Women Parliamentarians and Deforestation Around The World

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Abstract

Deforestation has now taken the center stage in the climate change debate which has become a heavily politicized process. We argue that involvement of women in that process can be instrumental in reducing deforestation. We find significant and robust evidence for this hypothesis in a cross-section of 163 countries covering 1990–2010. Our results have important policy implications and call for wider involvement of women in the climate change debates and policy making.

Keywords: women; parliament; environment; deforestation.

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1. Introduction

Deforestation has now taken the center stage in the climate change debate[2].Indeed, according to the UN estimates, about 11 percent of global greenhouse gas emissions is a direct result of the annual loss of about 12 million hectares of the planet's forests[3].At the same time, Intergovernmental Panel on Climate Change argues[4] that "the most cost-effective mitigation options in forestry are afforestation, sustainable forest management and reducing deforestation". In that light, it should be seen as a natural development that during the 2015 UN climate change meeting in Paris known as COP21, the global community formally recognized the key role that resilient forests and landscapes play for curbing global warming[5].

Unfortunately, very often, climate change debate finds itself in the midst of political confrontations, in which the outcome is largely dependent on the personal characteristics of the political decision makers and their preferences. A vivid example is the political discourse in the US, where, in President Obama's words[6], the Republicans seem to be the only major party in the world that is in denial of anthropogenic nature of climate change and, therefore, unwilling to accommodate any policies designed to curb global warming by introducing constraints on economic activity. However, the extant literature on the antecedents of climate change seems to have largely focused on assessment of national level characteristics affecting contribution to global warming via carbon dioxide emissions (Jorgenson, 2007; Roberts et al., 2003; Schofer and Hironaka, 2005; York, 2008; Obydenkova et al., 2016; Obydenkova and Salahodjaev, 2016) and much less on the political determinants, such as political regimes (Libman and Obydenkova, 2014) and the

[2] Deforestation is only one of many ideas that are being circulated within the climate change debate both from academics and practitioners. They include infrastructure upgrades, expansion of renewable energy solutions and propagation of vegetarianism among others. See "10 Solutions for Climate Change" available at http://www.scientificamerican.com/

[3] See, e.g. "COP21: UN spotlights need to protect forests and agriculture to improve livelihoods, feed the world" from December 1, 2015, available on www.un.org

[4] See "Summary for Policymakers" in the "5th Assessment Report" available at http://www.ipcc.ch/

[5] In fact, there has been some criticism of the language. For example, documents use words like "encouraged to" or "should" instead of more legally binding "shall". See, e.g., red-monitor.org among others.

[6] See, e.g. "Obama: GOP is the 'only major party in advanced world' to deny climate change" at http://www.theguardian.com/environment/2015/dec/18/obama-year-end-press-conference-climate-change-republicans

social determinants of green policies, such as the role of gender relationships in the society (Ergas and York, 2012).

In this paper, we aim to fill that gap in the literature and hypothesize that involvement of women in the political process can be instrumental in curbing deforestation. Women today become heads of states, occupy powerful parliamentary seats and are increasingly seen to be championing important political decisions with primary objective of improving long term social welfare. It has become a stylized fact in the literature that women are more pro-social than men when it comes to important investment and consumption decisions (Duflo, 2012). That is economic development empowers women and empowering women fosters economic development. Indeed, there is a growing body of literature documenting positive impact of women's participation in political power on child mortality rates (Miller, 2008), public health spending (Mavisakalyan, 2014), more development focused infrastructure investments (Chattopadhyay and Duflo, 2004; Goldstein and Udry, 2005), education spending (Clots-Figueras, 2011), primary education attainment rates (Clots-Figueras, 2012), government honesty (Chen, 2013), etc. Yet, women still remain substantially under-represented in parliaments around the globe with less than 20 percent of seats occupied by female parliamentarians.

Global appeal for women's active involvement in environmental policy making can be dated back to 1992, when the United Nations called for women to participate in environmental decision-making at all levels (Buckingham, 2010), based on the idea that voluntary regulation of population, and the unique role that women will enjoy with gender empowerment, help preserve the environment and achieve sustainable development[7]. Indeed, there seems to be a direct link between women's empowerment and better environmental policies as, in general public, women are consistently documented to report stronger environmental concerns than men (Bord and O'Connor 1997; Zelezny et al., 2000; McCright, 2010). A recent paper by Sundström and McCright (2014), importantly for our study, confirms this results for women politicians as well. Similar premise has been echoed in the literature on women's political interests (Tremblay, 1998, Reingold, 2000,

[7] See "General recommendations made by the Committee on the Elimination of Discrimination against Women" available at http://www.un.org/

Wangnerud, 2009). However, empirical research seems to produce mixed results (McAllister and Studlar, 1992, Esaiasson and Holmberg, 1996; Jones, 1997, Jensen, 2000; Stokes, 2005; Fredriksson and Wang, 2011) and we aim to shed more light on the effect of women's participation in legislature on environmental outcomes.

