Determinants of Civilian Participation Rate in G7 Countries from (1980-2018)

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Abstract

This paper examines the factors that contribute to the civilian participation rates of the labor force in the Group of Seven (G7) countries between 1980 and 2018. The analysis utilizing the time series data examines the effect of four macroeconomic variables, such as average weekly earnings, real GDP, unemployment rate, and inflation, on labor participation across the United States, Canada, France, Germany, Italy, Japan, and the United Kingdom. Both country-specific and comparative relations were evaluated using Ordinary Least Squares (OLS) regression models. The results indicate that the real GDP and unemployment rates significantly and negatively affect the rates of participation, meaning that slowdowns in the economy and lack of jobs deter the involvement of the labor market. On the other hand, there is a positive and significant relationship with inflation and it can be argued that moderate price increment can lead to an increased labor participation. The average weekly wages were also found to impact in a negligible or declining manner in most economies. It is statistically stable, unbiased and consistent as the models are confirmed with the help of diagnostic tests. The paper finds that macroeconomic stability, especially in labour force participation and output, is crucial to the high participation of labour force in the developed economies.

Keywords: Civic involvement in labor, G7 economies, real GDP, unemployment, inflation, income, time series modeling.

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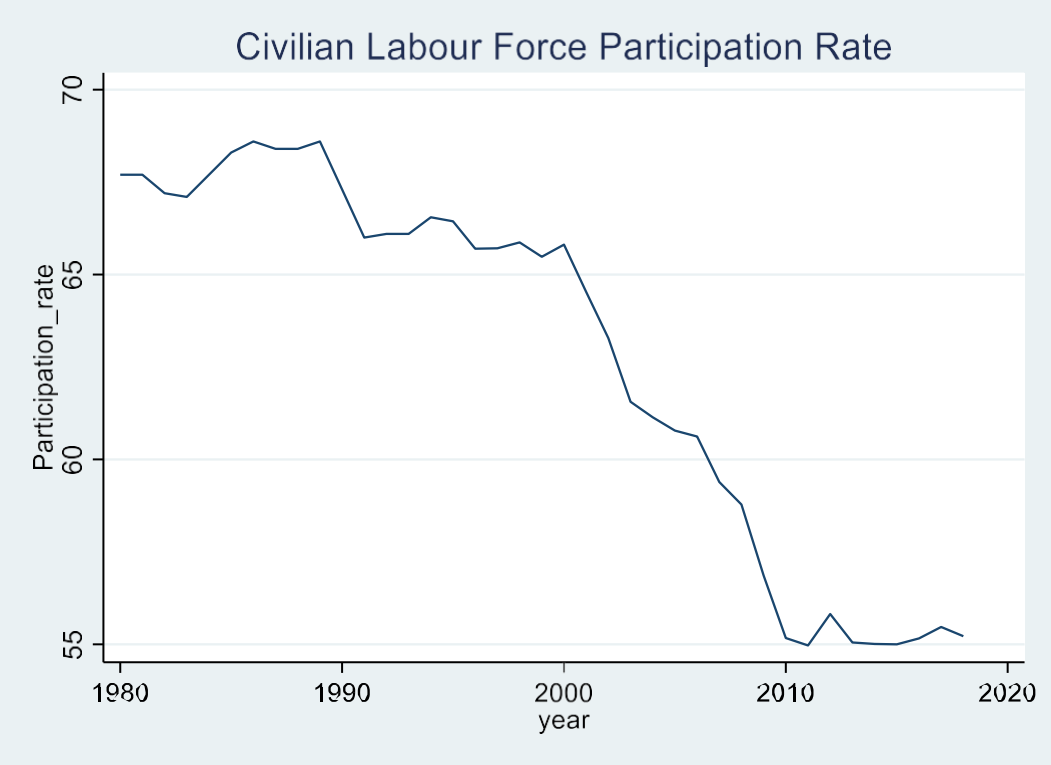
The first step of time series analysis is to plot the series

For Analysis we will fist plot all the five series.

