Female Labor Force Participation on GDP per Capita in Latin American and the Caribbean

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1 Introduction

Across the world, economic empowerment for women is a topic of the utmost importance for policymakers and civil society alike. Female labor force participation rates are often viewed as a metric of gender parity in the economic sphere. And while most people generally view women's economic empowerment favorably, a better understanding of how female labor force participation rates impact other indicators of economic well-being within a country would benefit those trying to implement policies that encourage women to enter the workforce. While female labor force participation rates are steadily increasing around the world, the effects on economic development are ambiguous due to other social and employment factors.

In this paper, we investigate how female labor force participation (LFP hereafter) in the Latin America and Caribbean region influences GDP per capita. In our empirical analysis, we utilize data from the World Bank spanning the years of 1990-2018 and estimate an ordinary least squares equation of GDP on female LFP and the gender difference in LFP on GDP. We further consider the interaction effects between female LFP rate and average schooling to estimate the marginal effects. Additional models include interactions between our main variable of female labor force participation rate with fertility, political representation, female unemployment rate, and law and order.

We predict that female labor force participation and smaller gender differences in LFP will have a positive effect on GDP, as more women in the workforce and a smaller disparity between the percentage of men and women who are in the labor market would facilitate greater production capacity for a country. On the other hand, there is also reason to believe that the opposite could be the case. If female labor force participation increased, the effect on GDP could be negative if they are not compensated for their wages relative to their true marginal productivity. This relationship can be driven by inefficiency that arises from a mismatch in skills or taste-based gender discrimination.

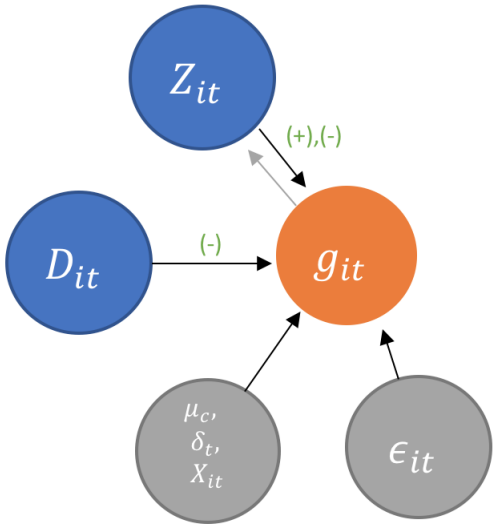
The gender gap in labor force participation, or the difference between labor force participation rates for men and women, has generally been on the decline in recent years. Between

1980 and 2008, for instance, there was a decrease in the gender gap in labor force participation of six percentage points (Ortiz-Ospina & Tzvetkova, 2017). This change has been driven in part by increases in female labor force participation rates; conversely, declining labor force participation rates for men in some regions have impacted this gap, as well. In general, the literature on this topic finds a "u-shaped" relationship between female labor force participation and economic growth, wherein countries in the early stages of economic development see declining female labor force participation, before increasing again as the country develops (Lechman & Kaur, 2015). However, this hypothesis does not hold when looking into the relationship between female labor force participation and GDP per capita. In fact, Lechman and Kaur find a generally positive relationship between the two indicators (Lechman & Kaur, 2015).

Latin America in particular has experienced large increases in the rates at which women participate in the labor force (Ortiz-Ospina & Tzvetkova, 2017). These gains have been attributed to increased higher education attainment for women, declining fertility rates, and perhaps even increasingly efficient household goods (Klasen, 2019). This paper will attempt to evaluate how these trends have impacted the per capita GDPs of the countries in this region. This is of increasing importance, as the recent pandemic has disturbed existing labor market trends, the consequences of which have been distinctly gendered. In fact, a recent study found that women are nearly 25% more likely to lose their jobs during the pandemic than their male counterparts (Dang & Nguyen, 2021). If female labor force participation is, as we predict, associated with higher GDP per capita, then working to increase labor force participation could help recoup some of the losses in GDP seen during the pandemic.

We do in fact find that an increase in female labor force participation rates would positively affect a country's GDP and that the gender difference in labor force participation rate negatively affects a country's GDP in the Latin America and Caribbean region. Furthermore, we find that the effect of female LFP rate varies with schooling and the effect of female LFP on GDP can be driven by the effect of schooling. Additionally, we conclude

Figure 1: Flowchart



that the effects of female LFP rate on GDP do not vary over different levels of fertility, but the marginal effects of female LFP rate on GDP are positive at increasing levels of female political representation and law and order.

The paper is organized as follows. Section 2 presents the research framework. Section 3 describes the data and sample selection. Section 4 presents the baseline empirical model with additional modifications in interaction terms and instrumental variables. Section 5 shows four additional models and results. Sections 6 concludes with policy implications and areas for further research.

2 Research Framework

Our outcome variable g_{it} represents log GDP per capita in purchasing power parity. We utilized yearly data from the World Bank, restricted to countries within the Latin America and Caribbean region. The key explanatory variables in our research study are female labor force participation (Z_{it}) and the gender difference in labor force participation (D_{it}). We create the measure of D_{it} by subtracting the female LFP rate from the male LFP rate and

describe the variable as a difference of LFP by gender. We predict that the effect of the difference in LFP participation is negative. A larger disparity in labor force participation rates by gender may indicate that the overall labor force participation rate is lower, or it may show that there are lower levels of gender equality in a country, which could indicate a lower level of development, and thus a lower gross domestic product. We exclude the variable for male LFP because of perfect collinearity.

The vector of controls ($\mathbf{X}'_{it}$) includes average years of schooling, fertility rate, population growth, inflation, country exports, child mortality rate, investment, and government expenditure on education. We control for average years of schooling since education is an investment in human capital and these skills can be transferred to the workforce. We also include fertility rates and child mortality rate, as they could influence women's decision to exit the labor force to produce children. We also control for population growth, inflation, investment, government expenditures, and exports because these are all indicators for GDP that we have seen in the past (see Barro 1991).

μ_c is a vector for country fixed effects that control for country-specific time-constant unobserved characteristics. We include country fixed effects because we predict that there are unobserved characteristics that are related to both female labor force participation and GDP growth that are specific to each country within our chosen region. For example, an unobserved country-specific time-invariant characteristic specific to our research question is culture relating to views about women. δ_t denotes year fixed effects. Year fixed effects allow us to control for time-specific shocks, such as global recessions, that affect both our key explanatory variables and outcome variable in our model. We may see reverse causality in our regression, because higher GDP levels can indicate that economic conditions are positive, which would increase labor force participation for both men and women. If this were the case, we need to look towards an instrumental variable approach to see whether female LFP rate precedes GDP and thus establish a causal relationship.

3 Data

We use country-level data from the World Bank that span the years of 1990 to 2018 since data on female LFP rate is not documented until 1990. There are 173 countries and 10,380 country-year observations in the raw sample, and there are 25 countries and 640 country-year observations in our estimation sample. Notably, our estimation sample size is reduced once we restrict our sample to the Latin America and Caribbean region because the raw sample includes multiple countries around the world that are outside our region of interest. Furthermore, observations with missing data are dropped from our estimation.

