

## Introduction

For the analysis, we have taken data from World Bank from the year 2000-2015, of four countries USA, CANADA, MEXICO, and COSTA RICA.

Dependent variable- Life expectancy

Independent variable- GDP, Infant Mortality Rate

## ANALYSIS

### Constant Coefficient Model

Dependent Variable: LIFE\_EXPECTANCY\_AT\_BIRTH\_\_TOTAL\_\_YEARS\_\_  
\_SP\_DYN\_LE00\_IN\_

Method: Panel Least Squares

Date: 11/21/21 Time: 14:59

Sample: 2001 2015

Periods included: 15

Cross-sections included: 4

Total panel (balanced) observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	82.53626	0.273358	301.9348	0.0000
GDP__CONSTANT_2015_US\$__NY_G...	-1.14E-13	1.71E-14	-6.659765	0.0000
MORTALITY_RATE__INFANT__PER_1_0...	-0.408168	0.022064	-18.49962	0.0000
R-squared	0.857229	Mean dependent var		78.08358
Adjusted R-squared	0.852220	S.D. dependent var		2.137523
S.E. of regression	0.821711	Akaike info criterion		2.493851
Sum squared resid	38.48691	Schwarz criterion		2.598568
Log likelihood	-71.81552	Hannan-Quinn criter.		2.534811
F-statistic	171.1206	Durbin-Watson stat		0.052453
Prob(F-statistic)	0.000000			

Our model is able to estimate 85% of the variation in dependent variable through the independent variable.

All the above coefficients are significant at 5% level as our p-values < 0.05

As per Durbin Watson (0.0524) stat out data is highly positively auto correlated.

## Lagrange Multiplier

Lagrange Multiplier Tests for Random Effects

Null hypotheses: No effects

Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	0.095345 (0.7575)	6.784754 (0.0092)	6.880099 (0.0087)
Honda	0.308780 (0.3787)	-2.604756 (0.9954)	-1.623500 (0.9478)
King-Wu	0.308780 (0.3787)	-2.604756 (0.9954)	-0.814003 (0.7922)
Standardized Honda	2.542922 (0.0055)	-2.541283 (0.9945)	-5.295406 (1.0000)
Standardized King-Wu	2.542922 (0.0055)	-2.541283 (0.9945)	-4.050533 (1.0000)
Gourieroux, et al.	--	--	0.095345 (0.6171)

## Fixed effects Model

Dependent Variable: LIFE\_EXPECTANCY\_AT\_BIRTH\_\_TOTAL\_\_YEARS\_\_  
\_SP\_DYN\_LE00\_IN\_

Method: Panel Least Squares

Date: 11/21/21 Time: 15:01

Sample: 2001 2015

Periods included: 15

Cross-sections included: 4

Total panel (balanced) observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	75.26746	0.270582	278.1685	0.0000
GDP__CONSTANT_2015_US\$__NY_G...	-7.77E-14	5.10E-14	-1.523033	0.1356
MORTALITY_RATE__INFANT__PER_1_0...	0.329913	0.025562	12.90639	0.0000

### Effects Specification

Cross-section fixed (dummy variables)

Period fixed (dummy variables)

R-squared	0.995132	Mean dependent var	78.08358
Adjusted R-squared	0.992820	S.D. dependent var	2.137523
S.E. of regression	0.181128	Akaike info criterion	-0.318029
Sum squared resid	1.312287	Schwarz criterion	0.380086
Log likelihood	29.54088	Hannan-Quinn criter.	-0.044958
F-statistic	430.3598	Durbin-Watson stat	0.444335
Prob(F-statistic)	0.000000		

Our model is able to estimate 99% of the variation in dependent variable through the independent variable.

All the above coefficients are significant at 5% level as our p-values < 0.05 except GDP as p-value > 0.05

As per Durbin Watson (0.44) stat out data is highly positively auto correlated

## FEM \_ Likelihood Test

Redundant Fixed Effects Tests

Equation: Untitled

Test cross-section and period fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	359.917437	(3,40)	0.0000
Cross-section Chi-square	199.919000	3	0.0000
Period F	30.345185	(14,40)	0.0000
Period Chi-square	147.167871	14	0.0000
Cross-Section/Period F	66.654385	(17,40)	0.0000
Cross-Section/Period Chi-square	202.712794	17	0.0000

Cross-section fixed effects test equation:

Dependent Variable: LIFE\_EXPECTANCY\_AT\_BIRTH\_\_TOTAL\_\_YEARS\_\_

SP\_DYN\_LE00\_IN

Method: Panel Least Squares

Date: 11/21/21 Time: 15:02

Sample: 2001 2015

Periods included: 15

Cross-sections included: 4

Total panel (balanced) observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	82.47505	0.311164	265.0530	0.0000
GDP__CONSTANT_2015_US\$__NY_G...	-1.14E-13	1.93E-14	-5.895851	0.0000
MORTALITY_RATE__INFANT__PER_1_0...	-0.402020	0.025274	-15.90649	0.0000

