

# Agriculture and Non-Agriculture Growth, Inflation and Income Inequality in Developed and Developing Countries

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## Abstract

The aim of this article is to examine how agriculture and non-agriculture growth and inflation affect income inequality. The multivariate panel data approach is used to examine the application of Kuznets hypothesis between income inequality and agriculture and non-agriculture growth and test the existence of nonlinear relationship between income inequality and inflation rate in a large sample of data collected for developed and developing countries. The Hodrick-Prescott (HP) filter is used to separate the cyclical component from the trend component of inflation rate and agriculture and non-agriculture growth. The results demonstrate a significant negative nonlinear relationship between income inequality and the HP filtered inflation rate squared in developed countries. The findings confirm the application of a 'U-shaped' of Kuznets curve between income inequality and agriculture growth and between income inequality and non-agriculture growth in developed countries. In addition, the results show Kuznets inverted 'U-shaped' curve between agriculture growth and income inequality, and Kuznets 'U-shaped' curve between non-agriculture growth and income inequality in developing countries.

**Keywords:** inflation, income inequality, agriculture and non-agriculture growth, multivariate panel data approach

## 1. Introduction

In the mainstream literature, the study of the relationship between the economic growth, inflation, and the distribution of income is very important and has been devoted considerable attention of research from both academia and organizations. The equitable distribution of income with sustainable economic growth lies at the heart of an enduring issue in political economy and thus concerning some politicians and decision makers. Wright (2017) analyzed the relationship between the public's level of concern for income inequality and support for government intervention by using survey data going back to 1966 and found that support for government intervention do not follow the concern for income inequality (Figure 1). It is believed that the governments are responsible for inefficient fiscal policies that led to higher income inequality and inefficient allocation of resources. Furthermore, the gap between the poor and the rich people has accelerated by implementing an inefficient monetary policy in the countries.

In the economics of well-being, it is very important to increase economic welfare with avoiding income inequality which needs to increase economic growth and control surges in inflation or deflation. Kuznets (1955) analyzed the development path of the rich and the poor countries and developed the hypothesis that as an economy develops, income inequality first increases and then it decreases. He investigated the factors such as education, lower inter-sectoral productivity differences, lower return to capital, and political pressure for social transfers. He then looked at factors such as transfers of labor from agriculture to the other sectors specifically manufacturing and found that income inequality rises and reaches to its highest level and then decreases.

Historical data show that the gap between the rich and the poor is widening in all countries, specifically in the advanced countries, and therefore the current upswing in income inequality as the second Kuznets curve in the new age might be driven by the factors such as technological revolution and the transfer of the labor from more homogenous manufacturing into skilled heterogeneous services (Milanovic, 2016).

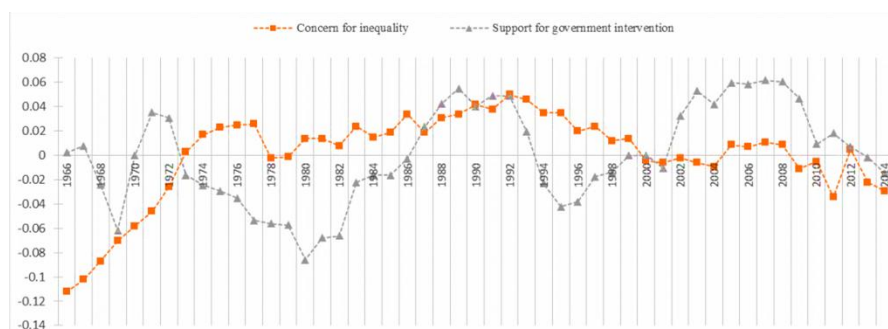


Figure 1. Concern for inequality vs. support for government intervention

Source of Data: Wright (2017).

