers
Below Primary Education
Bathing facility Enclosure without roof
Illiterate
Percentage
State-District
MADHYA PRADESH_DEWAS
MADHYA PRADESH_GUNA
MADHYA PRADESH_UJJAIN
RAJASTHAN_BHARATPUR
RAJASTHAN_DHOLPUR
62.69
35.04
27.01
44.72
38.64
80.02
41.55
31.98
59.98
48.29
55.86
32.2
24.95
37.93
36.47
79.61
46.77
23.86
55.21
42.02
83.53
43.95
30.42
62.44
44.72


Inference for Low Districts for Crimes against SCs
No latrine facility within the premises
Cultivator Workers
Below Primary Education
Bathing facility Enclosure without roof
Illiterate
Percentage
0
10
20
30
40
50
60
70
80
27.48
17.26
47.65
43.35
52.17
26.38
16.4
17.34
24.05
15.66
21.9
8.31
14.53
16.73
81.07
27.15
19.94
66.51
32.12
83.06
22.08
20.35
61.18
42.56
ANDHRA PRADESH_ADILABAD
KARNATAKA_DAVANAGERE
MAHARASHTRA_PUNE
UTTAR PRADESH_AMBEDKAR NAGAR
UTTAR PRADESH_KAUSHAMBI
State-District


Inference for Top States for Crimes against SCs
No latrine facility within the premises
Cultivator Workers
Below Primary Education
Bathing facility Enclosure without roof
Illiterate
Percentage
State
ANDHRA PRADESH
BIHAR
MADHYA PRADESH
RAJASTHAN
UTTAR PRADESH
0
10
20
30
40
50
60
70
80
49.17
16.47
17.66
24.62
33.17
76.68
20.72
33.37
69.92
41.85
70.84
31.18
24.83
45.34
38.79
64.79
45.57
25.19
33.71
43.01
28.96
22.97
47.35
35.3


Inference for Low States for Crimes against SCs
No latrine facility within the premises
Cultivator Workers
Below Primary Education
Bathing facility Enclosure without roof
Illiterate
Percentage
State
HARYANA
JHARKHAND
MAHARASHTRA
PUNJAB
WEST BENGAL
30.31
27.82
15.27
17.43
29.77
77.75
29.12
22.8
35.22
35.74
39.01
25.43
12.39
24.74
21.68
19.71
19.55
13.33
19.64
28.03
39.63
14.72
16.98
24.34
29.4

Inference drawn from the plots are:

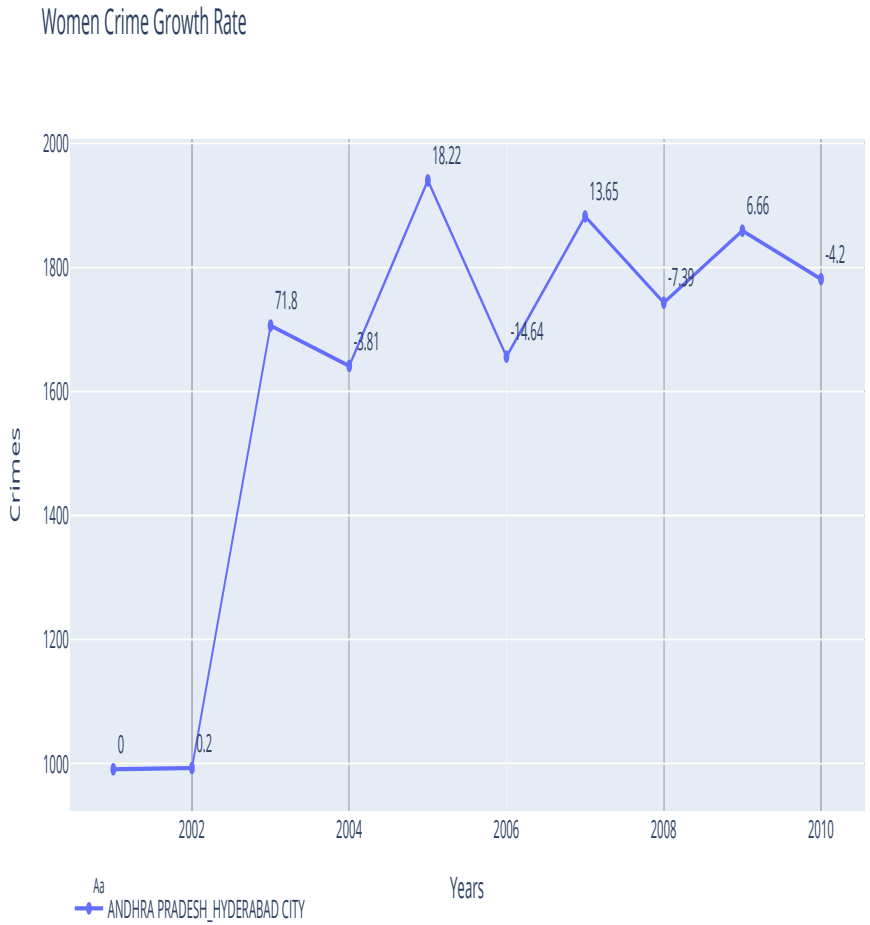
- Illiteracy as factor, low for state/district having low crime count against SCs. Example, Punjab(28 percent) a cold-spot but Bihar(41 percent) is a hot-spot. In districts, Pune(16 percent) a cold-spot and Bharatpur(42 percent) is a hot-spot for crimes against SCs.
- For Bathing Facility without roof percentage is more in Ujjain District(38 percent), a hot-spot but in Pune(14 percent) is a cold-spot. For state MP with 45 percent, a hot-spot but Maharashtra with 24 percent is a cold-spot for crimes against SCs.
- For Below Primary Education, Uttar Pradesh(23 percent),a hot-spot and West Bengal(16 percent) is a cold-spot for crime against SCs. In districts, Dewas district(27 percent) is hot-spot and district Adilabad(17 percent) is a cold-spot for crime against SCs.
- Cultivator Workers for district Dholpur(43 percent), a hot-spot whereas Kaushambi(22 percent) is a cold-spot. For state Rajasthan(45 percent) is a hot-spot and Jharkhand(29 percent) is a coldpot.

