THE QUALITY OF INSTITUTIONS AND ECONOMIC GROWTH (Panel regression analysis for sample of CEE countries in time series 1992-2007 and 2008-2011)

Abstract

We have known that technological improvements, investment in physical and human capital are the main factors which determine economic growth and differences in level of income per capita among countries. But the question which economists try to answer is: why do some countries invest more than other in physical and human capital? And why are some countries so much more productive than others? Maybe the right answer to this question we should find in differences in institutional infrastructure. The main idea is that institutions and government policies determine the economic environment within which individuals accumulate skills, and firms accumulate capital and produce goods. In that context, econometric techniques have been applied on cross-country data for a sample of CEE region, just to investigate the influence of institutions on economic growth and level of income per capita before and during the global economic crisis period. However, testing the correlation and causality between institutions and growth involves the difficult issue how to measure the quality of institutions, taking in consideration that many international agencies and researchers have developed plenty of empirical indicators recently, which measure different institutional aspects.

Key words: economic growth, institutional infrastructure and quality of institutions, OLS Panel regression, cross-country data, factor analysis.

Introduction

We have known that technological improvements, investment in physical and human capital are the main factors which determine economic growth and differences in level of income per capita among countries. But the question which economists try to answer is: why do some countries invest more than other in physical and human capital? And why are some countries so much more productive than others? Maybe the right answer of this question we should find in differences in institutional infrastructure. The main idea is that institutions and government policies determine the economic environment within which individuals accumulate skills, and firms accumulate capital and produce goods. In that context, panel econometric techniques have been applied on cross-country data for sample of CEE countries, just to investigate the influence of institutions on economic growth and level of income per capita in the long run and during the global economic crisis period. However, testing the correlation and causality between institutions and growth involving the difficult issue how to measure the quality of institutions. Many international agencies and researchers have developed plenty of empirical indicators recently, which measure different aspects such as financial stability, quality of government regulations, democracy, quality of laws and courts, corruption and many others. One of the key challenges confronting us in this empirical study, having in mine the large number of government and institutional indicators, is how to combine this set of indicators into a one dimension with a clear-cut interpretation of quality of institutions and then analyze his influence on income per capita and economic growth. The most widely used approach to construct composite variables is to select relevant indicators and weigh them together using predetermined equal weights.

Theoretical model of institutions, capital and economic growth

In the economic literature, especially in theory of growth there are many attempts which have been done to incorporate the influence of institution in growth models. In addition, we will try to do this work by interpreting the model of growth with quality of institutions to see how institution framework is correlate with economic performance in long run. In that context, we start our analysis with aggregate production function which describes how the inputs (physical and human capital, labor and technology) are combined to produce output.[1]

$$Y_t = A_t K_t^{\alpha} H_t^{\beta} L_t^{1-\alpha-\beta} \quad (1)$$ [2]

The equation of production function can write in per capita form

$$\frac{Y_t}{L_t} = \frac{K_t^{\alpha}}{L_t} \frac{H_t^{\beta}}{L_t} \frac{A_t L_t^{1-\alpha-\beta}}{L_t} \quad (2)$$

$$y_t = A_t k_t^{\alpha} h^{\beta} \quad (3)$$

Traditional macroeconomic growth models do not include the influence of institutional quality as a factor of economic growth. These models implicitly assume an underlying set of good institutions. The fact that institutions have important role in growth process, the economists try to implement the institutional quality in growth models.

$$A_t = A_0 k_t^{\delta_1 (In - In^*)} h_t^{\delta_2 (In - In^*)} \quad (4)$$

Substituting the equation (3) into equation of production function per worker, we get:

$$y_t = A_0 k_t^{\delta_1 (In - In^*)} h_t^{\delta_2 (In - In^*)} k_t^{\alpha} h_t^{\beta} \quad (5)$$

---

[1]

[2] The equation (1) we can write in this terms: $Y_t = K_t^{\alpha} H_t^{\beta} (A_t L_t^{1-\alpha-\beta})$

Rewriting this equation we get:

$$y_t = A_0 k_t^{\alpha+\delta_1(In-In^*)} h_t^{\beta+\delta_2(In-In^*)} \tag{6}$$

To study the dynamic of output per capita, we will use a simple *mathematical trick* that economists often used in the study of growth.[3] The mathematical trick is to "take logs and then derivatives".

If we take logs of equation (6), we obtain:

$$\log y_t = \log A_0 + \left[\alpha + \delta_1(In - In^*)\right]\log k_t + \left[\beta + \delta_2(In - In^*)\right]\log h_t \tag{6}$$

Derivatives regarding time t, we obtain following form:

$$\frac{d\log y_t}{dt} = \frac{d\log A_0}{dt} + \left[\alpha + \delta_1(In - In^*)\right]\frac{d\log k_t}{dt} + \left[\beta + \delta_2(In - In^*)\right]\frac{d\log h_t}{dt} \tag{7}$$

As we can see, the equation (8), show the growth rate of output per capita:

$$\frac{\Delta y_t}{y_t} = \frac{\Delta A_0}{A_0} + \left[\alpha + \delta_1(In - In^*)\right]\frac{\Delta k_t}{k_t} + \left[\beta + \delta_2(In - In^*)\right]\frac{\Delta h_t}{h_t} \tag{8}$$ [4]

Rewriting equation (8) we get following form of growth rate of output per capita:

$$\frac{\Delta y_t}{y_t} = \frac{\Delta A_0}{A_0} + \left[(\alpha - \delta_1 In^*) + \delta_1 In\right]\frac{\Delta k_t}{k_t} + \left[(\beta - \delta_2 In^*) + \delta_2 In\right]\frac{\Delta h_t}{h_t} \tag{9}$$

---

[3] Mathematical notes: The theory of growth uses some properties of natural logarithms. One of that properties is: The statement regarding the timing of the logarithms of a variable, gives the growth rate of that variable:

If $y(t) = \log x(t)$, than, $\frac{dy}{dt} = \frac{dy}{dx}\frac{dx}{dt} = \frac{1}{x}\Delta x = \frac{\Delta x}{x}$

[4] Where symbol, Δ, denotes changes of parameters.