This article is a contribution to identifying the relationship between income inequality and agriculture and non-agriculture value added *per capita* on one hand, and the relationship between income inequality and inflation on the other hand. The study carried out for data over the 1990-2014 periods in a large sample of developed and developing countries. The author aims to quantify the underlie factors contributing to income inequality in the agriculture and non-agriculture sectors and determine any evidence for the existence of an inverted 'U-Shaped' Kuznets hypothesis between sectors growth and income inequality. The motivation behind of this article is to identify whether income inequality exists in developed and developing countries at their own stage of development. Addressing this question will help us draw practical inference for strategy policy considerations. In addition, this article determines if there is any nonlinear relationship between inflation and income inequality.

The rest of the article is organized as follows. Section 2 reviews the literature. Section 3 describes the data used for the study. Section 4 presents the methods of analysis. The results of regression analysis presented in Section 5, and Section 6 concludes the article.

## 2. Literature Review

There are a few studies on the factor influencing income inequality trying to understand why income inequality has increased in most countries. Some of these studies focus on the monetary policy's effects on income inequality while others analyze the fiscal policy effect. Some of the studies have considered the demographic factors and the others have investigated the effects of globalization and Foreign Direct Investment (FDI) on income inequality. This section reviews some of the related studies.

Adams (2003) investigated the impact of economic growth on poverty and inequality by using a panel data of 50 developing countries. He used two different approaches for economic growth including 1) measures by survey mean income (consumption), and 2) measures by Gross Domestic Product (GDP) *per capita*. The results showed a strong statistical relationship between the survey mean income or consumption and poverty reduction; whereas, no strong relationship between GDP *per capita* and poverty reduction was observed. Furthermore, Adams reported that the elasticity of poverty with respect to the survey mean income as a measure for economic growth accounted about -2.59.

Liu and Sicular (2008) identified the determinants of nonagricultural income and employment and assessed the contribution of these determinants to income inequality in the Chinese economy. The results indicated that education inequality and regional development plays important roles in nonagricultural income inequality. According to their results, education inequality accounts for 9% and 36% of the wage and self-employment income inequality, while the community characteristics accounts for 46% and 32% of the wage and self-employment income inequality.

El Benni et al. (2011) discussed the development of income inequality in the production of Swiss agriculture by valley, hill and mountain regions for the period of 1990 to 2009. The results demonstrated that household income inequality increased in the sample of study. It was reported that the effects of agricultural policy reforms on income inequality were different in the regions. They found that: 1) an increase in direct payment income would decrease the household income inequality, and 2) off-farm income decreases income inequality; while 3) market income increases income inequality.

Khattak et al. (2014) examined the relationship between economic growth, income distribution, and inflation, and examined the existence of Kuznets hypothesis in Pakistan for the period of 1980-2002. They used Johnson's

cointegration analysis and found that income inequality has a positive long-run relationship with economic growth, and inflation. The results confirmed the existence of Kuznets hypothesis in Pakistan. Ali et al. (2014) examined the effects of agriculture and service sector value added, exports and Foreign Direct Investment (FDI) on income inequality in Pakistan. The results showed that all variables, except service sector value added, have negative significant long-run effect on income inequality.

Bouincha and Karim (2018) analyzed the causality relationship between economic growth and inequality by using a panel data of 189 countries for the period of 1990-2015. The results showed that economic growth is not significant in the global model and in the developing countries, but it has statistically negative relationship with inequality in developed countries. The results confirmed the application of Kuznets hypothesis when economic growth is measured by the Human Development Indicator (HDI).

Siامي-Namini and Hudson (2019a) investigated linear and nonlinear impacts of inflation on income inequality and tested the Kuznets hypothesis by using a panel data of 24 developed countries and 66 developing countries for the period of 1990 to 2014. They used the Toda- Yamamoto (1995) and Vector Error Correction Model (VECM) and found a nonlinear relationship between inflation and income inequality. They also confirmed the existence of Kuznets 'U-shaped' and inverted 'U-shaped' hypothesis between income inequality and real GDP *per capita* in developed and developing countries. They did not find bidirectional Granger causality between inflation and income inequality in the short-run, but there was in the long-run for both developed and developing countries.

