Inequality and Growth: Nonlinear Evidence from Heterogeneous Panel Data

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I. Introduction

Income inequality has been a major concern in development and welfare economics for more than a century. Kuznets (1955) suggests an influential hypothesis that income inequality should follow an inverse-U shape along the development process. Since then, assessing the relationship between economic growth and income inequality has long been an active topic. However, the effects of income inequality on economic growth are still controversial that requires both theoretical and empirical dedication (Aghion *et al.* (1999), Benabou (1996b), Barro (2000)).

First, Kuznets (1955) and Kaldor (1957) argue that there is a trade-off be-

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tween reducing income inequality and promoting economic growth. Individual saving rates increase with the level of income. A redistribution of resources from the rich to the poor tends to diminish an aggregate rate of saving in an economy. In this case, a higher level of income inequality would enhance economic growth at least in a transitional sense. In recent studies, Saint-Paul and Verdier (1993), Benabou (1996a), and Galor and Tsiddon (1997a, 1997b) find that income inequality will increase economic growth via human capital strengthening and externality.

Contrary to the argument that supports the positive effects of income inequality, Alesina and Rodrik (1994) and Persson and Tabellini (1994) argue that income inequality could encourage the redistribution through elections, in which redistribution policy could restrict economic growth by reducing an incentive to invest.

These two arguments have been formally tested in many previous studies, but the results are somewhat incoherent. In the early 1990s, the negative relationship between income inequality and economic growth was proven in Alesina and Rodrik (1994) and Persson and Tabellini (1994), which was before the important data collection of Deininger and Squire (1996, 1998).[1] Their data set has a panel structure with several consecutive measures of income inequality for each country. Researchers are able to overcome some biases from country-specific error terms and measurement errors by using a panel data set. For example, Forbes (2000) uses a fixed effects estimation, and provides some interesting findings; in the medium and short-run, an increase in the level of income inequality in a

1 See Benabou (1996) and Perroti (1997) for summary of previous studies based on cross-sectional ordinary least squares (OLS) analyses.

country exhibits a positive and significant relationship with subsequent economic growth rates.[2] In contrast, Barro (2000) uses a three-stage least squares (3SLS) estimator which treats the country-specific error term as a random variable. The results find no relationship between income inequality and economic growth. However, he divides his sample into poor and rich countries, and finds a negative relationship between income inequality and economic growth in a sample of poor countries, but a positive relationship in a sample of rich countries.

Banerjee and Duflo (2003) argue that the lack of consistency in the results is due to the fact that empirical studies estimate a linear model, whereas the true relationship is not linear; the growth rate is an inverted U-shaped function of net changes in income inequality. They further show how this nonlinearity can explain different findings in previous studies. In regard to the nonlinear relationship between income inequality and economic growth, Lin *et al.* (2009) employ Caner and Hansen (2004)'s instrumental variables threshold regressions approach, and suggest that the effects of income inequality on economic growth are negative and remain strongly significant below the threshold level of development. Above the threshold, the effects of income inequality become highly positive.

This paper explores nonlinear impacts of income inequality on economic growth using a panel smooth transition regression (PSTR) model. Our study is in line with Lin *et al.* (2009) in a sense that we also estimate the threshold endogenously in the income inequality-economic growth relationship. Contrary to Lin *et al.* (2009), we control the potential endogeneity problem by employing the panel data structure instead of the cross-sectional data structure, and using lagged explanatory variables as in Forbes (2000). Another distinctive feature is the use of

2 See Castello-Climent (2010).

the 'Standardized World Income Inequality Database (SWIID)'.[3] By using a custom missing-data algorithm, SWIID overcomes the limitations of existing inequality data sets, it thus provides greater coverage across countries and over time. Then we use imputed Gini coefficients for 77 countries in our sample, and for the period 1980-2007.[4]

Our results suggest that while income inequality hinders economic growth in most of the countries, it accelerates economic growth only in a country where the level of income inequality is very low. The point above which the estimated time-varying coefficient turns from positive to negative is found to be the Gini index of 24.5. Furthermore, the results reveal that the negative effects of income inequality on economic growth tend to be more severe in developing countries whose inequality is relatively higher.

