Inequality, Human Capital, Growth and Mobility in Armenia

Edgar Begrakyan*

Economic Research Department, Central Bank of Armenia†

May, 2013

Abstract

The paper examines the relationship between income distribution, human capital and economic growth in Armenia over the last decade. I use "Household's Integrated Living Conditions Survey" database, real GDP per capita and real private investment per capita from the National Statistical Service of Republic of Armenia for empirical estimation. The paper finds that income inequality and human capital have negatively and positively significant influence on economic growth respectively. The dynamic analysis of the interplay between income inequality and economic growth is also conducted showing that it takes economic growth rather long time to return back to its long run trend due to the shock in income inequality. In addition, the evolution of income distribution is demonstrated both from the static and from dynamic point of view in Armenia. The findings show that the probability is high that the poor (the rich) will remain poor (rich) over the time. Moreover, the intergenerational educational transition matrices and mobility indices are constructed which state that if a parent has higher (primary) education the probability is greater (smaller) that the offspring will also get higher education.

JEL Classification: C32, C11, D31, I25, O40, J60.
Keywords: inequality, human capital, economic growth and mobility.

*E-mail: edgar.begrakyan@cba.am

†The views expressed in the paper are those of the author and do not necessarily represent those of the Central Bank of Armenia or its policy.

1 Introduction

Armenia, as well as other CIS (Commonwealth of Independent States) countries, experienced a dramatic economic downturn after the collapse of Soviet Union. Its immediate aftermath was that the living conditions began to worsen, poor people emerged and income inequality started rising. An interesting and important economic and social issue arises: *whether income inequality may hinder the further economic growth*?

There are numerous theories and empirical works concerning the relationship between income inequality and economic growth. From the classical point of view income distribution has a positive effect on economic growth (Kaldor 1955). Classical hypothesis consideres that, as the marginal propensity to save increases with wealth, inequality directs the resources towards the rich people. As a result, it increases aggregate savings, capital accumulation and, hence, economic growth. The Classical hypothesis was replaced by Neoclassical approach which was based on the representative agent paradigm and rejected the relevance of heterogeneity and, consequently, the impact of income distribution on economic growth. Over the last few decades a number of new theories and empirical works emerged which stated the significant influence of income inequality on economic growth. In theory two approaches were formulated explaining the negative long run consequences of income inequality: credit market imperfections and political economy. Credit market imperfection hypothesis was pioneered by Galor and Zeira (1993) who considered that, in case of existing credit constrains and fixed costs associated with investment in education, income distribution affected the occupational choice (becoming skilled or unskilled worker). Particularly, if the interest rate is higher for borrower than for lender it results in underinvestment in human capital and, as a result, income inequality negatively impacts on economic growth in the short run, as well as, because of intergenerational transfers it adversely influences on economic growth and development in the long run. The political economy approach also advanced the viewpoint of the negative impact of inequality on economic growth assuming that inequality generates a pressure to adopt redistributive polices which are associated with distortions resulting in underinvestment in human and physical capital, i.e. they adversely affect on economic growth.

From the empirical side there are number of attempts to test the theoretical hypotheses using cross-sectional, time-series and panel data. On the one hand, Alesina and Rodrik (1994), Person and Tabellini (1994) and Perotti (1996), Deininger and Squire (1998) show that there exists negative interplay between inequality and economic growth. On the other hand, Lee and Zou (1998), Forbes (2000) find positive relationship and Barro (2000)

concludes positive association for rich countries and negative for the poor. Lately, Easterly (2007), Dierk and Sebastian (2012) restated the hypothesis, that inequality negatively impacts on economic growth.

The aim of this paper is to investigate the relationship between income distribution, human capital and economic growth.[1] First, I estimate the effect of income inequality on economic growth in Armenia over the last decade. I use "Households Survey" database, quarterly real GDP (Gross Domestic Product) per capita and real private investment per capita from the National Statistical Office of Republic of Armenia. The estimates state that there is a negative relationship between income inequality and economic growth, i.e. one standard deviation increase in the growth rate of income inequality may decline economic growth by 1.3 percent. In addition, I find positive association between human capital, investment and economic growth. Second, I also analyze the evaluation of income distribution from the static and from dynamic point of view. The findings show that the mobility of individuals between different income groups is very small, i.e. the probability is high that the poor (the rich) will remain poor (rich) during the time. Next, intergenerational educational linkages are explored using transition matrices and indices which present that the probability of getting higher education is higher for the offspring if his or her parent has higher education. Lastly, I use multinomial logit model to assess the relationship between the education of the head of household and the household income level. The estimated probabilities present positive relationship between the level of education and income. To my knowledge it is the first attempt to carry out such kind of analysis concerning the nexus between income distribution, human capital and economic growth in Armenia.

The paper is organized as follows: Section 2 outlines the source of data. Subsection 2.1 draws on Section 2 and shows the evolution of inequality. Section 3 estimates the impact of inequality on growth. Section 4 makes Monte Carlo simulations based on the model of the Section 3. Section 5 develops dynamical analysis of growth. Section 6 presents mobility of individuals beween different income groups. Section 7 investigates intergenerational educational linkages. Section 8 finds positive relationship between education and income. Section 9 concludes.

[1]For empirical estimation I benefitted from the paper by Birchenall, A., J. (2001).

2 Data

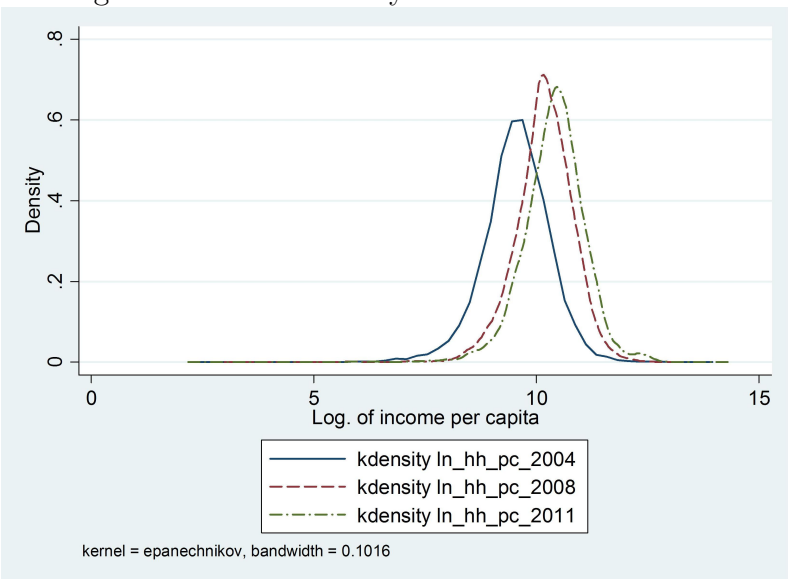
I use "Household's Integrated Living Conditions Survey" anonymised microdata database (by households and by household members) from 2004 to 2011 published by National Statistical Service of Republic of Armenia.[2] The database is representative for Armenian population and the number of households differs between 5000 and 8000 (around 30000 household members) depending on year. The main aim of this database is to provide necessary information about the households to government and organizations in order to make monitoring and policy. I have also taken quarterly real GDP (Gross Domestic Product) per capita and real private investments per capita which are seasonally adjusted. As well as, I have constructed Gini indices as a proxy for income inequality and average years of schooling for human capital from the above mentioned microdata. Gini indices are based on household per capita income and population weights are also included for the sample bias correction. DASP (Distributive Analysis Stata Package) package is used for calculation of Gini indices.[3]As I have intended to do my empirical estimation for 2000-2011 periods and there has been missing data for 2000-2003 I have benefitted from the UNU-WIDER (United Nations University-World Institute for Development Economics Research) World Income Inequality Database (WIID).[4] The average years of schooling is calculated from the Households Survey by members. First, members (older than 25 years) are stratified into different groups depending on their educational level (e.g. primary, secondary). Second, the share of each group (weight) is multiplied by the respective years of schooling (e.g. for primary education it is four years) and the sum of weighted years of schooling represents the proxy for the human capital in Armenia. In this case, I also need data for 2000-2003 and I take advantage of the Barro-Lee dataset but the measures are calculated for every five year interval.[5] So I have taken years of schooling in 2000, calculated compounding growth rate between 2000 and 2004, then I have built new observations for 2001-2003. Overall, I have had 12 observations from 2000 to 2011. The sample is very small and it is senseless to run regressions and make any implications. So, because of data limitations I have disaggregated the data from annual to quarterly using Boot-Feibes-Lisman method[6] and, now, I have got 48 observations.[7]

[2]http://www.armstat.am/en/
[3]Araar, A. and Duclos, J.-Y. (2007).
[4]UNU-WIDER,(2008)
[5]Barro, J., R. and Lee, J.-W. (2010).
[6]See Boot, J.C.G., Feibes, W. and Lisman, J.H.C. (1967).
[7]The figures of variables are available in Appendix (A.1).

