# Status of Women Empowerment in India

Project Report for CS595 - Data Visualization Lab at IIT Guwahati

*By, Ode Deepkumar Rameshbhai (204161011).*

## Motivation

Although a quote from an ancient Indian text,

<div align="center">

यत्र नार्यस्तु पूज्यन्ते रमन्ते तत्र देवता:।

(Where women are worshipped, there gods rejoice).

</div>

dates long back; gender discrimination against women remains a major issue faced by the modern Indian society.

A nation cannot prosper when half of its population is not empowered. Reports of crimes against women are common in newspapers every day. In addition to those victims, it is widely acknowledged fact that there exists considerable gender inequality in education, economy, health and other sectors against women in India. One might argue, perhaps truly, that situation is much better today than it was a few decades back, there remains a lot to be done.

Although gender discrimination is a worldwide issue and discrimination is mostly against women, various gender inequality indices used are controversial and hence, are not in wide usage. This might be due to fact that quantizing empowerment is a hard task & might get subjective at points. Instead this report compares various states of India with help of data visualization on basis of different indices pertaining to different sectors – focusing mainly on Education sector and Economical sector. This is based on belief that education and financial independence goes long way in empowering a person.

## Objective

The report aims to find answers of the following questions using various data visualizations.

1.  What is gender ratio in different states of the India?
2.  What is status of women education in various Indian states? How are states performing on various education related indices? Are there any regional trends?
3.  Is there correlation between women education and GDP?
4.  What is status of women employment in different Indian states? Are there any regional trends?
5.  Is there correlation between women employment rate and GDP?

6.  Which sectors do women work in?
7.  Which states are better at women safety?
8.  What are impacts of the women education on population growth rate?
9.  Is there any relation between crimes against women and women education? Have higher rates of such crimes discouraged women from higher education?

# Methodology

The graphics were developed using R language. All plots but one follows grammar of graphics. The data used was obtained from many different sources, the main ones being
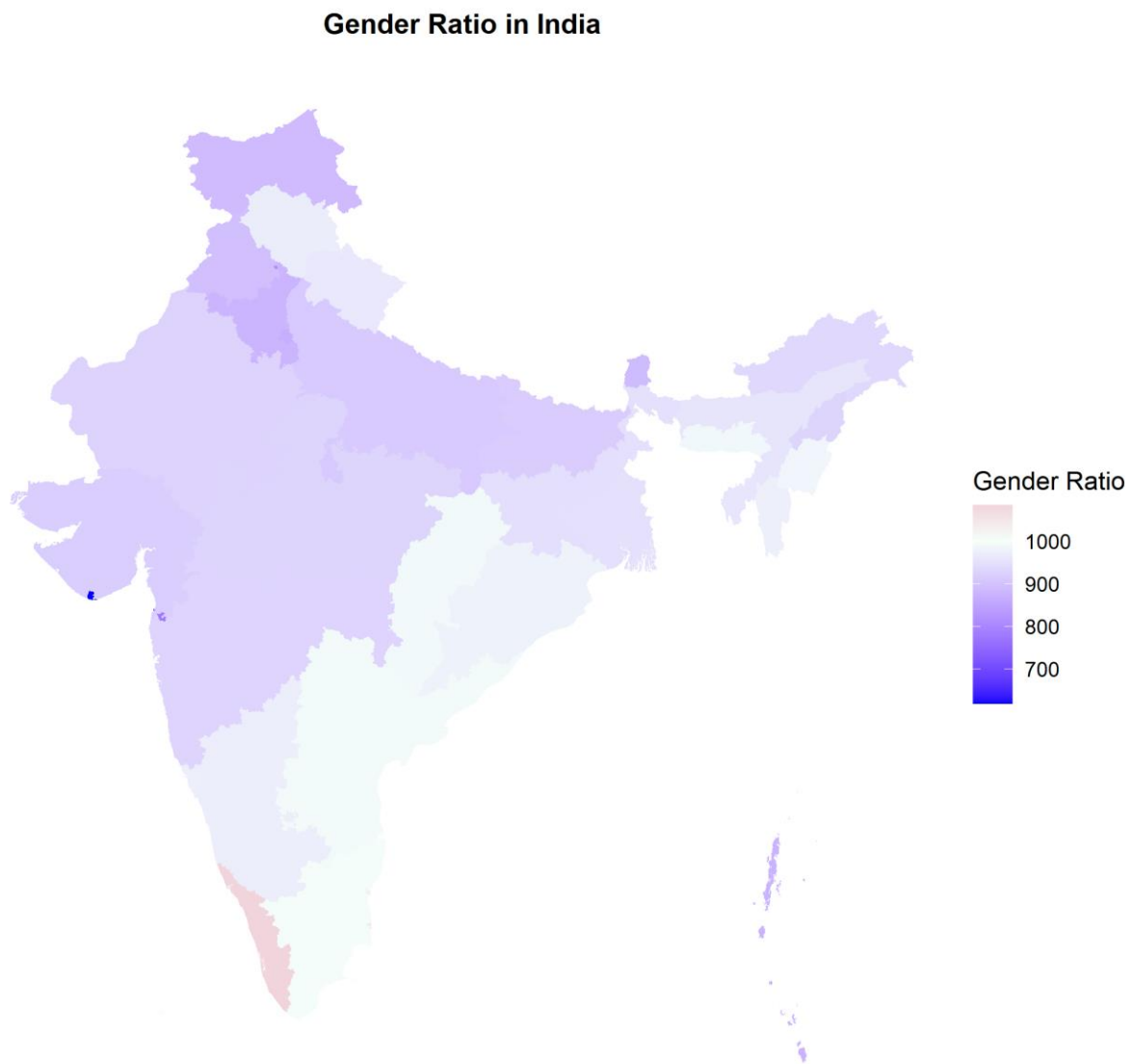
- Census of India, 2011 and
- Open Government Data Platform.

The complete list of sources can be found in Appendix A at the end of the report.

All other details necessary for reproducing graphics presented in this report, along with exact links to the data sources, source code and a readme file with instructions on how to execute the code are included in a separate folder submitted along with this submission.

# Visualizations

- What is gender ratio in different Indian states?

**Gender Ratio in India**



Source : Census of India, 2011

Many ways of comparing states on basis of one number have been explored in this report. A gradient filled map of India conveys the information well using common (although cliché) scheme – Blue for men and Pink for women.

The states with darker shades of blue have more men than women. Only Kerala and Pudduchery have more women than men. The mint cream colored states have almost equal population of both men and women.

- Education Sector

A natural choice to compare women education would be women literacy rate. Which states have better women literacy rate? This can be easily visualized by an ordered lollipop chart.



Female literacy rate in Indian states
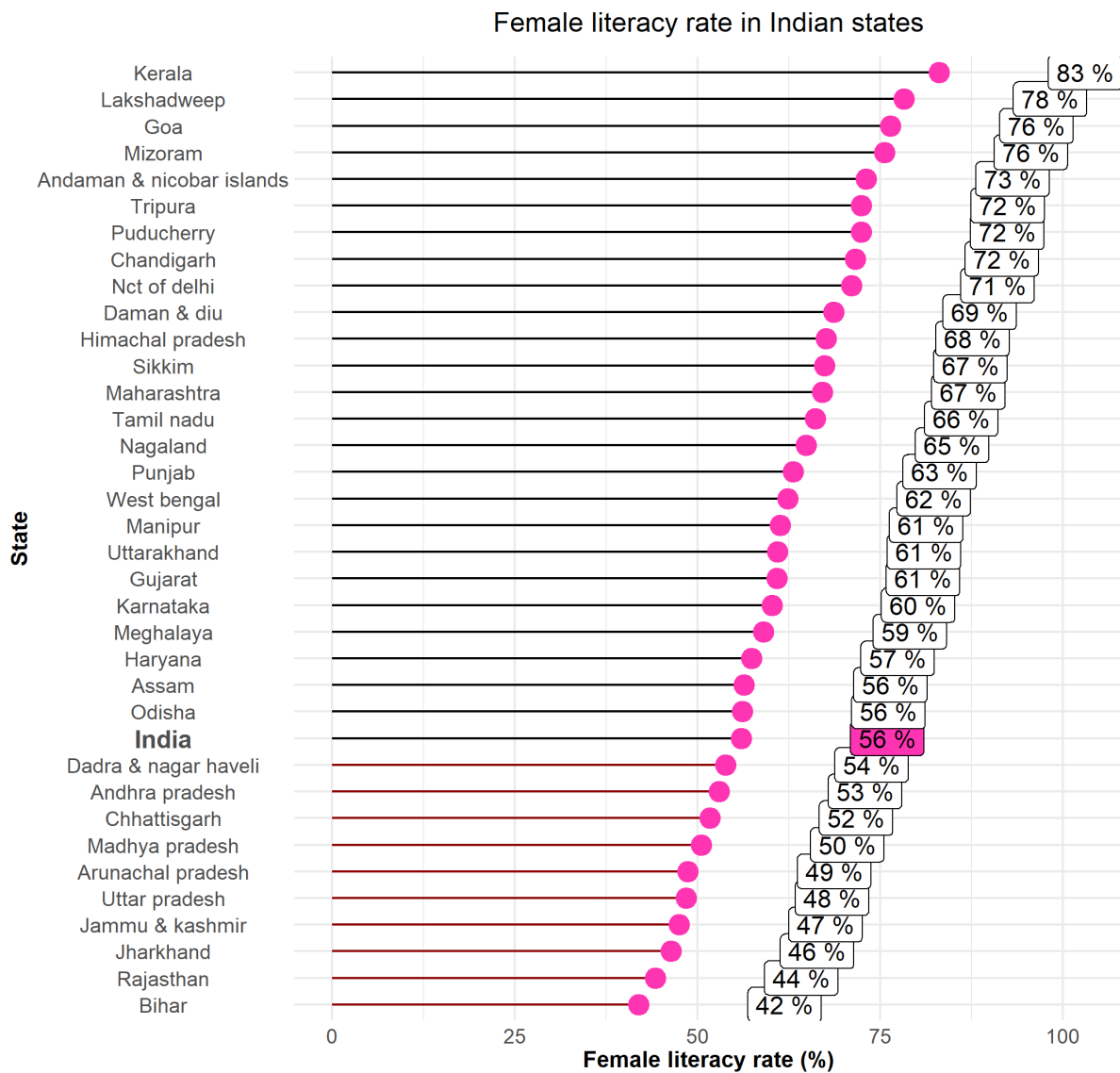
Source : Indian Census, 2011

Kerala is topping the list again with 83%, which is almost 150% more than the national average. Only some of the states have literacy rate lower than the national average, this is due to fact that those states are highly populous states such as Uttar Pradesh, Bihar, Madhya Pradesh. The lower literacy rate in such highly populous states is worrisome.