The rest of the paper is structured as follows. Section 2 introduces the PSTR model. Section 3 describes the data used in this study, and presents the empirical results estimated from the PSTR model. Section 4 supplements the results from the nonlinear model with those of the linear model, considering additional explanatory variables, the possible endogeneity problem, and the Granger causality test. Section 5 concludes.

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3 See Solt (2009) for more details regarding SWIID.

4 Similarly, Herzer and Vollmer (2012) use the generated Gini coefficients from the Estimated Household Income Inequality (EHHI) data set which is constructed by Galbraith and Kum (2005). By use of the EHII data set, they can employ a panel cointegration estimation which requires long time series data.

II. The Panel Smooth Transition Regression Model

We use the PSTR model with fixed effects, first developed by González *et al.* (2005). The PSTR model is a generalization of the panel threshold regression (PTR) model introduced by Hansen (1999). The model allows the regression coefficients to move smoothly between the two extreme regimes. To control for the potential endogeneity problem between income inequality and economic growth, we use the lagged explanatory variables as in Forbes (2000). The PSTR model with two regimes is given by

$$\Delta y_{it} = \mu_i + \beta_{01} g_{i,t-1} + \delta_{01} y_{i,t-1} + \left[\beta_{11} g_{i,t-1} + \delta_{11} y_{i,t-1}\right] G(z_{it}; \gamma, c) + \varepsilon_{it}, \quad (1)$$

for $i = 1, \dots, N$, and $t = 1, \dots, T$, where N is the cross section dimension, and T is time dimension of the heterogeneous panel data set, respectively.[5] μ_i is the fixed effect; and the error term ε_{it} is independently and identically distributed. y_{it} is log real per capita GDP, Δy_{it} is real per capita GDP growth rate, and g_{it} is the log of the Gini index. Following Granger and Teräsvirta (1993) and Teräsvirta (1994), the transition function is selected as the following logistic function

$$G(z_{it}; \gamma, c) = (1 + \exp(-\gamma(z_{it} - c)))^{-1} \text{ with } \gamma > 0, \quad (2)$$

[5] The data set is an unbalanced panel.

where z_{it} is the transition variable, γ is a slope parameter, and c is a location parameter. The logistic function is bounded between the values of zero and unity, as regards the transition variable z_{it} for individual i at time t. The two values of the transition variable z_{it} and slope parameter γ determine the speed of convergence between the lower and upper regimes.[6] The location parameter c can be regarded as the threshold between the two regimes which corresponds to $G(z_{it};\gamma,c)=0$ and $G(z_{it};\gamma,c)=1$ since the logistic function moves monotonically from 0 to 1 as the transition variable (z_{it}) increases, while $G(c;\gamma,c)=0.5$. To estimate the parameter coefficients in the PSTR model, we first eliminate the fixed individual effects μ_i in Equation (1) by getting rid of individual specific means. Next, we implement the nonlinear least squares (NLS) estimation using the transformed data.[7]

6 Higher values of the slope parameter γ imply faster transitions.

7 As explained in González *et al.* (2005), eliminating fixed effects using the within transformation is standard in linear panel data models, however, nonlinear panel data models such as the PSTR model require more steps to take. Please see pages 7-8 of González *et al.* (2005) for more details.

III. Results from the PSTR Model

1. Data

In this paper we use a panel data set of 77 countries for the period 1980-2007 to analyze the relationship between economic growth and income inequality. The data set comprises annual measures on all countries. The data on real GDP and population are collected from the Penn World Table (PWT80).[8] Human capital index and openness (defined as the proportion of the sum of exports and imports of goods and services in GDP) also comes from PWT80.

The Gini coefficients are collected and generated by the 'Standardized World Income Inequality Database (SWIID)'. The Gini coefficients used in this paper are based on post-tax incomes. To overcome the missing data on the Gini coefficients, the Gini coefficients have been imputed in the database, referring to the Luxemburg Income Survey (LIS) and Dennis and Squire's World Bank data sets.