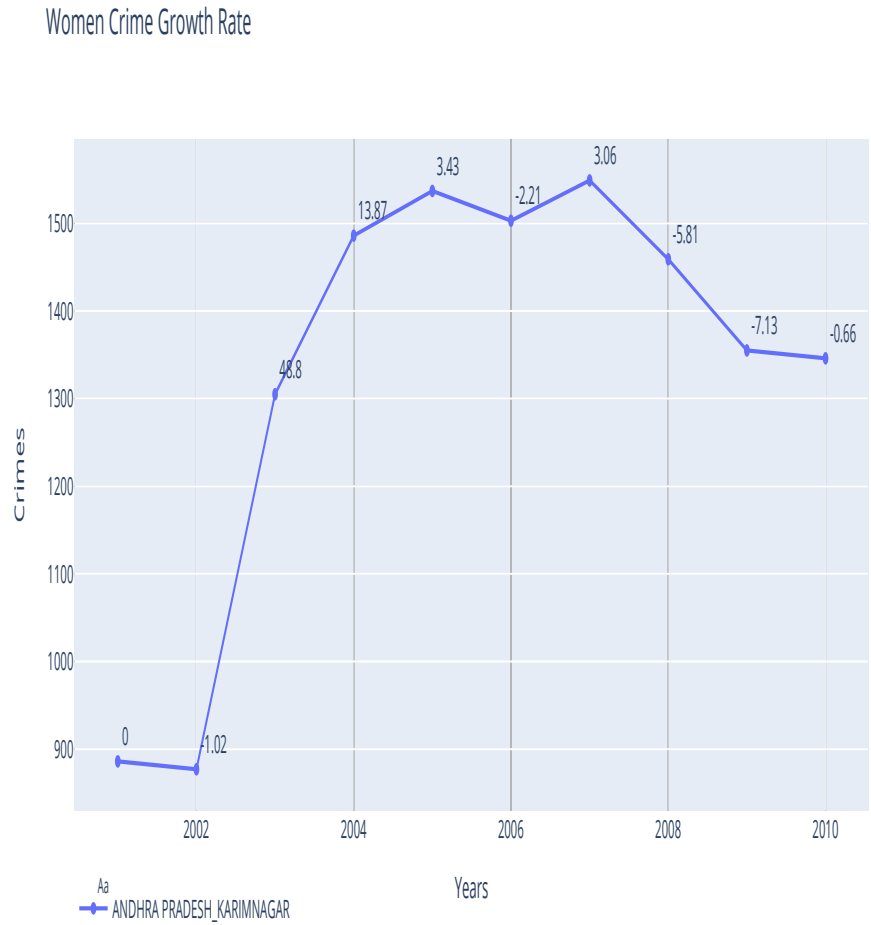
Women

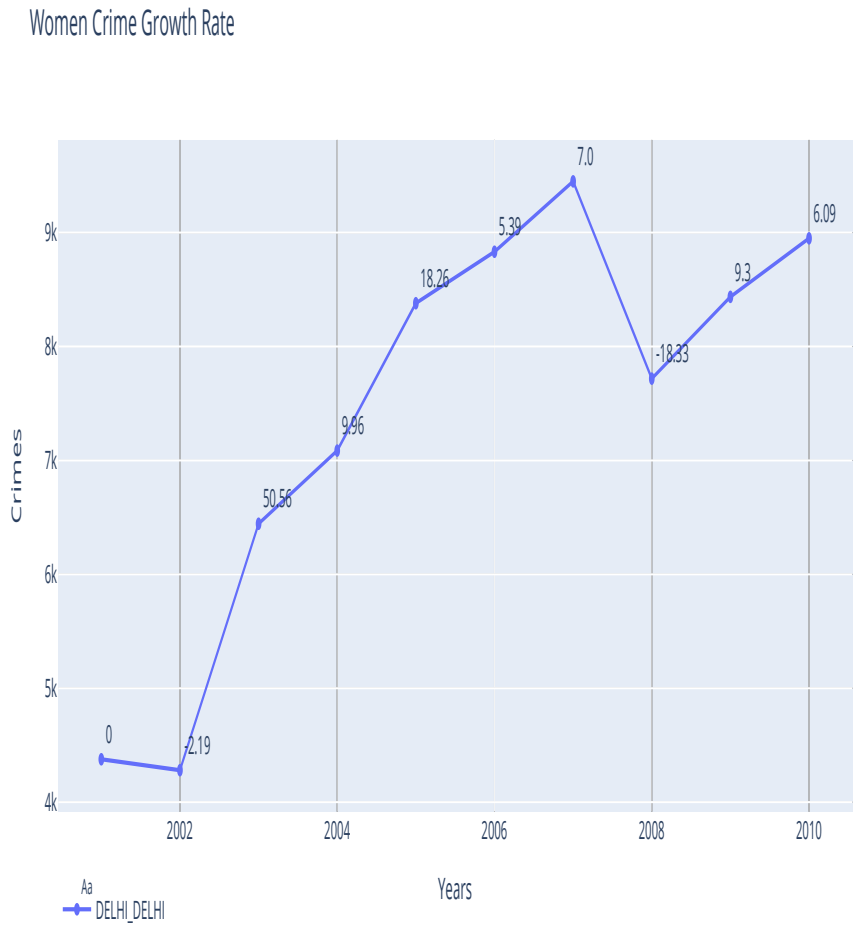
Population			
Districts		**States**	
Top	Low	Top	Low
DELHI	DEHRADUN	DELHI	HARYANA
HYDERABAD CITY	MADHUBANI	A.P	CHHATTISGARH
CHITTORGARH	SIHORE	M.P	JHARKHAND
KARIMNAGAR	ETAH	RAJASTHAN	PUNJAB
KOTA	HISSAR	W.B	J & K

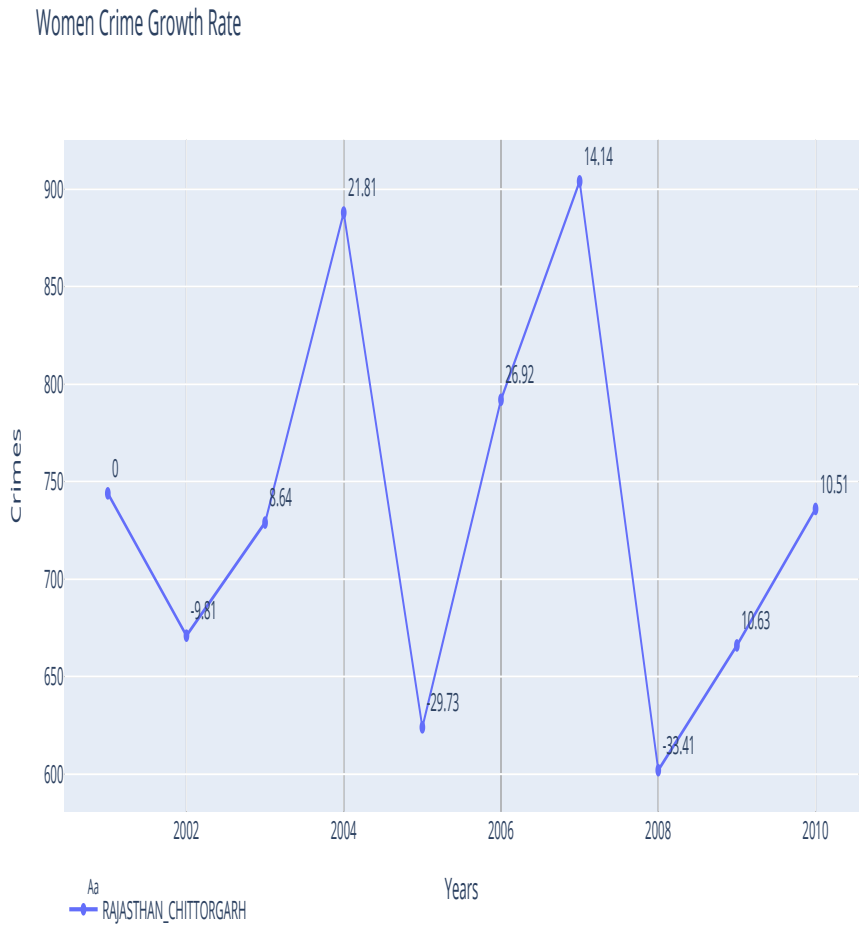
Zscore			
Districts		**States**	
Top	Low	Top	Low
DELHI	TAMENGLONG	U.P	LAKSHADWEEP
24 PARGANAS SOUTH	LONGLENG	A.P	DAMAN & DIU
MUMBAI	ANJAW	M.P	NAGALAND
24 PARGANAS NORTH	KIPHIRE	W.B	D & N HAVELI
HYDERABAD CITY	CHANDEL	RAJASTHAN	PUDUCHERRY