Comparisons of the means and standard deviations for the raw and estimation samples are located in Table 7. In the raw sample, the average Female LFP rate (50.76) is slightly higher relative to that of our estimation sample (49.85), but the raw sample also has a higher standard deviation. On the other hand, our estimation sample has a higher average gender difference in LFP rate (29.61) relative to that of the raw sample (23.39). These comparisons may indicate that the male LFP rate is higher in the Latin America and Caribbean region relative to the other regions in the raw sample.

Table 1: Variable Descriptions

Variable	Description
Log GDP per Capita (g_{it})	Natural log transformation of GDP per capita in units of PPP
Female LFP Rate (Z_{it})	% of the women active in the labor force out of the total labor force. The total labor force comprises men and women over the age of 15 who supply labor for the production of goods and services or are searching for work
Gender Difference in LFP Rate (D_{it})	% difference between female LFP and and male LFP rate. The value after subtracting female LFP rate from male LFP rate
Controls (X_{it})	

Variable	Description
Schooling	Average years of schooling for adult population
Fertility rate	Births per woman
Population growth	The exponential rate of growth of midyear population from year $t-1$ to t, annual %
Inflation	GDP deflator, annual %
Investment	Gross fixed capital formation, % of GDP
Exports	Exported goods and services, % of GDP
Mortality rate	Probability per 1,000 that a newborn baby will die before reaching age five
Government expenditure	% of GDP spent on education
Unemployment Rate	% of female labor force that is unemployed; unemployed individuals are those without work but available for and seeking employment
Women in Parliament	Proportion of seats held by women in national parliaments (%)
Law and Order	ICRG Indicators for six dimensions of governance: Voice and Accountability; Political Stability and Absence of Violence/Terrorism; Government Effectiveness; Regulatory Quality; Rule of Law; Control of Corruption.
Country fixed effects (μ_c)	Dummy variables for each country
Year fixed effects (δ_c)	Dummy variables for each year in the sample

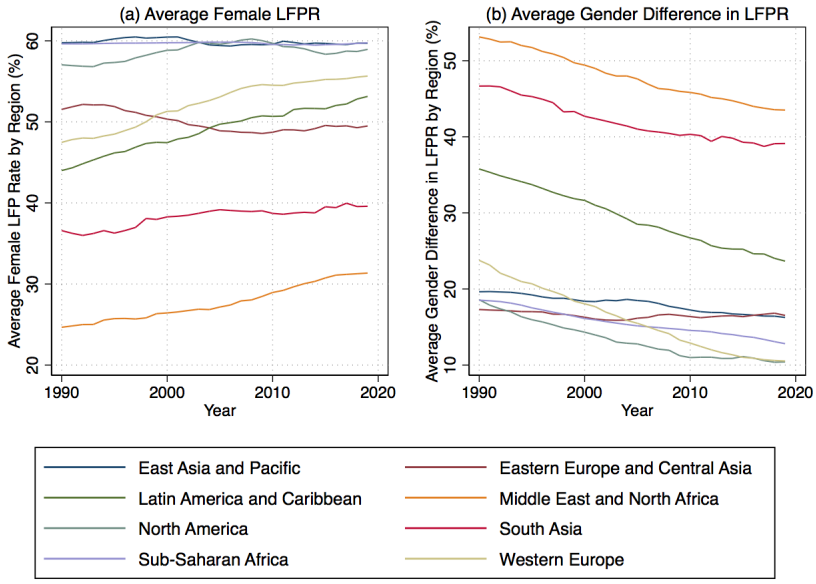
Figure 2 shows how our explanatory variables of interest vary over time by world region. We average the value of female LFP rate and gender difference in LFP rate by region since countries within each region have different rates. In Figure 2a, the average female LPR of the Latin America and Caribbean region positively rises over 1990 to 2018. As for the average

Table 2: Sample Summary Statistics

	Raw Sample	Estimation Sample
Log of GDP Per Capita	8.864	9.015
	(1.259)	(0.598)
Female LFP Rate	50.76	49.85
	(16.39)	(9.088)
Gender Difference in LFP Rate	23.39	29.61
	(15.85)	(10.61)
Schooling	5.942	7.494
	(3.430)	(1.793)
Investment	22.21	20.53
	(8.156)	(5.386)
Population Growth	1.853	1.409
	(1.575)	(0.673)
Government Expenditures	15.69	12.82
	(7.269)	(3.749)
Inflation	34.62	51.83
	(445.4)	(406.3)
Exports	34.65	33.02
	(25.57)	(17.90)
Fertility	4.091	2.741
	(2.046)	(0.745)
Mortality	78.69	29.33
	(78.65)	(20.45)
Observations	10380	640

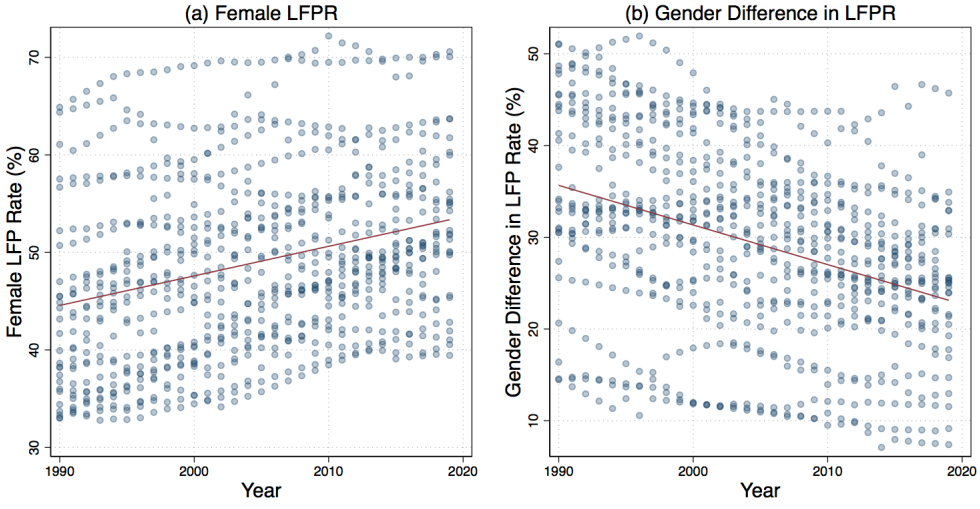
Notes: Standard deviations are presented below the means. See Data Appendix for minimum and maximum values.

Figure 2: Average LFP Trends by Region



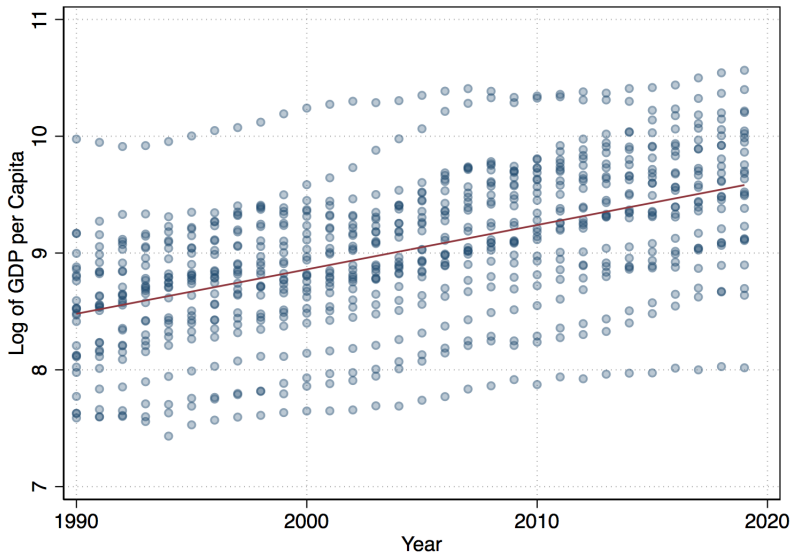
Notes: Graphs present average values of female LFP and gender difference in LFP by world region over 1990-2018.