2.1 Kernel Densities, Lorenz Curves, Gini and Polarization Indices

Before turning to empirical estimation of the effect of income inequality on economic growth I perform the evolution of income distribution from the static point of view. On this purpose I construct kernel densities of households income per capita for each year. From the Figure 1 we can see that income distribution shifted to the right during the time, as the average incomes have risen. As well as, we notice that distributions of 2008 (dashed) and 2011 (dash-dotted) are more concentrated around the mode than for 2004 (solid), but, at the meantime, both the left and the right tails of 2011 distribution have moved to opposite directions. In order to say whether income inequality increased or decreased I have evaluated the Lorenz curves and Gini coefficients for corresponding years.

Figure 1: Kernel Density of Income Distribution



In Figure 2 we can see Lorenz curves for Armenia in 2004, 2008 and 2011 respectively. Each point on the Lorenz curve shows the share of income that is earned by the cumulative share of people (from the lowest income to the highest income). 45 degree line shows the perfect equality (for example, 20 percent of population owns 20 percent of income). The closer the Lorenz curve is to the line of perfect equality the smaller is the income inequality. We can observe that, although, income inequality has significantly narrowed from 2004 to 2008, it reversed between 2008 and 2011 probably because of financial crisis. Anyway, it remains lower than it was in 2004. We can also

see the same thing as I mentioned above by looking at the Figure 3, where the evolution of Gini indices is plotted. At first, it goes down from 0.395 to 0.337 (in 2008) and then increases and slightly decreases down to 0.368 in the end (in 2011).

Figure 2: Lorenz Curves in Armenia

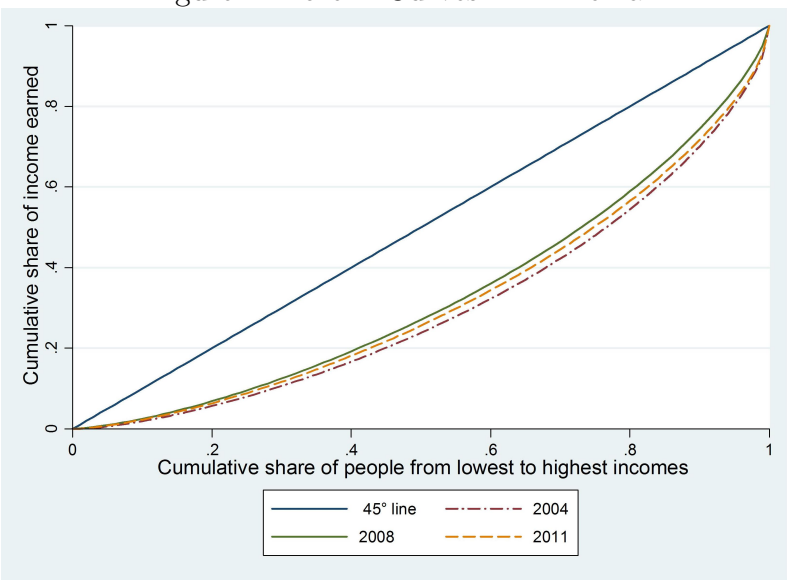
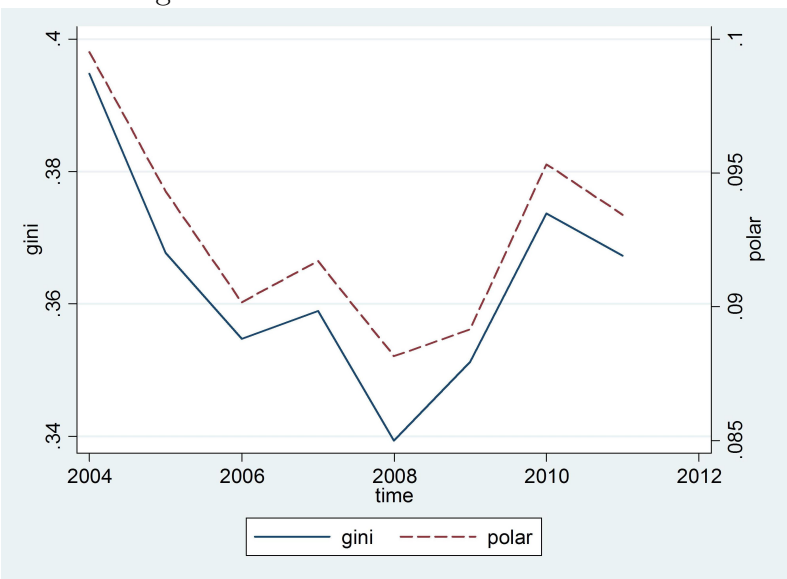


Figure 3: Gini and Polarization Indices



I have also assessed the polarization index for the Armenian population

in order to measure the tension in society.[8] Although we do not have bimodal distribution (or multimodal) it may still be interesting for implications. The population is divided into rich and poor classes and within each class it is assumed that people are homogenous but between the classes they are heterogeneous based on income. From the Figure 3 we notice that the polarization index becomes smaller parallel Gini index and vice versa. So, it is reasonable that when the gap between the rich and the poor becomes larger the tension increases in the society.

3 Model Specification and Estimation

For the assessment of causal relationship between inequality and growth I have evaluated the indirect effect of income inequality (Based on Galor-Zeira model) on economic growth through human capital using IV (Instrumental Variable) methodology, but I have not got any significant results (I do not report them here). Further I have estimated the direct effect of income inequality on economic growth and the model specification has the following form:

$$rgdp\_st_t = \beta_1 gini\_st_t + \beta_2 human\_st_t + \beta_3 rinvest\_st_t + \varepsilon_t \tag{1}$$

where $rgdp\_st_t$, $gini\_st_t$, $human\_st_t$ and $rinvest\_st_t$ are the deviations from the long run trend of the real GDP per capita, income inequality, human capital and real private investment per capita (All variables are in the natural logarithm form.) which are standardized, i.e. they have 0 mean and 1 standard deviation.[9] Equation (1) is estimated using OLS (Ordinary Least Square) and the results are presented in Table 1. From the Table 1 we can say that income inequality influences economic growth negatively while human capital and investment have positive impact (though the magnitude of investment is higher). The findings show that one standard deviation increase of income inequality causes nearly 0.25 standard deviation or 1.3 percent fall in the economic growth. The other important result refers to human capital: if it goes up one standard deviation then economic growth increases by approximately 2 percent. Lastly, upturn of investment by one standard deviation results about 3 percent rise in economic growth. These estimates should be taken into account in policy making as they can be beneficial.

[8] See Esteban and Ray (1994) for details.

[9] Augmented Dickey Fuller unit-root tests show that the variables are inegrated of order one. I do not report the output of the tests in the paper. The trends are estimated using HP (Hodrick and Prescott(1981)) filter. The figures of standardized variables are available in Appendix (A.1) and summary statistics for them are shown in Appendix (A.2).

