論 説

Income Inequality and Economic Growth Nexus in Japan: A Multivariate Analysis

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Abstract

Using time series data over the period 1960–2015, this paper empirically investigates the impact of income inequality on economic growth in Japan. It also examines the theoretical predictions of some of the transmission channels through which inequality affects growth. Empirical results consistently show that income inequality significantly hinders Japanese growth. Furthermore, greater inequality increases relative redistribution and reduces investment, education, and property rights protection, which may, in turn, hamper growth. Estimated results are robust to the inclusion of control variables, alternative measures of income inequality, and different estimation techniques.

Keywords: income inequality, economic growth, Japan

JEL classifications: O15, O40, O53

1. Introduction

The relationship between income inequality and economic growth has received significant attention from researchers and policymakers over many decades. The interest has recently gained significant momentum after releasing the Oxfam (2014) report which reveals that the richest 85 people have the same wealth as the poorest half of the world. In his best-selling book, *Capital in the Twenty-First Century,* Piketty (2014) has drawn attention to the increasing income and wealth inequality over the past few decades in most of the advanced countries which are heading back to the inequality that prevailed a century ago.

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The recent Oxfam (2016) report shows that the gap between the richest and the rest has widened dramatically in the past year with 62 people now owning as much wealth as the poorest half of the world's population.

Inequality has significantly increased in most of the advanced and developing countries since the 1980s. For example, the richest 10 percent of the population in the OECD today earn about 9.5 times the income of the poorest 10 percent, however, the ratio was at 7: 1 in the 1980s (OECD, 2014). On average, income inequality has increased by 11 percent in developing countries between 1990 and 2010 (UNDP, 2013). This rising inequality has become one of the biggest threats to the world. Stiglitz (2012) argues that inequality is bad for the stability of the economy, and the United Nations (2014) states that the current level of inequality creates significant barriers for sustainable development in the post-2015 world. OECD (2015) warns that the gap between the rich and the poor keeps widening which not only threatens economic growth but also raises social, economic and political concerns. Despite a large and burgeoning literature, the empirical evidence on inequality-growth nexus remains inconclusive.[2] Most of this studies regress economic growth on income inequality without providing any information about the relevant mechanism through which inequality influences growth.

Japan has long been considered as an equal society and thus it may be exception to Piketty's thesis because income inequality in Japan—measured by the share of total personal income taken by the top 1% earners—appears to have levelled off, and even fallen a bit, in recent years after rising steadily from the early 1990s (Schlesinger, 2015). However, historical trend shows that income inequality in Japan has started growing since the 1980s: the market Gini coefficients of income distribution rose from 29.63 in 1980 to 46.09 in 2011; whereas the top 1% income shares grew from 31.34% in 1980 to 40.57% in 2011 (Solt, 2016; Alvaredo *et al.,* 2016). This widening income gap does not tell the whole story about income inequality because Japanese society has experienced changes in the population structure, family structure, and mobility among the income classes during the last three decades (Ohtake, 2008). Technological changes, population aging, increasing temporary employment and wage gap, changes in household structures, and class mobility are among major underlying reasons behind rising income inequality in Japan (Takanami, 2010; Ohtake *et al.,* 2013). This higher inequality significantly hampers growth and raises poverty in Japanese society.

Instead of focusing on a large number of sample countries with considerable heterogeneity, this paper is particularly interested in investigating inequality-growth nexus in one of the advanced economies in East Asia, Japan. We make two contributions to the time series empirical literature. First, it does not only investigate the effects of inequality on growth but also examine the potential transmission channels through which inequality affects Japanese growth over the period 1960-2015. Exploring several possible transmission channels in a single study enables a wide-ranging macroeconomic analysis of the effects of income inequality on growth. Second, it considers four alternative estimators to check robustness of its findings. Estimated results consistently show significant negative effects of inequality on economic growth in Japan.

The rest of the paper is organized as follows. Section 2 reviews empirical literature on inequality-growth nexus. Section 3 illustrates income inequality in Japan. Section 4 discusses empirical framework, methodology, and data. Section 5 undertakes the empirical estimates. The last section concludes.

2. Literature Review on Inequality and Growth

The relationship between inequality and economic growth has been hotly debated among researchers and policy makers for many decades. The debate commenced with the argument by classical economists that income inequality is conducive for investment and growth in the post-industrialization period because marginal propensity to save increases with income and wealth and therefore, inequality channels resources towards individuals with higher marginal propensity to save, which in turn increases aggregate savings, investment and economic growth (Keynes, 1920; Kaldor, 1955). Neoclassical growth models predict that the poor countries tend to grow faster than their wealthy counterparts due to diminishing returns to capital, and thereby historical inequality tends to vanish in the long run (Solow, 1956). Kuznets (1955) finds a non-linear relationship between income distribution and economic development, where inequality increases with development at the first stage and then decreases gradually in the later stage. However, modern growth theories criticize this classical and neoclassical approach and argue that income inequality adversely affects economic growth (Galor and Zeira, 1993; Alesina and Rodrik, 1994; Perotti, 1996; Easterly, 2007).

