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Women's representation in parliament and tax mobilization

Thon T.C. Hoang[†]

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Abstract

Some studies show that the higher share of female politicians enhances the implementation of policies that benefiting for women such as childcare services, childcare spots, antenatal and childhood health services, and early education. As a result, they encourage women to participate in labor market. It is also suggested that women have higher tax compliance level and countries having higher proportion of women undergo lower corruption level. This research attempts to examine the relationship between female politicians and tax revenue mobilization. If the positive relationship is proven, there is a fiscal reason to support female politicians and the policies benefiting women. In this study, panel data of 137 countries from 1998 to 2019 will be combined with fixed effect models. The results show the positive influence of the female politicians on tax mobilization. The positive influence is still significant when year effect, interaction variables with income groups, and exponents are included in the model. The study also indicates that while the presence of female politicians in parliament has no discernible impact on tax revenue in high-income groups, in other income groups, a 1 percent increase in female representation in parliament corresponds to a 0.1 percent increase in tax revenue as a percentage of GDP.

Keywords: Female politicians, tax mobilization, fixed effect, high-order polynomial

JEL Classification: J16, H20

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1. Introduction

The share of women in parliament has increased considerably over the past few decades in almost regions and income groups (Figure 1). The female politician proportion in parliament on average are double from 12% (2000) to 24.7% (2021). The proportion of the lower middle-income group increased nearly three times from 7.7% (2000) to 20.6% (2021). The number of South Asia surged from 9.3% (2002) to 33.2% (2008), then decreased to nearly 30% between 2014 and 2017, and then climbed to 33.5% (2018). The proportion of Middle East and North Africa rise remarkably (four times) from 4% (1999) to 16.3% (2021). Besides, the proportion of other income groups and regions (except Sub-Saharan Africa) went up by two or three times between 2000 and 2021.

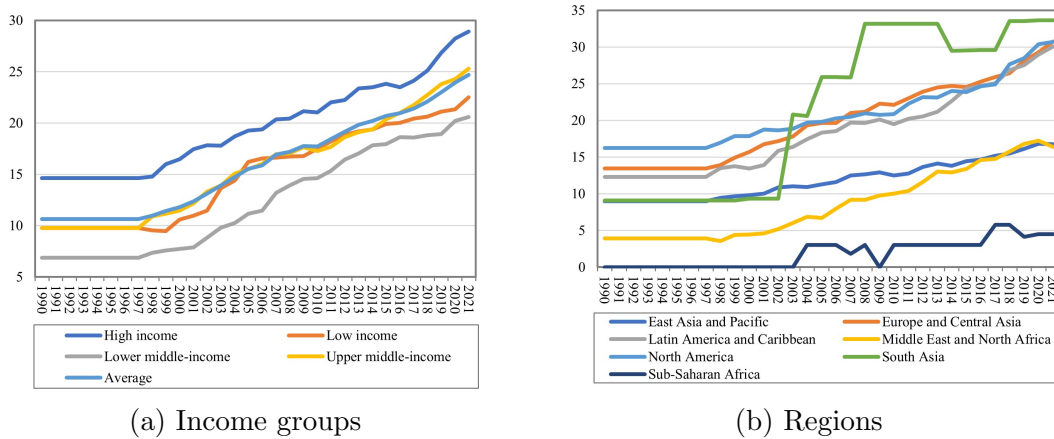


Figure 1. The share of women in parliament by region and income group, 1990-2021 (%)

Source: HDI (2022)

Beside the trend of the share of women in parliament on average, the extreme value of the share of women also climbed up dramatically (see Table A1 in Appendix). In 2000, there were 10 countries with 30% or more seats held by female in parliament, and only Sweden had the female proportion in parliament in the range 40% or more. However, in 2021, the corresponding numbers were 63 countries and 22 countries, respectively. Furthermore, there were 4 countries with 50% or more seats held by female in parliament, and they were United Arab Emirates (50%), Nicaragua (50.5%), Cuba (53.4%), Rwanda (55.7%).

The relationship between the women’s representation in parliament and policy outcomes has been considerable scholarly. There are some studies show the economic benefits of women’s representation in parliament through the women empowerment. They illustrate that more women’s political representation leads to more “women-friendly” policies such as an increase in investment in early edu-

cation (Clots-Figueras, 2011), antenatal and childhood health services (Bhalotra and Clots-Figueras, 2014), an increase in government spending in childcare services (Enns-Jedenastik, 2017), and an increase of childcare spots (Hessami and Baskaran, 2019). As a result, women are more autonomy, and the proportion of women in the labor force increases in the countries with higher proportion of female politicians (Bolzendahl and Brooks, 2006). However, they do not investigate the effect of female representation in parliament on the tax revenue, the increase in tax revenue could be the financial resource for the implement of “women-friendly” policies. This gap will be filled by this study.

Because of the foregoing, this study collected data from credible sources to examine the impact of the female politician proportion in parliament on the tax mobilization worldwide. The study will utilize the fixed-effect models combined with the panel data of 137 countries from 1998 to 2019 to show the relationship between the share of women in parliament and tax revenue mobilization. The data of the study is collected from World Development Indicators, Government Revenue Dataset, Worldwide Government Indicators, Human Development Index, and Pen World Table 10.00. Furthermore, the study using the interaction variables investigates the heterogeneity of the effect of female politicians amongst income groups. Finally, a high-order polynomial is employed to examine the minimum percentage of women in parliament to impact tax mobilization.

There are three main findings of the study. First, the results show a positive relationship between the female politician proportion in parliament and tax revenue mobilization. When incorporating the year effect, interaction variables with income groups, and exponents into the model, the positive influence remains substantial. In baseline model, the share of women in parliament increases 1 percent point, tax revenue might increase 0.07 percent point of GDP. Second, the study found diversified results amongst income groups. The positive effect of female politician proportion in parliament on tax revenue does not exist in high-income group. Meanwhile, in other income groups, the female politician proportion in parliament increases 1 percent point, the tax revenue might increase 0.1 percent point of GDP. Finally, the results also imply that there are high chances for the countries with more than 30% female politician proportion in parliament having significant influence on tax revenue mobilization. According to the dataset, in 2000, there were only 10 countries satisfying the condition of having the share of women in parliament 30% or above, however, this number surged to 63 countries in 2021.

This study is related to two threads of literature. The first one is the feminist economics, and the second one is the tax revenue mobilization. The higher pro-

portion of local female politicians enhances to implement more policies benefiting for women such as childcare services (Ennsner-Jedenastik, 2017), childcare spots (Hessami and Baskaran, 2019), antenatal and childhood health services (Bhalotra and Clots-Figueras, 2014), and early education (Beaman et al., 2012). As a result, they encourage women to involve in labor market, earn more income which can enlarge not only income tax base but also consumption tax base. In addition, the indirect effect of women on tax mobilization is to enhance tax compliance (Yimam and Asmare, 2020; Damayanti and Supramono, 2019; Hofmann et al., 2017) and lower corruption level (Salari and Noghanihambari, 2021). Akitoby et al. (2020) shows that tax compliance is one of main determinants of tax revenue mobilization. In line with these previous studies, this research reveals the positive impact of female politicians on tax revenue mobilization, thereby providing a fiscal rationale for supporting female politicians and policies that benefit women.

Furthermore, this study also shows that the positive effect of female politician proportion in parliament on tax revenue does not exist in high-income group, while the opposite is true with other income groups. This result is an additional contribution to confirm the distinguish of the effect of female politicians in different income groups that have been investigated in some previous studies. It has been evident that the local female politician participation does not have a positive influence on the size and composition of public spending in developed countries (Ferreira and Gyourko, 2014; Geys and Sorensen, 2019; Bagues and Campa, 2021; Hessami and Baskaran, 2019) whilst, in India (a developing country), female politicians have positive influence on public spending and others policy outcomes (Chattopadhyay and Duflo, 2004; Bhalotra and Clots-Figueras, 2014; Clots-Figueras, 2011). Rather focusing on local level as abovementioned studies, however, this research explores the effects of female representation in parliament on fiscal policy outcomes at country level. The findings also imply that the positive influence would be more significant if the female proportion in parliament to be 30% or above. It partly supports the suggestions that a minimum percentage of female politicians are needed to impact policy on a descriptive study of Beckwith (2007).

