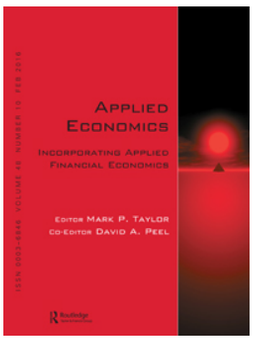

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The relationship between income inequality and aggregate saving: an empirical analysis using cross-country panel data

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ABSTRACT

If the rich save more than the poor, an increase in income inequality raises aggregate saving. We investigate whether income inequality is positively related to aggregate saving ratio by estimating a fixed-effect model based on a panel data of 48 countries for the period 1991–2010. We find evidence that aggregate saving ratio increases with income inequality using various inequality measures. In particular, the effect of income distribution on saving is greater and statistically more significant with in financially developed, rich and OECD countries. It suggests that the rich save much more than the poor under advanced financial system and in a rich country. We also find that the relationship between income inequality and saving ratio is closer in the 2000s than the 1990s. This finding may result from financial development and the high income level in the 2000s.

KEYWORDS

Income inequality; saving ratio; GINI coefficient; marginal propensity to save; financial development

JEL CLASSIFICATION

E21; D31

I. Introduction

This article examines whether an increase in income inequality raises aggregate saving ratio. The effect of income distribution on saving has long received attention because income inequality can affect economic growth through capital formation. Because of the increasing trend of income inequality, the link between income distribution and saving needs to be further investigated.

In the early neo-Keynesian growth models Kaldor (1957) states that income inequality has a positive effect on saving because the marginal propensity to save for the rich is higher than the poor. Stiglitz (1969) also points out that, if the saving function is convex, i.e. the marginal propensity to save increases with income, more unequal distribution of income results in higher capital intensity through greater aggregate saving.

Then, why do the rich save more? The answer dates back to Keynes (1936) who states that the consumption propensities decrease with income. The life-cycle hypothesis allowing for bequests supports a higher marginal propensity to save for rich households. According to Kotlikoff and Summers (1981), if bequests are luxurious goods, saving rates for wealthier households are higher than less wealthier ones. Becker (1975) offers an alternative explanation for high saving rate for the rich. Because of decreasing returns to scale in human capital, the poor tends to invest relatively more in human capital than the rich. Since expenditure on human capital is counted as consumption, saving rate for the poor appears lower than the rich. In fact, using micro data of the US, Dynan, Skinner, and Zeldes (2004) find a positive relationship between personal savings rates and lifetime income.

Precautionary saving motive and borrowing constraints, however, exert the opposite effect on the relationship between income inequality and aggregate saving rate. Carroll and Kimball (1996) claim that people save for precautionary motive. If the poor are more risk-averse and face the more income uncertainty, they must save more for stronger precautionary motive. Deaton (1991) points out borrowing constraints as a motive for saving. If the poor are more likely to face borrowing constraints, they have incentive to save more. If precautionary motive and borrowing constraint effect are strong enough, the marginal propensity to save for the rich may not be higher than for the poor. The effect of income inequality on the aggregate saving, then, may be weakened or reversed. It is also noted that many

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political economy literatures including Alesina and Rodrik (1994) claim that income inequality reduces the economic growth rate and saving rates through tensions and political instability.

In theory, the effect of income distribution on aggregate saving is not clear. The link between income distribution and aggregate saving remains an empirical problem. Most empirical studies on the relationship between income distribution and saving are mainly based on the cross-country data. Della Valle and Oguchi (1976) find that an increase in income inequality raises the saving ratio for the OECD countries. Cook (1995) also reports a positive effect of income inequality on saving ratio using 49 less-developed country data. In contrast, Edwards (1996) finds ambiguous effect of inequality on saving by using panel data for both the developing and OECD countries.

In a recent empirical analysis, Schmidt-Hebbel and Servén (2000) make both the cross section and fixed-effect estimation using the annual cross-country, time-series data for the period 1965–1994. They find no support for any significant effect of income inequality on aggregate saving. Li and Zou (2004) also report mixed results for the association between income inequality and saving. In contrast, Smith (2001) finds evidence that inequality affects private saving rates positively in both cross-sectional and panel data. While most existing studies use GINI index as a measure of inequality, Leigh and Posso (2009) focus on the income share of the top 10% and 1% as inequality variables. Using a very long time series of 11 developed countries for the period 1921–2002, they fail to find a consistent relationship between top income shares and national saving rate. Oppositely, Alvarez-Cuadrado and Vilalta (2012) report a negative association between income inequality and aggregate saving rates based on panel data of six OECD countries. They ascribe this result to interpersonal comparisons behaviour of consumption.