Many southern-western states can be seen at the top of the list, where as northern-central Indian states below the national average. This led to me to explore any regional differences in women literacy rates.
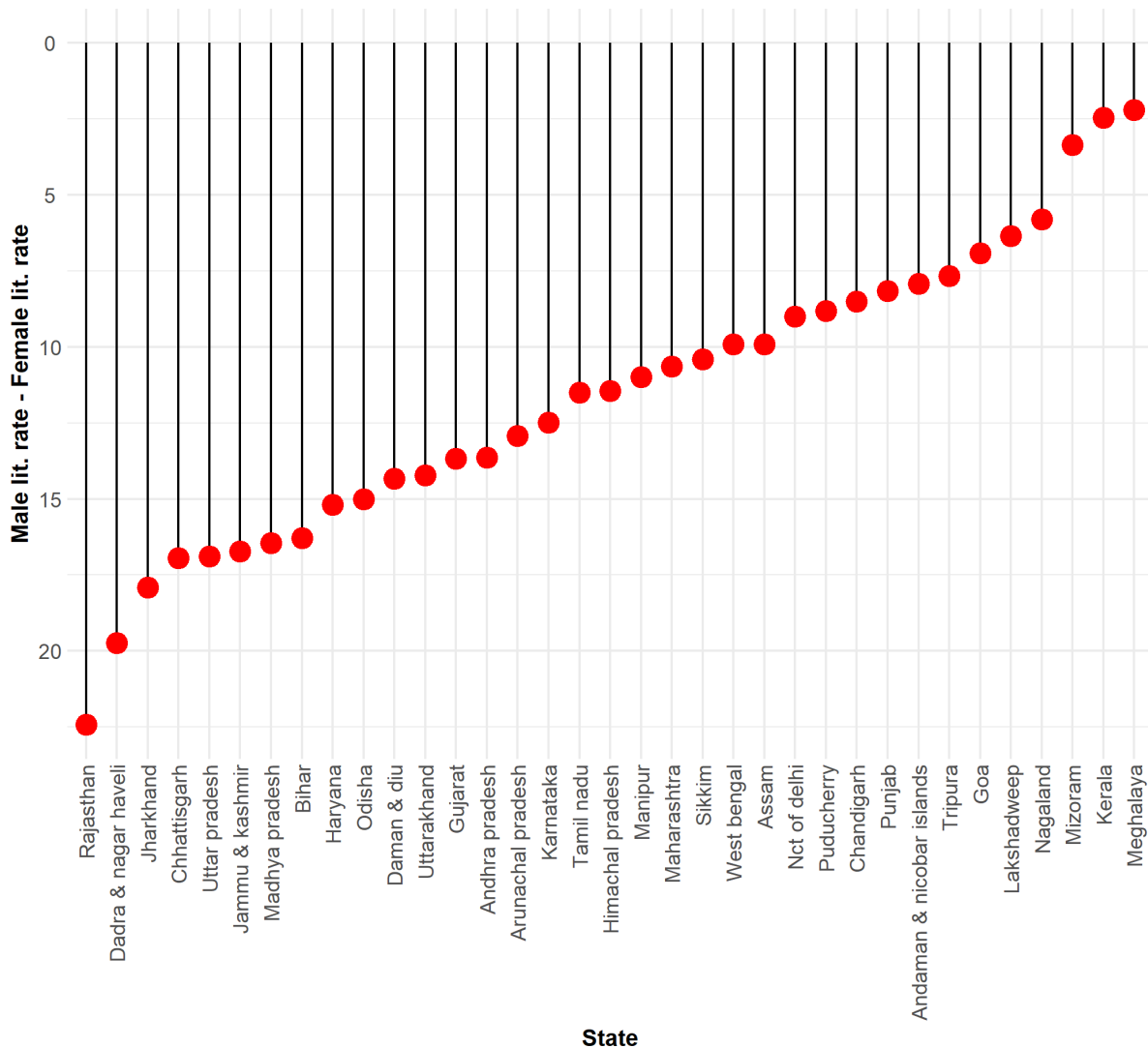
Regional female literacy rate in India
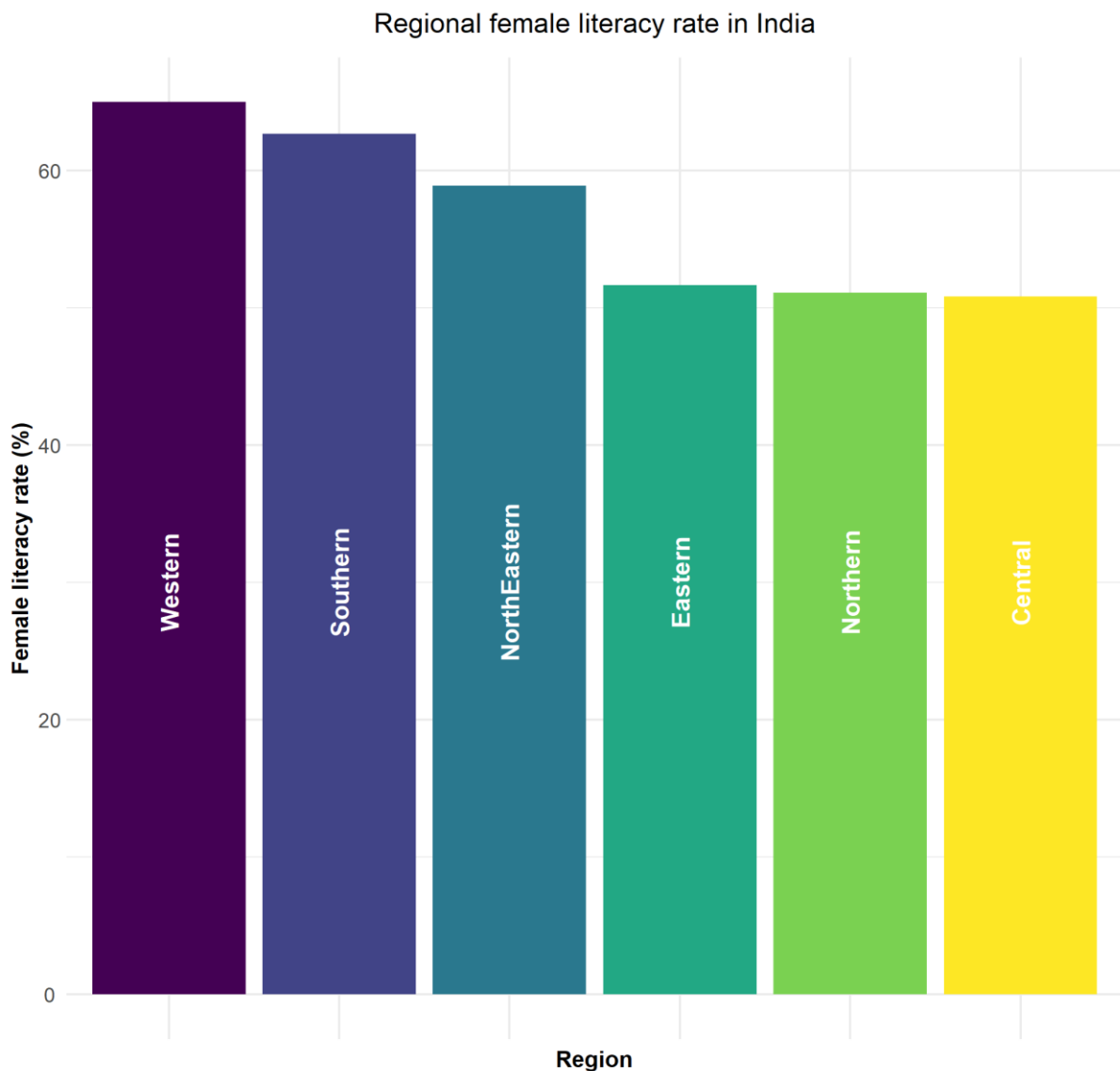


Source : Indian Census, 2011

As we figured out from previous graph, there exists a strong regional difference when it comes to women literacy rate with Western and Southern India doing better than Northern and Central India.

But, it is known that Bihar has lower overall literacy rate as well. So does this lower women literacy rate points towards discrimination against women in Northern and Central states or are these states performing poorly even when it comes to men?  This question can be answered by visualizing the **difference between male and female literacy rates** of various Indian states, again, we have used ordered lollipop chart, flipped vertically.