Figure 3: LFP Trends in Latin America and Caribbean



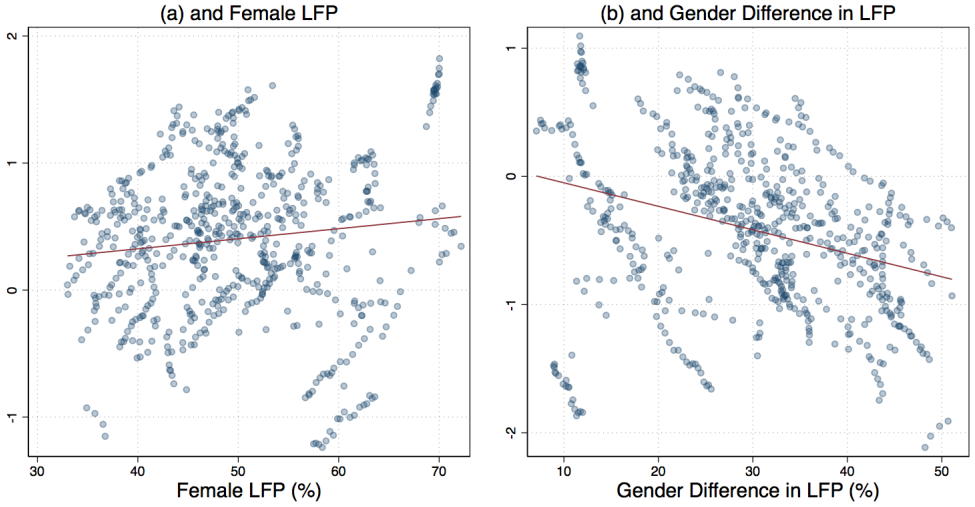
Notes: Graphs present values of female LFP and gender difference in LFP rate in the Latin America and Caribbean region over 1990-2018.

Figure 4: Log GDP Per Capita Trend in Latin America and Caribbean



Notes: Graph shows the values of log GDP per capita (PPP) in the Latin America and Caribbean region over 1990-2018.

Figure 5: Partial Association Between per Capita GDP



gender difference in LFP rate in the Latin America and Caribbean region, it appears to fall the most sharply over time relative to the other world regions.

Figures 3a and 3b show the trends of female LFP rate and gender difference in LFP rate within Latin America and the Carribean. Both the female LFP and the gender difference in our region of interest LFP vary by country. Similar to the average rates shown in Figure 2, female LFP appears to be increasing over time and the gender difference in LFP rate appears to be decreasing over time in the Latin America and Caribbean. Figure 4 presents the log of GDP per capita in PPP over 1990 to 2018. We see a general positive increase over time. Thus, we predict that female LFP rate and GDP is positively correlated, while the gender difference in LFP rate and GDP is negatively correlated.

4 Empirical Methodology

We determine whether there is a causal relationship between female LFP rate or the gender difference of LFP rate and the log of GDP per capita. With the relationship we presented in the flowchart (Figure 1), we empirically estimate the following baseline model with ordinary least squares on the log of GDP per capita,

$$g_{it} = \beta_0 + \beta_1 Z_{it} + \beta_2 D_{it} + \mathbf{X}'_{it}\gamma + \mu_c + \delta_t + \epsilon_{it}, \tag{1}$$

where the variables are defined in Section 3. We utilize robust standard errors in our estimates. The model assumes strict exogeneity, $E(\epsilon_{it}) = E(X_{it}\epsilon_{it}) = 0$, where the observed variables in the model are uncorrelated with unobservables in the error term. This also means there is no omitted variable bias that would skew our coefficient estimates. The assumptions on the error term may be violated because there may exist some unobserved variable that is correlated with an observed variable(s) represented in the model which leads to modifications of Equation (1) seen further in this section.

In column (2), we find that female participation in the labor force has a significant pre-

dicted effect with a p-value of less than 0.01 and a positive relationship with the natural log of GDP per capita. The coefficient of 0.008 can be interpreted as for each additional percentage point increase in female labor force participation, GDP is expected to increase by 0.8 percent, ceteris paribus. This positive relationship is consistent with our expectations in that as female LFP increases, GDP does as well. The difference in labor force participation rates between males and females is also significant with a low p-value of near zero and a negative relationship with GDP per capita. Our results show that for every additional percentage point increase of the gender difference in labor force participation, GDP is estimated to decrease by 1.4 percentage points, all else equal.

The estimates for Equation (1) are presented in Table 3. Column (1) presents the results for our model when we exclude female LFP rate and the gender difference in LFP rate. The effect of average years of schooling becomes less negative and population growth becomes positive and significant once we control for female LFP rate and the gender difference in column (2). This means that the effects of schooling are negatively overstated and the effects of population growth are understated when we omit the LFP variables. In terms of the other variables within our model, average years of schooling, investment, population growth, inflation, exports of goods and services, fertility, and child mortality are all significant predictors. Government expenditure, however, is not significant.

Overall, our results for the relationship between female LFP and GDP were consistent with our expectations. However, we were surprised by several of the coefficients on our control variables, such as the negative relationship between average schooling years and GDP. We further investigate whether these estimates are biased by including an interaction term between schooling and female labor force participation rate.

Our initial baseline model (Eq. 1) includes country fixed effects that control for country-specific time-constant unobserved characteristics. However, in order to have a comparison between a model without country fixed effects and with country fixed effects, we generate the model:

Table 3: Baseline Model Estimates of Log of GDP on Female Labor Force Participation

	(1) Without LFP	(2) With LFP
Schooling	-0.0313**	-0.0233*
	(0.0143)	(0.0131)
Investment	0.0102***	0.0100***
	(0.0019)	(0.0019)
Population Growth	-0.0101	0.0331*
	(0.0206)	(0.0185)
Government Expenditures	0.0002	0.0024
	(0.0021)	(0.0022)
Inflation	-0.0000	0.0000**
	(0.0000)	(0.0000)
Exports	-0.0021*	-0.0036***
	(0.0011)	(0.0012)
Fertility	0.1017***	0.0994***
	(0.0286)	(0.0290)
Mortality	-0.0025***	-0.0029***
	(0.0008)	(0.0009)
Female LFP Rate		0.0081***
		(0.0025)
Gender Difference in LFP Rate		-0.0138***
		(0.0032)
Constant	8.9166***	8.8448***
	(0.1518)	(0.2412)
Country Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
Observations	640	640
R^2	0.9700	0.9772

Notes: The dependent variable is the log of GDP. All variables and units are described in Table 3. Robust standard errors shown in parentheses; * $p < 0.01$, ** $p < 0.05$, *** $p < 0.01$.

$$g_{it} = \beta_0 + \beta_1 Z_{it} + \beta_2 D_{it} + \mathbf{X}'_{it}\gamma + \delta_t + \epsilon_{it}. \tag{2}$$

Table 4 provides the estimates for the original baseline model (Equation 1) and the baseline model without the inclusion of country fixed effects (Equation 2). From the estimates, we observe a slight alteration in significance levels for the coefficients. For example, Government Expenditures is not significant in Eq.1, but is significant at the 0.05 alpha level in Eq. 2. Inflation, that was significant in Eq. 1, proved to be insignificant in Eq. 2. This suggests that there are unobserved characteristics that are country-dependent that exist and influence the model. Using country fixed effects allows for the controlling of these unobservable characteristics.

