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INFLATION AND INCOME INEQUALITY IN DEVELOPED AND DEVELOPING COUNTRIES

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1. Introduction

A key open question in analyzing policy responses to income inequality is why economic growth would decrease income inequality in developed countries (DCs) but increase income inequality in developing countries or less developed countries (LDCs)? What is the nature of the relationship between income inequality and economic growth, and other related macroeconomic variables? Kuznets (1955) shows how income inequality would increase until a critical threshold level of income is attained, and after reaching the threshold income inequality begins to decrease. Kuznets (1955) predicts that as economies develop and the level of income increases, income inequality will first rise, then reaches a maximum, and then falls after a specific critical threshold development stage and income level. Kuznets's (1955) claim is based on both cross-country (a panel of countries including United States, England, and Germany) and time series data. Kuznets proposed the idea of the "*inverted U-shaped hypothesis"* of income inequality (Kuznets, 1955; 1963), which is consistent with the Lewis dual economy model (Lewis, 1954). On the other hand, inflation is considered to be as a purely monetary phenomenon that influences a country's income inequality level in different ways. Since David Hume (1711-1776), it has long been believed that wages lag inflation (Mayer, 1980). Therefore, one mechanism through which inflation can increase income inequality is by shifting income away from wage earners towards profits (Laidler & Parkin, 1975; Fischer & Modigliani, 1978).

Historically over the past few decades, and especially since the global financial crisis in 2008, income inequality has increased in most developed and many developing countries reflecting a range of external factors like globalization and its consequences as well as internal factors like monetary and fiscal policy affecting economic growth (OECD, 2013; IMF, 2014). The driving idea is that there is a typical trade-off between equality and economic growth (Okun, 1975). However, the findings of some recent research studies question this conclusion. Although in recent years, there has been a lot of research about income inequality and its negative impacts on economic growth (Kravis, 1960; Oshima, 1962; Thirlwall & Barton, 1971; Paukert, 1973; Bach & Stephenson, 1974; Laidler & Parkin, 1975; Fischer & Modigliani, 1978; Blinder & Esaki, 1978; Papanek & Kyn, 1986; Ram, 1988; Alesina & Rodrik, 1994; Persson & Tabellini, 1994; Clarke, 1995; Perotti, 1996; Birdsall & Londono, 1997; Aghion & Bolton, 1997; Deininger & Squire, 1998; Li & Zou, 1998; Dolmas et al., 2000; Deininger & Olinto, 2000; Forbes, 2000; Barro, 2000; Dadkhah, 2001; Jantti & Jenkins, 2001; Castellò & Domenéch, 2002; Hongyi, 2002; Banerjee & Duflo, 2003; Knowles, 2005; Voitchovsky, 2005; Heyse, 2006; Malinen, 2008; Castelló-Climent, 2010; Shahbaz, 2010; Binatli, 2012; Ostry, Berg & Tsangarides, 2014; Halter et al., 2014), only a limited number of empirical research studies has analyzed the relationship between inflation and income inequality and have reported some inconsistent results (Bach & Stephenson, 1974; Laidler & Parkin, 1975; Blinder & Esaki, 1978; Buse, 1982; Blank & Blinder, 1986; Blejer & Guerrero, 1990; Björklund, 1991; Silber & Zilberfab, 1994; Jantti, 1994; Bishop et al., 1994; Bulif & Marie, 1995; Romer & Romer, 1998; Tyson, 1998; Mocan, 1999; Jantti & Jenkins, 2001; Bulir, 2001; Albanesi, 2001; Gali & Van Der Hoeven, 2001; Heer & Süssmuth, 2003; Amornthum, 2004; Cysne et al., 2005; Desai et al., 2005; Beck et al., 2007; Ang, 2010; Bertola, 2010; Maestri & Roventini, 2012; Thalassinos et al., 2012; Khattak et al., 2014; Cardoso et al., 2015). However, most often these studies are carried out from different perspectives. Moreover, the utilization of different methods has identified income inequality as a function of inflation with a set of macroeconomic indicators.

Given the inconsistent results and the obvious importance to affected populations, the relationship between inflation and income inequality is still a major concern for policy analysis and decision makers. Policymakers are challenged by concerns about distributional considerations of government policies on one hand and pursuing price stabilization programs on the other. As income inequality within many countries has been steadily rising since 1990 (Atkinson et al., 2011; Piketty, 2014; Dabla-Norris et al., 2015), and according to the global agenda survey (World Economic Forum, 2015), the poorest half of the population controls less than 10 percent of wealth in DCs and LDCs alike. The primary question is then how we can assess the efficiency of monetary policy and other related government policies for reducing income inequality and its negative economic consequences. Ben Bernanke, the former Federal Reserve Chairman, partially addressed this question when he announced that the Federal Reserve did not have the appropriate tools to address all long-run distributional trends of income inequality. Most of the disagreement between economists involves normative debates over the appropriate role of government policies on one hand and the relative importance of other factors like economic growth, investment, technology, openness to international trade, unemployment rate, real exchange rate, productivity, taxes, subsidies, education, etc., on the other (Federal Reserve, 2013).

Overall, inequality of income distribution is a global phenomenon that has received considerable attention – the former U.S. President Barak Obama, pointed to a combination of growing income inequality and a lack of upward mobility as the "*defining challenge of time*" (Kaplan, 2013). Income inequality can adversely affect investment and economic growth by fueling economic, financial and political instability, and reallocating scarce resources for poverty reduction goals (Putnam, 2000; Bourguignon & Dessus, 2009; Kumhof et al., 2010; Acemoglu, 2011; Stiglitz, 2012; Corak, 2013; Rajan, 2015). It is not surprising that the extent of relative income inequality, its major drivers, and what to do about it, have become the most heated and debated issues by policymakers and researchers alike during the time (Dabla-Norris et al., 2015).

The first main objective of the present article is to investigate the hypothesis of nonlinear effects of inflation on income inequality in line with a set of control independent variables in a group of DCs and LDCs where consistent data can be obtained. The recognition of a nonlinear relationship between inflation and income inequality is important for DCs and LDCs in controlling inflation through contractionary monetary policy. Moreover, in parallel to the discussion of the validity (or not) of the non-linearity hypothesis in inflation, the potential existence of the Kuznets' inverted 'U-shaped' hypothesis will be examined for both DCs and LDCs groups.

The second main objective of this article is to explore the short and long-run relationship between inflation and income inequality. However, the existence of a cointegration relationship does not offer us any further information on the short and long-run causality relationship between inflation and income inequality. Therefore, the third main objective of this article is to examine Granger causality using a Toda-Yamamoto (1995) test and a vector error correction model (VECM), the latter of which provides a more comprehensive test of causality than the standard Granger causality test. Using a balanced panel data set of 24 DCs and 66 LDCs observed over the period 1990 to 2014, the results of Granger causality tests show that there is no short but long-run causality between inflation and income inequality.

This article contributes to the literature in at least four points: First, contrary to general use of developed and developing countries, this article examines the dynamic linear and nonlinear relationship between inflation and income inequality for a large balanced panel data set of 24 DCs and 66 LDCs observed over the period of 1990 to 2014. Second, unlike the literature exploring only the relationship between inflation and income inequality or only the relationship between economic growth and income inequality, we pool the data and apply panel unit root tests and panel cointegration which is a more robust test of the relationship between those variables. Third, we consider a different approach such as Toda-Yamamoto (1995) test and vector error correction model (VECM) to provide a more comprehensive test of the short- and long-run Granger causality rather than other method, which is an improvement of prior studies. Finally, the empirical results contribute to the literature by testing the existence of jointly Granger short- and long-run causality which is critical in monetary policy recommendations.

The remainder of this article is structured as follows: Section 2 briefly reviews the theoretical and empirical literature and points to some limitations in our understanding. Then, Section 3 describes data and methodology and briefly explains econometric methods adopted and presents empirical results. In the last section (Section 4), we conclude the paper and provide directions for future work.