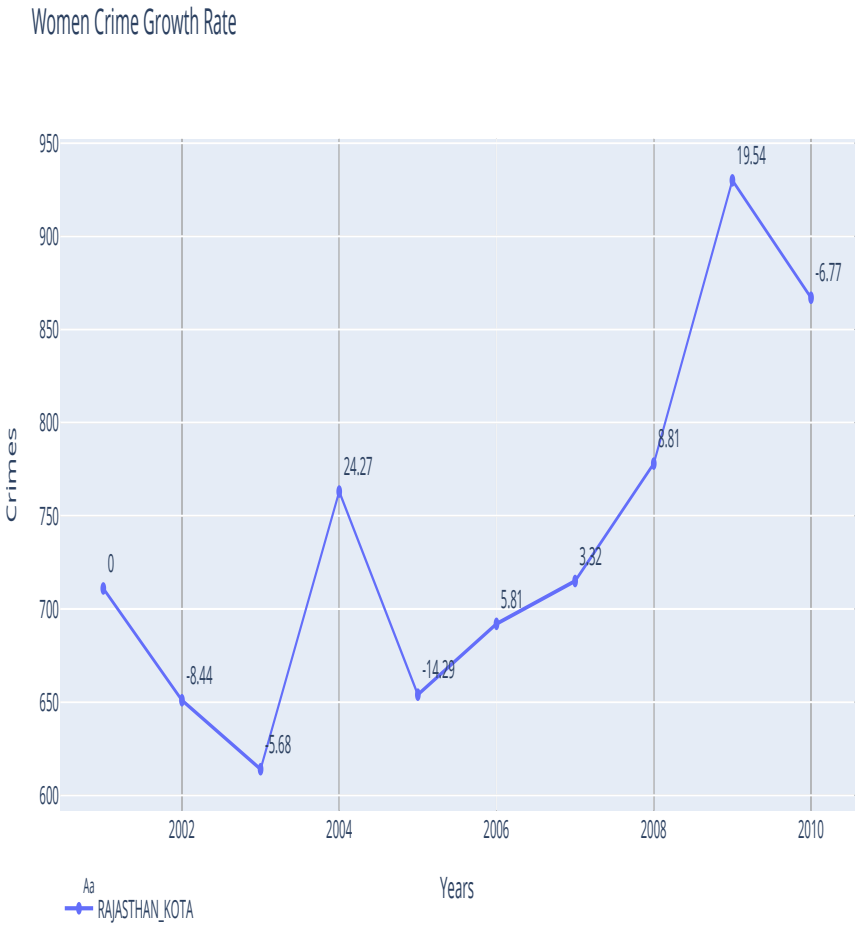
Growth Rate of Women

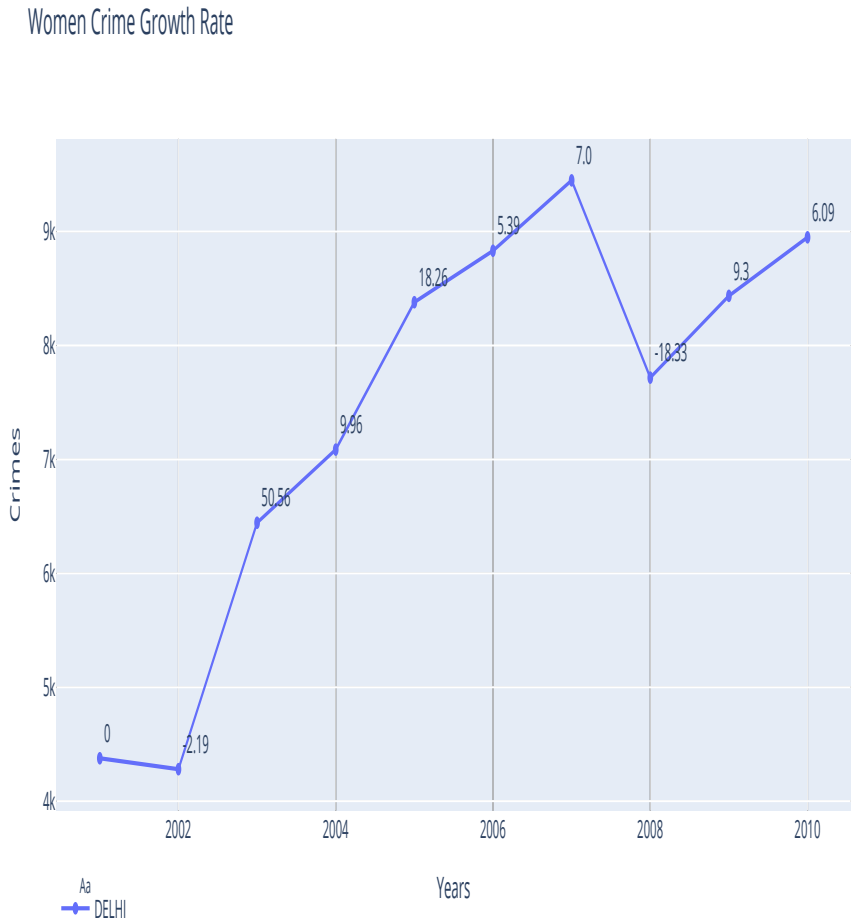


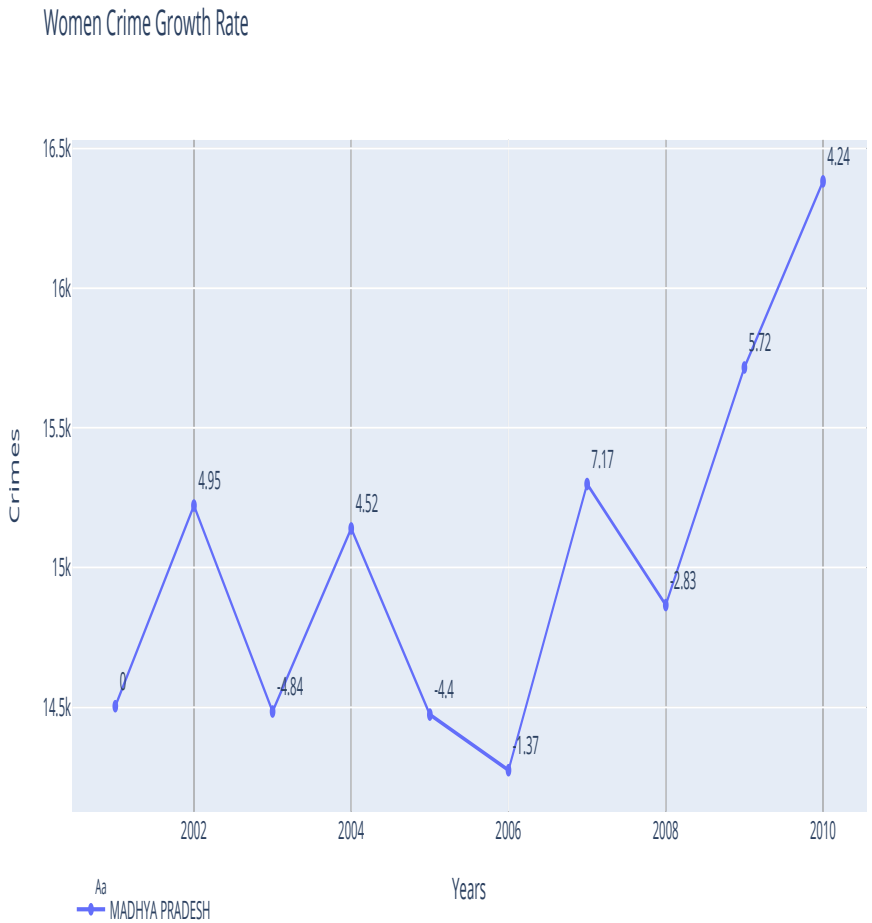


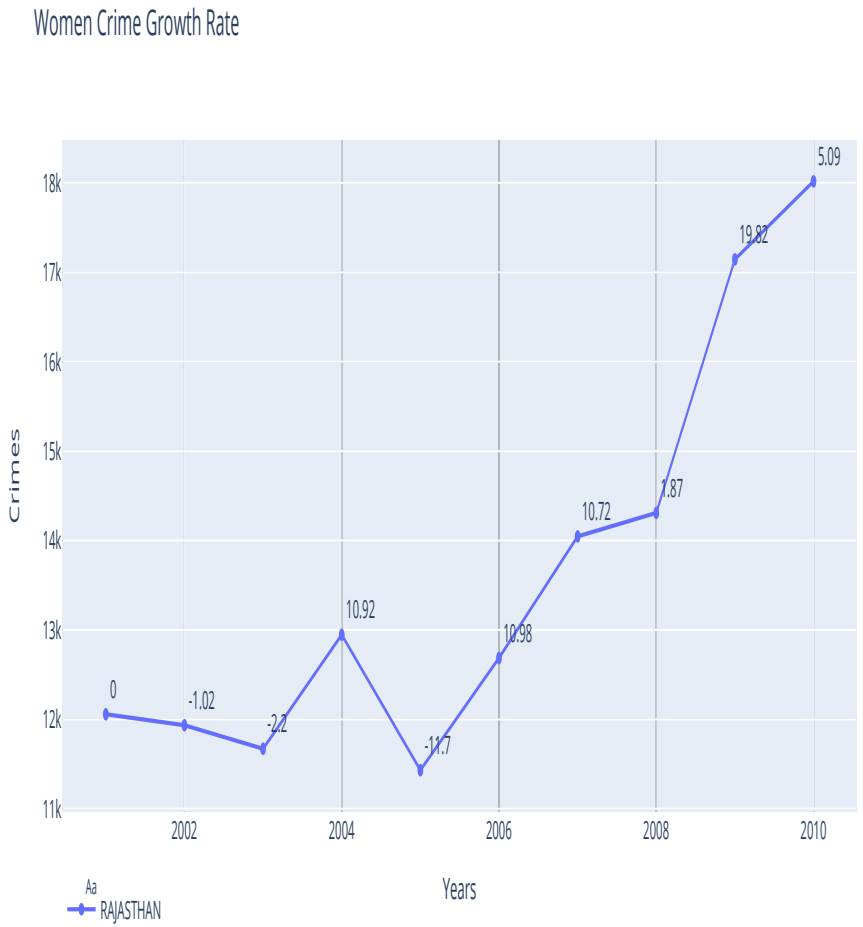

Women Crime Growth Rate
Crimes
9k
8k
7k
6k
5k
4k
2002
2004
2006
2008
2010
Years
0