Siامي-Namini and Hudson (2019b) examined the effects of sector growth and monetary policy on income inequality by using a cross-country panel of 92 developing countries for the period 1990-2014. They found that agricultural and industrial sectors growth have a dominate impact in reducing income inequality. However, service sector growth had positive effect on income inequality in the developing countries. Their results confirmed the existence of Kuznets inverted 'U-shaped' hypothesis for industry sector growth and Kuznets 'U-shaped' hypothesis for service sector growth. They found that service sector growth and inflation affect income inequality in the long run.

Much of the studies and discussion regarding the relationship between economic growth and income inequality is based on Kuznets hypothesis. However, only a few studies have analyzed the nonlinear relationship between income inequality and inflation under the Kuznets hypothesis curve. Furthermore, there is no empirical evidence in analyzing the effects of agriculture and non-agriculture value added *per capita*, and inflation on income inequality and testing the application of Kuznets hypothesis in agriculture and non-agriculture value added *per capita* and at the same time examining the nonlinear relationship between inflation and income inequality is the main contribution of this article to the literature.

### 3. Data

The study and analyses carry out in this article are based on an annual balanced panel data set of 26 developed and 66 developing countries from 1990 to 2014, which have been collected from the World Bank website (Note 1). The author collected 1) the GINI index as a measure of income inequality, 2) real Gross Domestic Product (GDP) *per capita* (constant 2005 US\$), 3) Consumer Price Index (CPI) inflation, 4) urbanization index, 5) real agriculture and real non-agriculture value added *per capita* (constant 2005 US\$), 6) openness to international trade, and 7) unemployment rate.

The Hodrick and Prescott (1981) filter (the HP filter) is used to estimate the anticipated (long-run component) and unanticipated (short-run component) inflation, the HP filter absorbed real GDP and GDP gap (or the cyclical component of real GDP), and decomposes real agriculture and non-agriculture value added *per capita* by long-run and short-run components. Table 1 represents description of the data series.

Table 2 summarizes the descriptive statistics of the time series data collected for developed and developing countries. All the time series data are used in the log form. As reported in Table 2, for developed countries:

- The average of the log of real GDP *per capita* is 9.9223,
- The log of GINI index on average is 3.4573 (or 31.73 percent after taking antilog),
- The log of inflation rate on average is 1.1435 (or 3.138 percent after taking antilog),
- The log of real agriculture value added *per capita* on average is 6.0622,
- The log of real non-agriculture valued added *per capita* on average is 9.8944.

Table 1. Data description

Data	Description
GINI	The GINI indexes
GDP	GDP <i>per capita</i> (constant 2005 US\$)
$\pi$	Inflation rate, consumer price index (annual percent)
$\pi^{hp}$	HP filtered inflation (long-run inflation trend)
$\pi^{gap}$	Inflation gap (short-run inflation or inflation cycles)
AGR	Agriculture, value added <i>per capita</i> (constant 2005 US\$)
$AGR^{hp}$	HP filtered agriculture value added [long-run agriculture value added <i>per capita</i> trend (constant 2005 US\$)]
$AGR^{gap}$	Agriculture value added gap (short-run agriculture value added <i>per capita</i> or agriculture value added <i>per capita</i> cycles)
NAGR	Non- agriculture value added <i>per capita</i> (constant 2005 US\$)
$NAGR^{hp}$	HP filtered non-agriculture value added [long-run non-agriculture value added <i>per capita</i> trend (constant 2005 US\$)]
$NAGR^{gap}$	Non-agriculture value added gap [short-run non-agriculture value added <i>per capita</i> or non-agriculture value added <i>per capita</i> cycles]
OPEN	Openness to international, trade (percent of GDP)
UR	Urbanization index, measured as a percentage of population living in urban areas
UN	Unemployment rate, total (percent of total labor force) (modeled ILO estimate)

On the other hand, for developing countries:

- The log of real GDP *per capita* on average is 7.1677,
- The log of GINI index on average is 3.7299 (or 41.67 percent after taking antilog),
- The log of inflation rate on average is 2.0347 (or 7.65 percent after taking antilog),
- The log of real agriculture value added *per capita* on average is 5.1566,
- The log of real non-agriculture valued added *per capita* on average is 6.9686.