2. Literature Review

Recent research studies present mixed findings on the inequality-inflation relationship both in theoretical and empirical literature. This section of this article briefly reviews the theoretical and empirical literature to highlight the hole in the literature and explore possible needs for analysis to address the inconsistency in results.

(a) Theoretical Literature Review

Despite recent efforts in analyzing income inequality and its contributing factors, the theoretical foundations of the relationship between inflation and income inequality is still unclear. There are three general approaches to explain this relationship and are briefly discussed in this section.

A first approach to economics is *macroeconomic populism,* which "emphasizes growth and income redistribution and de-emphasizes the risks of inflation and deficit finance, external constraints, and the reaction of economic agents to aggressive non-market policies" (Dornbusch & Edwards, 1989). According to this model, high-income inequality creates a fertile ground for populist policies to intensify political pressure for macroeconomic policies and thus improve the incomes of all low-income people by raising their minimum wages (*a typical populist redistribution policy*). In theory, while raising the minimum wages would help stimulate the economy due to the increased purchasing power of workers, it may cause an adverse effect on employment on one hand, and force business owners to raise the prices of goods and services on the other hand, thereby spurring inflation.

A second approach, referred to as the "asymmetric *war of attrition model*," addresses the reasons countries delay stabilization which are basically due to the existing conflicts between different social and political groups about deciding how to divide the burden of a fiscal adjustment. Therefore, income inequality can play a key role in fixing commitment to stabilization, design, and implementation because of political gridlocks which undermine the stability that are typically originated in income inequality (Alesina & Drazen, 1991; Drazen & Grilli, 1993; Kaminsky & Pereira, 1996).

Finally, the third approach provides the linkage between income inequality and inflation based on the "*distributive asymmetries of the inflationary process*" (Beetsma & Van Der Ploeg, 1996). Consequently, in a median-voter theorem, it is assumed that when assets and government debt are unequally distributed between individuals in a society, the median voter is likely to be in lower-income strata. As a matter of fact, the government in a democratic society serves the interests of the poor people, which in turn it will find hard to fix a policy of low inflation (Beetsma & Van Der Ploeg, 1996).

On the other side, inflation reduces real purchasing power. If the nominal wage is relatively fixed, inflation reduces real income, which disproportionately affects lower-income people. This is because they often do not have access to passive income, which has a nominal rate positively correlated to inflation. Thus, a rise in inflation can increase income inequality (Shiller, 1996; Easterly & Fisher, 2001; Amornthum, 2004).

Generally, inflation does not affect all different types of income sources (such as labor income, capital income, and government transfers) homogenously (Monnin, 2014). For labor income, inflation can modify all earnings through the exposure channel and the *Cantillon effect*[1]. The former refers to the wage-inflation link, but the latter reflects the lag between moments when printing money cause inflation because of devaluation of currency (Bordo, 1983; Williamson, 2008; Ledoit, 2011). For capital income, access to financial markets for a hedge against inflation is not equal between low and high-income people due to entry cost barriers. This induces a positive link between inflation and inequality (Cysne et al., 2005; Areosa & Areosa, 2006). For government transfers, as another income source, the impact of inflation depends on the degree of inflation[2] persistence, and generally lower-income people benefits from these transfers (Galli & Van Der Hoeven, 2001; Niehues, 2010).

According to the Phillips curve[3], when the unemployment rate is high, inflation is low, and hence inflation affects income inequality in a negative way. Therefore, a trade-off between the unemployment rate and inflation can cause a trade-off between inflation and income inequality. This trade-off results in a hypothesis that there is the existence of a nonlinear relationship between inflation and income inequality (Galli & Van Der Hoeven, 2001; Amornthum, 2004). Because of different underlying macroeconomic conditions, we would expect this non-linear relationship to be potentially different for developed and less-developed countries, which is the main hypothesis set out in this article.

(b) Empirical Literature Review

The early history of empirical literature has focused on the factors affecting income inequality aimed at explaining the relationship between income inequality, economic growth, and inflation. The results are noticeably mixed and somewhat conflicting. Some studies found evidence consistent with the existence of a negative relationship between income inequality and inflation, while others found no significant relationship between them. The outcomes are so diverse that some findings argue that inflation should be a regressive or progressive tax, or to be unrelated to income distribution at all (Galli & Van Der Hoeven, 2001). We briefly represent some of these results in this section.

Most of the empirical studies on the inequality-growth linkage were mostly carried out in a cross-country context. These empirical studies, exemplified by Paukert (1973), Ahluwalia (1976a, 1976b), Anand and Kanbur (1993), Milanovic (2000) found an inverted 'U-shaped' linkage between economic growth and income inequality, indicating that income inequality peaked in the category of middle income countries (MICs)[4]. While there was a tendency to interpret this linkage in terms of causal relationship, subsequent research work in which fixed effects were incorporated into cross-country panel regressions, failed to detect any significant nonlinear relationship between economic growth and income inequality (Deininger & Squire, 1998; Easterly, 1999; Fields, 2000). For example, Brueckner et al. (2014) investigated the impact of national income on income inequality using two-stage least squares (2SLS) regression analysis for 80 advanced and developing countries over the period of 1960 to 2007 and found that increases in national income have a significant moderating effect on income inequality.

The empirical evidence suggests that the income of the low-income people declines with the increase of inflation which lowers their real minimum wages (Tyson, 1998). Furthermore, inflation would tax low-income people, who hold a high fraction of their wealth in fiat money, more heavily than the high-income people, who hold both capital and fiat money. This indicates that inflation should increase income inequality (Blejer & Guerrero, 1990; Björklund, 1991; Silber & Zilberfarb, 1994; Beetsma & Van Der Ploeg, 1996; Albanesi, 2001; Desai et al. 2005; Thalassinos et al., 2012).

Bulir (2001) tested the hypothesis of nonlinear effects of inflation on income inequality using a panel data of 75 countries over the period of 1970 to 1991. The findings showed that low inflation can improve income inequality in each country, but the negative impact is very noticeable for a period of hyperinflation. Galli and Van Der Hoeven (2001) showed that a rise in inflation can both reduce and at the same time enhance income inequality, and it depends strongly on the initial level of inflation. Hongyi (2002) explored the impact of inflation on income distribution and economic growth using cross-country panel data of 46 countries for the period 1950 to 1992. The results showed that inflation worsens income distribution, raises the income share of the high-income people, reduces the economic growth, and has an insignificant negative effect on the income shares of the low- and middle-income people. Maestri and Roventini (2012), and Coibion et al. (2012) found a negative relationship between inflation and income inequality. Monnin (2014) found a U-shaped relationship between long-run inflation and income inequality with a minimum threshold inflation about 13.3% for a panel data of ten OECD countries during the period 1971 through 2010. He also found a normal U-shape curve between GDP *per capita* as a measure of economic development level and income inequality.

N'Yilimon (2015) found a non-linear relationship between inflation and income inequality for a panel data of 46 developing countries over the period of 2000 to 2012. The results confirmed a positive significant effect of inflation on income inequality. Munir and Sultan (2017) analyzed the macroeconomic determinants of income inequality by utilizing the panel data of two countries including India and Pakistan from 1973 to 2015. They did not observe any significant relationship between inflation and income inequality. However, they found a positive relationship between per capita GDP and income inequality, which implies both countries are at the initial stages of development, indicating that income inequality will increase with economic development.

Deyshappriya (2017) analyzed the macroeconomic determinants of income inequality for a panel data of 33 Asian countries over the period of 1990-2013 by using the generalized method of moments (GMM). He found an inverted U-shaped relationship between income inequality and GDP. The results also showed that higher inflation, political risk, terms of trade and unemployment rate increase income inequality; while, other independent variables such as official development assistance, education, and labor force participation reduce income inequality.

