Data Management Project - final part

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Research question

The 2023 Agenda for Sustainable Development puts a strong emphasis on advancing gender equality and the empowerment of women in leadership and decision-making roles within the framework of SDG 5: Gender Equality. Indeed, with women constituting almost half of every country's population, their inclusion in the decision-making process is key to ensuring more representation in politics.Beyond transforming social norms and ensuring diversity, research has also shown that the involvement of women in politics could lead to shifts in policy priorities by positively influencing legislation regarding social justice, education, and peace. For instance, O'Brien and Piscopo (2018) demonstrated that female representatives can diversify legislative agendas in favor of vulnerable groups, while Ramstetter and Habersack (2019) found that within the European Parliament, women were notably more supportive of environmental legislation than men. This suggests that increasing the number of women in the legislative process could have a positive impact on a country's development by shifting public policy orientations.

Therefore rather than focusing on how a countries of level of development could empower women , this paper aims to study how putting women in position of legislative power could improve the development of a country.

Our study aims to explore the correlation between the proportion of women occupying parliamentary seats and the implementation of public policies. We seek to analyze the interplay between women in parliament and various development and socio-economic indicators to identify recurring patterns. Thus, **we will investigate the extent to which the proportion of seats held by women in national parliaments influences public policy outcomes** by conducting an analysis across countries at the world level, the regional level, and within income groups to better understand the disparities and nuances within similar countries in terms of development.To account for different dimensions of a country's development and policy priorities, we will consider several indicators offering different lenses through which we can assess the influence of women in parliaments on public policies.We will first analyze basic development indicators such as the **Human Development Index (HDI) and the Annual GDP growth** to assess whether women's participation in decision-making correlates positively with

human and economic development. Given the existing correlation between higher development and gender equality, we will also conduct analyses within regions and income groups to see if there are any patterns.In addition, we will also introduce other economic variables such as the **Total Labor Participation Rate and the Female Participation Rate** to assess the correlation with employment and economic growth.Furthermore, this study also aims to investigate the outcome of public policies regarding gender development with indicators such as the **Gender Development Index (GDI) and the Women Business and the Law Index Score**, which reflects legal frameworks supporting women in business and law.To assess potential shifts in policy orientation towards social justice and equality rather than economic growth and military spending, we will incorporate the **Military Expenditure (% of GDP)** indicator and the **Gini Coefficient ,** which provides a measure for policies regarding income inequality and wealth distribution.Finally, we will evaluate the relationship between women parliamentarians and the priority given to environmental issues through the incorporation of the **Planetary Pressures-Adjusted Human Development Index (PHDI).**

Data sets descriptions

We will use a dataset that contains the variables that we want to study and some variables that will be used to compare the countries (income group, region of the world).

Size of the dataset

The dataset has 119 rows (countries) and 14 columns (variables).

Production condition

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Production condition

To create our dataset we used databases from the World Bank and the UNDP websites where we chose the variables we wanted to study in our project. Then we cleaned and we joined the different databases to keep all the information in one database. The process to clean and to join the databases is explained with more details in the annex.

Main variables

All the data is for the year 2021.

Proportion of seats held by women in national parliaments(in %)

We want to study the impact of the *share of women in parliament* on other variables. It is the percentage of parliamentary seats (single or lower chamber) held by women in a country.

Human Development Index

The *Human Development Index (HDI)* is a composite index that measures a country's average achievement in human development. It takes into account three dimensions: health, education, and standard of living. The HDI is calculated by taking the geometric mean of three normalized indices for each dimension: life expectancy at birth (health), mean years of schooling for adults aged 25 years and older, and expected years of schooling for children of school-entering age (education), and the gross national income per capita measured in logarithm (standard of living). (UNDP , 2023)

Gender Development Index

The *Gender Development Index (GDI)* is a variant of the HDI which measures gender inequalities in the achievement of human development. It takes into account the same dimensions as HDI while considering the disparities between men and women. The indicators for each dimensions are : female and male life expectancy at birth (health) , female and male expected years of schooling for children and female and male mean years of schooling for adults ages 25 years and older (education) and female and male estimated earned income (standard of living/command over economic resources).(UNDP , 2023)

Gini Coefficient

The *Gini coefficient* aims to measures income inequality within a population. It takes a value from 0 (perfect equality) to 1 (perfect inequality).

GDP Growth (annual %)

The *Annual GDP Growth* is the annual percentage growth rate of GDP at market prices based on constant local currency. According to the World Bank's (2023) definition , the GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It aims to measure economic growth.

Planetary Pressures- Adjusted Human Development Index

The *Planetary Pressures-Adjusted Human Development Index (PHDI)* is also a variant of the HDI which discounts from the HDI the pressures on the planet. It is the level of HDI adjusted by carbon dioxide emissions per person (production-based) and material footprint per capita to account. With no pressures on the planet, it is equal to the HDI. It integrates environmental and sustainability concerns into the measurement of Human Development. (UNDP , 2023)

Labor force participation rate , total (% of total population ages 15+)(modeled ILO estimate)

The *Labor force participation rate* is the proportion of the population ages 15 and older that are economically active. Here "economically active" concerns "all people who supply labor for the production of goods and services during a specified period". (World Bank , 2023).

Labor force participation rate , female (% of female population ages 15+)

The *Female Labor force participation rate* is the proportion of the female population ages 15 and older that are economically active.