Table 2. Descriptive statistics

Developed Countries						Developing Countries				
Variables	Obs.	Mean	Max	Min	Std. Dev.	Obs.	Mean	Max	Min	Std. Dev.
LGINI	650	3.4573	4.1288	2.9699	0.1795	1650	3.7299	4.3457	2.7869	0.2341
LGDP	650	9.9223	11.1432	7.5988	0.8805	1650	7.1677	9.3833	4.7351	1.0602
<b>Lπ</b>	650	1.1435	7.3132	-4.0739	1.2202	1650	2.0347	8.9202	-3.3440	1.3576
<b>Lπ<sup>hp</sup></b>	650	1.1435	4.2542	-0.4560	0.8143	1650	2.0347	5.7784	-0.2630	0.9202
<b>Lπ<sup>gap</sup></b>	650	3.08E-12	3.8340	-4.7124	0.7931	1650	-3.03E-12	5.4254	-6.1352	0.8548
LAGR	650	6.0622	7.1013	4.8219	0.5238	1650	5.1566	6.5694	3.5544	0.5502
<b>LAGR<sup>hp</sup></b>	650	6.0622	6.9288	4.9772	0.4768	1650	5.1566	6.5469	3.9287	0.5059
<b>LAGR<sup>gap</sup></b>	650	-2.00E-11	0.9370	-0.9447	0.1664	1650	-3.27E-11	0.9794	-0.9618	0.1665
LNAGR	650	9.8944	11.1283	7.4946	0.8987	1650	6.9686	9.3503	3.9368	1.1944
<b>LNAGR<sup>hp</sup></b>	650	9.8945	11.1633	7.4845	0.8408	1650	6.9686	9.3689	4.1506	1.1149
<b>LNAGR<sup>gap</sup></b>	650	-4.62E-12	1.1978	-1.2488	0.2413	1650	2.06E-11	1.8726	-1.9051	0.3244
LOPEN	650	4.3322	5.3125	2.9824	0.4743	1650	4.1751	5.3955	2.3748	0.5137
LUR	650	4.2228	4.5831	3.0594	0.2758	1650	3.7218	4.5555	1.6894	0.5613
LUN	650	2.0746	3.3069	-0.5108	0.5352	1650	1.9285	3.6712	-1.6094	0.8148

#### 4. Method

The author uses a multivariate panel data approach carried out in several steps as follows:

##### 4.1 The Relationship Amongst Income Inequality, Agricultural and Nonagricultural Growth

As a general theory of income distribution, the author examines the application of the Kuznets hypothesis in the first step. Kuznets (1955) indicates that as *per capita* income increases, income inequality increases at first stage (developing or pre-industrial economies) but then, after reaching some turning point income inequality (industrial economies) starts declining (developed or post-industrial economies/service economy). Kuznets debates that the distribution of income becomes more unequal at the early stages of income growth but that the distribution eventually moves back toward greater equality as economic growth continues. This changing in

relationship between *per capita* income and income inequality can be presented by a ‘bell-shaped’ curve or inverted ‘U-shaped’ known as the Kuznets hypothesis (Kuznets, 1955; 1963), which is in harmony with the Lewis dual economy model (Lewis, 1954).

According to the Kuznets’s hypothesis of inverted ‘U-shaped’ in explaining the path of inequality, if agriculture workers all earn a low wage and industry workers earn an identical higher wage, then the transition from agriculture to industry will create an inverted ‘U-shaped’ in inequality. In time, as more of the population moves out of the traditional, rural, agriculture sector into the modern, urban, industry sectors and real wages in industry begin to rise, income inequality decreases (Deutsch and Silber, 2004).