This study has two main limitations. First, the number of countries in the sample is accounted for 63% of total number of all countries/territories in the world. While the percentage of low-income groups and high-income groups in the baseline model are lower than the global figure, the opposite is true with the figure of middle-income groups. However, the number of observations on average is not diverse amongst income groups. By region, the proportion of Sub-Saharan Africa and Europe and Central Asia in the sample is slightly higher than the global figure,

the opposite is true with the figures of East Asia and Pacific, and Latin America and Caribbean. And the number of observations on average fluctuates slightly amongst regions. Second, the magnitude of coefficient of key variables decreases significantly when having both country and year effect.

The remainder of the paper is organized as follows. The previous studies related to the role of female politicians and tax mobilization will be introduced in Section II. Section III details the empirical framework and data. Section IV provides the results, specification checks, mechanism, and discussions. Section V is conclusions, and further descriptions of sample are found in appendix.

2. Literature review

Firstly, there are some studies which show the positive effect of women's representation in parliament on tax base through the women empowerment. Higher female politicians in parliament have significant influence on the chance of feminist issues into the policy agenda (Devlin and Elgie, 2008; Lippmann, 2022). The parliament with higher share of women are more likely approval gender sensitive laws (Asiedu et al., 2018). Furthermore, higher proportion of women in parliament are also related to an increase in welfare spending policies and higher share of women in the labor force (Bolzendahl and Brooks, 2006). More women in the labor force might increase number of taxpayers and taxable income, which are crucial components of tax base. However, the mechanism between an increase in welfare spending and the proportion of women in the labor force is not demonstrated in Bolzendahl and Brooks (2006). That is fulfilled by Ennsner-Jedenastik (2017) and Clayton and Zetterberg (2018).

Ennsner-Jedenastik (2017) shows that higher proportion of female politicians affects positively the government spending on family benefits, such as childcare service. Clayton and Zetterberg (2018) also suggest that higher share of female politicians increase government spending towards public health. As a result, higher investment in social infrastructure (education, childcare, healthcare, and social care) leads more women to participate in the labor market (Onaran, Oyvatt, and Fotopoulou, 2022). Although Ennsner-Jedenastik (2017) clarifies the mechanism of women representation in parliament and the women empowerment, but it is under context of OECD nations. And both Ennsner-Jedenastik (2017) and Clayton and Zetterberg (2018) do not demonstrate the effect on the tax revenue which is an evidence of policy efficiency as revenue mobilization is one of crucial aspects when assessing policy change in general. Furthermore, an increase in the total tax revenue could feasibly expand resources to finance welfare spending. In the

other word, an increase in the tax revenue due to higher proportion of women in parliament would firmly raise welfare spending.

Beside the studies about women’s representation in parliament, there are several studies investigating the women’s participation in local councils and women empowerment. Female leaders in villages in India have significant influence on the types of public goods provided which are the needs of women (Chattopadhyay and Duflo, 2004), the educational attainment of adolescent girls (Beaman et al., 2012), and antenatal and childhood health services (Bhalotra and Clots-Figueras, 2014). Moreover, women’s representation in the state legislatures in India have significant impact on investment in health and early education and high tiers of education (Clots-Figueras, 2011). By contrast with India (a developing country), some studies in developed countries such as the United States (Ferreira and Gyourko, 2014), Norway (Geys and Sorensen, 2019), and Spain (Bagues and Campa, 2021) suggest that local female politicians do not affect the size and composition of public spending. However, Hessami and Baskaran (2019) show that higher proportion of women in municipal councils in a state of Germany leads to a larger number of childcare spots although the government spending for childcare might not increase.

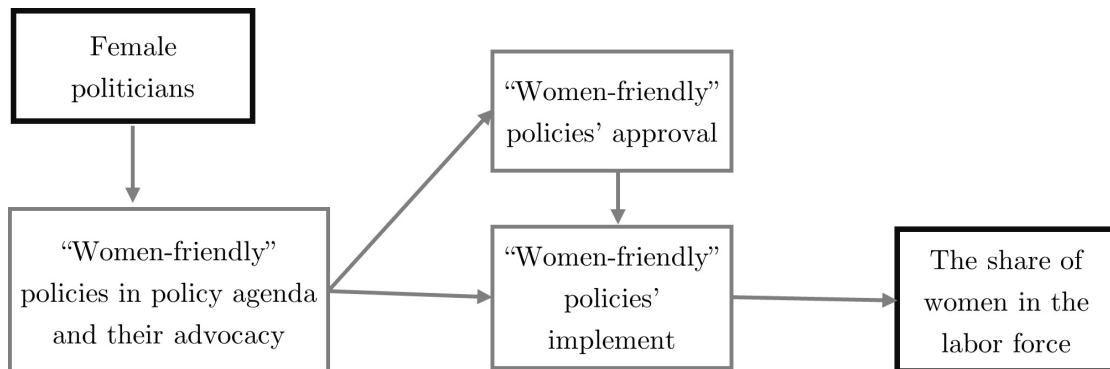


Figure 2. The economic benefits of female politicians

Source: Authors’ synthesis from literature review

Secondly, there are some papers demonstrating the positive influence of women in tax compliance. That is the indirect effect of women on the tax mobilization as Table A2 (see Appendix) shows that tax compliance is one of main determinants of tax revenue mobilization (Akitoby et al., 2020). Previous studies claim that enterprises owned by women are more likely to comply with tax regulations than those owned by men (Yimam and Asmare, 2020). Female top managers and owners have positive influence on the firm-level tax compliance (Damayanti and Supramono, 2019) as it is proven that gender has an effect on tax compliant behaviors, especially in Europe and North America (Hofmann et al., 2017).

Moreover, the influence of female politicians on corruption may play a crucial role in tax mobilization. According to Zallé (2022), corruption can significantly impede tax mobilization efforts. Nevertheless, research by Salari and Noghanibehambari (2021) indicates that an increased representation of women in parliament can potentially decrease corruption, particularly in nations with substantial natural resource rents. In such countries, a higher proportion of women in parliamentary positions correlates with reduced corruption in the management of natural resources.

As can be seen that the abovementioned studies show the economic benefits of women’s representation in parliament through the women empowerment. They illustrate that more women’s political representation leads to more “women-friendly” policies such as an increase in investment in early education (Clots-Figueras, 2011), antenatal and childhood health services (Bhalotra and Clots-Figueras, 2014), an increase in government spending in childcare services (Ennserr-Jedenastik, 2017), and an increase of childcare spots (Hessami and Baskaran, 2019). As a result, women are more autonomy, and the proportion of women in the labor force increases in the countries with higher proportion of female politicians (Bolzendahl and Brooks, 2006). Additionally, some studies also show the influence of female participation in parliament on corruption (Salari and Noghanibehambari, 2021) and impact of women on tax compliance (Damayanti and Supramono, 2019; Hofmann et al., 2017; Yimam and Asmare, 2020). However, they do not investigate the effect of female representation in parliament on the tax revenue, the increase in tax revenue could be the financial resource for the implement of “women-friendly” policies. This gap will be filled by this study.

3. Empirical framework and data

3.1. Empirical framework

This section will illustrate more details about models and variables in this study. The dependent variable is tax revenue as a share of GDP which could be a proxy for tax mobilization (Adegboye et al., 2022; Zallé, 2022; Wandaogo, Sawadogo, and Lastunen, 2022; Mawejje, 2019; Balima, Combes, and Minea, 2016). The key independent variable is the share of women in parliament and the control variables are socio-economic indicators. Table A2 (see Appendix) provides a summary of studies that investigate the relationship between tax mobilization and a number of key independent variables. In those studies, the control variables are socio-economic indicators such as GDP per capita, share of agriculture (% of GDP), and

population growth rate (Adegboye et al., 2022), nature resources rent, control of corruption, GDP per capita, public expenditure, and human capital (Zallé, 2022), GDP per capita, inflation, share of agriculture (% of GDP), natural resources rent, trade, corruption perception, foreign direct investment in GDP, aid, voice and accountability (Mawejje, 2019).