Women Business and the Law Index Score (scale 1-100)

The *Women Business and the Law Index Score* is an Index developed by the World Bank that measures on a scale from 1 to 100 how laws and regulations affect women's economic opportunity. It is computed by taking the average score of 9 indices (Mobility, Workplace, Pay, Marriage, Parenthood, Entrepreneurship, Assets and Pension). (World Bank, 2023)

Military expenditure (% of GDP)

The *Military expenditure* (% of GDP) includes the proportion in the GDP of all current and capital expenditures on the armed forces, including peacekeeping forces; defense ministries and other government agencies engaged in defense projects; paramilitary forces. It aims to measure a nation's prioritisation of defense spending relative to its overall economic activity. (World Bank , 2023)
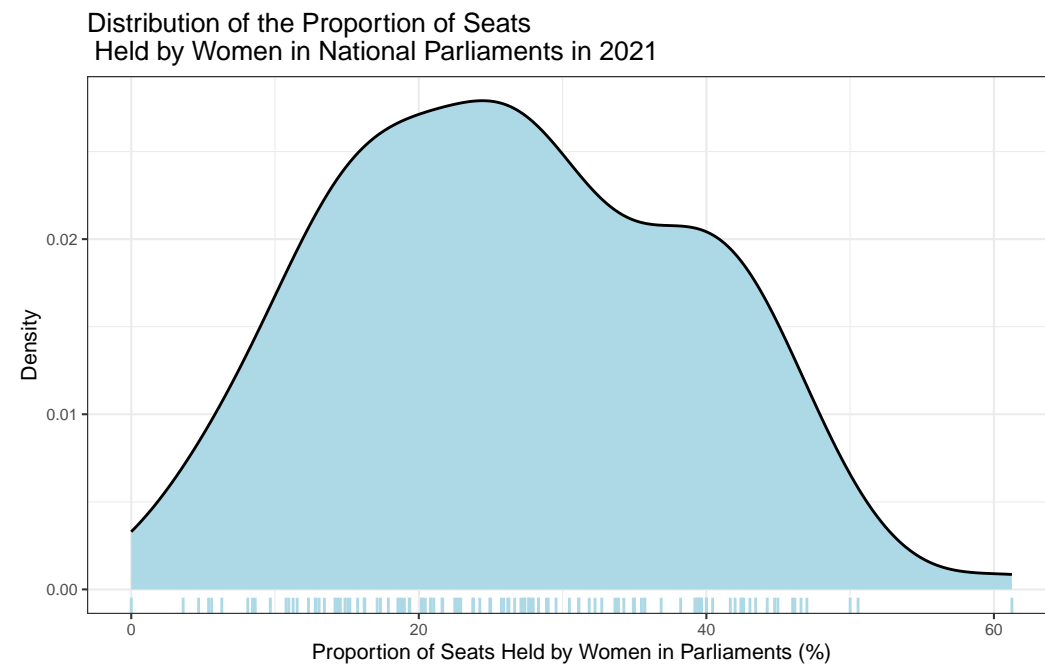
Data analysis

General presentation of our main variable

We will start by giving a general presentation of our main variable: the **Proportion of seats held by women in national parliaments in 2021**.
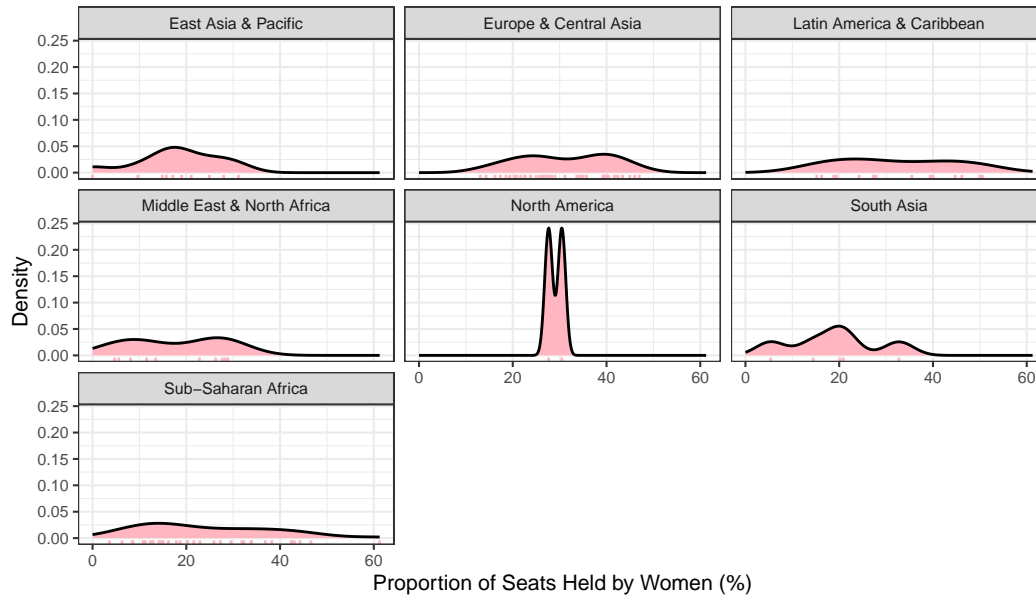
Distribution