# Gender wise Difference in Literacy Rates



**Male lit. rate - Female lit. rate** (y-axis)

**State** (x-axis)

States (left to right): Rajasthan, Dadra & nagar haveli, Jharkhand, Chhattisgarh, Uttar pradesh, Jammu & kashmir, Madhya pradesh, Bihar, Haryana, Odisha, Daman & diu, Uttarakhand, Gujarat, Andhra pradesh, Arunachal pradesh, Karnataka, Tamil nadu, Himachal pradesh, Manipur, Maharashtra, Sikkim, West bengal, Assam, Nct of delhi, Puducherry, Chandigarh, Punjab, Andaman & nicobar islands, Tripura, Goa, Lakshadweep, Nagaland, Mizoram, Kerala, Meghalaya

Source : Census of India, 2011

Lower the red bubble is, larger is the gender wise difference in literacy rates.

It can be seen that even here, states like Rajasthan, Chhatisgarh, Uttar Pradesh, M.P and Bihar are performing poorly, while Kerala, Goa along with North – Eastern states are topping the list, yet again.

Let us look at national statistic once and see whether the situation is improving or not. The best way to do so, would be to look at how our literacy rate has improved over years. The line chart best serves the purpose.

### Decadal growth in literacy rate of India - Gender wise
#### From 1881 to 2011



Source : Wikipedia
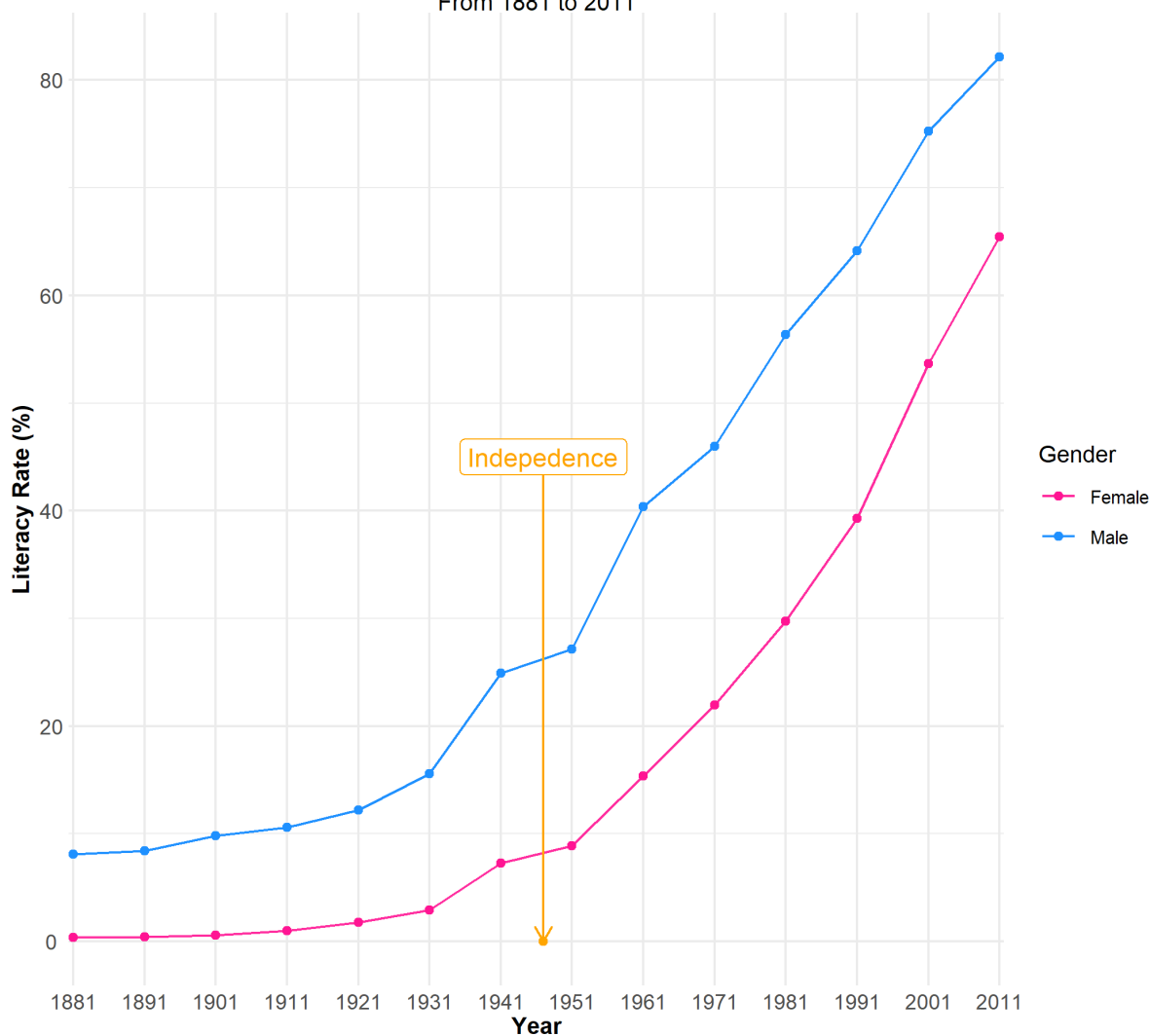
This data comes from decadal Census of India. It can be seen that after gaining independence from the British Crown in 1947, there is boost in both female and male literacy rates. The gender gap is also being bridged, albeit slowly.

This makes one wonder whether gender discrimination is less amongst youth. One way to answer this question is to look at the gender wise enrolment at various levels of education such as primary, higher secondary, graduation and above, considering only young people. The following horizontally stacked bar chart is appropriate choice for this problem as one can readily compare different education levels along with gender wise enrolment.

## Gender wise Enrollement at Various Education Levels

### Age : 18 - 29 years



Source : Census of India, 2011
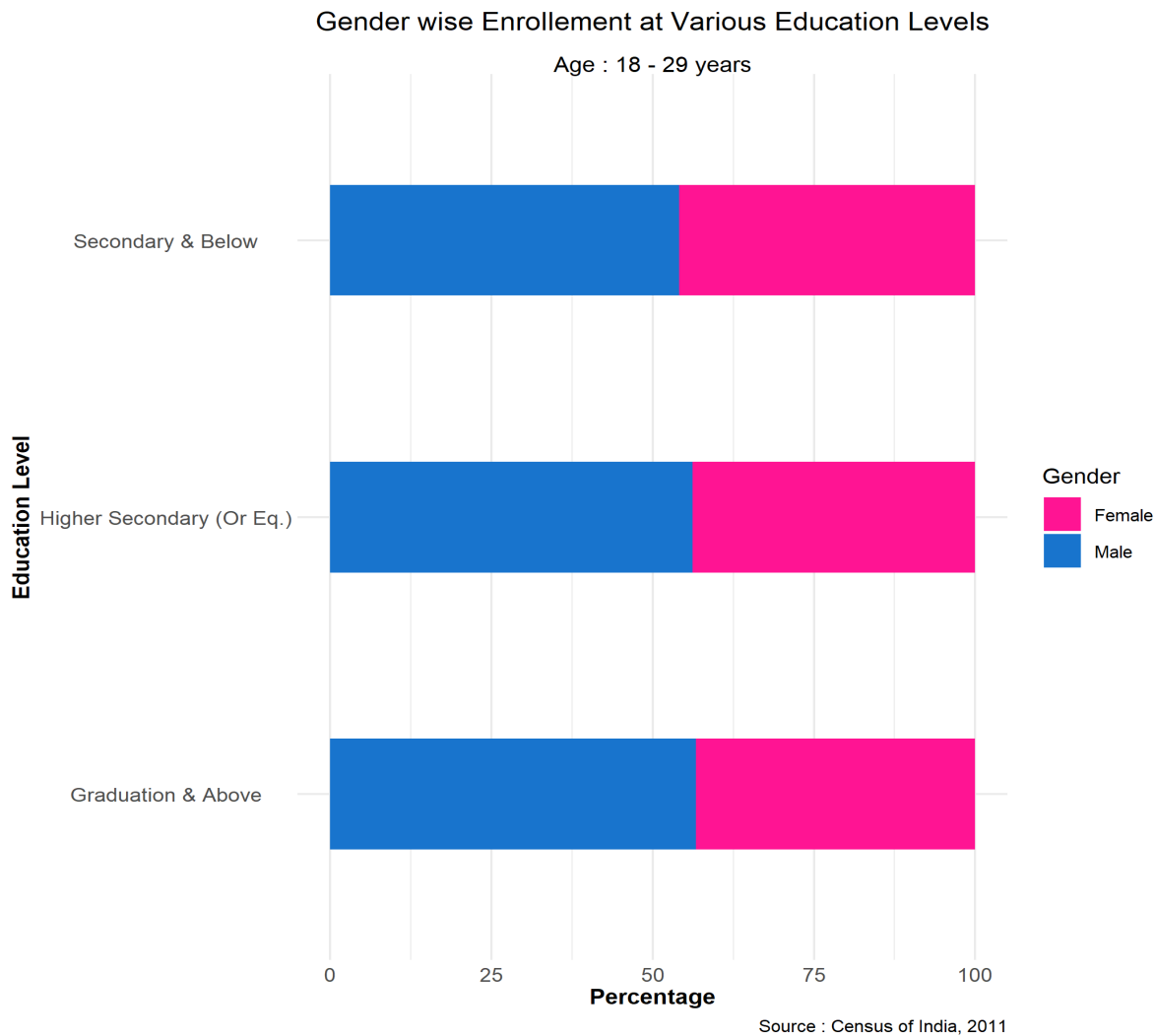
For the purpose of the question, we only considered people from age 18 to 29. It can be seen from above plot that in this range, number of men having secondary as their highest education is almost equal to number of women. This ratio remains almost same at all levels of education.