Additionally, we predict that female labor force participation rate may affect a country's GDP with different levels of average years of schooling. This prediction stems from the idea that as average years spent in school increases, less time is spent in the labor force; and students are not included in the labor force participation rate. Furthermore, the effect of female LFP may be stronger when there are higher levels of schooling since schooling leads to a higher investment of human capital for the workforce. We also see that the coefficient on schooling changes when we add additional controls of labor force participation. Thus, we have modified the original baseline model (Equation 1) by adding an interaction term between female labor force participation and average years of schooling (S_{it}). The model with the inclusion of the interaction term is as follows:

$$g_{it} = \beta_0 + \beta_1 Z_{it} + \beta_2 D_{it} + \theta(Z_{it} S_{it}) + \mathbf{X}'_{it}\gamma + \mu_c + \delta_t + \epsilon_{it}, \tag{3}$$

where S_{it} is average schooling (and S_{it} is in the vector of controls, $\mathbf{X}'_{it}$). The coefficient on female LFP rate is the estimated effect on GDP when average schooling is zero and the coefficient on the interaction term shows how female labor force participation changes with average years of schooling. The results are located in Table 4. The interaction term has a

coefficient of -0.002 and is significant at all levels. This suggests that for every additional year in average schooling in a country increases, the effect of the female labor force participation rate on GDP decreases. The negative and significant coefficient on the interaction term implies that the female labor force participation rate has a stronger negative effect on GDP when the average schooling increases.This could also be read as when female labor force participation rate increases, the effect of a country's average amount of school on the GDP lessens.

After further analysis of the key variable of interest, finding an instrumental variable that does not directly impact GDP per capita has proven difficult. Initially, it was thought that average household size could be used, however, data was lacking and the variable might be jointly determined with GDP, failing the exogeneity assumption. Due to the coverage GDP per capita has, and the many variables that influence the measure, discovering a variable that directly impacts female LFP on a macro-level, without directly influencing GDP, due to how likely they are to be jointly determined. We settled on using a lagged version of female labor force participation as the instrumental variable. To be valid, the lagged female LFP rate must only affect GDP per capita through the direct channel of female LFP. In other words, lagged female LFP rate explains variation in female LFP, but does not impact GDP per capita, unless indirectly through female LFP. We predict that lagged female LFP rate directly influences female LFP since the rate at which women participate in the labor force in one year will be impacted by the rate at which they participated in years prior. On the other hand, female GDP at $t - 10$ likely does not impact GDP per capita in year t which supports the use of this variable as an instrument. We introduce a two-stage least squares model with the endogenous variable and instruments,

$$g_{it} = \beta_0 + \beta_1 Z_{it} + \beta_2 D_{it} + \mathbf{X}'_{it}\gamma + \mu_c + \delta_t + u_{it}, \tag{4}$$

$$Z_{it} = \beta_0 + \beta_1 IV_{it} + \beta_2 D_{it} + \mathbf{X}'_{it}\gamma + \mu_c + \delta_t + \epsilon_{it} \text{ (first-stage)}, \tag{5}$$

Table 4: Modified Estimates of Log of GDP on Female Labor Force Participation

	(1) No Country FE	(2) Baseline	(3) Interaction
Female LFP Rate	0.0090**	0.0081***	0.0244***
	(0.0040)	(0.0025)	(0.0067)
Gender Difference in LFP Rate	0.0100**	-0.0138***	-0.0102***
	(0.0042)	(0.0032)	(0.0037)
Schooling	0.1277***	-0.0233*	0.0616*
	(0.0136)	(0.0131)	(0.0342)
Female LFP Rate*Schooling			-0.0018***
			(0.0006)
Investment	0.0133***	0.0100***	0.0096***
	(0.0028)	(0.0019)	(0.0019)
Population Growth	-0.0289	0.0331*	0.0378**
	(0.0318)	(0.0185)	(0.0181)
Government Expenditures	-0.0229***	0.0024	0.0020
	(0.0039)	(0.0022)	(0.0021)
Inflation	0.0000	0.0000**	0.0000**
	(0.0000)	(0.0000)	(0.0000)
Exports	-0.0062***	-0.0036***	-0.0040***
	(0.0009)	(0.0012)	(0.0012)
Fertility	-0.2765***	0.0994***	0.1180***
	(0.0439)	(0.0290)	(0.0293)
Mortality	-0.0068***	-0.0029***	-0.0028***
	(0.0012)	(0.0009)	(0.0009)
Constant	8.5378***	8.8448***	7.9484***
	(0.3477)	(0.2412)	(0.4380)
Country Fixed Effects	No	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Observations	640	640	640
R^2	0.7244	0.9772	0.9777

Notes: The dependent variable is the log of GDP. All variables and units are described in Table 3. Robust standard errors shown in parentheses; * $p < 0.01$, ** $p < 0.05$, *** $p < 0.01$.

where Equation 1 is our baseline model and Equation 5 is the first stage model that includes the instrumental variable of female LFP lagged 10 years and denoted as IV_{it}. In this first stage, female LFP is estimated through the use of the baseline variables, but where female LFP is instead a 10 year lag of female LFP. This estimate should be used for female LFP then is used in the baseline model to provide more realistic predictions. When utilizing the instrumental variables approach, the relevance assumption must hold for the instrument and thus X must directly influence female labor force participation rate. Additionally, we impose the strict exogeneity assumption on the instrument, where $E(IV_{it}u_{it}) = 0$. Initial results for the instrumental variable are located in the Appendix.

5 Additional Models

In this section, we estimate four additional models. The models include interactions between female labor force participation rate with each of the following variables: fertility rate,[1] percentage of women in parliament,[2] female unemployment,[3] and law and order.[4]

5.1 Fertility

I further modify our baseline model to include an interaction between fertility rate and female labor force participation rate. This will enable us to discern how the effect of female labor force participation on GDP changes based on the average number of births per woman in a country. The modified model is as follows:

$$g_{it} = \beta_0 + \beta_1 Z_{it} + \beta_2 D_{it} + \beta_3 F_{it} + \gamma(Zit * Fit) + \mathbf{X}'_{it} + \mu_c + \delta_t + \epsilon_{it}, \tag{6}$$

where F_{it} represents average births per woman, which was already included in the control

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vector ($\mathbf{X}'_{it}$) in the original model, but is shown separately and as an interaction term here.