By comparison, this study and some previous studies in Table A2 share the same set of control variables, but the number of control variables and composition are different. In previous studies, the control variables are usually government spending, GDP per capita, control of corruption, natural resources rent, human capital. Though GDP per capita has been commonly utilized in prior studies concerning tax mobilization, it is not employed in the current investigation (see Table A3 in Appendix). The reason for its exclusion is the excessive variance inflation factor (VIF) index observed for this variable (see Table A4 in Appendix). Similarly, the choice between human capital and human capital growth is affected by the same consideration. The fixed effect model used for panel data introduces country-dummy variables to the model, causing a substantial increase in the variance inflation factor of both GDP per capita and human capital. (exceeding 50 and 40, respectively).

Therefore, a fixed effect model for panel data will be utilized to show the effect of the share of women in parliament on the tax revenue mobilization. The sample including the data of 137 countries in 21 years (from 1998 to 2019) will be employed to show the relationship between the proportion of female in parliament and tax mobilization. The fixed effect model (Wooldridge, 2019) will be applied to estimate parameters of the model which is estimated by STATA version 17 and presented in Equation 1.

$$\begin{aligned}
 TAX_{i,t} = & \beta_0 + \beta_1 WOM_{i,t} + \beta_2 GOV_{i,t} + \beta_3 GDP_{i,t} + \beta_4 COR_{i,t} \\
 & + \beta_5 HUM_{i,t} + \beta_6 NAT_{i,t} + \xi_i + \varepsilon_{i,t}
 \end{aligned} \tag{1}$$

here, i indicates a country and t indicates a year. $TAX_{i,t}$ is the tax revenue (excluding social contribution) in country i in year t . $WOM_{i,t}$ represents the proportion of female in parliament of country i in year t . Control variables include control of corruption ($COR_{i,t}$), human capital ($HUM_{i,t}$), government expenditure ($GOV_{i,t}$), GDP growth ($GDP_{i,t}$), and natural resources rent ($NAT_{i,t}$). The unobserved effect over years is presented in ξ_i which also be known as fixed effects for country. The error term $\varepsilon_{i,t}$ is clustered at the country level to account for serial correlation (Cameron and Miller, 2015; MacKinnon, Nielsen, and Webb, 2023).

Furthermore, there might be the differences of the effect of female politician

proportion on tax mobilization amongst income groups. The size and composition of public spending might not be affected by local female politician proportion in developed countries (Ferreira and Gyourko, 2014; Geys and Sorensen, 2019; Bagues and Campa, 2021; Hessami and Baskaran, 2019). In contrast, in India (a developing country), local female politicians have positive influence on public spending and others policy outcomes (Chattopadhyay and Duflo, 2004; Bhalotra and Clots-Figueras, 2014; Clots-Figueras, 2011). The interaction between income group and the share of women in parliament will be employed to examine the differences of the effect of central female politician proportion amongst income groups. The model is presented in Equation 2:

$$TAX_{i,t} = \beta_0 + \sum_{k=1}^4 \beta_1^k WOM_{i,t} + \beta_2 GOV_{i,t} + \beta_3 GDP_{i,t} + \beta_4 COR_{i,t} + \beta_5 HUM_{i,t} + \beta_6 NAT_{i,t} + \xi_i + \varepsilon_{i,t} \quad (2)$$

where, k indicates an income group. There are four income groups including: high income, low income, lower middle income, and upper middle income (WB, 2023).

Last but not least, Beckwith (2007) claims the effects of women in parliament on policies outcomes are visible as the proportion of female politicians passed a critical point. A model including the high-order polynomials of the key variable are employed to confirm the critical point of the female politician proportion in parliament (Equation 3).

$$TAX_{i,t} = \beta_0 + \sum_{x=1}^3 \beta_1^x WOM_{i,t}^x + \beta_2 GOV_{i,t} + \beta_3 GDP_{i,t} + \beta_4 COR_{i,t} + \beta_5 HUM_{i,t} + \beta_6 NAT_{i,t} + \xi_i + \varepsilon_{i,t} \quad (3)$$

where, x is an integer. As the proportion of female politicians is from 0% to 100%, the critical point can be existed if the coefficient related to the quadratic variable is negative and the magnitude of coefficient of the second and the third exponents decreases remarkably.

3.2. Data

The data of variables are collected from various sources such as World Development Indicators, Government Revenue Dataset, Worldwide Government Indicators, Human Development Index, and Pen World Table 10.00. Tax revenue (dependent variable) from Government Revenue Dataset of United Nations University (UNU-WIDER), the version updated in October 2022, and it does not include social

contributions. Share of women in parliament (key independent variable) is from Human Development Index. Control variables are government spending, GDP growth, and natural resources rent from World Development Indicators, human capital from Pen World Table 10.00, and control of corruption from Worldwide Government Indicators.

Some outliers are eliminated when cleaning data, and observations with missing value are deleted automatically when running models. In the raw data, some small countries/territories having tax revenue and government spending equal to GDP or greater than GDP. The outliers deleted are 1% highest value of tax revenue and government spending. To compare Table A5 with Table 1, the outlier elimination leads to the maximum of tax revenue and government spending dropping from over 100% of GDP to 35.6% of GDP and 55.9%, respectively. Furthermore, Table A5 also points out that there are many missing values, especially the human capital growth. When running models, the observations with missing values will be deleted automatically. The number of observations in the baseline model (Table 1) are smaller than the number of observations in the whole sample (Table A5). And the statistics of GDP growth rate and natural resources rent are remarkably changed, but, in positive way. The range of both GDP growth rate and natural resources rent decrease, the mean and the median of GDP growth rate are almost the same after deleting missing values (Table 1).

Table 1 shows some statistics of the variables after some observations are deleted because of outliers and missing values. In general, except natural resources rent and control of corruption index, the mean and median of other variables are quite close together. Tax revenue excluding social contributions in the baseline model is 15.52% of GDP on average, and its range is from 0.05% of GDP to 35.1% of GDP. Meanwhile the share of women in parliament is from 0% to 57.55%, the average of this variable is 19.1%. Thus, the standard deviation of the share of women in parliament might be much bigger than that of tax revenue. With control variables, the mean of government spending and GDP growth rate are almost the same as their median. The statistics of control of corruption are small because the ideologically range of control of corruption is from -2.5 to 2.5. The variable with biggest standard deviation is natural resources rent with the range (0, 58.92), the mean 5.52% of GDP, and the median 1.96% of GDP.

Table 1. Summary statistics

	N	Mean	Median	Min	Max
Tax revenue (% of GDP)	2508	15.52	14.78	0.05	35.09
Share of women in parliament (%)	2508	19.05	17.31	0.00	57.55
Government spending (% of GDP)	2508	15.63	15.68	2.05	39.68
GDP growth (%)	2508	3.80	3.89	-20.60	26.42
Control of corruption (index)	2508	0.090	-0.15	-1.60	2.46
Human capital growth (%)	2508	0.84	0.73	-1.93	5.48
Natural resources rent (% of GDP)	2508	5.52	1.96	0.00	58.92

Source: Authors' calculations

The proportion by income group and region in the baseline model differs slightly from the world's overall distribution. Table 2 shows that the total number of countries/territories in the baseline model is 63% of total number of all countries/territories in the world. By income group, while the percentage of low-income group and high-income group in the baseline model are lower than the global figure, the opposite is true with the figure of middle-income groups. By region, the proportion of Sub-Saharan Africa and Europe and Central Asia in the sample is slightly higher than the global figure, the opposite is true with the figures of East Asia and Pacific, and Latin America and Caribbean. However, Table A6 (see Appendix) shows that the number of observations on average is not too diverse amongst income groups and regions.

Table 2. Countries/territories classified by income group and region

Income group*	All the world		The sample		Region	All the world		The sample	
	Number	Percent	Number	Percent		Number	Percent	Number	Percent
Low	29	13.3	17	12.4	East Asia and Pacific	37	17.1	17	12.4
Lower middle	56	25.7	38	27.7	Europe and Central Asia	58	26.7	40	29.2
Upper middle	50	22.9	34	24.8	Latin America and Caribbean	42	19.4	23	16.8
High	83	38.1	48	35.1	Middle East and North Africa	21	9.7	14	10.2
					North America	3	1.4	2	1.5
					South Asia	8	3.7	6	4.4
					Sub-Saharan Africa	48	22.1	35	25.5
Total	217	100	137	100	Total	217	100	137	100

Note: * Countries/territories are classified based on the GNI per capita in fiscal year 2019 (WB, 2023).