There are four major channels through which inequality adversely affects growth in modern expositions. First, the *fertility* channel shows that poorer parents have more children and invest less in education and therefore, an increase in inequality enhances fertility that lowers human capital accumulation and growth (De La Croix and Doepke, 2003). Second, the *education* channel demonstrates that in the presence of credit market imperfections and fixed costs associated with the acquisition of human capital, income inequality may be harmful to human capital formation and growth (Galor and Zeira, 1993). Third, the *fiscal policy* channel shows that inequality creates political pressure for income redistribution by increasing taxes which induces lower investment and slower economic growth (Persson and Tabellini, 1994). Fourth, the *socio-political instability* channel illustrates that inequality generates socio-political instability by increasing crime, riots, and other violent activities which in turn enhances the uncertainty of property rights, and thereby reduces investment and growth (Alesina and Perotti, 1996).

If incomes or changes in incomes are persistent, one would expect that the rich would be getting richer and the poor would be getting poorer, leading to persistent income gap between the rich and the poor which in turn increasing inequality over time. A number of recent literature find the evidence of persistence and significance of long-term income inequality, thereby suggesting that poor families do not catch up their rich counterparts and thus income inequality persists across generations (Banerjee and Newman, 1993, Piketty, 1997, Matsuyama, 2002). Higher inequality may create political pressure for higher redistributive taxes; however, inequality may still persist by generating an incentive for better-endowed agents to lobby against redistribution, thus preventing the implementation of efficient redistribution policies (Benabou, 2000, 2002).

Growing inequality since the 1980s may be explained, at least in part, by declining power of labor unions, increased immigration and the effects of international trade and globalization, and growth in information technology (Katz and Murphy, 1992). Alvaredo *et al.* (2013) identify four important factors that have contributed to the growing income shares at the very top level of income distribution over the past forty years. First, top tax rates have moved in the opposite direction from top pre-tax income shares. Second, there are significant changes to bargaining power and greater individualization of pay. Third, private wealth relative to national wealth has followed a U-shaped path over time, and inherited wealth may be making the higher return, and thus inheritance and capital income taxation may become the central policy issue to reduce inequality. Finally, the greater correlation between earned income and capital income which is prominent especially in the US. Bourguignon and Morrisson (2002) argue that most inequalities in the early 19th century were due to the income differences within countries, later, it was due to income inequality between countries. Hence most of the variations in global inequality arise from income inequality across nations.

3. Income Inequality in Japan

Japan used to be an equal society, and the distribution of household incomes was more equal during Japan's high economic growth between the 1960s and 1970s. However, Japan experienced bubble economy in the late 1980s through the early 1990s; thereby Japanese income inequality has started increasing since the 1980s (Takanami, 2010). Moriguchi and Saez (2008) analyse Japanese income inequality over the period 1886–2005 and find (a) income concentration in Japan was extremely high throughout the pre-WWII period during which the nation underwent rapid industrialization; (b) a drastic de-concentration of income at the top took place in 1938-1945; (c) income concentration remained low during the rest of the century but shows some sign of increase in the last decade; and (d) top income composition in Japan has shifted dramatically from capital income to employment income over the course of the twentieth century. Although top income shares in Japan in the 1920s were extremely high by modern standards, they were roughly comparable to those of other industrial nations, such as Britain, the United States, France, Germany, and the Netherlands, during the same decade (Piketty & Saez, 2003; Moriguchi and Saez, 2008).

Moriguchi and Saez (2008) argue that the quick fall in income concentration in Japan during WWII is primarily due to the collapse of capital income for wartime regulations and inflation. In contrast to the sharp increase in wage income inequality observed in the United States since 1970, the top wage income shares in Japan have remained relatively stable over the last thirty years. Moriguchi and Saez (2008) show that the change in technology or tax policies alone cannot account for the comparative experience of Japan and the United States. Instead, Moriguchi and Saez (2008) suggest that institutional factors such as internal labor markets and union structure are important determinants of wage income concentration.

Ohtake and Saito (1998) argue that income inequality in Japan in the 1980s and 1990s can be explained mainly by population aging. Dispersions of income, consumption expenditure, and wealth within the age group increase among the elderly, so an increase in older people leads to a rise in income inequality across the entire country (Ohtake *et al.,* 2013). Similar to the UK and the US, increasing income inequality in Japan since 1980s may be characterized by a widening income gap due to educational attainment and an increase in the incomes of higher income groups (Piketty and Saez, 2006). In other words, skill-biased technological change (SBTC) may be one of the influential factors behind this growing income inequality in Japan.