Table 1: The impacts of inequality, human capital and investment on growth

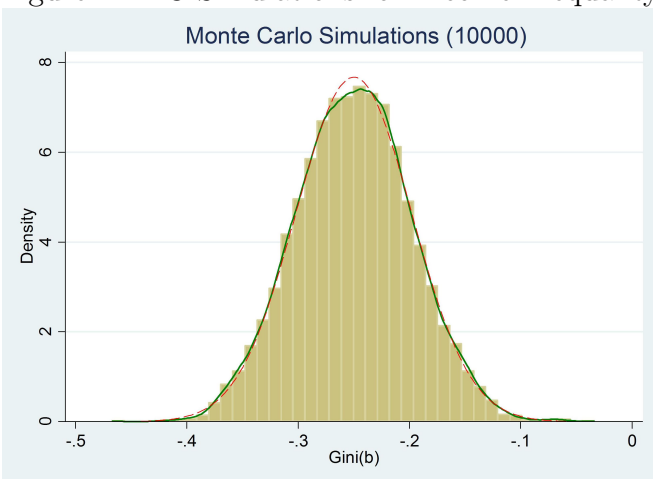
	OLS
$gini\_st_t$	-0.248**
	(-2.81)
$human\_st_t$	0.393***
	(5.32)
$rinvest\_st_t$	0.561***
	(4.34)
Observations	48
R^2_{adj}	0.65

Note: t statistics in parantheses. * p<0.05, ** p<0.01, *** p<0.001.
Standard errors are assessed via bootstraping

4 Monte Carlo Simulations

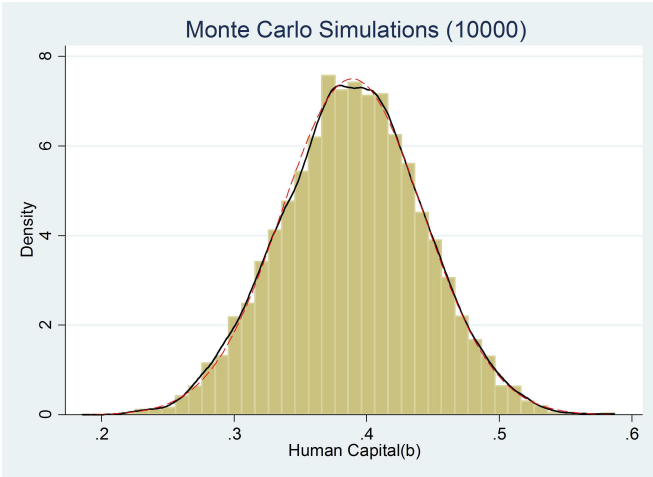
In this section I run Monte Carlo (MC) simulation to test the performance of the estimates which we have got from the small sample using OLS in previous section. We have done 10 000 replications for the model and the distribution of assessed coefficients for income inequality, human capital and investments can be seen in Figure 4, 5 and 6 respectively. From the graphs it is clear that on average the estimated coefficients from the simulations are very close to small sample estimates.

Figure 4: MC Simulations for Income Inequality



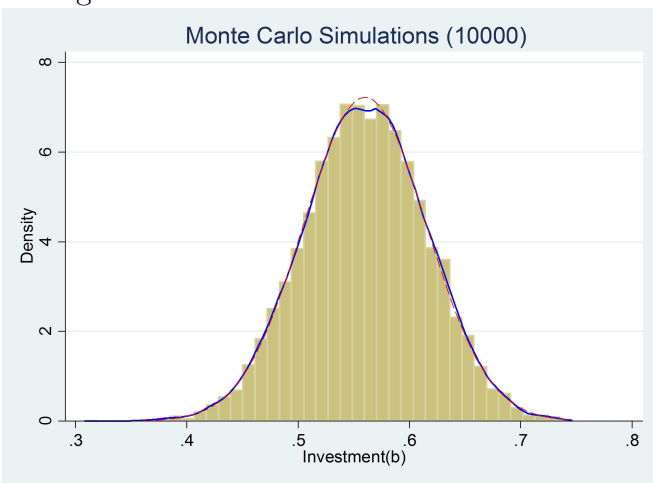
Note: The solid curve is the kernel density of MC estimates and the dashed curve is the normal distribution.

Figure 5: MC Simulations for Human Capital



Note: The solid curve is the kernel density of MC estimates and the dashed curve is the normal distribution.

Figure 6: MC Simulations for Investment



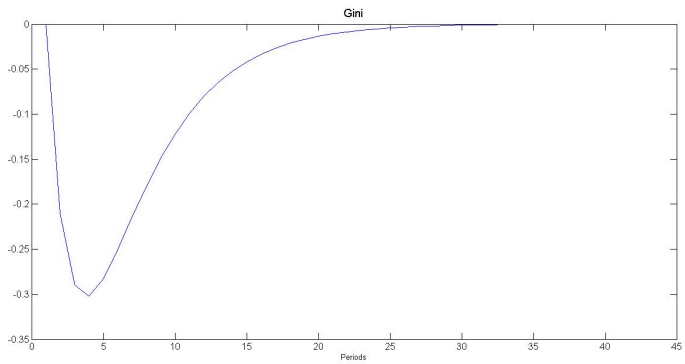
Note: The solid curve is the kernel density of MC estimates and the dashed curve is the normal distribution.

I have also done unbaisedness tests for estimates (I do not report them here.) and they confirm the well performing properties of the small sample estimates. So we have got true model specification and corresponding estimates for examining the causal relationship between income inequality and economic growth.

5 Dynamics of Economic Growth

In Section 3 I checked the nexus between income inequality and economic growth from the static point of view. It is important to see the behavior of economic growth and other variables in dynamics. I consider that all variables follow an autoregressive process of order one (AR(1)). In addition, I assume that economic growth, besides its first lag, depends on the first lagged values of income inequality, human capital and investment. I evaluate this system with BVAR (Bayesian Vector Autoregression) methodology and as priors for lagged values of inequality, human capital and investment (In growth equation) I take the estimates of parameters from the previous section. Although these estimates are for contemporaneous relationship I assume that they also exist for the lagged values. In general, to my knowledge there are no other empirical works or experimental judgments about these relationships in this context in Armenia in order to take into account in my work. The estimate from the AR(1) process of growth is taken as prior for the lagged value of growth. In the same way I do for the lagged inequality, human capital and investment for AR(1) equations correspondingly. As I believe in my priors I give higher weights them than to the maximum likelihood estimates.[10] For observing the dynamical properties of the system I give one standard deviation shock to the income inequality, human capital and investment. Figure 7 demonstrates the impulse response of economic growth to the one standard deviation of income inequality.

Figure 7: Response of economic growth to one std. dev. shock in inequality



[10]This approach is similar, to some extent, to Litterman, R. (1980).

Remarkably, it takes the growth nearly from 7 to 8 years (In Figures 7, 8 and 9 the periods are quarterly.) to return back to its long run trend. In the same way we can interpret Figure 8 and 9.

Figure 8: Response of economic growth to one std. dev. increase in human capital

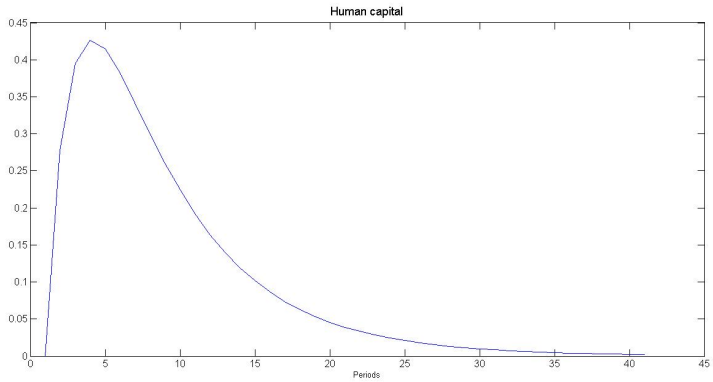


Figure 9: Response of economic growth to one std. dev. increase in investment

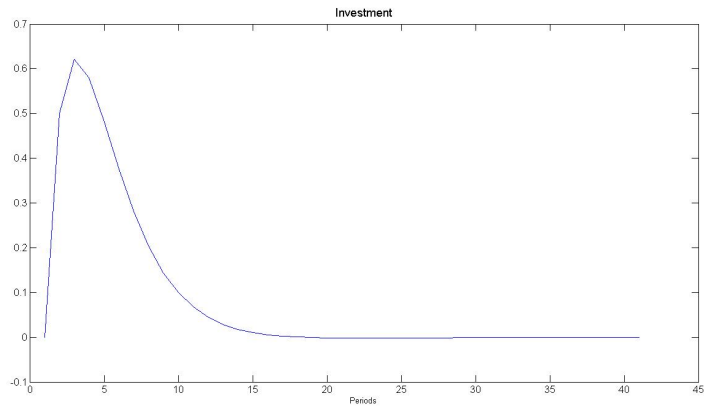


Table 4 and 5 present the response of growth in standard deviations and

in percent respectively for the first 4 years. Quantitatively, we can say that one standard deviation of income inequality decreases economic growth by 1.43 percent in the first year, 1.05 percent in the second, 0.48 in the third, 0.2 in the fourth year and so on. In the same way we can interpret for the human capital and investment. In general, we see that there is persistence in the variables.