If we assume that: $\varphi_1 = (\alpha - \delta_1 In^*)$; $\varphi_2 = (\beta - \delta_2 In^*)$ and $\alpha_0 = \Delta A_0$, and adding an error term ε_t, we get final equation of growth rate of output per capita:

$$\frac{\Delta y_t}{y_y} = \alpha_0 + \varphi_1 \frac{\Delta k_t}{k_t} + \delta_1 In \frac{\Delta k_t}{k_t} + \varphi_2 \frac{\Delta h_t}{h_t} + \delta_2 In \frac{\Delta h_t}{h_t} + \varepsilon_t \qquad (10)$$

The final basic equation that we got in our theoretical model can use to test the impact of institution on the growth by the influence of institution's quality on the productivity of physical and human capital. In addition, we explain the coefficient estimates for $\varphi_1, \varphi_2, \delta_1, \delta_2$. The coefficient φ_1 and φ_2 measure the return to physical and human capital investments (the productivity of capital investments) in a country with the worst possible institutional quality, while coefficient δ_1 and δ_2 showing an increasing return to these capital investments as the country's institutional quality improves to the ideal level for economy based of market foundations.

OLS Panel regression analysis of income per capita and institutional quality for CEE courtiers (1993-2007)

Variable	Variable description	Obs	Mean	Std. Dev.	Min	Max
LGDP	Log GDP per capita, US$	124	8.088048	0.7498555	6.096838	9.511979
Institution	Institution quality (Index of corruption, political rights and civil liabilities)	122	0.5344152	0.7152418	-2.38324	1.20147
Innovation	Innovation capacity (Royal payments, GERD and Journal articles)	120	-1.892837	0.3460532	-2.696032	-1.173705
Human capital	Human capital (Gross enrolment in primary, secondary and tertiary education and education spending)	135	3.865763	0.1192445	3.570382	4.080292
Export demand	Export demand for goods and services, US$	135	18.14359	1.590651	13.92526	21.09715
Bank credit	Bank credit to private sector, as % of GDP	131	3.052384	0.71494	1.252763	4.484921

	Log of GDP	Institution quality	Innovation capacity	Human capital	Bank credit	Investment	FDI inflow	Export	Openness	Inflation
Log of GDP	1									
Institution quality	0.5959	1								
Innovation capacity	0.6068	0.3561	1							
Human capital	0.6254	0.7871	0.1672	1						
Bank credit	0.8022	0.3884	0.5361	0.5263	1					
Investment	0.6469	0.3539	0.2345	0.3811	0.5676	1				
Remittances	0.4147	0.1735	0.087	0.4297	0.5574	0.3503				
Net FDI inflow	0.5358	0.2449	0.3007	0.1597	0.3474	0.2567	1			
Export	0.3373	-0.0273	0.22	-0.0378	0.2057	0.0122	0.8303	1		
Openness	0.3822	0.6002	0.2897	0.5854	0.4189	0.2911	-0.0852	-0.3147	1	
Inflation	-0.6122	-0.4973	-0.2874	-0.6209	-0.4328	-0.4237	-0.1163	0.0492	-0.3607	1

DEPENDENT VARIABLES: Log GDP per capita	OLS Panel regression	OLS Panel regression	Random-effects GLS regression	Fixed-effects (within) regression
INDEPENDENT VARIABLES				

Institution quality	0.157	0.192**	0.160**	0.0130**
	(0.152)	(0.0795)	(0.009)	(0.030)
Innovation capacity	0.642***			0.124**
	(0.175)			(0.236)
Human capital	2.672***	1.368***	2.709**	1.149**
	(0.774)	(0.502)	(0.000)	(0.061)
Export demand	0.178***	0.142***	0.240**	0.534**
	(0.0346)	(0.0244)	(0.000)	(0.000)
Bank credit to private sector	0.227**	0.142***	0.078**	
	(0.0911)	(0.0635)	(0.125)	
Investment in physical capital		1.211***	0.709**	0.523**
		(0.125)	(0.000)	(0.000)
Constant	-5.155*	-4.369**	-9.303081**	-7.709**
	(2.762)	(1.947)	(0.000)	(0.000)
Observations	99	108	108	101
R-squared	0.696	0.800	0.715	0.474

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

<u>OLS Panel regression analysis of economic growth per capita and institutional quality for CEE courtiers (1993-2007)</u>

	Growth rate	*Investment*	*Human capital*	*Innovation*	*Competitive*	*Institution quality*	*Infrastruc.*
Growth rate	1						
Investment	0.2744	1					
Human capital	0.3334	-0.0572	1				
Innovation	0.3272	0.4098	0.2814	1			
Competitiveness	0.4654	0.5401	0.4552	0.568	1		
Institution quality	0.2756	0.1267	0.5393	0.1298	0.369	1	
Infrastructure	0.4427	0.3721	0.5391	0.7477	0.6456	0.3606	1

The results from empirical study for economic growth per capita and institutional quality that we have partly done by using data for group of CEE countries in modified Panel econometric methods and OLS regression analysis show two controversial results. First, regression analysis which we use to estimate the first econometric model shows strong positive statistical correlation between quality of institutions and economic growth in time series of 1993-2007 for sample of CEE countries.