The average value of the Gini index for each country is represented in the Appendix. The most prominent feature of the data is that while the Gini index is relatively low in most of advanced economies, it is generally high in developing economies such as Asia and Latin America. The average Gini index of advanced economies is 30.0, but the figure for emerging markets and developing economies

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8 See Feenstra, Inklaar, and Timmer (2013) for further details about PWT80. After the version 8.0, the Penn World Table has been maintained by Feenstra, Inklaar, and Timmer (2013) instead of Heston and Summers.

is 41.5. Second, the data show that the level of inequality has been deteriorated for most of the regions when it is divided into two sub-periods: first half (1981-1993) and second half (1994-2007). In the first half period, the Gini index in advanced economies is 29.0, but it increases to 31.1 in the second half period. Likewise, the Gini index in developing economies is 40.2 in the first half period, then it rises to 42.7 in the second half period.

2. Results from the PSTR Model

To examine the hypothesis that the effects of income inequality on economic growth have changed as the level of inequality changes, we use the PSTR model where the transition variable is the one-year lagged Gini index. First of all, we test the linear specification of the one-year lagged Gini index against the nonlinear specification with some threshold effects. If the null hypothesis of linearity can be rejected, we then consider the PSTR model to capture all the nonlinear nature. In Table 1, we report the test result for the linearity. For the transition variable chosen, we implement the likelihood ratio (*LR*) test, and report the test statistic. The test for linearity rejects the null hypothesis that the model under consideration is linear, thus we need to use the PSTR model to take into account nonlinearity in the model. This also indicates that the one-year lagged Gini index $(g_{i,t-1})$ is suitable for the transition variable.

In Table 1, we report the parameter coefficients estimated from the PSTR model. The estimated transition parameter γ appears to be small, and this implies that the transition function cannot be reduced to that of the PTR model. The estimated threshold value c of regime switching depending on the one-year lagged Gini index is found to be 38.9. Figure 1 plots the estimated transition

Table 1. Estimation Results from the PSTR Model

$$\Delta y_{it} = \mu_i + \beta_{01} g_{i,t-1} + \delta_{01} y_{i,t-1} + [\beta_{11} g_{i,t-1} + \delta_{11} y_{i,t-1}] G(z_{it}; \gamma, c) + \epsilon_{it},$$

where $G(z_{it}; \gamma, c) = (1 + \exp(-\gamma(z_{it} - c)))^{-1}$, and $z_{it} = g_{i,t-1}$

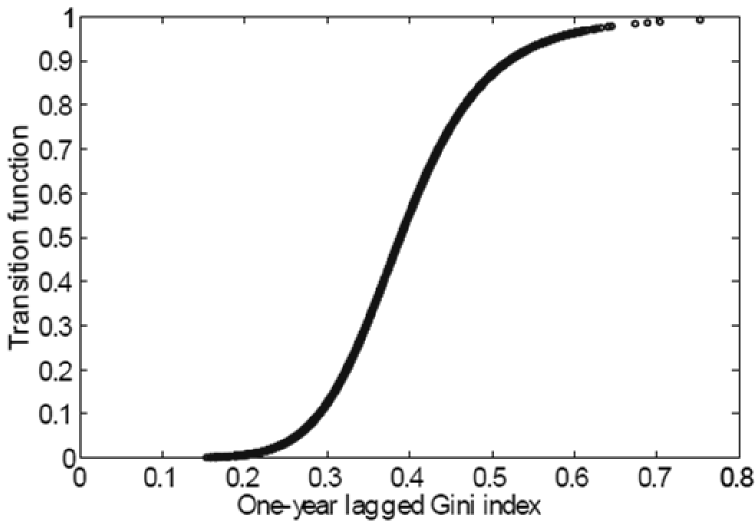
Parameter Estimates			
Linear Part		Nonlinear Part	
β_{01}	0.075*	β_{11}	-0.098***
	(0.042)		(0.026)
δ_{01}	-0.076***	δ_{11}	0.044***
	(0.015)		(0.014)
Transition Parameters		Test Statistic And P-Value	
γ	7.540	*LR*	21.424
	(0.537)		(0.000)
c	3.661		
	(0.013)		
AIC	-5.260		
BIC	-5.243		
Number of obs.	2079		