This is a good sign about current status of education in India – as almost same number of men and women have comparable educations. Women of India now have and are taking opportunities to educate their selves at all levels.

But still, there is strong prevailing inequality in society. Is this caused to lower financial independence? Is it because they're involved in less paying jobs? Let's explore economical data to find possible answers.
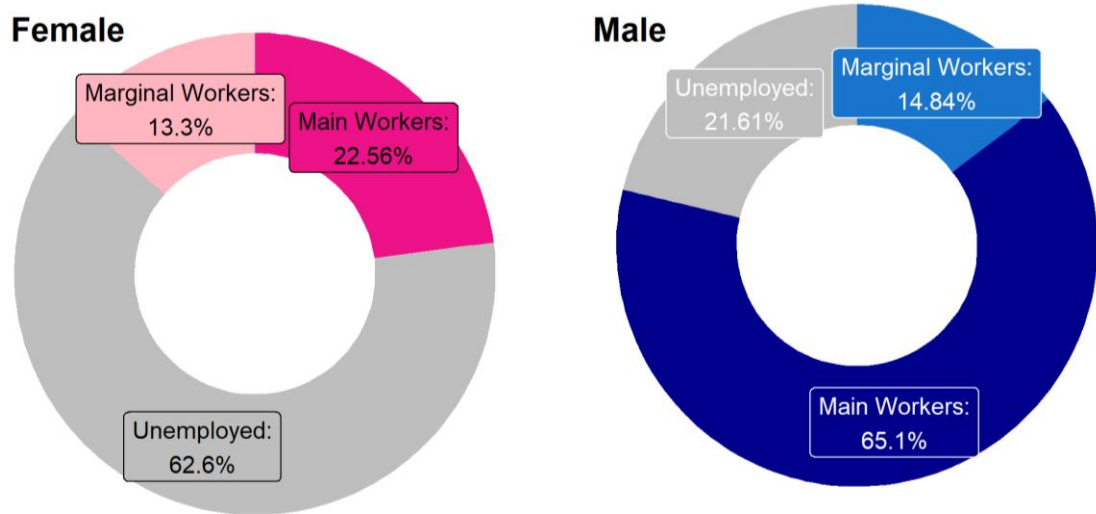
- Economical Sector

Before we start looking at purely economical data, let's see if there's any correlation between GDP and female literacy rate.

Relation between GDP & female literacy rate
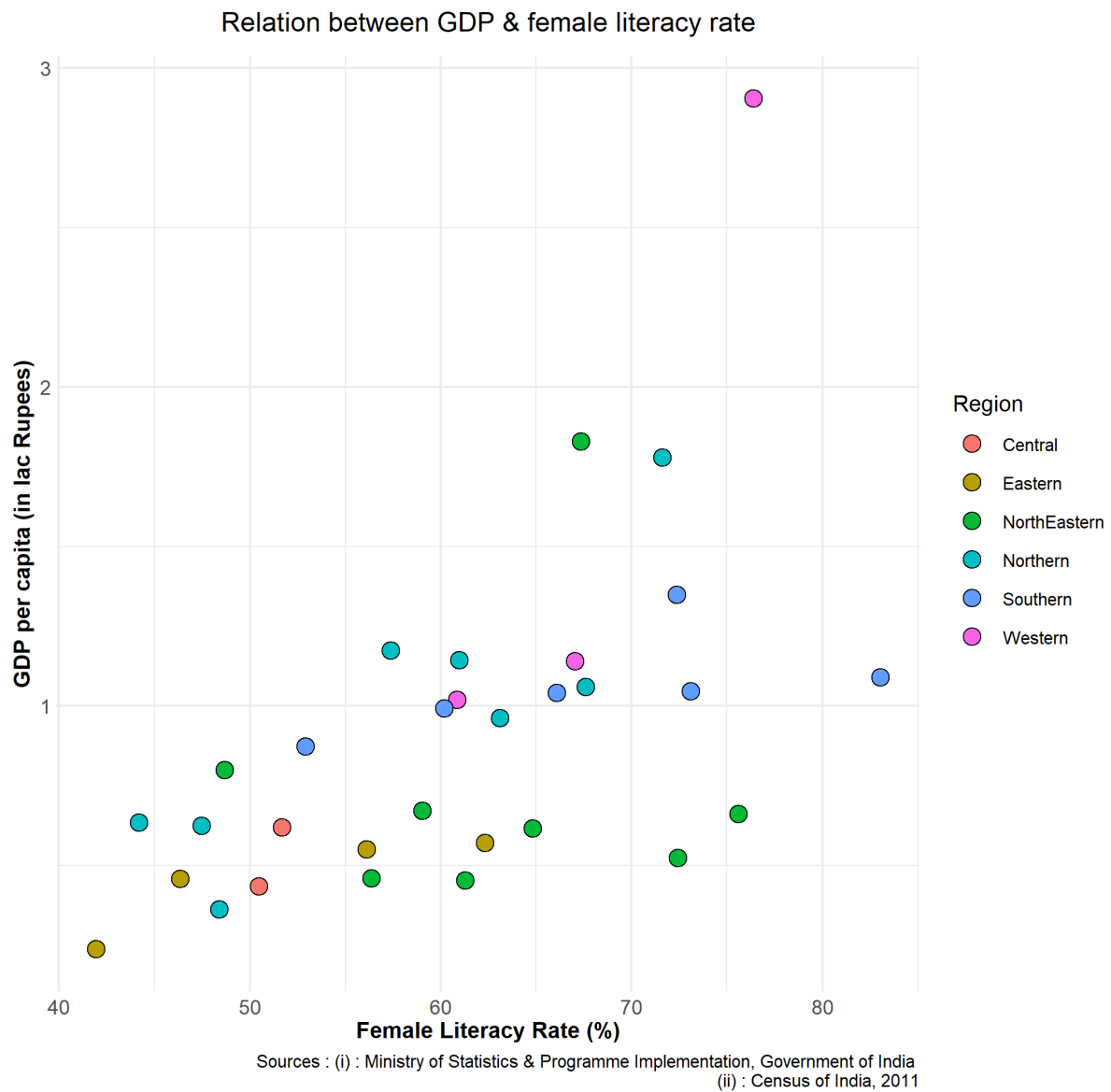
There seems to be positive correlation. Of course, correlation doesn't imply causation. In fact, this relation – increase in GDP and female literacy seems to be going on together. Literate humans are essential resource for growth of any state. On other hand, as a state grows, family's income and expenditure on education by state may improve resulting in more female literacy.

Now let's explore what is difference in employment rates for men and women. How many of them are main workers and how many are marginal workers.



**Female**

Marginal Workers: 13.3%

Main Workers: 22.56%

Unemployed: 62.6%

**Male**

Unemployed: 21.61%

Marginal Workers: 14.84%

Main Workers: 65.1%

Age : 15-60 years
Source : Census of India, 2011

The difference between unemployment rates is huge! The data consists of people of working age and 62.6% women are not involved in any sort of work. This is almost thrice as compared to men unemployment rate. The lesser women involved in economic activity means large share of Indian population is financially dependent. Not just that, it also limits their buying capacity which severally affects overall economy.

Let's compare state wise women unemployment now with choropleth map. One might guess that states with higher women literacy – southern and western states; which are also often viewed as more 'richer' states compared to other, shall have more women employment.

But the plot below tells us a different story.

# Women Employment Rate in various Indian states



Age : 15-60 years
Source : Census of India, 2011
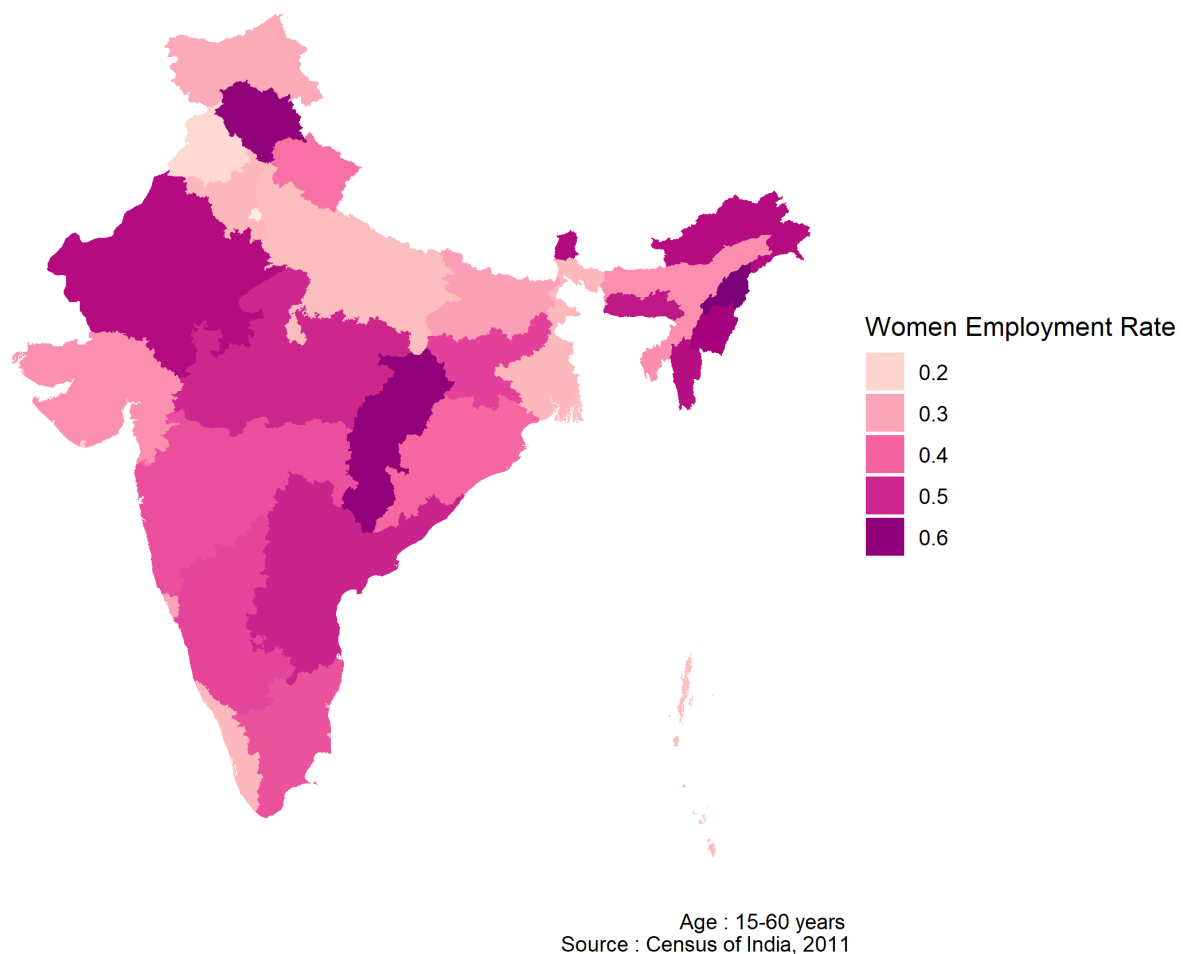
The very states like Chhatisgarh, Rajasthan and UP which were performing poorly on educational measures, now have highest employment rates! The north eastern states (apart from Assam), which are conventionally thought of as less developed rural states have more women employment rate which might go against population conceptions.  The same fact is reiterated by regional boxplot below which shows unemployment rate.