Table 5 shows the results of the regression outlined above. When including the interaction term, we no longer see significant effects of female labor force participation on GDP, though we do see that the gender difference in labor force participation has a strong negative effect on GDP per capita. The coefficient on the interaction term indicates that as fertility rate increases, the impact of female labor force participation on per capita GDP does as well, or that as female labor force participation increases, the impact of fertility rate on GDP per capita does as well. This effect, however, is not statistically significant. The effect of fertility rate itself on GDP per capita is similarly insignificant, which represents a change from our baseline model in which the effect of fertility rate was highly significant and a one unit increase in average births per woman leads to a nearly 10% increase in GDP. In our modified model shown below, a one unit increase in average births per woman leads to a 7.6% increase in GDP.

Figure 6 shows the marginal effect of female labor force participation rate on GDP per capita at different fertility rates. This figure shows that there is indeed a positive and increasing relationship between the fertility rates and the effect of female labor force participation on GDP. Figure 7 represents the marginal effect of fertility rate on GDP per capita at different rates of female labor force participation. This graph once again represents a positive and increasing relationship.

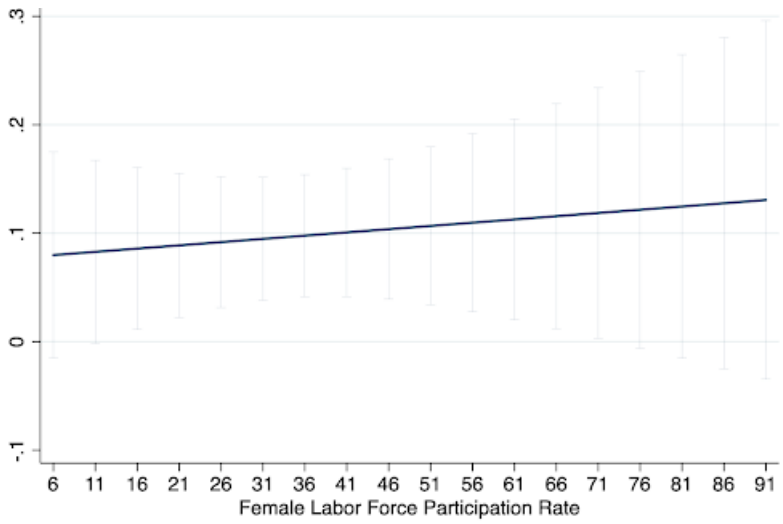
Overall, when interacting the variable for average births per woman with female labor force participation rate, we see that fertility rate, female labor force participation rate, and the interaction term are no longer significant. However, the effect of the interaction term is positive, which indicates a stronger marginal effect of fertility rate on per capita GDP at higher levels of female labor force participation and a stronger marginal effect of female labor force participation on per capita GDP at higher fertility rates.

Table 5: Effect of Female LFP Rate on GDP with Fertility Interaction

	(1) Fertility Interaction
Female LFP Rate	0.0066
	(0.0041)
Gender Difference in LFP Rate	-0.0135***
	(0.0033)
Fertility	0.0763
	(0.0555)
Female LFP Rate*Fertility	0.0006
	(0.0014)
Schooling	-0.0234*
	(0.0130)
Investment	0.0100***
	(0.0019)
Population Growth	0.0320*
	(0.0191)
Government Expenditures	0.0023
	(0.0022)
Inflation	0.0000**
	(0.0000)
Exports	-0.0037***
	(0.0012)
Mortality	-0.0030***
	(0.0010)
Constant	8.8957***
	(0.2741)
Country FE	Yes
Time FE	Yes
Observations	640
R^2	0.9773

Notes: The dependent variable is the log of GDP. All variables and units are described in Table 3. Robust standard errors shown in parentheses; * $p < 0.01$, ** $p < 0.05$, *** $p < 0.01$.

Figure 6: Marginal Effect of Fertility Rate on GDP



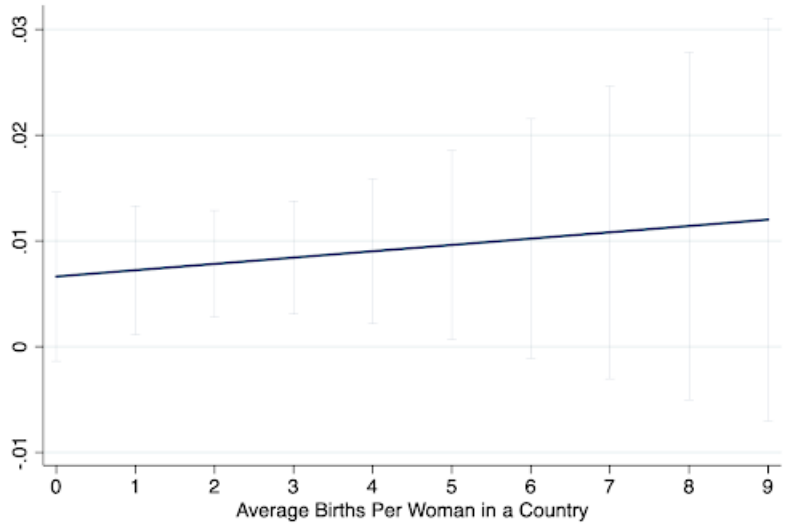
5.2 Women in Parliament

The effect of female labor force participation on GDP may be stronger when there are higher levels of female representation in countries' political systems. A higher percentage of women make up parliament can be an indicator for the expansion of women's formal work and participation in the labor force. This can also translate to the deterioration of gender roles and the appropriate economic valuation of women's work in society. Thus, I estimate the following model,

$$g_{it} = \beta_0 + \beta_1 Z_{it} + \beta_2 D_{it} + \eta_1 P_{it} + \eta_2 Z_{it} P_{it} + \mathbf{X}'_{it}\gamma + \mu_c + \delta_t + \epsilon_{it} \tag{7}$$

where P_{it} is the percentage of seats held by women in parliament and $Z_{it}P_{it}$ is the interaction between female labor force participation rate and the percentage of seats held by women in parliament. With this model, we can estimate how the effect of the female labor force participation rate affects GDP at different levels of the percentage of women holding seats in parliament and vice versa. The sample size decreases to 478 observations due to missing data on the new variable of political representation. Results and statistics are presented in Table 6.

Figure 7: Marginal Effect of Female LFP Rate on GDP



When adding the variable of the proportion of seats held by women in parliament, the effect of the gender difference in LFP on log GDP becomes insignificant. On the other hand, the effect of female LFP becomes more positive than the baseline estimates found in Table 3. In column (1), the estimates show that for each additional percentage point increase in female labor force participation, GDP is expected to increase by 1.5 percent, holding all else constant. This estimate is higher than the predicted 0.8 percent increase for each percentage point of female LFP rate found in Table 3. Furthermore, GDP is estimated to increase by 0.38 percent for every additional percentage point of parliament seats held by women, ceteris paribus.

In column (2), I include the interaction term between the percentage of parliament seats held by women and the female labor force participation rate. The gender difference in LFP rate remains significant and the coefficient on the parliament representation variable becomes insignificant. When the proportion of seats held by women in parliament is zero, an additional percentage point increase in female LFP rate is predicted to increase GDP by 1.2 percentage points, holding all else constant. The coefficient on the interaction term shows the extent to which the effect of female LFP rate has on GDP when the measure of parliament seats held by women increases by one percentage point. For every additional

percentage point increase in seats held by women in parliament, female LFP rate is expected to increase GDP by an additional 0.01%. The coefficient also shows the extent to which the effect of the percentage of parliament seats held by women has on GDP when female LFP increases by one percentage point.