Existing empirical studies using cross-country data, therefore, have so far yielded mixed results. Recent studies attempt to adopt new econometric method, or to investigate the channels by which income inequality affects saving behaviour. Malinen (2013) points out that mixed results may be due to the mis-specification of the estimated models by assuming stationary income inequality and applies panel cointegration method. Gu, Dong, and Huang (2015) claim that the relationship between saving and income distribution depends on the financial status of consumers. Focusing on the period of 2000–2007, they find a negative link between income inequality and saving for the US but a positive link for the Asian countries including China.

The methodology in this article is conventional in that it adopts cross-country panel data. Distinct research strategy in this article is, however, to identify the source of the relationship between income inequality and saving. We hypothesize that the effect of income inequality on saving depends on financial development. The poor may have less incentive to save in a financially developed country because they are able to easily access to financial borrowings. Difference in the marginal propensity to save of the rich and the poor is larger in financially developed countries. It suggests that the relationship between income distribution and aggregate saving is strong in a financially developed county.

We also investigate whether the effect of income inequality on aggregate saving is greater in rich countries. Many authors including Blinder (1975) and Dynan, Skinner, and Zeldes (2004) point out that the marginal propensity to save increases non-linearly with income. Difference in saving incentive of the rich and the poor is larger as the average income level is higher. We hypothesize that the effect of income inequality on aggregate saving ratio is greater in rich countries. In addition, if per capita income has increased over time, we conjecture that saving ratio is more strongly affected by income distribution recently than in the past.

We apply fixed-effect estimation and two-step GMM (General Method of Moments) estimation using a panel data of 48 countries for the period 1991–2010. Using various dummy variables, we examine whether the effect of income inequality on aggregate saving rate depends on the degree of financial development, the average income level, OECD membership and time periods.

Main findings in the article are: first, income inequality is positively related to aggregate saving ratio; second, income inequality affects the saving ratio more strongly in financially developed countries, OECD member countries and high income countries; third, the association between income distribution and saving rate is stronger in the 2000s than the 1990s.

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Our findings indicate that redistribution policy towards the poor may reduce the aggregate saving. A negative effect of income equality on saving is greater in financially developed and rich countries. It does not, however, imply that income equality has negative net effect on economic growth because there are other positive effects of equal income distribution on growth, as described by Barro (2000).

The rest of the article is organized as follows. Section II describes the data properties and estimation methodology. Section III reports the estimation results. Section IV is a short conclusion.

II. Data and methodology

Data

We construct a panel data of 48 countries for period 1991–2010. The data are mainly drawn from the World Development Indicator (WDI) of World Bank database. We select countries by the following criteria: first, too poor countries are not included in the sample[1]; second, the country should have at least one observation for all the variables every 5 years. The sample accounts for nearly 80% of the world GDP and comprises four 5-year average of variables of 1991–1995, 1996–2000, 2001–2005 and 2006–2010 for each country.

We use three measures of income inequality. The *GINI* of most countries is drawn from the WDI database following Deininger and Squire (1996) while that of OECD countries is derived from the OECD Social and Welfare Statistics.[2] To maintain the robustness of results, we employ income share data as well. The *H20/L40* is defined as the ratio of income that accrues to the top 20% to the bottom 40% of population. We also employ the *M60* defined as the sum of income share held by the second, the third and the fourth 20%.[3] An increase in *M60* is interpreted as a reduction of income inequality.

We use both *GDS* (gross domestic saving ratio) and *GNS* (gross national saving ratio) as aggregate saving ratio.[4] The natural log transformation and the growth rate of per capita real GDP and per capita real GNP are used as control variables.

We consider some demographic control variables. Age dependency is an age-population ratio of those typically not in the labour force to those typically in the labour force. Dependency of young people (under 14 years of age) and old people (over 65 years of age) is measured by *dep_young* and *dep_old*, respectively. According to the life-cycle hypothesis of Modigliani and Brumberg (1954), the individuals have negative savings when they are young and old, and positive savings during their mature period.

If social security system is well established, saving rate will be lower. Individuals tend to save more without well-developed social security system because of precautionary saving motive. Insufficient public expenditure on social security will lead to high aggregate saving. We employ the ratio of public health expenditure to GDP as a proxy variable for social security benefits.