Notes: *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors adjusted for heteroskedasticity are reported in parentheses below the corresponding parameters. The likelihood ratio *(LR)* test result of linearity using the log of the Gini index in the previous period ($g_{i,t-1}$) as a transition variable is reported. H_0:Linear model is tested against H_1: PSTR model with at least one transition variable.

function against the transition variable which is the lagged Gini index. The shape of the transition function clearly indicates that the regime switching is smooth from one regime to another.

We are primarily interested in the time-varying coefficient estimate on income inequality in the functional specifications. Based on the nonlinear nature in the model, the structural coefficients are made up of the following two: linear and nonlinear components. The parameter coefficient of the one-year lagged Gini

Figure 1. Estimated Transition Function Against The Transition Variable



Note: The plot depicts the values of $\widehat{G}\,(z_{it};\gamma,c)$ against the one-year lagged Gini index after taking antilog. Each circle denotes one single observation.

index obtained from the PSTR model changing over time is given by

$$\beta_{it} = \frac{\partial \Delta y_{it}}{\partial g_{i,t-1}} = \beta_{01} + \beta_{11} G\left(g_{i,t-1};\gamma,c\right) + \beta_{11} g_{i,t-1} \frac{\partial G\left(g_{i,t-1};\gamma,c\right)}{\partial g_{i,t-1}}, \tag{3}$$

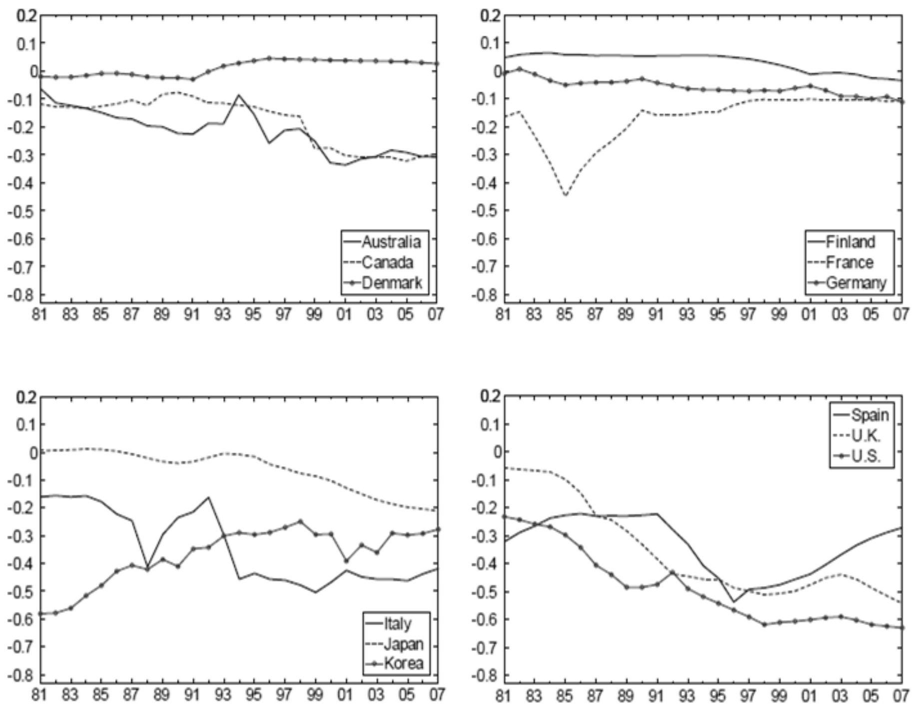
where β_{01} is the parameter estimate from the linear component of the PSTR model and β_{11} the parameter estimate from the nonlinear component.[9]

Figure 2 depicts time-varying coefficients of the lagged Gini index for selected 28 countries. Most of all, the coefficients turn from positive to negative as the

[9] We focus primarily on the direct effect of income inequality on economic growth by isolating the effect of real per capita GDP in Equation (3).

