

Economic Growth and Income inequality in Korea

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I. Motivation

Inclusive Growth would be a global paradigm since slow growth and worsening income inequality have been recently common global phenomenon. The Korean economy has the same problem and Korea's income gap took a particular turn for the worse following the 1997 financial crisis.

Income inequality arises from technological progress, economic integration and an aging population. Accordingly, if Korea fails to achieve a full-scale policy shift towards a more inclusive growth, it will be difficult to sustain mid-to long-term development.

A new strategy should be formulated that embraces inclusion and innovation and Korea should push forward for a policy paradigm that pursues both growth and distribution.

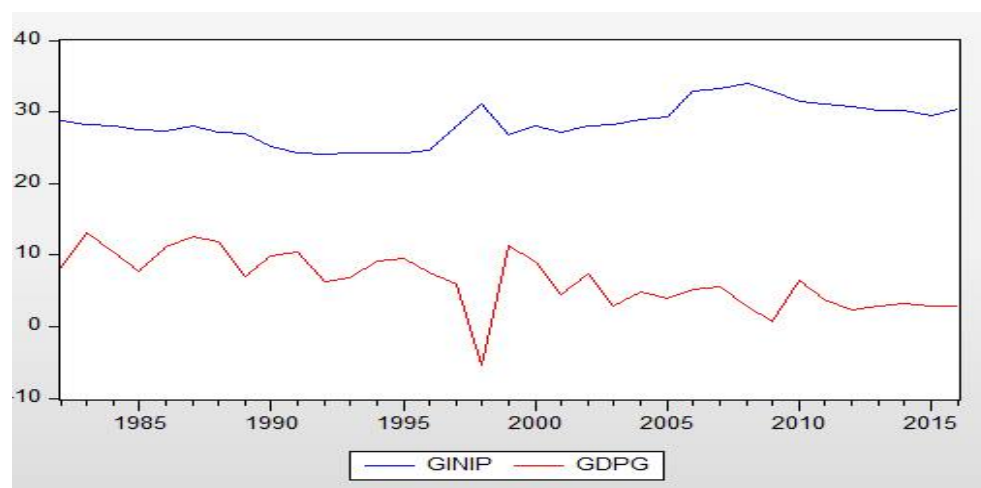
In this current critical situation in Korea, it is a top priority that the harmonious policy groping for the pursuit of concurrent development of economic growth and income inequality would be found. There may have not been getting better of income distribution even though recent government had implemented strong distributive policy rather than economic growth by sharp increase of social welfare spending during 2002-2017 in Korea. So it is needed that the reason why the result occurred has been examined.

My research is intended to focus on the issue and to analyze its implication empirically.

- <Table 1>: The trends of both gini coefficients over market income before tax and disposable income after tax have decreased slightly after 2010 compared to previous deteriorating period during 2006-2016.
- [Figure 1] : The opposite trends between economic growth rate and income inequality(correlation coeff. btw eco. Growth and gini coeff.=-.57 during 1982-2016).

<Table 2> Gini coefficients trends(2006–2016) [Figure 1] Economic Growth rate and Gini coeff.(1982–2016)

Year		2006	2008	2009	2011	2012	2014	2015	2016
Disposable income (after tax)	All family	0.306	0.314	0.31	0.311	0.307	0.302	0.295	0.304
	Over 2 person non-farm family	0.291	0.296	0.29	0.288	0.285	0.277	0.27	0.278
Market income(before tax)	All family	0.33	0.344	0.35	0.342	0.338	0.341	0.34	0.353
	Over 2 pers. non-farm family	0.312	0.323	0.32	0.313	0.311	0.308	0.31	0.317



II. Theoretical Issues

- **Economic growth analysis** has focused its attention on the factors that influence the growth of nations, such as **fiscal policy or improvement of human capital, R&D investment, openness as main sources of econ. growth.** Nevertheless, it is also interesting to study **the effects of income distribution on economic growth** to determine if it has positive effects on growth.

- From the 1980s, and especially with the introduction of **endogenous growth models** [Romer(1986); Rebelo(1991)], models took into account **the effects of income distribution on growth**. Two conclusions emerged [Aghion, Garcia-Penalosa, and Garoli(1998)]. (1) **Income inequality motivates economic incentives, improving economic growth**. The reason is if we **need savings to improve growth, it is necessary to shift income from poor to rich individuals**. (2) **The Kuznets [1955] curve which states that inequality will increase in the first development stages and will be lower later**.