Region wise distribution of women unemployment rate

Age : 15-60 years
Source : Census of India, 2011
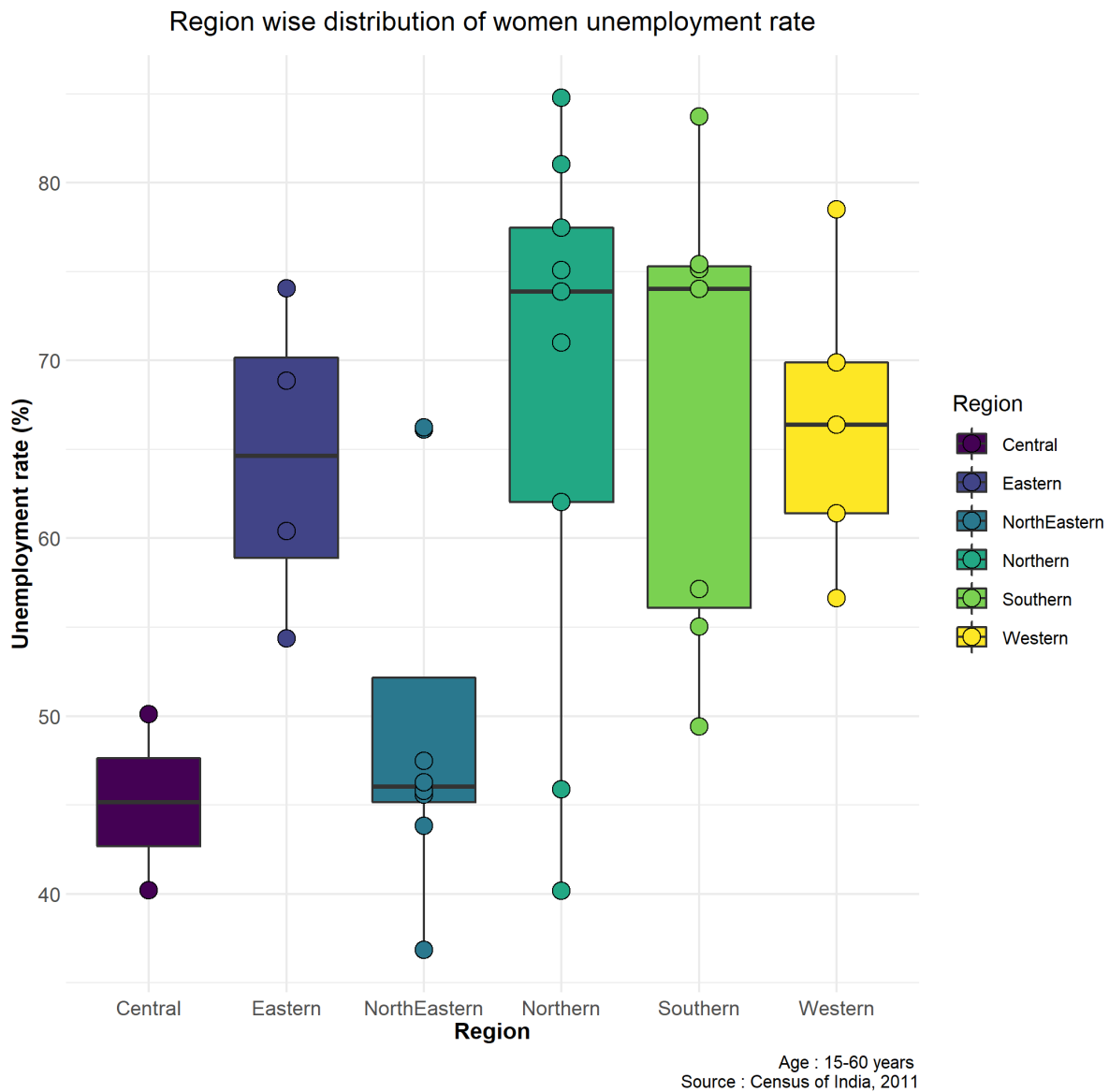
Central and North Eastern states have very less unemployment rate. Whereas Southern region has high unemployment. Is it so that richer states have, contradictorily, lesser employment rates? This relation can be best explored with help of a scatterplot showing how unemployment rate is changing with GDP.

Women unemployment is higher in richer states!
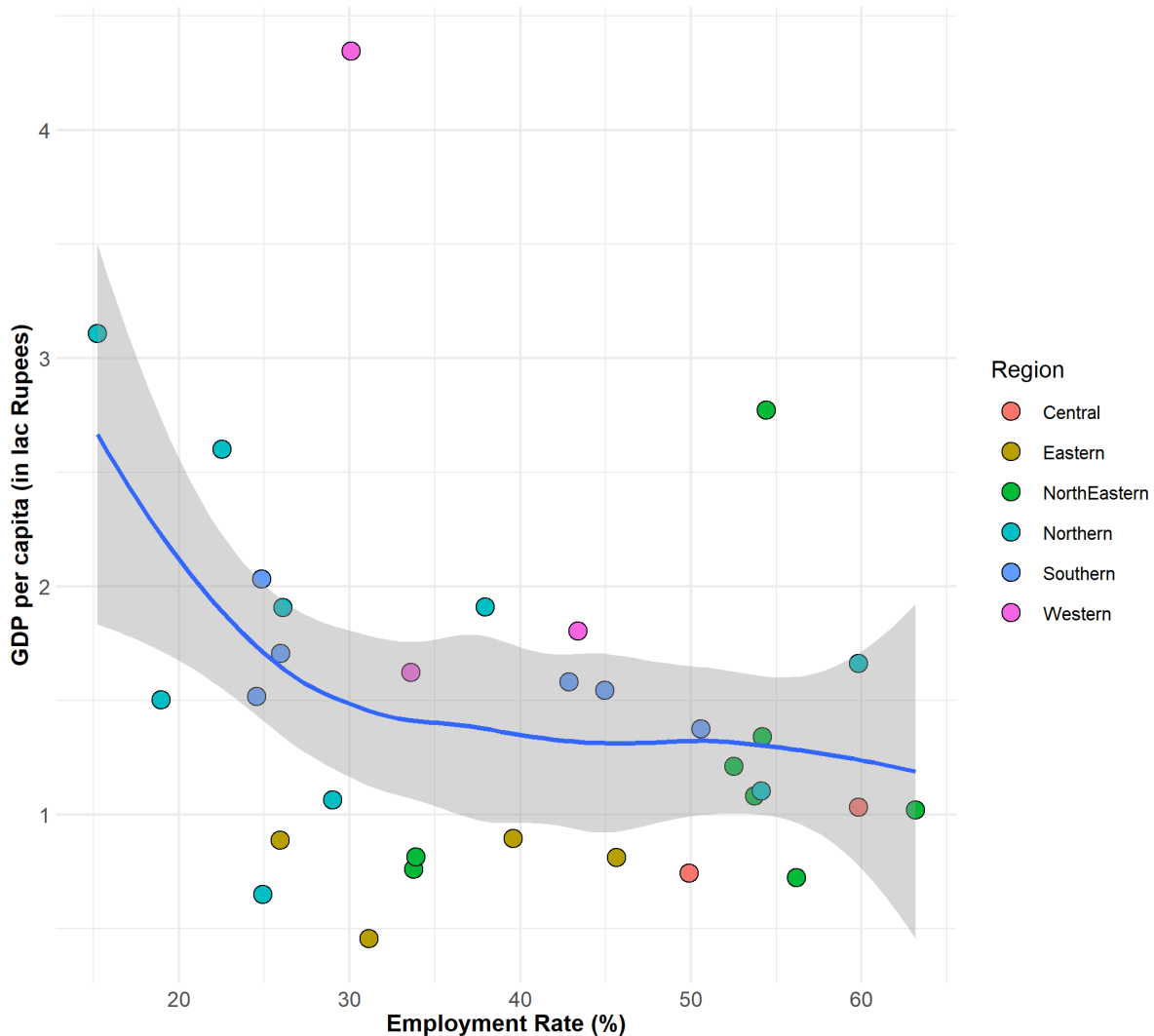
There is a weak negative correlation showing that GDP is higher in states where women employment rate is lower and GDP is lower in states having higher women employment rate. This might appear contradictory at first, but it shows that majority of women are employed in lesser paying, more labourous jobs. To understand this pattern, we have to understand which sectors do Indian women work in.
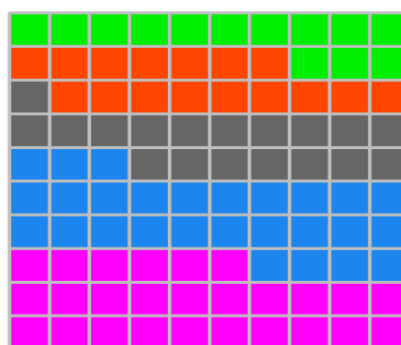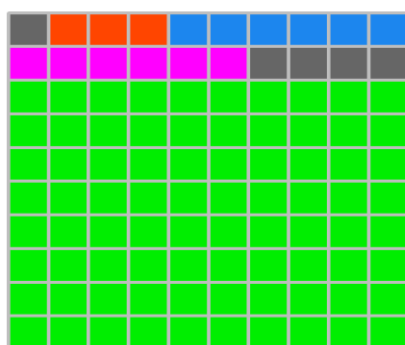
While there maybe again many ways to visualise this, waffle chart seems to be great in this case it readily conveys the message and is better than pie plots for the same.