-2.19
50.56
9.96
18.26
5.39
7.0
-18.33
9.3
6.09
Aa
DELHI_DELHI

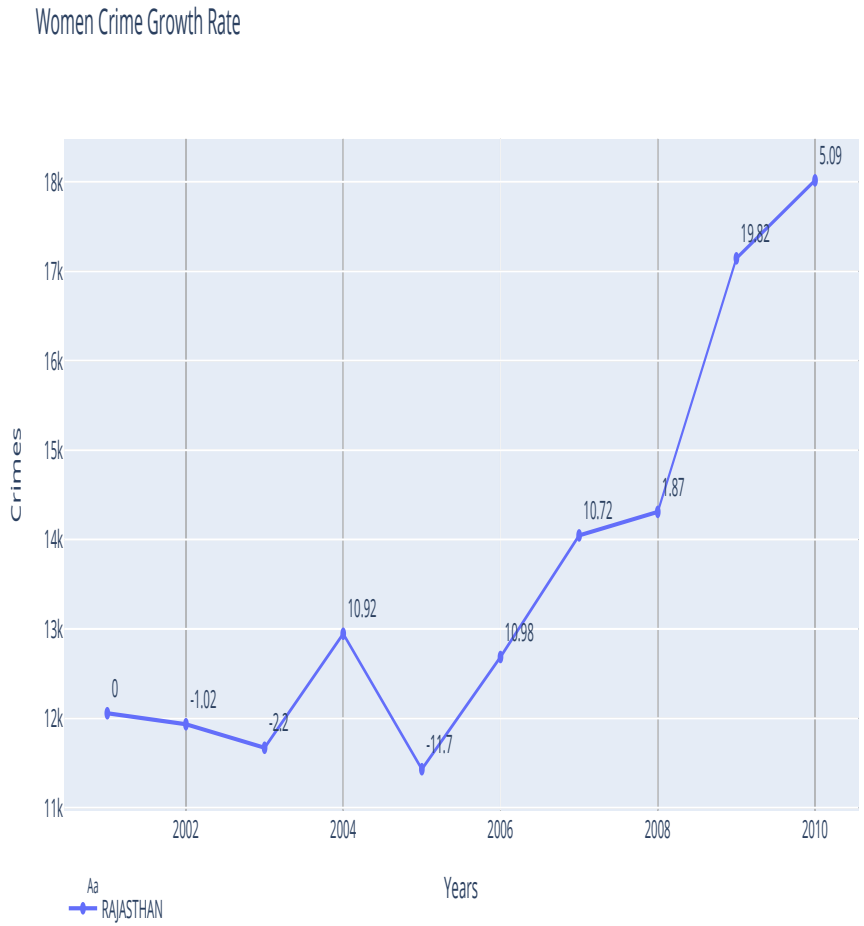

Women Crime Growth Rate
Crimes
900
850
800
750
700
650
600
2002
2004
2006
2008
2010
Years
0
-9.81
8.64
21.81
-29.73
26.92
14.14
-33.41
10.63
10.51
Aa
RAJASTHAN_CHITTORGARH