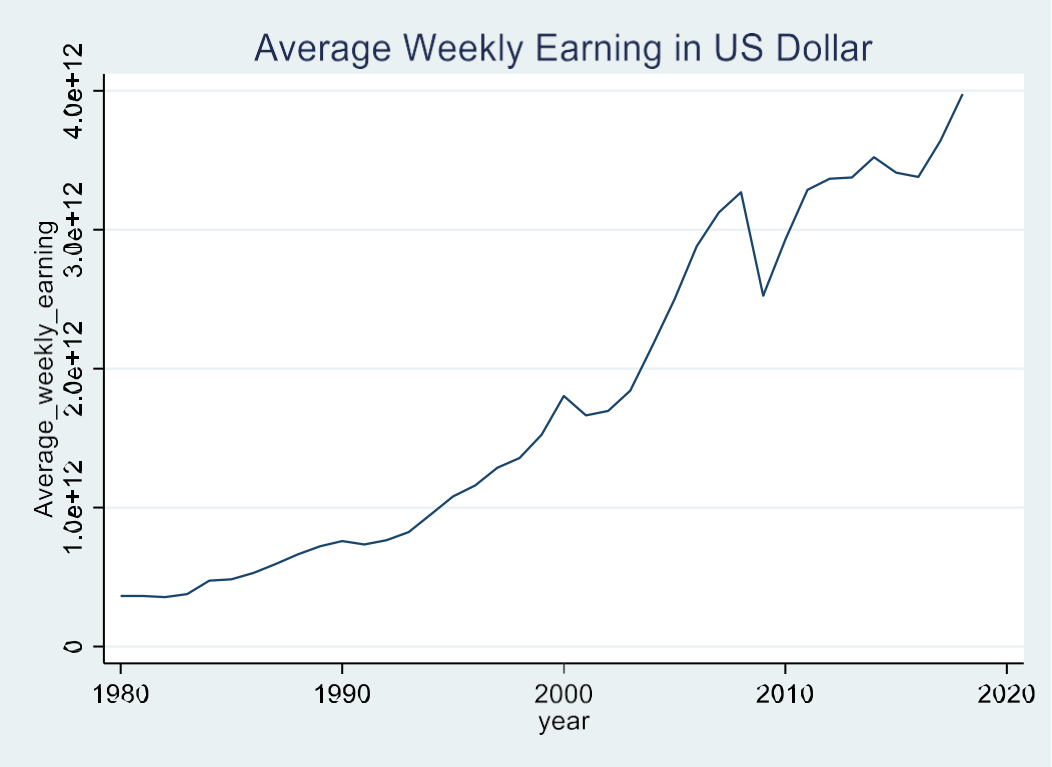
Graphical Analysis for US Countries

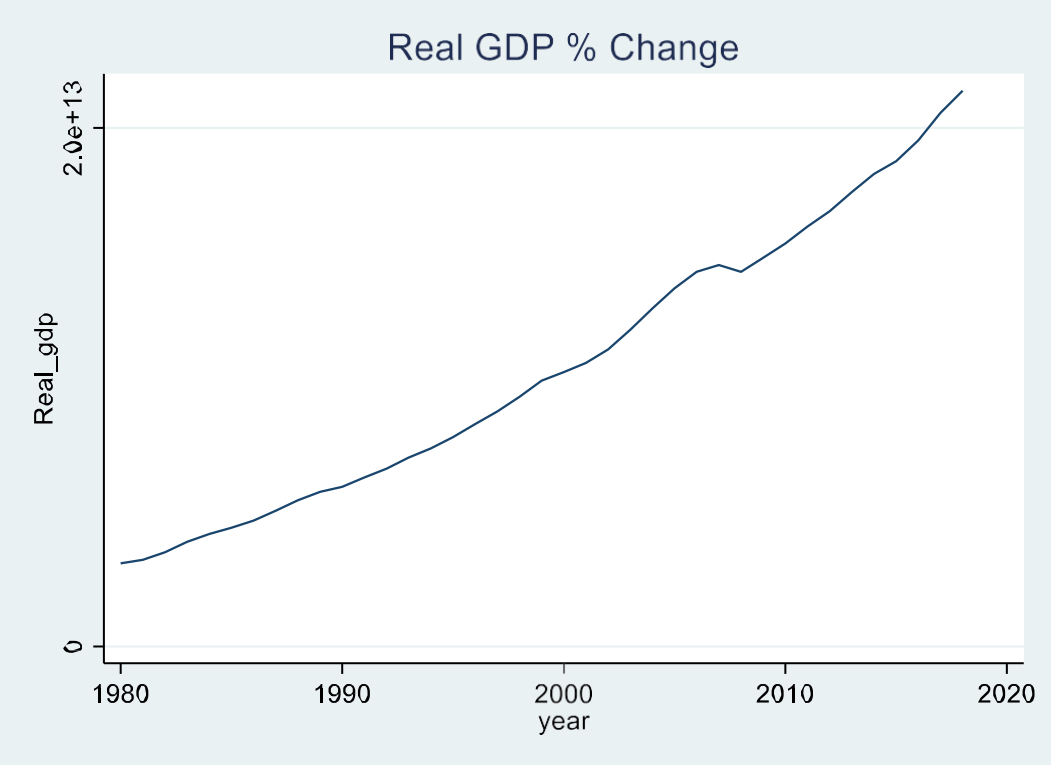


Explanation of Line Plot

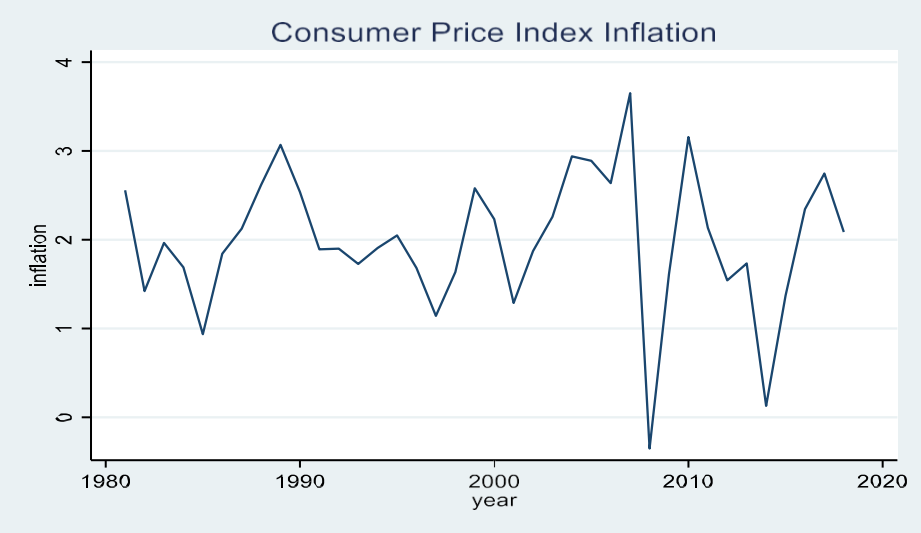
This plot shows that the series is non stationary as it is downward trend wit time from 1980 to 2018.

Graphical visualization is good for time series to get the idea of trend how its move with time.


Average Weekly Earning in US Dollar
Average_weekly_earning
0
1.0e+12
2.0e+12
3.0e+12
4.0e+12
1980
1990
2000
2010
2020
year


Real GDP % Change
Real_gdp
0
2.0e+13
1980
1990
2000
2010
2020
year


Unemployment Rate
unemployment_rate
4
6
8
10
1980
1990
2000
2010
2020
year


Consumer Price Index Inflation
inflation
0
1
2
3
4
1980
1990
2000
2010
2020
year

Regression Equation

$$Paticipation\ Rate = \beta_0 + \beta 1_{Average\ Weekly\ Earning} + \beta 2_{Real\_GDP} + \beta 3_{Unemployment\ Rate} + \beta 4_{Inflation} + \mu$$

United States Correlation, Descriptive, Regression

Matrix of correlations US

Variables	(1)	(2)	(3)	(4)	(5)
(1) participation_~e	1.000				
(2) average_weekly~g	-0.963	1.000			
(3) real_gdp	-0.957	0.984	1.000		
(4) unemployment_r~e	0.047	-0.209	-0.299	1.000	
(5) inflation	0.043	-0.024	0.001	-0.227	1.000