The functional form of the model for investigating the contribution of economic sector growth in income inequality in this study is given by:

$$\ln GINI_{it} = \beta_0 + \beta_1 \ln AGR_{it} + \beta_2 (\ln AGR_{it})^2 + \beta_3 \ln NAGR_{it} + \beta_4 (\ln NAGR_{it})^2 + d \ln X_{it} + \varepsilon_{it} \quad (1)$$

where:

- $\ln GINI_{it}$  is the log of GINI index as a measure of income inequality,
- $\ln AGR_{it}$  is the log of real agriculture value added *per capita*,
- $(\ln AGR_{it})^2$  is the log of real agriculture value added *per capita* squared,
- $\ln NAGR_{it}$  is the log of real nonagricultural value added *per capita*,
- $(\ln NAGR_{it})^2$  is the log of real nonagricultural value added *per capita* squared,
- $\ln X_{it}$  is a set of control variables such as unemployment rate, urbanization, and openness to international trade,
- $\varepsilon_{it}$  is the error term.

The subscript  $i$  and  $t$  denote country and time, respectively. The coefficient  $\beta_1 > 0$  and  $\beta_2 < 0$  and also  $\beta_3 > 0$  and  $\beta_4 < 0$  are regularly predicted in testing intended for the Kuznets inverted ‘U-shaped’ hypothesis for agricultural and nonagricultural sectors, respectively. The coefficient  $\beta_0$  is the intercept term.

#### 4.2 The Nonlinear Relationship Between Income Inequality and Inflation

Following the Amornthum (2004) and Bulir (2001), the author estimates the nonlinearity relationship between inflation and income inequality and test the application of the Kuznets hypothesis in the developed and developing countries. The effect of inflation and real agriculture and non-agriculture value added *per capita* on income inequality is distinguished between the long-run and the short-run. The general form of quadratic function is as

$$\ln GINI_{it} = \delta_0 + \delta_1 \ln AGR_{it} + \delta_2 (\ln AGR_{it})^2 + \delta_3 \ln NAGR_{it} + \delta_4 (\ln NAGR_{it})^2 + \delta_5 \ln \pi_{it} + \delta_6 (\ln \pi_{it})^2 + d \ln X_{it} + \varepsilon_{it} \quad (2)$$

where:

- $\ln GINI_{it}$  is the log of GINI index as a measure of income inequality,
- $\ln AGR_{it}$  is the log of real agricultural value added *per capita*,
- $(\ln AGR_{it})^2$  is the log of real agricultural value added *per capita* squared,
- $\ln NAGR_{it}$  is the log of real nonagricultural value added *per capita*,
- $(\ln NAGR_{it})^2$  is the log of real nonagricultural value added *per capita* squared,
- $\ln \pi_{it}$  is the log of inflation rate,
- $(\ln \pi_{it})^2$  is the log of inflation rate squared,
- $\ln X_{it}$  is the log of control variables such as unemployment rate, urbanization, and openness to international trade,
- $\varepsilon_{it}$  is the error term.

The subscript  $i$  and  $t$  denote country and time, respectively. The coefficient  $\delta_1 > 0$  and  $\delta_2 < 0$  and also  $\delta_3 > 0$  and  $\delta_4 < 0$  are regularly predicted in testing the application of Kuznets inverted ‘U-shaped’ hypothesis (Gallup, 2012). Also, the coefficient  $\delta_5 < 0$  and  $\delta_6 > 0$  are testing the application of nonlinearity relationship between inflation and income distribution. The coefficient  $\delta_0$  is the intercept term.