To measure financial development of each country, we collect M3, the broadest concept of money. The degree of financial development is measured by the ratio of M3 to real GDP.[5] We also employ the ratio of domestic credit to private sectors to real GDP as a financial development measurement. Because of insufficient data availability, we exclude some countries from the sample when we consider financial development variable.[6]

Because the inclusion of too many variables in the regression may cause heteroscedasticity and multicollinearity problems, we save many control variables. We considered inflation rate, real interest rate, urban population rate, and so on as control variables, but most of them are statistically insignificant, and are not reported.

[1]According to the World Bank 2010 standard, we exclude countries of which average income level is below 1005 dollars. Musgrove (1980) argues that income distribution does not affect saving rate in poor countries since many agents are near subsistence. We also consider that poor data quality of low-income countries may bias the result.

[2]Because the WDI does not offer GINI index for some advanced countries like Germany, UK, US, and so on, we derive GINI data for OECD countries from the OECD data set.

[3]We employ only 40 countries in the regressions using income share because of insufficient data availability. Excluded countries are listed in Appendix.

[4]It is unclear which variable is appropriate. Schmidt-Hebbel and Servén (2000) employ GNS while Smith (2001) uses private saving rate. Recently, Alvarez-Cuadrado and Vilalata (2012) adopt personal saving rate. Because many countries do not offer private or personal saving rate, we do not adopt them to include as many countries as possible in the sample.

[5]Since King and Levine (1993), the ratio of financial asset value to real production is used as a measure of financial development.

[6]Eight countries are excluded for M3 data and one country is excluded for private credit data. Excluded countries are listed in Appendix.

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Table 1. Descriptive statistics of variables.

	Mean	SD	Minimum	Maximum
GINI	0.376	0.102	0.210	0.600
H20/L40	2.620	1.291	1.083	7.259
M60	0.474	0.060	0.339	0.559
GNS	0.223	0.069	0.029	0.524
GDS	0.219	0.067	0.029	0.524
pcgnp_growth	0.022	0.030	−0.142	0.109
pcgdp_growth	0.022	0.031	−0.134	0.110
Ln(pcgnp)	8.627	1.167	6.284	10.624
Ln(pcgdp)	8.653	1.154	6.289	10.620
dep_old	0.161	0.073	0.054	0.331
dep_young	0.385	0.158	0.197	0.867
Health	0.044	0.021	0.007	0.089
M3	0.577	0.403	0.030	2.240
Credit	0.662	0.494	0.025	2.177

Notes: *GINI*, GINI index; *GNS*, gross national saving ratio; *GDS*, gross domestic saving ratio; *pcgnp_growth*, growth rate of pcgnp; *pcgdp_growth*, growth rate of pcgdp; *pcgnp*: per capita real GNP; *pcgdp*, per capita real GDP; *dep_old*, dependency ratio of old population; *dep_young*, dependency ratio of young population; *H20/L40*, the ratio of top 20% income to bottom 40% income; *M60*, the ratio of the middle group income; *Health*, the ratio of public health expenditure to GDP; *M3*, the ratio of broad money to GDP; *Credit*, the ratio of domestic credit to private sector to GDP.

In Table 1, we present descriptive statistics including means, SDs, minimum and maximum of each variable. *GINI* lies between 0.210 and 0.600 and its average is 0.376. On average, top 20% of population earns 2.6 times as much as bottom 40% of population. The middle 60% of people earn 47% of total income.

There is not much difference between *GNS* and *GDS*. The level and the growth rate of GNP and GDP are similar. The average dependency ratio of the old is 16% and that of the young is 38%.

Government expenditure on health takes 4% of GDP. There seems to be a wide difference in financial development among countries. The ratio of M3 to GDP lies between 0.03 and 2.24 and private credit to GDP lies between 0.025 and 2.177.

Methodology

We adopt a fixed-effect model including country dummies. Because time effect is statistically insignificant, we exclude time dummies in the equation:

$$S_{it} = \text{constant} + \alpha GINI_{it} + \beta X_{it} + \gamma Z_i \times GINI_{it} + \varepsilon_{it}$$

where S is saving ratio measured by *GDS* and *GNS*. X includes the level of per capita real GDP (GNP), the growth rate of per capita real GDP (GNP), dependency ratios and public health expenditure.