Descriptive Statistics US

Variable	Obs	Mean	Std. Dev.	Min	Max
participation rate	39	62.835	5.107	54.97	68.6
average weekly ear~g	39	1.788e+12	1.198e+12	3.558e+11	3.977e+12
real gdp	39	1.077e+13	5.412e+12	3.207e+12	2.143e+13
unemployment rate	39	6.179	1.683	3.67	9.7
inflation	38	1.988	.779	-.351	3.65

Linear regression US

participation_rate ~s	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
average_weekly_ear~s	0	0	-0.08	.94	0	0	
real_gdp_us	0	0	-5.98	0	0	0	***
unemployment_rate_us	-.82	.098	-8.40	0	-1.019	-.622	***
inflation_us	-.201	.167	-1.21	.236	-.539	.138	
Constant	78.896	1.123	70.23	0	76.613	81.179	***

Mean dependent var	62.835	SD dependent var	5.107
R-squared	0.977	Number of obs	39.000
F-test	362.146	Prob > F	0.000
Akaike crit. (AIC)	95.617	Bayesian crit. (BIC)	100.608

*** $p<.01$, ** $p<.05$, * $p<.1$

CANADA Correlation, Descriptive, Regression

Matrix of correlations for Canada

Variables	(1)	(2)	(3)	(4)
(1) participation_~a	1.000			
(2) average_weekly~d	-0.069	1.000		
(3) real_gdp_canada	-0.457	-0.076	1.000	
(4) unemployment_r~a	0.262	-0.129	-0.664	1.000
(5) inflation_canada	0.854	-0.087	-0.539	0.222

Descriptive Statistics for Canada

Variable	Obs	Mean	Std. Dev.	Min	Max
participation rate~a	39	66.615	5.227	59.22	80.01
average weekly ear~a	39	2.531	2.689	-6.306	7.339
real gdp canada	39	9.317e+11	5.319e+11	2.739e+11	1.847e+12
unemployment rate ~a	39	8.263	1.703	5.83	12.02
inflation canada	39	3.171	2.718	.166	12.472

Linear regression for Canada

participation_rate ~a	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
average_weekly_ear~a	.075	.18	0.42	.681	-.291	.44	
real_gdp_canada	0	0	0.89	.38	0	0	
unemployment_rate_~a	.474	.383	1.24	.224	-.304	1.253	
inflation_canada	1.716	.209	8.20	0	1.291	2.141	***
Constant	55.882	4.674	11.96	0	46.382	65.381	***

Mean dependent var	66.615	SD dependent var	5.227
R-squared	0.740	Number of obs	39.000
F-test	24.228	Prob > F	0.000
Akaike crit. (AIC)	194.089	Bayesian crit. (BIC)	200.744

*** *p<.01*, ** *p<.05*, * *p<.1*

FRANCE Correlation, Descriptive and Linear Regression

Matrix of correlations for France

Variables	(1)	(2)	(3)	(4)	(5)
(1) participation_~e	1.000				
(2) average_weekly~c	-0.167	1.000			
(3) real_gdp_france	-0.200	-0.278	1.000		
(4) unemployment_r~e	-0.298	0.461	-0.111	1.000	
(5) inflation_france	0.312	-0.221	-0.645	-0.484	1.000

Descriptive Statistics for France

Variable	Obs	Mean	Std. Dev.	Min	Max
participation rate~e	39	34.572	1.805	31.84	41.29
average weekly ear~e	39	1.749	1.626	-2.842	5.268
real gdp france	39	1.711e+12	7.943e+11	5.307e+11	2.918e+12
unemployment rate ~e	39	9.624	1.523	6.42	12.59
inflation france	39	3.075	3.434	.038	13.563

Linear regression for France

participation_rate ~e	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
average_weekly_e ar~e	-.141	.218	-0.64	.524	-.585	.303	
real_gdp_france	0	0	-1.05	.299	0	0	
unemployment_ra te_~e	-.362	.277	-1.31	.201	-.925	.201	
inflation_france	-.034	.17	-0.20	.843	-.38	.312	
Constant	39.613	3.914	10.12	0	31.659	47.567	***

