Women Participation Force & GDP Growth

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ABSTRACT

Utilizing data from The World Bank's 2019 dataset, the primary focus is to investigate if the participation of women in the labor force directly influences a country's economic growth over time.

This analysis takes into account various factors including population size, inflation rates, high-technology exports, the proportion of exports to GDP, unemployment rates, the time required to start a business, and the duration of paid maternity leave.

INVESTIGATION QUESTION & HYPOTHESIS

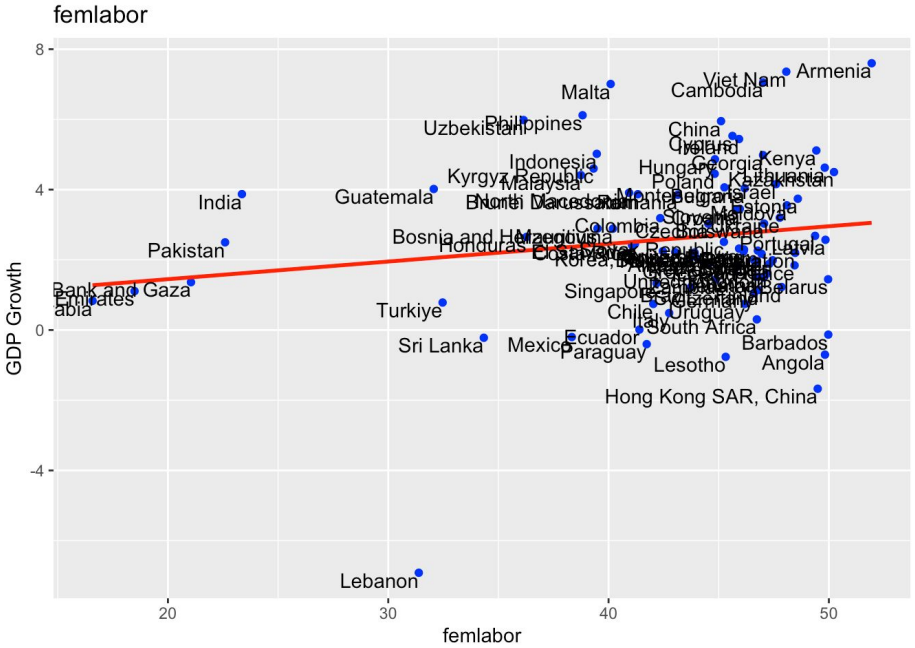
- **Does the Participation of Females in the Workforce Cause Changes in a Country's GDP Growth?**

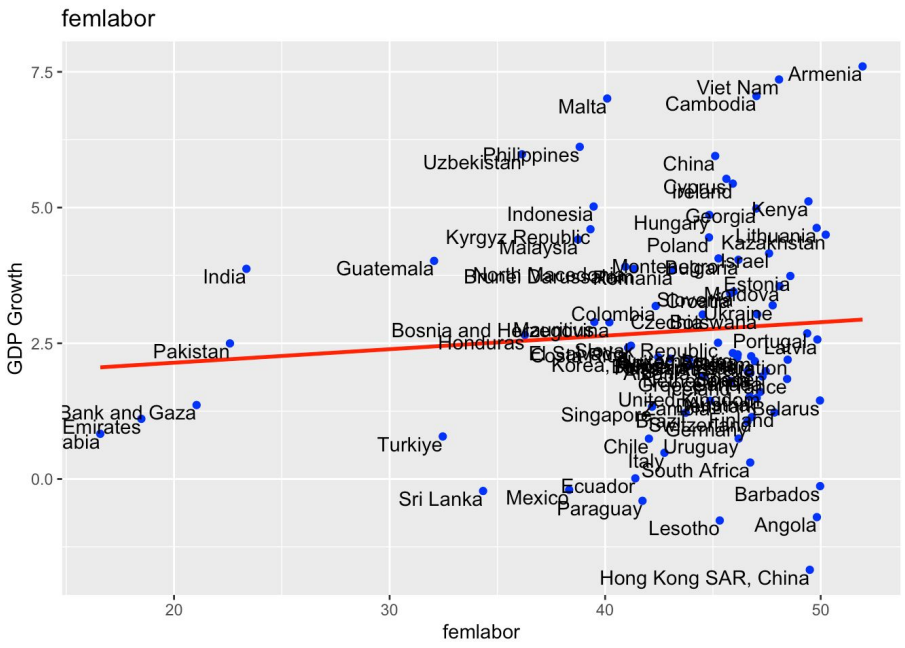
- **"Greater Female Labor Force Participation Positively Influences a Country's Economic Growth and Societal Development."**