The Ideas of models

neg. income distribution effect on growth

- 1) **Macroeconomic volatility** : [Alesina and Perotti(1996)]. **Inequality encourages political and institutional instabilities, and as savers and investors are different. When macroeconomic volatility appears, the former group can become discouraged about saving, resulting in negative effects to investment and growth processes.**
- 2) **Approaching political economy aspects** :[Perotti(1993); Bertola(1993); Alesina and Rodrik(1994); Persson and Tabellini(1994)]. **Inequality effects on taxation** exist in a country through the political process when individuals modify or choose the taxation rate by voting. The reason is that in an **economy with a high inequality rate, voters prefer better income distribution through higher taxation. In this case, investment could decrease, reducing the economic growth process, at least in the transition to the steady-state.**

Positive income distribution effect on econ. growth

- **unequal distribution of assets, more than of income, can be an impediment to rapid growth, implying that redistributive policies that enhance people's access to credit markets and, thus, their ability to invest could contribute to growth.**
- **only if redistribution does not jeopardize investment. (Deininger and Squire(1997))**

- The critical link between income distribution and growth is provided by the **theory of public choice** and in particular **the median voter theorem** :. The **impact of income distribution on growth is viewed as being mediated through a political process.** Taking their market income as a starting point, voters assess their estimated benefits and losses from redistribution, and vote on redistribution policy. In this way redistribution can affect **economic growth**(Persson and Tabellini(1994), Perroti(1993)).
- **human capital is the source of growth**
idea: an externality whereby investment in human capital by one group increases the productivity of other groups, thus potentially enabling them to invest in human capital(Perroti(1993)).

- Clark, Lawson and Robert model(2008) attempt to shed light on the empirical debate about the role of tax policy in determining economic growth and the income distribution. The estimated results show that 1) **higher overall levels of taxation/spending are negatively related to growth** by using cross-country panel data around the world, 2) countries pursuing **more progressive tax policies have more equal distributions of income**, 3) **sounder legal and monetary environments are conducive to both faster growth and greater degrees of income equality**. But the trade-off between economic growth and income equality is rejected in case of lower income countries.

III. Estimation Model and Data

The Model set-up based on Jha(1999), Panizza(2002), Clark, Lawson and Robert(2008), Bayraktar and Moreno-Dodson(2010)

$$gdpq_t = c + b_1 \Delta rgdp_t + b_2 \Delta IPY_t + b_3 \Delta School_t + b_4 \Delta Fiscal_t + b_5 \Delta REVY_t + b_6 CPIG_t + b_7 \Delta GINI_t + b_8 \Delta OPEN_t + \epsilon_t$$

|

$$\Delta GINI_t = c + b_1 gdpq_t + b_2 \Delta IPY_t + b_3 \Delta School_t + b_4 \Delta REVY_t + b_5 \Delta Fiscal_t + b_6 CPIG_t + b_8 \Delta OPEN_t + \eta_t$$

- where, $gdpq_t$ = real GDP growth rate per capita at t period,
- Δ : difference operator
- $rgdp$ = real GDP
- ipy = [Private investment/GDP]*100
- $School$ = average school year as human capital index
- $revy$ = [Tax revenue/GDP]*100
- $fiscal$ = [Fiscal spending/GDP]*100 or [Social welfare/GDP]*100
- cpi = CPI growth rate as inflation rate
- $GINI$ = gini coefficient as income inequality index,
- $OPEN$ = openness(= [(export+import)/GDP]*100) or [export/GDP]*100
- c = constant, η , ϵ = error term

*** DATA :**

The annual data for each of these series from 1981 to 2017(gini coefficient data which are available only after 1981) in Korea which are used in the estimation are as follows:

- GDP: nominal Domestic Product, real GDP(2005 year constant price), GDP growth rate extracted from National Account, Bank of Korea(BOK).
- per capita GDP growth rate: percentage rate of [real GDP growth rate/ population], population data are from estimated population, Korea National Statistical Office(NSO).
- Average educational attainment(average school year): as a proxy variable of human capital used publication data from NSO and Barro and Lee(2001)
- Inflation rate(CPI growth rate): consumer price index growth rate used from NSO publication data
- gini coefficient, as inequality index from NSO data.
- Fiscal spending: percentage rate of nom. government expenditure of general government divided by nom. GDP from Economic Statistics System, BOK.
- Social welfare spending: proxy variable of transfer spending used data which are the percentage rate of health expenditure plus social protection spending divided by GDP from BOK Eco. System
- Tax revenue used the percentage rate of tax revenue divided by GDP which is from publication data, NSO.
- Openness: percentage rate of [export+import]/GDP or export/GDP from BOK Eco System.