Mean dependent var	34.572	SD dependent var	1.805
R-squared	0.154	Number of obs	39.000
F-test	1.548	Prob > F	0.211
Akaike crit. (AIC)	157.214	Bayesian crit. (BIC)	163.869

*** *p<.01*, ** *p<.05*, * *p<.1*

Germany Correlation, Descriptive and Linear Regression

Matrix of correlations for Germancy

Variables	(1)	(2)	(3)	(4)	(5)
(1) participation_~y	1.000				
(2) average_weekly~a	0.173	1.000			
(3) real_gdp_germany	-0.656	-0.076	1.000		
(4) unemployment_r~y	-0.311	-0.189	-0.153	1.000	
(5) inflation_germ~y	0.626	-0.265	-0.434	-0.056	1.000

Descriptive Statistics or Germancy

Variable	Obs	Mean	Std. Dev.	Min	Max
participation rat~ny	39	50.472	3.754	44.31	58.9
average weekly ea~ny	39	1.745	2.06	-4.241	5.459
real gdp germany	39	2.361e+12	1.036e+12	7.251e+11	3.964e+12
unemployment rate~ny	39	7.168	1.938	3.38	11.17
inflation germany	39	2.11	1.522	-.129	6.344

Linear regression or Germancy

participation_rat~ny	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
average_weekly_ea~ny	.346	.176	1.97	.057	-.012	.705	*
real_gdp_germany	0	0	-4.85	0	0	0	***
unemployment_rate~ny	-.633	.18	-3.52	.001	-.999	-.267	***
inflation_germany	1.088	.261	4.17	0	.557	1.618	***
Constant	56.389	2.195	25.69	0	51.929	60.849	***

Mean dependent var	50.472	SD dependent var	3.754
R-squared	0.739	Number of obs	39.000
F-test	24.042	Prob > F	0.000
Akaike crit. (AIC)	168.490	Bayesian crit. (BIC)	175.144

*** *p<.01*, ** *p<.05*, * *p<.1*

Italy Correlation, Descriptive and Linear Regression

Matrix of correlations for Italy

Variables	(1)	(2)	(3)	(4)	(5)
(1) participation_~y	1.000				
(2) average_weekly~y	0.409	1.000			
(3) real_gdp_italy	-0.942	-0.499	1.000		
(4) unemployment_r~y	-0.083	0.373	-0.101	1.000	
(5) inflation_italy	0.834	0.083	-0.760	-0.299	1.000

Descriptive Statistics for Italy

Variable	Obs	Mean	Std. Dev.	Min	Max
participation rat~ly	39	33.792	9.214	21.68	50.461
average weekly ea~ly	39	1.175	2.109	-4.04	5.586
real gdp italy	39	1.391e+12	6.188e+11	4.273e+11	2.399e+12
unemployment rate~ly	39	9.856	1.733	6.08	12.68
inflation italy	39	4.806	5.012	-.094	21.064

Linear regression for Italy

participation_rat~ly	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
average_weekly_ea~ly	.233	.27	0.86	.395	-.316	.782	
real_gdp_italy	0	0	-7.54	0	0	0	***
unemployment_rate~ly	-.616	.299	-2.06	.047	-1.224	-.008	**
inflation_italy	.395	.172	2.29	.028	.044	.745	**
Constant	53.513	4.974	10.76	0	43.404	63.621	***

Mean dependent var	33.792	SD dependent var	9.214
R-squared	0.930	Number of obs	39.000
F-test	113.107	Prob > F	0.000
Akaike crit. (AIC)	187.111	Bayesian crit. (BIC)	193.765

*** *p<.01*, ** *p<.05*, * *p<.1*

Japan Correlation, Descriptive and Linear Regression

Matrix of correlations for Japan

Variables	(1)	(2)	(3)	(4)	(5)
(1) participation_~p	1.000				
(2) average_weekly~p	-0.239	1.000			
(3) real_gdp_jap	0.453	-0.380	1.000		
(4) unemployment_r~p	0.085	-0.371	0.615	1.000	
(5) inflation_jap	-0.386	0.145	-0.672	-0.717	1.000