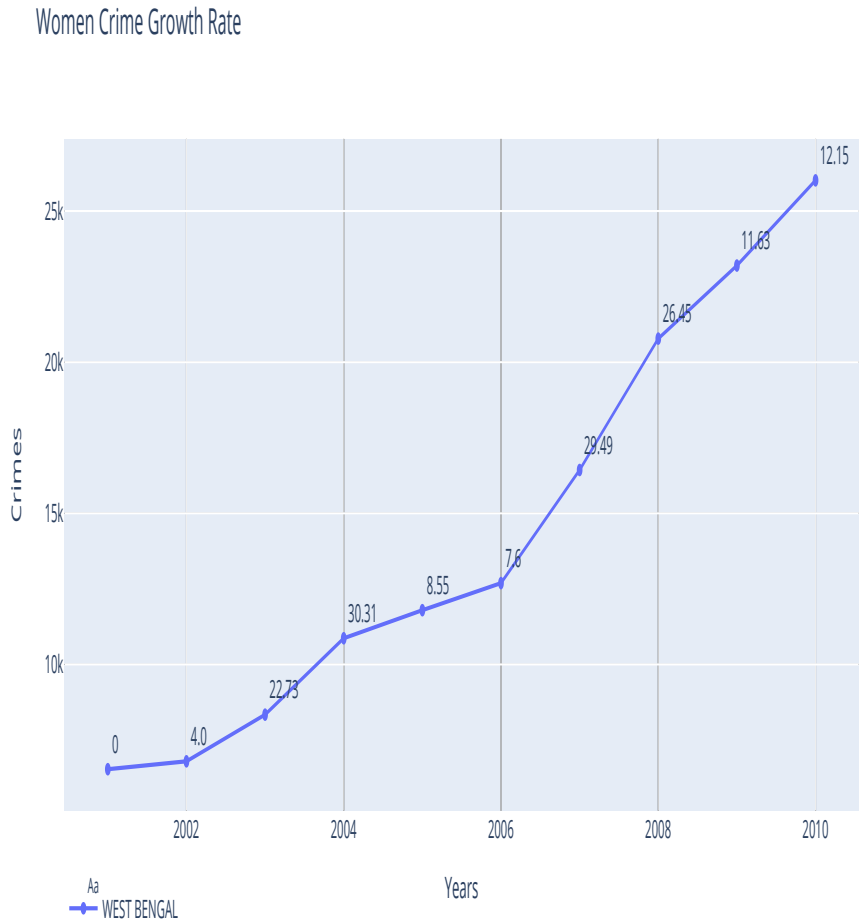

Women Crime Growth Rate
950
900
850
800
750
700
650
600
Crimes
2002
2004
2006
2008
2010
Years
0
-8.44
-5.68
24.27
-14.29
5.81
3.32
8.81
19.54
-6.77
Aa
RAJASTHAN_KOTA


Women Crime Growth Rate
9k
8k
7k
6k
5k
4k
Crimes
2002
2004
2006
2008
2010
Years
0
-2.19
50.56
9.96
18.26
5.39
7.0
-18.33
9.3
6.09
Aa
DELHI

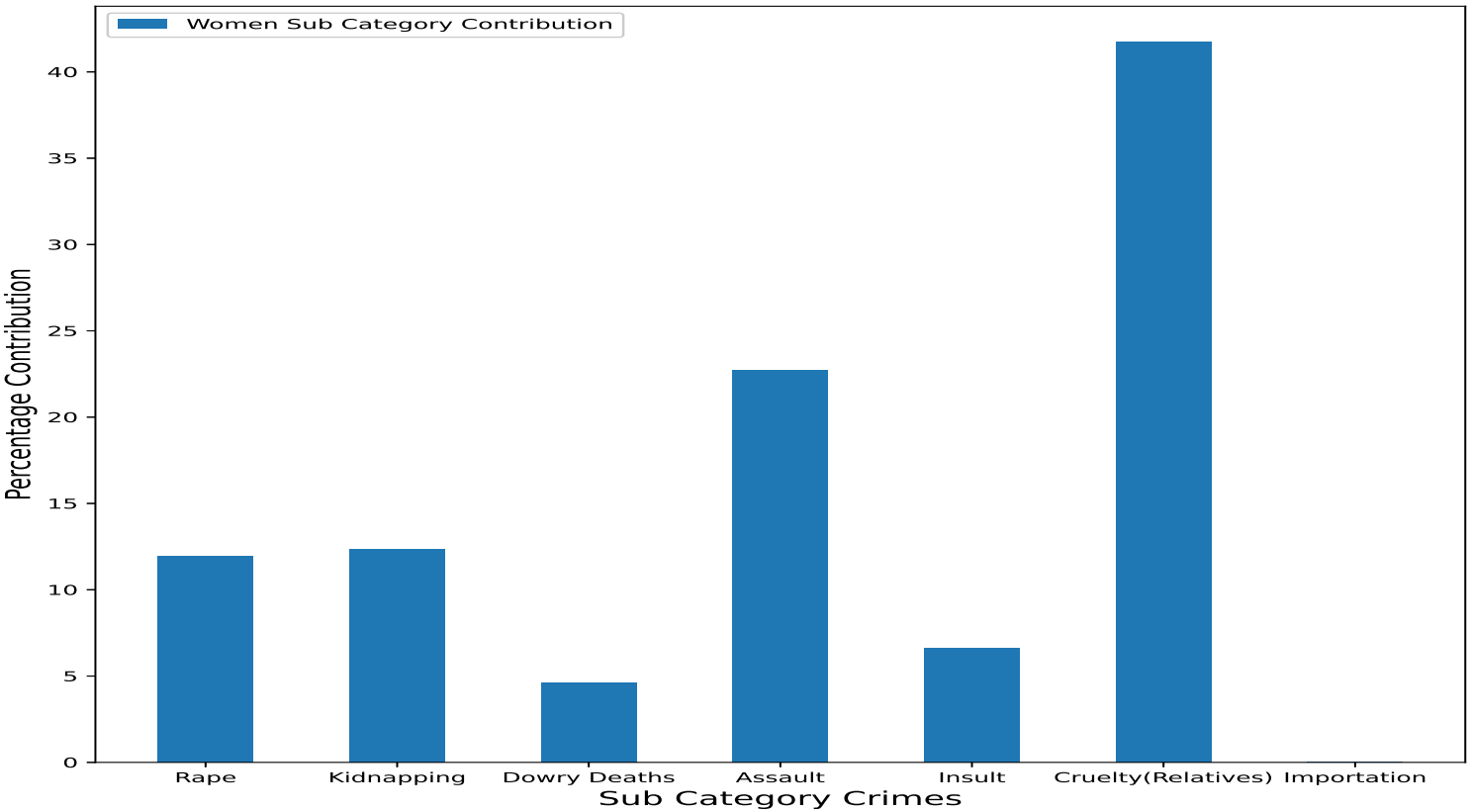

Women Crime Growth Rate
16.5k
16k
15.5k
15k
14.5k
Crimes
0
4.95
-4.84
4.52
-4.4
-7.37
7.17
-2.83
5.72
4.24
2002
2004
2006
2008
2010
Years
Aa
MADHYA PRADESH


Women Crime Growth Rate
18k
17k
16k
15k
14k
13k
12k
11k
Crimes
0
-1.02
-2.2
10.92
-11.7
10.98
10.72
11.87
19.82
5.09
2002
2004
2006
2008
2010
Years
Aa
RAJASTHAN