[Table 3] main indicators of data

year	per capita GDP growth rate	fiscal spending /GDP	tax/GDP	gini coeff.	social welfare/GDP
1970–1979	7.52	14.71	14.01	–	4.75
1980–1989	7.30	16.01	14.12	0.28 (81–89)	6.18
1990–1999	5.68	17.02	13.90	0.25	7.27
2000–2010	4.13	19.26	14.97	0.30	7.94
2011–2017	2.44	20.69	14.54	0.30	9.58

T.3 Characteristics of data: per capita economic growth rate has been decreasing gradually for 47 years. But ratio of [tax/GDP] increases not much, on the other while [fiscal spending/GDP] increases rapidly comparatively, which shows fiscal expansion trend, particularly comes from growing rapid social welfare spending. But we can find the gini coefficient has increased, which means the income distribution indicator has not been better even worse even though rapid social welfare spending.

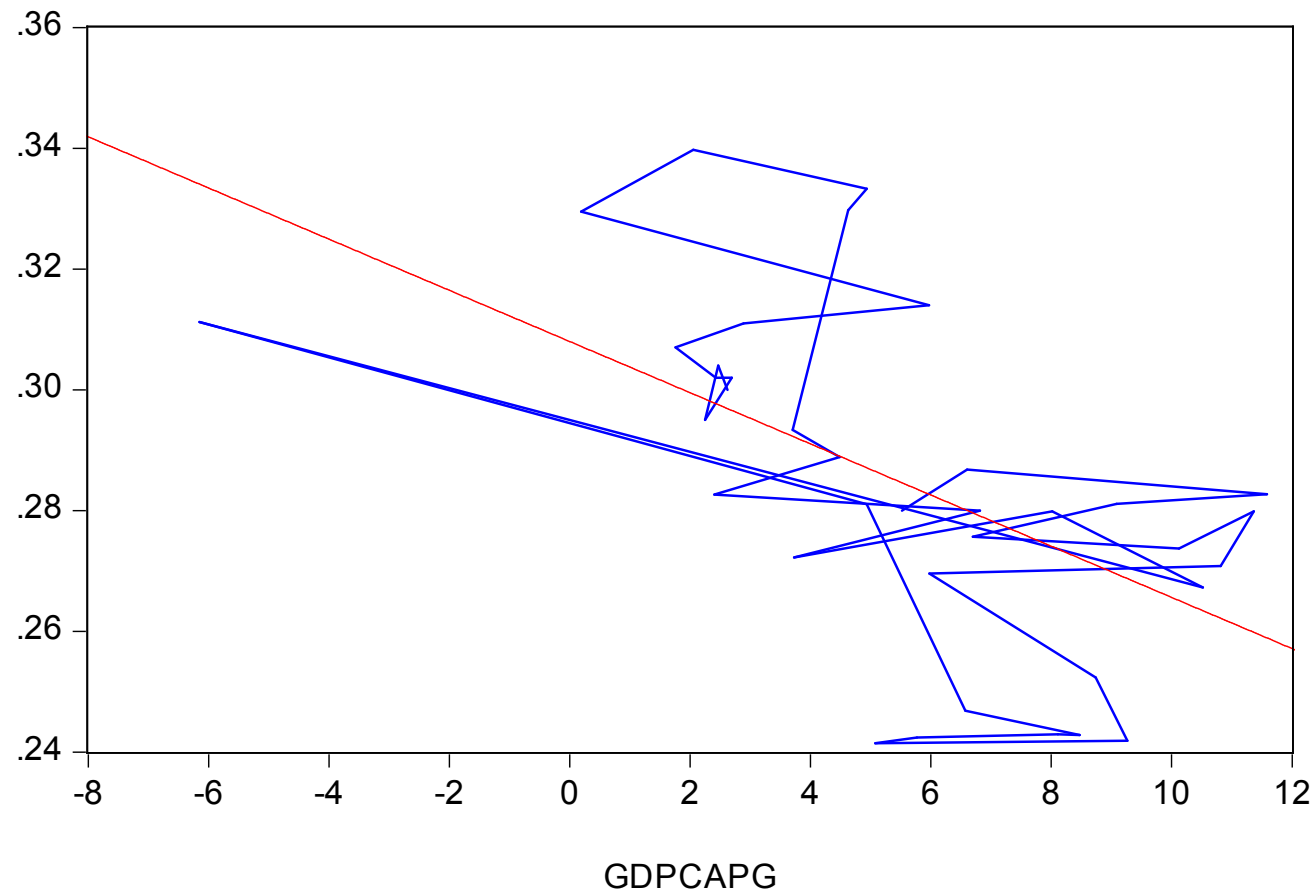
<T. 4> Descriptive statistics for major variables(1981-2017)