In the World

Distribution of the Proportion of Seats
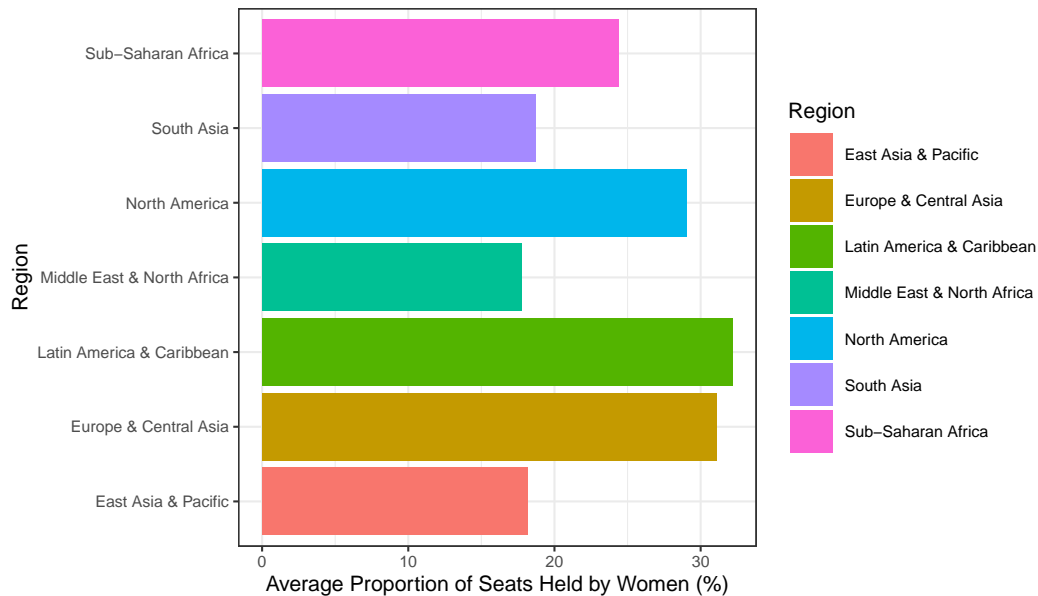Held by Women in National Parliaments in 2021

The worldwide mean share of female parliamentarians is 26.5388061. Thus , at the world level , women occupy less than half of the seats in parliaments on average.

Distribution conditioned on the region

Distribution of the Proportion of Seats
Held by Women in National Parliaments by Regions in 2021

Average Proportion of Seats
Held by Women in National Parliaments by Regions in 2021

The average proportion of seats held by women in national parliaments is the highest in Latin America & Caribbeean region followed by European & Central Asia . The lowest share of women parliaments is in the East Asian & Pacific region and South Asia. The difference might be driven by the level of economic development in this region. Thus, we will further our

analysis by looking at the distribution of income groups within those regions.

## Distribution of Income Groups within Regions

We see that the average share of female Parliamentarians is lower in East Asia & Pacific than in Sub-Saharan Africa whereas most of Sub-Saharan countries have a lower income than East Asia & Pacific countries . Thus, we could think that national income and share of female parliamentarians are not really related. However, we also observe that for almost all the regions, the share of female parliamentarians vary a lot within the region. The exception is North America where we see that we have a spike around 30%. We know North America is mostly composed of high income countries whereas in other regions the level of development can vary a lot from a country to another. This can lead us to think that for countries that are part of the same income group the proportion of seats held by women in national parliament would not vary a lot so that is what we are going to see now.

Distribution conditioned on the Income Group

Distribution of the Proportion of Seats
Held by Women in National Parliaments by Income Groups in 2021
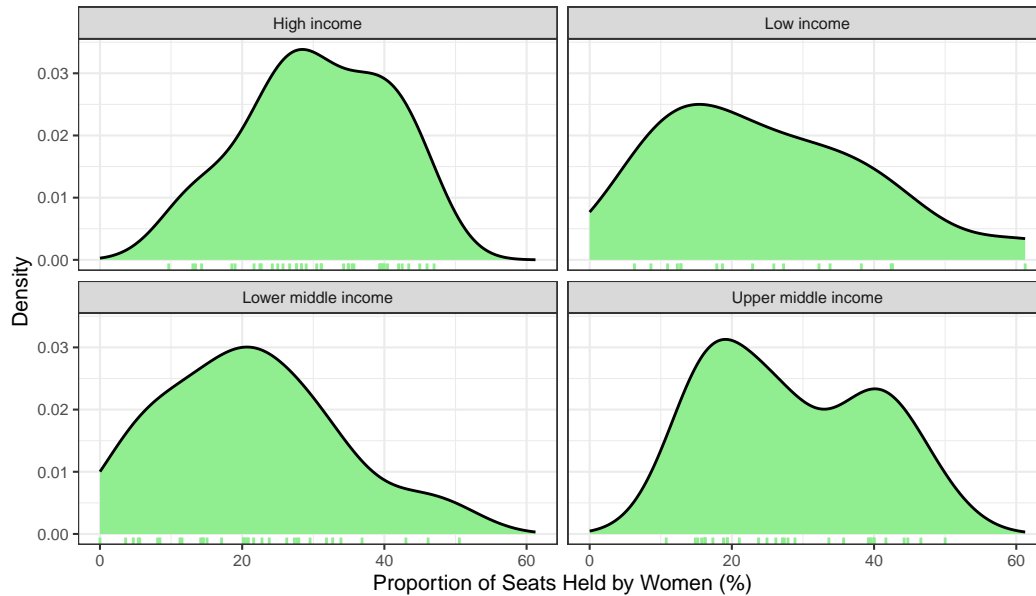
Average Proportion of Seats Held by Women in National Parliaments
by Income Group in 2021
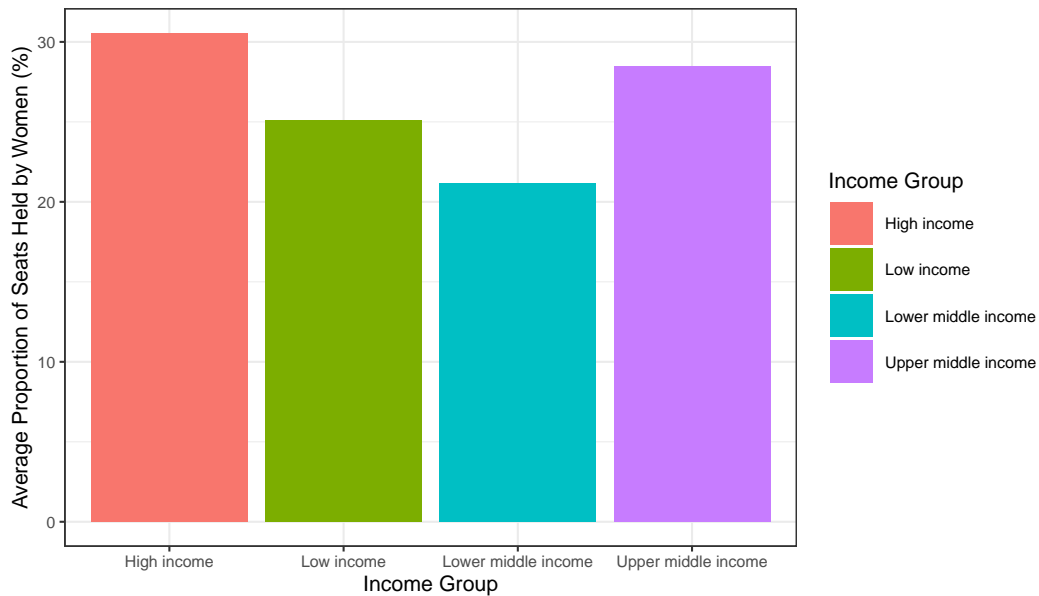
Thanks to the plots, we can clearly see that the proportion of female parliamentarians vary within the countries that are part of the same income group. We also see that higher income countries have a higher average share of women parliamentarians than the others but the difference is not huge. Also, we see that low income countries have more female parliamentarians