### Effects Specification

Period fixed (dummy variables)

R-squared	0.863725	Mean dependent var	78.08358
Adjusted R-squared	0.813018	S.D. dependent var	2.137523
S.E. of regression	0.924296	Akaike info criterion	2.913954
Sum squared resid	36.73591	Schwarz criterion	3.507352
Log likelihood	-70.41862	Hannan-Quinn criter.	3.146064
F-statistic	17.03360	Durbin-Watson stat	0.048867
Prob(F-statistic)	0.000000		

Period fixed effects test equation:

Dependent Variable: LIFE\_EXPECTANCY\_AT\_BIRTH\_\_TOTAL\_\_YEARS\_\_SP\_DYN\_LE00\_IN

Method: Panel Least Squares

Date: 11/21/21 Time: 15:02

Sample: 2001 2015

Periods included: 15

Cross-sections included: 4

Total panel (balanced) observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	76.01063	0.782670	97.11708	0.0000
GDP__CONSTANT_2015_US\$__NY_G...	5.73E-13	1.14E-13	5.027819	0.0000
MORTALITY_RATE__INFANT__PER_1_0...	-0.058920	0.049716	-1.185135	0.2412

### Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.943429	Mean dependent var	78.08358
Adjusted R-squared	0.938191	S.D. dependent var	2.137523
S.E. of regression	0.531417	Akaike info criterion	1.668102
Sum squared resid	15.24985	Schwarz criterion	1.877536
Log likelihood	-44.04306	Hannan-Quinn criter.	1.750023
F-statistic	180.1114	Durbin-Watson stat	0.110944
Prob(F-statistic)	0.000000		

Cross-section and period fixed effects test equation:

Dependent Variable: LIFE\_EXPECTANCY\_AT\_BIRTH\_\_TOTAL\_\_YEARS\_\_SP\_DYN\_LE00\_IN

Method: Panel Least Squares

Date: 11/21/21 Time: 15:02

Sample: 2001 2015

Periods included: 15

Cross-sections included: 4

Total panel (balanced) observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	82.53626	0.273358	301.9348	0.0000
GDP__CONSTANT_2015_US\$__NY_G...	-1.14E-13	1.71E-14	-6.659765	0.0000
MORTALITY_RATE__INFANT__PER_1_0...	-0.408168	0.022064	-18.49962	0.0000

R-squared	0.857229	Mean dependent var	78.08358
Adjusted R-squared	0.852220	S.D. dependent var	2.137523
S.E. of regression	0.821711	Akaike info criterion	2.493851
Sum squared resid	38.48691	Schwarz criterion	2.598568
Log likelihood	-71.81552	Hannan-Quinn criter.	2.534811
F-statistic	171.1206	Durbin-Watson stat	0.052453
Prob(F-statistic)	0.000000		

## REM

Dependent Variable: LIFE\_EXPECTANCY\_AT\_BIRTH\_\_TOTAL\_\_YEARS\_\_  
\_SP\_DYN\_LE00\_IN\_

Method: Panel EGLS (Two-way random effects)

Date: 11/21/21 Time: 15:03

Sample: 2001 2015

Periods included: 15

Cross-sections included: 4

Total panel (balanced) observations: 60

Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	78.63175	0.946259	83.09746	0.0000
GDP__CONSTANT_2015_US\$__NY_G...	1.55E-13	7.96E-14	1.946499	0.0565
MORTALITY_RATE__INFANT__PER_1_0...	-0.131214	0.054351	-2.414179	0.0190
Effects Specification				
			S.D.	Rho
Cross-section random			0.356562	0.7949
Period random			0.000000	0.0000
Idiosyncratic random			0.181128	0.2051
Weighted Statistics				
R-squared	0.180157	Mean dependent var	10.15454	
Adjusted R-squared	0.151391	S.D. dependent var	0.688867	
S.E. of regression	0.634584	Sum squared resid	22.95371	
F-statistic	6.262760	Durbin-Watson stat	0.059074	
Prob(F-statistic)	0.003478			
Unweighted Statistics				
R-squared	0.103748	Mean dependent var	78.08358	
Sum squared resid	241.6036	Durbin-Watson stat	0.005612	

Our model is able to estimate 10% of the variation in dependent variable through the independent variable.

Mortality rate coefficients is significant at 5% level as our p-values < 0.05 but GDP is insignificant as p-value > 0.05

As per Durbin Watson (0.0524) stat out data is highly positively auto correlated.