In this paper, we examine the effect of proportion of seats in national parliaments held by women on deforestation in a cross-section of 163 countries. We find that allowing more women into legislative power has a positive effect on reducing deforestation. Our paper can be viewed as complementary to Ergas and York (2012) which finds that more women politicians implies lower anthropogenic gas emissions. However, we extend the analysis into a specific mechanism of reducing carbon dioxide emissions. The latter can be achieved via a variety of ways which have been discussed by researchers for decades[8], including trimming consumption of fossil fuels, climatic engineering aimed at changing Earth's reflectivity as well as reforestation and reducing deforestation. Among these, cutting consumption is likely to have a negative effect on economic growth, at least in the short run. Engineering solutions are likely to be associated with substantial financial costs. Forests are probably the most win-win in terms of supporting economic development and addressing anthropogenic global warming. Hence, our results have important policy implications.

The rest of the paper is structured as follows. The following section discusses the data used in our study as well as construction of variables. Section 3 reports the results of our empirical analysis leading to the conclusion in Section 4.

2. Data

We employ a cross-country dataset containing information on 163 countries for the period of 1990–2010. The research period account for importance of post-Communist regime transition in Europe and the external impact of the European Union on democratization in neighboring states (e.g., Obydenkova 2008; 2012). The sample covers the majority of low-, middle- and high-income nations from all geographical

[8] See, e.g. a survey paper by Nordhaus (1993).

regions[9].Because of low variation in the share of female parliamentarians within our sample[10], our key independent variable, which comes from The World Bank's World Development Indicators, we divide our data into four five-year periods and create a four-period longitudinal dataset with countries as units of observation. Conveniently, doing so also addresses the following important issue. The time period of 1990–2010 includes some major economic shocks that the global economy experienced. Specifically, they are:

- Collapse of the former Soviet Union along with the whole camp of socialist economies leading to the emergence of numerous transition economies;
- Asian financial crisis of 1997 leading to the Russian default in 1998;
- Global financial crisis of 2008 which caused recession in many countries for a number of years that followed.

Creating four five-year periods in the panel results in four time dummies each of which covers exactly one of the above events.

For the dependent variable, deforestation rate, we take the average change in annual forest cover within each five-year period. For interpretational convenience, we change the sign of the dependent variable so that deforestation rate is represented by positive values. We assess the share of women in parliaments, the key independent variable in our study, by the corresponding percentage of parliamentary seats occupied by females in the first year of each period. This is done with the purpose of addressing possible endogeneity problems since with this approach we will be regressing deforestation rates, which aggregates five annual observations throughout each period, against female representation in parliaments, which is observed at the beginning of the each period.

In order to address the possible omitted variable bias, we include various determinants into empirical specifications that can explain the variation of the rate of change in forest cover. Namely, we include such explanatory variables as the GDP per capita, which captures overall level of economic development and income levels,

[9] Our sample is substantially more representative of the global population and covers longer time span than that of Ergas and York (2012), whose sample consisted of just over 100 countries.

[10] For countries with two chambers of the parliament, data on the proportion of seats held by women in national parliaments only considers women in the lower chamber.

democracy index to account for efficiency of institutions and social norms as well as the cereal yield as a proxy for technology. Lastly, to address the possible simultaneity problem arising between existing forest stock and deforestation rates, we include logged total forest area into the empirical model.

Formally, our empirical specification is given by the relationship below:

$$DEFORESTATION_{it}=\alpha_i+ \alpha_t+ \alpha_t WOMEN_{it}+X_{it}\beta+\varepsilon_{it} \quad (1)$$

where *DEFORESTATION* is the average annual deforestation rate in country *i* at period *t*; *WOMEN* is the share of women parliamentarians; *X* is the vector of control variables (including the GDP per capita, democracy index, cereal yield, etc.); α_i and α_t are region and time fixed effects respectively. Table 1 contains key summary statistics of our dataset.

[INSERT TABLE 1 ABOUT HERE]

3. Main findings

The main findings of our study are reported in Table 2. Column 1 reflects the coefficient estimates for a simple linear regression model using the share of women in parliament as the independent variable. As expected, female representation in cabinet, on average, has a negative relationship with deforestation rates. That is, the higher is the number of parliamentary seats occupied by females the lower is the rate of change of deforestation in a given nation. Specifically, our results suggest that, when no controls are included, a 10 percentage point increase in the share of female parliamentarians reduces national deforestation rate by nearly 0.13 percent.

