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ESKILSTUNA VÄSTERÅS

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Female Labor Force Participation Rate and Economic Growth

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Abstract

This thesis analysed the effect of female labor force participation rate (FLFPR) on economic growth and included changes in male labor force participation rate (MLFPR) to help improve the power of the model. Here, three robust regressions were used on the sample of 16 Latin Countries (Argentina, Bolivia, Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Venezuela, RB, Jamaica, Mexico, Nicaragua, Panama, Paraguay, El Salvador) for the period of 1995-2015 in order to identify the effect of each key variable when tested separately and when tested together. According to the results, the coefficients of FLFPR and MLFPR are different and also the addition of MLFPR to the model that has an explanatory variable FLFPR and dependent variable economic growth clearly improves the predicting power of the model and helps obtain better coefficients. It was also identified that FLFPR has a strong positive relationship with economic growth, while MLFPR has a negative effect on the latter. Finally, the existence of u-shape relationship between FLFPR and economic growth was reaffirmed in this thesis, while it was also shown that MLFPR does not have a u-shape relationship with the economic growth.

Keywords: Labor Force Participation Rate, Economic Growth, Solow Model, Female Labor Force Participation Rate

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1. Introduction

In the current stable global economic setting, countries are struggling to maintain the previously recorded remarkable economic growth rates. This might be due to the fact that the countries have approached their maximum output volumes with given resources. Thus, the policymakers and scholars are forced to seek new avenues of growth for the countries. One of such interesting ways was identified after finding the thought-provoking relationship between the female labor force participation rate (FLFPR) and the economic growth by numerous researchers such as Psacharopoulos, G. and Tzannatos, Z. (1989), Zhand, W.B. (1993), Goldin, C. (1994), who converged on the idea that there is a significant positive relationship between these variables. Psacharopoulos, G. and Tzannatos, Z. (1989) proposed that this might be due to the fact that the male labor force participation rate has reached its maximum, however the female participation rate has the potential to grow, because the old obstacles for women's participation in the labor force are being almost completely removed in the majority of the countries. The relationship can be logically explained as it can be predicted that the addition of more people in the workforce should lead to the increase in the potential output (Mckinsey Global Institute, 2015). To attempt to explain it from another perspective, numerous studies prove that the human capital has a significant positive effect on the long-run economic growth of the countries (Barro, 1999). Additionally, there is evidence that there are underlying differences to how male and female human capital are correlated with the economic growth (Sehrawat and Giri, 2017). The paper suggests that the male human capital has a positive relationship with the economic growth, however, the coefficient of the effect is insignificant. On the other hand, the female human capital has a significant positive relationship to the long-turn economic performance. This relationship provides a link for the topic of our research in a form of an interesting observation. In order to explain the latter statement, it

is important to refer to the work of Solow (1956), who suggested that the long rung economic growth of the countries depend on the rate of technological change and the changes in the size of the labor force. So, as male and human capital might have different effects on the rates of economic growth, the goal of this research is to identify if the impact of changes in the female labor force participation (FLFPR) and male labor force participation rates (MLFPR) might also have different effects on the economic growth.

1.1. Aim of the research

A key proposition of this research is that there is a gap in the studies of the relationship between either of female labor force participation rate or male labor force participation rate and the economic growth. Therefore, the aim of this thesis is to separately study the effects of the FLFPR and MLFPR on the economic growth. As the textbook Solow theory also includes fixed capital in the production function, a control variable such as gross capital formation will be used in this thesis. This thesis can be regarded as the extension of the findings of Mankiw, Romer and Weil (1992). What is going to be different from their paper is the fact that I will use the female and male labor force participation rates as primary independent variables and add gross capital formation as an additional explanatory variable to the model.