than lower middle income countries. In conclusion, based on these basic plots and statistics, we would be tempted to say that there is no evident correlation between the proportion of female parliamentarians and national income or region of the world.

Correlation matrix

To try to go deeper, we will study the correlation matrix between our variables.

The correlation matrix gives us a general idea about relationships between our target variable (share of women in Parliaments) and the other variables. We can see that the variables that are more correlated (positively) with the share of women in national parliaments are the Women Business and Law Index Score, the GDI, the HDI and the PHDI. We also see that the HDI and the PHDI are strongly positively correlated which we will have to take into account later in our analysis.'

Table 1: Correlation matrix

|	GDI_val	HDI_val	Gini_coef	PHDI	Proportion of seats held by women in national parliaments (%)	Labor force participation rate, female (% of female population ages 15+) (modeled ILO estimate)	Labor force participation rate, total (% of total population ages 15+) (modeled ILO estimate)	GDP growth (annual %)	Women Business and the Law Index Score (scale 1-100)	Military expenditure (% of GDP)
GDI_val	1.000	0.673	-0.160	0.642	0.290	0.314	0.171	0.304	0.625	-0.146
HDI_val	0.673	1.000	-0.470	0.922	0.233	-0.099	-0.194	0.221	0.548	0.042
Gini_coef	-0.160	-0.470	1.000	-0.405	-0.026	0.222	0.294	0.041	-0.156	-0.042
PHDI	0.642	0.922	-0.405	1.000	0.230	-0.215	-0.291	0.289	0.472	0.070
Proportion of seats held by women in national parliaments (%)	0.290	0.233	-0.026	0.230	1.000	0.199	0.146	0.187	0.450	-0.148
Labor force participation rate, female (% of female population ages 15+) (modeled ILO estimate)	0.314	-0.099	0.222	-0.215	0.199	1.000	0.925	-0.030	0.401	-0.304
Labor force participation rate, total (% of total population ages 15+) (modeled ILO estimate)	0.171	-0.194	0.294	-0.291	0.146	0.925	1.000	-0.033	0.226	-0.276
GDP growth (annual %)	0.304	0.221	0.041	0.289	0.187	-0.030	-0.033	1.000	0.351	-0.134
Women Business and the Law Index Score (scale 1-100)	0.625	0.548	-0.156	0.472	0.450	0.401	0.226	0.351	1.000	-0.192
Military expenditure (% of GDP)	-0.146	0.042	-0.042	0.070	-0.148	-0.304	-0.276	-0.134	-0.192	1.000

Conclusion of our general analysis of the main variable

As we know this analysis is not sufficient to make deep conclusions, we will now see in more details the impact of a high or low share of female parliamentarians on more specific topics.

Impact of the share of women in parliament in the development of a country

Impact of the share of female parliamentarians on the annual growth rate of the GDP

According to the **Growth Theory and the Solow model**, countries that have a low growth rate of the GDP are the countries that are near their steady-state which means that they are already highly economically rich. We chose the GDP growth rate and not the GDP because the GDP growth rate reflects more the impact of the public policies.