To estimate the effect of country characteristics on the relationship between income distribution and saving rate, we define various dummy variables (Z_i). Z_i includes *HIFD, CHIFD, RICH* and *OECD*. *HIFD* is 1 if the ratio of broad money to real GDP exceeds the average of the sample, and 0 otherwise. *CHIFD* is 1 if the ratio of private domestic credit to GDP is over the sample mean, and 0 otherwise. *OECD* is 1 if the country is a member of OECD, and 0 otherwise. *RICH* is 1 if per capita real GNP is over the sample mean, and 0 otherwise.

To investigate whether the relationship between income distribution and saving ratio has been stronger nowadays, we define a dummy variable (Z_i) that captures time period. *New* is 1 if the time period is 2000–2004 or 2005–2010, and 0 otherwise.

If saving ratio increases with income inequality, α is positive. Both the growth rate and the level of income are expected to positively affect saving. Dependency ratio is negatively related to saving ratio. Public health expenditure is also negatively related to saving ratio.

The sign of γ determines whether the effect of income inequality on saving ratio is greater when Z_i is 1. For example, when Z_i is *HIFD*, positive γ suggests that the effect of income inequality on saving ratio is greater in financially developed countries.

Fixed-effect model is estimated by OLS estimation. Because some regressors may cause the endogeneity problems, we adopt the panel GMM estimation method. The instruments are the lagged terms of some explanatory variables. To test the overall validity of the instruments, we apply the Sargan test and LM (Lagrange multiplier) under-identification test.

III. Estimation results

Table 2 shows basic estimation results using two sets of sample. The joint test of all country effects being zero is significantly rejected. We do not report individual country effects in the table. When we use GNS as saving rate in Column (1), we find that *GINI* is positively related to saving rate. It suggests that aggregate saving rate increases as income is more unevenly distributed. For instance, an increase in *GINI* by 0.01 raises the aggregate saving rate by 0.166%. We obtain the expected sign for the

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Table 2. Basic estimation results.

	(1) GNS	(2) GNS	(3) GNS	(4) GDS	(5) GDS	(6) GDS
GINI	0.166			0.225*		
	(1.120)			(1.740)		
H20/L40		0.005			0.006	
		(0.440)			(0.640)	
M60			−0.214			−0.220
			(−0.770)			(−1.040)
pcgnp_rate	0.111	0.124	0.123			
	(0.800)	(0.770)	(0.760)			
pcgdp_rate				0.131	0.166	0.162
				(0.680)	(0.720)	(0.700)
ln(pcgnp)	0.101**	0.102**	0.101**			
	(2.530)	(2.200)	(2.270)			
ln(pcgdp)				0.074***	0.070**	0.071**
				(2.720)	(2.220)	(2.330)
dep_old	−0.757***	−0.838*	−0.840*	−0.773**	−0.788	−0.791
	(−2.670)	(−1.730)	(−1.760)	(−2.650)	(−1.590)	(−1.620)
dep_young	−0.054	−0.063	−0.064	−0.121	−0.131	−0.130
	(−0.390)	(−0.430)	(−0.450)	(−0.920)	(−0.950)	(−0.980)
Health	−1.009*	−0.875	−0.871	−0.693	−0.472	−0.477
	(−1.910)	(−1.400)	(−1.430)	(−1.390)	(−0.850)	(−0.880)
R^2	0.291	0.264	0.268	0.253	0.218	0.221
N	192	160	160	192	160	160

Notes: *t*-Statistics in parentheses are computed by using heteroscedasticity-robust SE.
*, ** and *** denote statistical significance at 10%, 5% and 1%, respectively.
N is the number of observations.

coefficients in *H20/L40* and *M60* in Columns (2) and (3). An increase in high income share relative to low income share and a decrease in the proportion of middle income group lead to a rise in saving ratio. The effect of income inequality on aggregate saving is, however, statistically insignificant.

Coefficients in the level and the growth rate of income are all positive in consistence with the life-cycle model by Modigliani (1970). If the saving rate increases with income at the individual level, an increase in average income has a positive effect on saving at the aggregate level. Dependency ratios of the young and the old are negatively related to saving rate in all cases. According to the life-cycle model, the individuals will have negative saving when they lack in the ability to work, and positive saving during their mature period. As dependency ratios increase, the aggregate saving is lower. Public expenditure on health plays a role of decreasing aggregate saving.

These results are almost the same for GDS. An increase in *GINI* and *H20/L40* and a decrease in *M60* raise aggregate saving ratio. All other control variables have the expected signs although some are statistically insignificant.