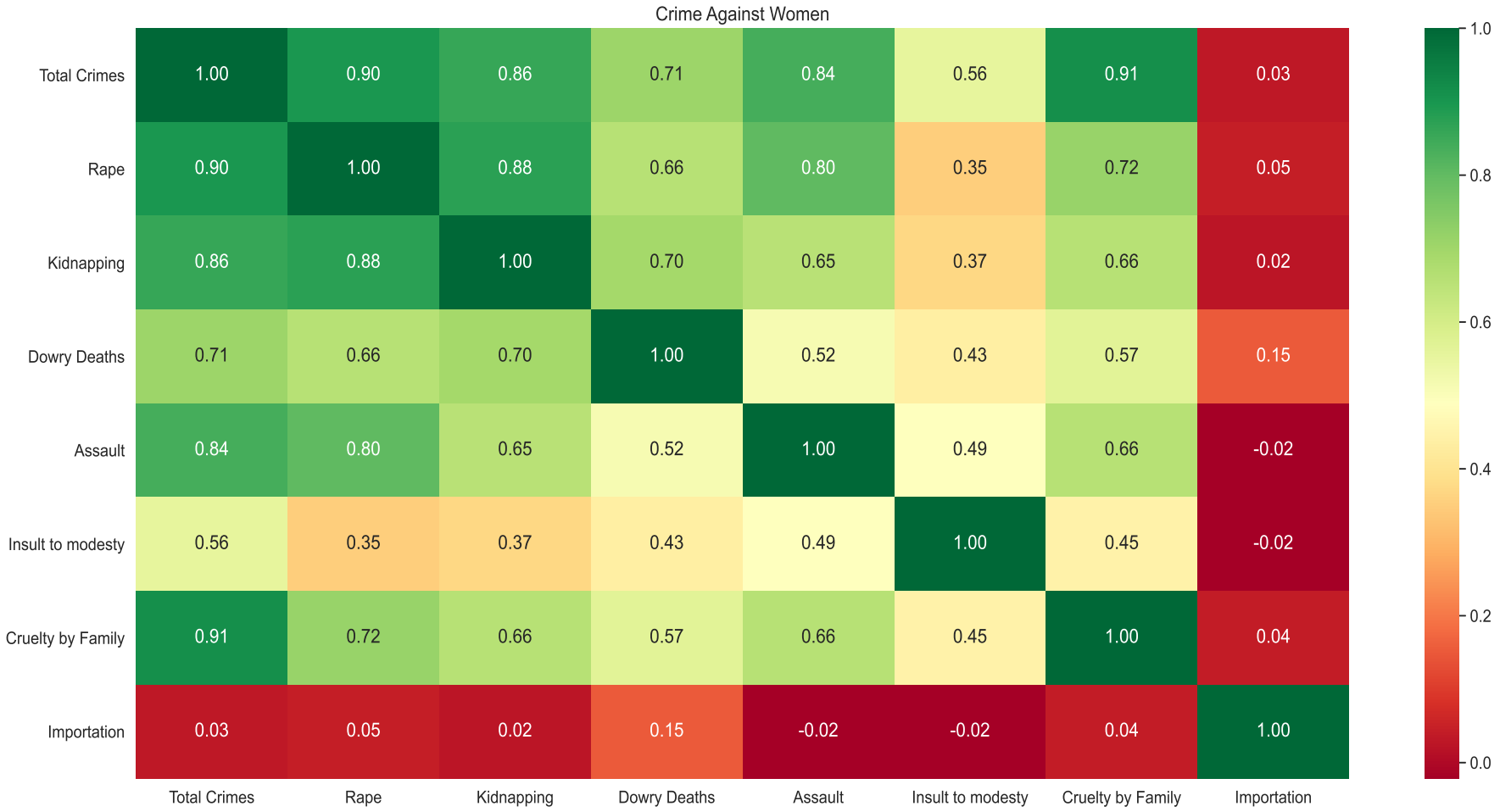

Women Crime Growth Rate
Crimes
18k
17k
16k
15k
14k
13k
12k
11k
0
-1.02
-2.2
10.92
-11.7
10.98
10.72
11.87
19.82
5.09
2002
2004
2006
2008
2010
Years
Aa
RAJASTHAN


Women Crime Growth Rate
Crimes
25k
20k
15k
10k
0
4.0
22.73
30.31
8.55
7.6
28.49
26.45
11.63
12.15
2002
2004
2006
2008
2010
Years
Aa
WEST BENGAL