As the female labor force participation rate increases, the effect of the proportion of seats held by women in parliament on log GDP becomes stronger. The effect is predicted to be negative when the female LFP rate is between 0% and 30% but positive thereafter. Similarly, as the proportion of seats held by women parliament increases within a country, the effect of the female labor force participation rate on log GDP becomes stronger. This effect of female LFP participation is estimated to be positive at all levels of female political representation.

The results in this section show that the female labor force participation rate affects GDP at different levels political representation of women affects. The relationship of these two covariates enhance the predicted effects on GDP. Additional considerations to this section include modifications on the strength of democracy in the institutions. Using female political representation should also be further investigated as an instrument for female labor force participation, since represent may directly influence it.

Table 6: Effect of Female LFP on Log GDP Per Capita with Parliament Interaction

	(1) Parliament	(2) Parliament Interaction	(3) Summary
Log GDP Per Capita			9.141
			0.587
Female LFP Rate	0.0151***	0.0119***	51.274
	(0.0036)	(0.0042)	(0.587)
Gender Difference in LFP Rate	-0.0056	-0.0067	27.767
	(0.0045)	(0.0046)	(10.020)
Women in Parliament	0.0038***	-0.0037	17.567
	(0.0008)	(0.0038)	(10.654)
Schooling	0.0103	0.0101	7.808
	(0.0139)	(0.0138)	(1.753)
Investment	0.0154***	0.0154***	20.862
	(0.0017)	(0.0017)	(5.216)
Population Growth	0.0763***	0.0733***	1.318
	(0.0269)	(0.0261)	(0.640)
Government Expenditures	-0.0029	-0.0022	13.172
	(0.0035)	(0.0035)	(3.324)
Inflation	0.0015***	0.0016***	6.912
	(0.0005)	(0.0005)	(7.509)
Exports	-0.0048***	-0.0046***	33.081
	(0.0010)	(0.0010)	(15.806)
Fertility	0.0459	0.0442	2.559
	(0.0305)	(0.0298)	(0.618)
Mortality	-0.0028***	-0.0027***	25.281
	(0.0007)	(0.0006)	(17.679)
Women in Parliament*Female LFP Rate		0.0001**	
		(0.0001)	
Constant	8.0944***	8.2845***	
	(0.3590)	(0.3804)	
Country Fixed Effects	Yes	Yes	
Time Fixed Effects	Yes	Yes	
Observations	478	478	478
R^2	0.9845	0.9846	

Notes: The dependent variable is the log of GDP. All variables and units are described in Table 3. Robust standard errors shown in parentheses; * $p < 0.01$, ** $p < 0.05$, *** $p < 0.01$. Means with standard deviations in parentheses of this sample shown in column (2).

Figure 8: Marginal Effect of Women in Parliament on GDP per Capita

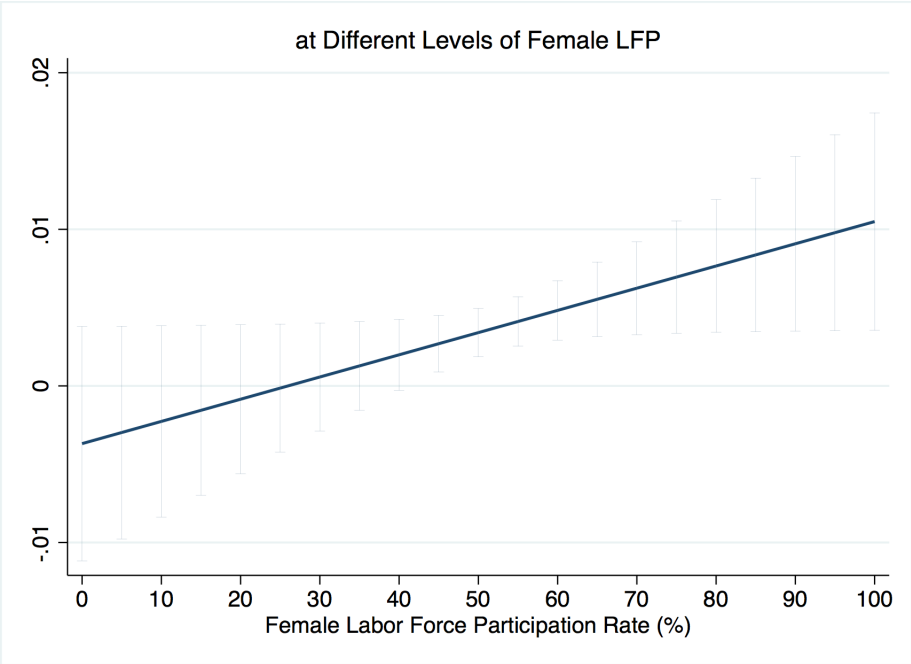
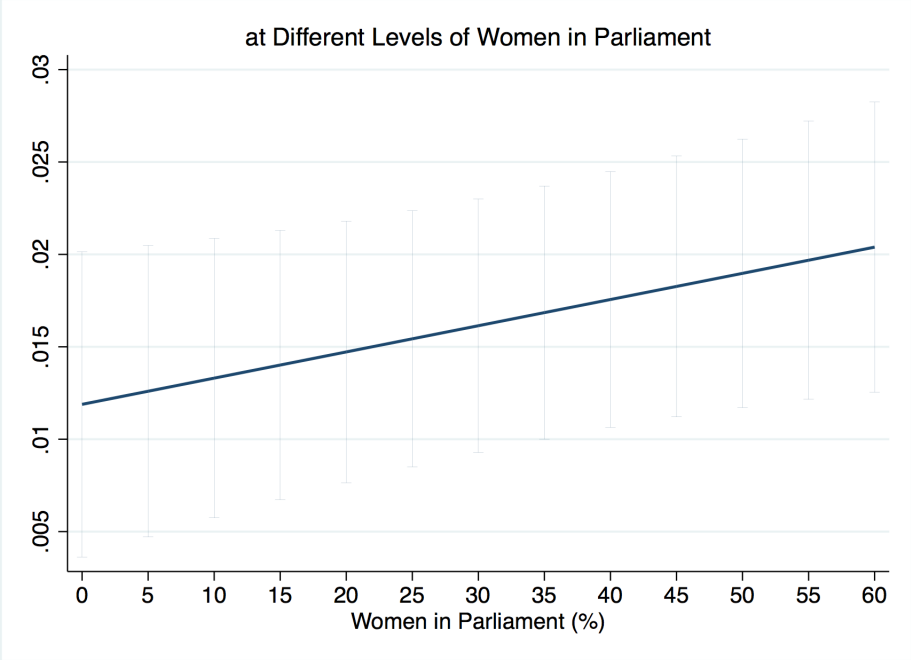