Source: Calculated from the data sample and WB (2023).

3.3. Descriptive analysis

Figure 3 shows that the relationship between the tax revenue and share of seats held by women in parliament might be positive. Countries with higher tax revenue might tend to have the higher share of women in parliament. However, the relationship might be not strong because the points spread out and not show the

clear linear relationship between tax revenue and share of seats held by women in parliament.

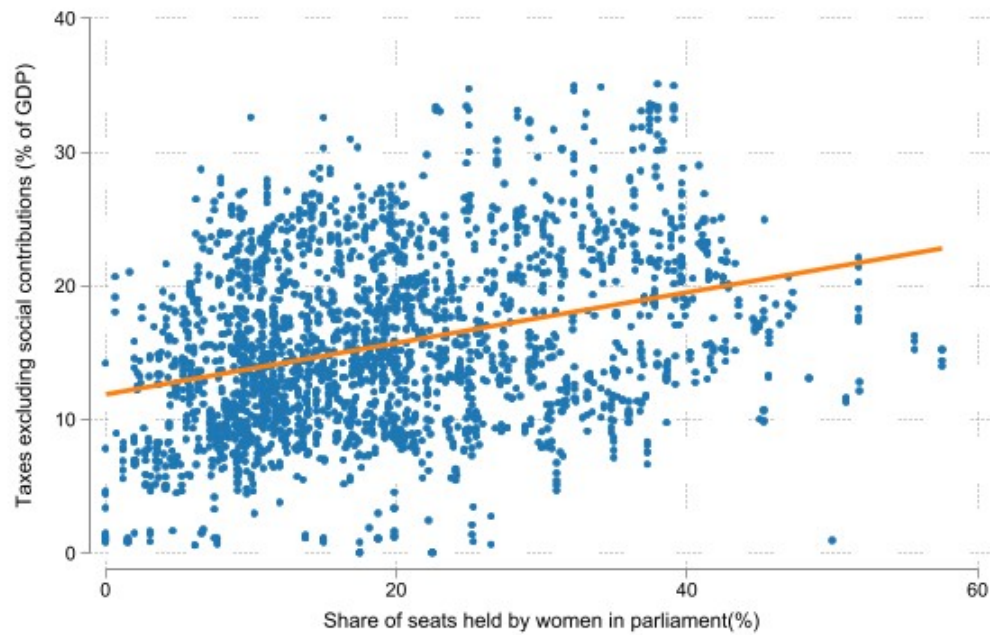


Figure 3. Tax revenue and percentage of women in parliament

Figure 4 shows the relationship between tax revenue and control variables. The relationship between tax revenue and government spending could be positive and strong because the points are quite tightly clustered around a line of the best fit. The relationship between tax revenue and other control variables are conceivable, because the points in other graphs are spread out and not locate close to the fitted estimation line.

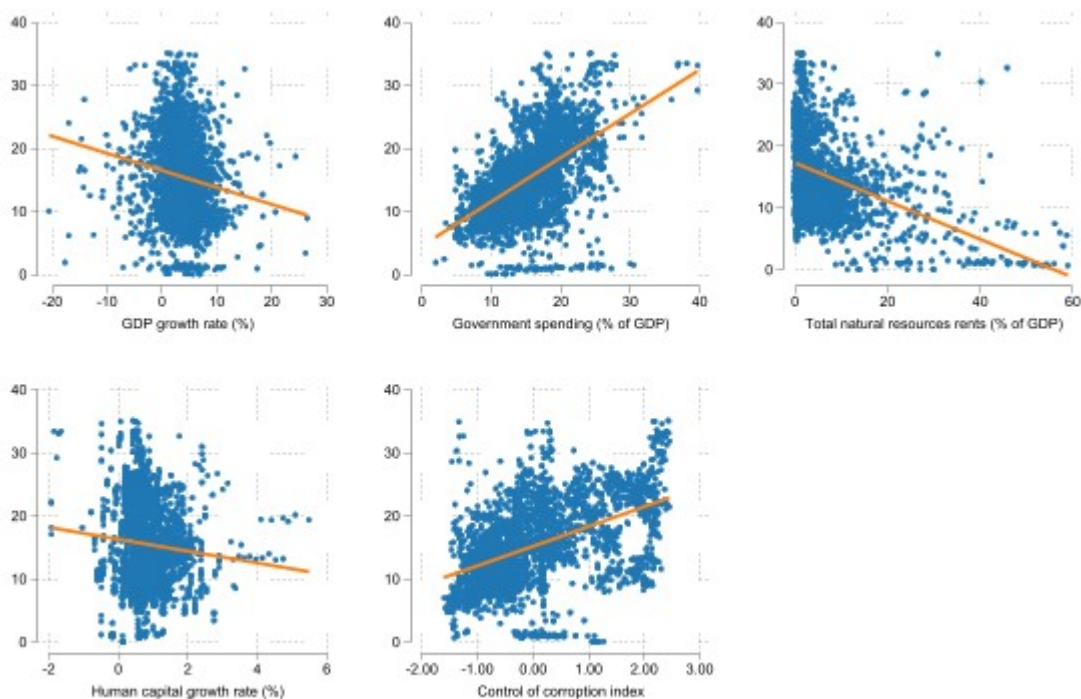


Figure 4. Correlation between dependent variable and other variables
 Note: The vertical axis in all graphs is taxes excluding social contributions (% of GDP) (dependent variable)

Table 3 shows the correlation amongst variables in the sample. There correlation amongst independent variables might be acceptable, except the figure between control of corruption and government spending. The correlation coefficients between natural resources rent and other independent variables are negative, except GDP growth. The same is true with the variable human capital growth. The correlation coefficients between GDP growth and control of corruption, tax revenue, and share of women in parliament are negative. It might indicate that the countries with high GDP growth are the low- and middle-income countries. The correlation coefficients amongst other independent variables are positive.

Table 3. Countries/territories classified by income group and region

	Tax revenue	Share of women in parliament	Government spending	GDP growth	Control of corruption	Human capital	Natural resources rent
Tax revenue	1						
Share of women in parliament	0.32***	1					
Government spending	0.54***	0.281***	1				
GDP growth	-0.15***	-0.11***	-0.27***	1			
Control of corruption	0.48***	0.35***	0.49***	-0.17***	1		
Human capital growth	-0.10***	-0.09***	-0.22***	0.13***	-0.22***	1	
Natural resources rent	-0.41***	-0.18***	-0.11***	0.14***	-0.32***	-0.001	1

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4. Baseline specification, robustness, and extensions

4.1. Baseline specification

The positive relationship between female politicians and tax revenue mobilization are confirmed. According to the results of the fixed effect model in Table 4, the coefficients of the key independent variable in all models are significant with the significant level 1%. The coefficients of control variables are statistically significant with the significant level 10%, except the coefficient of control of corruption. The sign of coefficients of all variables remains unchanged, except the sign of control of corruption, but the coefficient of control of corruption is statistically insignificant. The results show that if the share of women in parliament increases 1 percent point, tax revenue maybe increase 0.07 percent point of GDP. And government spending could play a crucial role for tax revenue collection.

4.2. Robustness

Several models are used to check the robustness of the baseline model. The results of the baseline model are repeated in column (1) in Table 5, and the other columns present the results of the other models. In previous section, a fixed effect model is estimated with the key independent variable (share of women in parliament) and control variables (government spending, GDP growth, control of corruption, human capital growth, and natural resources rent). That means the baseline model in the previous section has only country-fixed effects. This section shows the results of other models with the same variables as the baseline model, but two of them are added dummy variables which control year-fixed effect. Furthermore, the coefficients of the baseline model are estimated by xtreg command in STATA 17. Meanwhile, other models using the regression command (columns (2) and (3)) and reghdfe command (column (4) and (5)).

The results could be robust. The coefficient of the key independent variable is still statistically significant, and the sign remains unchanged. However, in two-dimension fixed effect models, the magnitude of the coefficient of the key independent is lower than the coefficient in the country – fixed effect model. In contrast, the magnitude of constant run by regression command is remarkably higher than other models. The coefficients of control variables are still significant, except the coefficient of control of corruption, their sign is the same, and their magnitude of coefficients of control variables remains unchanged or increases slightly.