To address possible omitted variable bias, we include a number of covariates in our alternative specifications for ordinary–least–squares (OLS) estimations. Specifically, to account for the level of economic development in individual countries, we control for the GDP per capita, including its squared and cubic terms for easier interpretation of the environmental Kuznets curve (EKC) for deforestation. Results reported in column (2) lend support to the U–shaped relationship between GDP per capita and deforestation rates, with the minimum point in this specification reached at approximately USD 50 thousand. The

coefficient for females in cabinet remains significant at 5 percent level, suggesting that the share of women in parliament is an important antecedent of deforestation rates.

Finally, we include controls for democracy index, cereal yield and log of forest cover in an alternative specification the results of which are reported in column (3). The coefficient of democracy index suggests that the rates of deforestation, on average, are higher in less democratic nations. At the same time, positive coefficient of the forest stock indicator provides evidence that the influence of females in parliament on deforestation rates is not biased by the size of existing forest cover. Finally, more developed technology, measured in cereal yield, appears to help lower deforestation rates. Thus, the coefficients of all these covariates have meaningful signs and are statistically significant at 1, 5 and 10 percent level, respectively.

Despite the strong results obtained and reported above, there may be endogeneity issues potentially driven by reverse causality mechanisms. Should this be the case, for example, due to possible correlation of the share of women in parliaments and deforestation rates with other unobserved and omitted variables in empirical specifications reported above, the OLS estimates can be biased and inconsistent. Accounting for region and time effects can enable us to control for some of such omitted variables, such as geography and climate. However, they are time invariant and, therefore, these fixed effects estimates will fail to account for time variant variables excluded from our empirical model.

To address this empirical issue as well as to ensure that we capture the true direction of causality, we perform more empirical estimations of relationship (1) by employing an instrumental variable (IV) approach. Given that the main variable of interest in our study is the deforestation rate, the IV approach entails finding such variables, instruments for the share of females in parliament that are not related with deforestation processes. In column (4) we instrument the share of females in parliament with the share of Muslim population and prevalence of anemia among pregnant women (in percent). The choice of these instruments is motivated by the extant literature. For instance, there are studies that show that female labor force participation rates are inherently lower in Muslim countries (Spierings et al. 2009), while higher prevalence of anemia among pregnant females reduces the rates of human capital accumulation among women (Bobonis et al.,

2006). Therefore, it is plausible to assume that these two variables can be instrumented for the number of female representatives in national parliaments.

The two stage least squares estimation for IV approach is reported under column (4) and the results suggests that adjusted R-squared from the first stage regression shows that instruments capture approximately 28 percent of cross-country differences of females in cabinet representation. The credibility of the instruments is also supported by the first-stage F-statistics (F=17.22; p=0.00). The instrumented share of females in parliament is negative and statistically significant at 1 percent level. Thus, our findings suggest that a 10 percentage point increase in instrumented share of females in parliament reduces deforestation rates by nearly 0.9 percent (more than half the standard deviation).

[INSERT TABLE 2 ABOUT HERE]

Finally, we expand our analysis of the role of institutions to ensure robustness of our baseline findings, the results of which are presented in Table 3.First, since we are exploring legislative bodies of government, our results may be potentially driven bycross-national differences in legal environments. Indeed, legal origins have been shown to be strongly associated with economic freedom (Nattinger and Hall, 2012), financial development (Beck et al., 2003) and property rights (Levine, 2005). By using a binary variable for legal origin, we can control for this important factor and report the results in column (1). Similar to previous findings, the coefficient of the share of females in parliament is negative and significant, indicating that the relationship between female policymakers and management of forest cover is not driven by cross-national differences in legal origins.

Furthermore, a number of recent studies document a non-linear relationship between democracy and deforestation and democracy (Li and Reuveny, 2007). For instance, Buitenzorgy and Mol (2011), using a sample of 177 countries show that democracy has inverted U-shaped effect on deforestation. Moreover, deforestation rates decline as the countries pass the democratic transition peak. Therefore, following Andersen (2002), the authors argue that immature pre-democratic countries cannot enforce environmental policies at the initial stages. However, as a country introduces more

democratic institutions, marginal social benefit of environmental policies increases making them more effective. As a result, governments in such nations are inclined to introduce more innovative environmental policies along with the enforcement of existing policies.

Hence, to control for these issues we also add democracy index to our model and report the corresponding findings in column (2). Indeed, our estimates show a statistically significant inverted U-shape relation between democracy and deforestation rate. The results for the share of females in parliaments also remain stable.

Lastly, in column (3) we report an alternative specification with a vector of controls that includes average GDP growth rates, population density and population growth rates. Of these variables only population growth and population density are positive and statistically significant, suggesting that deforestation rates increase due to higher demographic growth. Again, we find the coefficient of female parliamentarism to remain robust.