Kawaguchi and Mori (2008) argue that both the demand and supply for skilled workers have increased because of the skill-based technological change (SBTC), a rise in the number of college-educated workers induced by educational policy changes, and the aging of the population. The growing income gap in the late 1990s in Japan is associated with an increase in income and consumption inequality within the unemployed, in particular among those aged 45 and over (Ohtake *et al.,* 2013). In sum, changes in wages, household structure, taxes and the social security system, population aging, technological change, globalization, and social mobility mainly contribute to widening inequality in Japan (Takanami, 2010).

4. Empirical Framework, Estimation Methodology, and Data

4.1 *Empirical Framework*

To investigate the long-run effects of income inequality on economic growth in Japan we estimate the following regression model over the period 1960-2015:

$$lnGDPC_t = \beta_0 + \beta_1 lnINQ_t + \beta_2 lnFD_t + \beta_3 lnSCH_t + \beta_4 lnOP_t + \beta_5 lnGOV_t + \varepsilon_t, \quad (1)$$

where, *GDPC* is the real GDP per capita, *INQ* indicates income inequality measured by two alternative indicators: the market Gini coefficients (*GINI*) and the top one percent income shares (*TOP*), *FD* is the financial development measured as the ratio of private sector credit to GDP, *SCH* is the educational attainment measured as the average years of schooling in the population aged 25 years and above; *OP* is the openness measured as the ratio of the sum of imports and exports to GDP, *GOV* is the ratio of government consumption expenditures to GDP, ε is the random error term, subscript t indicates period, and *ln* indicates natural logarithm. Gini coefficients measure average income inequality, whereas top 1% income shares measure income inequality at the top. Leigh (2007) finds a strong and robust relationship between top income shares and Gini coefficient and suggests that top income shares might be a useful substitute for other measures of inequality.

Among the control variables, *financial development* may help an economy to allocate productive resources, diversify risks and ease credit availability which in turn improves growth (Levine *et al.,* 2000). *Educational attainment* does not only enhance the ability of a country to develop its own technological innovation, but also increases its ability to adapt existing knowledge which is one of the preconditions for growth (Benhabib & Spiegel, 1994). *Openness* may be one of the important growth determinants because countries that are more open to the rest of the world have greater ability to absorb foreign technology (Barro and Sala-i-Martin, 1995). Finally, higher *government consumption expenditures* may lead to the crowding out of private-sector investment and thereby negatively affect growth (Landau, 1983).

4.2 *Estimation Methodology*

We have used four alternative estimators to estimate long-run relationship between finance and growth nexus: (i) ARDL (Autoregressive Distributed Lag Model) of Pesaran *et al.* (2001); (ii) FMOLS (Fully Modified OLS) of Phillips and Hansen (1990); (iii) CCR (Canonical Cointegrating Regression) of Park (1992); and (iv) DOLS (Dynamic OLS) of Stock and Watson (1993). We start with the ARDL procedure which involves two distinct stages in the estimations: in the first stage, we test the existence of the long-run relationship between inequality and growth using Bounds test, once the long-run relationship is established, we estimate the following ARDL version of the empirical model of Eq. (1):

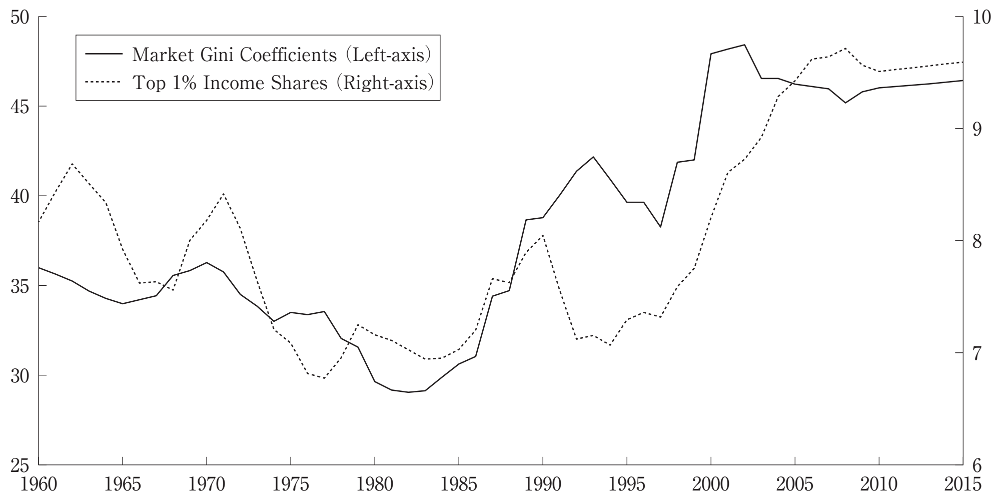
$$\begin{aligned}\Delta lnGDPC_t &= \alpha_0 + \alpha_1 lnGDPC_{t-1} + \alpha_2 lnINQ_{t-1} + \alpha_3 lnFD_{t-1} + \alpha_4 lnSCH_{t-1} + \alpha_5 lnOP_{t-1} \\ &+ \alpha_6 lnGOV_{t-1} + \textstyle\sum_{i=1}^{m}\alpha_7 \Delta lnGDPC_{t-i} + \sum_{i=0}^{p}\alpha_8 \Delta lnINQ_{t-i} + \sum_{i=0}^{q}\alpha_9 \Delta lnFD_{t-i} \\ &+ \textstyle\sum_{i=0}^{r}\alpha_{10} \Delta lnSCH_{t-i} + \sum_{i=0}^{s}\alpha_{11} \Delta lnOP_{t-i} + \sum_{i=0}^{u}\alpha_{12} \Delta lnGOV_{t-i} + \varepsilon_t, \end{aligned} \quad (2)$$