DEPENDENT VARIABLES: ECONOMIC GROWTH	OLS Panel regression	OLS Panel regression	Random-effects GLS regression	Random-effects GLS regression
INDEPENDENT VARIABLES				
Institution quality	0.188***	0.196**	0.110**	0.106*
	(0.215)	(0.172)	(0.0552)	(0.0546)
Innovation capacity	0.242**	0.265**		
	(0.029)	(0.029)		
Human capital	1.642**	0.761**	2.148***	0.386***
	(0.002)	(0.002)	(0.304)	(0.122)
Infrastructure				1.024**
				(0.495)
Economic competitiveness		0.427**		0.250***
		(0.000)		(0.0323)
Investment in physical capital	0.138**		0.239***	
	(0.003)		(0.032)	
Trust			0.594***	0.205
			(0.184)	(0.213)
Constant	-3.946**	0.698**	-1.930	2.324
	(0.108)	(0.670)	(1.223)	(1.949)
Observations	214	229	378	373
R-squared	0.504	0.591	0.56	0.54

Standard errors in parentheses

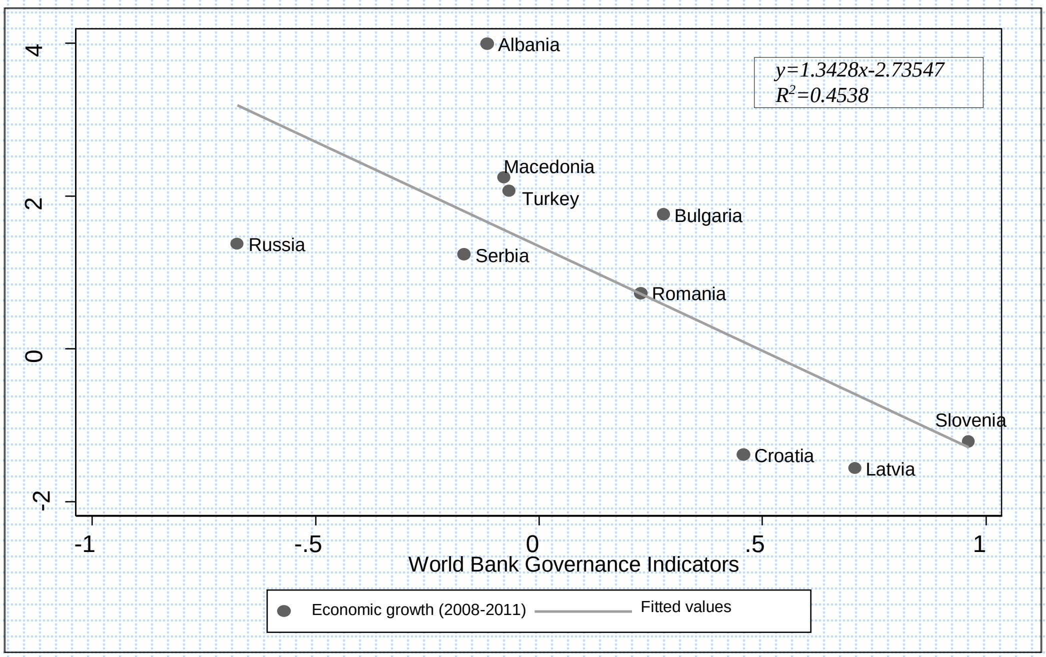
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The quality of institutions have positive effect and influence of economic performance during transition and post-transition period for all sample of countries, that means, those countries which have implemented growth-promoting institutions (high level of transition progress to market economy, successful results in integration process to EU and adaptation to EU-compatible institutions, high quality of government policy making) have high level of GDP per capita and sustainable economic growth in long run.

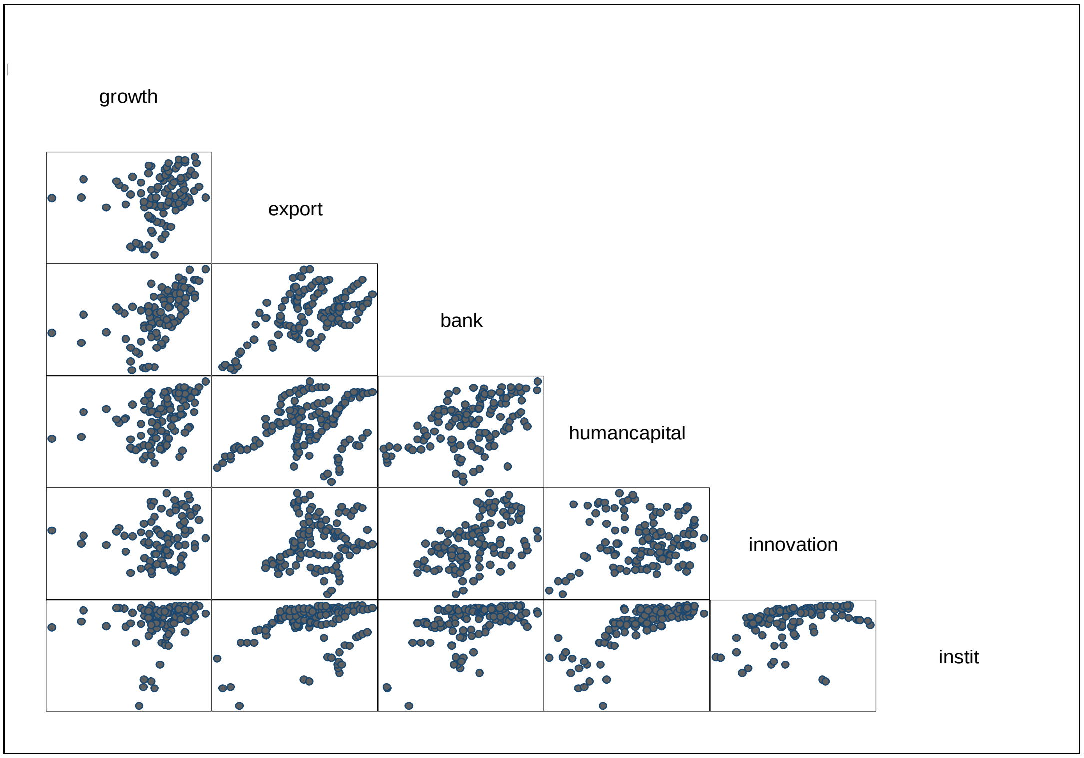
On the other hand, our second regression model that we have estimated using different set of variables to represent the quality of institutions (WBGI, EBRD Index, EU integration), for the time period (2008-2011), shows negative correlation between institutions and economic growth. The logical explanation of the negative influence of institutional quality we should find out in fact that countries in CEE which have made the most significant institutional progress by integration to EU are more vulnerable to the crisis. This sensitivity and vulnerability to the crisis, primarily came from the higher degree of openness to the transmission effects through financial flows and falling export demand. But, at the same time they have better chance to overcome the crisis and better opportunities for recovering their economies, since private sector in those countries operate within a more supportive and market oriented institutional environment.[5]