tradey, piy, gdpcapg, infcpi are relatively volatile

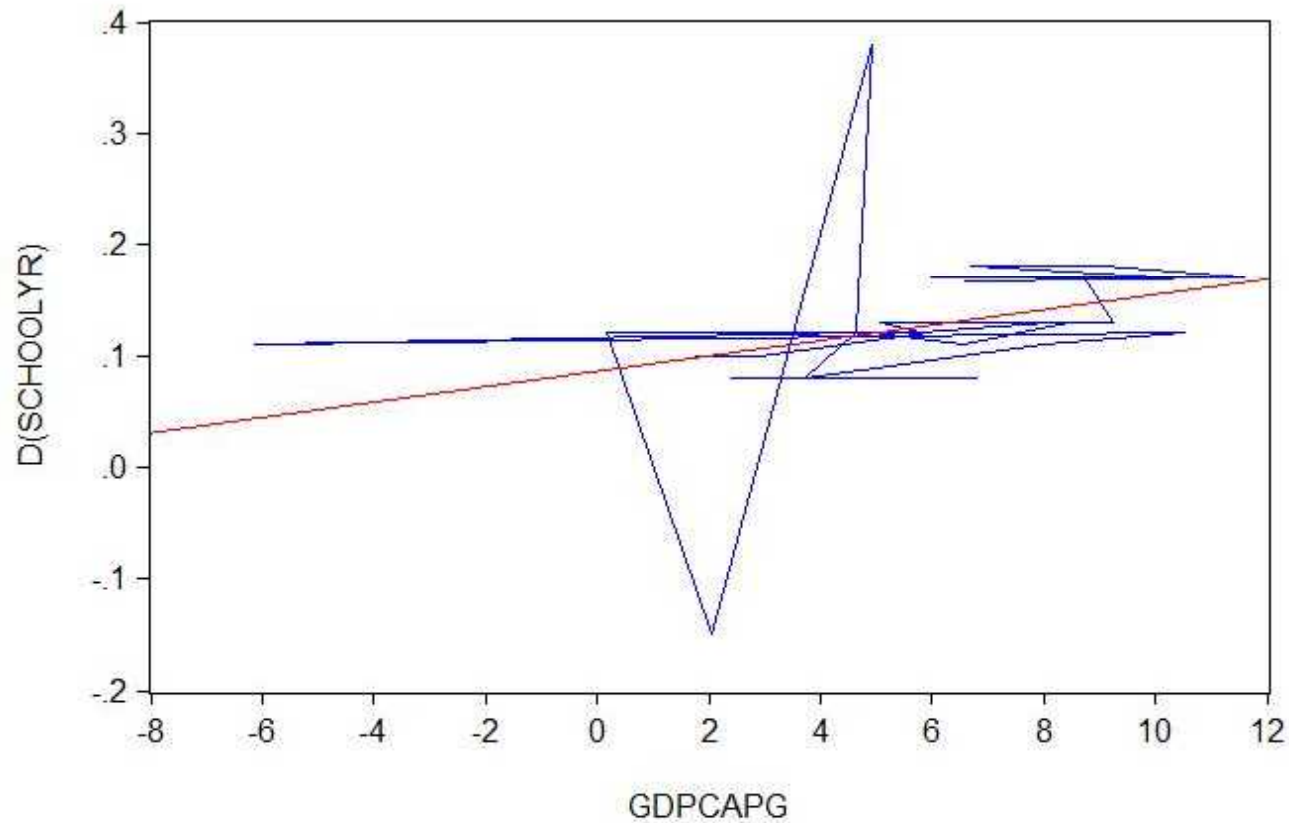
	GDPCAP G	LGDP CAP R	PIY	SCHOOL Y R	GTY	TAXY	INFCPI	GINI	TRADEY	SOCIALY
Mean	5.489147	9.447339	27.55738	10.78632	18.40872	13.92601	4.301919	28.47181	69.56234	7.35778
Median	5.521254	9.545627	26.63456	10.95	18.3426	13.92004	3.421	28.109	63.393	7.2073
Maximum	11.58487	10.17168	36.75204	12.75	21.63508	15.6318	21.352	33.971	110.0001	10.628
Minimum	-6.15113	8.26979	20.75459	8.304	15.97081	12.70569	0.706	24.147	47.5874	5.23155
Std. Dev.	3.622636	0.573541	4.139013	1.295859	1.236828	0.77471	3.613005	2.701045	17.91289	1.43888
Skewness	-0.59524	-0.56671	0.859068	-0.28984	0.051575	0.335305	2.984128	0.10296	0.87445	0.670228
Kurtosis	4.1751	2.125525	2.745867	1.988483	2.796635	2.312906	14.49516	2.402207	2.700644	2.733731
Jarque-Bera	4.313768	3.159409	4.650551	2.095442	0.080162	1.421135	258.6282	0.616295	4.85358	2.879401
Probability	0.115685	0.206036	0.097756	0.350736	0.960712	0.491365	0	0.734807	0.08832	0.236999
Sum	203.0984	349.5515	1019.623	399.094	681.1225	515.2623	159.171	1053.457	2573.807	272.2377
Sum Sq. Dev.	472.4456	11.84219	616.7315	60.453	55.07077	21.60634	469.937	262.6432	11551.38	74.5335
Observations	37	37	37	37	37	37	37	37	37	37