## 5. Results

This section evaluates the time series data for the purpose of stationary and non-stationary properties. The author applies panel data approach for testing the unit root null hypothesis. The power of the panel unit root test is higher than using a separate unit root test for each individual (country) time series (Levin et al., 2002). A panel data is denoted  $I(0)$  when it is stationary at each level, and  $I(d)$  when it must be different over the times in order to achieve stationarity. The results of panel unit root tests illustrate that some of time series data are stationary (integrated of order zero  $I(0)$  in level), and the other time series data are non-stationary (integrated of order one  $I(1)$  in level). In this article, the non-stationary variables become stationary after taking first difference. The empirical results of a multiple regression analysis fitted for the developed and developing countries' data are given in the two next subsections.

### 5.1 The Estimation Results for Developed Countries

The estimation results of the multivariate panel data regression analysis for the developed countries are presented in Table 3. The author estimated five individual models for the developed countries. As shown in Table 3, the results show a significant negative correlation between income inequality and the aggregated inflation rate in model (1) for the developed countries. Model (2) identifies a non-significant positive link between income inequality and the aggregated inflation rate, and a significant negative nonlinear link between income inequality and the aggregate inflation rate squared. In model (3), the results show a non-significant negative link between income inequality and the HP filtered inflation rate. In model (4), the results show a non-significant negative link between income inequality and the HP filtered inflation rate, and a non-significant negative relationship between income inequality and inflation gap or the cyclical component of inflation rate. In model (5), with the adding of the HP filtered inflation rate squared, the results show a significant positive linear relationship between income inequality and the HP filtered inflation rate, a significant negative nonlinear relationship between income inequality and the HP filtered inflation rate squared, and a non-significant negative link between income inequality and inflation gap in developed countries. As shown in Table 3, the  $R^2$  coefficient of determination are almost the same in all five estimated models for developed countries.

The author identifies a significant nonlinear link between real agriculture value added *per capita* and income inequality in all five models. However, the results are not consistent with the existence of an inverted 'U-shaped' of Kuznets curve between income inequality and real agriculture value added *per capita*. The results confirm the application of a 'U-shaped' of Kuznets curve between income inequality and the agriculture value added *per capita* for the developed countries. In all five estimated models, the coefficient of agriculture gap or the cyclical component of real agriculture value added *per capita* is positive, but it is not significant at 5 percent significance level. The same results are found for real non-agriculture value added *per capita* in all five models, which confirms the existence of a 'U-shaped' curve between non-agriculture value added *per capita* and income inequality. The coefficient of non-agriculture gap or the cyclical component of real non-agriculture value added *per capita* is a positive correlation statistically significant at 5 percent significance level in model (1), (3), and (4). The results show a significant positive pro-cyclical link between non-agriculture gap and income inequality in all five estimated models in developed countries.

The other control variables are significant at 5 percent significance level in all five models. The findings show a significant positive relationship between unemployment rate and income inequality as expected. The results show a significant negative link between openness to trade and income inequality, and a significant negative relationship between urbanization index and income inequality in all five models for developed countries (Siami-Namini & Hudson, 2019a and 2019b; Siami-Namini, 2019; Shirvani et al., 2019; Shirvani & Volchenkov, 2019; Siami-Namini et al., 2018; Siami-Namini, 2017; Khalessi & Siami-Namini, 2004).

### 5.2 The Estimation Results for Developing Countries

The estimation results of the multivariate panel data regression analysis for the developing countries are presented in Table 3. The author estimated five separate models simultaneously for the developing countries. As shown in Table 3, the results show a significant negative correlation between income inequality and the aggregate inflation rate in model (1). In model (2), the author identifies a non-significant negative link between income inequality and the aggregate inflation rate and a significant negative link between income inequality and the aggregate inflation rate squared at 10 percent significance level. The results also show a negative significant link between income inequality and the HP filtered inflation rate in model (3). The results show a non-significant negative link between income inequality and inflation gap or the cyclical component of inflation rate in model (4). In model (5), with the adding of the HP filtered inflation squared for testing the existence of a nonlinear relationship, the findings show a significant negative linear relation between income inequality and the HP

filtered inflation rate and also a non-significant positive relationship between income inequality and the HP filtered squared for the developing countries. The coefficient of inflation gap or the cyclical component of inflation rate is negative, but it is not significant. The  $R^2$  coefficients of determination are almost the same in all five estimated models in the developing countries.