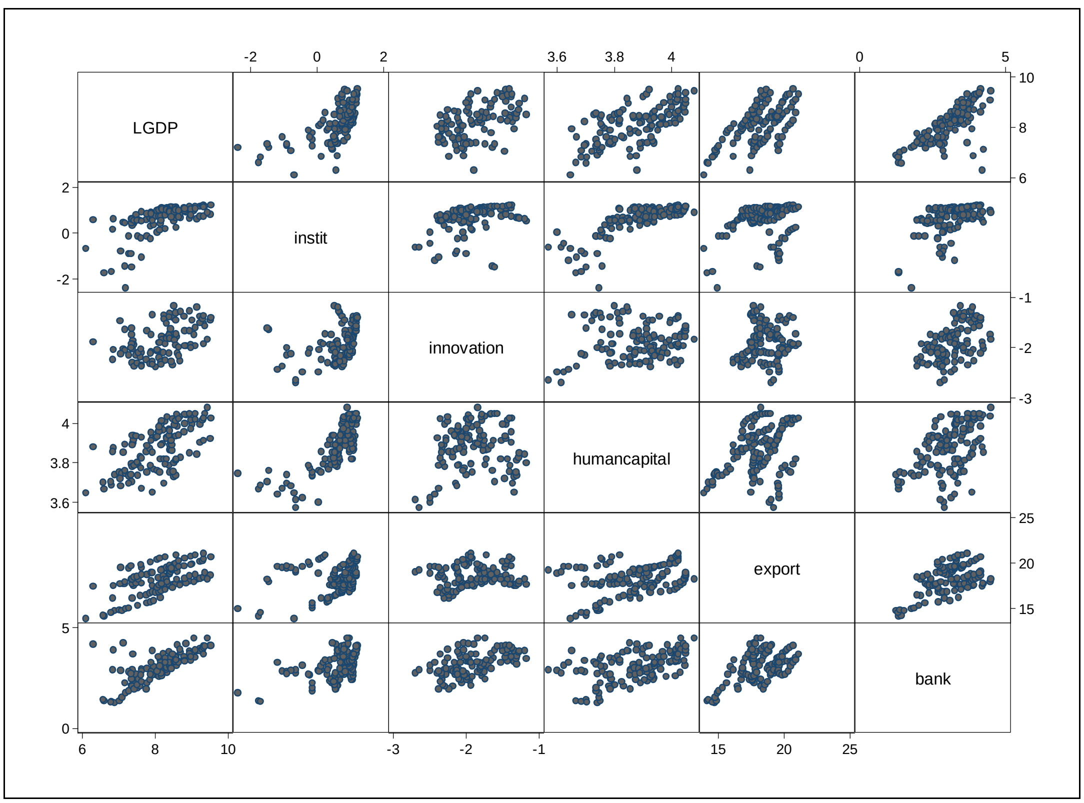
Figure1. Average economic growth and Quality of institutions (2008-2011)

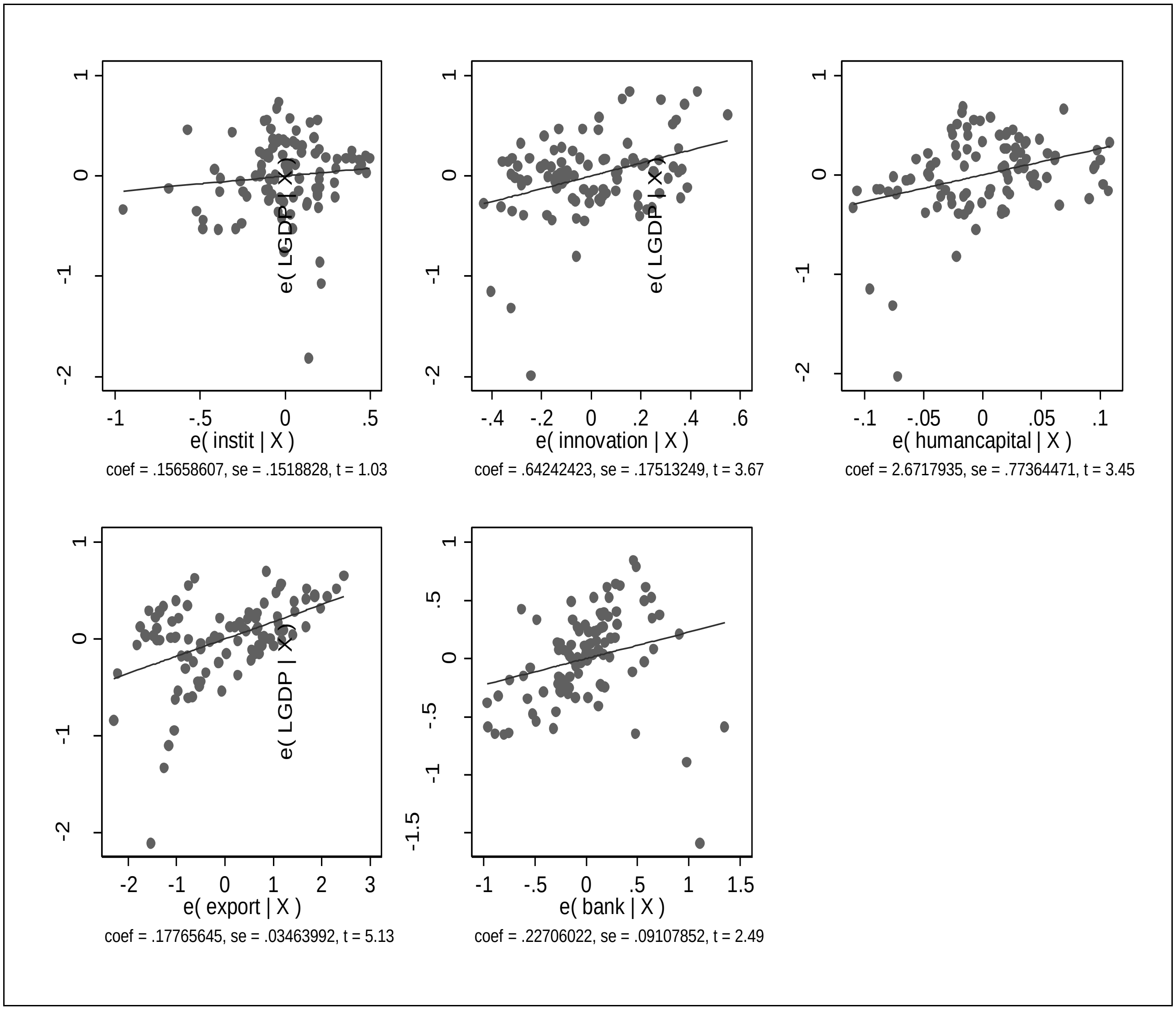
[5] Will Bartlett and Ivana Prica (2011): The variable impact of the global economic crisis in South East Europe, London School of Economics.