The impact of the share of female parliamentarians on the GDP annual growth rate in 2021
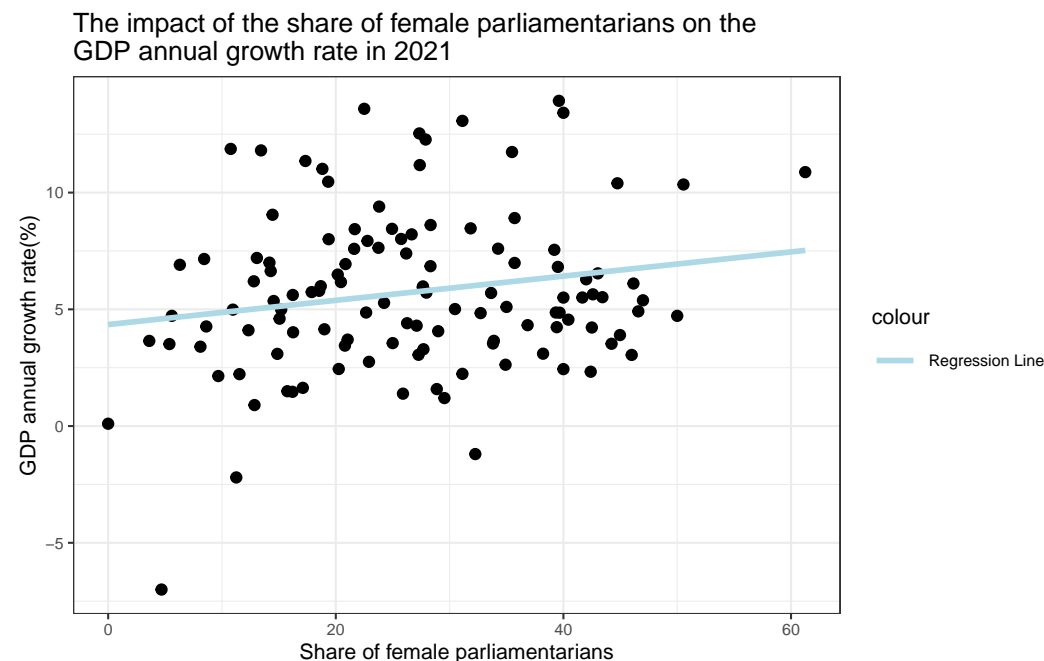
Based on the plot and the regression line, it seems that there is a slight positive correlation between the share of female parliamentarians and the GDP annual growth rate. However, the points are scaterred: the GDP annual growth rate vary a lot for the same level of share of female parliamentarians. We can do a t-test to see if our variable has a significant impact on the GDP annual growth rate.

At a significance level of 5%, the variable "Proportion of seats held by women in national parliaments (%)" is significant. At a significance level of 1%, the variable "Proportion of seats held by women in national parliaments (%)" is not significant.

Table 2: Linear Regression Results

term	estimate	std.error	statistic	p.value
(Intercept)	4.348	0.737	5.90	0.000
'Proportion of seats held by women in national parliaments (%)'	0.052	0.025	2.06	0.042

Table 3: Linear Regression Results

term	estimate	std.error	statistic	p.value
(Intercept)	0.649	0.034	19.13	0.000
'Proportion of seats held by women in national parliaments (%)'	0.003	0.001	2.59	0.011

Impact of the share of female parliamentarians on the HDI

The impact of the share of female parliamentarians on the HDI in 2021
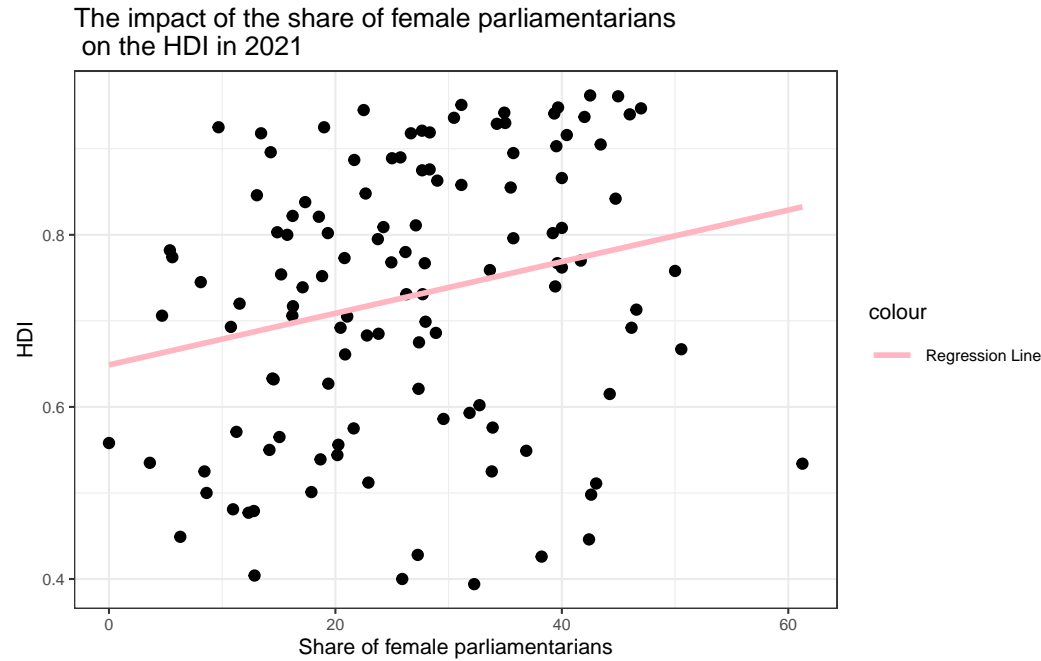
Again, we observe a lot of disparity between the points. For the same level of share of female parliamentarians we have countries that have a high HDI value and countries that have a low HDI value. Since the share of female parliamentarians is more correlated with the HDI than with the GDP annual growth rate, we will further the analysis of the relationship between the share of female parliamentarians and the HDI. We can do a t-test to see if our variable has a significant impact on the HDI.