[INSERT TABLE 3 ABOUT HERE]

4. Conclusion

Parliament is a place where different groups of a society gather together to determine a country's economic, political and social agenda directed at improving nation's welfare. For the past couple of decades, the issue of female participation in parliamentary decisions and parliament per se has been subject to a scrutiny.

While the benefits of reducing gender inequality in political and economic decision-making is universally accepted, females still remain substantially under-represented in parliaments around the globe. Up-to-date, average female occupation of parliamentary seats is rather modest and accounts less than 20 percent.

In this study we present the evidence that more active participation of females in parliamentary decision-making results in favorable sustainable development agenda. Specifically, we report evidence that more extensive participation of women in parliaments positively reflects on deforestation rates. Our results, based on a cross-country panel dataset covering 163 countries over two decades, are robust to various specifications and estimation methods.

This provides novel evidence on a specific mechanism, reducing deforestation, through which women's involvement in high level political decision making can contribute to curbing global warming. Debates about anthropogenic global warming have become heavily politicized in many countries and our contribution helps shed light on one way to advance the debate effectively, that is through inviting more women into the process.

We believe that further research in this direction could focus on the micro level analysis of how political negotiations proceed with regard to climate change and how women manage to affect the outcomes.

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TABLES TO BE INSERTED IN THE PAPER

Table 1. Descriptive statistics

Variable	Description	Mean	St. Dev.	Min	Max
Deforestation	Average five-year change in forest cover (%)	0.061	1.375	-8.861	10.217
Women	Proportion of seats held by women in national parliaments (%)	12.051	9.304	0.000	48.800
Forest stock	Logged forest area (sq. km)	9.282	3.170	0.000	15.907
GDP per capita	GDP per capita, PPP (constant 2011 international $)	13.872	17.442	0.247	114.840
Democracy index	Average of civil rights and political liberties	3.551	2.035	1.000	7.000
Cereal yield	Cereal yield ('000 kg per hectare)	2.542	1.820	0.131	15.000

Table 2. Main findings

	(1) OLS	(2) OLS	(3) OLS	(4) IV 2SLS
Women in parliament	-0.013**	-0.015**	-0.017***	-0.063**
	(0.007)	(0.007)	(0.006)	(0.029)
GDP per capita		-0.073***	-0.074***	-0.082***
		(0.015)	(0.014)	(0.016)
GDP per capita squared		0.002***	0.002***	0.002***
		(0.001)	(0.001)	(0.001)
GDP per capita cubic		-0.000***	-0.000***	-0.000***
		(0.000)	(0.000)	(0.000)
Democracy index			-0.079**	-0.111***
			(0.033)	(0.031)
Cereal yield			-0.072**	-0.102**
			(0.031)	(0.044)
Forest cover (log)			0.065**	0.079***
			(0.029)	(0.028)
Constant	-0.209	0.171	0.268	0.942**
	(0.148)	(0.168)	(0.537)	(0.422)
N	626	593	543	536
adj. R^2	0.115	0.166	0.181	0.061

Notes: Standard errors in parentheses; In all regression we control for time and region fixed effects; * p<0.1, ** p<0.05, *** p<0.01

Table 3. Robustness tests

	(1)	(2)	(3)
Women in parliament	-0.0135**	-0.0188***	-0.0194***

	(0.0067)	(0.0064)	(0.0065)
Legal origins: Great Britain	-0.2680		
	(0.3058)		
Legal origins: France	-0.3301		
	(0.3024)		
Legal origins: Socialist	-0.6629**		
	(0.3227)		
Legal origins: Scandinavian	-1.1434***		
	(0.3941)		
GDP per capita	-0.0816***	-0.0667***	-0.0664***
	(0.0166)	(0.0169)	(0.0176)
GDP per capita squared	0.0019***	0.0017***	0.0017***
	(0.0005)	(0.0005)	(0.0005)
GDP per capita cubic	-0.0000***	-0.0000***	-0.0000***
	(0.0000)	(0.0000)	(0.0000)
Forest cover (log)	0.0866***	0.0861***	0.0963***
	(0.0190)	(0.0190)	(0.0211)
Democracy		0.3975***	0.3353**
		(0.1466)	(0.1536)
Democracy squared		-0.0572***	-0.0502***
		(0.0182)	(0.0189)
Population density			0.0002**
			(0.0001)
Economic growth			-0.0056
			(0.0112)
Population growth			0.0865*
			(0.0507)
Constant	-0.1267	-1.1219***	-1.2985***
	(0.4707)	(0.4290)	(0.4459)
N	589	589	576
adj. R^2	0.2051	0.2119	0.2185

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01