Figure 9: Marginal Effect of Female LFP on GDP per Capita



5.3 Female Unemployment Rate

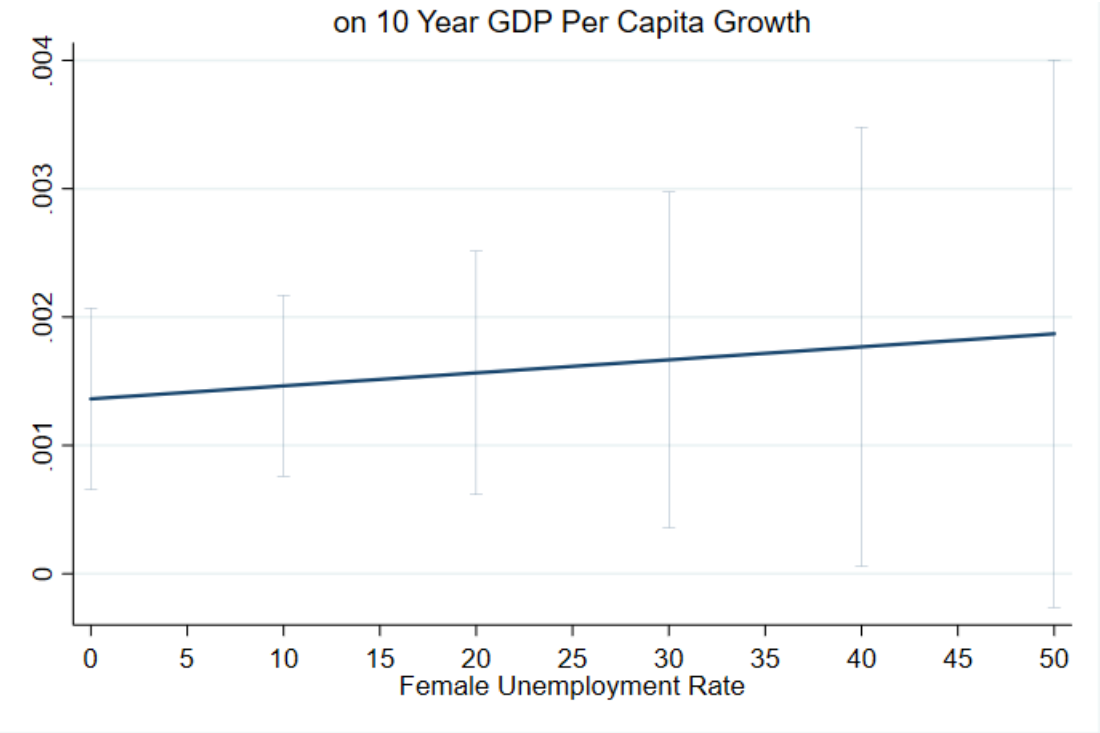
A modification to the original model would be to change the outcome variable to GDP and to include female unemployment. This modification would be important as it would help us to understand the long term impact of female labor force on a country's development while also allowing us to control for the fact that an increase in female labor force participation rate might just be a result of females entering the labor market as unemployed. This would give us a clearer image of how females participating in an economy affects it. I propose the model,

$$g_{it} = \beta_0 + \beta_1 Z_{it} + \beta_2 D_{it} + \beta_3 U_{it} + \gamma Z_{it} U_{it} + \mathbf{X}'_{it}\gamma + \mu_c + \delta_t + \epsilon_{it}, \tag{8}$$

where U_{it} is the female unemployment rate and $Z_{it}U_{it}$ is the interaction between female unemployment rate and female LFP rate. The estimates for this model are located in Table 7.

Our modified baseline shows a positive relationship between GDP and female labor force participation. This corroborates our previous results that an increase in female labor force participation rate is associated with an increase in GDP, but now we know this is also true in the long term. Table 7 also shows multiple regressions meant to test the hypothesis that the female unemployment rate plays a role in the growth of the nations of interest. We see that the coefficient when we add female unemployment to the list of controls the coefficient is positive and significant suggesting that all else equal as female unemployment increases so does predicted growth for a nation. This contrasts with the fact that an increase in female labor force participation rate is correlated with an increasing growth when holding the female unemployment (and all the other covariates constant). This is seeming a contradiction as it makes no sense for both an increase in employment (an increase in female labor force participation holding unemployment constant) and an increase in unemployment to have the same effect on growth. The findings also suggest that there is likely something inherently wrong with this model and that further steps should be taken to verify the effects.

Figure 10: Marginal Effect of Female Labor Force Participation Rate



A possible way to expand and verify this information would be to find and use an instrumental variable in an attempt to get a better estimation of the effect and hopefully dealing with the contradiction. Another possible way to get a better estimate of these relationships would be to expand the sample to other countries in the hope that an increase in observations might help show the relationship better. There is a third model which includes an interaction term between female labor force participation and female unemployment. Including this term makes the female unemployment term insignificant and the resulting interaction term itself is not significant suggesting that this is a bad addition to the model. The model suggests that as the unemployment rate rises the marginal effect of female labor force participation on growth increases.

Table 7: Effect of Female LFP on Log GDP Per Capita with Unemployment Interaction

	(1) Unemployment	(2) Interaction
Female LFP Rate	0.001***	0.001***
	(0.000)	(0.000)
Gender Difference in LFP Rate	0.002***	0.002***
	(0.000)	(0.000)
Female Unemployment Rate	0.002***	0.001
	(0.000)	(0.001)
Female LFP*Female Unemployment Rate		0.000
		(0.000)
Schooling	0.003*	0.003*
	(0.002)	(0.002)
Investment	0.001***	0.001***
	(0.000)	(0.000)
Population Growth	-0.009***	-0.009***
	(0.002)	(0.002)
Government Expenditures	-0.002***	-0.002***
	(0.000)	(0.000)
Inflation	-0.000	-0.000
	(0.000)	(0.000)
Exports	-0.000	-0.000
	(0.000)	(0.000)
Fertility	0.010**	0.010**
	(0.004)	(0.004)
Mortality	-0.000***	-0.000***
	(0.000)	(0.000)
Constant	-0.126***	-0.124***
	(0.035)	(0.035)
Region Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	370	370
R^2	0.783	0.783

Notes: The dependent variable is the log of GDP. All variables and units are described in Table 3. Robust standard errors shown in parentheses; * $p < 0.01$, ** $p < 0.05$, *** $p < 0.01$.

5.4 Law and Order

Using the baseline model (Eq. 1), the variable law and order, denoted as L_{it}, is added to determine whether the additional variable aids in explaining the variability in GDP per capita. Law and order is interacted with female labor force participation,

$$g_{it} = \beta_0 + \beta_1 Z_{it} + \beta_2 D_{it} + \eta_1 L_{it} + \eta_2 Z_{it} L_{it} + \mathbf{X}'_{it}\gamma + \mu_c + \delta_t + \epsilon_{it}. \tag{9}$$

The interaction term that interacts female labor force participation and law and order is generated since it is believed that female labor force participation has a different effect on GDP per capita depending on the level of law and order present in a particular country. Alternatively, this interaction could be interpreted as the effect of female labor force participation depends on the level of law and order, or vice versa. Intuitively, with a more strict criminal justice system in place, females will feel safer and be more willing to enter the labor force. The estimates for Eq. 9 are shown in Table 8.

The coefficient for the interaction term is 0.003, indicating that as the level of law and order increases, the effect of female labor force participation on GDP per capita increases as well. Consistent with the initial hypothesis, the interaction between female labor force participation and the level of law and order is significant, with a p-value of 0.001. Law and order is significant individually, with a p-value of 0.035, and coefficient of -0.103.