Balcilar et al. (2017) employed a semiparametric instrument variable estimator to evaluate the relationship between income inequality and inflation for a cross-state panel of the U.S. economy over the period of 1976 to 2007. The results confirmed the existence of a nonlinear relationship between inflation and income inequality. Also, the results showed that there is a positive relationship between inflation and income inequality when the states exceed a threshold level of inflation.

Siami-Namini and Hudson (2017) examined the impacts of sector growth and monetary policy on income inequality by using a cross-country panel of 92 developing countries for the period of 1990 to 2014. They found that agricultural and industrial growth have a negative effect, while service sector growth has a positive effect on income inequality. The results supported the existence of Kuznets inverted 'U' hypothesis for industry growth and Kuznets 'U' hypothesis for service sector growth. Using inflation as a proxy for monetary policy in developing countries, they found that sector growth and inflation affect income inequality in the long-run.

3. Data and Methods

3.1 Data

Our analysis uses annual data for a sample of 24 DCs[5] and 66 LDCs[6] from 1990 to 2014 taken from different sources including the World Development Indicators (WDI) that can be accessed via the World Bank data portal, Eurostat database, the IMF International Financial Statistics (IFS), and the countries' central bank websites. Not all developing countries could be included in the data as some countries had inconsistent data or data whose reliability could not be verified and must be cross-checked with other data sources for accuracy. Therefore, a restricted sample of LDCs was used to maintain data integrity. A similar data collection methodology was employed for the sample of DCs. Finally; in our final decision of selecting countries for this study we chose a sample of 24 and 66 countries for DCs and LDCs groups, respectively.

Generally, income inequality is often measured by the GINI index, a measure between 0 and 1. It is defined as the ratio of the area between the Lorenz curve[7] and the perfect equality line. A GINI index of 0 indicates perfect equality; whereas, a GINI index of 1 indicates maximum inequality. We collected information on the 1) GINI index, 2) GDP *per capita* (constant 2005 US$), 3) the annual inflation rate (π), which is calculated from consumer price index, 4) urbanization index (UR) - measured as a percentage of population living in urban areas, 5) openness to international trade (OPEN), and 6) the unemployment rate (UN) - total (percent of total labor force). It is worth noting that time series data for the GINI index includes missing values, which are replaced by linear interpolation methods. Furthermore, the natural logarithms of the variables were used.

We use the Hodrick and Prescott (1981) filter (hereafter, the HP-filter) for smoothing the annual inflation rate and employ the HP-filtered inflation (π^{hp}) as a proxy for anticipated inflation (or long-run inflation trend) in our model. We then calculate the inflation gap (π^{gap}) as a proxy for unanticipated inflation (or short-run inflation, also known as inflation cycles) based on the difference between the aggregate inflation and the HP-filtered inflation. As it is apparent in our model, the inflation gap is not a component of anticipated inflation. This approach assumes that all agents distinguish between the long-run component and the short-run shock from the observed inflation. All agents expect that the future inflation to be equal to the current HP-filtered inflation. We also use the HP-filter for decomposing real GDP *per capita* by two different components: HP-filtered GDP *per capita* (GDP^{hp}) and the output gap or GDP cycles *per capita* (GDP^{gap}). A more detailed description of the data is provided in Table 1.

Table 2 presents the descriptive statistics of the variables captured for DCs and LDCs. The real GDP *per capita* for DCs averaged \$23,837 (after taking antilog). The GINI index on average is 31.17 percent; whereas, the annual inflation rate has averaged 2.78 percent during the 1990-2014 period. Also, the openness to international trade, urbanization index, and unemployment rate averaged 74.46, 72.20, and 7.66 percents, respectively.

For the LDCs, the real GDP *per capita* averaged \$1,296, the GINI index has averaged 41.67 percent, and the annual inflation rate has averaged 7.65 percent during the same period. Furthermore, the openness to international trade, urbanization index, and unemployment rate averaged 65.05, 41.34, and 6.88 percents, respectively.

The mean of the GINI index and inflation for the LDCs are greater than those in the DCs group. Also, the mean of the other control variables, including openness to international trade, urbanization index, and unemployment rate for the LDCs group are lower than those in DCs. The standard deviation of all variables in LDCs are greater than those for the DCs, group suggesting greater variability in the key variables across countries and time.

3.2 Methods

Using panel data approach, the key stages in our estimation framework can be summarized as follows:

(a) The Model Procedure: General Form of the Model

The effect of inflation is distinguished between the long-run and the short-run using a general approach, as suggested by Amornthum (2004). If inflation has no effect on the real economy in long-run, we should only observe its short-run effects in our model. Amornthum (2004) follows the concept of nonlinearity ('U-shaped' or 'J-shaped' curve) proposed by Bulir (2001) and estimates the relationship between inflation and income inequality based on the traditional Kuznets hypothesis. Therefore, the functional form of the estimated model in the present article is as below:

$$GINI_{i,t} = \alpha_0 + \alpha_1 GDP_{i,t} + \alpha_2 (GDP_{i,t})^2 + \alpha_3 \pi_{i,t} + \alpha_4 (\pi_{i,t})^2 + bX_{i,t} + \varepsilon_{i,t}, \qquad (1)$$

Where $GINI_{it}$ is the measure of income inequality, GDP_{it} is the real GDP *per capita* or an adequate measure for economic development, $(GDP_{i,t})^2$ is the squared GDP *per capita*, π_{it} is the inflation, $(\pi_{i,t})^2$ is the squared inflation term, X_{it} is a set of control variables such as unemployment rate, urbanization, and openness to international trade, and ε_{it} is the error term of the equation. The subscript i and t denote country and time, respectively. The coefficient α_0 is the intercept term. The coefficient $\alpha_1 > 0$ and $\alpha_2 < 0$ is regularly predicted in testing for the Kuznets inverted 'U-shaped' hypothesis. Also, the coefficient $\alpha_3 < 0$ and $\alpha_4 > 0$ test the existence of a nonlinear relationship between inflation and income inequality.

(b) A Panel Unit Root and Panel Cointegration Test

The unit root properties of the variables are investigated through a panel data approach. The power of the panel unit root test is higher than using a separate unit root test for each individual time series (Levin et al., 2002). The panel data are denoted as I (0) when they are stationary at the levels, and I (d) when they must be differenced d times to achieve stationarity.[8] Additionally, the implications of the stationary results are examined to explore the existence of a long-run relationship between variables using Kao residual panel cointegration test (McCoskey & Kao, 1998; Kao, 1999). In this context, McCoskey and Kao (1998) proposed the average Augmented Dickey-Fuller (ADF) test for varying slopes and intercepts across all elements (i.e., countries in this article) of a panel. Kao (1999) also proposed test statistics based on the Engle-Granger two-step procedure, and imposed homogeneity on the individuals (countries) in the panel. Kao proposed two types of cointegration tests from individual (country) time series in a panel data framework to test the null hypothesis of no cointegration panel data based on Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) unit root test that can be calculated from the estimated residuals. The Kao residual panel cointegration test allows more variables in the test than the other residual-based panel cointegration tests like Pedroni (1999), which enables us test for maximum seven explanatory variables.

(c) Panel Data Granger Causality Tests

In the next step, panel Granger causality tests are utilized to examine the causal relationship between the inflation and income inequality based on Toda-Yamamoto procedure and a panel of VECM framework.

(i) Panel Granger Causality Test: Toda-Yamamoto Approach

The results of the Granger causality test suggest that inflation and income inequality are endogenous. As pointed out by Toda and Yamamoto (1995) and Zapata and Rambaldi (1997), the power of unit root and cointegration test are very low against the alternative hypotheses of stationarity. Thus, the Toda-Yamamoto procedure is used for testing causality between integrated variables based on an asymptotic distribution.