## REM Hausman Test

Correlated Random Effects - Hausman Test  
Equation: Untitled  
Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	2	1.0000
Period random	0.000000	2	1.0000
Cross-section and period random	0.000000	2	1.0000

\* Cross-section test variance is invalid. Hausman statistic set to zero.  
\* Period test variance is invalid. Hausman statistic set to zero.  
\*\* WARNING: estimated period random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
GDP__CONSTANT_2015_US\$__NY_G...	0.000000	0.000000	-0.000000	NA
MORTALITY_RATE__INFANT__PER_1_0...	-0.058920	-0.131214	-0.002667	NA

Cross-section random effects test equation:  
Dependent Variable: LIFE\_EXPECTANCY\_AT\_BIRTH\_\_TOTAL\_\_YEARS\_\_  
\_\_SP\_DYN\_LE00\_IN\_\_  
Method: Panel EGLS (Period random effects)  
Date: 11/21/21 Time: 15:03  
Sample: 2001 2015  
Periods included: 15  
Cross-sections included: 4  
Total panel (balanced) observations: 60  
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	76.01063	0.266764	284.9358	0.0000
GDP__CONSTANT_2015_US\$__NY_G...	5.73E-13	3.88E-14	14.75133	0.0000
MORTALITY_RATE__INFANT__PER_1_0...	-0.058920	0.016945	-3.477116	0.0010

Effects Specification			S.D.	Rho
Cross-section fixed (dummy variables)				
Period random			0.000000	0.0000
Idiosyncratic random			0.181128	1.0000

Weighted Statistics			
R-squared	0.943429	Mean dependent var	78.08358
Adjusted R-squared	0.938191	S.D. dependent var	2.137523
S.E. of regression	0.531417	Sum squared resid	15.24985
F-statistic	180.1114	Durbin-Watson stat	0.110944
Prob(F-statistic)	0.000000		

Unweighted Statistics			
R-squared	0.943429	Mean dependent var	78.08358
Sum squared resid	15.24985	Durbin-Watson stat	0.110944

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
GDP__CONSTANT_2015_US\$__NY_G...	0.000000	0.000000	-0.000000	NA
MORTALITY_RATE__INFANT__PER_1_0...	0.109112	-0.131214	-0.002560	NA

Period random effects test equation:  
Dependent Variable: LIFE\_EXPECTANCY\_AT\_BIRTH\_\_TOTAL\_\_YEARS\_\_SP\_DYN\_LE00\_IN\_\_  
Method: Panel EGLS (Cross-section random effects)  
Date: 11/21/21 Time: 15:03  
Sample: 2001 2015  
Periods included: 15  
Cross-sections included: 4  
Total panel (balanced) observations: 60  
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	76.84278	0.223028	344.5425	0.0000
GDP__CONSTANT_2015_US\$__NY_G...	4.14E-14	2.35E-14	1.758935	0.0857
MORTALITY_RATE__INFANT__PER_1_0...	0.109112	0.019847	5.497639	0.0000

Effects Specification			S.D.	Rho
Cross-section random			0.356562	0.7949
Period fixed (dummy variables)				
Idiosyncratic random			0.181128	0.2051

Weighted Statistics			
R-squared	0.633326	Mean dependent var	78.08358
Adjusted R-squared	0.496889	S.D. dependent var	0.688867
S.E. of regression	0.488615	Sum squared resid	10.26603
F-statistic	4.641895	Durbin-Watson stat	0.053711
Prob(F-statistic)	0.000029		

Unweighted Statistics			
R-squared	-0.434533	Mean dependent var	78.08358
Sum squared resid	386.7088	Durbin-Watson stat	0.001426

Cross-section and period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
GDP__CONSTANT_2015_US\$__NY_G...	-0.000000	0.000000	-0.000000	NA
MORTALITY_RATE__INFANT__PER_1_0...	0.329913	-0.131214	-0.002301	NA

Cross-section and period random effects test equation:  
Dependent Variable: LIFE\_EXPECTANCY\_AT\_BIRTH\_\_TOTAL\_\_YEARS\_\_SP\_DYN\_LE00\_IN\_\_  
Method: Panel Least Squares  
Date: 11/21/21 Time: 15:03  
Sample: 2001 2015  
Periods included: 15  
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Total panel (balanced) observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	75.26746	0.270582	278.1685	0.0000
GDP__CONSTANT_2015_US\$__NY_G...	-7.77E-14	5.10E-14	-1.523033	0.1356
MORTALITY_RATE__INFANT__PER_1_0...	0.329913	0.025562	12.90639	0.0000

Effects Specification			
Cross-section fixed (dummy variables)			
Period fixed (dummy variables)			
R-squared	0.995132	Mean dependent var	78.08358
Adjusted R-squared	0.992820	S.D. dependent var	2.137523
S.E. of regression	0.181128	Akaike info criterion	-0.318029
Sum squared resid	1.312287	Schwarz criterion	0.380086
Log likelihood	29.54088	Hannan-Quinn criter.	-0.044958
F-statistic	430.3598	Durbin-Watson stat	0.444335
Prob(F-statistic)	0.000000		

This test is used to find out whether fixed model or random effects model better helps estimate our data set

Since P-value  $> 0.05$  we conclude that Random effects model provides a better estimation for our data as compared to Fixed effects model.