The author observes a significant nonlinear link between real agriculture value added *per capita* and income inequality in all five models at 10 percent significant level. The results are consistent with the existence of Kuznets inverted 'U-shaped' hypothesis between income inequality and real agriculture value added *per capita*. That is, as real agriculture value added *per capita* increases, income inequality first goes up and then comes back down. Similar results were also observed for real non-agriculture value added *per capita* in all five models for the developing countries. However, for this case, the results are consistent with the existence of Kuznets 'U-shaped' hypothesis between income inequality and real non-agriculture value added *per capita*. The results show a significant negative link between agriculture gap or the cyclical component of real agriculture value added *per capita* and income inequality, and a significant positive relationship between non-agriculture gap or the cyclical component of real non-agriculture value added *per capita* and income inequality in all five estimated models in the developing countries.

Table 3. The results of the regression analysis

Dependent Variable: LGINI	Developed Countries					Developing Countries				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
C	14.3086 (0.0000)	14.1907 (0.0000)	14.3599 (0.0000)	14.2860 (0.0000)	15.0112 (0.0000)	3.7864 (0.0000)	3.8118 (0.0000)	3.7931 (0.0000)	3.7988 (0.0000)	3.7987 (0.0000)
LAGR <sup>hp</sup>	-2.7497 (0.0000)	-2.5690 (0.0000)	-2.8228 (0.0000)	-2.7537 (0.0000)	-1.6236 (0.0000)	0.2098 (0.0670)	0.1866 (0.0994)	0.1995 (0.0821)	0.1950 (0.0895)	0.1959 (0.0886)
(LAGR <sup>hp</sup> ) <sup>2</sup>	0.2241 (0.0000)	0.2087 (0.0000)	0.2302 (0.0000)	0.2244 (0.0000)	0.1321 (0.0000)	-0.0276 (0.0114)	-0.0254 (0.0185)	-0.0263 (0.0154)	-0.0260 (0.0172)	-0.0259 (0.0174)
LAGR <sup>gap</sup>	0.0321 (0.2916)	0.0518 (0.0714)	0.0376 (0.1931)	0.0320 (0.2925)	0.0426 (0.1187)	-0.0598 (0.0169)	-0.0515 (0.0398)	-0.0810 (0.0011)	-0.0803 (0.0014)	-0.0780 (0.0021)
LNAGR <sup>hp</sup>	-0.2050 (0.1968)	-0.3016 (0.0519)	-0.1876 (0.2385)	-0.1996 (0.2140)	-1.1489 (0.0000)	-0.0969 (0.0307)	-0.0861 (0.0509)	-0.0805 (0.0770)	-0.0786 (0.0846)	-0.0817 (0.0716)
(LNAGR <sup>hp</sup> ) <sup>2</sup>	0.01527 (0.0634)	0.0193 (0.0160)	0.0146 (0.0728)	0.0151 (0.0679)	0.0634 (0.0000)	0.0148 (0.0000)	0.0140 (0.0000)	0.0135 (0.0000)	0.0134 (0.0000)	0.0135 (0.0000)
LNAGR <sup>gap</sup>	0.0931 (0.0006)	0.0340 (0.2307)	0.1080 (0.0000)	0.0927 (0.0007)	0.0367 (0.1584)	0.0662 (0.0000)	0.0631 (0.0000)	0.0759 (0.0000)	0.0755 (0.0000)	0.0749 (0.0000)
L $\pi$	-0.0088 (0.0688)	0.0058 (0.2436)	-	-	-	-0.0104 (0.0000)	-0.0040 (0.3440)	-	-	-
(L $\pi$ ) <sup>2</sup>	-	-0.0064 (0.0000)	-	-	-	-	-0.0014 (0.0982)	-	-	-
L $\pi$ <sup>hp</sup>	-	-	-0.0019 (0.8367)	-0.0069 (0.4701)	0.1520 (0.0000)	-	-	-0.0274 (0.0000)	-0.0271 (0.0000)	-0.0272 (0.0197)
(L $\pi$ <sup>hp</sup> ) <sup>2</sup>	-	-	-	-	-0.0484 (0.0000)	-	-	-	-	0.0002 (0.9311)
L $\pi$ <sup>gap</sup>	-	-	-	-0.0096 (0.1027)	-0.0081 (0.1176)	-	-	-	-0.0005 (0.8787)	-0.0074 (0.8402)
LOPEN	-0.0936 (0.0000)	-0.0904 (0.0000)	-0.0865 (0.0000)	-0.0935 (0.0000)	-0.1028 (0.0000)	-0.0479 (0.0000)	-0.0489 (0.0000)	-0.0547 (0.0000)	-0.0547 (0.0000)	-0.0533 (0.0000)
LUN	0.0661 (0.0000)	0.0589 (0.0000)	0.0700 (0.0000)	0.0665 (0.0000)	0.0642 (0.0000)	0.0283 (0.0000)	0.0283 (0.0000)	0.0310 (0.0000)	0.0310 (0.0000)	0.03100 (0.0000)
LUR	-0.3936 (0.0000)	-0.3580 (0.0000)	-0.3926 (0.0000)	-0.3944 (0.0000)	-0.2938 (0.0000)	-0.0764 (0.0000)	-0.0765 (0.0000)	-0.0711 (0.0000)	-0.0715 (0.0000)	-0.07047 (0.0000)
R <sup>2</sup>	0.44	0.47	0.44	0.44	0.50	0.30	0.30	0.32	0.32	0.31