where, m, p, q, r, s, and u are the optimal lag lengths for each variable. The coefficients (α_1, α_2, α_3, α_4, α_5, α_6) of the first part of the ARDL model measure the long-run relationship; whereas, the coefficients (α_7, α_8, α_9, α_{10}, α_{11}, α_{12}) of the second part of the model represent the short-run dynamics. The null hypothesis of no long-run relationship between *lnGDPC* and its determinants is, H_0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$; i.e. there is no cointegration among the variables. We first estimate equation (2) using the OLS estimator and then calculate the *F*-statistic. The test for cointegration is provided by two asymptotic critical value bounds when the independent variables are either I (0) or I (1). The lower bound assumes all the independent variables are I (0), and the upper bound assumes they are I (1). If the computed F-statistic is greater than the upper bound critical value, the null is rejected and we can conclude that a long-run relationship exists. Then we proceed to the second stage procedure to derive the long-run and short-run estimates using the underlying ARDL model (Pesaran *et al.,* 2001).

Apart from ARDL approach, we use three additional estimators to show the consistency of our empirical findings. The Fully Modified OLS (FMOLS) estimator is asymptotically unbiased which employs a semi-parametric correction to eliminate the problems caused by the long run correlation between the cointegrating equation and stochastic regressors innovations (Phillips and Hansen, 1990). FMOLS employs preliminary estimates of the symmetric and one-sided long-run covariance matrices of the residuals (Phillips and Hansen, 1990). The Canonical Cointegrating Regression (CCR) is closely related to FMOLS, but instead employs stationary transformations of the data to obtain least squares estimates to remove the long-run dependence between the cointegrating equation and stochastic regressors innovations (Park, 1992). Like FMOLS, CCR estimates follow a mixture of normal distribution which is free of non-scalar nuisance parameters and permits asymptotic Chi-square testing (Park, 1992).

The Dynamic OLS (DOLS) is a simple approach to constructing an asymptotically efficient estimator that eliminates the feedback in the cointegrating system (Stock and Watson, 1993). DOLS involves augmenting the cointegrating regression with *lags and leads* so that the resulting cointegrating equation error term is orthogonal to the entire history of the stochastic regressor innovations (Stock and Watson, 1993). In Monte Carlo simulation, Stock and Watson (1993) show the evidence that DOLS estimator is asymptotically efficient and it outperforms a large number of alternative estimators of long-run parameters. This DOLS procedure corrects for potential endogeneity problems and provides estimates of the cointegrating vector which are asymptotically efficient (Ang, 2008).

Figure 1. Trends in Gini coefficient and Top 1% income shares in Japan: 1960-2015



4.3 *Data*

The income inequality data used in this paper are the market Gini coefficients (*GINI*) and the top 1 percent income shares (*TOP*). We compile the GINI and the TOP data from the Standardized World Income Inequality Database (SWIID) of Solt (2016) and the World Wealth and Income Database (WID) of Alvaredo *et al.* (2016), respectively. The inequality data are available from 1960 to 2011, hence data for the last 4-period (2012-2015) are spliced with the ratio of real GDP per capita to average wages, and these data are collected from the World Development Indicators (WDI) database and the International Labour Organization (ILO) database, respectively. It is noted that empirical results remain consistent after excluding these 4-year observations. Financial Development (the ratio of private sector credit to GDP) (*FD*), trade openness (the ratio of the sum of exports and imports to GDP) (*OP*), and government expenditures (the ratio of government consumption expenditures to GDP) (*GOV*) data are also collected from WDI. Finally, educational attainment (average years of schooling aged 25 years and above) (*SCH*) are compiled from the Barro-Lee Educational Attainment Database.

To investigate transmission channels of income inequality, we have considered few additional variables. For example, investment rate (ratio of fixed investment to GDP) (*INV*), fertility rate (births per woman) (*FERT*), mortality rate (infant per 1,000 live births) (*MORT*) data are collected from WDI. The relative redistribution (*REDS*) is calculated as the ratio of the difference between market Gini and net Gini to the market Gini, and the data are extracted from SWIID. Finally, Fraser Institute's *Legal structure and security of property rights index* is used to represent property rights protection (*PROP*).