Figure 2. Time-varying Coefficient Parameters for Income Inequality Estimated from the PSTR Model

(a) Advanced countries

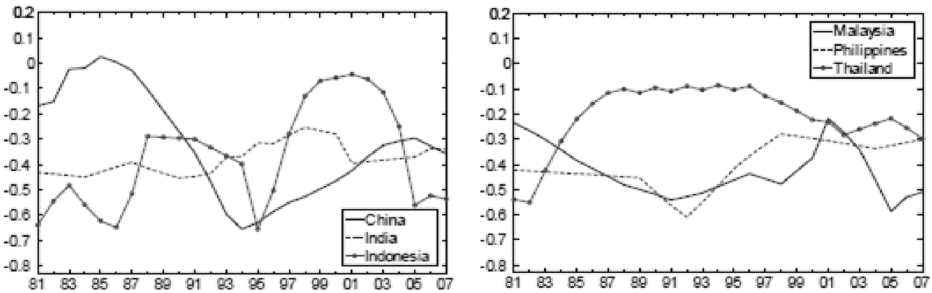


Gini index rises, and the turning point of Gini index is found to be 24.5. That is, an increase in income inequality spurs economic growth when the inequality level is very low, while it deters economic growth when the Gini index is greater than the turning point of 24.5. In 2007, only three (Mauritius, Denmark, and Norway) out of 77 countries in our sample exhibited the Gini index below 24.5. This implies that most of countries are currently in the stage where the deterioration of

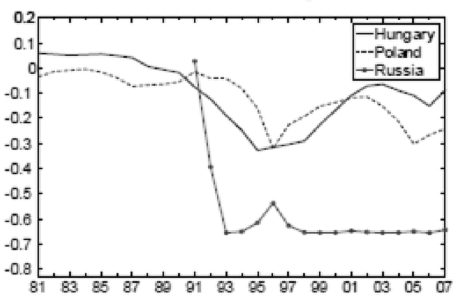
Figure 2. Time-varying Coefficient Parameters for Income Inequality Estimated from the PSTR Model (cont'd)

(b) Developing countries

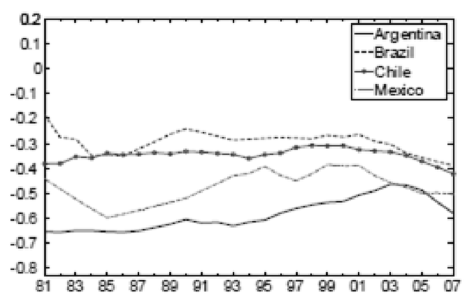
(1) Asia



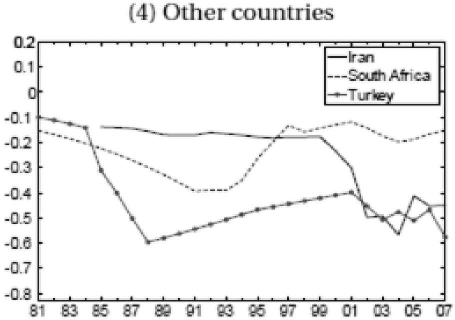
(2) Eastern Europe



(3) Latin America



(4) Other countries



income inequality hinders economic growth. In general, most of Western European countries have relatively greater and consistent coefficients compared to other advanced and developing countries, since they have relative lower and consistent level of income inequality. For example, the estimated time-varying coefficient for Denmark is very close to zero throughout our sample period, and ends with a still small but positive coefficient, indicating that income inequality is not a serious problem in Denmark in terms of economic growth. On the contrary, Latin American countries have relatively and consistently smaller coefficients, in which further aggravation of income equality would seriously hamper economic growth in those countries.

