Democracy, demography and economic growth:

Empirical investigation of association between those three

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Abstract

In this paper the issue of democracy, demography and economic growth has been investigated. As the results prove the effect of democracy on economic growth are positive and statistically significant in all of the models presented in the paper. While the coefficient on the logarithm of population is ambiguous, whether one checks for the sign on that variable or its statistical significance. This is in line with the population neutralism view. Besides, the main variables models are augmented with other explanatory variables, and dependent side variable in some regressions is economic development. In the last section of the empirics of the paper there are presented two models, where this study controls for age structure of the population.

Keywords: democracy, demography, economic growth,economic development

JEL codes: J10,J11,P16

Introduction

In this paper the issue of democracy, demography and economic growth has been investigated. Acemoglu et al(2008)[2],denote that the relationship between income and democracy is one of the

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[2]Acemoglu, D., Johnson, S., Robinson, J.,Yared,P.,(2008), ***Income and Democracy***, *American Economic Review 2008, 98:3, 808–842*

most notable and important regularities in the field of economic growth. Barro (1999)[3],states that increase in standard of living will have a consequence rise in democracy, either wise democracies that rise without prior development, tend not to last. On the other hand the issue of population change on economic growth has been of concern of economic thinkers for decades, Bloom, Canning, Sevilla, (2001)[4]. Recently, *age structure*[5] of the population has emerged in prominence in the debate. People's economic behavior differs at different stages in their life. For, example countries with many young people in their population are likely to devote resources for the care of their offspring. This will tend to depress growth.

The model and expected signs on the variables and methodology explained

We use following basic regression to estimate the effect of log of population and Freedom House political rights index on economic growth and economic development.

$$\Delta \log(y_{it} - y_{it-1}) = \beta_0 + \beta_{1it} \log P + \beta_{2it} FHPR + \beta_{3it} W_{it} + \varepsilon_{it}$$

(1)

Or

$$\log(y_{it}) = \beta_0 + \beta_{1it} \log P + \beta_{2it} FHPR + \beta_{3it} W_{it} + \varepsilon_{it}$$

(2)

$$Y_{it} = \beta_0 + \beta_1 X_{it} + e_{it}$$

(3)

$$e_{it} = \rho e_{i,t-1} + \varepsilon_{it}$$

(4)

[3]Barro,J,R.,(1999),***Determinants of democracy***, Journal of political economy,Vol. 107, No. S6 (December 1999), pp. S158-S183
[4]Bloom,D.,Canning,D.,Sevilla,J.,(2001), ***Economic growth and the demographic transition***,NBER Working papers
[5]Age structure refers to the way in which population is distributed across different age groups.

When ρ is the autocorrelation coefficient of first order we have

$$E\ (\varepsilon_{it})\ \neq\ 0 \tag{5}$$

$$\text{var}(\ \varepsilon_{it})\ =\ \sigma^{2} \tag{6}$$

$$\text{cov}(\varepsilon_{it}, \varepsilon_{i,t-1}) = 0, s \neq 0 \tag{7}$$

If ρ is known we can use quasi differenced equation, known as **prais-wintsten** transformation, and if ρ is not known we can use first differenced equation[6]. When random errors are correlate by order 1 usual variance is:

$$\text{var}(b_1) = \frac{\sigma^2}{\sum x_i^2}(1 + 2\rho\frac{\sum \text{x}_\text{t} x_{t-1}}{\sum x_t^2} + 2\rho^2\frac{\sum \text{x}_\text{t} x_{t-2}}{\sum x_t^2} + ...)$$

(8)

On this basis one can conclude that the variance like this is biased. Direction of bias depends whether expression in the bracket is lower or higher than one. So in the presence of autocorrelation random errors are not BLUE, i.e. are not best linear unbiased estimators.

Descriptive statistics and data sources

In the next table 1 descriptive statistics of some of the variables in the panel it has been presented.

6Gujaraty, D.,(2004), *Basic Econometrics* , 4th Edition,

Table 1

Variables	Mean	Standard deviation	Minimum	Maximum	Observations
Log of Real GDP per capita overall	8.149145	1.033388	5.773925	10.6917	N = 1231
between		0.94637	6.245381	9.861974	n = 153
within		0.365425	6.632956	9.453366	T-bar = 8.04575
Human capital overall	4.323804	2.852792	0.042	12.179	N = 818
between		2.669154	0.363875	10.68912	n = 108
within		1.001921	1.010179	7.86718	T = 7.57407
Freedom House political rightsindex overall	0.513199	0.364369	0	1	N = 1517
between		0.311265	0	1	n = 195
within		0.194482	-0.16438	1.276533	T-bar = 7.77949
Logarithm of Population overall	8.438424	1.984607	3.465736	14.04857	N = 1661
between		2.007553	3.465736	13.76542	n = 187
within		0.303139	6.456378	9.930784	T-bar = 8.88235
Nominal savings overall	0.164544	0.135567	-0.766	0.739617	N = 1238
between		0.119338	-0.3957	0.450008	n = 153
within		0.075025	-0.20891	0.759593	T-bar = 8.0915
Combined political score Polity IV overall	0.49152	0.382785	0	1	N = 1362
between		0.321249	0	1	n = 170
within		0.203463	-0.16303	1.159702	T-bar = 8.01176
Dummy for socialist countries and iron curtain overall	0.151659	0.358767	0	1	N = 2321
between		0.359543	0	1	n = 211
within		0	0.151659	0.151659	T = 11