Table 4. Baseline model

	(1)	(2)	(3)	(4)	(5)
Share of women in parliament (%)	0.0746*** (0.0190)	0.0796*** (0.0185)	0.0754*** (0.0183)	0.0708*** (0.0199)	0.0726*** (0.0196)
Government spending (% of GDP)	0.1636** (0.0685)	0.1887*** (0.0680)	0.1992*** (0.0705)	0.2279** (0.0926)	0.2507** (0.0960)
GDP growth (%)		0.0654*** (0.0164)	0.0650*** (0.0174)	0.0820*** (0.0220)	0.0728*** (0.0189)
Control of corruption (index)			0.3596 (0.3523)	-0.0679 (0.1870)	-0.0806 (0.1847)
Human capital growth (%)				0.3722* (0.2089)	0.3671* (0.2054)
Natural resources rent (% of GDP)					0.0853* (0.0505)
Constant	11.4751*** (1.0499)	10.7616*** (1.0602)	10.6834*** (1.1040)	9.9940*** (1.3860)	9.1729*** (1.5357)
<i>N</i>	3521	3517	3119	2508	2508
<i>F</i>	14.191	17.640	12.297	9.545	8.260
<i>R2_within</i>	0.0776	0.0909	0.0890	0.1082	0.1237
<i>R2_between</i>	0.2362	0.2143	0.2523	0.3048	0.0784
<i>R2_overall</i>	0.3018	0.2946	0.3287	0.2787	0.1066

Note: Standard errors are in parentheses and clustered by country.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5. High-dimension fixed effect models

	(1)	(2)	(3)	(4)	(5)
	xtreg	OLS	OLS	reghdfe	reghdfe
Share of women in parliament (%)	0.0726*** (0.0196)	0.0726*** (0.0202)	0.0173* (0.0105)	0.0726*** (0.0196)	0.0173* (0.0105)
Government spending (% of GDP)	0.2507** (0.0960)	0.2507** (0.0987)	0.2578*** (0.0379)	0.2507** (0.0960)	0.2578*** (0.0379)
GDP growth (%)	0.0728*** (0.0189)	0.0728*** (0.0194)	0.0707*** (0.0208)	0.0728*** (0.0189)	0.0707*** (0.0208)
Control of corruption (index)	-0.0806 (0.1847)	-0.0806 (0.1899)	-0.0297 (0.1371)	-0.0806 (0.1847)	-0.0297 (0.1371)
Human capital growth (%)	0.3671* (0.2054)	0.3671* (0.2112)	0.3418*** (0.1039)	0.3671* (0.2054)	0.3418*** (0.1039)
Natural resources rent (% of GDP)	0.0853* (0.0505)	0.0853 (0.0520)	0.0850*** (0.0228)	0.0853* (0.0505)	0.0850*** (0.0228)
Constant	9.1729*** (1.5357)	16.4598*** (2.3180)	16.8817*** (1.8806)	9.1713*** (1.5357)	10.1404*** (0.6454)
Country effect	Yes	Yes	Yes	Yes	Yes
Year effect	No	No	Yes	No	Yes
<i>N</i>	2508	2508	2508	2507	2507
<i>R</i> ²	0.1237	0.9165	0.9205	0.9165	0.9205
<i>R</i> ² _{overall}	0.1066				

Note: Standard errors in parentheses. In Model 1, 2, and 4, standard errors are clustered by country. In Model 3 and 5 having both country and year fixed effects, vce(robust) is applied. * p < 0.1, ** p < 0.05, *** p < 0.01

4.3. Mechanism, heterogeneity, and minimum proportionality

Mechanism The mechanism of the relationship between the share of women in parliament and tax mobilization is presented in Figure 5. There are direct and indirect effects of the female politicians on tax mobilization. First, female politicians have positive influence on tax base. Female politicians have good impact on education (Beaman et al., 2012; Clots-Figueras, 2011) and public goods which benefit for families (Bolzendahl and Brooks, 2006; Bhalotra and Clots-Figueras, 2014; Enns-Jedenastik, 2017; Clayton and Zetterberg, 2018; Hessami and Baskaran, 2019). With better support from government through public services such as health care, childcare and education, as a result, women are more autonomy, and the proportion of women in the labor force increases in the countries with higher proportion of female politicians (Bolzendahl and Brooks, 2006). The share of women in parliament might decrease the corruption level (Salari and Noghanibehambari, 2021), that could be also the direct effect on tax mobilization beside the enlargement of tax base.

Secondly, tax compliance is enhanced when the share of women in labor force increases. Previous studies claim that enterprises owned by women are more likely to comply with tax regulations than those owned by men (Yimam and Asmare, 2020), female top managers and owners have positive influence on the firm-level tax compliance (Damayanti and Supramono, 2019), and gender has a influence to tax compliant behaviors, especially in Europe and North America (Hofmann et al., 2017). Furthermore, female politicians focus on public goods and services which bring more benefit for families (Bolzendahl and Brooks, 2006; Bhalotra and Clots-Figueras, 2014; Enns-Jedenastik, 2017; Clayton and Zetterberg, 2018; Hessami and Baskaran, 2019). That might leave good impress on public opinion about government spending which, in turn, could boost the tax compliance of taxpayers. In additional, it is possible that higher education can nurture tax compliance (Nwokoye et al., 2023; Remali and Jalil, 2021). Thus, female politicians indirectly make impact on compliant rate as they significantly influence education policy or investment in education (Beaman et al., 2012; Clots-Figueras, 2011).

Heterogeneity

There is a controversy about the influence of the local female politicians amongst countries in previous studies. In India (a developing country), local female politicians have positive influence on public spending and others policy outcomes (Chattopadhyay and Duflo, 2004; Bhalotra and Clots-Figueras, 2014; Clots-Figueras, 2011). In contrast, local female politicians do not affect the size and composition

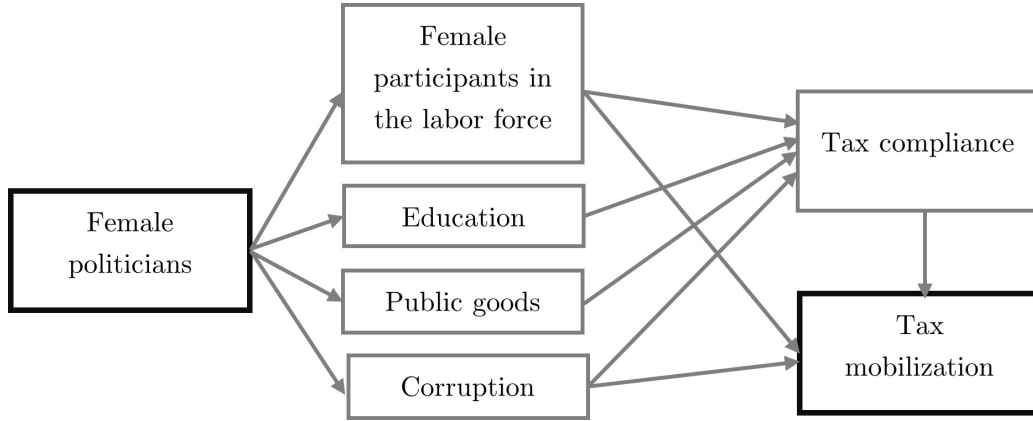


Figure 5. The mechanism of female politicians and tax mobilization

of public spending in developed countries, such as United States (Ferreira and Gyourko, 2014), Norway (Geys and Sorensen, 2019), Spain (Bagues and Campa, 2021), and Germany (Hessami and Baskaran, 2019). It might be that the budget allocation in developed countries is affected by many policy choices or developed countries have already allocated large share of budget for education, healthcare, other social transfers (Hessami and Fonseca, 2020).

As this research focus on the impacts of female representation in parliament on tax revenue collection at country level rather on local level, Table 6 presents the distinguish of the effects amongst different income groups. Columns (1) and (2) show that the coefficients of the interaction between share of women in parliament and high-income group are statistically significant. Meanwhile the opposite is true with the coefficients of lower middle-income and upper middle-income groups. As the interaction between share of women in parliament and low-income group is eliminated, the results in columns (1) and (2) suggest the effect of female politicians in low-income group and high-income one totally different, while the effect of female politicians in low-income group and other ones are likely constant.