IV. Supplementary Linear Panel Estimations

1. Linear Dynamic Panel Estimations

In this section, we examine the robustness of the results using the linear dynamic panel data (DPD) estimation method, and compare the results with those obtained from the PSTR model. The DPD estimation method cannot generate the time-varying coefficients in nature, but it may include as many covariates as possible, and control for the potential endogeneity problem in a more systemic way than just lagging the explanatory variables. We consider a linear model which is comparable to the nonlinear model as in Equation (1):

$$\Delta y_{it} = \beta g_{i,t-1} + \delta \log y_{i,t-1} + X_{i,t-1}B + \mu_i + \eta_t + \varepsilon_{i,t} \tag{4}$$

where $y_{i,t}$ is log real per capita GDP of country *i* at time *t*, Δy_{it} is real per capita GDP growth rate, $g_{i,t}$ is the log of the Gini coefficient of country *i* at time *t*, and $X_{i,t}$ is a vector that contains other relevant covariates. Then, we can rewrite Equation (4):

$$\log y_{i,t} = \beta g_{i,t-1} + \tilde{\delta} \log y_{i,t-1} + X_{i,t-1}B + \mu_i + \eta_t + \varepsilon_{i,t} \tag{5}$$

where $\tilde{\delta} = 1 + \delta$. We estimate Equation (5) using the fixed effects (FE) estimation and Arellano and Bond's GMM estimation methods. The estimation results are summarized in Table 2. Table 2A presents the estimates for the entire sample

Table 2. Estimations Results from Dynamic Linear Panel Models

A. Entire Sample Period (1981-2007)						
	Fixed Effects			Arellano and Bond		
Inequality	0.013	0.006	0.005	0.004	-0.070***	-0.073***
	(0.016)	(0.014)	(0.014)	(0.022)	(0.021)	(0.021)
Human Capital		0.125***	0.119***		0.250***	0.232***
		(0.011)	(0.011)		(0.013)	(0.015)
Openness			0.008*			0.024***
			(0.004)			(0.009)
Countries	77	77	77	77	77	77
B. First-half of Sample Period (1981-1993)						
	Fixed Effects			Arellano and Bond		
Inequality	-0.031	0.000	-0.010	-0.016	-0.055	-0.062
	(0.029)	(0.026)	(0.026)	(0.059)	(0.052)	(0.052)
Human Capital		0.161***	0.162***		0.166***	0.163***
		(0.025)	(0.024)		(0.037)	(0.038)
Openness			0.063***			0.040
			(0.017)			(0.030)
Countries	71	71	71	71	71	71
C. Second-half of Sample Period (1994-2007)						
	Fixed Effects			Arellano and Bond		
Inequality	-0.171***	-0.110***	-0.109***	-0.339***	-0.270***	-0.263***
	(0.028)	(0.028)	(0.028)	(0.046)	(0.045)	(0.045)
Human Capital		0.163***	0.160***		0.185***	0.108***
		(0.024)	(0.025)		(0.031)	(0.034)
Openness			0.003			0.073***
			(0.007)			(0.014)
Countries	77	77	77	77	77	77

Note: Dependent variable is per capital income growth rate. Standard errors are in parentheses. ***,**, and * indicates significance at 1%, 5%, and 10% level, respectively.

period. While the FE estimation method provides no significant effects of income inequality on economic growth, controlling the potential endogeneity problem by the GMM estimation method generates significant effects. It appears that a 1 percent increase in the Gini coefficient causes an approximately 0.1 percent decrease in the economic growth rate.

Table 2B and 2C report the results for the two sub-periods: i) 1981-1993 and ii) 1994-2007. We divide our sample period into the first half and second half periods to check the robustness. As expected, the coefficients of income inequality are insignificant and small in the first half period, while they become significant and greater in the second half period. Since the inequality level measured by the Gini index is worsening in general (see the Table in Appendix), the results from the PSTR model are very consistent with those from the linear model even after controlling for additional relevant explanatory variables and the potential endogeneity problem.

2. Panel Granger Causality Test

The extensive time period allows us to test for Granger causality between economic growth and income inequality. However, our analysis uses a panel data set, different from single-country time series studies in which a test of Granger causality has been well defined. In a panel data structure, Granger causality is difficult to define because the null and alternative hypotheses are not distinctive as coefficients might not be homogeneous in a model using panel data. Considering the ambiguous distinction between the null and alternative hypotheses, Dumitrescu and Hurlin (2012) develop a method to test for Granger causality in heterogeneous panels. They assume that coefficients vary across countries, but are fixed along the time. Following Dumitrescu and Hurlin (2012), we test Granger causality of inequality measures on economic growth.