We investigate whether country characteristics matter to the relationship between income inequality and the saving rate. The interaction terms between dummies for country characteristics and *GINI* are employed in Table 3.[7] We find negative coefficients in *GINI* in some equations but they are statistically insignificant. It suggests that income inequality does

Table 3. The effects of country characteristics and time.

	(1) GNS	(2) GNS	(3) GNS	(4) GNS	(5) GNS
GINI	−0.130	−0.056	0.047	0.040	0.147
	(−0.800)	(−0.310)	(0.290)	(0.260)	(0.990)
GINI × *HIFD*	0.666**				
	(2.120)				
GINI × *CHIFD*		0.639**			
		(2.120)			
GINI × *OECD*			0.768***		
			(2.900)		
GINI × *RICH*				0.950***	
				(3.940)	
GINI × *NEW*					0.034*
					(1.840)
ln(pcgnp)	0.091**	0.090**	0.097**	0.096**	0.099**
	(3.300)	(2.140)	(2.440)	(2.440)	(2.450)
pcgnp_rate	0.064	0.073	0.097	0.096	0.111
	(0.450)	(0.480)	(0.700)	(0.700)	(0.800)
dep_old	−0.838**	−0.769***	−0.785***	−0.802***	−0.824***
	(−2.470)	(−2.870)	(−3.020)	(−3.100)	(−2.840)
dep_young	−0.108	−0.104	−0.064	−0.072	0.044
	(−0.770)	(−0.730)	(−0.460)	(−0.520)	(0.280)
Health	−0.973	−1.129**	−1.163**	−1.174**	−1.221**
	(−1.550)	(−2.030)	(−2.250)	(−2.300)	(−2.300)
R^2	0.323	0.325	0.316	0.325	0.301
N	160	188	192	192	192

(*Continued*)

[7]We do not report the results of regressions using *H20/L40* and *M60* because the results are almost the same.

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Table 3. (Continued).

	(6) GDS	(7) GDS	(8) GDS	(9) GDS	(10) GDS
GINI	−0.081	0.004	0.078	0.071	0.206
	(−0.490)	(0.020)	(0.580)	(0.540)	(1.580)
GINI × *HIFD*	0.644**				
	(2.380)				
GINI × *CHIFD*		0.665**			
		(2.360)			
GINI × *OECD*			0.935***		
			(3.410)		
GINI × *RICH*				1.147***	
				(4.790)	
GINI × *NEW*					0.033*
					(1.910)
ln(pcgdp)	0.065**	0.058**	0.070***	0.070***	0.071**
	(2.300)	(2.110)	(2.690)	(2.710)	(2.660)
pcgdp_rate	0.105	0.105	0.118	0.124	0.134
	(0.510)	(0.500)	(0.610)	(0.650)	(0.700)
dep_old	−0.893**	−0.773***	−0.811***	−0.835***	−0.838***
	(−2.570)	(−2.900)	(−3.140)	(−3.250)	(−2.810)
dep_young	−0.168	−0.183	−0.129	−0.136	−0.026
	(−1.260)	(−1.360)	(−0.980)	(−1.040)	(−0.180)
Health	−0.450	−0.713	−0.869*	−0.867*	−0.886*
	(−0.790)	(−1.370)	(−1.850)	(−1.890)	(−1.820)
R^2	0.294	0.288	0.293	0.307	0.265
N	160	188	192	192	192

Notes: *t*-Statistics in parentheses are computed by using heteroscedasticity-robust SE.

*, ** and *** denote statistical significance at 10%, 5% and 1%, respectively.

HIFD = 1 if the ratio of M3 to GDP is over the sample mean, and 0 otherwise; *OECD* = 1 for a member of OECD, and 0 otherwise; *NEW* = 1 if the observation belong to the second 10 years, 2001–2010, and 0 otherwise; *CHIFD* = 1 if the ratio of domestic credit to private sector to GDP is over the sample mean, and 0 otherwise; *RICH* = 1 if pcgnp is over the sample mean, and 0 otherwise.

not affect aggregate saving if dummies are zero. All control variables have the sign that we expect although some of them are insignificant.