As one can see from the table the most important variables in the model are logarithm of Real GDP per capita, Freedom house political rights index, logarithm of Population, Nominal savings variable which is derived $\frac{Y-C-G}{Y}$, that is income minus consumption minus government spending weighted by the income. With a capital letter N it is denoted the number of observation, while with lower letter n, countries in the panel have been denoted. T-stands for the average time periods in each panel. The panel is strongly balanced, i.e. each panel contains exact same number of years. The time dimension consists of 5-yearly panels from 1950 to the year 2000. In the data also it has been used combined political score, namely Polity IV variable, and also for the robustness of the results dummy for the ex-socialist countries has been used. Data are gathered from Penn world tables, Integrated Network for Social Conflict Research (INCSR)[7], and other sources.

Results from the estimation

Next, are presented the results from the estimation of the econometric equations. In the tables are reported coefficients, standard errors and z value. The later indicates statistical significance of the variables. In the model one cannot find problems with the statistical significance of the variables.In the first regression we show the statistical relation between economic growth which is calculated as first difference of the logarithm of Real GDP as measured by the Penn tables. Data on the variables are times series by 5 –year panels. And, the panels consist of time dimension from 1965 to 2000. In the table 2 are presented two models, in model one we use regression to estimate the effect of logarithm of population and Freedom house political rights index. And in the model 2 we control for the ex-socialist countries. Results with basic statistics for the models are presented in the following table.

[7] http://www.systemicpeace.org/inscr/inscr.htm

Table 2

Generalized least squares regression Economic growth 1950-2000 is dependent variable						
	Model 1			**Model 2**		
Economic growth 1950-2000 (5 year panel)	**Coefficient**	**Standard error**	**Z value**	**Coefficient**	**Standard error**	**Z value**
Logarithm of population	-0.00721	0.004199	-1.72	-0.007	0.004206	-1.67
Freedom House Political rights index	0.052453	0.018329	2.86	0.053	0.018345	2.88
Dummy for ex-socialist countries	-	-	-	-0.027	0.031334	-0.85
Constant	0.120511	0.0398	3.03	0.121	0.0398225	3.03
Autocorrelation	0.17			0.17		
Wald test p-value	0.026			0.057		
R^2	0.053			0.057		

From the previous table one can see that logarithm of population is negatively associated with the economic growth, and the result is significant, z-value is -1.72.The coefficient, though is of small size. This applies for the first model (whole sample) and for the second model that controls for ex-socialist countries. Coefficient on autocorrelation is of small size, which indicates absence of autocorrelation, which is good and that is the reason why we apply this model. Coefficient on Freedom house political rights index is positive of small size and significant in the model 1 and model 2. The coefficient on the dummy variable for ex-socialist countries is insignificant. This indicates that controlling for ex-socialist countries would not make any difference to the results from the basic model. In the next model we include human capital variable. This variable has been measure as average years of schooling, and is expected to be positive, the results for this variable that is most likely to get after its first inclusion in the model of MRW model,(1992)[8]. The results from this regression are presented in the following table 3. Also, this regression has been augmented with the nominal savings variable, this variable we get when from income we deduct private consumption and public consumption, and we divide this result by the income. So, one can

[8]Mankiw,N.,G.,Romer,D.,Weil,N.,D.,(1992), ***A Contribution to the Empirics of Economic Growth***, *The Quarterly Journal of Economics*, Vol. 107, No. 2. (May, 1992), pp. 407-437.

see from the table that the inclusion of nominal savings and human capital does have for result insignificant Freedom house political rights index, the sign on the population as expected is negative, nominal savings rate does positively affect growth. Its coefficient is of size 0.224 and it also is very statistically significant.

Table 3 Inclusion of human capital, nominal savings and labor share in the growth equation

Generalized least squares regression Economic growth 1950-2000 is dependent variable						
Economic growth 1950-2000 (5 year panel)	**Coefficient**	**Standard error**	**Z value**	**Coefficient**	**Standard error**	**Z value**
Logarithm of population	-0.091	0.0241	-3.78	0.256	0.041	6.17
Freedom House Political rights index	0.016	0.0433	0.38	0.095	0.068	1.41
Human capital (average schooling years)	1.539	0.1398	11.01			
Nominal savings (Y-C-G/Y)	0.224	0.0087	25.77	1.988	0.224	8.88
Labor share				0.416	0.201	2.07
Constant	7.789	0.2133	36.51	5.271	0.398	13.25
Autocorrelation	0.4			0.66		
Wald test p-value	0.000			0.0000		
R^2	0.78			0.04		