Descriptive Statistics for Japan

Variable	Obs	Mean	Std. Dev.	Min	Max
participation rate~p	39	44.761	1.721	41.561	48.15
average weekly ear~p	39	1.635	2.498	-5.311	6.609
real gdp jap	39	3.981e+12	1.463e+12	1.105e+12	6.203e+12
unemployment rate ~p	39	3.47	1.053	2	5.4
inflation jap	39	1.001	1.752	-1.353	7.779

Linear regression for Japan

participation_rate ~p	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
average_weekly_ear~p	-.172	.107	-1.61	.116	-.389	.045	
real_gdp_jap	0	0	1.92	.063	0	0	*
unemployment_rate_~p	-1.039	.343	-3.03	.005	-1.736	-.342	***
inflation_jap	-.54	.218	-2.47	.019	-.984	-.096	**
Constant	47.408	1.694	27.99	0	43.965	50.85	***

Mean dependent var	44.761	SD dependent var	1.721
R-squared	0.390	Number of obs	39.000
F-test	5.441	Prob > F	0.002
Akaike crit. (AIC)	140.712	Bayesian crit. (BIC)	147.367

*** *p<.01*, ** *p<.05*, * *p<.1*

UK Correlation, Descriptive and Linear Regression

Matrix of correlations for UK

Variables	(1)	(2)	(3)	(4)	(5)
(1) participation_~k	1.000				
(2) average_weekly~k	0.021	1.000			
(3) real_gdp_uk	-0.903	-0.205	1.000		
(4) unemployment_r~k	0.669	0.114	-0.754	1.000	
(5) inflation_uk	0.740	-0.394	-0.584	0.388	1.000

Descriptive Statistics for UK

Variable	Obs	Mean	Std. Dev.	Min	Max
participation rate~k	39	60.659	4.036	55.22	67.952
average weekly ear~k	39	2.405	2.348	-4.016	7.084
real gdp uk	39	1.733e+12	8.944e+11	4.615e+11	3.101e+12
unemployment rate uk	39	7.462	2.338	4	11.51
inflation uk	39	3.746	3.335	.368	17.966

Linear regression for UK

participation_rate ~k	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
average_weekly_ear~k	.007	.137	0.05	.96	-.271	.285	
real_gdp_uk	0	0	-5.81	0	0	0	***
unemployment_rate_uk	.023	.157	0.15	.883	-.295	.342	
inflation_uk	.395	.116	3.39	.002	.158	.632	***
Constant	64.469	2.342	27.53	0	59.711	69.228	***

Mean dependent var	60.659	SD dependent var	4.036
R-squared	0.883	Number of obs	39.000
F-test	64.458	Prob > F	0.000
Akaike crit. (AIC)	142.642	Bayesian crit. (BIC)	149.296

*** p<.01, ** p<.05, * p<.1*

Final Regression Analysis of G7 Countries

Dependent Variable Civilian Labor Force Participation Rate	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
VARIABLES	**United States**	**Canada**	**France**	**Germany**	**Italy**	**Japan**	**United Kingdom**
average_weekly_earning	-0.005	0.0746	-0.141	0.346*	0.233	-0.172	0.00688
	(0)	(0.180)	(0.218)	(0.176)	(0.270)	(0.107)	(0.137)
real_gdp	-0.002***	-0.032***	-0.014***	-0.072***	-0.002***	-0.025***	-0.018***
	(0)	(0)	(0)	(0)	(0)	(0)	(0)
unemployment_rate	-0.810***	0.474	-0.362	-0.633***	-0.616**	-1.039***	0.0233
	(0.0992)	(0.383)	(0.277)	(0.180)	(0.299)	(0.343)	(0.157)
inflation	-0.116	1.716***	-0.0341	1.088***	0.395**	-0.540**	0.395***
	(0.180)	(0.209)	(0.170)	(0.261)	(0.172)	(0.218)	(0.116)
Constant	78.60***	55.88***	39.61***	56.39***	53.51***	47.41***	64.47***
	(1.129)	(4.674)	(3.914)	(2.195)	(4.974)	(1.694)	(2.342)
Observations	39	39	39	39	39	39	39
R-squared	0.976	0.740	0.154	0.739	0.930	0.390	0.883
F Statistics F(4, 34)	351.31	24.23	1.55	24.04	113.11	5.44	64.46
P Value	0.000	0.000	0.2107	0.000	0.000	0.0017	0.0000