In a financially developed country, the effect of income inequality on saving rate is greater and statistically more significant. While the coefficient for financially underdeveloped country is −0.130 and statistically insignificant, the coefficient for highly financially developed country is 0.536 and statistically significant, as shown in Column (1). The coefficient of interaction term *GINI* × *CHIFD* in Column (2) is also positive and statistically significant. These findings suggest that the rich save much more than the poor when financial system is better developed. Because the rich can access diverse saving channels, the rich seem to have more incentive to save under a developed financial system. In contrast, the poor save much less because they are less likely to face borrowing constraints, and have weak precautionary saving motive in a financially developed country. As the difference between the marginal propensity to save for the rich and for the poor is larger under developed financial system, the effect of income inequality on the aggregate saving ratio is greater.[8]

If the relationship between income and marginal propensity to save is nonlinear,[9] the effect of income inequality on aggregate saving in rich countries should be greater than poor countries. That is because the difference in saving behaviour between the poor and the rich is larger in rich countries of which average income is greater than poor countries. We find significant difference in the relationship between income inequality and saving rate between the *OECD* countries and the *NONOECD* countries. In Column (3), the coefficient in the interaction term between *OECD* and *GINI* is positive and statistically significant. We also find the coefficient of interaction term *GINI* × *RICH* is significantly positive in Column (4).

We examine whether the relationship between income inequality and saving rate is closer recently than in the past. As shown in Column (5) in Table 3, the coefficient in the interaction term between *NEW* and *GINI* is positive and statistically significant, suggesting that the relationship is stronger in the 2000s. This result may be due to financial development in the 2000s. The ratio of M3 to GDP in the 1990s is 0.471 while that in the 2000s is 0.599. Other reason may be an increase in the income level in the 2000s. We conjecture that, as income increased in the 2000s, the greater difference in the marginal propensity to consume for the rich and the poor reinforces the effect of income inequality on the aggregate saving.

Columns (6)–(10) in Table 3 report the results using GDS and per capita GDP. The results are not

[8] At a first glance, this result seems different from Smith (2001) who claims that a negative association between income equality and saving ratio is weaker in financially developed countries. It is, however, noted that he measures equality by the income share of the poorest 40% of the population. The poor tend to have incentive to save because they have limited access to financial system. An increase in the income share of the poor has small impacts on saving behaviour of the poor in developed financial system where the poor do not face serious borrowing constraints. The negative effect of income equality on the aggregate saving is, therefore, weak in developed financial system. In contrast, we claim that the difference in saving behaviour between the rich and the poor is larger, thereby the effect of income inequality on the aggregate saving rate being greater in financially developed countries.

[9] Many papers including Blinder (1975) and Dynan, Skinner, and Zeldes (2004) offer evidence that the marginal propensity to save increases with disposable income at the micro level.

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Table 4. Basic estimation results (GMM).

	(1) GNS	(2) GNS	(3) GNS	(4) GDS	(5) GDS	(6) GDS
GINI	0.130			0.183		
	(0.950)			(1.360)		
H20/L40		0.004			0.004	
		(0.390)			(0.380)	
M60			−0.229			−0.212
			(−0.960)			(−0.920)
pcgnp_rate	0.308	0.343	0.331			
	(1.540)	(1.470)	(1.420)			
pcgdp_rate				0.288	0.307	0.286
				(1.430)	(1.430)	(1.340)
ln(pcgnp)	0.127***	0.108**	0.106**			
	(3.430)	(2.510)	(2.470)			
ln(pcgdp)				0.106***	0.085**	0.119**
				(2.850)	(2.040)	(2.030)
dep_old	−0.888***	−0.970***	−0.963***	−0.903***	−0.913**	−0.904**
	(−3.540)	(−2.600)	(−2.580)	(−3.600)	(−2.500)	(−2.490)
dep_young	0.064	0.004	−0.004	0.005	−0.057	−0.065
	(0.480)	(0.020)	(−0.030)	(0.040)	(−0.420)	(−0.490)
Health	−0.580	−0.326	−0.340	−0.400	−0.125	−0.163
	(−0.860)	(−0.410)	(−0.430)	(−0.590)	(−0.160)	(−0.210)
Sargan	0.340	0.246	0.189	0.312	0.150	0.172
Under-identification	29.120***	21.833***	21.542***	27.719***	25.393***	25.231***
N	190	158	158	190	158	158

Notes: *t*-Statistics in parentheses are computed by using heteroscedasticity-robust SE.
** and *** denote statistical significance at 5% and 1%, respectively.
Once and twice-lagged terms of the *ln(pcgnp)* and *pcgnp_rate* are used as instruments.

much different from the results using GNS. The relationship between income inequality and saving is stronger in a country where financial depth is higher, which is a member of OECD, and of which average income level is higher. We find a closer relationship between income distribution and saving ratio for recent data.