1.2. Methodology

The process of reviewing the literature on the topic revealed that the most appropriate method for conducting this type of research is to employ deductive approach. This latter choice has been made because the hypotheses that were developed to test the research question and objectives are derived from the existing theory. As this thesis uses panel data, and the assumption of homoscedasticity was not satisfied, the Hausman test was executed in order to choose between fixed and random effects regression (appendix). According to the test, the random effects model is the best fit for the

data. Therefore, this model is used in the analysis. Additionally, the test for heteroscedasticity was positive, thus, the robust random effects regression was needed to correct for this factor.

1.3.Structure of the Thesis

The thesis will begin with the theoretical background, where the theoretical framework behind the topic will be discussed. The key theories and main assumptions will be discussed in this part. Later in this part, the hypotheses will be presented. Next section will concentrate on the survey of previous literature on the topic. This section will present the advances in the topic by other researchers and will demonstrate the state of the progress in the sphere. Next section will contain the information about the data that has been used in order to test the hypotheses of the research. Descriptive statistics and description of the data will be provided in this part. Proceeding part will report the results and will describe whether the hypotheses that were set out are accepted or rejected. The final parts of the thesis will be summary and conclusions that will summarize all the findings and will provide commentary on the results of the thesis.

2. Theoretical Background and Previous Literature

2.1. Theoretical Background

Main theory behind this thesis is the fundamental Solow's (1956) theory of economic growth built in the neoclassical economic framework. According to Solow (1956), the economic growth is contingent upon the changes in capital accumulation, labor and technological progress. The Solow growth equation is $k'(t) = sAk(t)\alpha - (\delta + \mathrm{n})\mathrm{k(t)}$.

This differential equation, where (k) stands for capital per worker, shows the process of capital accumulation in the economy. First part of the equation depicts the growth of capital thanks to investments (s), whereas the second part shows the decline in capital accumulation (δ+n) because of the effective depreciation.

Additionally, according to the theory, the long term economic growth depends on the rate of technological progress. As a follow-up to this theory, Mankiw, Romer and Weil (1992) have produced a paper that included human capital to the textbook Solow model of economic growth. Therefore, the classical production function ($Y = AK^{\alpha}L^{\beta}$, where Y stands for income, A for total factor productivity, L for labor, K for capital, finally, α and β are the constants that stand for the capital and labor elasticities respectively) also included human capital in it. This aided in obtaining better estimates of the coefficients of independent variables such as capital and labor. Regarding the assumptions of those models, the key ones are the diminishing marginal returns on the inputs, non-zero rate of labor growth, and non-zero technological progress.

These papers are among the several that served as motivation for this thesis to concentrate on the topic of male and female labor force participation rates and their effects on the economic growth.

2.2. Previous Literature

2.2.1. Solow-Swan Model

The amount of literature on the empirics of economic growth is remarkably rich and advanced and it would probably be most appropriate to start surveying it with the works of Solow (1956) and Swan (1956). These authors have separately studied the topic of economic growth and income convergence across countries and produced one of the most famous theories of economic growth. The main postulate of their studies was that the long term economic growth in countries is determined by exogenous factors, and is mainly facilitated by the rate of technological advancement and increase in the labor force. Important seminal paper by Mankiw, Romer and Weil (1992) investigated the Solow model from different perspectives to analyse the differences in incomes of developed and emerging countries and why they fail to converge in terms of gross domestic product per capita (GDPPC). Although they have stated that the Solow-Swan model correctly estimates the effects of savings and investments on economic growth, they also argued that the coefficients of these effects are biased. After the addition of human capital to the textbook Solow model, they have been able to show that the Solow model overestimated the effects of those variables. This has led researchers to start analysing the effect of such a variable as human capital on the dynamics of economic growth. Obviously, the most important factor that has a positive influence on human capital accumulation is education (Passaro, Quinto and Thomas, 2018). Indeed, the research from Oztunc, Chi Oo and Serin (2015) conducted on the Asia-Pacific region for the period of 1990-2010, which used the random effects panel regression analysis, have estimated that female school enrollment rate has a positive effect on GDPPC.