Contribution of sub category in Women crimes

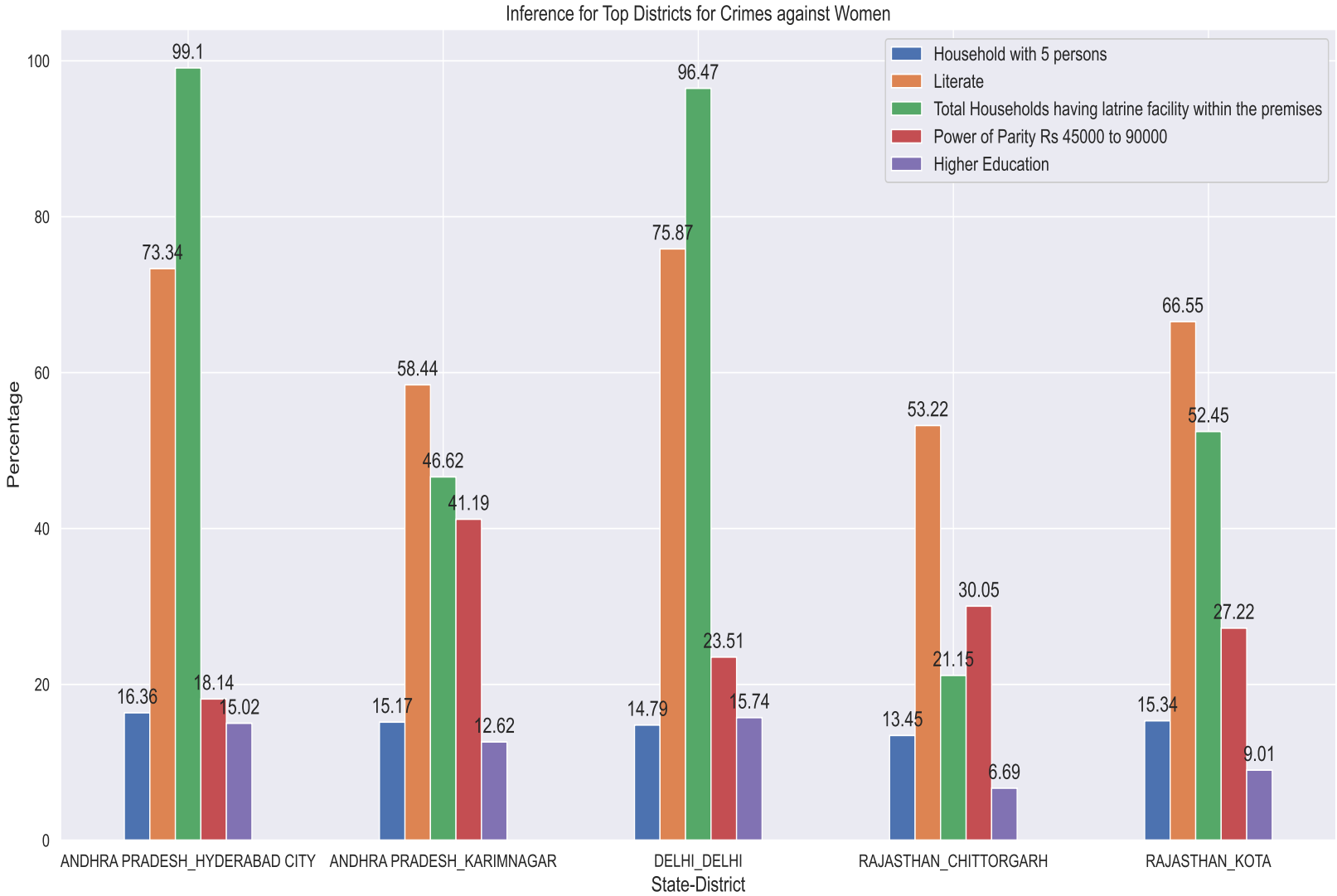


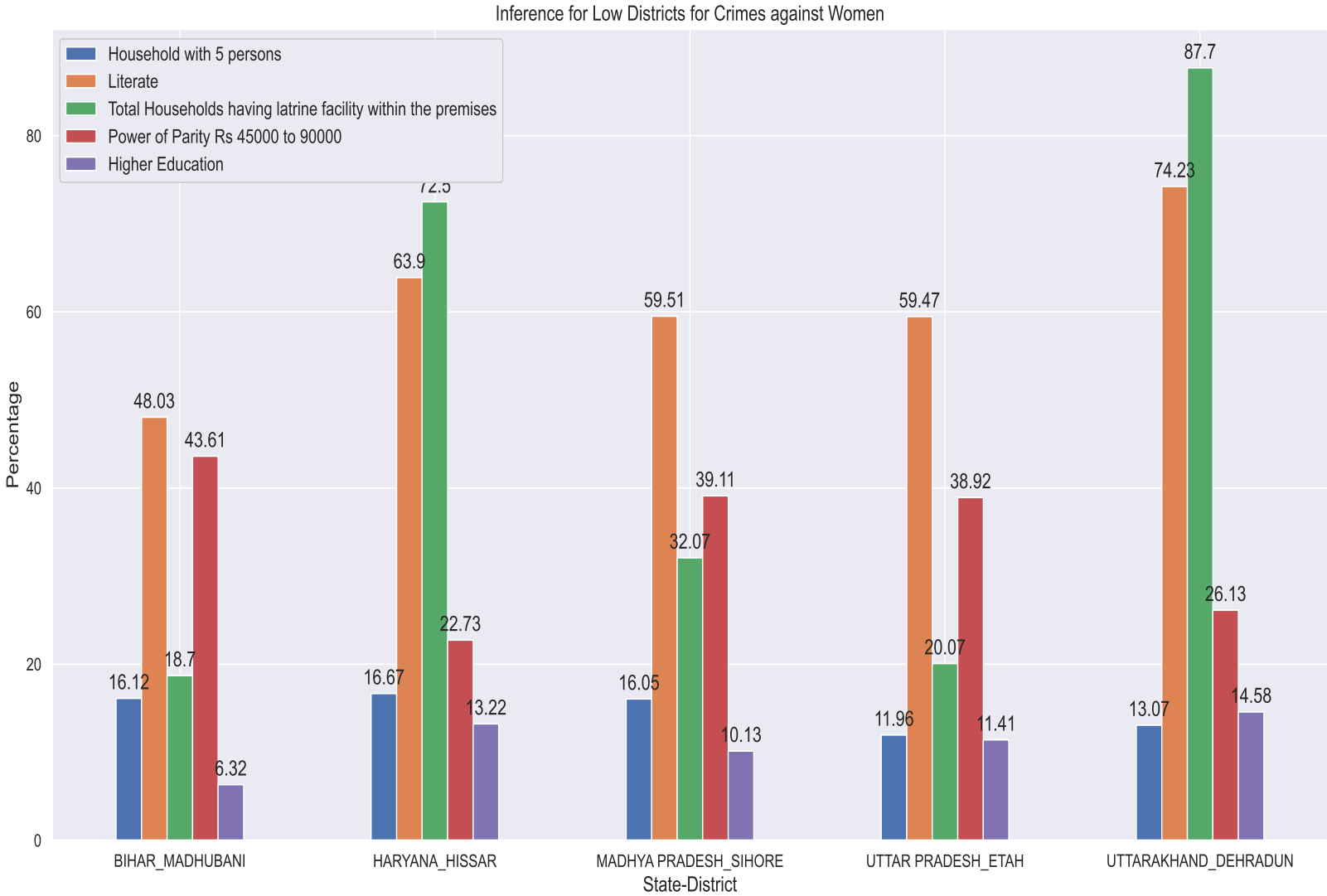
Inference

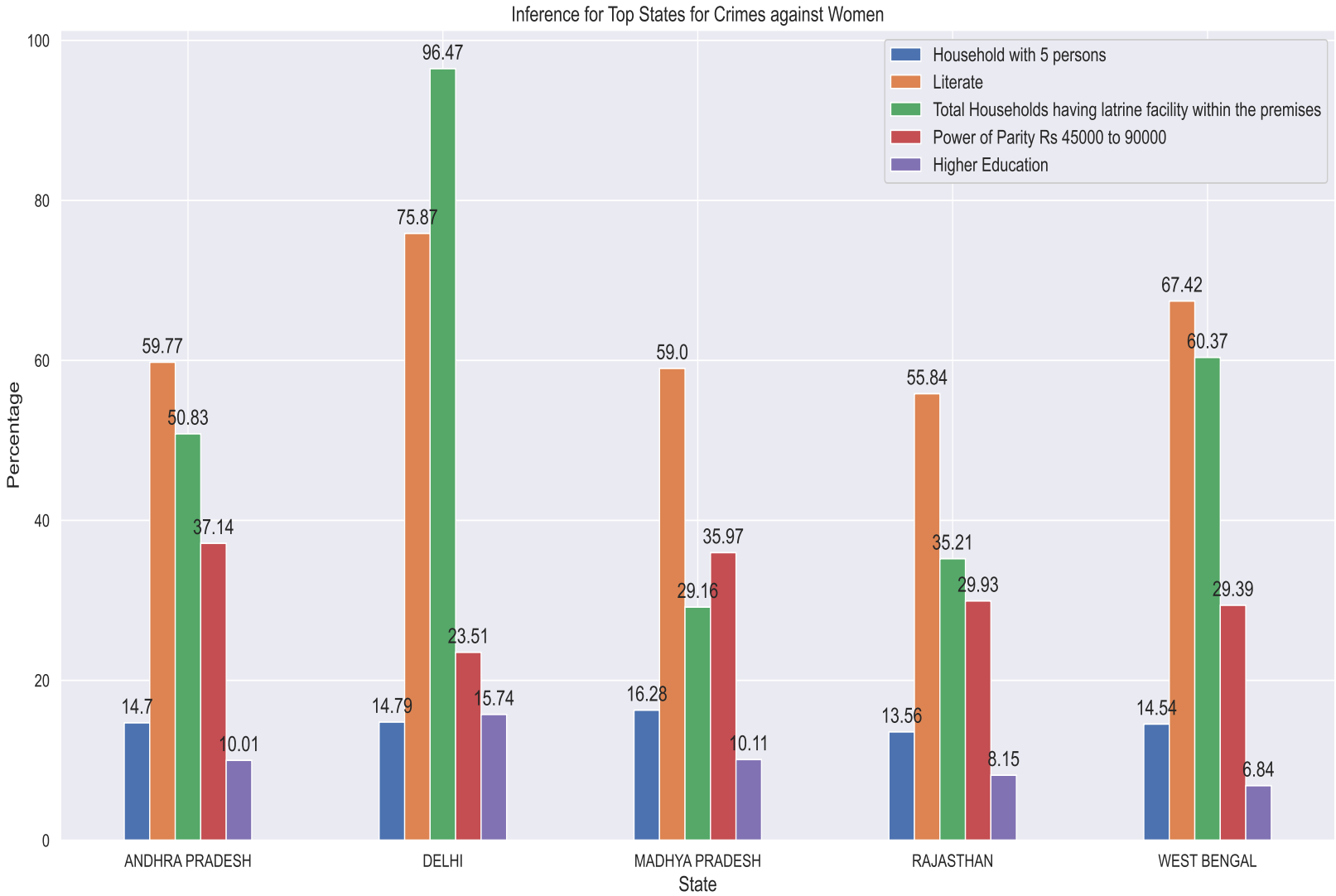

Crime Against Women
Total Crimes
Rape
Kidnapping
Dowry Deaths
Assault
Insult to modesty
Cruelty by Family
Importation
1.00 0.90 0.86 0.71 0.84 0.56 0.91 0.03
0.90 1.00 0.88 0.66 0.80 0.35 0.72 0.05
0.86 0.88 1.00 0.70 0.65 0.37 0.66 0.02
0.71 0.66 0.70 1.00 0.52 0.43 0.57 0.15
0.84 0.80 0.65 0.52 1.00 0.49 0.66 -0.02
0.56 0.35 0.37 0.43 0.49 1.00 0.45 -0.02
0.91 0.72 0.66 0.57 0.66 0.45 1.00 0.04
0.03 0.05 0.02 0.15 -0.02 -0.02 0.04 1.00
Total Crimes
Rape
Kidnapping
Dowry Deaths
Assault
Insult to modesty
Cruelty by Family
Importation
1.0
0.8
0.6
0.4
0.2
0.0