At a significance level of 5%, the variable "Proportion of seats held by women in national parliaments (%)" is significant. At a significance level of 1%, the variable "Proportion of seats held by women in national parliaments (%)" is not significant.

Table 4: Linear Regression Results

term	estimate	std.error	statistic	p.value
(Intercept)	66.758	2.883	23.16	0
'Proportion of seats held by women in national parliaments (%)'	0.537	0.099	5.45	0

Does female parliamentarians support women's status?

Now, we want to see if women that have the legislative power tend to favour women's conditions in the society. To illustrate that, we are going to study the impact of the share of female parliamentarians on the Women Business and the Law Index Score because we saw in the correlation matrix that these two variables had a higher correlation coefficient. We also could have used the female participation rate but the correlation coefficient is not really high so a further analysis will not be really useful.

Women Business and the Law Index Score Scale

The impact of the share of female parliamentarians on the Business and the Law Index Score in 2021
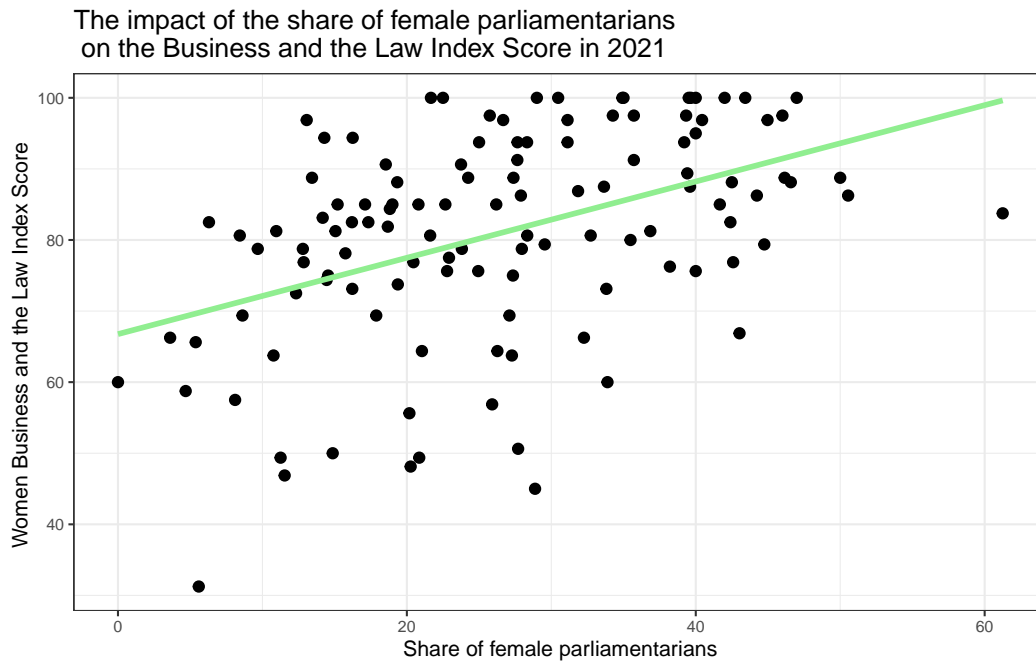
It seems that the relationship between the two variables have a positive relationship. To go deeper into the analysis, we will do a t-test.

According to our results, the share of female parliamentarians is significant to explain the Women Business and the Law score index at a significance level of 1%.

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We could ask ourselves if there is a reverse causality: is it the share of female parliamentarians that influence the Women Business and the Law score index or is it the opposite ? As we said earlier, the Women Business and the Law score index takes into account 9 indices: Mobility, Workplace, Pay, Marriage, Parenthood, Entrepreneurship, Assets and Pension. Some of this indices can influence women's empowerment and inclusion the political sphere. Therefore, we cannot assess the causality efficiently between the share of female parliamentarians and the Women Business and the Law score Index.

Women in Parliaments and policies favoring social justice

To assess potential shifts in policy orientation towards social justice and equality rather than economic growth and military spending , we will first assess the link between the **Military Expenditure (% of GDP)** and the proportion of women in parliaments to see whether women are more or concerned by defense matters. Then, we're going to analyse the link between women in parliaments and social justice by focusing on the correlations with the Gini coefficient to assess whether more gender representation in parliaments would favor more policies reducing inequalities .

Impact of the share of women parliamentarians on Military Spending.