To apply Toda-Yamamoto causality method, first the maximum order of integration of time series is determined ('d-max'). Second, the optimal lag length for the vector auto-regression (VAR) model is determined using the Akaike Information Criterion (AIC), k. Third, a VAR model is constructed at their levels with a total of (k + 'd-max') lags. And finally, the hypothesis is tested using a standard Wald statistic test, which has an asymptotic chi-square distribution with m degrees of freedom. Specifically, we consider a bivariate VAR model with a total of (k + 'd-max') lags as following:

$$GINI_{i,t} = \alpha_{1,i} + \sum_{i=1}^{k+'d-max'} \theta_{1,i}\pi_{i,t-i} + \sum_{i=1}^{k+'d-max'} \vartheta_{1,i}GINI_{i,t-i} + \varepsilon_{1,i,t} \quad (2)$$

$$\pi_{i,t} = \alpha_{2,i} + \sum_{i=1}^{k+'d-max'} \theta_{2,i}\pi_{i,t-i} + \sum_{i=1}^{k+'d-max'} \vartheta_{2,i}GINI_{i,t-i} + \varepsilon_{2,i,t} \quad (3)$$

Where k is the optimal lag length, 'd-max' is the maximal order of integration of the time series in the system and both error terms $\varepsilon_{1,i,t}$ and $\varepsilon_{2,i,t}$ are assumed to be white noise with zero mean and constant variance. The error terms may, however, be correlated across equations. In Eq. (2), π "does not Granger cause" $GINI$ if it is $\theta_{1,i} = 0$ for i $\leq$ k. Similarly, in Eq. (3), $GINI$ "does not Granger cause" π if it is $\vartheta_{2,i} = 0$ for i $\leq$ k. Notice that the additional lags (d) are unrestricted. Accordingly, these functions ensure that the asymptotical critical values can be applied when test of causality between integrated variables are conducted. The zero restrictions are tested by computing the modified Wald test statistic. This method is applicable whether the VAR's are stationary, integrated of an arbitrary order, or cointegrated of an arbitrary order.

(ii) Panel Granger Causality Test: A VECM Approach

We also test for Granger causality based on a VECM framework. Consider the following equations:

$$D(GINI_{i,t}) = \delta_{1,i} + \emptyset_{1,i}ECT_{i,t-1} + \sum_{j=1}^{k}\gamma_{1,j,i}D(\pi_{i,t-j}) + \sum_{j=1}^{k}\theta_{1,j,i}D(GINI_{i,t-j}) + \varepsilon_{1,i,t} \quad (4)$$

$$D(\pi_{i,t}) = \delta_{2,i} + \emptyset_{2,i}ECT_{i,t-1} + \sum_{j=1}^{k}\gamma_{2,j,i}D(\pi_{i,t-j}) + \sum_{j=1}^{k}\theta_{2,j,i}D(GINI_{i,t-j}) + \varepsilon_{2,i,t} \quad (5)$$

Where i refers to the country ($i = 1, 2, \ldots, N$), t is time trend ($t = 1, 2, \ldots, T$), and j is the optimum lag length considering Schwarz Information Criterion (SIC). Also, $ECT_{i,t-1}$ is the lagged error correction term derived from the long-run cointegrating relationship, $\emptyset_{1,i}$ and $\emptyset_{2,i}$ are adjustment coefficients and $\varepsilon_{1,i,t}$ and $\varepsilon_{2,i,t}$ are disturbance terms that are assumed to be white-noise and uncorrelated. We determine the sources of causation by testing for significance of the coefficients on the lagged variables in Eq. (4) and (5). First, we evaluate Granger short-run causality using an F-statistic for testing the null hypothesis (H_0: $\gamma_{1,j,i} = 0$ or $\theta_{2,j,i} = 0$) in Eq. (4) and (5), respectively. If the null hypothesis is rejected, the existence of Granger short-run causality is confirmed. Second, we identify Granger long-run causality using the ECT coefficients in the equations above. The coefficients on the ECT represent how fast deviations from the long-run equilibrium are eliminated following changes in each variable. If the ECTs coefficients are zero ($\emptyset_{1,i} = 0$ or $\emptyset_{2,i} = 0$), there is no Granger long-run causality from explanatory variables to dependent variables. Finally, we can jointly check the existence of both Granger short-run and long-run causalities using an F-statistic for testing null hypothesis H_0: $\gamma_{1,j,i} = 0$ or $\emptyset_{1,i} = 0$ in Eq. (4), and H_0: $\theta_{2,j,i} = 0$ or $\emptyset_{2,i} = 0$ in Eq. (5). This is referred to as a strong Granger causality test.

5. Empirical Results

This section discusses time series analysis and reports the empirical results on the relationship between inflation and income inequality for DCs and LDCs.

(a) *The Results of Panel Unit Root and Panel Cointegration Tests*

The findings indicate that a large majority of the different panel unit root tests for each variable is stationary or integrated of order one I (1) in levels for DCs and LDCs.[9] As a result, we proceed to examine the presence or non-presence of long-run relationships among the variables through the panel cointegration tests. As shown in Table 3, the panel Kao residual cointegration test for variables associated to DCs and LDCs rejects the null hypothesis of no cointegration. As shown in Table 3, there is a long-run relationship between the variables in DCs and LDCs.

The results for the Breusch-Pagan LM test (a test for cross-sectional dependence) strongly reject the null hypothesis of no correlation at conventional significance levels. Therefore, we detected cross-sectional dependence by using a generalized least square estimator.

(b) The Results of a Multiple Regression Analysis

As mentioned earlier, we evaluate the relationship between aggregate inflation (and its two components including HP-filtered inflation and inflation gap) and income inequality in line with a set of control variables. As reported in Table 4, we find a significant negative correlation between income inequality and aggregated inflation for the DCs group in column (1). It means aggregated inflation has a strong negative linear effect on income inequality. To test the existence of nonlinear effect of aggregated inflation on income inequality, we identify a non-significant positive correlation between income inequality and aggregated inflation and a significant negative correlation between income inequality and the squared aggregated inflation for the DCs group in column (2). The findings indicate a non-significant positive relationship between income inequality and the HP-filtered inflation in column (3). These findings suggest that there might be a significant negative relationship between income inequality and HP-filtered inflation, which in turn, confirms that the method of reducing inflation can cause income inequality to be arisen in the DCs group. By adding inflation gap to the estimation equation in column (4), we find a significant negative relationship between income inequality and the inflation gap. Earlier literature suggested that the inflation gap has an impact on real economy in short-run, but income inequality changes in long-run. As a result, the inflation gap cannot explain long-run changes in income inequality.

In column (5), with adding the squared HP-filtered inflation for testing the existence of a nonlinear relationship, the results demonstrate a significant positive relationship between income inequality and the HP-filtered inflation, and a significant negative relationship between income inequality and the squared HP-filtered inflation for DCs group. As shown in column (5), the inflation gap has a significant negative effect on income inequality. In other words, the results confirm the existence of a nonlinear relationship between income inequality and the HP filtered inflation.

We could not identify any significant nonlinear link between real GDP *per capita* and income inequality for all estimation equations through columns (1) to (4) for the DCs group, but the results in column (5) show us the existence of the Kuznets' U-shaped hypothesis between income inequality and real GDP *per capita*. The findings are consistent with the outcomes presented by Gallup (2012), Lim and Sek (2014), and Monnin (2014). We observe a positive significant pro-cyclical link between GDP gap (business cycles) and income inequality for all estimation equations through columns (1) to (5) for DCs group.[10]

Furthermore, other control variables are significant at 5 percent level for all estimation equations through columns (1) to (5) for the DCs group. The findings indicate a significant positive relationship between the unemployment rate and income inequality, as it was expected. Therefore, the higher the unemployment rate, the higher income inequality. We observe a significant positive relationship between openness to international trade and income inequality. The openness to international trade is found to be somewhat related with high-income inequality (at least for the 1990s). According to the Heckscher-Ohlin theory, income inequality increases in wealthy countries and decreases in poor countries because of increased trade, and it can be supported in this study. In general, the DCs group can be said to be well-endowed with capital and LDCs group with unskilled labor. From this theoretical standpoint, we can argue that openness to international trade would benefit unskilled laborers in the LDCs group and capital-owners in the DCs group (Leamer, 1995; Anderson, 2005; Jakobsson, 2006). Also, the results show a significant negative relationship between urbanization index and income inequality for all estimation equations through columns (1) to (5) for the DCs group.