Note. Probability values are in parenthesis.

The other control variables are significant at 5 percent significance level in all five estimation models. The results show a significant positive relationship between unemployment rate and income inequality. The results

show a significant negative link between openness to trade and income inequality, and a significant negative relationship between urbanization index and income inequality in all five estimated models for the developing countries.

## 6. Conclusion

This article explores the relationship amongst real agriculture and non-agriculture value added *per capita*, inflation and income inequality in a large sample of data collected for selected developed and developing countries. The multivariate panel data approach is used to examine the application of Kuznets hypothesis between income inequality and agriculture and non-agriculture growth and test the existence of nonlinear relationship between income inequality and inflation rate. The panel unit root test is used to identify the stationarity of time series data. The HP filter is used to separate the cyclical component from the trend component of inflation rate and real agriculture and non-agriculture value added *per capita*.

The author estimates five individual models for both developed and developing countries. The results describe a significant positive linear relationship between income inequality and the HP filtered inflation rate, a significant negative nonlinear relationship between income inequality and the HP filtered inflation rate squared, and a non-significant negative link between income inequality and inflation gap in the developed countries. For developing countries, the findings show a significant negative linear relation between income inequality and the HP filtered inflation rate, and a non-significant positive relationship between income inequality and the HP filtered squared.

The author uses real agriculture and non-agriculture value added *per capita* as two components of GDP. The results confirm the application of a ‘U-shaped’ of Kuznets curve between income inequality and agriculture value added *per capita* and between income inequality and non-agriculture value added *per capita* in developed countries. The results show the existence of nonlinear relation between real agriculture value added *per capita* and income inequality (inverted ‘U-shaped’ curve), and between non-agriculture value added *per capita* and income inequality (‘U-shaped’ curve) for developing countries.

The results show a significant positive relationship between unemployment rate and income inequality, a significant negative link between openness to trade and income inequality, and a significant negative relationship between urbanization index and income inequality in all estimation models for both developed and developing countries.

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## Note

Note 1. <https://www.worldbank.org/>

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