2.2.2. Female Labor Force Participation

This section will explore the literature on the topic of the relationship between a variable such as female labor force participation rate and economic growth. The link between labor force participation and economic growth and unemployment has long been a key concern in the literature. After surveying significant literature on the topic from such authors as Psacharopoulos and Tzannatos (1989), Goldin (1994), Fatima and Sultana (2009), one common conclusion was found. The listed authors, among numerous others, have identified and reaffirmed that female labor force participation rate has a U-shaped relationship with economic growth.

Psacharopoulos and Tzannatos (1989) have analysed data on 136 countries for the period of the early 1980s and found that the female labor force participation exhibits higher levels at the lower or beginning stages of economic development. Afterwards, the levels of female labor force participation drop in the middle of the transition from agrarian to industrial economy. However, in the final stage of transformation female labor force participation start to climb again. One possible reason is that the pressure of not working is increasing due to the increased levels of compensation in the economy, and women find themselves better off by bringing additional income to the family. Additional reason given by Fatima and Sultana (2009) is that the women that are able to obtain higher levels of education during the time of transition find more matching opportunities in the labor market after the transformation happens. This leads to increased levels of incentives for women to join the workforce. Regarding female education attainment, Evans (2009) has examined the dynamics of the relationship between education levels of females and the corresponding changes in the economic development and have identified that there is a significant positive relationship between these variables. Finally, Goldin (1994) has reviewed several seminal papers on this issue and also conducted a research to identify the reasons for the u-shaped

relationship. Her findings also reveal that the quality of jobs that females are occupied in differ at the different stages of economic growth, and the decline in their labor participation at the phase of growth means that women are shifting their preferences towards spending time out of the workforce in order to gain necessary skills in order to be qualified for the better jobs that are being created in the economy.

2.3. Research Questions and Objectives and Hypotheses

The research question of this thesis: Is there a difference between the effects of Female and Male Labor Force Participation Rate on economic growth?

Research Objectives are:

1) Study the impact of FLFPR and MLFPR separately and together on the economic growth.
2) Conduct regression analysis to identify if there is a difference in the effects of FLFPR and MLFPR.

To accomplish the goals of this thesis to a maximum extent, the following hypotheses were formulated:

Hypothesis 1:

There is a statistically significant relationship between female labor force participation rate and economic growth;

The survey of numerous articles from such authors as Psacharopoulos and Tzannatos (1989), Goldin (1994), Fatima and Sultana (2009) have influenced the formulation of this hypothesis.

Hypothesis 2:

There is a statistically significant relationship between male labor force participation rate and economic growth;

This hypothesis is important to test because an interesting observation from Sehrawat and Giri (2017) identified that male human capital is uncorrelated with economic growth, consequently, one of the aims of this research is to identify how the male labor force participation rate is related to economic growth.

Hypothesis 3:

The effects of FLFPR and MLFPR on economic growth are different.

The latter is the key hypothesis of this thesis. The thought behind this hypothesis is that if there is a difference in the ways how economic growth is influenced by female human capital and male human capital respectively, then there might be such a case that the FLFPR and MLFPR also have different effects on economic growth

3. Data, Limitations and Model Specification

The data used in this thesis were pooled from the open databases from Databank tool of World Bank. These data were collected for 16 Latin American countries for 1995-2015. The period and the selection of the countries was determined as a precaution for avoiding the potential bias of the estimators due to the financial crises in the major Latin American countries in the prior dates. According to the proposition in this thesis, the changes in independent variables such as FLFPR and MLFPR and gross capital formation as a percentage of GDP could have different effects on the dependent variable GDPPC. Therefore, the data on these variables in 16 Latin American

countries have been accumulated. Female labor force participation rate is the share of the working women to the total number of females (aged 16-65) in the country, and the MLFPR is the same statistic for male citizens. Gross capital formation (as a percentage of GDP) is the statistic that illustrates the difference between the fixed assets that were acquired in the economy less the disposal of fixed assets and helps demonstrate the amount of new value added that was invested in contrast to being consumed. Cross sectional and time series data were pooled to create balanced panel dataset. The random effects regression was chosen for all our tests.