Table 2: Dynamics of growth in SD

Growth	Gini	Human	Investment
Year1	-0.25	0.38	0.55
Year2	-0.20	0.32	0.25
Year3	-0.09	0.18	0.06
Year4	-0.04	0.09	.009

Source: Author's calculations.

Table 3: Dynamics of growth in percent

Growth	Gini	Human	Investment
Year1	-1.33	2.00	2.87
Year2	-1.05	1.70	1.32
Year3	-0.48	1.00	0.32
Year4	-0.20	0.50	0.04

Source: Author's calculations.

6 Transition Matrices and Mobility Indices

In Subsection 2.1 I have shown the evolution of income distribution from the static point of view as we have just looked at the change of the distribution shape. But this approach overlooks the discussion of mobility between different income groups (for instance, from poor to rich). In this sense, I would say that society is more mobile if the present time (period), compared to the previous, within which a person changes his or her income class is shorter. In order to conduct this analysis I need the transition probabilities between different classes for constructing the transition matrix. From the "Household's Integrated Living Conditions Survey" anonymised microdata database I construct the income quintiles for population as I want to estimate the transition probabilities and the matrix. The transition probabilities are defined in the following way:

$$Prob(Y_{t+s} \in q_j(t+s)|Y_t \in q_i(t)) = M_{ij}(t) = M_{ij} \tag{2}$$

where s is the time difference between observations and M_{ij} characterize the transition of agents among different income groups (i.e. quintiles) and they are stationary. In general, each element of M matrix describes the transition probability of agents (e.g. the agent is in quintile 2 in t+s time given that he was in quintile 1 in t time) and the transition matrix has the following form:[11]

$$\begin{pmatrix} M_{11} & \cdots & M_{1n} \\ \vdots & \ddots & \vdots \\ M_{n1} & \cdots & M_{nn} \end{pmatrix}$$

There are some restrictions on the values of transition probabilities: first, they are positive and lie between zero and one; second, sum of the elements in each row is equal to one.

$$0 \leq M_{ij} \leq 1 \tag{3}$$

$$\sum_{j=1}^{n} M_{ij} = 1, \forall i \tag{4}$$

If I assume that $P_i(t)$ is the share of income for group i at time t and $\bar{P}(t) = [P_1(t), P_2(t), \cdots, P_n(t)]$ represent the system, then the evolution of these variables may be described in this way:

$$P_j(t+s) = \sum_{j=1}^{n} \{P_i(t) M_{ij}(t)\}, \tag{5}$$

$$\bar{P}_j(t+s) = \bar{P}_i(t) M_{ij}(t), \tag{6}$$

While constructing the transition probabilities I have met problems as "Household's Integrated Living Conditions Survey" anonymised microdata database does not provide information about the movements of agents (i.e. I do not have individual panel data). From the database I can only get aggregate data: just the number of individuals in each quintile and time point. Therefore, to overcome this problem the transition probabilities are estimated by econometric approach using BVAR. The assessed transition matrices presented in Table 5:

[11] See Lee, T. C., Judge G. G. and Zellner A. (1970).

Table 4: Estimated Transition matrix.

		2011					
		Q1	Q2	Q3	Q4	Q5	Total
2004	Q1	0.50	0.30	0.13	0.05	0.02	1
	Q2	0.22	0.40	0.24	0.09	0.05	1
	Q3	0.10	0.16	0.45	0.21	0.08	1
	Q4	0.02	0.10	0.16	0.49	0.23	1
	Q5	0.01	0.02	0.05	0.24	0.68	1

Source: author's calculations.

From Table 6 it can be seen that the probability of an individual being in the first quintile in 2004 and remaining in the same quintile in 2011 is approximately 0.5: so it is high enough. The transition probability from the first quintile to the last is very small. In contrast, we can see the opposite picture in the last row of the matrix. In other words, the probability that the poor will remain poor is higher than they will become rich in 2011. The story is the same for the rich individuals. In general, we notice that diagonal elements are higher than the respective off diagonal ones. Hence, we conclude that to some extent there is persistence in society. It is important to say that the middle class (quintile 3) has a higher probability to become richer than poorer. From Table 6 I have also evaluated mobility indices which explain the evolution of income distribution from the dynamic perspective.[12] I shall give some explanation for better understanding. The analysis is based on the diagonal elements of transition matrix which reflect the persistence in society. These indices may be represented as the difference between the observed (Table 6) and limit matrix. All rows of the limit matrix are equal and constant which shows the equal opportunities for the society regardless of initial states. In this sense, the estimated indices represent how close the income distribution is to the perfectly equal opportunities. The indices are assessed based on the eigenvalues of the transition matrix and mathematically have the forms reported in Table 6.

Table 5: Mobility indices

μ_T		μ_A	μ_L	μ_D
$\frac{n-Trace(M)}{n-1}$	$= \frac{n-\sum_j \lambda_j}{n-1}$	$\frac{n-\sum_j \lvert\lambda_j\rvert}{n-1}$	$1-\lvert\lambda_2\rvert$	$1-\lvert\prod_j \lambda_j\rvert^{\frac{1}{n-1}}$

Source: Shorrocks (1978) and Geweke, Marshal and Zarkin (1986).

The indices can take on values between zero and one. If the index takes

[12]See Shorrocks (1978) and Geweke, Marshal and Zarkin (1986).

zero value it means there is perfect immobility and we have identity matrix. In contrast, if the index is equal to one then there is either perfect mobility or equal opportunities in the society. The estimated indices are reported in Table 8.

Table 6: Mobility indices

	2004-2011	Equal opportunities
μ_T	0.618	1
μ_A	0.618	1
μ_L	0.289	1
μ_D	0.669	1

Source: author's calculations based on table 4.

Especially the third index shows that there is high persistence in society and, in my opinion, it captures the real picture of Armenia.

7 Intergenerational Educational Mobility

Galor-Zeira model shows that family conditions (wealth) or the education of parents are decisive for the future generations' income and education level. Based on this view, let us look at the intergenerational educational mobility in Armenia from 2004 to 2011. In general, it would be better to have data for thirty or forty years (one generation) for looking at dynamics but we have data limitation. Anyway, it is interesting to check this phenomenon in Armenian reality. As "Household's Integrated Living Conditions Survey" anonymised microdata database contains information about the education level of head of household and his or her offspring I have constructed transition matrices for every year. In Tables 9-16 the matrices are interpreted in the similar way as we have done in the previous section (Table 6). Until 2008 the parents that had had primary education their children also had higher probability to get primary education but this picture has somehow changed since then. The most interesting and important thing that we see from the tables is the following: the parents that have primary, secondary and vocational education their children have lower probability to get higher education (e.g. 0.0865, 0.0868 and 0.2348 respectively in 2011) than the parents that have higher education (0.4275 in 2011). As a consequence, I can restate the hypothesis that there is a linkage between parental and children's education level. The linkage is more emphasized for higher education as it is likely to be connected with the financial conditions (as well as with ability) while an

individual can get primary and secondary education in the public schools which are free of charge.

Table 7: Intergenerational educational mobility (2004).

		Children's educational level				
		Primary	Secondary	Vocational	Higher	Total
Parent's educational level	Primary	0.3514	0.4133	0.1740	0.0613	1
	Secondary	0.3473	0.4381	0.1456	0.069	1
	Vocational	0.3129	0.3583	0.2212	0.1076	1
	Higher	0.2998	0.2539	0.1859	0.2604	1

Note: author's calculations. Source:" Household survey" database .

Table 8: Intergenerational educational mobility (2005).

		Children's educational level				
		Primary	Secondary	Vocational	Higher	Total
Parent's educational level	Primary	0.2754	0.4801	0.1849	0.0596	1
	Secondary	0.3011	0.4984	0.1387	0.0618	1
	Vocational	0.2788	0.3841	0.221	0.1161	1
	Higher	0.2975	0.2502	0.1961	0.2562	1

Note: author's calculations. Source:" Household survey" database.

Table 9: Intergenerational educational mobility (2006).