Albania
y=1.3428x-2.73547
R2=0.4538
Macedonia
Turkey
Bulgaria
Russia
Serbia
Romania
Slovenia
Croatia
Latvia
4
2
0
-2
-1
-.5
0
.5
1
World Bank Governance Indicators
Economic growth (2008-2011)
Fitted values

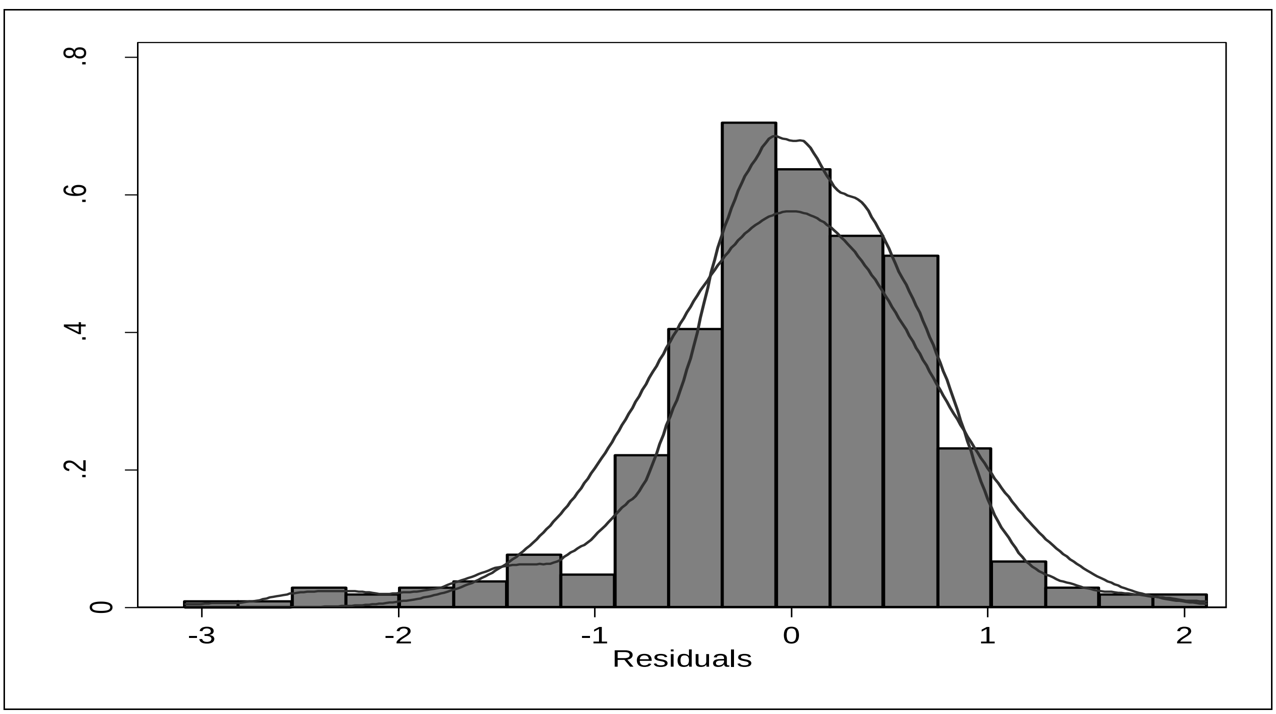

growth
export
bank
humancapital
innovation
instit


LGDP
instit
innovation
humancapital
export
bank

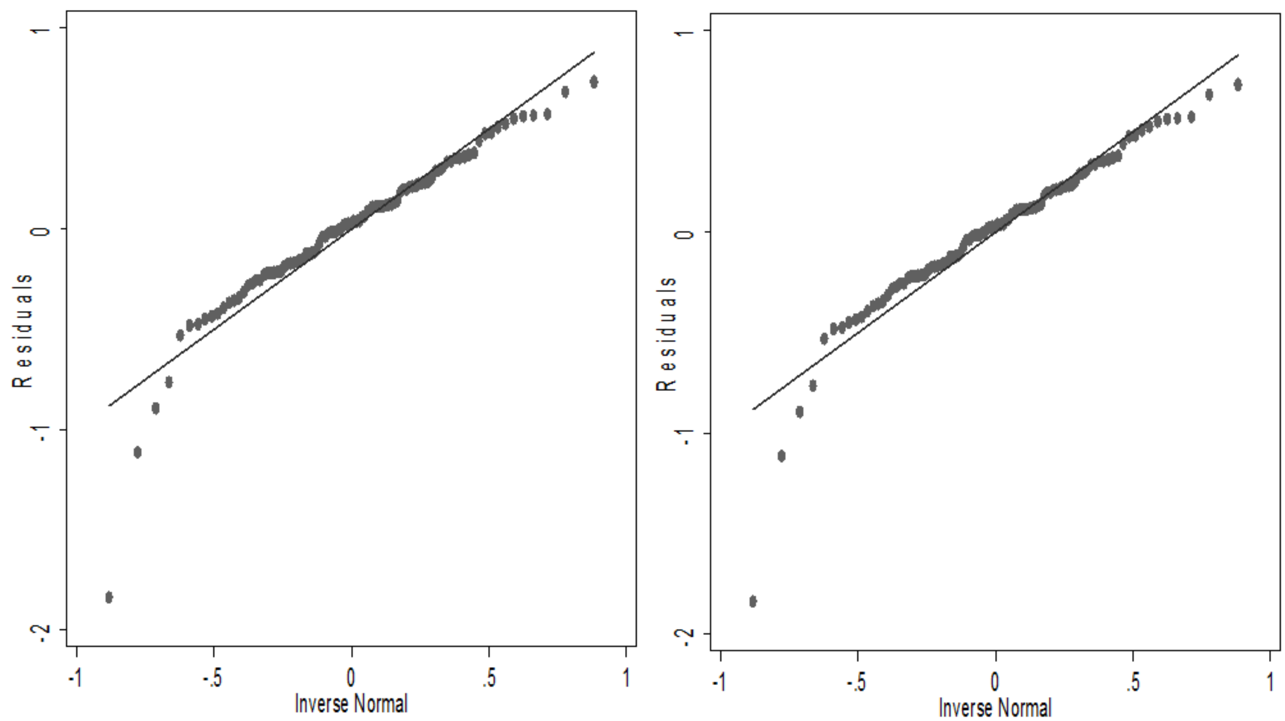

e(LGDP | X)
e(instit | X)
coef = .15658607, se = .1518828, t = 1.03
e(innovation | X)
coef = .64242423, se = .17513249, t = 3.67
e(humancapital | X)
coef = 2.6717935, se = .77364471, t = 3.45
e(export | X)
coef = .17765645, se = .03463992, t = 5.13
e(bank | X)
coef = .22706022, se = .09107852, t = 2.49

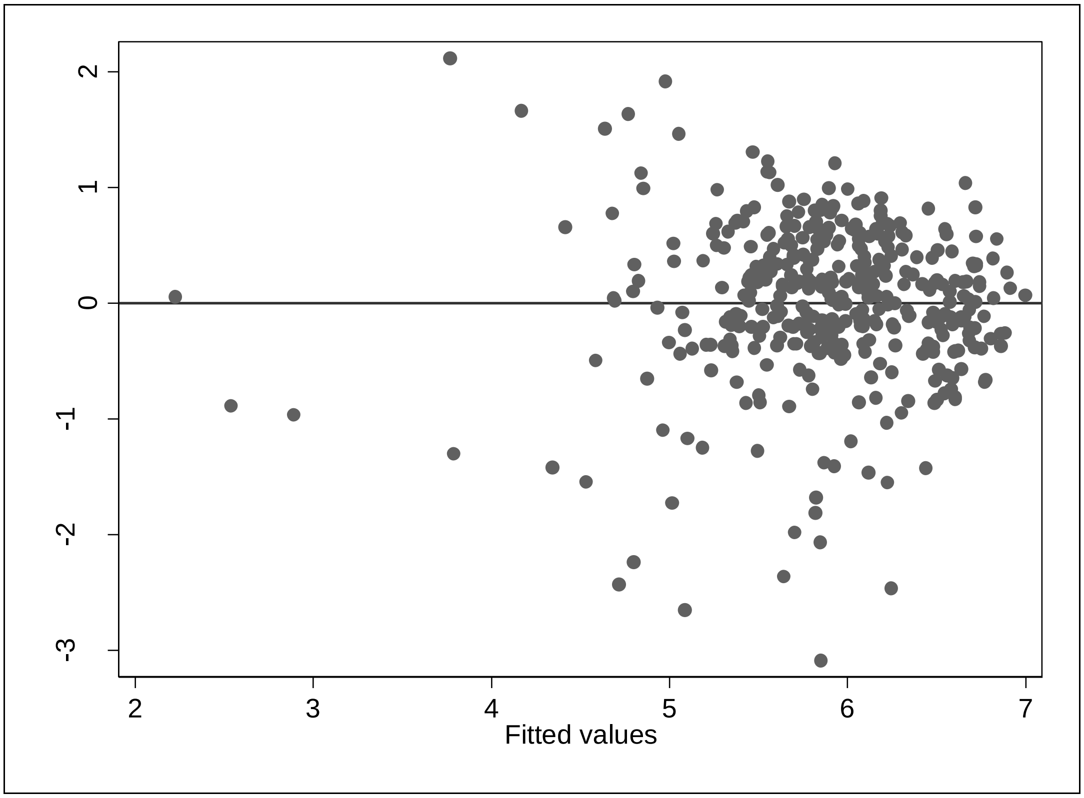
```
Ramsey RESET test using powers of the fitted values of growthrate

      Ho:  model has no omitted variables
                F(3, 370) =      1.42
                 Prob > F =      0.2364
```

```
      Source |       SS       df       MS              Number of obs =     378
-------------+------------------------------           F(  2,   375) =  158.15
       Model |  151.484139     2  75.7420694           Prob > F      =  0.0000
    Residual |  179.602308   375  .478939488           R-squared     =  0.4575
-------------+------------------------------           Adj R-squared =  0.4546
       Total |  331.086447   377  .878213386           Root MSE      =  .69205

------------------------------------------------------------------------------
  growthrate |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   1.608009    .424873     3.78   0.000     .7725771    2.443441
      _hatsq |  -.0562156   .0389352    -1.44   0.150    -.1327743    .0203432
       _cons |  -1.608843   1.163243    -1.38   0.167    -3.896139     .678453
------------------------------------------------------------------------------
```



A kernel density plot produces a kind of histogram for normal distribution of the residuals. Here residuals seem to follow quite a normal distribution.