Relationship between Women in Parliaments and Military Expenditure
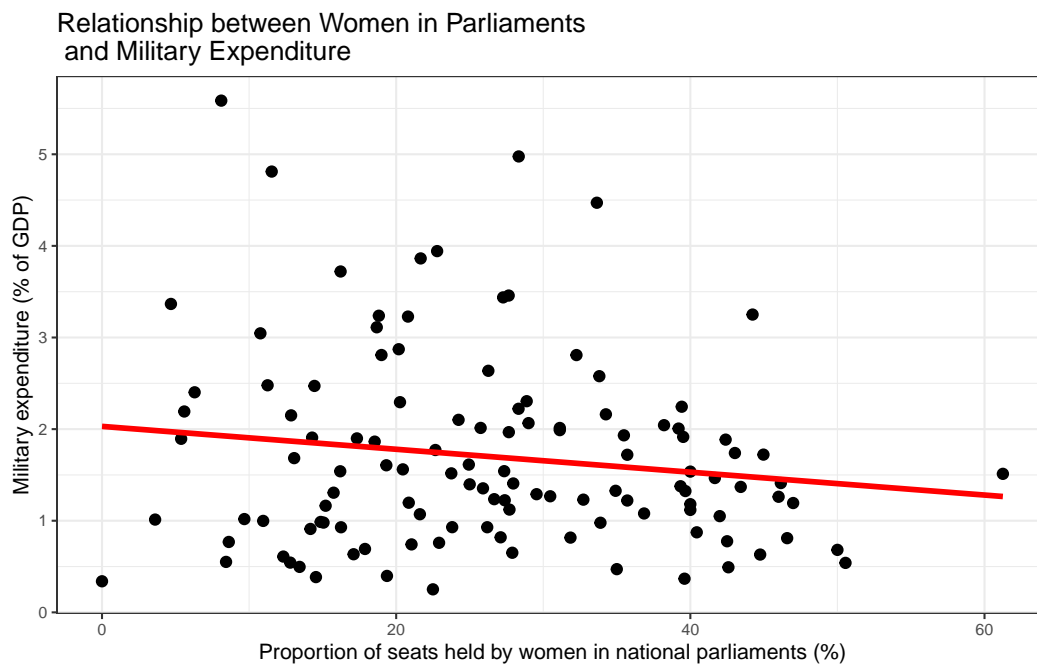
The correlation matrix suggests that that there is a weak negative correlation between Military Spending and Women in Parliaments , which is also illustrated the scatter plot.We thus suspect

term	estimate	std.error	statistic	p.value
(Intercept)	2.030	0.226	8.97	0.000
'Proportion of seats held by women in national parliaments (%)'	-0.012	0.008	-1.61	0.109

that there is no causality between those variables . To further assess whether there is causality , we will perform a linear regression

The p-value is over 0.05 , so the proportion of seats held by women in national parliaments is not a significant variable. There is indeed no causal relationships between those two variables.

Impact of the share of women parliamentarians on inequalities.

The correlation coefficient between the proportion of seats of women is close to 0 (-0.026) according to the correlation matrix. Thus, we can deduce that there is no significant relationship between the Gini index and the share of women parliaments at the national level.

From this analysis , we can deduce that more representation of women in national parliaments does not significantly entails more public policies favoring social justice and equality or national defense.

**Women in Parliaments and environmental policies**

This section will focus on the impact of more women in legislative institutions on environmental policies by highlighting the correlation between the proportion of seats held by women in national parliament and the PHDI , which we chose as an indicator for the environmental performance of a country . The correlation matrix suggest that the Planetary Pressures-Adjusted Human Development Index and HDI are highly correlated , thus we expect similar conclusions.

Impact of the share of women parliamentarians on the PHDI

We know that HDI and PHDI are strongly correlated (0.922) so the results are quite identical.

Table 6: Linear Regression Results

term	estimate	std.error	statistic	p.value
(Intercept)	0.564	0.026	22.05	0.000
'Proportion of seats held by women in national parliaments (%)'	0.002	0.001	2.06	0.042
'GDP growth (annual %)'	0.008	0.003	2.87	0.005
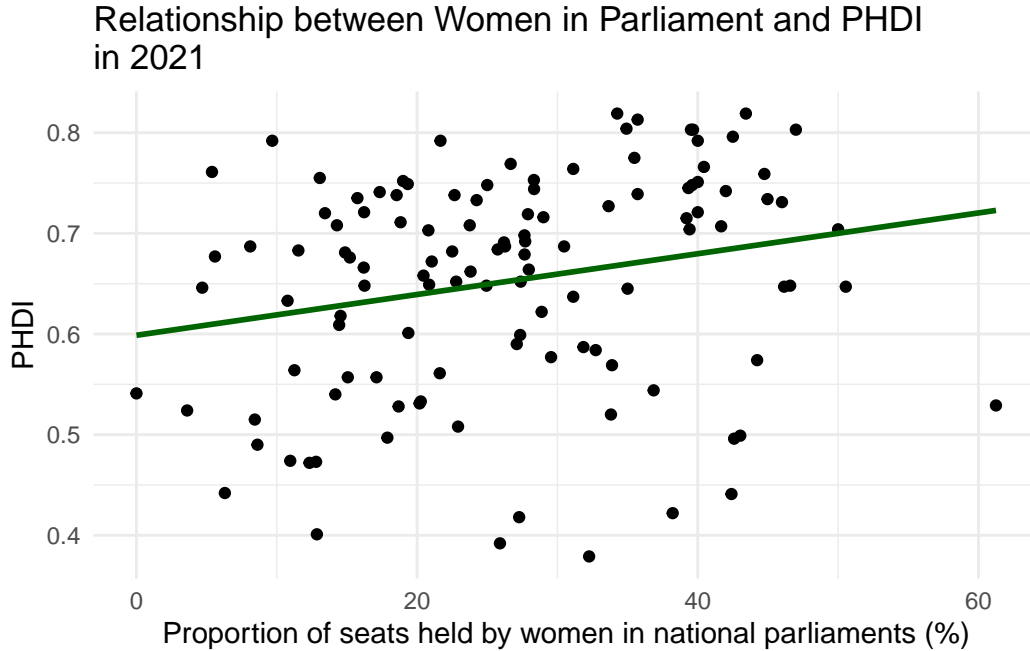
Relationship between Women in Parliament and PHDI in 2021

The correlation coefficient between the proportion of seats held by women in national parliaments and the PHDI (0.230) and the scatter plot suggest there is a weak positive correlation between women parliamentarians and the PHDI.

To assess whether there is causality , we will perform a linear regression to asses the impact of women parliamentarians on the PHDI. The level of development of a country might also drive the PHDI since developing countries pollute more than developed ones , so we controlled for this variable with the GDP variable.