DATASET ANALYSIS

DEPENDENT VARIABLE	→	GDP GROWTH
INDEPENDENT VARIABLE OF INTEREST	→	FEMLABOR
CONTROL VARIABLES	→	• POPULATION • INFLATION • HIGH TECh EXPORTS • EXPORTS • UNEMPLOYMENT • TIME BUSINESS • FMR • DAYSMAYTERNITY

SCATTERPLOT





DESCRIPTIVE STATISTICS

Table of Descriptive Statistics

Statistic	N	Mean	Median	St. Dev.
timebusiness	86	15.53	10.05	16.33
unemployment	86	7.04	5.26	5.06
exports	86	50.02	39.90	36.83
hightechexp	86	31,387,281,480.00	1,602,408,848	91,021,880,164.00
cap2assets	86	10.11	9.12	7.05
inflation	86	2.98	2.24	3.35
savings	86	153,326,104,779.00	19,372,954,550.00	528,448,281,058.00
population	86	67,941,248.00	10,479,066.0	214,967,914.00
gdpgrowth	86	2.72	2.37	1.96
femlabor	86	43.23	45.47	7.01
FMR	86	74.61	78.36	14.42
mlabor	86	70.84	70.08	7.31
daysmaternity	86	119.62	112	67.43

BASELINE REGRESSION ANALYSIS

Part E: Baseline Regression Analysis

Results Table

	Dependent variable:									
	gdpgrowth									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
femlabor	0.025	0.037	0.032	0.050	0.047	0.042	0.044	0.078	0.060	0.072
	(0.026)	(0.024)	(0.027)	(0.029)	(0.026)	(0.031)	(0.026)	(0.033)	(0.039)	(0.035)
I(population/1e+06)		0.002	0.002	0.004	0.003		0.003	0.004	0.004	0.004
		(0.0004)	(0.001)	(0.002)	(0.002)		(0.001)	(0.001)	(0.001)	(0.001)
I(log(population))						0.266				
						(0.225)				
inflation			-0.040	-0.054	0.224	0.201	0.199	0.091	0.381	0.119
			(0.075)	(0.079)	(0.154)	(0.161)	(0.156)	(0.164)	(0.263)	(0.168)
unemployment			-0.067	-0.075	0.004	-0.005	-0.018	-0.171	-0.129	-0.539
			(0.039)	(0.040)	(0.047)	(0.047)	(0.045)	(0.138)	(0.140)	(0.346)
exports			0.003	0.006	0.008	0.010	0.007	0.049	0.049	0.045
			(0.009)	(0.008)	(0.008)	(0.012)	(0.009)	(0.018)	(0.018)	(0.019)
I(hightechexp/1e+06)				-0.00001	-0.00001					
				(0.00000)	(0.00000)					
I(log(hightechexp))						-0.168	-0.138	-0.181	-0.186	-0.172
						(0.119)	(0.086)	(0.078)	(0.078)	(0.080)
I(inflation2)								0.036	-0.021	0.032
								(0.018)	(0.051)	(0.020)
I(unemployment2)								0.010	0.009	0.047
								(0.006)	(0.006)	(0.030)
I(exports2)								-0.0002	-0.0002	-0.0002
								(0.0001)	(0.0001)	(0.0001)
I(inflation3)									0.003	
									(0.002)	
I(unemployment3)										-0.001
										(0.001)
inflation:unemployment					-0.026	-0.027	-0.024	-0.056	-0.063	-0.055
					(0.010)	(0.010)	(0.010)	(0.019)	(0.017)	(0.021)
Constant	1.644	0.995	1.649	0.906	0.175	-0.307	3.315	2.149	2.626	3.179
	(1.093)	(1.023)	(1.332)	(1.324)	(1.195)	(3.526)	(1.938)	(1.917)	(1.987)	(2.177)
Observations	86	86	86	86	86	86	86	86	86	86
R2	0.008	0.043	0.091	0.131	0.172	0.128	0.169	0.276	0.286	0.290
Adjusted R2	-0.004	0.020	0.034	0.065	0.097	0.050	0.094	0.179	0.180	0.184
Residual Std. Error	1.962	1.938	1.925	1.893	1.860	1.909	1.864	1.774	1.773	1.769
F Statistic	0.671	1.871	1.595	1.986	2.311	1.633	2.265	2.852	2.699	2.745
Note:										NA

BASELINE REGRESSION SUMMARY

From **Regression 1 to 5** we added the interest variables and other control variables into the regressions step by step.