The effect of female politicians in parliament in developing countries might be higher than that in developed countries. The combination of the negative sign of the interactions between female in parliament and high-income group in columns (1) and (2) and the insignificant coefficients of the interactions between female in parliament and other income groups indicates that the effect of female politicians in high-income group is smaller than that in other groups. In column (3), the coefficient of the interaction between share of women in parliament and high-income group is not significant statistically, while the opposite is true with the coefficients of the interaction between share of women in parliament and other groups. That means the female politician participation does not affect tax revenue mobilization in high-income group, but, that female participants in parliament

Table 6. The effect of female politician by income groups

	(1)	(2)	(3)
Share of women in parliament (%)	0.1287** (0.0593)	0.0647*** (0.0219)	
High income countries*Share of women in parliament	-0.1664** (0.0652)	-0.1907*** (0.0250)	-0.0377 (0.0262)
Low-income countries*Share of women in parliament			0.1287** (0.0593)
Lower middle-income countries*Share of women in parliament	-0.0279 (0.0643)	-0.0163 (0.0248)	0.1008*** (0.0307)
Upper middle-income countries*Share of women in parliament	-0.0074 (0.0676)	-0.0177 (0.0262)	0.1213*** (0.0292)
Government spending (% of GDP)	0.2411** (0.0944)	0.2475*** (0.0378)	0.2411** (0.0944)
GDP growth (%)	0.0662*** (0.0191)	0.0626*** (0.0207)	0.0662*** (0.0191)
Control of corruption (index)	-0.1301 (0.1726)	-0.0735 (0.1361)	-0.1301 (0.1726)
Human capital growth (%)	0.3712* (0.1947)	0.3394*** (0.1019)	0.3712* (0.1947)
Natural resources rent (% of GDP)	0.0851 (0.0518)	0.0846*** (0.0233)	0.0851 (0.0518)
Constant	9.7945*** (1.5530)	11.1447*** (0.6590)	9.7945*** (1.5530)
Country effect	Yes	Yes	Yes
Year effect	No	Yes	No
<i>N</i>	2508	2507	2508
<i>F</i>	9.986	24.252	9.986
<i>P-value</i>	0.000	0.000	0.000
<i>R</i> ²	0.1581	0.9249	0.1581

Note: Standard errors in parentheses.* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Column (1) and (3) have only country effect and standard errors are clustered by country. Column (2) has both country and year effect and vce(robust) is applied.

have remarkable influence in other groups. As the share of women in parliament increases 1 percent point, the tax revenue increases 0.13, 0.10, and 0.12 percent point of GDP in low-income group, lower middle-income one, and upper middle-income one, respectively.

Minimum proportionality

Table 7 shows that there is a high-order polynomial of female proportion in parliament. The coefficient of the key variable and its exponents are significant statistically (columns (2) and (4)). The sign and the magnitude of the exponents of key variable is the same as the expectation in the empirical framework presented in Section 3.1. To specify, the sign of quadratic form of key variable is negative, and the magnitude of the quadratic form is remarkably greater than the magnitude of the third exponent. The sign and magnitude of other variables are the same as them in the model without exponents (columns (1) and (3)). Some critical statistics of the models with and without exponents are almost the same.

There is the critical point of the share of women in parliament. According to the results in columns (2) and (4), a simulation of the high-order polynomial of female proportion in parliament is in Figure A1 and Figure A2. The effect of female proportion in parliament on tax revenue mobilization might be not positive when the proportion is low. After passing a critical point, the effect of female proportion in parliament on tax revenue mobilization increase remarkably. Although the coefficient of the key value of the model with and without year effect vary remarkably, the coefficients of high exponents in two models are nearly the same. According to the model with only country effect, the positive influence of the female politician proportion in parliament changes significantly after 35%. By comparison, the model with both country and year effect suggests that the female politician proportion in parliament have positive influence on tax mobilization after passing 30%.

A descriptive study of Beckwith (2007) suggests that a minimum percentage of female politicians are needed to impact policy. The results of the model without year effect (column (2)) might not support the suggestion of Beckwith (2007). The results show that the share of woman in parliament always has the positive influence on tax mobilization (Figure A1). The share of woman in parliament should be higher than one third or lower than 15% (Figure A1), because in those periods, the share increases 1 percent point, the tax revenue increase more than 0.05 percent point of GDP. In contrast, the results of the model with year effect (column (4)) support to the minimum proportion of Beckwith (2007). The influence of female proportion in parliament on tax revenue is negative between 13.63% and 30.06% (Figure A2). The share of women in parliament should be higher than

Table 7. A high-order polynomial

	(1) xtreg	(2) xtreg	(3) reghdfe	(4) reghdfe
Share of women in parliament (%)	0.0726*** (0.0196)	0.2081*** (0.0753)	0.0173* (0.0105)	0.1327*** (0.0365)
The quadratic form of the share of women in parliament		-0.0073** (0.0036)		-0.0071*** (0.0017)
The 3 rd exponent of the share of women in parliament		0.0001** (0.0000)		0.0001*** (0.0000)
Government spending (% of GDP)	0.2507** (0.0960)	0.2536*** (0.0943)	0.2578*** (0.0379)	0.2573*** (0.0375)
GDP growth (%)	0.0728*** (0.0189)	0.0743*** (0.0186)	0.0707*** (0.0208)	0.0729*** (0.0206)
Control of corruption (index)	-0.0806 (0.1847)	-0.1547 (0.1569)	-0.0297 (0.1371)	-0.1047 (0.1348)
Human capital growth (%)	0.3671* (0.2054)	0.3624* (0.2078)	0.3418*** (0.1039)	0.3259*** (0.1047)
Natural resources rent (% of GDP)	0.0853* (0.0505)	0.0859* (0.0509)	0.0850*** (0.0228)	0.0861*** (0.0226)
Constant	9.1729*** (1.5357)	8.5541*** (1.5827)	10.1404*** (0.6454)	9.7852*** (0.6921)
Country effect	Yes	Yes	Yes	Yes
Year effect	No	No	Yes	Yes
<i>N</i>	2508	2508	2507	2507
<i>F</i>	8.260	7.294	13.187	13.515
<i>P-value</i>	0.000	0.000	0.000	0.000
<i>R</i> ²	0.1237	0.1304	0.9205	0.9213
<i>R</i> ² _{within}	0.1237	0.1304		
<i>R</i> ² _{between}	0.0784	0.0684		
<i>R</i> ² _{overall}	0.1066	0.0919		
<i>Corr (u_i, Xb)</i>	0.0852	0.0641		
<i>sigma_e</i>	1.9502	1.9435		
<i>sigma_u</i>	6.3120	6.3437		
<i>rho</i>	0.9129	0.9142		

Note: Standard errors in parentheses.* p < 0.1, ** p < 0.05, *** p < 0.01. Columns (1) and (3) have only country effect and standard errors are clustered by country. Column (2) has both country and year effect and vce(robust) is applied.

30% or lower than 14%.

5. Conclusions

Some studies show that the higher proportion of female politicians enhances the implementation of policies that benefiting for women such as childcare services, childcare spots, antenatal and childhood health services, and early education. As a result, they encourage women to involve in labor market. In addition, some studies using micro data suggest that higher tax compliance level are related to female taxpayers, higher education, and good social considerations (such as public goods and voting). And other studies claim that countries having higher proportion of women undergo lower corruption level. From the literature, the relationship between female politicians and tax revenue mobilization attracts interest of this research.

Therefore, some data from reliable sources are collected to investigate the impacts of the female representation in parliament on the tax mobilization worldwide. The dataset includes World Development Indicators, Government Revenue Dataset, Worldwide Government Indicators, Human Development Index, and PennWorld Table 10.00. Furthermore, fixed-effect models combined with the panel data of about 137 countries from 1998 to 2019 are utilized. Moreover, the interaction variables are used to investigate the heterogeneity of the effect of female politicians amongst income groups. Finally, the high-order polynomial is employed to examine the minimum percentage of women in parliament to impact tax mobilization.