The regression suggests that both the proportion of seats held by women in national parliaments and GDP growth are significant at a 5% confidence level since their p-value is inferior to 0.05.

These results indeed suggests that there might a causality between the number of women in parliaments and policies that protect the environment. However , there might be other variable that impact both of these variables simultaneoulsy. Therefore , we cannot conclude that there

is causality between those two variables since we need to perferm futher regression with other variables that are not included on our dataset to fully confirm this causal relationship.

Conclusion

In conclusion , our results suggests that the proportion of seats occupied by women in national parliaments seems to not have an influence on national defenses , policies that aim to reduce inequalities as there is not a significant correlation or causation links between women in parliaments and the variables Military Spending and the Gini Coefficient. For the Women and Business Law Index Score which measures how laws and regulations affect women's economic opportunity , there is a strong possibility that there might be a positive causality. However, there might be a case of reverse causality : positive women's conditions can favour the access to political functions for women. When it comes to the standard of living, environmental policies and economic development, there is a positive correlation. Our linear regressions also suggest a positive causality. However we did not incorporate enough control variables that might impact both of the number of women in parliaments and theses variables simultaneously. Therefore , the results drawn from our dataset suggest that there might be a a link between the number of women in parliaments and public policies that favour economic growth , the environment and the conditions of women. To further analyse the causality between those variables, other regressions that incorporate more control variables need to be performed to efficiently assess the causal relationship.

Even if we found that the share of female parliamentarians can have a relationship with other variables, our results have to be hold with a grain of salt since we may have biased models. Moreover, the correlation between the share of female parliamentarians and most of the other variables are weak (cf: correlation matrix). This leads us to think that in reality, the share of female parliamentarians may have a weak impact on government policies. If this is true, we can make one conclusion: the gender of the parliamentarians does not have a significant impact on government policies so there is no reason to reject the presence of women in the legislative body. If it is really the case, why are there still countries that have a low share of female parliamentarians ? We saw that the share of female legislators does not depend on the income group, the disparities are more present between the different regions. The share of female parliamentarians can depend on culture and other variables rather than the level of development of a country. For example, Japan is a high income country but the share of female parliamentarians is equal to 9.68% which is far below the world mean (26.53%) while Nicaragua is a Low middle income country and has a share of female parliamentarians equal to 50.5% (two times the world average). Thus, the reasons behind the amount of female parliamentarians may be specific to each country.

Annex

Description of the data joining and cleaning

Data Cleaning

World Development Indicators Dataset

The first step involved cleaning the World Development Indicators dataset in order to convert the missing values denoted as ",", into NA values.In addition , we converted the data type of the value of each indicator from string to numeric, while making sure to change the decimal indicator from "," to "." for RStudio to correctly identify the value as a decimal number.

UNDP Databases

For the UNDP Databases (Human Development Indices), this step involved selecting the columns of the variables we are interested in , changing the decimal indicator from "," to "." and renaming the columns in order to have uniform names across all databases.

Meta-data Databases

For the Meta-data Databases for both the World Bank's and the UNDP's databases , this step involved selecting the columns with the variables we are interested in and renaming them to ensure the uniformity of the variables' names across the datasets.

Data Joining

Meta-Data and Databases

For the UNDP datasets , we computed a function to simplify the joining process with the meta-data. The aim of the function is to perform a left join with the UNDP and the meta-data databases, rename the columns names and delete the country name column from the final dataset in order to join them with the main dataset (World Development Indicators) afterwards.

Because some countries' names were computed differently in the meta-data database, we computed them manually by creating a separate dataset with the countries' names (as in the UNDP datasets) and their country code and binded them to the initial UNDP meta-data database.

For the World Bank database , we joined the meta-data with the regions and the income groups by country code to the World Development Indicators database.

As a last step , we joined the UNDP databases to the World Development Indicators' one.

Final Dataset

Finally , we created the final dataset by using the pivot_wider() function in order to transform the world development indicators into columns to have separate variables. Then, we eliminated all the countries that had at least one NA .

Github link

https://github.com/inesdamiche/dataman_project.git

Sources

United Nations Development Programme (2023). Human Development Index. [online] United Nations Development Programme. Available at: https://hdr.undp.org/data-center/human-development-index#/indicies/HDI.

United Nations Development Programme (2023). Gender Development Index. [online] hdr.undp.org. Available at: https://hdr.undp.org/gender-development-index#/indicies/GDI.

United Nations Development Programme (2023). Planetary pressures–adjusted Human Development Index. [online] hdr.undp.org. Available at: https://hdr.undp.org/planetary-pressures-adjusted-human-development-index#/indicies/PHDI.

World Bank (2023). GDP Growth (annual %) | Data. [online] Worldbank.org. Available at: https://data.worldbank.org/indicator/ny.gdp.mktp.kd.zg

World Bank (2023).. Women Business and the Law Index Score (scale 1-100) | Data. [online] Available at: https://data.worldbank.org/indicator/SG.LAW.INDX.

The World Bank (2023). Military expenditure (% of GDP) | Data. [online] Worldbank.org. Available at:https://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS.

O'Brien, D.Z. and Piscopo, J.M. (2018). The Impact of Women in Parliament. *The Palgrave Handbook of Women's Political Rights*, pp.53–72.

Ramstetter, L. and Habersack, F. (2019). Do Women Make a difference? Analysing Environmental Attitudes and Actions of Members of the European Parliament. *Environmental Politics*, 29(6), pp.1–22.