For the LDCs group, as shown in Table 4, we obtain a significant negative correlation between income inequality and aggregate inflation for the equation denoted in column (1). In column (2), we identify a significant nonlinear (U-shaped) relationship between income inequality and aggregate inflation for the LDCs group, but this observed relationship is opposite of that found in the DCs group.

The results also indicate a negative significant correlation between income inequality and the HP-filtered inflation in column (3). Therefore, higher inflation is associated with a lower income inequality in the LDCs group. The results show a significant negative correlation between income inequality and the HP-filtered inflation, and between income inequality and the inflation gap in column (4). In column (5), with adding the squared HP-filtered inflation for testing the existence of a nonlinear relationship, we find a significant nonlinear (U-shaped) relationship between income inequality and the HP filtered inflation, which is consistent with the results proposed by Galli and Van Der Hoeven (2001), and Auda (2010). For low inflation level, more inflation leads to decreasing income inequality, and for high inflation level, more inflation coincides with increasing income inequality.

We also identify a significant nonlinear link between real GDP *per capita* and income inequality for all estimation equations through columns (1) to (4) at 10 percent significance level for the LDCs group. The results are consistent with the existence of Kuznets' inverted 'U-shaped' hypothesis between income inequality and real GDP *per capita*. That is, as economic growth increases, income inequality first elevates and then it returns down. But, there is no sign of the inverted U of the Kuznets hypothesis in estimation equation in column (5). There is a negative relationship between the GDP gap and income inequality for all estimation equations through columns (1) to (5).

Like the DCs group, the findings show a positive relationship between unemployment rate and income inequality in the LDCs group. No significant relationship between openness to international trade and income inequality was observed in any of the estimation equations through columns (1) to (5) for the LDCs group. Likewise, a significant relationship between urbanization index and income inequality was found for estimation equations in column (2) and (5) in the LDCs group.

(c) The Results of Panel Granger Causality Tests

The panel cointegration test induced by Kao indicates that there is a cointegrated relationship between the variables in long-run, implying that there is a long-run equilibrium relationship between inflation and income inequality in line with other control variables. In this section, we present the results of panel Granger causality tests between inflation and income inequality based on Toda-Yamamoto (1995) and VECM approach.

(i) The Results of Granger Causality Test Based on Toda-Yamamoto Approach

The results of chi-square statistic and probability value for Granger causality test based on Toda and Yamamoto (1995) approach are presented in Table 5. The findings show that aggregate inflation (π), HP-filtered inflation (π^{hp}) and inflation gap (π^{gap}) do not Granger cause income inequality (GINI) in both the DCs and LDCs groups at 5 percent level. Also, there is unidirectional Granger causality running from income inequality to aggregate inflation and running from income inequality to the HP-filtered inflation separately at 10 percent significance level for the LDCs group.

The results suggest that there is no bi-directional Granger causality between income inequality and inflation as a proxy for the stance of monetary policy in the DCs group in short run. This result also confirms that the monetary authorities do not have any appropriate tools to address all changes in income inequality in short-run. But, in long-run, a higher inflation target would help reduce income inequality. Over the last decade, the monetary authorities in the DCs group have intended to maintain low-inflation targeting to stabilize the economy, which in turn has worsened income inequality in these countries.

(ii) The Results of Granger Causality Test Based on VECM Approach

The results of F-test values for Granger causality test based on VECM approach are reported in Table 6. The findings indicate that there is no observed bi-directional causality running from income inequality to the aggregate inflation, and its two components including the HP-filtered inflation and inflation gap at 5 percent significance level for both the DCs and LDCs groups in short-run. The results show that there is a bilateral long-run causality between income inequality and aggregate inflation as the F-statistic values (for ECT coefficient) are statistically significant for both DCs and LDCs group. These results provide evidence that supports the claims by Beetsma and Van der Ploeg (1996), Al-marhubi (1997), and Dolmas et al. (2000) that changes in income inequality can cause changes in the aggregate inflation as well.

The findings show that there is unidirectional Granger causality running from the HP-filtered inflation to income inequality in both DCs and LDCs groups. Also, there is unidirectional Granger causality running from income inequality to the inflation gap in DCs group, and bilateral long-run causality between income inequality and inflation gap in LDCs group, respectively. Therefore, monetary authorities can influence the unanticipated inflation. As an application of these results, we can conclude that the aggregate inflation plays an important role for explaining income inequality in the long-run, and vice versa.

Furthermore, the joint test results indicate that there is a bilateral causality between income inequality and aggregate inflation in both the DCs and LDCs groups. In other words, whenever a shock occurs in the system, the variables would make short-run adjustments to restore long-run equilibrium. As shown in Table 6, the joint test results show us that there is unidirectional Granger causality running from the HP-filtered inflation to income inequality for both the DCs and LDCs groups. Also, the joint test results show that there is unidirectional causality running from income inequality to the inflation gap in DCs group, and a bilateral causality between income inequality and inflation gap in the LDCs group.

6. Conclusion

In this article, the association between inflation and income inequality was examined in both the DC and LDC groups. Using a panel of 24 developed and 66 developing countries followed over 25 years, we studied the non-stationarity and cointegration properties of the variables related to income inequality, inflation, economic development, and a set of control variables. The results of panel cointegration test suggested by Kao indicate that there is a long-run equilibrium relationship between inflation and income inequality across countries.

We found a nonlinear relationship between inflation and income inequality, but the pattern is different between the DCs and LDCs groups. We examined the existence of Kuznets hypothesis, and found an inverted 'U-shaped' curve between real GDP *per capita* and income inequality in the LDCs group, but a 'U-shaped' curve for DCs group.

The results of Granger causality test based on Toda and Yamamoto approach showed that the aggregate inflation (π), the HP-filtered inflation (π^{hp}) and the inflation gap (π^{gap}) do not Granger cause income inequality (GINI) in both the DCs and LDCs group. Furthermore, there is unidirectional Granger causality running from income inequality to the aggregate inflation, and from income inequality to the HP-filtered inflation in LDCs group. As a result, there is no bi-directional Granger causality between income inequality and inflation as a proxy for the stance of monetary policy in DCs group in short-run. But for LDCs group, the results suggest that aggregate inflation and the HP-filtered inflation has been affected by income inequality.

Evidence from a panel VECM approach for testing Granger causality between inflation and income inequality indicated that there is no bi-directional Granger causality between the aggregate inflation (and its two main components including the HP-filtered inflation and the inflation gap) and income inequality in the short-run, but there is a bi-directional long-run Granger causality between aggregate inflation and income inequality in both DCs and LDCs group. Also, there is a unidirectional long-run Granger causality relationship running from income inequality to the inflation gap in DCs group, and a bilateral long-run causality between the inflation gap and income inequality in LDCs group.

Overall, the structure of both DCs and LDCs group are different, and every country has their own specific policies and decision-making process. Those individual policies should be considered in future studies to more finely predict the effects of inflation targeting and other monetary/fiscal policies on income inequality. Clearly, central bank intervention to target inflation has differential impacts on income inequality in both DCs and LDCs groups. One-size fits all policy prescriptions are not only counter-productive but could be detrimental to economic well-being of citizens in different types of countries.

References

Acemoglu D. 2011. Thoughts on Inequality and the Financial Crisis. *Presentation at the American Economic Association Annual Meeting.*

Aghion P., Bolton P. 1997. A Theory of Trickle-Down Growth and Development. *The Review of Economics Studies 64(2):* 151-172.