Which sectords do Indian women work in?
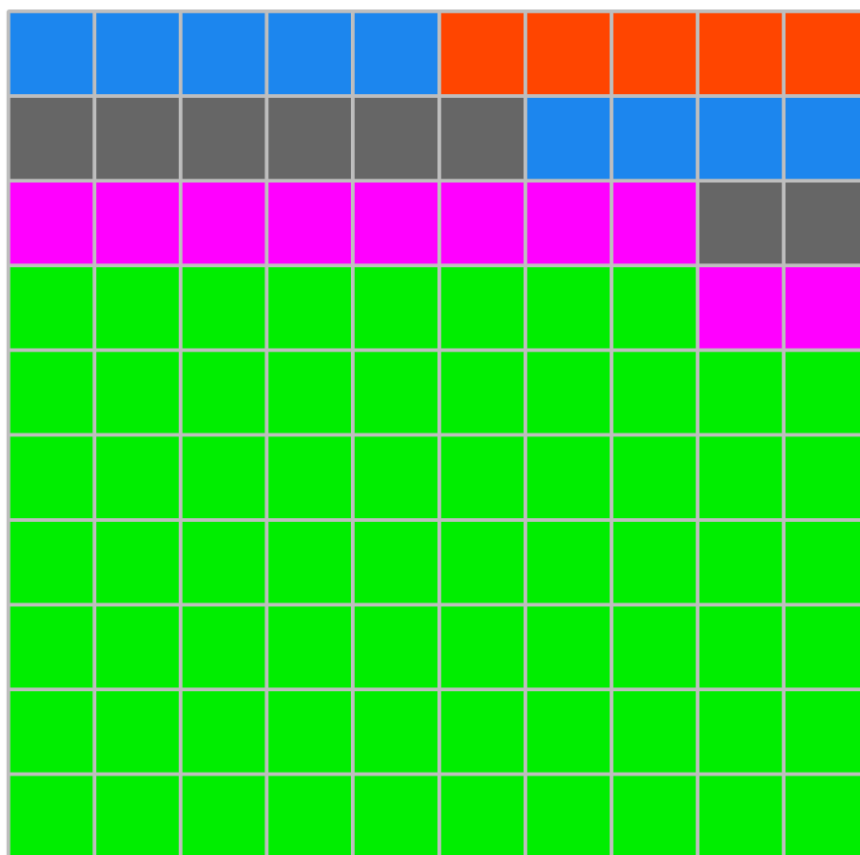


Sector  ▮ Agriculture & Allied  ▮ Other Services  ▮ Manufacturing  ▮ Others  ▮ Education, Health & Social Services

**Rural**                                    **Urban**



Majority of Indian women are employed in agriculture and allied activies like fishing, cultivating, cattle related business, etc. In rural areas, out of all employed women, 80% are employed in such activities

whereas economical activities are much diverse in urban areas. Let us see how agriculture employment rate varies with GDP of the states.

### Effect of GDP on Women Employment Rate in Indian states
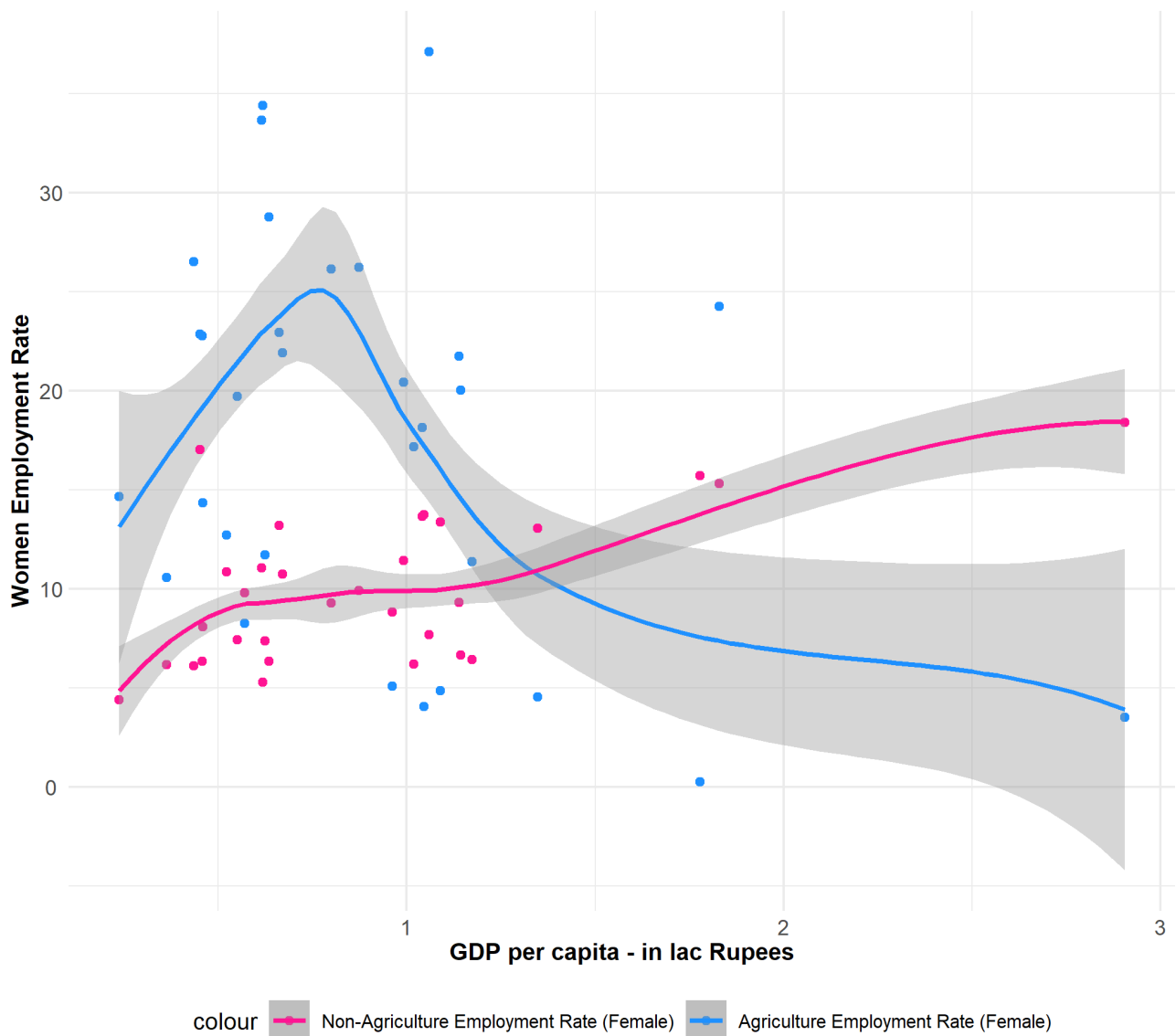
This chart shows women employment rate. Non-agricultural employment rate is shown with pink color, whereas agricultural employment rate is show with blue. The corresponding regression lines help us visualizing the trend.

We can conclude following from the plot,

When state is too poor i.e. it has very low GDP per capita, both kind of women employment is less. Moderately 'rich' states, i.e. states with moderate GDP probably have agriculture products as their main source of GDP. Naturally, agricultural employment rate peaks in these states whereas non-agricultural employment rate stays low to moderate. However, it turns out that with agricultural prodcuts as their main

products, these states cannot improve their GDP per capita after certain limit. In higher GDP per capita states, agriculutral employment rate shoots down while non-agriculutral employent shoots up. From this we can infer that increase in GDP led to people's transition from agricultural sector to non-agricultural i.e. industrial ones.

We've already seen that there's huge difference between female and male employment rates, let's see where this difference is larger. This time we will use connected dot plot, which is excellent at showing both figures simultaneously and the magnitude of the difference. In addition, by ordering states by how large the difference is, we can get information related to ranking at once.