The findings show that there is a positive relationship between the female politician proportion in parliament and tax revenue mobilization. The positive influence is still significant when year effect, interaction variables with income groups, and exponents are included in the model. In the baseline model, the share of women in parliament increases 1 percent point, tax revenue might increase 0.07 percent point of GDP. And there might be both direct and indirect effect of the central female politicians on tax revenue mobilization. The direct effect could be the increase in the share of women in the labor force and the decrease in corruption, and the indirect effect could be the improvement of tax compliance. This finding is aligned with Bertocchi (2011) which claims that the female franchise facilitates higher tax rate. However, the influence of share of women in parliament are diversified by income groups. The positive effect of female politician proportion in parliament on tax revenue does not exist in high-income group. Meanwhile, in other income groups, the female politician proportion in parliament increases

1 percent point, the tax revenue might increase 0.1 percent point of GDP. In addition, the study suggests that the female politician proportion in parliament should be higher than 30% to have crucial influence in tax revenue mobilization. In 2000, there were 10% of countries satisfying this condition, but 46% of countries had the share of women in parliament 25% or more in 2021.

This study has some limitations. First, the number of countries in the sample only accounts for 63% of total number of all countries/territories in the world. While the percentage of low-income group and high-income group in the baseline model are lower than the global figure, the opposite is true with the figure of middle-income groups. However, the number of observations on average is not diverse amongst income groups. By region, the proportion of Sub-Saharan Africa and Europe and Central Asia in the sample is slightly higher than the global figure, the opposite is true with the figures of East Asia and Pacific, and Latin America and Caribbean. And the number of observations on average fluctuates slightly amongst regions. Second, the VIF ratio of a control variable is higher than 10, and its coefficient is not significant statistically. Finally, the magnitude of coefficient of key variable decreases significantly when including both country and year effect.

In summary, this study highlights the importance of representation of women in parliament on revenue mobilization but also acknowledges the limitations in data scope, confirmation of findings from previous studies and mechanism explanation. Addressing these limitations in future research will enhance the depth and reliability of our understanding of the complex interplay between women representation in parliament and tax revenue mobilization.

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Appendix

Table A1. Countries with high share of women in parliament, 1990-2021

	Under 14%		25% or over		30% or over		40% or over		50% or over		Nmb of total countries ^a
	Nmb	Pct ^b	Nmb	Pct	Nmb	Pct	Nmb	Pct	Nmb	Pct	
1990	119	75.80	11	7.01	4	2.55	1	0.64	0	0.00	157
1991	119	75.80	11	7.01	4	2.55	1	0.64	0	0.00	157
1992	119	75.80	11	7.01	4	2.55	1	0.64	0	0.00	157
1993	119	75.80	11	7.01	4	2.55	1	0.64	0	0.00	157
1994	119	75.80	11	7.01	4	2.55	1	0.64	0	0.00	157
1995	119	75.80	11	7.01	4	2.55	1	0.64	0	0.00	157
1996	119	75.80	11	7.01	4	2.55	1	0.64	0	0.00	157
1997	119	75.80	11	7.01	4	2.55	1	0.64	0	0.00	157
1998	120	72.29	12	7.23	5	3.01	1	0.60	0	0.00	166
1999	121	70.76	12	7.02	7	4.09	1	0.58	0	0.00	171
2000	121	69.14	17	9.71	10	5.71	1	0.57	0	0.00	175
2001	117	65.36	18	10.06	9	5.03	1	0.56	0	0.00	179
2002	110	61.11	23	12.78	10	5.56	1	0.56	0	0.00	180
2003	105	57.69	24	13.19	14	7.69	2	1.10	0	0.00	182
2004	101	54.89	29	15.76	18	9.78	2	1.09	0	0.00	184
2005	97	51.87	32	17.11	21	11.23	2	1.07	0	0.00	187
2006	94	49.47	38	20.00	19	10.00	2	1.05	0	0.00	190
2007	82	43.16	41	21.58	21	11.05	3	1.58	0	0.00	190
2008	86	45.26	44	23.16	25	13.16	4	2.11	1	0.53	190
2009	82	43.16	44	23.16	28	14.74	6	3.16	1	0.53	190
2010	81	42.41	42	21.99	27	14.14	6	3.14	1	0.52	191
2011	79	41.15	45	23.44	30	15.63	8	4.17	2	1.04	192
2012	71	36.98	49	25.52	32	16.67	9	4.69	2	1.04	192
2013	65	33.85	55	28.65	37	19.27	9	4.69	2	1.04	192
2014	62	32.29	58	30.21	36	18.75	12	6.25	3	1.56	192
2015	61	31.77	62	32.29	42	21.88	13	6.77	2	1.04	192
2016	58	30.05	64	33.16	42	21.76	12	6.22	2	1.04	193
2017	55	28.50	68	35.23	44	22.80	11	5.70	2	1.04	193
2018	51	26.42	68	35.23	49	25.39	12	6.22	3	1.55	193
2019	45	23.32	72	37.31	52	26.94	17	8.81	4	2.07	193
2020	41	21.24	82	42.49	56	29.02	19	9.84	3	1.55	193
2021	38	19.69	89	46.11	63	32.64	22	11.40	4	2.07	193

Note: Nmb and Pct are abbreviations of Number and Percentage, respectively.

^a This is the percentage of countries with over 20% seats held by female in parliament, and the figure in this column is a dividend of the last column and the previous column. The figure in other “percent” columns have the same meaning with the corresponding share of seats held by female in the first row.

^b This is the total number of countries have the data about the share of women in parliament in Human Development Index database.

Source: HDI (2022)

Table A2. Determinants of tax mobilizaion

Research	Data	Method	Factors/key variables	Impact
Adegboye et al. (2022)	48 Sub-Saharan African countries	Generalized Method of Moments	Information and Technology Communication	Non-linear relationship
Zallé (2022)	166 countries	Cross-section augmented autoregressive distributed lag	Natural resource dependence Control of corruption	Negative impact on non-resource tax revenue
Wandaogo, Sawadogo and Lastunen (2022)	96 developing countries	Propensity scores matching	Person-to-government (P2G) mobile phone payments	Increasing direct tax revenue
Akitoby et al. (2020)	55 episodes of large tax revenue increases in low-income countries and emerging markets	Descriptive statistics	Reforms of indirect taxes and exemptions Tax administration reforms and tax reforms go together Key compliance areas (risk-based audits, registration, filing, payment, and reporting)	There are the key factors boosting tax-to-GDP ratio quickly
Mawejje (2019)	31 Sub Saharan African countries	Panel fixed effects and dynamic panel generalized methods of moments	Extractive Industries Transparency Initiative	Offsetting the negative impact of natural resource dependence
Castañeda Rodríguez (2018)	138 countries from 1976 to 2015	Panel corrected standard errors and system generalized method of moments	Quality of government	Positive relationship
Balima, Combes, and Minea (2016)	119 developing countries	Propensity scores matching	Accessing to bond markets or external commercial loans	Fostering internal taxes
Botlhole, Asafu-Adjaye, and Carmignani (2012)	45 Sub-Sahara African countries	Instrumental variable two-stage least squares method	The quality of institution	More resource revenues reduce tax revenues when institutions are poor

Source: Authors' synthesis.

Table A3. Variables and data sources

Variables	Sources	Explanations
Tax revenue (% of GDP)	UNU-WIDER Government Revenue Dataset 2022 (GRD, 2022)	Taxes excluding social contributions is generally equal to the sum of the sub-components of tax revenue, i.e., total taxes on income, profits, and capital gains.
Share of women in parliament (%)	Human Development Index (HDI, 2022)	Share of seats held by women in parliament
Natural Resource rent (% of GDP)	World Development Indicators (World Bank, 2023)	The total natural resource rent is compared to GDP of each country. It is equal to the sum of oil rents, natural gas rents, coal rents, mineral rents, and forest rents.
Control of corruption index	Worldwide Governance Indicators (WGI, 2023)	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.
GDP growth (%)	World Development Indicators (World Bank, 2023)	Annual percentage growth rate of GDP at market prices based on constant local currency.
Government spendings (% of GDP)	World Development Indicators (World Bank, 2023)	General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees).
Human capital growth (%)	Pen World Table 10.0 (PWT, 2023)	Human capital index based on years of schooling and returns to education. Then, the growth is the change of the index of the current compared to the one of the previous year.
Income groups	World Development Indicators (World Bank, 2023)	There are four income groups in the database of World Development Indicators, including: high-income, low-income, lower middle-income, and upper middle-income. Then, four dummy variables are created to represent for four income groups.

Source: Authors' synthesis.