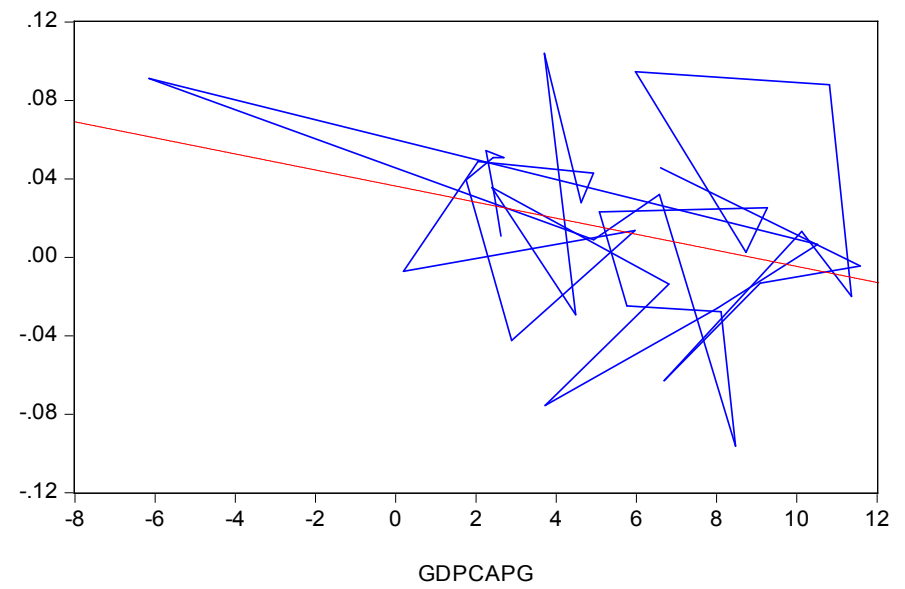
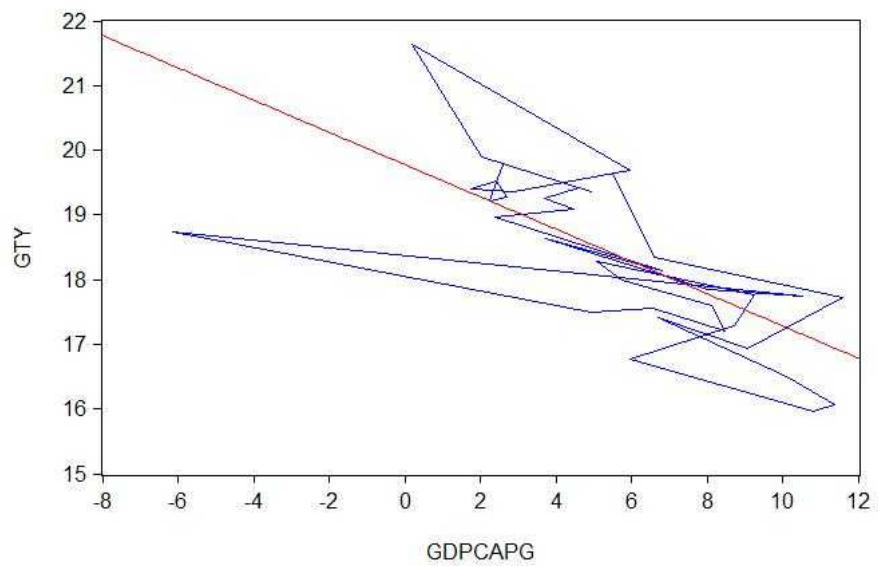
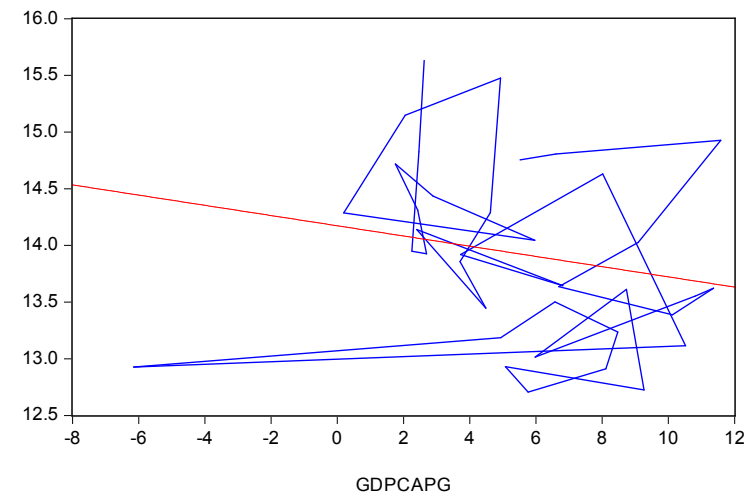
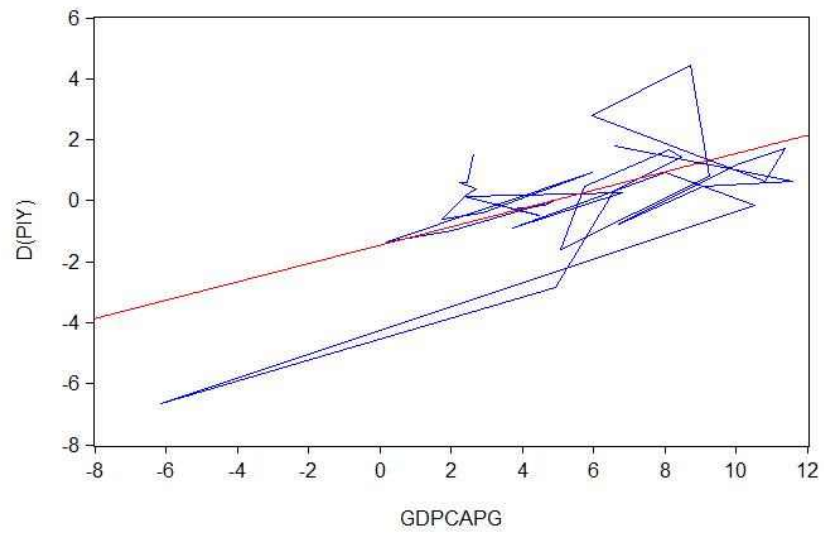
IV. Estimation Results