Figure 1 exhibits the trend of income inequality in Japan over the period 1960-2015. The market Gini coefficients show that income inequality declined between 1960 and 1983, its

Table 1. Summary Statistics of the Key Variables in Japan: 1960-2015

	$lnGDPC_t$	$lnGINI_t$	$lnTOP_t$	$lnFD_t$	$lnSCH_t$	$lnOP_t$	$lnGOV_t$
Mean	14.70	3.64	2.08	4.98	2.22	3.12	2.68
Std. Dev.	0.48	0.16	0.11	0.37	0.19	0.23	0.20
Minimum	13.51	3.37	1.91	4.03	1.94	2.77	2.35
Maximum	15.18	3.88	2.27	5.43	2.47	3.65	3.03
Observations	56	56	56	56	56	56	56

Notes: *ln* indicates natural logarithm. Variable specifications: *GDPC* = real GDP per capita; *GINI* = market Gini coefficients; *TOP* = top 1 percent income shares; *FD* = financial development measured as the ratio of private sector credit to GDP; *SCH* = average years of schooling in the population aged 25 years and above; *OP* = openness measured as the ratio of the sum of imports and exports to GDP; and *GOV* = ratio of government consumption expenditures to GDP.

rate significantly increased between 1983 and 2002 and slowed down afterward. The top 1% income shares show mild fluctuations in income inequality between 1960 and 1994, but inequality increased sharply between 1994 and 2008 and slowed down afterward.

Table 1 reports summary statistics of the key variables used in the empirical analysis of this study. Most of the variables have a sufficient degree of identifying variations to yield efficient parameter estimates.

5. Empirical Results

The pre-condition for ARDL bounds test is that the underlying variables should be integrated at an order less than two; i.e. I (2) variables are not allowed in this procedure. We have considered three alternative unit root tests to assess the order of integration of the variables: Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Dickey-Fuller Generalized Least Squares (DF-GLS). All these three approaches test the null hypothesis of a unit root against the alternative of stationarity.

5.1 Unit Root Test

Estimated results in Table 2 suggest that all the variables are integrated in order one (i.e. I (1)). Hence, it is confirmed that the ARDL approach, as well as other three estimators (FMOLS, CCR, DOLS) can be applied to analyze the long-run relationship.

5.2 *Cointegration Test*

After investigating time series properties of all variables, we proceed to ARDL bounds test where we have considered two periods lags to conserve the degrees of freedom. Table 3 reports the *F*-statistic for the ARDL bounds tests. The test for the presence of a long-run relationship results in an *F*-statistic of 18.06 for *GINI* and 9.16 for *TOP*. These statistics are greater than the 1% upper bound of 4.63, suggesting that the null of no

Table 2. Results for Unit Root Tests: 1960-2015

	Augmented Dickey Fuller (ADF)		Phillips-Perron (PP)		Dickey Fuller Generalized Least Squares (DF-GLS)	
	Levels	*1st-differenced*	*Levels*	*1st-differenced*	*Levels*	*1st-differenced*
$lnGDPC_t$	−2.71	−5.89***	−2.68	−5.82***	−0.60	−5.84***
$lnGINI_t$	−2.77	−4.07**	−1.99	−6.57***	−2.44	−4.13***
$lnTOP_t$	−2.36	−4.55**	−1.61	−4.56***	−1.98	−4.18***
$lnFD_t$	−2.59	−6.17***	−2.08	−6.07***	−1.58	−6.06***
$lnSCH_t$	−1.21	−3.75**	−1.49	−3.80**	−2.46	−3.49**
$lnOP_t$	−1.74	−6.83***	−1.85	−6.92***	−1.78	−6.92***
$lnGOV_t$	−2.43	−5.32***	−2.41	−5.35***	−2.37	−4.75***

Notes: For ADF and DF-GLS, Schwarz Information Criterion (SIC) is used to select the lag length and the maximum number of lags is set at ten. For PP, Barlett-Kernel is used as the spectral estimation method. The bandwidth is selected using the Newey-West method. The null-hypothesis in the Unit Root test is that the series has a unit root. Asterisk *, ** and *** indicate 10%, 5%, and 1% levels of significance, respectively. See also notes to Table 1.