We did **NOT** get statistical significance in any of the models.

BASELINE REGRESSION SUMMARY

In **Regressions 6 and 7** we tested the use of logs on the variables population and high tech exports,

This did **NOT** have an effect in achieving statistical significance on the variable of interest.

BASELINE REGRESSION SUMMARY

Lastly, we tested for other non-linearities in **Regressions 8 to 10**.

We used a **quadratic** approach on Regression 8 for the variables inflation, unemployment, and exports and we achieved statistical significance for the variable of interest.

In **Regressions 9 and 10** we included inflation cube and unemployment cube, respectively. We achieved statistical significance on the variable of interest in Regression 10.

BASELINE MODEL SELECTION: F TEST 1

```
Linear hypothesis test

Hypothesis:
I(inflation^2) = 0
I(unemployment^2) = 0
I(exports^2) = 0

Model 1: restricted model
Model 2: gdpgrowth ~ femlabor + I(population/1e+06) + inflation + unemployment
+
    exports + I(log(hightechexp)) + (inflation * unemployment) +
    I(inflation^2) + I(unemployment^2) + I(exports^2)

Note: Coefficient covariance matrix supplied.

  Res.Df Df      F  Pr(>F)
1     78
2     75  3 3.3389 0.02372 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

REGRESSION 7

VS

REGRESSION 8

BASELINE MODEL SELECTION: F TEST 2

REGRESSION 8

VS

REGRESSION 9

```
Linear hypothesis test

Hypothesis:
I(inflation^3) = 0

Model 1: restricted model
Model 2: gdpgrowth ~ femlabor + I(population/1e+06) + inflation + unemployment
+
    exports + I(log(hightechexp)) + (inflation * unemployment) +
    I(inflation^2) + I(unemployment^2) + I(exports^2) + I(inflation^3)

Note: Coefficient covariance matrix supplied.

  Res.Df Df      F Pr(>F)
1     75
2     74  1 1.5383 0.2188
```

BASELINE MODEL SELECTION: F TEST 3

```
Linear hypothesis test

Hypothesis:
I(unemployment^3) = 0

Model 1: restricted model
Model 2: gdpgrowth ~ femlabor + I(population/1e+06) + inflation + unemployment
+
    exports + I(log(hightechexp)) + (inflation * unemployment) +
    I(inflation^2) + I(unemployment^2) + I(exports^2) + I(unemployment^3)

Note: Coefficient covariance matrix supplied.