3.1. Limitations and Model Specification

In order to avoid the concern regarding the autocorrelation between MLFPR and FPFPR variables, Wooldridge test for autocorrelation among independent variables and the heteroscedasticity test was conducted. Consistent to the tests, the issue of autocorrelation, multicollinearity and heteroscedasticity were noted (appendix). Therefore, the robust regression was used to obtain unbiased standard errors for the problem of autocorrelation and heteroscedasticity. To summarize, the researcher initially attempted to analyse the data with the pooled OLS, however, due to the fact that the assumptions were not met, the researcher attempted to choose between the random effects and fixed effects regressions. Random effects was the test which was employed by the number of researchers on the topic, additionally, the Hausman test (appendix) has shown that the random effects model better fits the data. Additional limitation of this research concerns the generalizability of its results. In the opinion of the researcher, the sample is to a strong extent restricted, and readers may not make global inferences by looking at the results of this thesis. Moreover, although the topic of different kinds of jobs the women are undertaking at different stages of economic cycles has been touched in the literature review, it was not possible to attempt

to investigate the differences in the jobs that the women are taking now with those that they have been performing in the beginning of the period.

Stemming from our discussion above, the theoretical model that should depict the relationship between the variables is the following.

$$GDPPC_{ij} = \beta_0 + \beta_1 Gcap_{ij} + \beta_2 FLFPR_{ij} + \beta_3 MLFPR_{ij} + u_j + e_{ij}$$

In this model, GDPPC stands for gross domestic product per capita, Gcap for gross capital formation as share of GDP, MLFPR and FLFPR for male and female labor force participation rates respectively, "u" and "e" are for the corresponding residuals, "i" is for individual observations and "j" is for grouping by countries.

According to this model, changes in gross domestic product per capita should be parallel to the changes in female labor force participation, male labor force participation rate and gross capital formation. Thus, positive changes in FLFPR, MLFPR and gross capital formation are predicted to have the positive effect on the gross domestic product per capita. The random effects model will be used later in the thesis to obtain the estimates for the coefficients in the model.

3.2. Descriptive Statistics

This section will present the descriptive statistics on the variables that have been used in this thesis.

Table 1 (Descriptive Statistics)

Variable	Number of Observations	Mean Value	Standard Deviation	Minimum Value	Maximum Value
GDPPC (In Thousands, Adjusted to PPP)	336	$9.58	$4.3	0*	$20.89
Gross Capital formation (% of GDP)	336	0.19	0.06	0*	0.43
FLFPR	336	0.52	0.07	0.35	.67
MLFPR	336	0.81	0.04	0.72	0.89

** Data on GDP per capita and on gross capital formation for Venezuela, RB was unavailable for year 2015, therefore, the minimum values are not actually zero.*

The table shows the main statistics for the variables of this thesis. The number of observations in this thesis is 336. Mean value of GDP per capita is $9582 adjusted to purchasing power parity. Standard deviation is quite high and is equal to $4303. The maximum GDP per capita that was recorded is $20885. Regarding gross capital formation, the mean value is 19.26%, whereas the standard deviation and maximum values are 6% and 43% respectively. About female labor force participation rate, the mean value was 51,83%. The standard deviation, minimum and maximum values were equal to 6.9%, 34.87% and 66.79% respectively. Finally, in the collected sample, mean male labor force participation rate was equal to 80.7%, with 3% standard deviation and 72% and 89% minimum and maximum values respectively. In this table, we may observe that the

differences in incomes among the countries tend to differ significantly, as the standard deviation is equal to almost a half of the mean value. On the other hand, other statistics have much lower relative standard deviations. For example, standard deviation of female labor force participation rate is equal to nearly 12% of the mean value for this statistic

4. Results

This section is focused on testing the hypotheses through a quantitative evaluation of the collected data. As was mentioned above, after running tests for fit of the data, it was decided to employ robust random effects regression.