		Children's educational level				
		Primary	Secondary	Vocational	Higher	Total
Parent's educational level	Primary	0.2934	0.473	0.1693	0.06436	1
	Secondary	0.2533	0.5183	0.1702	0.0582	1
	Vocational	0.2352	0.3617	0.2643	0.1388	1
	Higher	0.2552	0.2319	0.2448	0.2681	1

Note: author's calculations. Source:" Household survey" database.

Table 10: Intergenerational educational mobility (2007).

		Children's educational level				
		Primary	Secondary	Vocational	Higher	Total
Parent's educational level	Primary	0.2918	0.4751	0.1708	0.0623	1
	Secondary	0.2791	0.5243	0.1119	0.0847	1
	Vocational	0.2561	0.4109	0.1783	0.1547	1
	Higher	0.2475	0.2989	0.0717	0.3819	1

Note: author's calculations. Source:" Household survey" database.

Table 11: Intergenerational educational mobility (2008).

		Children's educational level				
		Primary	Secondary	Vocational	Higher	Total
Parent's educational level	Primary	0.0600	0.6585	0.1989	0.0826	1
	Secondary	0.2053	0.6005	0.1156	0.0786	1
	Vocational	0.2027	0.4396	0.1719	0.1858	1
	Higher	0.2390	0.3014	0.0893	0.3703	1

Note: author's calculations. Source:" Household survey" database.

Table 12: Intergenerational educational mobility (2009).

		Children's educational level				
		Primary	Secondary	Vocational	Higher	Total
Parent's educational level	Primary	0.0901	0.6308	0.2308	0.0483	1
	Secondary	0.2047	0.5819	0.1286	0.0848	1
	Vocational	0.2073	0.4280	0.1651	0.1996	1
	Higher	0.2556	0.2919	0.0863	0.3662	1

Note: author's calculations. Source:" Household survey" database.

Table 13: Intergenerational educational mobility (2010).

		Children's educational level				
		Primary	Secondary	Vocational	Higher	Total
Parent's educational level	Primary	0.0559	0.6648	0.2095	0.0698	1
	Secondary	0.2052	0.5909	0.1179	0.0860	1
	Vocational	0.1778	0.4579	0.1724	0.1919	1
	Higher	0.2063	0.3300	0.0784	0.3853	1

Note: author's calculations. Source:" Household survey" database.

Table 14: Intergenerational educational mobility (2011).

		Children's educational level				
		Primary	Secondary	Vocational	Higher	Total
Parent's educational level	Primary	0.0897	0.6346	0.1892	0.0865	1
	Secondary	0.1615	0.6253	0.1264	0.0868	1
	Vocational	0.1460	0.4332	0.1860	0.2348	1
	Higher	0.1902	0.3021	0.0802	0.4275	1

Note: author's calculations. Source:" Household survey" database.

In Figure 10 the intergenerational educational mobility index is drawn from 2004 to 2011 periods. From the graph we notice that the mobility index fluctuated until 2008, but, thereafter, it jumped. This phenomenon

may be explained, in a way, that the return to human capital has increased which enables more people to become educated. Because, now, more people can borrow money from the banks to meet their educational costs and return back in the future (By the way, nowadays they are a number of educational funds which support Armenian students to get education in foreign well-known universities). The next reason may be the availability of educational loans, i.e. now they are less costly.

Figure 10:

8 Does higher education lead to higher income?

Galor and Zeira (1993) show that the individuals who get higher education earn higher income than those without education. In this section I test the reality of this phenomenon using "Household Survey" database. So, I construct probability matrices representing the relationship between education level of head of household and different income groups (quintiles). The probabilities are estimated using multinomial logit model specifications.[13]

$$P(Y = j|X) = \frac{exp(x\beta_j)}{1 + \sum_{h=1}^{n} exp(x\beta_h)}, j = 1, \cdots, J \tag{7}$$

[13]Wooldridge J. M. (2002).

where Y is random variable and takes $\{0, 1, \cdots, J\}$ values, X is $1 \times K$ vector, where the first element is one and β_j is $K \times 1$ vector. In our case Y represents different income groups (quintiles) and X includes such variables as education, age, marital status and gender. The assessed probability matrices are reported in Table 16 and 17:

Table 15: Probability of being in different quintiles depending on education level (2004).

		Income groups					
		Quintile1	Quintile2	Quintile3	Quintile4	Quintile5	Total
Head of household	Primary	0.2481	0.2104	0.2155	0.2086	0.1172	1
	Secondary	0.2269	0.2223	0.1987	0.1887	0.1632	1
	Vocational	0.1695	0.2039	0.2258	0.2049	0.1956	1
	Higher	0.1129	0.1549	0.1853	0.2389	0.3079	1

Note: author's calculations. Source:" Household survey" database.

Table 16: Probability of being in different quintiles depending on education level (2011).

		Income groups					
		Quintile1	Quintile2	Quintile3	Quintile4	Quintile5	Total
Head of household	Primary	0.2578	0.2647	0.1629	0.1701	0.1444	1
	Secondary	0.2041	0.2154	0.2094	0.2036	0.1675	1
	Vocational	0.0808	0.1129	0.1973	0.2348	0.3740	1
	Higher	0.0325	0.0595	0.1289	0.1481	0.6308	1

Note: author's calculations. Source:" Household survey" database.

From the Tables 16 and 17 we can see that the higher the education level of head of household is the higher is the probability of falling in upper quintiles. Moreover, over time the probabilities of being in the last quintile are increased for all education levels, therefore, I can say that the mobility has risen. Especially, the possibility of the higher educated people to move to the last quintile has jumped significantly (i.e. It is doubled.). At the meantime, for all education levels, besides the primary education, the opportunity of staying in the first quintile decreased. From the above mentioned, we can restate the hypothesis regarding the human capital and its increased return and as well as the mobility of individuals.

9 Conclusion

The paper looks into the relationship between income inequality, human capital and economic growth. The results restate the fact that income inequality

negatively impacts on economic growth. The estimates show that one standard deviation upturn of income inequality downturns economic growth by nearly 1.3 percent. The next important result is the positive and significant influence of human capital on economic growth, i.e. one standard deviation of human capital causes 2 percent increase in growth. Lastly, the positive effects of investments are the biggest in magnitude and its one standard deviation rise makes 3 percent increase in growth. I have also got very important results concerning the dynamics of economic growth: that is one standard deviation of growth rates of inequality, human capital and investment will cause the economic growth to deviate from its long run trend and return back in nearly seven to eight years.

The next result refers to the transition probabilities and mobility indices between different income quintiles which shows that to some extent there is persistence in mobility in Armenia. In other words, the probability is high that the poor(the rich) will remain poor(rich) over the time.

The paper also presents very interesting results about the intergenerational educational linkages. If a parent has higher (primary) education it is more (less) likely that the offspring will also get higher education. Lastly, the higher the education level of head of household is the more likely is that he or she will fall in upper quintiles.

To sum up, the results have important policy implications. Especially, economic policy aimed at reducing income inequality will end up with the higher rate of economic growth. The reforms that are intended to make bigger the pool of human capital are very important and may narrow income inequality. Recent paper by Fournier and Koske (2012) has shown that the increase in the share of secondary educated people in population will decrease earning (wage) inequality. So the monitoring and responsibility of secondary schools should be increased, as well as the employment of qualified teachers. The encouragement of getting higher education is likely to have an ambiguous impact on income inequality. On the one hand, this kind of reforms may raise the dispersion of incomes by making bigger the share of employees who get higher incomes. On the other hand, this effect may be counterbalanced by the decrease of relative return to higher education compared to the lower education. Therefore, there should be created respective mechanisms to aid the poor to get higher education. Particularly, financial support should be provided in form of educational loan which they will return back in the future. So, increasing the opportunities of mobility in society, in other words decreasing the dependence on family conditions for getting education, will bring into play economic growth. De Gregorio and Lee (2002) show that more equal opportunities of getting education will result in more equal income distribution.

The results of the paper are important contribution to economic research as to my knowledge this is the first attempt to make such kind of evaluations for Armenia.

References

[1] Alesina, A., and D. Rodrik (1994).“*Distribution Politics and Economic Growth*”, Quarterly Journal of Economics 109, 465-490.