  Res.Df Df     F Pr(>F)
1     75
2     74  1 1.716 0.1943
```

REGRESSION 8

VS

REGRESSION 10

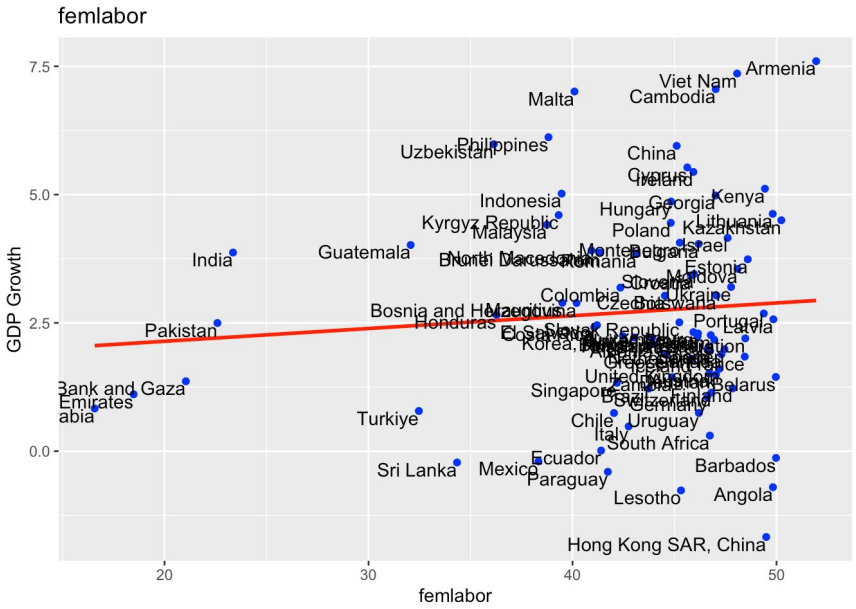
CHOSEN BASELINE REGRESSION

Results Table

	Dependent variable:
	gdpgrowth
femlabor	0.078
	(0.033)
I(population/1e+06)	0.004
	(0.001)
inflation	0.091
	(0.164)
unemployment	-0.171
	(0.138)
exports	0.049
	(0.018)
I(log(hightechexp))	-0.181
	(0.078)
I(inflation2)	0.036
	(0.018)
I(unemployment2)	0.010
	(0.006)
I(exports2)	-0.0002
	(0.0001)
inflation:unemployment	-0.056
	(0.019)
Constant	2.149
	(1.917)
Observations	86
R2	0.276
Adjusted R2	0.179
Residual Std. Error	1.774
F Statistic	2.852
Note:	NA

ALTERNATIVE REGRESSION ANALYSIS

The spread of the data is not enough, it's not reasonable to change female labor force participation rate into two-group dummies.



ALTERNATIVE REGRESSION ANALYSIS

How can we test the strength of FEMALE to GDP growth comparing with MALE?

- Femlabor = *Female Labor Force / Overall labor force*
- FMR = *(FemaleLabor /overall) / (MaleLabor / overall)*

Holding other factors constant, increasing FMR by 1%, GDP growth increase 0.027%

FMR increase 1%: Relatively increase in female labor force.

	Dependent variable:	
	gdpgrowth	
	(1)	(2)
femlabor	0.078	
	(0.033)	
FMR		0.024
		(0.016)
I(population/1e+06)	0.004	0.003
	(0.001)	(0.001)
inflation	0.091	0.202
	(0.164)	(0.170)
unemployment	-0.171	-0.116
	(0.138)	(0.144)
exports	0.049	0.051
	(0.018)	(0.018)
I(log(hightechexp))	-0.181	-0.158
	(0.078)	(0.079)
I(inflation2)	0.036	0.026
	(0.018)	(0.018)
I(unemployment2)	0.010	0.008
	(0.006)	(0.006)
I(exports2)	-0.0002	-0.0002
	(0.0001)	(0.0001)
inflation:unemployment	-0.056	-0.053
	(0.019)	(0.020)
Observations	86	86
R2	0.276	0.253
Adjusted R2	0.179	0.141
Residual Std. Error	1.774	1.814
F Statistic	2.852	2.273

ALTERNATIVE REGRESSION ANALYSIS

Instrumental variable: Length of paid maternity leave (calendar days)

- It is a weak instrument
- It is exogenous. This model is not consistent with OLS

```
Diagnostic tests:
                 df1 df2 statistic p-value
Weak instruments   1  75     0.044   0.835
Wu-Hausman         1  74     4.117   0.046 *
Sargan             0  NA        NA      NA
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

	Dependent variable:		
	gdpgrowth OLS	femlabor OLS	gdpgrowth instrumental variable
	(1)	(2)	(3)
femlabor	0.078		-2.974
	(0.031)		(14.577)
I(population/1e+06)	0.004		-0.029
	(0.001)		(0.162)
inflation	0.091		5.403
	(0.154)		(26.248)
unemployment	-0.171		3.434
	(0.129)		(17.532)
exports	0.049		0.353
	(0.017)		(1.422)
I(log(hightechexp))	-0.181		1.716
	(0.073)		(9.356)
I(inflation2)	0.036		-0.735
	(0.017)		(3.743)
I(unemployment2)	0.010		-0.185
	(0.005)		(0.946)
I(exports2)	-0.0002		-0.002
	(0.0001)		(0.007)
inflation:unemployment	-0.056		0.457
	(0.017)		(2.489)
daysmaternity		0.007	
		(0.009)	
Constant	2.149	42.429	62.976
	(1.790)	(1.570)	(284.011)
Observations	86	86	86
R2	0.276	0.004	-70.023
Adjusted R2	0.179	-0.008	-79.492
Residual Std. Error	1.774	7.032	17.569
F Statistic	2.852	0.352	
Note:			NA

SENSITIVITY ANALYSIS AND LIMITATIONS

1. Internal Validity

- Omitted Variable Bias

- Endogeneity

2. External Validity

- Generalizability

- Timeframe

CONCLUSION

What is the causal effect of the Female Labor Force on GDP Growth?

The report explored if there exists a causal relationship between female labor force participation and a country's GDP growth.

The evidence indicates a positive correlation, suggesting that **higher female workforce engagement may contribute to economic advancement.** The findings from the investigation align with our hypothesis

CONCLUSION

What is the causal effect of the Female Labor Force on GDP Growth?

However, **establishing a direct causal relationship demands further nuanced exploration considering the complex interplay of economic, social, and policy factors** because we had 14 different regressions testing for different variables and in all of the cases there has been a positive relationship between ‘Female Labor’ and ‘GDP Growth’, but this relationship was not always statistically significant.