Rvfplot scatter plotting residuals vs. predicted values (Yhat) which means that residuals seem to slightly expand at higher levels of Yhat.

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of LGDP
         chi2(1)      =     2.88
         Prob > chi2  =   0.0895
```

This is the Breusch-Pagan test for heteroskedasticity. The null hypothesis is that residuals are homoskedastic. Here we accept the null and concluded that residuals are homoskedastic. (the minimum threshold p-value is 0.05)

Variable	VIF	1/VIF
humancapital	2.66	0.376304
instit	2.61	0.383801
bank	1.87	0.534089
export	1.34	0.746060
investment	1.12	0.891900
Mean VIF	1.92	

A vif> 10 or a 1/vif< 0.10 indicates that there is multicolinearity problem in regression model. One of the reason why we use principle-component analysis in our regression is to avoid the problem of multicolinearity. Neither of independent variables in the regression is nor causal correlate each other, that is signal for not multicolinearity bias.

Appendix1 Factor analysis of Innovation capacity: Royal payments, number of patents, journal articles and expenditure of research and development.

```
Factor analysis/correlation                        Number of obs    =      323
    Method: principal-component factors            Retained factors =        1
    Rotation: (unrotated)                          Number of params =        4

    --------------------------------------------------------------------------
         Factor  |   Eigenvalue   Difference        Proportion   Cumulative
    -------------+------------------------------------------------------------
        Factor1  |      2.50990      1.57707            0.6275       0.6275
        Factor2  |      0.93283      0.65074            0.2332       0.8607
        Factor3  |      0.28209      0.00691            0.0705       0.9312
        Factor4  |      0.27518            .            0.0688       1.0000
    --------------------------------------------------------------------------
    LR test: independent vs. saturated:  chi2(6)  =  547.07 Prob>chi2 = 0.0000
```

```
Factor loadings (pattern matrix) and unique variances

    ---------------------------------------
        Variable |  Factor1 |   Uniqueness
    -------------+----------+--------------
        di1royag |   0.3691 |      0.8638
      di6patecap |   0.8786 |      0.2281
      di7articap |   0.8887 |      0.2103
       di16merdt |   0.9011 |      0.1880
    ---------------------------------------
```

```
Factor analysis/correlation                        Number of obs    =      323
    Method: principal-component factors            Retained factors =        1
    Rotation: orthogonal varimax (Kaiser off)      Number of params =        4

    --------------------------------------------------------------------------
         Factor  |     Variance   Difference        Proportion   Cumulative
    -------------+------------------------------------------------------------
        Factor1  |      2.50990            .            0.6275       0.6275
    --------------------------------------------------------------------------
    LR test: independent vs. saturated:  chi2(6)  =  547.07 Prob>chi2 = 0.0000
```

```
Rotated factor loadings (pattern matrix) and unique variances

    ---------------------------------------
        Variable |  Factor1 |   Uniqueness
    -------------+----------+--------------
        di1royag |   0.3691 |      0.8638
      di6patecap |   0.8786 |      0.2281
      di7articap |   0.8887 |      0.2103
       di16merdt |   0.9011 |      0.1880
    ---------------------------------------
```

```
Factor rotation matrix

    -----------------------
                 | Factor1
    -------------+---------
         Factor1 |  1.0000
    -----------------------
```

Appendix2 Factor analysis of human capital: gross enrolment in primary, secondary and tertiary education, education spending and number of teacher per student.

```
Factor analysis/correlation                        Number of obs    =      356
    Method: principal factors                      Retained factors =        3
    Rotation: (unrotated)                          Number of params =       15

         Factor  |   Eigenvalue   Difference        Proportion   Cumulative

    -------------+------------------------------------------------------------
        Factor1  |      2.42104      2.11148            1.0396       1.0396
        Factor2  |      0.30956      0.24784            0.1329       1.1725
        Factor3  |      0.06172      0.18163            0.0265       1.1990
        Factor4  |     -0.11990      0.00644           -0.0515       1.1475
        Factor5  |     -0.12634      0.09082           -0.0542       1.0932
        Factor6  |     -0.21716            .           -0.0932       1.0000
    --------------------------------------------------------------------------
    LR test: independent vs. saturated:  chi2(15) =  703.63 Prob>chi2 = 0.0000
```

```
Factor loadings (pattern matrix) and unique variances

        Variable |  Factor1   Factor2   Factor3 |   Uniqueness

    -------------+------------------------------+--------------
        es1enrop |   0.1462    0.4204    0.0060 |      0.8019
        es2enros |   0.8465   -0.0026   -0.0880 |      0.2756
        es3enrot |   0.7256   -0.0318    0.1010 |      0.4623
       es10schom |   0.5978    0.2323    0.0967 |      0.5793
       es12educe |   0.4284   -0.2684    0.1218 |      0.7296
       es14teacr |   0.7846   -0.0765   -0.1398 |      0.3590
    -----------------------------------------------------------
```

```
Factor analysis/correlation                        Number of obs    =      356
    Method: principal factors                      Retained factors =        3
    Rotation: orthogonal varimax (Kaiser off)      Number of params =       15