Table 3. ARDL Bounds Tests: 1960-2015

		$lnGINI_t$	$\ln TOP_t$
F-statistic		18.06	9.16
Diagnostic Checks:	χ^2_{NORMAL}	1.13	0.25
		(0.56)	(0.88)
	χ^2_{SERIAL}	4.12	1.91
		(0.12)	(0.17)
	χ^2_{WHITE}	20.65	18.41
		(0.71)	(0.62)
	χ^2_{ARCH}	0.46	4.96
		(0.49)	(0.17)

Notes: The test statistics in ARDL models are compared against the critical values reported in Pesaran *et al.* (2001). The 10%, 5%, and 1% critical value bounds for the ARDL bounds test are (2.49, 3.38), (2.81, 3.76), and (3.52, 4.63), respectively. χ^2_{NORMAL} refers to the Jarque-Bera statistic of the test for normal residuals, χ^2_{SERIAL} is the Breusch-Godfrey LM test statistic for no first-order serial correlation, $\chi^2 WHITE$ denotes White's test statistic to test for homoskedastic errors, and χ^2_{ARCH} is Engle's test statistic for no autoregressive conditional heteroskedasticity. Figures in parentheses indicate *p*-values. *, **, and *** indicate 10%, 5%, and 1% levels of significance, respectively. See also notes to Table 1.

cointegrated relationship between the variables can be rejected; hence, we can expect a long run relationship between income inequality and economic growth in Japan over the sample period. We have also checked Johansen's co-integration test and found similar evidence of long-run cointegrating relationship between inequality and growth (not reported).

5.3 *Inequality-Growth Nexus*

Table 4 provides long-run estimated results using four alternative estimators. We do not find any consistent short-run estimates, and our focus is on the long-run relationship; hence we have only reported the long run coefficients to conserve space. Income inequality enters the long-run equation significantly at the 5% level for *GINI* and 1% level for *TOP*

Table 4. Long-run Estimates of Inequality-Growth Nexus: 1960–2015

	ARDL		FMOLS		CCR		DOLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$lnGINI_t$	−0.18**		−0.36**		−0.37**		−0.39***	
	(−2.67)		(−2.11)		(−2.16)		(−2.89)	
$lnTOP_t$		−0.26***		−0.53***		−0.54***		−0.49***
		(−3.25)		(−2.87)		(−3.09)		(3.52)
$lnFD_t$	0.11**	0.20***	0.66***	0.56***	0.64***	0.57***	0.27**	0.33**
	(2.61)	(5.96)	(6.92)	(5.26)	(6.29)	(5.27)	(2.19)	(2.10)
$lnSCH_t$	1.98*	1.49*	−0.24	−0.11	−0.17	−0.16	0.49	0.35
	(1.96)	(2.01)	(−0.40)	(−0.21)	(−0.33)	(−0.33)	(1.08)	(0.54)
$lnOP_t$	0.09	0.01	0.02	0.17**	0.02	0.17**	−0.08	0.10
	(0.48)	(0.81)	(0.17)	(2.13)	(0.15)	(2.07)	(−0.39)	(1.51)
$lnGOV_t$	−0.77***	−0.65***	−0.80***	−0.88***	−0.81***	−0.88***	−1.05***	−1.09***
	(−7.15)	(−8.47)	(−3.35)	(−3.78)	(−3.20)	(−3.58)	(−5.20)	(−5.38)
Intercept	0.52*	1.89**	14.59***	14.33***	14.56***	14.40***	15.81***	15.01***
	(1.73)	(2.14)	(8.52)	(10.14)	(8.21)	(10.50)	(12.06)	(13.31)
R^2	0.99	0.99	0.98	0.98	0.98	0.98	0.99	0.99

Notes: The numbers in parentheses are t-values. *, ** and *** denote 10%, 5% and 1% significance levels, respectively. See also notes to Table 1.

with expected negative sign. Specifically, the average long-run elasticity of the real GDP per capita with respect to *GINI* and *TOP* are found to be 0.325 and 0.455, respectively. Therefore, estimated results suggest that a 10% increase in income inequality reduces Japanese growth by 3.25% when inequality is measured by Gini coefficient and by 4.55% when top 1% income shares represent inequality. The negative growth effects of income inequality are more pronounced with respect to *TOP* than they are with respect to *GINI*. Among the control variables, financial development significantly enhances growth; education marginally increases growth, but government consumption expenditures substantially hamper long-run growth in Japan.

A common feature of the large number empirical studies is that growth is regressed directly on measures of income inequality without paying sufficient attention to the possible transmission channels. Prior studies have considered investment, fertility, education, fiscal policy, and socio-political instability as potential transmission channels of income inequality; however almost all of them are done in isolation for cross-country studies, and the results are mixed. Therefore, we investigate all these five inequality channels in the following section. Exploring several potential transmission channels in a single study enables a wide-ranging macroeconomic analysis of the effects of income inequality on Japanese economic growth.

5.4 *Transmission Channels of Income Inequality*

Table 5 presents long-run estimates of five major transmission channels of income inequality using the DOLS estimator. Empirical results are consistent in other three estimators, such as ARDL, FMOLS, and CCR, however those results are not reported to conserve space. We have preferred DOLS approach because it does not only provide asymptotically efficient estimates of cointegrating vector but also corrects for potential endogeneity biases.