For each country *i*, we consider a vector autoregressive model with *K* lags:

$$\Delta y_{it} = \alpha_i + \sum_{k=1}^{K} \beta_{i,k} g_{i,t-k} + \varepsilon_{i,t} \tag{6}$$

The null hypothesis of the homogeneous non-causality is defined as:

$$H_0: \beta_{i,1} = \cdots = \beta_{i,K} = 0 \quad \forall i = 1, \cdots, N$$

The alternative hypothesis is defined as:

$$H_1: at\ least\ one\ of\ \beta_{i,k} \neq 0 \quad for\ some\ i$$

Note that for a subgroup of countries, there is a Granger causal relationship from inequality measure to economic growth under the alternative hypothesis.

The test statistic is calculated by simply running standard Granger causality regressions for each country *i*. The next step is to take the average of the individual Wald statistics for Granger causality. They are termed as the $\overline{W}$ statistic. Dumitrescu and Hurlin (2012) show that the standardized version of this statistic $\bar{Z}$ follows a standard normal distribution.

Table 3 reports the results from the Granger causality test. For the lags from 1 to 2, the null hypothesis that inequality measures do not homogeneously Granger-cause economic growth, is rejected. This implies that economic growth is affected by income inequality for some countries, and income inequality can be used to forecast economic growth for these countries. For the lag of K=3, the

Table 3. Panel Granger Causality Test

$$\Delta y_{it} = \alpha_i + \sum_{k=1}^{K} \beta_{i,k} g_{i,t-k} + \sum_{k=1}^{K} \gamma_{i,k} y_{i,t-k} + \varepsilon_{i,t}$$

$$H_0: \beta_{i,1} = \cdots = \beta_{i,K} = 0 \quad \forall i = 1, \cdots, N$$

$$H_1: at\ least\ one\ of\ \beta_{i,k} \neq 0 \quad for\ some\ i$$

Lag K	Test Statistics $\bar{W}$	p-value
1	3.173***	0.002
2	4.967***	0.000
3	3.987	0.249

Note: ***,**, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

log of the Gini coefficient does not Granger-cause economic growth. It is worth noting that the notion of Granger causality is not to test the true causality between two variables. It is just a hypothesis test for determining whether one variable can have an explanatory power in forecasting another variable.

V. Conclusion

This paper investigates nonlinear effects of income inequality on economic growth using the PSTR model, and finds that there exists the nonlinear relationship between the two variables. Therefore, the paper sheds light on the history-long debate by taking into account nonlinearity. The previous literature has reported some mixed and confusing results on the relationship since a linear model has been estimated. While some papers report the positive relationship, others report the negative one. However, employing a nonlinear model enables us to reveal some conditions for positive and negative coefficients.

Furthermore, the results suggest that most of world economies are currently facing the risk that GDP growth rates may slow down by further aggravation of income inequality since most of countries exhibit a higher level of income inequality than the threshold level which is endogeneously estimated within the PSTR model. The results are alarming particularly for those countries such as the U.K., the U.S. and China where the level of inequality has been dramatically and persistently worsened. It appears that enhanced income inequality tends to foster economic growth. For many developing countries with a prolonged high level of income inequality, they need to set a dual target: economic growth and reforms in the income distribution system.