[2] Araar, A. and Duclos, J.-Y. (2007).“*DASP: Distributive Analysis Stata Package*”, PEP, World Bank, UNDP and Universite Laval.

[3] Barro, J., R (2000).“*Inequality and Growth in a Panel of Countries*”, Journal of Economic Growth 5, 5-32.

[4] Barro, J., R. and Lee, J.-W. (2010).“*A New Data Set of Educational Attainment in the World, 1950-2010*”, NBER Working Paper No. 15902.

[5] Birchenall, A., J. (2001).“*Income Distribution, Human Capital and Economic Growth*”, Journal of Development Economics Vol. 66, 271-287.

[6] Boot, J.C.G., Feibes, W. and Lisman, J.H.C. (1967).“*Further methods of derivation of quarterly figures from annual data*”,Applied Statistics, vol. 16, n. 1, p. 65-75.

[7] De Gregorio, J., and Jong-Wha, L. (2002).“*Education and Income inequality: New Evidence from Cross-Country Data*”,Review of Income and Wealth, Series 48, Number 3.

[8] Deininger, K., and Squire, L. (1998).“*New Ways of Looking at Old Issues: Inequality and Growth.* ”, Journal of Development Economics 57, 259-287.

[9] Duclos, J.-Y., and Abdelkrim, A. (2006).“*Poverty and Equity: Measurement, Policy and Estimation with DAD*”, New York: Springer, and Ottawa: International Development Research Centre.

[10] Easterly, W. (2007).“*Inequality does cause underdevelopment: insights from a new instrument*”, Journal of Development Economics, 84, no.2, 755-776.

[11] Engle, R. and Granger, C. (1987).“*Co-integration and Error Correction: Representation, Estimation and Testing*”, Econometrica, 55, 251-276.

[12] Esteban, J.-M., Ray, D. (1994).“*The measurement of polarization*”, Econometrica 62 4 , 819-85.

[13] Forbes, K. (2000).“*A Reassessment of the Relationship Between Inequality and Growth*”, The American Economic Review.

[14] Fournier, J.-M., and Koske, I. (2012).“*Equality and Growth-Are They Compatible? Part 7. The Drivers of Labour Earnings Inequality-An Analysis Based on Conditional and Unconditional Quantile Regressions*”, OECD Economics Department Working Papers, No. 930, OECD Publishing.

[15] Galor, O., and J. Zeira. (1993).“*Income Distribution and Macroeconomics*”, Review of Economic Studies 60, 35-52.

[16] Galor, P., Tsiddon, D. (1997).“*Technological progress, mobility and economic growth*”, American Economic Review 87 3 , 363-382.

[17] Geweke, J., Marshall, R., Zarkin, G. (1986).“*Mobility indices in continuos time markov chains*”, Econometrica 54 6 , 1407-1423.

[18] Gregorio, J. De and J. Lee (2002).“*Education and Income Inequality: New Evidence from Cross-Country Data*”, Review of Income and Wealth, Vol. 48, No. 3, pp. 395-416.

[19] Hamilton, J.D. (1994).“*Time series analysis*”, Princeton University Press, Princeton.

[20] Herzer, D. and Vollmer, S. (2012).“*Inequality and Growth: Evidence from Panel Cointegration* ”, Journal of Income Inequality, 10, 489-503.

[21] Hodrick, R. and Prescott, E. (1981).“*Post-war U.S. Business Cycles: An Empirical Investigation*”, Journal of Money, Credit and Banking, 29, 1-16.

[22] Kaldor, N. (1957).“*Alternative Theory of Distribution*”, The Review of Economic Studies, Vol. 23, No. 2 (1955 - 1956), pp. 83-100

[23] Kuznets, S. (1955).“*Economic Growth and Income Inequality*”, American Economic Review45, 1-28.

[24] Joao, A.,S., Adelaide P., S., A. and Marta C., N., S. (2011).“*Inequality and Growth in Portugal: A Time-Series Analysis*”, Faculdade de Economia da Universidade de Coimbra.

[25] Johnston, J. and Dinardo, J. (1997).“*Econometric Methods*”, The McGraw-Hill Companies, Inc.

[26] Lee, C. A., and Mary, N. G. (2012).“*Monte Carlo Experiments Using Stata: A Primer with Examples*”.

[27] Lee,H. and Zou, H.-F. (1998).“*Income Inequality is not Harmful for Growth: Theory and Evidence*”, Review of Development Economics, 2(3), 318-334.

[28] Lee, T., Judge, G., and Zellner, A. (1970).“*Estimating the Parameters of the Markov Probability Model from Aggregate Time Series Data*”, North-Holland.

[29] Litterman, R. (1986).“*Forecasting with Bayesian vector autoregressions –five years of experience*”, Journal of Business and Economic Statistics, 4, 25-38.

[30] Perotti, R. (1996).“*Growth, Income Distribution and Democracy: What the Data Say*”, Discussion Paper Series No. 757.

[31] Persson, T., and G. Tabellini. (1994).“*Is Inequality Harmful for Growth? Theory and Evidence*”, American Economic Review 84, 600-621.

[32] Shorrocks, A. (1978).“*The measurement of mobility*”, Econometrica 46 5, 1013-1024.

[33] Virginia, M. and Andrea, R. (2012).“*Inequality and Macroeconomic Factors: A Time-Series Analysis for a Set of OECD Countries.*”, SSRN Working Paper.

[34] Voitchovsky, S. (2005).“*Does the Profile of Income Inequality Matter for Economic Growth.*”, Journal of Economic Growth 10, 273-296.

[35] Wooldridge J. M. (2002).“*Econometric Analysis of Cross Section and Panel Data*”, The MIT Press.

[36] UNU-WIDER,(2008).“*World Income Inequality Database*”, Version 2.0c.

A Appendix

A.1 Graphs

Figure 11:

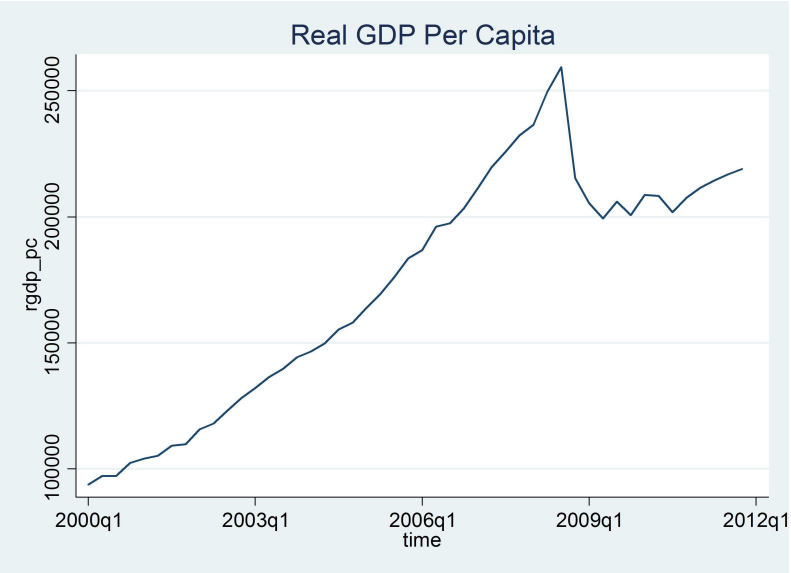


Figure 12:

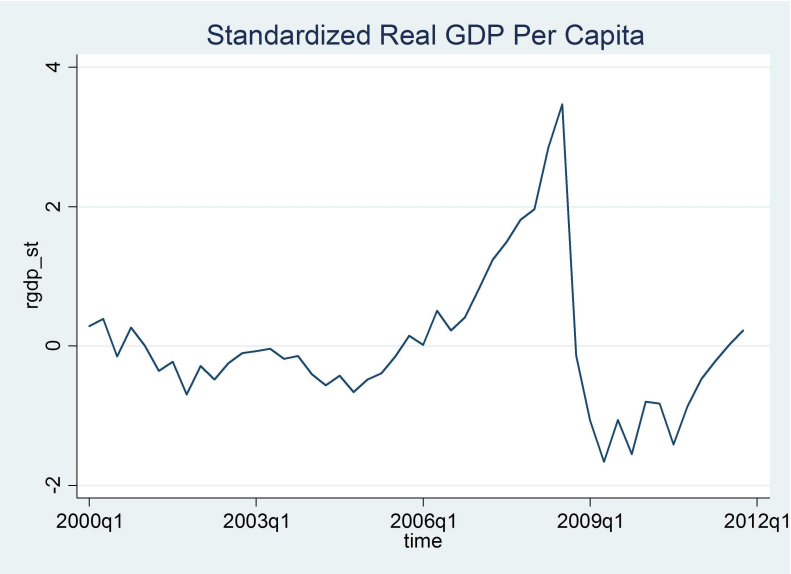


Figure 13:

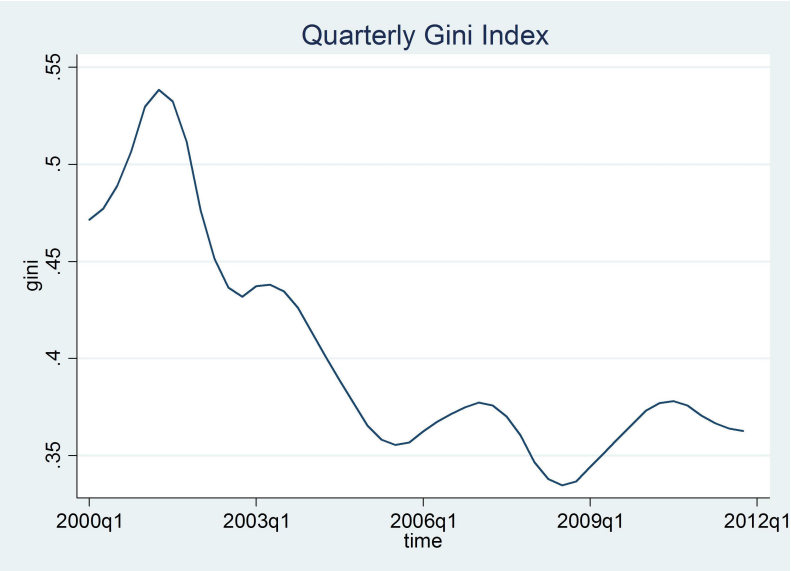


Figure 14:

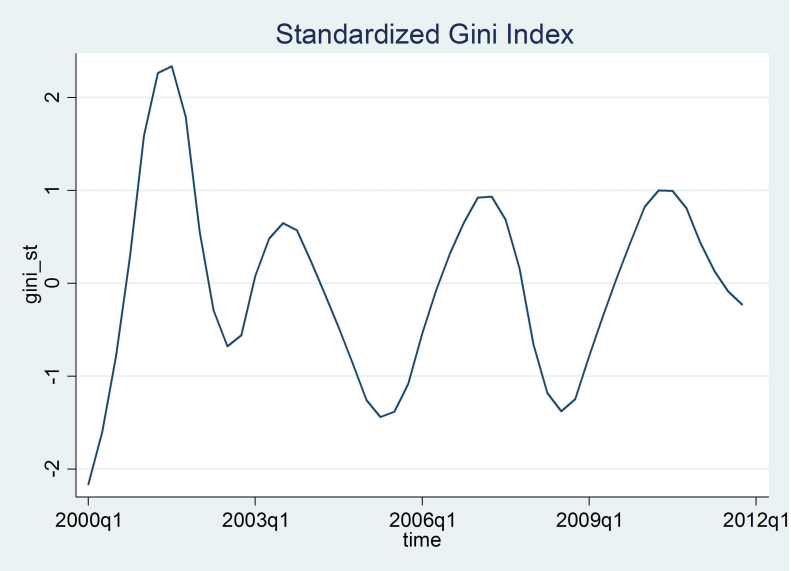


Figure 15:

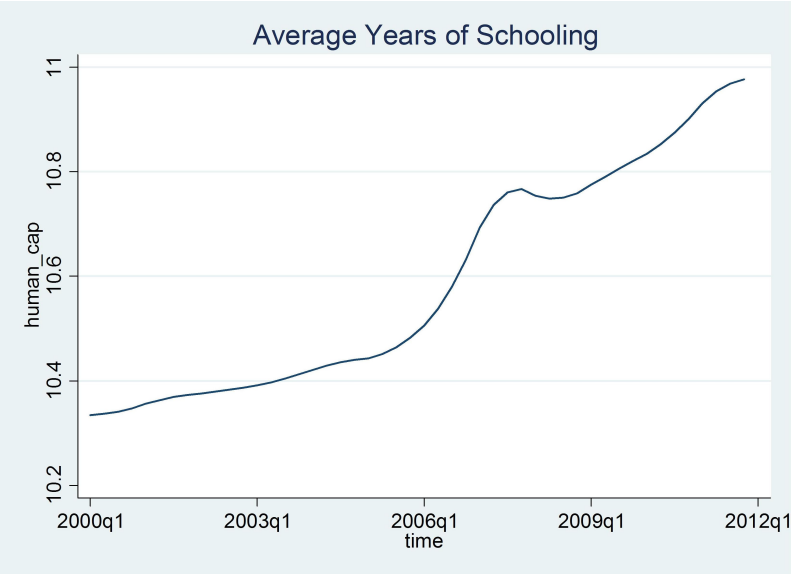


Figure 16:

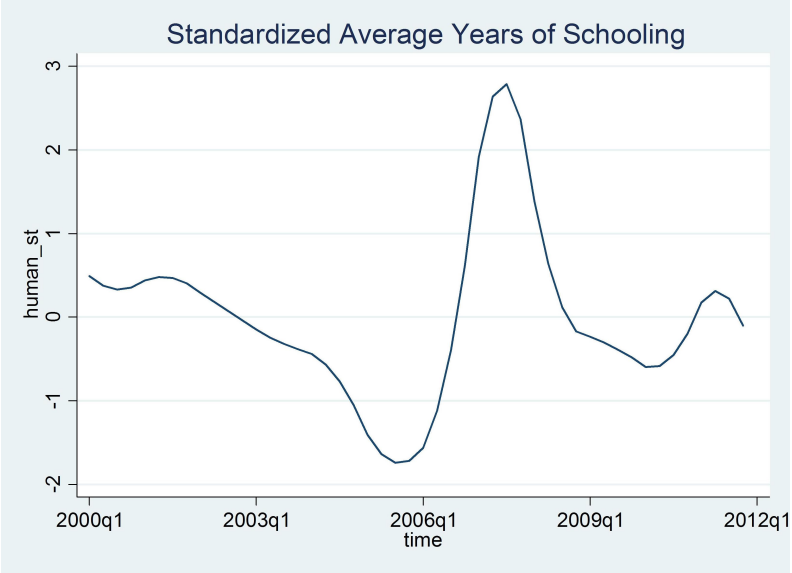


Figure 17:

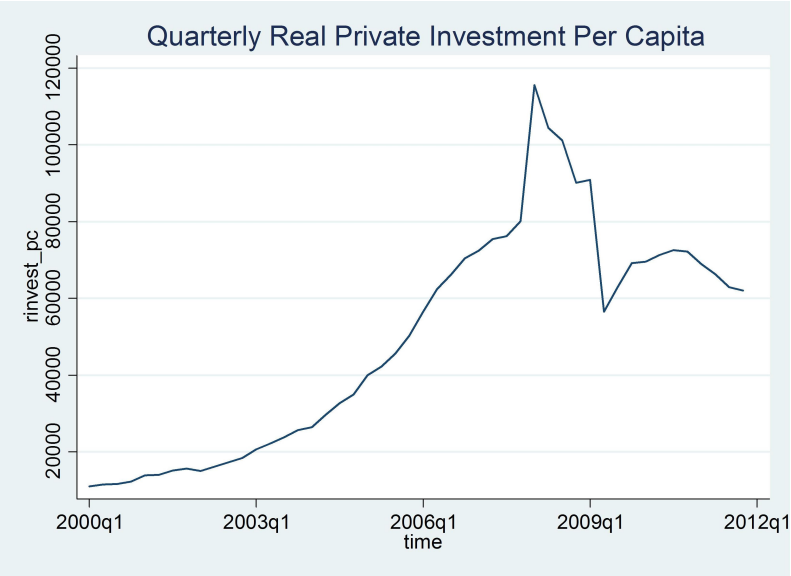


Figure 18:

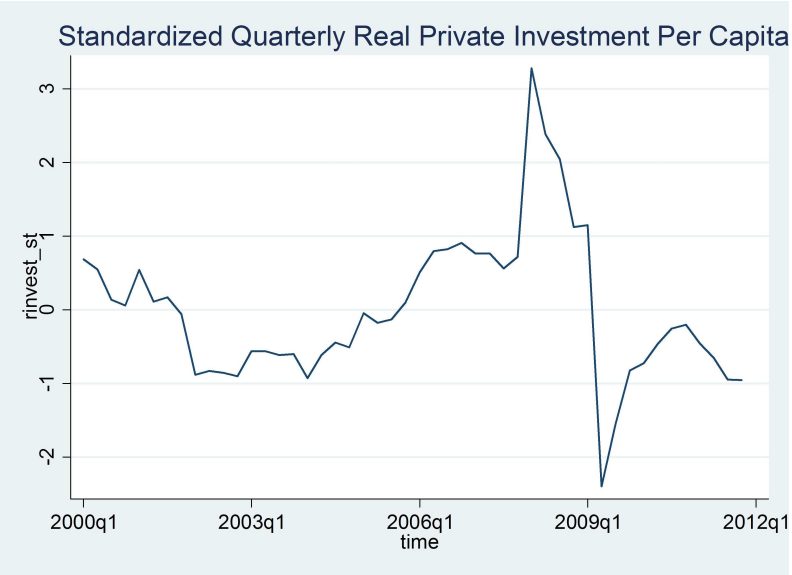


Figure 19:

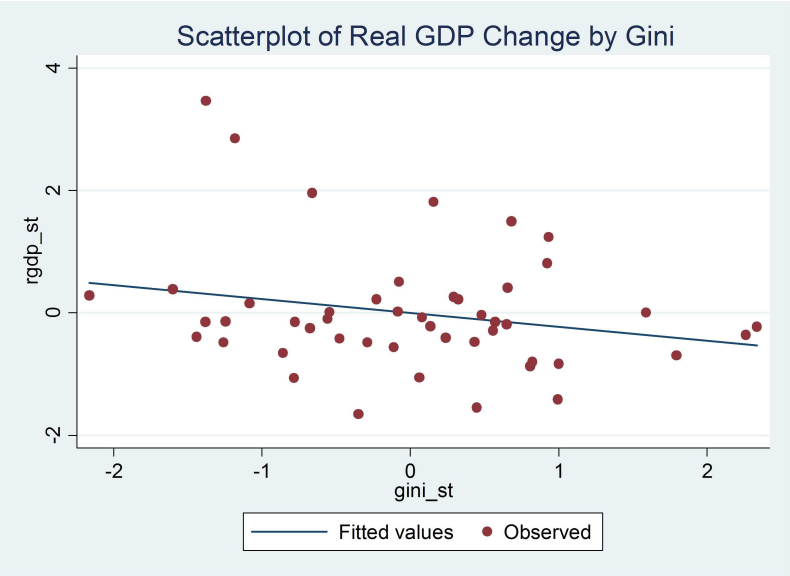


Figure 20:

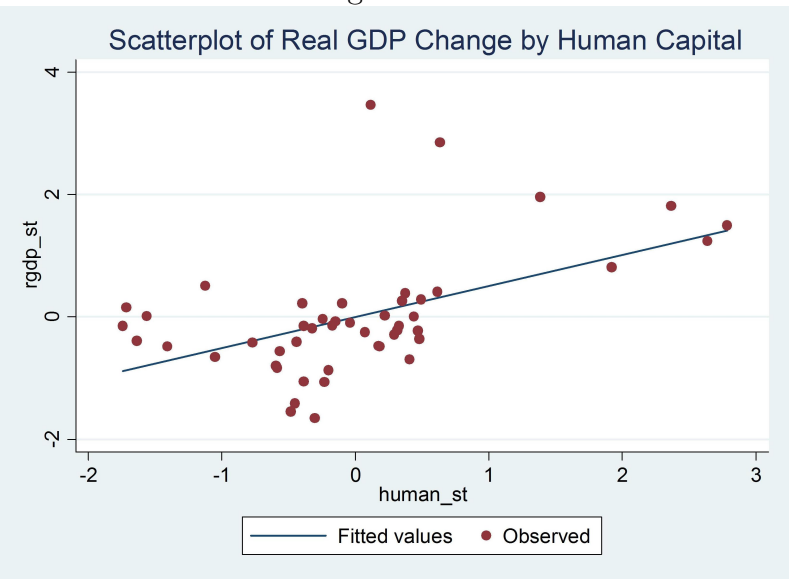


Figure 21:

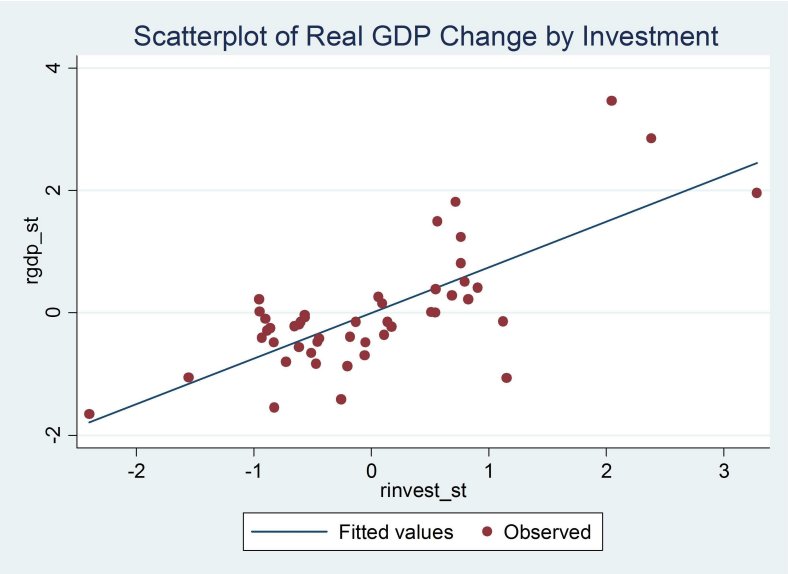
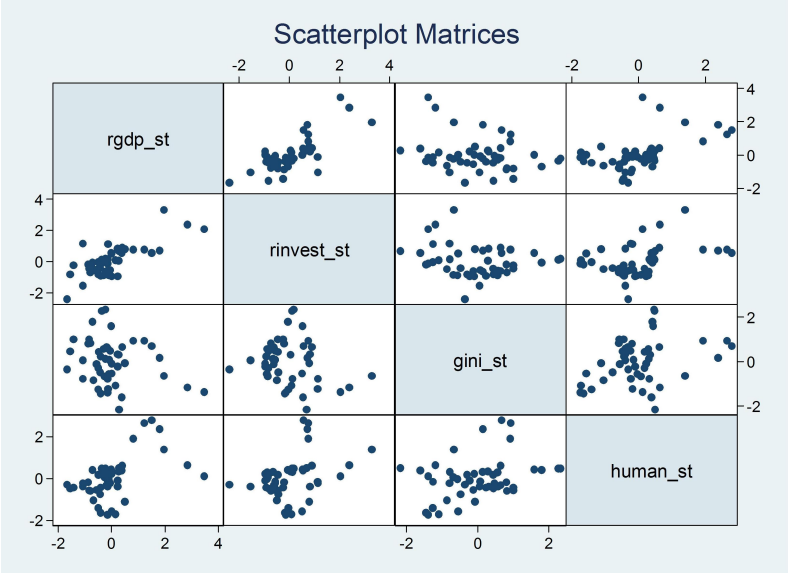


Figure 22:



A.2 Descriptive statistics

Table 17: Summary statistics of variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
rgdp_st	48	0	1	-1.6596	3.4689
gini_st	48	0	1	-2.1635	2.3341
human_st	48	0	1	-1.7416	2.7854
rinvest_st	48	0	1	-2.3983	3.2788

Table 18: Cross-correlation of variables: contemporaneous relationship

	rgdp_st	gini_st	human_st	rinvest_st
rgdp_st	1.000			
gini_st	-0.227	1.000		
	(0.120)			
human_st	0.509	0.330	1.000	
	(0.000)	(0.022)		
rinvest_st	0.747	-0.194	0.352	1.000
	(0.000)	(0.186)	(0.014)	

Note: p values in parentheses.