Hypothesis 1:

Table 2 (Random Effects Robust Regression #1)

VARIABLES	Gross Domestic Product Per Capita
Gross Capital Formation (Share of GDP)	7.93
	(5.62)
Female Labor Force Participation Rate	18.11***
	(5.86)
Constant	-1.33
	(2.91)
Observations	336
R-squared (Within, Between, Overall)	0.26, 0.02, 0.05
Number of countries	16

Robust standard errors in parentheses

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

With the robust random effects regression #1, we obtained R2 of 0.26. We can see from the table provided above that the variable FLFPR has a significant relationship with the GDP per capita, and indeed, according to the table, the variable "FLFPR" has a positive relationship with the dependent variable "GDPPC" and has an 18.11 coefficient at a p value of 0, which implies its significance. To interpret the key finding of this regression, a 1 percentage point increase in female labor force participation rate will lead to $18.1 increase in GDP per capita of a country. This result is in line with those published by Psacharopoulos and Tzannatos (1989), Goldin (1994), Fatima and Sultana (2009). Latin America has been experiencing transition from lower middle income

region to middle and high income region in the tested period. Therefore, according to the conducted regression, the data suggest that there is enough evidence for our first hypothesis to be accepted. According to data, the female labor force participation indeed has a significant positive relationship with the economic growth and the coefficient is quite high.

As an additional step of verification of the findings of the previous seminal studies on the topic, it was also decided to execute a test to identify whether the relationship between the female labor force participation rate and the gross domestic product per capita is u-shaped. According to the findings of the test, the shape of the relationship is indeed u-type (appendix).

However, there is a notable characteristic of the biased intercept and the insignificant coefficient for the gross capital formation in the regression output. The intercept of GDPPC adjusted for purchasing power parity is shown to be -1.33, which is meaningless and also is insignificant given its p value of 0.647. Gross capital formation also has a quite high p value of 0.158. This issue will be addressed at the test of the third hypothesis, where the male labor force participation rate will also be included in the regression and will be tested alongside with the female labor force participation rate.

Hypothesis 2:

Table 3 (Random Effects Robust Regression #2)	
VARIABLES	Gross Domestic Product Per Capita
Gross Capital Formation (Share of GDP)	9.81*
	(5.31)
Male Labor Force Participation Rate	-40.39***
	(11.35)
Constant	40.28***
	(9.43)
Observations	336
R-squared (Within, Between, Overall)	0.23, 0.14, 0.15
Number of countries	16
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1	

Regarding the second hypothesis about the male labor force participation, the data from the robust random effects regression #2 suggests significant negative influence on economic growth. In fact, the variable "MLFPR" has a negative -40.39 coefficient with less than 0.01 p value, which implies that the male labor force participation rate has had a negative effect on the selected sample of countries in the selected time span. According to the data, a 1 percentage point increase in male labor force participation rate led to $40.4 decrease in GDP. The possible explanations for this phenomenon will be attempted to be analysed further in this thesis. One interesting finding was made regarding the differences between the shape of the relationship of MFLPR and GDP per capita and the relationship between the FLFPR and GDP. The test for the U-shape proved the existence of the U-shaped relationship between the FLFPR and GDP (appendix). However, the same test rejected the existence of the U-shaped relationship between the MLFPR and GDP (appendix).

Hypothesis 3:

Table 4 (Random Effects Robust Regression #3)	
VARIABLES	Gross Domestic Product Per Capita
Gross Capital Formation	7.38
	(5.81)
Female Labor Force Participation Rate	14.2***
	(5.48)
Male Labor Force Participation Rate	-29.54***
	(9.20)
Constant	24.64***
	(8.10)
Observations	336
R-squared (Within, Between, Overall)	0.31, 0.08, 0.12
Number of countries	16
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1	

And lastly, regarding our main third hypothesis, we may confidently suggest that according to our panel data and regression #3 results, the male labor force participation rate and female labor force participation rate have different effects, due to the fact that their coefficients are different.

