UNDERGRADUATE RESEARCH

Connecting Cultural Gender Norms and National Prosperity

Molly P. Howell and Christopher C. Klein[1]

Abstract

Regression analysis is used to investigate the relationship between GDP per capita and several variables that capture gender norms in 91 countries. Our results largely mirror the literature in that characteristics of more flexible gender roles are associated with higher per capita national income. Nevertheless, some anomalies arise and we discuss some routes for their investigation in future research.

JEL codes: J11, J16, O15, O35

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Introduction

The range of cultural habits and customs in the modern world is broad. Particularly in the case of norms that govern the behaviors of women, expectations and available opportunities vary widely among diverse populations and cultural traditions. Prior studies have found that per capita income growth, or per capita GDP, is positively related to female labor force participation and education, but negatively related to fertility rates, maternal mortality, and age at first birth or first marriage. In an attempt to understand how these expectations for women's roles and the circumstances of women affect the prosperity of the nations in which they abide, we analyze cross-section data from 91 countries after the year 2000 for links between per capita gross domestic product (GDP) and representative variables reflecting these norms.

Generally, we find that indicators of less restrictive roles for women are positively related to GDP per capita. There are a few anomalies, however, that provide avenues for future research.

The next section reviews the literature on women's roles and national economic growth or income. We lay out our estimation strategy after that, then discuss the data. The results are summarized next, followed by a brief conclusion.

Literature Review

Ozutnc, Chi Oo, and Serin (2015) studied ties between long-term economic growth and gender norms in the Asia Pacific region between 1990 and 2010. They found that annual per capita income growth was positively associated with the fertility rate, the female labor force participation rate, and female primary school enrollment. Similarly, Torabi and Abbasi-Shavazi (2015) showed a link between women's human capital and economic growth in the Middle East and North Africa. They concluded that countries with lower maternal mortality, higher female literacy, more female

[1] This research is based on Molly Howell's Econometrics class project at Middle Tennessee State University where Christopher Klein (chris.klein@mtsu.edu) is a Professor of Economics and served as class instructor and mentor.

tertiary education, and professional childbirth attendance tended to have higher national-level income.

Santelli, Song, Garbers, Sharma, and Viner (2017) examined adolescent fertility rates and several macroeconomic variables. They found that the recent global decline in adolescent fertility is related to GDP per capita, income inequality, and national educational expenditures, with rising national income being the most important factor. Sarah Carmichael (2011) studied and found a relationship between educational attainment, the age of a woman at first marriage, and the spousal age gap. She concluded that education is a significant factor in increasing female age at first marriage.

Estimation Strategy

Based on the literature, we hypothesize that GDP per capita is related to indicators of gender roles. To test this, we estimate regression equations of the form:

$$GDP\ per\ capita = b_0 + b_1\,(literacy\ ratio) + b_2\,(LFP\ ratio) + b_3\,(total\ fertility) + b_4\,(maternal\ mortality) + b_5\,(age\ at\ first\ birth) + u$$

The independent variables were chosen to capture cultural norms and circumstantial realities that the literature suggests are associated with national prosperity. Therefore, we expect the following results for the regression coefficients.

b_1: The coefficient of the ratio of literate women to literate men (literacy ratio) should be positive. A higher literacy ratio can indicate that higher levels of education are available to a wider portion of the population, and higher levels of education frequently translate into higher wages.

b_2: The coefficient of the ratio of female to male participation in the labor force (LFP ratio) should be positive. A higher labor force participation ratio relative to men shows that more women participate in work outside of the home relative to men. A higher female to male labor force participation ratio suggests that the total labor force participation rate in a country is higher compared to countries with low female to male participation ratios. A higher rate of total participation maybe associated with a higher GDP per capita, other things equal.

b_3: The coefficient of a country's total fertility rate (TFR) is expected to be negative. This reflects the average number of children that would be born to each woman, if all women lived through their childbearing years. Increasing the number of children in a family can translate into more time spent childrearing by the parents, and less time spent working or attaining an education. This sacrifice of potential income maybe linked to lower GDP. Also, a high fertility rate increases the total population faster than a low fertility rate, meaning that total GDP is divided by a larger number to attain a relatively smaller GDP per capita.

b_4: The coefficient of the maternal mortality rate (MMR), as measured in deaths per 10,000 live births, should be negative. A higher mortality rate may lead to fewer mothers returning to the labor force, lowering GDP per capita. This may also reflect poor health care or nutrition that may reduce labor productivity.

b_5: The coefficient of the average age of a mother at first birth is expected to be positive. Women who have children later in life have more time to pursue further education and establish a career. This may lead to higher pay and a higher GDP per capita. We chose this variable over age at first marriage, since it is the birth of children and the accompanying childcare responsibilities that are more likely to interfere with education and career building.

Data

The variables and their sources are shown in the following table. Not all data were available for all years. We selected data for each country that best matched the most recent year available.

Variable	Source
GDP per capita	The CIA World Factbook (data between 2009 and 2016)
Literacy ratio	The CIA World Factbook (estimates between 2012 and 2016)
LFP ratio	United Nations Development Programme, Human Development Reports (2012 estimate)
TFR	The CIA World Factbook (2017 estimate)
MMR	The CIA World Factbook (2015 estimate)
First birth	The CIA World Factbook (estimates between 2007 and 2016)

The resulting cross-sectional dataset includes observations for 91 countries. Summary statistics are shown in Table 1.