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

Interpretation and Explanation of Table1

In this case our dependent variable is Civilian Participation rate, data span is from 1980-2018, number of independent variable are 4, namely, Average Weekly Earnings, Real GDP, Unemployment Rate, Inflation. One unit increase in average weekly earning on average civilian labor force participation rate decreases.

One unit increase in Real GDP on average civilian labor force participation rate decreases, which is statisticall siginificant at 1% level of significance. One unit increase in Unemployment rate on average civilian labor force participation rate decreases by 0.81, which is statisticall siginificant at 1% level of significance One unit increase in Inflation rate on average civilian labor force participation rate decreases by 0.11, which is statistically nor siginificant.

Now for model2 Canada

One unit increase in average weekly earning on average civilian labor force participation rate increase by 0.07, which is not stataistically significant. One unit increase in Real GDP on average civilian labor force participation rate decreases by .032, which is statisticall siginificant at 1% level of significance.

One unit increase in Unemployment rate on average civilian labor force participation rate increases by 0.474, which is statistically not siginificant. One unit increase in Inflation rate on average civilian labor force participation rate increases by 1.71, which is statistically nor siginificant.

R Squared:

R squared is the coefficient of determinants which shows that how much our independent variable jointly explained our dependent variable, higher the value of R squared better the model, so in first regression for US the value of R squared is 0.97, meaning that 97% variation in dependent variable Civilian participation rate is explained by all independent variable combine.

F Statistics

F statistics null is that all the coefficient equal to zero, So rejecting null hypothesis means that the model is good fits, by looking to P value all the model P value is less than 5%.

Table 2: Misspecification Test after regression

VARIABLES	United States	Canada	France	Germany	Italy	Japan	United Kingdom
Hetroskedasticity Test Brush Pagan	0.84	0.24	0.68	0.25	0.52	0.68	0.52
Hetroskedasticity White Test	0.82	0.36	0.72	0.58	0.24	0.72	0.25
Autocorrelation Test Brush Godfrey	0.000	0.017	0.023	0.040	0.030	0.023	0.010
Multicollinearity Test VIF	3.17	2.39	6.57	4.78	9.47	3.57	4.25
Normality Test Skewness	0.39	0.71	0.48	0.26	0.85	0.48	0.14

Interpretation and Explanation of Table2

In this case our dependent variable is Civilian Participation rate, data span is from 1980-2018, number of independent variable are 4, namely, Average Weekly Earning, Real GDP, Unemployment Rate, Inflation.These test have null and alternative hypothesis, so Hetroskedasticity null is that, no hetro, Autocorrelation Null is that no autocorrelation, same for Multicollinearity test null is that no multicollinearity, same for Normality test is that data is normal, so in mostly cases there is no problem of hetro, no multicollinearity, data is normal but in few countries such as United states data, Canada, France all countries have problem of autocorrelation, to remove problem of autocorrelation from the model, estimate a new model with dependent and independent lags.

Conclusion and Policy Recommendation

It is concluded from G7 countries time series study that variable Average Weekly earning, Reag GDP and Unemployment have negative and significant impact on civilian labor force participation rate, While the remaining Inflation have positive and significant effect on civilian labor force participation rate, After estimation of regression model the post test are also stable and reliable which shows that our models are unbiased and consistent. Our results are stable and

consistent with the results of (Allegati and Perrini, 2008; Harvey and Mills, 2005; Islam and Shabaz, 2013 This study highly recommended that if G7 countries want to increase labor force participation rate than inflation have positive impact on Labor Participation rate in all G7 countries. The other variable have negative impact such as real GDP, unemployment and average weekly earning.

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