And after proving our first two hypotheses, and finding that the FLFPR and MLFPR not only have effects of different magnitude on GDPPC, but their effects also have different directions, we may say that our third hypothesis also has enough evidence to be accepted. Additionally, touching back on the issue in the test of the first hypothesis, where the intercept was insignificant, we may see in table 4 that the combined testing of MLFPR and FLFPR not only increases the predicting power of the model, but also removes the issue of the intercept being insignificant an additional supporting point to include the MLFPR in the analyses concerning the female labor force participation rate. Regarding the interpretation of the table, 1 percentage point change in female

and male labor force participation rates lead to $14.2 and -$29.5 change in GDP per capita respectively. Interpretation of gross domestic capita is omitted due to the insignificance of the coefficient.

5. Summary

The random effect regressions were run on 16 countries, each of which had 25 years of records. Therefore, N is equal to 336. Additionally, the R2 is equal to 0.31, which indicates that the model is of a moderate predicting power. As this is an augmented version of Solow textbook model, we decided to include all main variables of the model such as labor and capital. However, we augmented the model slightly. The changes in variables of female and male labor force participation rates were chosen as proxies for changes in labor, and changes in gross capital formation was chosen as the proxy for changes in fixed capital in the countries, as the variable represents the share of GDP that have been reinvested in the economy. As we discussed previously all of the variables are significant at 95% confidence level except for the gross capital formation. FLFPR and gross capital formation have positive effects on economic growth, however, MLFPR is negatively correlated with the economic growth, although the coefficient is quite small. According to the last regression, 1 percentage point increase in female labor force participation rate leads to the $14.2 increase in GDP per capita in the sampled countries. Additionally, the one percentage point increase in MLFPR leads to the $29.5 decrease in GDP per capita. A possible explanation for that is that there is a surplus of males who are looking for work and the corresponding wage at which they are ready to accept a job is smaller, which leads to the decrease in the GDP per capita.

5.1. Female Labor Force Participation and Economic growth

This section is designed to provide more explanation as to why the variable FLFPR has a positive relationship with the economic growth on the chosen sample of countries. As was mentioned before, according to Goldin (1994) the changes in the female labor force participation are affected by the combination of education attainment and changing number of opportunities for women. Indeed, in the case of Latin America and Caribbean, the countries in majority have been in a phase of transition from lower income countries to middle or high income countries. Therefore, it may be said that the sample depicts only the phase where the movement of the female labor force participation has a positive effect on the economic growth, which is corresponding to the second stage in the possible scenario of relationship of these variables. Additionally, after the survey of data, we may see that countries now indeed have differences in types of work performed by women at the different economic cycles. Women are now engaged in more of skilled jobs as a result of higher education levels in the given period. Goldin (1994) from Harvard University has completed a very thorough analysis of the topic. Her work has reviewed numerous articles on the subject and have also reaffirmed that the relationship is U-shaped. Although the paper does not present much of the primary data analysis, it provides a significant amount of explanation as to why the relationship is of this shape although the explanation is rather limited to the case of United States of America. Goldin (1994) also links the changes in the female labor force participation to the combination of education attainment and changing number of opportunities for women. Additionally, the author brings up an interesting point about the differences in types of work performed by women at the different economic cycles. She states that women in poor economic conditions are forced to engage in more of unskilled jobs, or occupations that are not official. On

the other hand, in the times of economic boom, as was said before in the section, women have a choice from a wider range of opportunities and tend to exchange the option of doing home activities only to the jobs that match their skills and ambitions. Therefore, the quality of jobs performed at same levels of labor force participation, at different economic cycles, tend to differ significantly. Lastly, to reaffirm our conclusions, we may list the following paper of Klasen and Pieters (2012), whose study identifies the drivers of female labor force participation in urban India between 1987 and 2004. The findings show that at lower levels of education, female labor force participation is driven by necessity rather than economic opportunities.