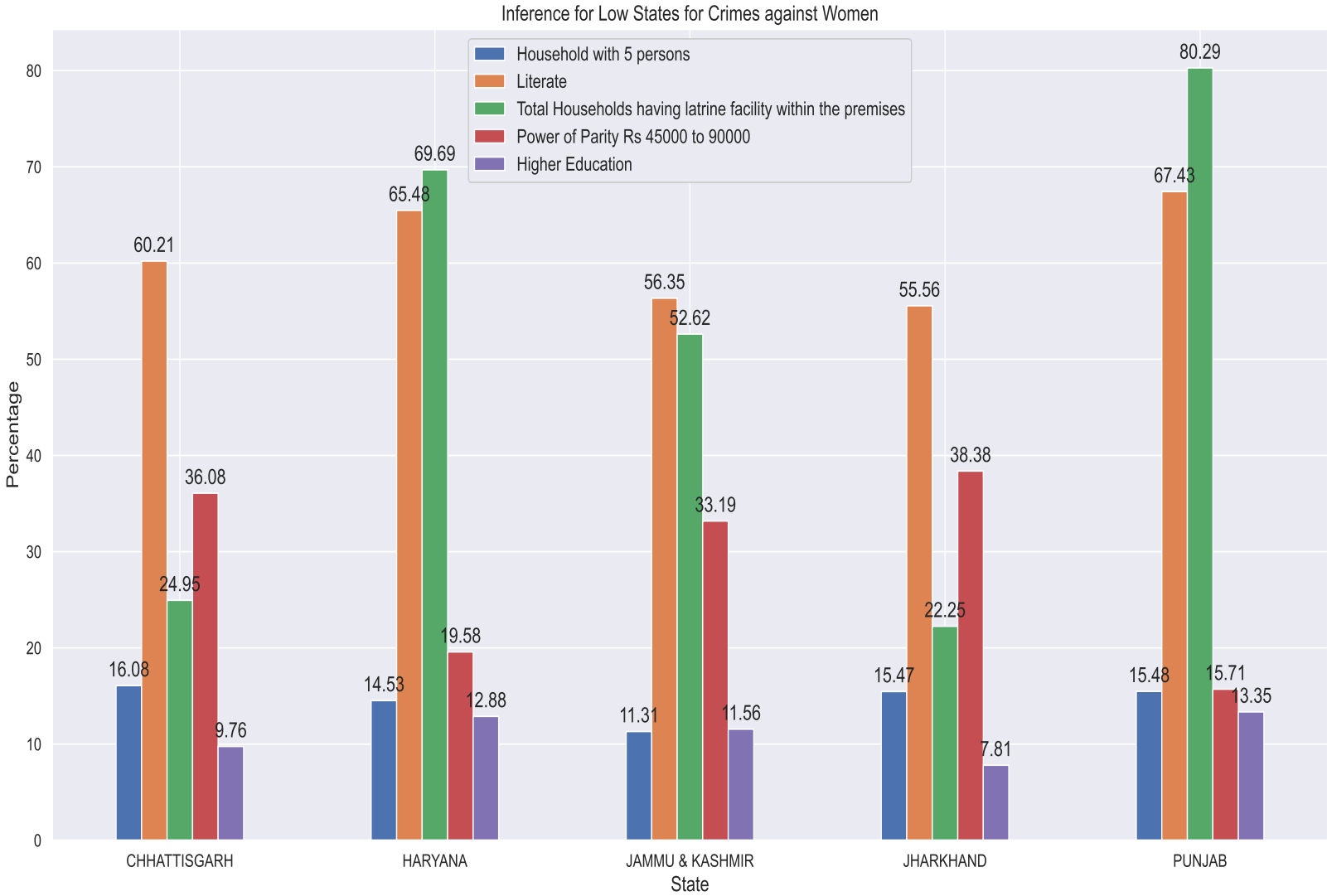
The attributes extracted from the heatmap are :

- Literates
- Households with 5 members.
- Households with latrine facility within the premises.
- Power of Parity Rs 45000 to 90000.
- Higher Education.


Inference for Top Districts for Crimes against Women
Household with 5 persons
Literate
Total Households having latrine facility within the premises
Power of Parity Rs 45000 to 90000
Higher Education
Percentage
0
20
40
60
80
100
16.36
73.34
99.1
18.14
15.02
15.17
58.44
46.62
41.19
12.62
14.79
75.87
96.47
23.51
15.74
13.45
53.22
21.15
30.05
6.69
15.34
66.55
52.45
27.22
9.01
ANDHRA PRADESH_HYDERABAD CITY
ANDHRA PRADESH_KARIMNAGAR
DELHI_DELHI
RAJASTHAN_CHITTORGARH
RAJASTHAN_KOTA
State-District


Inference for Low Districts for Crimes against Women
Household with 5 persons
Literate
Total Households having latrine facility within the premises
Power of Parity Rs 45000 to 90000
Higher Education
Percentage
0
20
40
60
80
16.12
48.03
18.7
43.61
6.32
16.67
63.9
72.5
22.73
13.22
16.05
59.51
32.07
39.11
10.13
11.96
59.47
20.07
38.92
11.41
13.07
74.23
87.7
26.13
14.58
BIHAR_MADHUBANI
HARYANA_HISSAR
MADHYA PRADESH_SIHORE
UTTAR PRADESH_ETAH
UTTARAKHAND_DEHRADUN
State-District


Inference for Top States for Crimes against Women
Household with 5 persons
Literate
Total Households having latrine facility within the premises
Power of Parity Rs 45000 to 90000
Higher Education
Percentage
State
ANDHRA PRADESH
DELHI
MADHYA PRADESH
RAJASTHAN
WEST BENGAL
14.7
59.77
50.83
37.14
10.01
14.79
75.87
96.47
23.51
15.74
16.28
59.0
29.16
35.97
10.11
13.56
55.84
35.21
29.93
8.15
14.54
67.42
60.37
29.39
6.84


Inference for Low States for Crimes against Women
Household with 5 persons
Literate
Total Households having latrine facility within the premises
Power of Parity Rs 45000 to 90000
Higher Education
Percentage
State
CHHATTISGARH
HARYANA
JAMMU & KASHMIR
JHARKHAND
PUNJAB
16.08
60.21
24.95
36.08
9.76
14.53
65.48
69.69
19.58
12.88
11.31
56.35
52.62
33.19
11.56
15.47
55.56
22.25
38.38
7.81
15.48
67.43
80.29
15.71
13.35

Inference drawn from the plots are:

- In major cases, districts appearing in top five hot-spot regions are cities.
- Power of Parity is on a higher side in low districts/states as compared to that in top districts/states. This can be considered as one the probable reason for crime against women.
- Higher Education is slightly high in major cases in low districts/states as compared to that in the top districts/states, clearly showing it's impact in total crimes against women.
- Other than the stated factors all other highly correlated factors stand in discriminating between hot-spots and cold-spot regions.

Future Directions

- We have only considered positively correlated census attributes while some negatively correlated attributes might help to explain analysis better.
- Comparative analysis can be improved by considering urban areas and rural areas separately.
- Prediction model could be trained to predict crimes in future.
- Other crimes might be considered which will expand breadth of the analysis.
- Data could be made more consistent using interpolation or regression model to predict missing values.
- Availability of more recent data may improve our results.

References I

S. V. Nath.
Crime pattern detection using data mining.
In *2006 IEEE/WIC/ACM International Conference on Web Intelligence and Intelligent Agent Technology Workshops*, pages 41–44, 2006.