Ahluwalia M.S. 1976a. Inequality, Poverty and Development. *Journal of Development Economics 6.*

Ahluwalia M.S. 1976b. Income Distribution and Development: Some Stylized Facts. *American Economic Review 66:* 1-28.

Albanesi S. 2001. Inflation and Inequality. *Universita Bocconi and IGIER:* 1-53.

Alesina A., Rodrik D. 1994. Distributive Politics and Economic Growth. *Quarterly Journal of Economics 2:* 465-490.

Alesina A., Drazen A. 1991. Why are Stabilizations Delayed? *American Economic Review 81:* 1170-1188.

Al-Marhubi F. 1997. A Note on the Link between Income Inequality and Inflation. *Economic Letters 55(3):* 317-319.

Amornthum S. 2004. Income Inequality, Inflation and Nonlinearity: The Case of Asian Economies.

Anand S., Kanbur R. 1993. The Kuznets Process and the Inequality Development Relationship. *Journal of Development Economics 40:* 25-52.

Anderson E. 2005. Openness and Inequality in Developing Countries: A Review of Theory and Recent Evidence. *World Development 33(7):* 1045-1063.

Ang J.B. 2010. Finance and Inequality: The Case of India. *Southern Economic Journal 76:* 738-761.

Areosa M., Areosa W. 2006. The Inequality Channel of Monetary Transmission. *Banco Central do Brasil Working Article Series 114.*

Atkinson A., Piketty T., Saez E. 2011. Top Incomes in the Long-run of History. *Journal of Economic Literature 49(1):* 3-71.

Auda H. 2010. New Tests of Symmetry in Regression Models: Application to the Relation between Income Inequality and Inflation". Manuscript.

Bach G., Stephenson J. 1974. Inflation and the Redistribution of Wealth. *The Review of Economics and Statistics 56:* 1-13.

Banerjee A.V., Duflo E. 2003. Inequality and Growth: What Can the Data Say? *Journal of Economic Growth 8(3):* 267-299.

Barro R.J. 2000. Inequality and Growth in a Panel of Countries. *Journal of Economic Growth 5:* 5-32.

Beck T., Demirguc-Kunt A., Levine R. 2007. Finance, Inequality and the Poor. *Journal of Economic Growth 12:* 27-49.

Beetsma R.M.J., Van Der Ploeg F. 1996. Does Inequality Cause Inflation? The Political Economy of Inflation, Taxation and Government Debt. *Kluwer Academic Publishers 87:* 43-162.

Bertola G. 2010. Inequality, Integration, and Policy: Issues and Evidence from EMU. *Journal of Economic Inequality 8(3): 354-365.*

Binatli A.O. 2012. Growth and Income Inequality: A Comparative Analysis. *Economics Research International 569890.*

Birdsall N., Londoño J. L. 1997. Asset Inequality Matters: An Assessment of the World Bank's Approach to Poverty Reduction. *American Economic Review 87(2):* 32-37.

Bishop J.A., Formby J.F., Sakano R. 1994. Evaluating Changes in the Distribution of Income in the United States. *Journal of Income Distribution 4:* 79-105.

Björklund A. 1991. Unemployment and Income Distribution-Time Series Evidence from Sweden. *Scandinavian Journal of Economics 93(3):* 457-465.

Blank R., Blinder A. 1986. Macroeconomics, Income Distribution, and Poverty. In: Danziger, S. and D. Weinger (Eds). *Fighting Poverty: What Works and What Doesn't.* Cambridge. MA. Harvard University Press.

Balcilar, M., Chang, S., Gupta, R., Miller, S.M., 2017. The Relationship between the Inflation Rate and Inequality Across U.S. States: A Semiparametric Approach. *Quality and Quantity Journal (Forthcoming).*

Blejer M.I., Guerrero I. 1990. The Impact of Macroeconomic Policies on Income Distribution: An Empirical Study of the Philippines. *Review of Economics and Statistics:* 414-423.

Blinder A., Esaki H.Y. 1978. Macroeconomic Activity and Income Distribution in the Postwar United States. *Review of Economics and Statistics 60:* 604-609.

Bordo M. 1983. Some Aspects of the Monetary Economics of Richard Cantillon. *Journal of Monetary Economics 12(2):* 235-258.

Bourguignon F., Dessus S. 2009. Equity and Development: Political Economy Considerations. In no Growth without Equity? Inequality, Interests, and Competition in Mexico. Edited by S. Levy and M. Walton. Washington: *World Bank.*

Brueckner M., Dabla-Norris E., Gradstein M. 2014. National Income and its Distribution. *IMF Working Article 101.*

Bulif A., Marie A. 1995. Monetary and Exchange Affairs Department Inflation and Income Distribution: Further Evidence on Empirical Links. *International Monetary Fund (IMF).*

Bulir A. 2001. Income Inequality: Does Inflation Matter? *IMF Staff Article 48(1).*

Bulir A., Gulde A.M. 1995. Inflation and Income Distribution: Further Evidence on Empirical Links. *IMF Working Article 86.*

Buse A. 1982. The Cyclical Behavior of the Size Distribution of Income in Canada: 1947-78. *Canadian Journal of Economics 15:* 189-204.

Cardoso E., Barro R., Urani A. 2015. Inflation and Unemployment as Determinants of Inequality in Brazil: The 1980. *IPEA Discussion Article 42*.

Castelló-Climent A., 2010. Inequality and Growth in Advanced Economies: An Empirical Investigation. *Journal of Economic Inequality 8(3):* 293-321.

Castelló-Climent A., Doménech R. 2002. Human Capital Inequality and Economic Growth: Some New Evidence. *Economic Journal 112(478):* C187-C200.

Clarke G.R.G. 1995. More Evidence on Income Distribution and Growth. *Journal of Development Economics 47(2):* 403-427.

Coibion O., Gorodnichenko Y., Kueng L., Silvia J. 2012. Innocent Bystanders? Monetary Policy and Inequality in the US. *IMF Working Article 199.*

Corak M. 2013. Income Inequality, Equality of Opportunity, and Intergenerational Mobility. *Journal of Economic Perspectives 27(3):* 79-102.

Cysne R.P., Maldonado W.L., Monteir P.K. 2005. Inflation and Income Inequality: A Shopping-time Approach. *Journal of Development Economics 78:* 516-528.

Dabla-Norris E., Kochhar K., Ricka F., Suphaphiphat N., Tsounta E. 2015. Causes and Consequences of Income Inequality: A Global Perspective. *IMF Staff Discussion Note SDN/15/13.*

Dadkhah K., 2001. Income Distribution and Economic Growth in the United States: 1947 - 2001. Thesis. Department of Economics Northeastern University Boston.

Deininger K., Olinto P. 2000. Asset Distribution, Inequality and Growth. *World Bank Research Working Article 2375.*

Deininger K., Squire L. 1998. New Ways of Looking at Old Issues: Inequality and Growth. *Journal of Development Economics 57(2):* 259-287.

Desai R.M., Olofsgard A., Yousef T.M. 2005. Inflation and Inequality: Does Political Structure Matter? *Economics Letters 87:* 41-46.

Deyshappriya, N.P.R. 2017. Impact of Macroeconomic Factors on Income Inequality and Income Distribution in Asian Countries. ADBI Working Paper 696. Tokyo: Asian Development Bank Institute.

Dolmas J., Huffman W.G., Wynne M.A. 2000. Inequality, Inflation and Central Bank Independence. *Canadian Journal of Economics 33 (1):* 271-287.

Dornbusch R., Edwards S. 1989. Macroeconomic Populism in Latin America. *NBER Working Article 2986.*

Drazen A., Grilli V. 1993. The Benefits of Crisis for Economic Reforms. *American Economic Review 83:* 598-607.