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Appendix

Gini Index

Group	Sub-group	Country	1981-1993	1994-2007	1981-2007
Advanced Economies	Euro area	Austria	26.4	26.7	26.6
		Belgium	22.7	26.1	24.5
		Estonia	25.8	34.8	30.5
		Finland	20.6	24.3	22.5
		France	30.3	28.0	29.1
		Germany	26.1	27.4	26.8
		Greece	32.7	33.8	33.3
		Ireland	33.5	31.6	32.5
		Italy	30.5	33.8	32.2
		Netherlands	25.1	25.4	25.2
		Portugal	26.4	35.5	31.1
		Spain	30.8	33.0	31.9
	Euro area		27.6	30.0	28.9
	Other advanced economies	Australia	29.1	31.1	30.1
		Canada	28.0	30.7	29.4
		Denmark	25.1	22.6	23.8
		Hong Kong	42.8	46.3	44.6
		Israel	31.0	34.9	33.0
		Japan	25.0	28.3	26.7
		Korea, Republic of	33.4	31.5	32.4
		New Zealand	28.6	33.3	31.0
		Norway	23.4	23.9	23.7
		Singapore	40.5	42.9	41.7
		Sweden	21.1	23.7	22.4
		Switzerland	31.8	28.0	29.9
		Taiwan	27.0	29.5	28.3
		United Kingdom	30.4	34.5	32.5
		United States	33.0	36.8	34.9
	Other advanced economies		30.0	31.9	31.0
Advanced Economies			29.0	31.0	30.0
Emerging market and developing economies	Central and eastern Europe	Bulgaria	21.8	27.2	24.6
		Hungary	24.4	29.0	26.8
		Latvia	23.5	32.7	28.3
		Lithuania	24.0	32.9	28.6
		Poland	26.1	29.7	28.0
		Turkey	49.0	46.4	47.6
	Central and eastern Europe		28.1	33.0	30.7
Emerging market and	Commonwealth of Independent States	Georgia	28.2	43.3	36.0
		Kazakhstan	24.5	32.8	28.8
		Kyrgyzstan	25.6	36.8	31.4
		Moldova	25.1	39.8	32.7
		Russia	26.3	40.8	33.8

developing economies		Tajikistan	26.6	31.7	29.3
		Ukraine	24.5	31.6	28.2
	Commonwealth of Independent States		25.8	36.7	31.5
	Developing Asia	China	29.6	47.5	38.9
		Fiji	51.6	40.9	46.1
		India	47.7	50.3	49.1
		Indonesia	36.4	55.2	46.2
		Malaysia	47.3	47.6	47.5
		Nepal	40.3	54.7	47.8
		Philippines	46.2	50.6	48.5
		Sri Lanka	41.8	45.9	43.9
		Thailand	58.1	55.2	56.6
	Developing Asia		44.3	49.8	47.2
	Latin America and the Caribbean	Argentina	40.8	44.7	42.8
		Brazil	51.5	50.9	51.2
		Chile	49.8	49.8	49.8
		Colombia	48.6	50.6	49.6
		Costa Rica	42.4	43.4	42.9
		El Salvador	43.4	45.9	44.7
		Guatemala	50.1	50.5	50.3
		Mexico	45.2	47.2	46.2
		Panama	48.2	50.2	49.3
		Peru	54.9	51.8	53.3
		Uruguay	42.2	43.2	42.7
		Venezuela	41.2	41.9	41.6
	Latin America and the Caribbean		46.5	47.5	47.0
	Middle East, North Africa, Afghanistan, and Pakistan	Egypt	34.4	35.7	35.1
		Iran	57.7	50.8	53.7
		Jordan	48.8	45.1	46.9
		Morocco	39.2	38.3	38.7
		Pakistan	35.4	40.8	38.2
		Tunisia	37.5	38.2	37.8
	Middle East, North Africa, Afghanistan, and Pakistan		41.5	41.5	41.5
Emerging market and developing economies	Sub-Saharan Africa	Cote d`Ivoire	41.3	41.0	41.1
		Ethiopia	37.6	35.4	36.5
		Madagascar	43.9	42.3	43.1
		Malawi	59.1	43.9	51.2
		Mauritius	20.3	17.0	18.6
		Nigeria	47.2	45.1	46.1
		Sierra Leone	57.4	45.9	51.5
		South Africa	51.9	57.5	54.8
		Tanzania	41.2	34.3	37.6
		Zambia	56.5	53.2	54.8
	Sub-Saharan Africa		45.6	41.6	43.5
	Emerging market and developing economies		40.2	42.7	41.5