Investment Channel. Inequality can affect investment via savings and credit market imperfections. Classical economics theory predicts that a rise in inequality will tend to increase investment because the rich save more and higher savings translate into higher investment（Keynes, 1920; Kaldor, 1957）. A contrasting argument is that investment will be adversely affected by inequality in the presence of credit market imperfections and fixed costs associated with investment（Galor and Zeira, 1993）. Columns（1）&（2）of Table 5 show a long-run significant negative impact of income inequality on investment rate in Japan. More specifically, a 10% increase in income inequality tends to reduce investment in Japan by 2.5%, on average.

Fertility Channel. Inequality can adversely affect growth by increasing the fertility rate. Perotti（1996）argues that countries with more equal income distribution experience lower fertility rates and higher investment rates in schooling and thereby faster growth. De La Croix and Doepke（2003）argue that fertility and education decisions are interdependent: poorer parents tend to have more children and invest less in education. Therefore, countries with higher income inequality will experience a higher fertility differential, lower average education, and consequently lower economic growth（De La Croix and Doepke, 2003）. Columns（3）&（4）of Table 5 do not exhibit any significant impact of income inequality on fertility in Japan.

Schooling Channel. Inequality can affect both the quantity and quality of education, with children from more affluent families more likely to receive additional schooling. This is driven by credit market imperfections and fixed costs associated with investment in education: inequality deters the financially constrained poor from investing in schooling because they are unable to cover education costs（Becker, 1960; Galor and Zeira, 1993）. Additionally, inequality may result in under-investment in schooling if the interest rate for borrowers is significantly higher than that for lenders（Galor and Zeira, 1993）. Lenders generally accept physical capital rather than human capital as collateral against their potential lending. Therefore, in the presence of borrowing constraints, the adverse effect of income inequality will be more prominent on human capital than physical capital（Deininger and Squire, 1998）. Columns（5）&（6）of Table 5 show a long-run significant negative effect of income inequality on educational attainment in Japan. More specifically, a 10% increase in income inequality tends to decrease educational attainment in Japan by 1.2%, on average.

Fiscal Policy Channel. The effect of inequality on government deficits and debt levels depends on the relative political power of various interest groups: the poor will demand redistribution that often results in distortionary taxes whilst the rich will demand fewer

Table 5. Channels of Inequality-Growth Nexus: 1960–2015

	$lnINV_t$		$lnFERT_t$		$lnSCH_t$		$lnREDS_t$		$lnPROP_t$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$lnGINI_t$	−0.19**		−0.35		−0.13***		1.83***		−0.54***	
	(−2.34)		(−1.45)		(−3.03)		(3.03)		(−2.79)	
$lnTOP_t$		−0.31***		−0.58		−0.11**		2.28***		−0.77***
		(−3.24)		(−1.51)		(−2.23)		(4.55)		(−5.89)
$lnFD_t$	0.08	0.11	0.38	0.09	0.02	0.06	0.35	−0.29	−1.20***	−0.61***
	(0.68)	(1.01)	(1.18)	(0.46)	(0.30)	(0.85)	(0.49)	(−0.62)	(−3.44)	(−3.32)
$lnSCH_t$	−0.52	−0.55	−3.60**	−3.40*			−0.07	−0.36	0.86	−1.17
	(−1.41)	(−1.57)	(−2.25)	(−1.79)			(−0.02)	(−0.16)	(0.78)	(−1.26)
$lnOP_t$	−0.12*	−0.01	0.22	0.18	0.02	0.04	0.23	−0.99***	−0.74***	−0.35***
	(−1.79)	(−0.17)	(1.58)	(1.28)	(0.58)	(1.07)	(0.57)	(−2.89)	(−3.58)	(−3.40)
$lnGOV_t$	−0.68***	−0.69***	0.97	0.79	0.42***	0.43***	−0.35	1.01	−0.79	0.23
	(3.53)	(3.80)	(0.89)	(0.60)	(7.89)	(6.20)	(−0.19)	(0.92)	(−1.23)	(0.39)
$lnGDPC_t$	0.19*	0.16*	0.52	0.08	0.18***	0.15**	−0.79	−0.28	−0.05	0.27
	(1.91)	(1.71)	(0.56)	(0.09)	(2.83)	(2.30)	(−0.90)	(−0.45)	(−0.12)	(0.85)
$lnMORT_t$			−0.10	−0.44						
			(−0.18)	(−0.93)						
$lnFERT_t$					−0.42***	−0.36***				
					(−6.15)	(−4.70)				
Intercept	4.20***	4.25***	−2.99	−2.99	−1.16**	−1.26**	6.45	5.36	7.73***	5.74***
	(4.62)	(4.98)	(−0.19)	(−0.19)	(2.38)	(2.31)	(0.81)	(0.96)	(3.05)	(2.89)
R^2	0.95	0.96	0.97	0.97	0.99	0.99	0.86	0.78	0.93	0.95