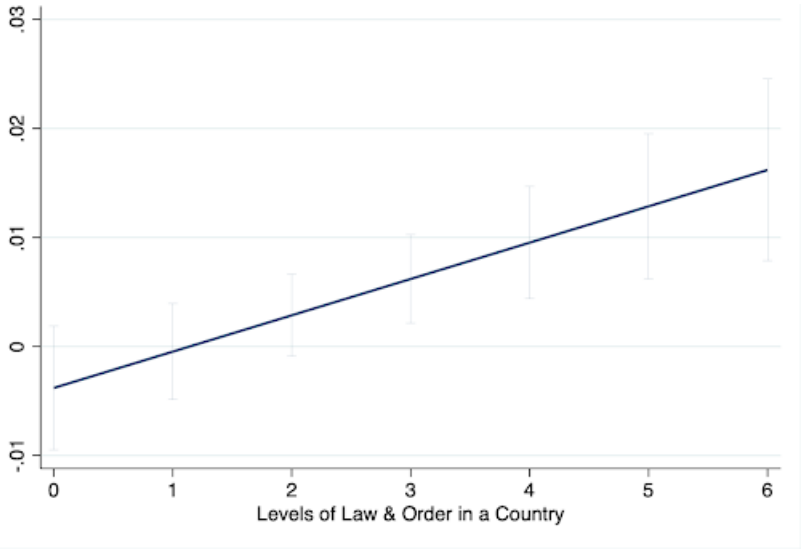
Using marginal effects, the change in GDP per capita when specified explanatory variables–female labor force participation and the level of law and order–change and holding all other covariates constant, can be interpreted. Figure 9 shows the average marginal effect of female labor force participation on GDP per capita for levels of law and order in countries within the Latin America and Caribbean region. The law and order levels are derived from the ICRG law and order index, where 6 indicates a high degree of law and order. From Figure 9, it can be observed that as the degree of law and order increases within a country, the female labor force participation rate becomes more positive.

Table 8: Effect of Female LFP on GDP with Law and Order Interaction

	(1) Law and Order Interaction	(2) Summary
Log of GDP Per Capita		8.971
		(0.553)
Female LFP Rate	-0.004	48.249
	(0.003)	(8.078)
Level of Law and Order	-0.103**	2.696
	(0.049)	(0.976)
Female LFP Rate * Level of Law and Order	0.003***	128.358
	(0.001)	(45.741)
Gender Difference in LFP Rate	-0.009***	31.238
	(0.003)	(9.791)
Schooling	-0.061***	7.145
	(0.014)	(1.639)
Investment	0.008***	20.708
	(0.002)	(5.477)
Population Growth	-0.022	1.364
	(0.025)	(0.616)
Government Expenditures	0.003*	12.689
	(0.002)	(4.013)
Inflation	0.000	62.873
	(0.000)	(454.551)
Exports	-0.003***	31.360
	(0.001)	(18.837)
Fertility	0.163***	2.742
	(0.022)	(0.688)
Mortality	-0.001	29.342
	(0.000)	(19.367)
Constant	9.208***	
	(0.197)	
Country FE	Yes	
Time FE	Yes	
Observations	510	510
R-squared	0.985	

Notes: The dependent variable is the log of GDP. All variables and units are described in Table 3. Robust standard errors shown in parentheses in column (1); * $p < 0.01$, ** $p < 0.05$, *** $p < 0.01$. Means with standard deviations in parentheses of this sample shown in column (2).

Figure 11: Marginal Effect of Female LFP on GDP (At Levels of Law and Order)



6 Conclusion

In this paper, we used data from the World Bank over the years of 1990 to 2018 to investigate whether female labor force participation rate and the gender difference in the labor force participation rate influences GDP per capita in the Latin America and Caribbean region. Generally, we find that an increase in female labor force participation rates positively affects a country's GDP and that the gender difference in labor force participation rate negatively affects a country's GDP in the Latin America and Caribbean region. Specifically, we find that the effect of female LFP rate varies with schooling and the effect of female LFP on GDP can be driven by the effect of schooling.

Additionally, we conclude that the effects of female LFP rate on GDP do not vary over different levels of fertility, but the marginal effects of female LFP rate on GDP are positive at increasing levels of female political representation and law and order. Though insignificant, there would be a stronger marginal effect of fertility rate on per capita GDP at higher levels of female labor force participation rates. Also, for every additional percentage point increase in seats held by women in parliament, female LFP rate is expected to increase GDP by 0.01%. The effect of female LFP rate on GDP also becomes insignificant when controlling

for the law and order interaction term and its effect on GDP becomes stronger with greater levels of law and order.

Policies regarding schooling, female political representation, and law and order should be further discussed due to the impact these components have on female LFP and GDP per capita as observed in our study. Given that the marginal effect of female LFP on GDP is positive at increasing levels of female political representation, countries may opt to adopt certain policies that promote women's political engagement. Policies encompassing law and order may prove beneficial for economic performance as well referencing Model IV. As the level of law and order increased, the effect of female LFP on GDP increased positively as well. Advocating for a more strict and or active justice system could lead to increasing female LFP rates, which ultimately affects GDP within a country.

Future research should consider adding lagged variables for schooling since schooling likely affects female LFP rate through the channel of human capital accumulation. With more robust data, researchers should additionally consider the role of different occupations and industries as the effects on GDP likely differ and women may sort into occupations differently. In conclusion, research on the female labor force participation rate on GDP is important in the two dimensions on efficiency and equity. Research on this topic can guide policy to reduce inefficiencies from job mismatch by gender in the labor market which in turn, affects countries' economic prosperity. Finally, this area research can address normative concerns surrounding the gender disparities in job opportunities which ultimately impact a country's GDP.

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Appendices

A Data Appendix

Table 9: Sample Summary Statistics

	mean	sd	min	max
Log of GDP per Capita	9.015	0.598	7.589	10.543
Female LFP Rate	49.849	9.088	33.000	72.190
Gender Difference in LFP Rate	29.612	10.608	7.090	51.080
Average Schooling	7.494	1.793	3.050	11.100
Investment	20.525	5.386	7.627	51.751
Population Growth	1.409	0.673	-0.555	3.836
Government Expenditures	12.825	3.749	2.926	43.479
Inflation	51.831	406.334	-26.300	6261.240
Exports	33.021	17.901	5.323	125.748
Fertility	2.741	0.745	1.613	5.437
Mortality	29.333	20.449	7.200	207.000
Observations	640			

Notes: Few observations due to sample selection

B Results

This table shows us the second stage of the 2sls. This model is mostly similar to our original model except the term for labor differences was excluded as it was directly related to female labor force participation. The result that the female labor force has a positive impact on GDP is corroborated by this model. Though it should be noted that this instrument is likely invalid as it is likely related to past GDP which is likely related to current GDP, making this instrument fail the exogeneity assumption.

Figure 12: Two-Stage Least Squares Estimates

	(1)
VARIABLES	Base
Female Labor Force Participation Rate	0.031***
	(0.007)
Schooling	0.175***
	(0.035)
Investment	0.016***
	(0.006)
Population Growth	-0.028
	(0.048)
Government Expenditures	0.016*
	(0.009)
Inflation	0.000
	(0.000)
Exports	-0.003
	(0.002)
Fertility	-0.035
	(0.071)
Mortality	-0.003
	(0.002)
Observations	619
Number of Countries	25
R-squared	0.844

Robust standard errors in parentheses

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