Table 1

Variable	Minimum	Maximum	Mean	Std Deviation
GDP per capita	800	87,900	12,666	13,765
Literacy ratio	0.4029	1.2596	0.8915	0.1620
LFP ratio	0.1970	1.0420	0.7504	0.1711
TFR	0.830	6.490	2.948	1.5169
MMR	2.0	1,100.0	221.2	242.9004
First birth	17.9	30.7	22.9	3.5133

Results

We tried several functional forms, including linear, polynomial, and log-linear forms for the regression equation. The log-linear regression produced the best fit, with an R^2 value that was 0.14 and 0.44 higher, respectively, than the other two. The log-linear form also has the advantage of interpreting coefficients as elasticities or relative percentage changes. Only the log-linear results are reported below.

The first log-linear regression results are shown in Table 2. Five coefficients are significant, the R^2 is 0.75 (adjusted $R^2 = 0.74$) and the F-statistic (52.4) is significant at 1%.

Table 2

Coefficients	Estimate	Std Error	t value	p value
Intercept	5.10550	2.95485	1.728	0.0876
Ln literacy ratio	0.85776	0.40525	2.117	0.0372
Ln LFP ratio	- 0.33925	0.22912	- 1.481	0.1424
Ln TFR	- 0.59850	0.26978	- 2.219	0.0292
Ln MMR	- 0.20785	0.08084	- 2.571	0.0119
Ln first birth	1.69006	0.85437	1.978	0.0512

We ran White's Test for heteroscedasticity in the R statistical package. This gave a chi-squared statistic of 5.2109 with a p-value of 0.0224. The null hypothesis of homoscedasticity was

rejected at the 5% level of significance. The heteroscedasticity corrected results are shown in Table 3.

Table 3

Coefficients	Estimate	Std Error	t value	p value
Intercept	5.105497	3.423411	1.4913	0.13957
Ln literacy ratio	0.857756	0.451110	1.9014	0.06063
Ln LFP ratio	-0.339252	0.199328	-1.7020	0.09241
Ln TFR	-0.598505	0.320767	-1.8659	0.06551
Ln MMR	-0.207847	0.093499	-2.2230	0.02887
Ln first birth	1.690062	0.971397	1.7398	0.08551

All of the coefficients of the explanatory variables are significant at the 10% level or better, although the intercept has become insignificant. Only the maternal mortality rate is significant at better than 5%. All of the signs for the coefficients except for the female to male labor force participation rate ratio are as expected.

Although the sign for the labor force participation rate ratio was expected to be positive, one possible reason it could be negative is the exchange of time spent working for time spent attaining an education as GDP per capita rises. This could also be an income effect akin to a backward bending labor supply curve. As GDP per capita rises, some women may choose to work less outside the home relative to men, as part of the increased potential household income is "spent" on less market employment. This bears further investigation.

Another notable result is the magnitude of the coefficient on age at first birth. In table 3, this is 1.69, suggesting that a 1% increase in age at first birth is associated with a 1.69% increase in GDP per capita. This coefficient is over twice as large in absolute value as any other variables' coefficient. Is age at first birth a proxy for other GDP determinants? We fear it may be, such that further research is necessary to confirm the importance of this variable. For example, age at first birth may correlate with education levels or career opportunities that are not precisely measured by other variables.

Similarly, the relatively significant coefficient for the maternal mortality rate may occur as this variable serves as a proxy for technological levels, availability of public health services, or less income inequality or poverty.

Table 4

	Ln MMR	*Ln TFR*	*Ln LFP ratio*	*Ln lit ratio*	*Ln first birth*
Ln MMR	1				
Ln TFR	0.849222734	1			
Ln LFP ratio	0.03715738	0.025156838	1		
Ln lit ratio	-0.563697111	-0.669030218	0.238828437	1	
Ln first birth	-0.856570138	-0.8225267	0.023597932	0.551283743	1
VIF	4.99	5.07	1.15	2.05	4.33

We did investigate possible multicollinearity among the explanatory variables. Table 4 shows pairwise correlation coefficients for all of the explanatory variables along with Variance Inflation Factors (VIF). None of the VIF's exceed the commonly accepted value of 10 that

indicates a serious problem, although TFR appears as the worst offender. Consequently, Table 5 shows the heteroscedasticity corrected results when TFR is dropped from the regression in Table 3.

Table 5

Coefficients	Estimate	Std Error	t value	p value
Intercept	2.970226	3.720618	0.7983	0.426887
Ln literacy ratio	1.253633	0.380703	3.2929	0.001440
Ln LFP ratio	-0.428138	0.207541	-2.0629	0.042137
Ln MMR	-0.285349	0.098564	-2.8951	0.004804
Ln first birth	2.310199	1.054919	2.1899	0.031237

All of the coefficients in Table 5 become more significant, but retain their former signs. The first birth coefficient increases to 2.31, perhaps deepening the mystery of the magnitude of this effect. Note that the t-test of the TFR coefficient in Table 3 is equivalent to an F-test between the two regressions in Tables 3 and 4. Since this test is significant, we would usually prefer the regression in Table 3. We reserve any further investigation for future research.

We also note that the direction of causation is not completely clear. Do more female-friendly gender norms lead to higher GDP per capita, or does higher GDP per capita lead to less restrictive norms for women? Our research shows a significant association, but cannot answer the question of causality.

Conclusion

While our results generally confirm findings in the literature, that variables consistent with more flexible gender roles for women are associated with higher per capita national income, we also find some anomalies. The negative sign of the female to male labor force participation rate ratio is the opposite of expected and the magnitude of the age at first birth coefficient is very large. Both of these deserve more investigation in future research. More and better data allowing more regressions of various combinations of variables could eliminate the multicollinearity that we suspect.

Further research could analyze broader regressions by including data on the female to male ratio of education completion at the primary, secondary, and tertiary levels. The difficulty of finding data on these variables across a sufficient number of countries precluded their use here. Additionally, studying the relationships among these variables in the context of a time series or panel regression could provide an interesting compliment to the understanding gained from the results reported here.

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