Easterly W., Fischer S. 2001. Inflation and the Poor. *Journal of Money, Credit and Banking 33 (2, Part I):* 160-178.

Easterly W. 1999. Life during Growth. *Journal of Economic Growth* 4(3): 239-276.

Engle R.F., Granger C.W.J. 1987. Cointegration and Error Correction: Representation, Estimation and Testing. *Econometrica 55:* 251-276.

Federal Reserve 2013. Transcript of Chairman Bernanke's Press Conference September 18.

Fields G.S. 2000. The Dynamics of Poverty, Inequality and Economic Well-being: African Economic Growth in Comparative Perspective. Cornell University ILR School.

Fischer S., Modigliani F. 1978. Towards an Understanding of the Real Effects and Costs of Inflation. *Weltwirtschaftliches 114:* 810-833.

Forbes K.J. 2000. A Reassessment of the Relationship between Inequality and Growth. *American Economic Review 90(4):* 869-887.

Galli R., Van Der Hoeven R. 2001. Is Inflation Bad for Income Inequality? The Importance of the Initial Rate of Inflation. *ILO Employment Article 29.*

Gallup J.L. 2012. Is There a Kuznets Curve? Portland State University.

Halter D., Oechslin M., Zweimüller J. 2014. Inequality and Growth: The Neglected Time Dimension. *Journal of Economic Growth 19:* 81-104.

Heer B., Sussmuth B. 2003. Cold Progression and its Effects on Income Distribution. *CESIFO Working Article Series 951.*

Heyse A. 2006. Income Distribution and Economic Growth in Developing Countries: An Empirical Analysis. *Unpublished Master Thesis*.

Hodrick R., Prescott E. 1981. Post-war US Business Cycles: An Empirical Investigation. *Discussion Article 451.* Carnegie-Mellon University.

Hongyi L. 2002. Inflation, Growth, and Income Distribution: A Cross-country Study. *Annals of Economics and Finance 3(1*): 85-101.

Hume D. 1955. Writings on Economics. Edited by Eugene Rotwein. Madison: University of Wisconsin Press.

Jakobsson A. 2006. Trade Openness and Income Inequality. *School of Economics and Management.* Lund University.

Jäntti M., Jenkins S.P. 2001. Examining the Impact of Macroeconomic Conditions on Income Inequality. *Journal of Economic Inequality 8:* 221-240.

Jäntti M. 1994. A More Efficient Estimate of the Effects of Macroeconomic Activity on the Distribution of Income. *Review of Economics and Statistics 76:* 372-378.

IMF. 2014. Fiscal Policy and Income Inequality. *IMF Staff Policy Article.*

Kaminsky L., Pereira A. 1996. The Debt Crisis: Lessons of the 1980s for the 1990s. *Journal of Development Economics 50:* 1-24.

Kao C. 1999. Spurious Regression and Residual Based Tests for Cointegration in Panel Data. *Journal of Econometrics 90:* 1-44.

Kaplan R. 2013. Obama: Income Inequality, "The Defining Challenge of Our Time". *CBS News.*

Khattak D., Muhammad A., Iqbal K. 2014. Determining the Relationship between Income Inequality, Economic Growth & Inflation. *Journal of Social Economics 1(3):* 104-114.

Knowles S. 2005. Inequality and Economic Growth: The Empirical Relationship Reconsidered in the Light of Comparable Data. *The Journal of Development Studies 41(1):* 135-159.

Kravis I.B. 1960. International Differences in the Distribution of Income. *Review of Economics and Statistics (November): 408-16.*

Kumhof M., Rancière R. 2010. Inequality, Leverage, and Crises. *IMF Working Paper 268.*

Kuznets S. 1963. Quantitative Aspects of the Economic Growth of Nations: VIII. Distribution of Income by Size. *Economic Development and Cultural Change.* Enero 2: 1-80.

Kuznets S. 1955. Economic Growth and Income Inequality. *The American Economic Review 45(1):* 1-28.

Laidler D., Parkin M. 1975. Inflation: A Survey. *Economic Journal 85:* 741-809.

Leamer E.E. 1995. The Heckscher-Ohlin Model in Theory and Practice. *Princeton Studies in International Finance 77.*

Ledoit O. 2011. The Redistributive Effects of Monetary Policy. University of Zurich Department of Economics. *Working Article 44.*

Levin A., Lin C., Chu, C.J. 2002. Unit Root Tests in Panel Data: Asymptotic and Finite-sample Properties. *Journal of Econometrics 108:* 1-24.

Lewis W.A. 1954. Economic Development with Unlimited Supplies of Labor. *Manchester School of Economic and Social Studies 22*: 139-91.

Li H., Zou H. 1998. Income Inequality is not Harmful for Growth: Theory and Evidence. *Review of Development Economics 2(3):* 318-334.

Lim C.Y., Sek S.K. 2014. Exploring the Two-way Relationship between Income Inequality and Growth. *Journal of Advanced Management Science 2(1).*

Lorenz M.O. 1905. Methods of Measuring the Concentration of Wealth. Publications of the *American Statistical Association 9(70):* 209-219.

Maestri V., Roventini A. 2012. GINI DP 30: Stylized Facts on Business Cycles and Inequality. *GINI Discussion Articles 30.* AIAS. Amsterdam Institute for Advanced Labor Studies.

Malinen T. 2008. Estimating the Long-run Relationship between Income Inequality and Economic Development. *Discussion Article 634.* University of Helsinki.

McKoskey S., Kao C. 1998. Comparing Panel Data Cointegration Tests with an Application to the "Twin Deficits" Problem, Mimeo.

Mayer T. 1980. David Hume and Monetarism. *Quarterly Journal of Economics 94:* 89-101.

Milanovic B. 2000. The Median-voter Hypothesis, Income Inequality, and Income Redistribution: An Empirical Test with the Required Data. *European Journal of Political Economy 16:* 367-410.

Mocan N.H. 1999. Structural Unemployment, Cyclical Unemployment, and Income Inequality. *Review of Economics and Statistics 81:* 122-134.

Monnin P. 2014. Inflation and Income Inequality in Developed Economies. *Council on Economic Policies. CEP Working Article Series 1.*

Munir, K., Sultan, M. 2017. Macroeconomic Determinants of Income Inequality in India and Pakistan. *Theoretical and Applied Economics Volume XXIV, No. 4(613):* 109-120.

N'Yilimon N. 2015. Income Inequality and Inflation in Developing Countries: An Empirical Investigation. *Economics Bulletin 35(4):* 2888-2902.

Niehues J. 2010. Social Spending Generosity and Income Inequality: A Dynamic Panel Approach. *IZA DP 5178.*

OECD. 2013. Crisis Squeezes Income and Puts Pressure on Inequality and Poverty: New Results from the OECD Income Distribution Database.

Okun A. 1975. Equality and Efficiency: The Big Trade-off. Brookings Institution.

Oshima H. 1962. The International Comparison of the Size Distribution of Family Income, with Special References to Asia. *Review of Economic and Statistics 44:* 439-444.

Ostry J., Berg A., Tsangarides C. 2014. Redistribution, Inequality, and Growth. *IMF Staff Discussion Note.* February 2014.

Papanek G.F., Kyn O. 1986. The Effect of Income Distribution on Development. *The Growth Rate and Economic Strategy 23.*

Paukert F. 1973. Income Distribution at Different Levels of Development: A Survey of Evidence. *International Labor Review 108:* 97-125.

Pedroni P. 1999. Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors. *Oxford Bulletin of Economics and Statistics 61:* 653-670.

Perotti R. 1996. Growth, Income Distribution and Democracy: What the Data Day. *Journal of Economic Growth 1(2):* 149-187.

Persson T., Tabellini G. 1994. Is Inequality Harmful for Growth? *American Economic Review 84(3):* 600-621.

Phillips A.W. 1958. The Relationship between Unemployment and the Rate of Change of Money Wages in the United Kingdom 1861-1957. *Economica 25(100):* 283-299.