It is interesting that the coefficient on the determination in this regression is very high, 0.78. In the second model where labor share is included besides nominal savings the sign on the coefficient on population is positive significant same as the coefficient on Labor share variable. Next, in the following table word democracy has been included

Table 4 Inclusion of the world democracy and nominal savings in the growth regression

Generalized least squares regression log of income 1950-2000 is dependent variable			
Log of Income 1950-2000 (5 year panel)	**Coefficient**	**Standard error**	**Z value**
Logarithm of population	0.168	0.0241	7.00
Freedom House Political rights index	0.217	0.0497	4.36
Nominal savings (Y-C-G/Y)	1.561	0.1387	11.25
World democracy	1.381	0.1918	7.2
Constant	5.800	0.2388	24.29
Autocorrelation	0.56		
Wald test p-value	0.000		
R^2	0.19		

The inclusion of world democracy in the table is important. This is sort of a variable that denotes spillover effect, its important because it is weighted by the trade, and world democracy does have positive effect on log of income, i.e. economic development.

Table 5 Controlling for years in the log of income regression

Generalized least squares regression log of income 1950-2000 is dependent variable			
Log of Income 1950-2000 (5 year panel)	**Coefficient**	**Standard error**	**Z value**
Freedom House Political rights index	0.2127057	0.0437336	4.86
Logarithm of population	-0.1576891	0.0288273	-5.47
1965	0.2060834	0.0393551	5.24
1970	0.3771611	0.0398885	9.46
1975	0.500269	0.0400744	12.48
1980	0.5885379	0.039958	14.73
1985	0.6266784	0.0404573	15.49
1990	0.7005541	0.0411195	17.04
1995	0.745401	0.0417616	17.85
2000	0.8730134	0.0434394	20.1

Constant	0.2060834	0.0393551	5.24
Autocorrelation	0.64		
Wald test p-value	0.000		
R^2	0.0718		

From the previous regression one can see that from 1965 to 2000 democracy has proven to have statistically significant and positive association with world income. While the population for the whole sample is negative. On the next two scatters graphically has been depicted the association between

Table 6 Controlling for population age in the economic growth regression

Generalized least squares regression Economic growth 1950-2000 is dependent variable						
Economic growth 1950-2000 (5 year panel)	**Coefficient**	**Standard error**	**Z value**	**Coefficient**	**Standard error**	**Z value**
Freedom House Political rights index	0.0407148	0.0201944	2.02	0.0451	0.0202366	2.23
Logarithm of population	0.0023755	0.0047443	0.5	0.0041	0.0046181	0.89
World democracy	0.0723019	0.0329341	2.2	0.0826	0.0326101	2.53
young age population	-0.1797238	0.0837146	-2.15			
middle-Age				0.2671	0.1575341	1.7
Constant	0.0848959	0.0704648	1.2	-0.0265	0.0481789	-0.55
Autocorrelation	0.047			0.048		
Wald test p-value	0.000			0.001		
R^2	0.267			0.259		

As from the table one can analyse that increase in the working age population is negatively associated with growth, primarily because it is challenge to provide work for all those young. This threatens economic and political stability. While when controlling for middle age countries, the result is positive though sustained economic growth will require productivity gains to offset slower work-force growth.

Conclusion

This paper uses simple macroeconomic models in order to address the issue of democracy, demography and economic growth interrelations. The study confirms the notion in public and academics that democracy is positively associated with economic growth, and that population role in this association is somewhat ambiguous. Population neutralism, which refers to the fact that population growth and ageing have no significant effect on economic growth, has a consequence encouragement of the economist and policy maker not to take into account demographics in their projections, but recently the investigations of the population structure suggest major challenges for macroeconomic policy. On the other hand the effects of population aging will not be noticeable for another two decades at least in the countries. Population of 60 + and 80+ years of age, rely more on government resources, family resources and personal savings. This part of population also relies more on health care and social pensions. People in their working age pay contributions and increase the output of the country. However, historically life expectancy increase has been strongly associated with the increase in per capita income, Preston (1975)[9]. Nowadays, as mortality is declines, policies to facilitate the planning of the family and to push down the fertility rates should be implemented in the societal norms. Also nowadays there is strong evidence of *demographic dividend*, which refers to the process of falling fertility rates due to significant reductions in child and mortality rates. For, a period of time there is increase in the dependency ratio, later young people enter in the working population, but with fertility rates continuing to fall and life expectancy continuing to decline. With a less young dependents and less old because of the shorter life expectancy, the largest segment of the population will enter in the working age. Combined with the effective public policies can induce more rapid economic growth. With fertility falling,

[9]Preston, S. H. (1975). ***The Changing Relation between Mortality and Level of Economic Development***.Population Studies 29(2): 231-48.

women will be more empowered and population aging is also like to fuel the demand for more equal distribution of political power, Dyson(2012)[10].

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