To reduce potential biases due to the endogeneity of some regressors, we apply GMM estimation technic to the basic specification in Table 4. Once and twice-lagged terms of income level and income growth variables are used as instruments. Sargan statistics and under-identification statistics show the validity of instruments.

Overall, the estimation results by GMM in Table 4 are similar to the results by OLS in Table 2. We find a positive relationship between income inequality and saving ratio using both GNS and GDS. The statistical significance of coefficients in *GINI, H20/L40* and *M60* is, however, low.

GMM estimation method is also implemented to the specifications with interaction terms between income inequality and country characteristics. Table 5 shows estimation results by GMM. In Columns (1)–(4), using GNS as saving ratio, we find that the effect of income inequality on saving ratio is greater and statistically more significant in financially developed countries, OECD member countries and rich countries. Column (5) shows that the effect of income inequality on saving is greater for recent data than the past data. By using GDS, we obtain similar results about the effect of country characteristics and time period on the

Table 5. The effects of country characteristics and time (GMM).

	(1) GNS	(2) GNS	(3) GNS	(4) GNS	(5) GNS
GINI	−0.130	−0.033	0.027	0.020	0.121
	(−0.760)	(−0.200)	(0.190)	(0.140)	(0.890)
GINI × HIFD	0.652**				
	(2.040)				
GINI × CHIFD		0.564*			
		(1.880)			
GINI × OECD			0.722**		
			(2.070)		
GINI × RICH				0.902**	
				(2.470)	
GINI × NEW					0.023
					(0.980)
pcgnp_rate	0.172	0.281	0.272	0.270	0.259
	(0.810)	(1.280)	(1.380)	(1.380)	(1.320)
ln(pcgnp)	0.087*	0.094**	0.114***	0.114***	0.122***
	(1.910)	(2.370)	(3.090)	(3.110)	(3.280)
dep_old	−0.890***	−0.850***	−0.888***	−0.905***	−0.907***
	(−2.820)	(−3.450)	(−3.630)	(−3.720)	(−3.630)
dep_young	−0.083	−0.037	0.029	0.021	0.110
	(−0.520)	(−0.250)	(0.220)	(0.160)	(0.780)
Health	−0.616	−0.589	−0.752	−0.766	−0.827
	(−0.750)	(−0.830)	(−1.120)	(−1.150)	(−1.200)
Sargan	0.183	0.762	0.074	0.104	0.655
Under-identification	19.338***	22.832***	28.161***	28.317***	28.811***
N	158	186	190	190	190

(*Continued*)

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Table 5. (Continued).

	(6) GDS	(7) GDS	(8) GDS	(9) GDS	(10) GDS
GINI	−0.095	0.008	0.049	0.040	0.175
	(−0.590)	(0.050)	(0.350)	(0.300)	(1.320)
GINI × HIFD	0.613**				
	(2.020)				
GINI × CHIFD		0.545*			
		(1.890)			
GINI × OECD			0.906***		
			(2.720)		
GINI × RICH				0.887**	
				(2.440)	
GINI × NEW					0.023
					(1.010)
pcgdp_rate	0.168	0.290	0.243	0.244	0.250
	(0.820)	(1.330)	(1.240)	(1.260)	(1.260)
ln(pcgdp)	0.076*	0.089**	0.094***	0.092***	0.100***
	(1.850)	(2.330)	(2.570)	(2.570)	(2.670)
dep_old	−0.951***	−0.897***	−0.908***	−0.928***	−0.923***
	(−3.080)	(−3.680)	(−3.750)	(−3.870)	(−3.690)
dep_young	−0.114	−0.051	−0.031	−0.042	0.050
	(−0.770)	(−0.350)	(−0.230)	(−0.320)	(0.340)
Health	−0.246	−0.312	−0.611	−0.617	−0.616
	(−0.310)	(−0.440)	(−0.930)	(−0.950)	(−0.900)
Sargan	0.581	0.400	0.211	0.228	0.440
Under-identification	21.711***	24.207***	27.202***	27.457***	27.643***
N	158	186	190	190	190

Notes: *t*-Statistics in parentheses are computed by using heteroscedasticity-robust SE.
*, ** and *** denote statistical significance at 10%, 5% and 1%, respectively.

relationship between income distribution and saving, as shown in Columns (6)–(10) in Table 5.