[Fig 2] neg rel. btw per capita growth rate and gini coefficient



[Fig. 3] pos. relation btw avg
school year and growth rate





Stationarity of time series data

<Table 5> Unit Root Test Results(ADF, PP)

	ADF		PP	
	level var	differ. var	level var	diff. var
per cap real GDP growth rate	-6.37***	-	-10.06***	-
gini after tax	-2.07	-5.91***	-2.07	-5.91***
Gov spend/GDP	-4.29***	-	-4.30***	-
Trade/GDP	-2.22	-5.67***	-2.36	-5.66***
Avg Schoolyr	-2.23	-8.68***	-2.42	-9.43***
Priv. Inv./GDP	-2.19	-4.19**	-2.06	-3.56**
CPI growth rate	-8.03***	-	-6.93***	-
Tax revenue/GDP	-2.30	-4.52***	-2.42	-4.31***
Social spending/GDP	-1.51	-4.96***	-1.89	-4.90***
Nonsocial spend/GDP	-4.28***	-	- 4.28***	-

note) Augmented Dickey-Fuller & Phillips-Perron test critical value : 1% -4.23, 5% -3.54, 10% -3.20

Co-integration test by Johansen-Juselius (1990):<Table 6>

Trend assumption: Linear deterministic trend

Series: NSOCIALY SOCIALY TAXY SCHOOLYR PIY INFCPI GINI TRADEY GDPCAPG

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.937167	379.4163	197.3709	0.0000
At most 1 *	0.910564	282.5616	159.5297	0.0000
At most 2 *	0.819036	198.0636	125.6154	0.0000
At most 3 *	0.761315	138.2326	95.75366	0.0000
At most 4 *	0.621918	88.09125	69.81889	0.0009
At most 5 *	0.493502	54.04874	47.85613	0.0117
At most 6 *	0.343308	30.24050	29.79707	0.0444
At most 7 *	0.226113	15.52161	15.49471	0.0495
At most 8 *	0.170677	6.550100	3.841466	0.0105