6. Conclusions and Recommendations

This thesis set out as its goal to provide more information into the topic of the relationship of female labor force participation rate and economic growth. As was explored in the literature review, the conventional econometric models of testing the relationship between these variables did not account for the effect from the changes in male labor force participation rate on the economic growth, thereby, possibly leading to incomplete picture of the effect of the female labor force participation rate on economic growth. In the analysis of the data we have noticed that the addition of the male labor force not only has benefited the predicting power of the model by increasing it by 5%, but also made the intercept significant. Additionally, the omission of male labor force participation rate from the model has biased the coefficient of FLFPR and made it significantly larger. Therefore, it brings up an interesting conclusion that the addition of MLFPR in the future research can lead to better results in studying the relationship between the aforementioned variables.

Concerning the practical implications of this research and policy recommendations, one key statement needs to be made. It is noticeable from the regression results that the female labor force participation is a strong driver of a long term economic growth, as it also has been pointed out in the literature review. Thus, the governments that are aiming to achieve better economic growth rates need to focus their policies on enhancing, promoting and facilitating equality within their communities. This will lead to the shift in the paradigm of the role of the women in the society in the countries that are struggling to achieve this transition. It will lead to more balanced workforce and better economic conditions in the long term. So, the question that we asked in the beginning: if female human capital have a different effect to the economic growth than male human capital has, does the female labor force participation rate also have a different effect on economic growth

than male labor force participation rate has been answered definitively. The effects of these two variables are significantly different and this fact needs to be accounted in the research.

Regarding the recommendations for the future researchers, I would suggest to address the limitations of the current research such as the quite restricted sample and addition of other variables as fertility, literacy rate and others in order to increase the predicting power of the model.

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Appendix

Hausman Test

N0: Difference in coefficients not systematic

chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)	1.20
Prob > chi2	0.7520

Not enough evidence to reject the null. Therefore, we use random effects model.

Hausman test is a useful tool to help identify which model to choose between random effects and fixed effects. Here, we can see that the null hypothesis that the difference in coefficients is not systematic is rejected. Therefore, the choice of the model shifted towards the random effects, which is helpful because the group means in this sample are not fixed and are a random sample from a population.

Woolbridge Test for Autocorrelation in Panel Data

H0: No First Order Autocorrelation

F (1, 15)	20.173
Prob > F	0.004

Enough evidence to reject the null. The test for autocorrelation (test of correlation between the given time series and a lagged version of itself over consecutive time intervals) is positive. Therefore, the trends observed in the past can be used to predict the future movements in the data.

Test for Multicollinearity

Multicollinearity test

Avg VIF	1.16
Condition Number	78.3616

As the Condition Number is significantly higher than 10, we assume that there is an instability in the data, therefore assumption of zero collinearity is not satisfied.

Test for U-shape (GDP per capita and FLFPR)

Test:

H1: Inverse U-shape

H0: Monotone or U-shape

Specification:	**f(x)=1/x**
Extreme point:	6.196036

	Lower Bound	**Upper Bound**
Interval	0	20.88
Slope	.	-.215

Extremum outside interval – trivial failure to reject H0.

As we see in the output, the u-shape relationship exists between FLFPR and GDP per capita. The lower and upper bounds show the extreme points of GDP per capita.

Test for U-shape (GDP per capita and MLFPR)

Test:

H1: U-shape

H0: Monotone or Inverse U-shape

Specification:	**f(x)=1/x**
Extreme point:	-

	Lower Bound	**Upper Bound**
Interval	72.228	88.996
Slope	-0.005	-0.005

Extremum outside interval – trivial failure to reject H0.

As we see in the output, the u-shape relationship does not exist between MLFPR and GDP per capita. The lower and upper bounds show the extreme points of MLFPR.