Notes: Results are based on DOLS using one lag and one lead in the estimations. *FERT, MORT,* and *PROP* indicate fertility rates, mortality rates, and security of property rights, respectively. The numbers in parentheses are t-values. *, ** and *** denote 10%, 5% and 1% significance levels, respectively. See also notes to Table 1.

redistributive taxes. While this effect can arise also in autocratic regimes, it is arguably more likely to arise in democracies. Greater inequality in income and wealth in a democratic society may result in higher taxation and redistributive economic policies that decrease investment and subsequently economic growth (Alesina and Rodrik, 1994; Persson and Tabellini, 1994). Progressive taxation and fiscal redistribution create a general disincentive to work and invest, hence the rich will lobby against the implementation of efficient redistribution policies (Benabou, 2002; Acemoglu and Robinson, 2008). Columns (7) & (8) of Table 5 confirm a long-run significant positive effect of income inequality on relative redistribution in Japan. A 10% increase in income inequality may increase relative redistribution in Japan by 20%, on average.

Socio-political Instability Channel. Inequality may increase social discontent and socio-political instability which may, in turn, increase the uncertainty in the politico-economic environment and reduce investment and growth (Alesina and Perotti, 1996). Increasing polarization may cause a deterioration in the security of property rights and contractual rights which may slow down the growth process (Keefer and Knack, 2002). A highly unequal income distribution may create strong incentives for organized individuals to pursue their interests outside the normal market activities and thus individuals in more unequal societies are prone to engage in rent-seeking activities or other socio-political instability manifestations, for example, violent protests, assassinations, and coups that create uncertainty and hamper growth (Gupta, 1990; Alesina and Perotti, 1996). Columns (9) & (10) of Table 5 demonstrate a long-run significant negative effect of income inequality on security of property rights in Japan. More precisely, a 10% increase in income inequality may reduce property rights protection in Japan by 6.5%, on average. Overall, income inequality adversely affects economic growth in Japan by increasing redistribution and decreasing investment, educational attainment, and property rights.

6. Conclusion

Japan has long been regarded as an equal society, however, like other advanced economies, it's income inequality has started rising since the 1980s. Despite the growing concern over the increasing inequality in Japan, few studies have attempted to assess the impact of inequality on growth as well as the potential channels through which inequality influences Japanese growth. Using time series data over the period 1960–2015, this paper empirically examines the effects of income inequality on economic growth in Japan. It also investigates to what extent income inequality transmits to economic growth through investment, fertility, education, fiscal policy, and socio-political instability channels. Income inequality is measured by the Gini coefficient and the top 1 percent income shares to capture general as well as top income inequality, respectively. A common feature of most of the studies is that economic growth is regressed directly on measures of income inequality without paying sufficient attention to the possible transmission channels. Yet from a policy perspective, the key challenge is to identify and target the appropriate underlying channels through which income inequality affects growth.

Using four alternative estimators, such as ARDL, FMOLS, CCR, and DOLS techniques, the empirical results show a significant long-run relationship between the real GDP per capita and income inequality along with other growth determinants. The results also reveal that income inequality consistently and significantly hampers Japanese growth. Further analysis suggests that income inequality adversely affects growth by increasing redistribution and reducing physical investment, human capital accumulation, and protection in property rights. However, inequality does not affect fertility in Japan. These results are robust to alternative measures of income inequality, inclusion of a number of control variables, and alternative model specifications.

Our results have important policy implications for the Japanese economy. First, rising income inequality substantially hinders economic growth in Japan, hence supporting policy measures to reduce inequality are likely to improve Japanese economic prosperity. Second, higher inequality significantly raises relative redistribution which may exert excess pressure on the Japanese national exchequer. Democratic society tends to increase tax and fiscal redistribution to counter inequality; however, the rich lobby against progressive taxation, hence government may increase debt to implement its re-distributive policy which in turn may transfer fiscal burden onto future generations. The Japanese government has already increased its fiscal spending on social security for the elderly along with population aging; hence redistribution resulting from higher inequality may increase substantial debt burden in Japan. Third, greater income inequality significantly hampers accumulation of physical capital, human capital and security of property rights, which are considered as the major factors for sustainable economic development in Japan. Finally, higher income inequality increases the population of lower income groups, which may generate social tensions and result in violent offenses and suicidal tendency in Japanese society.

Notes:

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2) A series of empirical studies find either significantly positive (Forbes, 2000; Partridge, 2005; Frank, 2009), significantly negative (Alesina and Rodrik, 1994; Persson and Tabellini, 1994; Deininger and Squire, 1998; Easterly, 2007), insignificant or inconclusive (Quah, 2001; Panizza, 2002), or even non-linear relationships between inequality and economic growth (Banerjee and Duflo, 2003). See, Neves and Silva (2014) for an excellent review of the literature on inequality and growth.

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