Table A4. The VIF ratio

Initial model	VIF	Baseline model	VIF
<i>Variables</i>		<i>Variables</i>	
Share of women in parliament (%)	5.68	Share of women in parliament (%)	3.78
Government spending (% of GDP)	7.45	Government spending (% of GDP)	7.50
GDP per capita (constant 2017 international \$)	51.93	GDP growth (%)	1.38
Control of corruption (index)	13.47	Control of corruption (index)	13.43
Human capital (index)	48.36	Human capital growth (%)	2.72
Natural resources rent (% of GDP)	8.72	Natural resources rent (% of GDP)	8.77
<i>Countries</i>		<i>Countries</i>	
Maximum of VIF amongst countries	13.02	Maximum of VIF amongst countries	5.21
Minimum of VIF amongst countries	1.12	Minimum of VIF amongst countries	1.10

Table A5. Summary Statistics for the whole sample

	Before outlier elimination					After outlier elimination				
	N	Mean	Median	Min	Max	N	Mean	Median	Min	Max
Tax revenue (% of GDP)	4301	15.63	14.98	0.05	110.6	4258	15.29	14.92	0.05	35.61
Share of women in parliament (%)	4807	17.33	15.73	0	57.55	4807	17.33	15.73	0	57.55
Government spending (% of GDP)	4424	17.01	16.07	0.91	147.7	4380	16.42	16	0.91	55.92
GDP growth (%)	5234	3.42	3.58	-54.24	150.0	5234	3.420	3.58	-54.24	150.0
Control of corruption (index)	4564	-0.01	-0.20	-1.92	2.46	4564	-0.01	-0.20	-1.92	2.46
Human capital growth (%)	3456	0.87	0.78	-2.43	5.48	3456	0.87	0.78	-2.43	5.48
Natural resources rent (% of GDP)	5079	6.60	1.57	0	87.58	5079	6.60	1.57	0	87.58

Table A6. Sample by income group and region

	Number of observations	Number of countries	Mean	Min	Max
<i>Income groups</i>					
High income	940	48	19.6	3	21
Low income	297	17	17.5	4	21
Lower middle income	662	38	17.4	3	21
Upper middle income	609	34	17.9	1	21
<i>Regions</i>					
East Asia and Pacific	314	17	18.5	4	21
Europe and Central Asia	788	40	19.7	4	21
Latin America and Caribbean	447	23	19.4	5	21
Middle East and North Africa	213	14	15.2	3	21
North America	41	2	20.5	20	21
South Asia	101	6	16.8	6	21
Sub-Saharan Africa	604	35	17.3	1	21
<i>Whole sample</i>	<i>2,508</i>	<i>137</i>	<i>18.3</i>	<i>1</i>	<i>21</i>

Table A7. The list of countries in the baseline model

Albania	Cameroon	Ethiopia	Israel	Mauritania	Philippines	Syria	Burkina Faso
Angola	Canada	Fiji	Italy	Mauritius	Poland	The Gambia	Burundi
Argentina	Togo	Finland	Jamaica	Mexico	Portugal	Kyrgyzstan	Cambodia
Armenia	Chile	France	Japan	Moldova	Qatar	Dominican	El Salvador
Australia	China	Gabon	Jordan	Mongolia	Romania	Egypt	Estonia
Austria	Colombia	Tanzania	Kazakhstan	Morocco	Tunisia	Congo, Dem.	Eswatini
Bahrain	Vietnam	Germany	Kenya	Mozambique	Rwanda	Congo, Rep.	Uruguay
Bangladesh	Zambia	Ghana	Korea, Rep.	Myanmar	Saudi Arabia	UAE	Iraq
Barbados	Costa Rica	Greece	Kuwait	Namibia	Senegal	United Kingdom	Ireland
Belgium	Cote d'Ivoire	Guatemala	Tajikistan	Nepal	Serbia	United States	Maldives
Belize	Croatia	Guyana	Lao PDR	Netherlands	Sierra Leone	Venezuela	Mali
Benin	Cyprus	Haiti	Latvia	New Zealand	Singapore	Slovakia	Malta
Bolivia	Czechia	Honduras	Lesotho	Nicaragua	Ukraine	Iran	Panama
Botswana	Denmark	Hungary	Lithuania	Niger	Slovenia	Zimbabwe	Paraguay
Brazil	Turkiye	Iceland	Luxembourg	Nigeria	South Africa	Russia	Peru
Thailand	Ecuador	India	Madagascar	Norway	Spain	Brunei Darussalam	Sudan
Bulgaria	Uganda	Indonesia	Malaysia	Pakistan	Sri Lanka	Central African	Sweden
Switzerland							

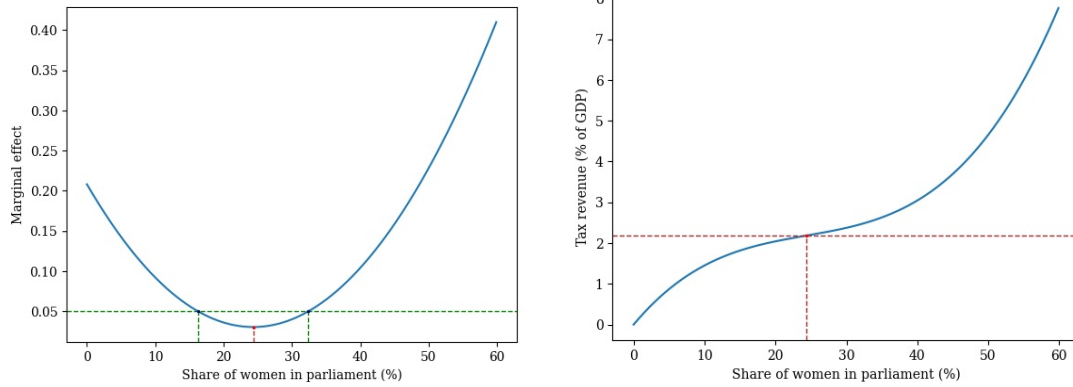


Figure A1. The results of the model without year effect

Note: According to the results of the model without year effect (column (2) Table 7), the function is $y = 0.2081x - 0.0073x^2 + 0.0001x^3$ with the domain $[0,100]$. The graphs are simulated by Python. As the marginal effect reaches the minimum point, the second derivative is equal to 0 at $x = 24.33$. The marginal effect decreases between 0% and 24.33%, and the marginal effect increases after 24.33%. The marginal effect is equal to 0.05 at $x = 16.26$ and $x = 32.04$.

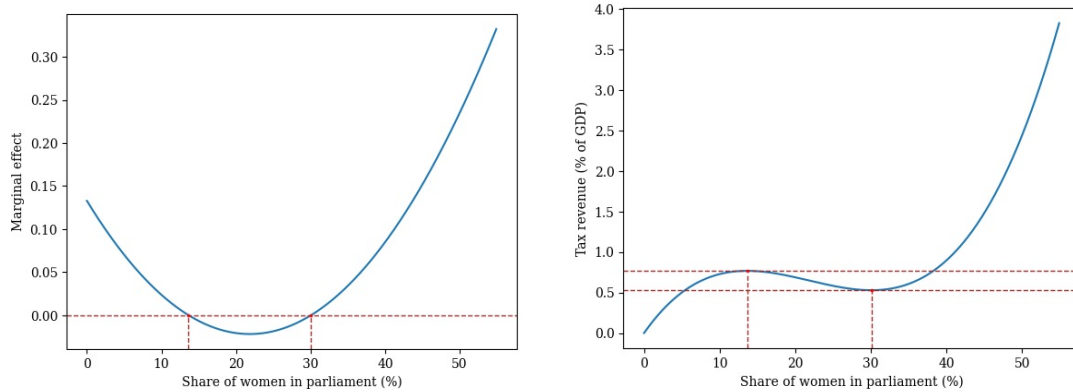


Figure A2. The results of the model without year effect

Note: According to the results of the model with year effect (column (4) Table 7), the function is $y = 0.1327487x - 0.007077x^2 + 0.000108x^3$ with the domain $[0,100]$. The graphs are simulated by Python. The marginal effect is equal to 0 at $x = 13.63$ and $x = 30.06$. The marginal effect is negative between 13.63% and 30.06%, and the marginal effect is positive and increases after 30.06%.