Gender wise differences in Unemployment Rate

Census of India, 2011
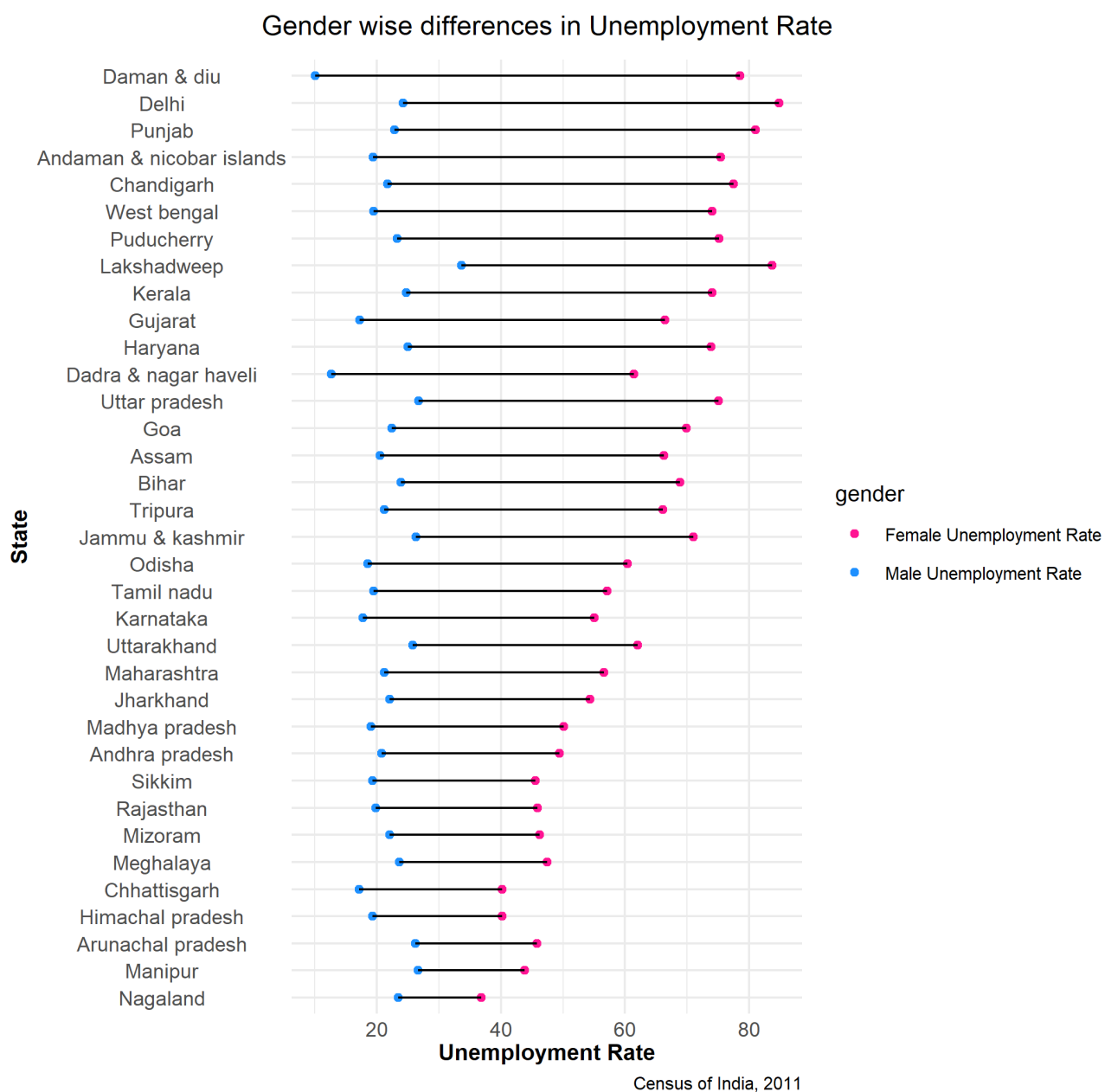
North eastern states have less difference between unemployment rates, which as we've seen above, can be attributed to fact these states have agriculture as their main economic activity.

- Demographical/ Health sector

There is an interesting correlation between population growth rate and women literacy rate. Mathematically, this is just a relation between two numerical quantities, which is best observed with scatter plot, but contextually it is very important. Why? Because population growth rate is an important demographical and health related measure. Though ideally, in family planning both parents shall have equal say – we wouldn't be too wrong to assume this decision previously was predominantly dominated by a man's say. Let's see how population growth rate varies with women literacy rate.
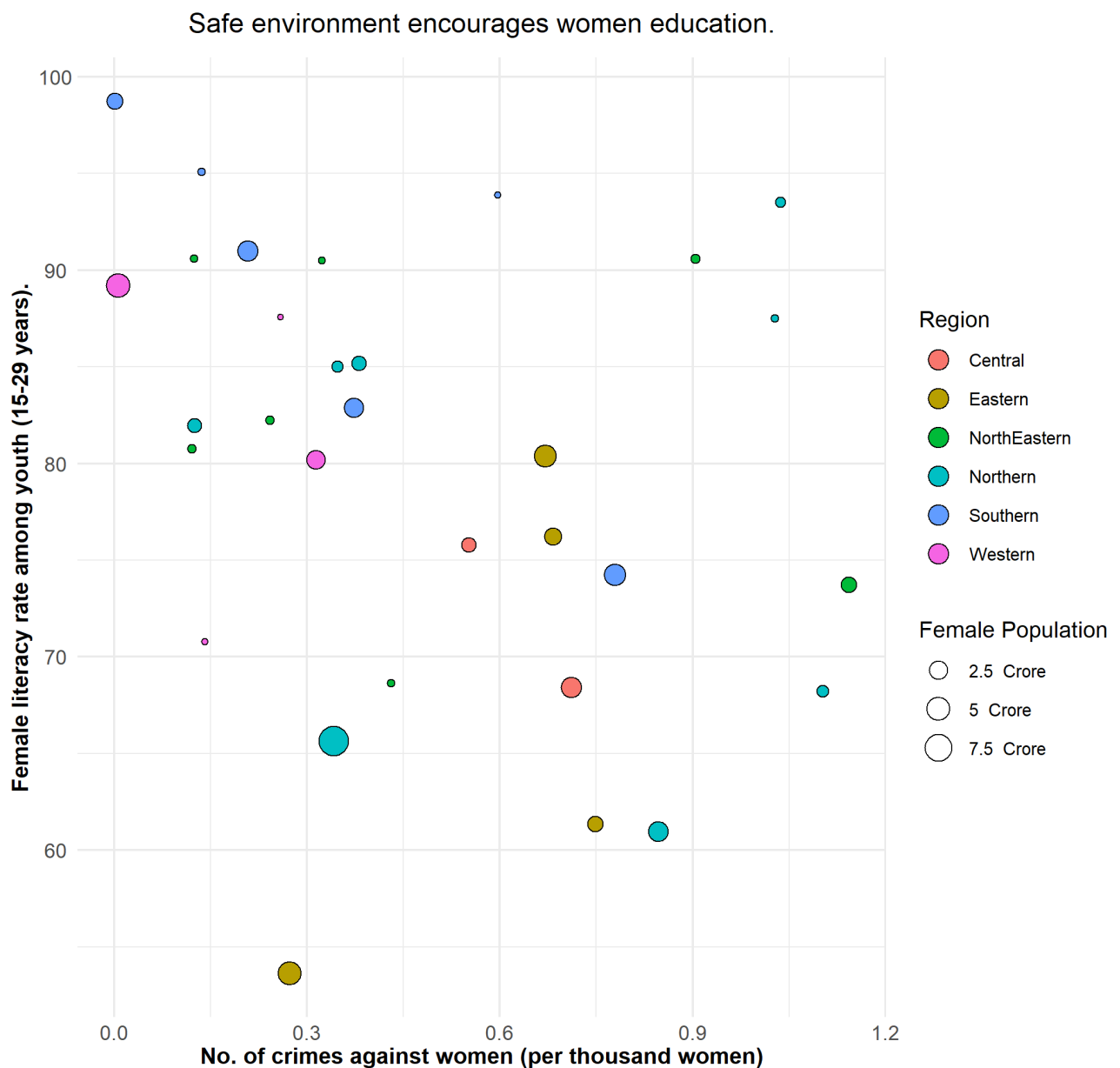