It is puzzling why the effect of income inequality on saving is statistically insignificant in basic specifications but significant in specifications with interaction terms. We attempt to test whether the effect of income inequality on saving depends on the income level. The offsetting effects of precautionary saving motive and borrowing constraints may make the relationship between income inequality and aggregate saving unclear in low income countries. Musgrove (1980) also suggests that the relationship between income inequality and saving holds in rich countries only. Because many individuals are near subsistence, the distribution of income affects saving rate little in poor countries.

We split the whole sample into three subsamples based on the income level. Table 6 shows that the positive effect of income inequality on saving ratio is statistically significant for high income group countries. Both OLS and GMM estimation results indicate that a positive relationship between income distribution and saving exist for high income countries only. There exists an ambiguous relation in the less-developed countries.[10] This finding explains why interaction terms between income inequality and country dummies for financial development, OECD members and higher income are positive and statistically significant.

IV. Concluding remarks

We find evidence that the aggregate saving rate increases with income inequality using cross-country

Table 6. Estimation results by income groups.

	(1) OLS	(2) OLS	(3) OLS	(4) GMM	(5) GMM	(5) GMM
	H_income	M_income	L_income	H_income	M_income	L_income
GINI	0.629**	−0.008	0.087	0.586**	−0.060	0.056
	(2.820)	(−0.050)	(0.450)	(2.350)	(−0.310)	(0.260)
pcgnp_rate	0.186	−0.233	0.286*	0.651	−0.389*	0.475
	(0.560)	(−1.010)	(1.920)	(1.590)	(−1.780)	(1.360)
ln(pcgnp)	0.148**	−0.020	0.139***	0.117**	−0.008	0.146***
	(2.640)	(−0.300)	(2.990)	(2.260)	(−0.110)	(2.730)
dep_old	−0.446**	−1.457***	−1.334	−0.518***	−1.422**	−1.787
	(−2.520)	(−3.310)	(−1.250)	(−3.350)	(−2.090)	(−1.540)
dep_young	0.172	−0.669***	0.053	−0.012	−0.638***	0.087
	(0.610)	(−3.040)	(0.340)	(−0.040)	(−3.290)	(0.490)
health	−1.039	−2.378***	−1.562	−0.204	−2.596	−0.742
	(−1.280)	(−3.440)	(−1.060)	(−0.240)	(−2.370)	(−0.370)
R^2	0.643	0.473	0.414			
Sargan				1.188	1.820	0.980
Under-identification				13.187***	11.384***	11.334***
N	56	56	80	56	54	80

Notes: *t*-Statistics in parentheses are computed by using heteroscedasticity-robust SE.
*, ** and *** denote statistical significance at 10%, 5% and 1%, respectively.
High income group (*H_income*) if average per capital real GNP >12 275; low income group (*L_income*) if average per capital real GNP <3975; middle income group (*M_income*) for the rest.

[10]When we split the sample into OECD and non-OECD groups, we find similar results. Strong relationship between income inequality and saving ratio exists for OECD countries only.

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panel data. If the marginal propensity to save for the rich is higher than for the poor, an increase in income inequality raises the aggregate saving rate.

Furthermore, the effect of income inequality on the aggregate saving ratio is greater for financially developed countries, OECD countries and rich countries where the difference in the marginal propensity to save between the rich and the poor is larger. Furthermore, the relationship between income inequality and aggregate saving seems to be reinforced in the 2000s. These results are robust to various specifications and estimation methods.

The findings in the article suggest that income redistribution policy towards the poor may lower aggregate saving ratio, and thereby reducing capital accumulation, especially in financially developed and rich countries. This finding only does not, however, imply that income equality retards economic growth because there may be other positive effects of equality on growth.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix List of countries in sample

Argentina	Colombia	Italy*	Norway	Thailand
Australia**	Czech Republic	Japan**	Paraguay	United Kingdom
Austria*(**)	Denmark	Jordan	Philippines	United States
Brazil	Ecuador	Kazakhstan	Poland	Uruguay
Bulgaria	Egypt, Arab Rep.	Latvia	Portugal*(**)	Venezuela, RB
Canada	Finland*	Malaysia	Romania**,^	Belarus
Chile	Germany*	Mexico	Russian Federation**	Costa Rica
Indonesia	Greece*	Morocco	Spain*	Dominican Republic
Peru	Hungary	Netherlands*	Sweden**	
Ukraine	China	New Zealand**	Honduras	

Notes: * denotes countries excluded from financial development data (8 countries).
** denotes countries excluded from income share data (8 countries).
^ denotes countries excluded from credit data (1 countries).

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