         Factor  |     Variance   Difference        Proportion   Cumulative

    -------------+------------------------------------------------------------
        Factor1  |      2.32436      1.99452            0.9980       0.9980
        Factor2  |      0.32983      0.19169            0.1416       1.1397
        Factor3  |      0.13814            .            0.0593       1.1990
    --------------------------------------------------------------------------
    LR test: independent vs. saturated:  chi2(15) =  703.63 Prob>chi2 = 0.0000
```

```
Rotated factor loadings (pattern matrix) and unique variances

        Variable |  Factor1   Factor2   Factor3 |   Uniqueness
    -------------+------------------------------+--------------
        es1enrop |   0.1078    0.4292   -0.0479 |      0.8019
        es2enros |   0.8454    0.0789    0.0588 |      0.2756
        es3enrot |   0.6940    0.0685    0.2267 |      0.4623
       es10schom |   0.5482    0.3118    0.1516 |      0.5793
       es12educe |   0.4185   -0.1935    0.2406 |      0.7296
       es14teacr |   0.8005   -0.0092    0.0120 |      0.3590
    -----------------------------------------------------------
```

```
Factor rotation matrix
                 | Factor1  Factor2  Factor3

    -------------+---------------------------
         Factor1 |  0.9789   0.1138   0.1695
         Factor2 | -0.0815   0.9791  -0.1866
         Factor3 | -0.1872   0.1688   0.9677
    -----------------------------------------
```

Appendix3 Factor analysis of the quality of institutions: Index of corruption, political rights, civic freedom and index of democracy.

```
Factor analysis/correlation                        Number of obs    =      356
    Method: principal factors                      Retained factors =        2
    Rotation: (unrotated)                          Number of params =        6

    --------------------------------------------------------------------------
         Factor  |   Eigenvalue   Difference        Proportion   Cumulative
    -------------+------------------------------------------------------------
        Factor1  |      2.06135      1.98990            1.0618       1.0618
        Factor2  |      0.07145      0.11807            0.0368       1.0986
        Factor3  |     -0.04662      0.09820           -0.0240       1.0746
        Factor4  |     -0.14482            .           -0.0746       1.0000
    --------------------------------------------------------------------------
    LR test: independent vs. saturated:  chi2(6)  =  633.89 Prob>chi2 = 0.0000
```

```
Factor loadings (pattern matrix) and unique variances

    -------------------------------------------------
        Variable |  Factor1   Factor2 |   Uniqueness
    -------------+--------------------+--------------
       pf20demoa |   0.8514    0.0896 |      0.2670
       pf23legic |   0.2500    0.1811 |      0.9047
        pf1corri |   0.6588   -0.1749 |      0.5354
       pf12polir |   0.9165   -0.0070 |      0.1601
    -------------------------------------------------
```

```
Factor analysis/correlation                        Number of obs    =      356
    Method: principal factors                      Retained factors =        2
    Rotation: orthogonal varimax (Kaiser off)      Number of params =        6

    --------------------------------------------------------------------------
         Factor  |     Variance   Difference        Proportion   Cumulative
    -------------+------------------------------------------------------------
        Factor1  |      2.06098      1.98916            1.0616       1.0616
        Factor2  |      0.07182            .            0.0370       1.0986
    --------------------------------------------------------------------------
    LR test: independent vs. saturated:  chi2(6)  =  633.89 Prob>chi2 = 0.0000
```

```
Rotated factor loadings (pattern matrix) and unique variances

    -------------------------------------------------
        Variable |  Factor1   Factor2 |   Uniqueness
    -------------+--------------------+--------------
       pf20demoa |   0.8526    0.0780 |      0.2670
       pf23legic |   0.2525    0.1777 |      0.9047
        pf1corri |   0.6563   -0.1839 |      0.5354
       pf12polir |   0.9163   -0.0195 |      0.1601
    -------------------------------------------------
```

```
Factor rotation matrix

    --------------------------------
```

```
             | Factor1  Factor2
-------------+------------------
     Factor1 |  0.9999  -0.0137
     Factor2 |  0.0137   0.9999
--------------------------------
```

Appendix4 Factor analysis of economic competitiveness: bank credit to private sector and openness to trade.

```
Factor analysis/correlation                        Number of obs    =      356
    Method: principal factors                      Retained factors =        1
    Rotation: (unrotated)                          Number of params =        1

    --------------------------------------------------------------------------
         Factor  |   Eigenvalue   Difference        Proportion   Cumulative
    -------------+------------------------------------------------------------
        Factor1  |      0.19642      0.33629            3.4736       3.4736
        Factor2  |     -0.13987            .           -2.4736       1.0000
    --------------------------------------------------------------------------
    LR test: independent vs. saturated:  chi2(1)  =   10.17 Prob>chi2 = 0.0014
```

```
Factor loadings (pattern matrix) and unique variances

    ---------------------------------------
        Variable |  Factor1 |   Uniqueness
    -------------+----------+--------------
       ec14credg |   0.3134 |      0.9018
       ec16openi |   0.3134 |      0.9018
    ---------------------------------------
```

```
Factor analysis/correlation                        Number of obs    =      356
    Method: principal factors                      Retained factors =        1
    Rotation: orthogonal varimax (Kaiser off)      Number of params =        1

    --------------------------------------------------------------------------
         Factor  |     Variance   Difference        Proportion   Cumulative
    -------------+------------------------------------------------------------
        Factor1  |      0.19642            .            3.4736       3.4736
    --------------------------------------------------------------------------
    LR test: independent vs. saturated:  chi2(1)  =   10.17 Prob>chi2 = 0.0014
```

```
Rotated factor loadings (pattern matrix) and unique variances

    ---------------------------------------
        Variable |  Factor1 |   Uniqueness
    -------------+----------+--------------
       ec14credg |   0.3134 |      0.9018
       ec16openi |   0.3134 |      0.9018
    ---------------------------------------
```

```
Factor rotation matrix

    -----------------------
                 | Factor1
    -------------+---------
         Factor1 |  1.0000
    -----------------------
```