Effect of women education on population growth rate
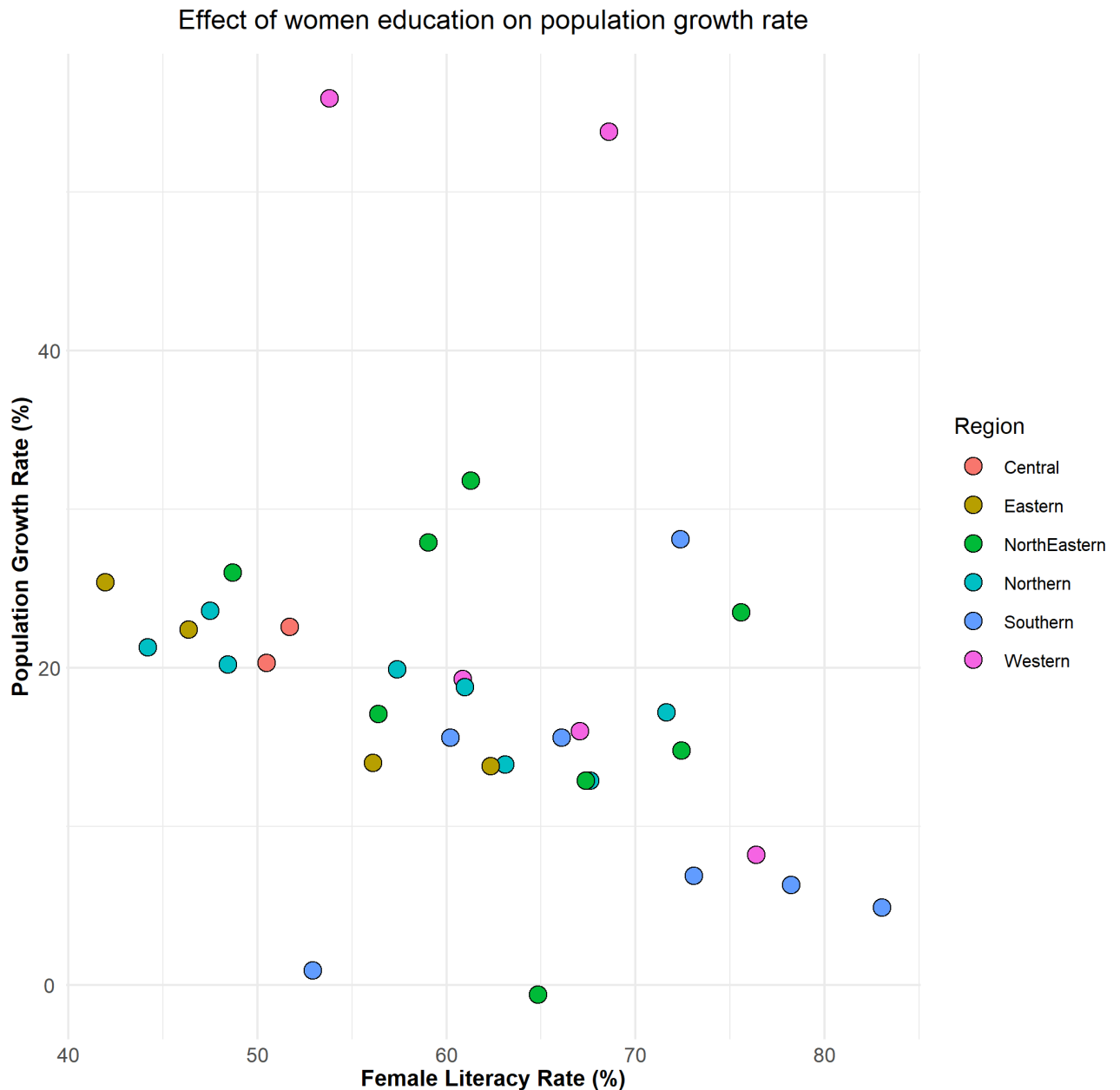
There is clearn negative correlation! In states with more literacy, decadel population growth rate is lower as compared to states where female literacy rate is very less. This says alot about how education plays a key role in empowering women.

- Crime

Crimes against women sadly remains one of the most challenging issue against India. Let's see which states have higher crime rates (crime per 1000 women), this time with treemap.
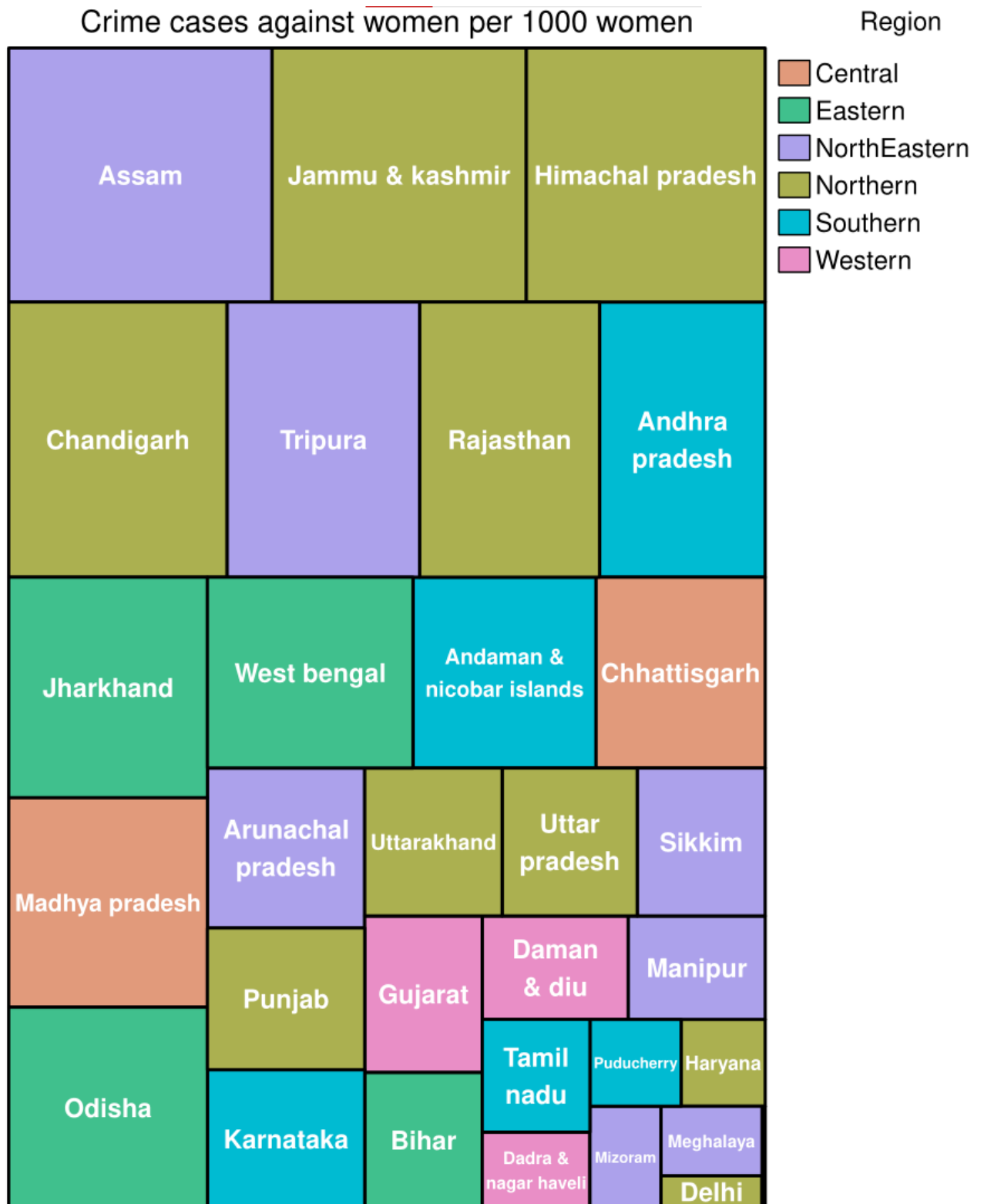
What are impacts of these crimes? There shouldn't be any doubt that questions against safety will hinder the growth of women empowerment in any state. Following plot shows impact of crime on education by showing correlation between crime rate and literacy rate.



Safe environment encourages women education.

Source : Open Government Data Platform & Census of India, 2011.

Again, a clear negative correlation shows that safe environment better encourages women (and as we are talking about just literacy, their parents) to get education. In rural villages, parents might not want to send a girl child for more education if there are risks against her safety.

It seems natural to ask that whether prevalence of higher crime rates has discouraged women from higher education. Because one might stop studying further if it involves moving in an unknown, lesser safe region.  Following scatter plot explores such a relation.

Prevalence of crime can discourage women from higher educatio.

Source : Open Government Data Platform & Census of India, 2011.

The plot shows correlation between crime rates and number of women who've at least graduated. There is a strong negative correlation, specially in states with larger populations. This tells us that such crimes do in fact discourage women from pursuing higher education.

## Conclusion

There are different states doing better in different sectors. Southern and Western states seem to be doing great when it comes to education. These states however have lesser women employment rate which is mostly due to fact that there is less agriculture in many of these states. Women in North Eastern states, Northern and Central states, have less education, however they have higher employment rates. Although this employment is mainly from marginal work in agriculture. Having not studied much, women in these states are working mainly in low paying agricultural jobs, but at least they are employed. There is a lot of scope of improvement in all states when it comes to women employment and this has a lot to do with social structure of India as well.

# Appendix A: List of Data Sources

| Sr. No. | Source | Name of dataset | Rename dataset to | Link |
|---|---|---|---|---|
| 1. | Census of India, 2011 | C-08 Educational Level By Age And Sex For Population Age 7 And Above (Total, SC/ST) (India & States/UTs-District Level) | `ed_level_above_7.xlsx` | Click on "India – C-08" from link |
| 2. | Census of India, 2011 | B-1 Main workers, Marginal workers, Non-workers and those marginal workers, non-workers seeking/available for work classified by age and sex(Total, SC/ST) | `workers.xls` | Click on "India – B-1" from link |
| 3. | Open Government Data Portal | Crime against Women during 2013 | `recovered_crime1.xls` | Download as xls from link. If you're prompted to recover file, click "Yes". |
| 4 | Ministry of Statistics and Programme Implementation | State Domestic Product and other aggregates, 2011-2012 series | `gdp.xls` | Download from link. |
| 5 | Open Government Data Portal | State-wise Population, Decadal Population Growth rate and Population Density - 2011 | `pop_growth.csv` | Download csv file from link. |
| 6 | Census of India, 2011 | B-17 Female Workers Classified By Industrial Category And Marital Status - 2011(India/State/UTs) | `f_workers.xlsx` | Download from link. Meaning of various categories can be read from this link. |
| 7 | Union Budget, Wikipedia | Literacy as seen in 2001 census. | `lit_rate_national.xlsx` | Original source (pdf) is down. Wikipedia cites same source and table is copied from there. |