Trace test indicates 9 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

- <Table 7> shows the correlation coefficient matrix over the sample period from 1981 to 2017. First of all, there is very high correlation between per capita GDP growth rate and GDP growth rate 0.78, and if we arrange the variables in order of higher correlation with GDP growth rate, these are non-social fiscal spending 0.73, private investment .64, gini coefficient -0.37, social spending -0.32, average school year .36, openness(trade/GDP) -0.16, inflation rate -0.13, tax revenue -0.05. On the other while, in case of the correlation with gini coefficient, those are private investment -0.42, openness 0.40, social spending 0.15, tax revenue .13, average school year -0.09, inflation rate 0.08, fiscal spending 0.06 in order of higher correlation. According to the results, we can find economic growth rate has the intimate positive relation with private investment, human capital as well as non-social fiscal spending. But tax revenue, inflation rate as well as income equality would have negative correlation with economic growth. And trade openness, social spending, and tax revenue have positive relationship with gini coefficient, but private investment and human capital have strong negative relationship which means reducing income inequality.

<Table 7> correlation coefficients(1981-2017)

	GDPCA PG	D(GINI)	NSOCIA LY	D(SOCI ALY)	D(TAXY)	D(SCHO OLYR)	D(PIY)	D(TRAD EY)	INFCPI
GDPCA PG	1.00								
D(GINI)	-0.37	1.00							
NSOCIA LY	0.73	0.08	1.00						
D(SOCI ALY)	-0.32	0.15	0.11	1.00					
D(TAXY)	-0.05	0.13	0.02	0.04	1.00				
D(SCHO OLYR)	0.36	-0.09	-0.34	-0.03	0.22	1.00			
D(PIY)	0.64	-0.43	-0.34	-0.15	0.24	0.22	1.00		
D(TRAD EY)	0.16	0.40	0.07	-0.10	0.14	-0.34	-0.29	1.00	
INFCPI	-0.13	0.08	-0.35	0.11	-0.19	0.05	0.03	0.19	1.00

- **pairwise Granger causality test** for looking at causation between variables and got the results as shown in <Table 8>. The results show that there is bi-directional causation relation between per capita GDP growth rate and income inequality, and also the same relation between avg. school year and fiscal spending. We can find that economic growth causes avg. sch. year, tax revenue, inflation, there are uni-directional causation from tax revenue to fiscal spending, fiscal spending to inflation, openness to fiscal spending, private investment to inflation and tax revenue, average school year to openness and inflation. Here it is interesting to note the facts that economic growth causes tax revenue and human capital, and also economic growth rate is closely related to income inequality each other, also fiscal spending is related to human capital. But it is important to note that the statement x Granger causes y does not imply that y is the effect or the result of x, which means that simply x helps in the prediction of y in the interpretation.

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<Table 8> Pairwise Granger Causality Tests

Null Hypothesis:	F-Statistic	Prob.
D(GINI) does not Granger Cause GDPCAPG	3.5043	0.0433
GDPCAPG does not Granger Cause D(GINI)	2.6541	0.0874
GDPCAPG does not Granger Cause D(SCHOOLYR)	2.6246	0.0896
GDPCAPG does not Granger Cause INFCPI	6.5196	0.0045
GDPCAPG does not Granger Cause D(TAXY)	4.9907	0.0137
D(TRADEY) does not Granger Cause GTY	2.8564	0.0737
D(SCHOOLYR) does not Granger Cause GTY	5.6259	0.0086
GTY does not Granger Cause D(SCHOOLYR)	3.1508	0.0578
GTY does not Granger Cause INFCPI	4.2685	0.0234
D(TAXY) does not Granger Cause GTY	4.1038	0.027
D(SCHOOLYR) does not Granger Cause D(TRADEY)	7.4381	0.0025
D(SCHOOLYR) does not Granger Cause INFCPI	2.5034	0.0993
D(PIY) does not Granger Cause INFCPI	7.7293	0.002
D(PIY) does not Granger Cause D(TAXY)	4.0623	0.0278

- <Table 9> shows the estimation results by using Vector Error Correction model. We can find the long-run and short-run relationship among the co-integrated variables from the results.
- From the long-run relationship, the results show that if we divide fiscal spending into two parts ie. social one and non-social one, the increase in non-social fiscal spending has relatively big positive effect(2.08) on economic growth. But social spending has big neg. effect(-3.32) on that. Next the increase in gini coefficient ie. worsening income inequality(-0.70) and Inflation rate(-0.47) have significant negative effects on economic growth, the increase in average school year(0.35) as a proxy variable of human capital have sig. positive effect on economic growth. The results imply that reducing income inequality as well as improving human capital with non-social fiscal spending is important factor on economic growth. Also it shows that Korea has the advanced economy's characteristics, which means that economic growth can help improving income distribution when income level is high in view of inverted U hypothesis by S. Kuznets(1955). Remember that there is neg. correlation between economic growth rate and gini coefficient, and has closely bi-directional causation each other.

<Table 9> Estimation Results by VEC Model

variable	Long-run relationship		Short-run relationship		
	coeff.	t-value	variable	coeff.	t-value
constant	-46.69		constant	0.21	0.27
			D(CAPG(-1))	0.15	1.05
TRADE(-1)	0.04***	3.81	D(TRADE(-1))	-0.05	-0.76
PI(-1)	0.15***	3.50	D(PI(-1))	0.04	0.17
SCHOOLYR(-1)	0.35*	1.83	D(SCHOOLYR(-1))	2.12***	5.39
NSOCIALY(-1)	2.08***	14.00	D(NSOCIALY(-1))	1.23*	0.92
SOICIALY(-1)	-3.32***	-3.32	D(SOCIALY(-1))	-2.76***	-3.06
REVY(-1)	-1.30***	-6.83	D(REVY(-1))	0.50	0.69
INFCPI(-1)	-0.47***	-9.40	D(INFCPI(-1))	-0.40***	-3.08
GINI(-1)	-0.70***	-8.26	D(GINI(-1))	0.02	0.06
			D98	-13.85***	-5.99

Test statistics			
R^2	0.86		
\bar{R}^2	0.80	Breusch–Godfrey serial correlation LM	76.12(0.14)
F–statistic	13.55	Heteroskedasticity B–P–G	6.19 (0.62)

Notes: 1) dummy(1998) means dummy variable which reflects foreign currency crisis in 1998. 2) The values in () below the values at the explanatory variables are t-value, and * represents statistically significance at the 10% level, **, at 5%, ***, at 1%, respectively.

3) The value in parenthesis at test statistic means p-value. Breusch_Godfrey Lagrange multiplier test for higher order of serial correlation is performed. The results shows that it would not reject the hypothesis of no serial correlation. And the results of Breusch-Pagan-Godfrey test denotes the test for heteroscedasticity also shows that it cannot reject the null hypothesis of no heteroscedasticity.

- **Also private investment(0.15) and increase in trade openness(0.04) ie. widening openness and are positively related to the economic growth. But tax revenue(-1.30) significantly negative effect on economic growth. This means that the activation of private enterprise through promotion of private investment is a most important determinant on economic growth. The estimated result is consistent with Clark and Lawson(2008) which the results show that increase in tax lowers economic growth.**
- Widening trade openness, ie. increase in export and import as the measure of international trade openness is important factor on economic growth, which means openness is important to small open and natural resource deficient country like Korea.

On the other while in the short-run relationship, the estimation result shows that average school year, private investment, and inflation rate have significant effect on economic growth. The avg. school year(2.12) and non-social public spending(1.23) increase economic growth rate, but inflation rate(-0.40) lowers economic growth rate.

V. Concluding Remarks

This paper investigates empirically the effects of macroeconomic variables on economic growth and income distribution, which intend to find the desirable policy and the harmonious policy groping for the pursuit of concurrent development of economic growth and income distribution in Korea, which uses annual data during 1981-2017. The VEC method is used to find out the effects as empirical analysis tools.

The results show as following:

1) Average school year of educational attainment as a proxy variable of human capital as well as non-social fiscal spending in the short-run and long-run has a significantly big positive effect on economic growth, but social fiscal spending in the long-run and the short-run and the tax revenue in the long-run have significantly negative effect on economic growth. This means that the cultivation of human capital through non-social fiscal spending would be a most important determinant on economic growth. And fiscal adjustments implemented by cutting tax revenue and social fiscal spending such as for improving the fiscal soundness seem to have an expansionary effect on the economic growth.

2) Decrease in gini coefficient ie. reducing income inequality has significant big positive effect on economic growth The results imply that reducing income inequality is important factor on economic growth. Also it has shown the advanced economy's characteristics in Korea, which means that economic growth can help improving income distribution as the income level becomes higher in view of inverted U hypothesis by S. Kuznets(1955).

3) Considering private investment has positive effect on economic growth in the long-run which means vitalizing private investment sector is important on economic growth and reducing income inequality. Also controlling inflation rate would be needed for the economy in the long-run and the short-run.

4) Also widening openness ie. increase in export and import as the measure of international trade openness is important factor on economic growth, which means openness is important to small open and natural resource deficient country like Korea.

In conclusion, they show that non-social public spending, the cultivation of human capital, the vitalization of private investment, and expansion of openness are important for long run economic growth and improving income distribution in Korea since non-social public spending, private investment and average schooling year would have been relatively more productive effects but fiscal policy factors such as social public spending and tax revenue have non-productive effects in the economy.

However this positive analysis would need to be confirmed by a more thorough assessment of the normative aspect.

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