Piketty T. 2014. Capital in the Twenty-first Century. Belknap press.

Putnam R.D. 2000. Bowling Alone: The Collapse and Revival of American Community. New York: Simon & Schuster.

Rajan R.G. 2015. Democracy, Inclusion, and Prosperity. Speech at the D.D. Kosambi Ideas Festival Goa. India.

Ram R. 1988. Economic Development and Income Inequality. *World Development 16(11).*

Rima I.H. 2009. Development of Economic Analysis. Routledge. London and New York.

Romer D.C., Romer H.D. 1998. Monetary Policy and the Well-being of the Poor. *National Bureau of Economic Research. Working Article 6793:* 159-201.

Shahbaz M. 2010. Income Inequality-Economic Growth and Non-linearity: A Case of Pakistan. *International Journal of Social Economics 37(8):* 613-636.

Shiller R. 1996. Why Do People Dislike Inflation? *NBER Working Article 5539.* Cambridge. Massachusetts.

Siami-Namini, S., Hudson, D., 2017. The Impacts of Sector Growth and Monetary Policy on Income Inequality in Developing Countries (*Under Review*). *(https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3059381)*

Silber J., Zilberfarb B. 1994. The Effect of Anticipated and Unanticipated Inflation on Income Distribution: The Israeli Case. *Journal of Income Distribution 4(1):* 41-49.

Stiglitz J. 2012. The Price of Inequality: How Today's Divided Society Endangers Our Future. New York: W.W. Norton.

Thalassinos E., Erginbay U., Yusuf M. 2012. Income Inequality and Inflation in the EU. *European Research Studies 15(1).*

Thirlwall A.P., Barton C.A. 1971. Inflation and Growth: The International Evidence. *Bonca Nazionale Del Lavoro Quarterly Review 98: 263-275.*

Toda H.Y., Yamamoto T. 1995. Statistical Inference in Vector Auto-regressions with Possibly Integrated Processes. *Journal of Econometrics 66:* 225-250.

Tyson L. 1998. Commentary: How Can Economic Policy Strike a Balance between Economic Efficiency and Income Equality? Income Inequality: Issues and Policy Options: 337-343.

Voitchovsky S. 2005. Does the Profile of Income Inequality Matter for Economic Growth? *Journal of Economic Growth 10(3):* 273-296.

Williamson J.G. 2008. Globalization and the Great Divergence: Terms of Trade Booms and Volatility in the Poor Periphery 1782-1913. *European Review of Economic History 12:* 355-91.

World Economic Forum 2015. Outlook on the Global Agenda.

Zapata H.O., Rambaldi A.N. 1997. Monte Carlo Evidence on Cointegration and Causation. *Oxford Bulletin of Economics and Statistics 59(2).*

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Appendix A

Table 1. Data Description

Data	**Description**
GINI	The GINI Index
GDP	GDP *Per Capita* (Constant 2005 U.S. Dollars)
$\mathbf{GDP^{hp}}$	HP-filtered GDP *Per Capita* (Long-run GDP Trend)
$\mathbf{GDP^{gap}}$	GDP Gap *Per Capita* (Short-run GDP or Business Cycles)
$\boldsymbol{\pi}$	Inflation, Consumer Price Index (Annual Percent)
$\boldsymbol{\pi}^{\mathbf{hp}}$	HP-filtered Inflation (Long-run Inflation Trend)
$\boldsymbol{\pi}^{\mathbf{gap}}$	Inflation Gap (Short-run Inflation or Inflation Cycles)
OPEN	Openness to International Trade (Percent of GDP)
UR	Urbanization Index measured as a Percentage of Population Living in U
UN	Unemployment Rate, Total (Percent of Total Labor Force) (Modeled IL

Table 2. Descriptive Statistics

	DCs Group					LD		
Variables	Obs.	Mean	Max	Min	Std. Dev.	Obs.	Mean	Max
GINI	600	3.4393	3.7612	2.9699	0.1469	1650	3.7299	4.3457
GDP	600	10.079	11.1432	7.8971	0.7120	1650	7.1677	9.3833
$\mathbf{GDP^{hp}}$	600	10.068	11.1773	8.2669	0.6670	1650	7.1677	9.3941
$\mathbf{GDP^{gap}}$	600	0.0115	1.1911	-1.2397	0.2248	1650	4.85E-12	1.6979
$\boldsymbol{\pi}$	600	1.0237	7.3132	-4.0739	1.1391	1650	2.0347	8.9202
$\boldsymbol{\pi^{hp}}$	600	1.0345	3.4792	-0.4560	0.7096	1650	2.0347	5.7784
$\boldsymbol{\pi^{gap}}$	600	-0.0109	3.8340	-4.7124	0.7989	1650	-3.03E-12	5.4254
OPEN	600	4.3103	5.2511	2.9824	0.4714	1650	4.1751	5.3955
UR	600	4.2795	4.5831	3.9059	0.1566	1650	3.7218	4.5555
UN	600	2.0358	3.3069	-0.5108	0.5118	1650	1.9285	3.6712

Table 3. Panel Kao Residual Cointegration Test

H_0: No Cointegration	t-Statistic (Prob.)	
	DCs Group	LDCs Group
ADF	-3.0917 (0.0010)	-4.6794 (0.000
Residual Variance	0.00064	0.001976
HAC* Variance	0.00093	0.002441

(Probability values are in parenthesis).

*. *Heteroscedasticity and Autocorrelation Consistent (HAC).*

This test rejects the null hypothesis of no cointegration at the 1 percent significant le

Table 4. The Results of the Regression Analysis

Dependent Variable: LGINI	DCs Group					LDC		
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(
C	5.4577 (0.0000)	4.8106 (0.0000)	5.2069 (0.0000)	5.2353 (0.0000)	5.9662 (0.0000)	3.6408 (0.0000)	3.6244 (0.0000)	3.6 (0.0
GDP^{hp}	-0.2454 (0.1142)	-0.1417 (0.3499)	-0.1692 (0.3100)	-0.1654 (0.3047)	-0.2773* (0.0929)	0.0590* (0.1077)	0.0623* (0.1005)	0.0 (0.0
$(GDP^{hp})^2$	0.0204 (0.0087)	0.0143* (0.0607)	0.0171 (0.0389)	0.01664 (0.0383)	0.0223 (0.0065)	-0.0062 (0.0025)	-0.0060 (0.0214)	-0.0 (0.0
GDP^{gap}	0.1966 (0.0000)	0.1717 (0.0000)	0.2079 (0.0000)	0.1880 (0.0000)	0.1814 (0.0000)	-0.0332 (0.0000)	-0.0290 (0.0003)	-0.0 (0.0
π	-0.0042 (0.0256)	0.0002 (0.9209)	-	-	-	-0.0054 (0.0003)	-0.0122 (0.0000)	
π^2	-	-0.0029 (0.0002)	-	-	-	-	0.00128 (0.0035)	
π^{hp}	-	-	0.0038 (0.4023)	0.0044 (0.3352)	0.0315 (0.0044)	-	-	-0.0 (0.0
$(\pi^{hp})^2$	-	-	-	-	-0.0095 (0.0217)	-	-	
π^{gap}	-	-	-	-0.0066 (0.0024)	-0.0069 (0.0035)	-	-	
OPEN	0.0236* (0.0754)	0.0254* (0.0592)	0.0256 (0.0476)	0.0267 (0.0385)	0.0243* (0.0930)	0.0029 (0.6538)	0.00791 (0.2220)	-0.0 (0.9
UN	0.0329 (0.0000)	0.0294 (0.0000)	0.342 (0.0000)	0.0294 (0.0000)	0.0323 (0.0000)	0.0212 (0.0004)	0.0206 (0.0006)	0.0 (0.0
UR	-0.4183 (0.0000)	-0.3664 (0.0000)	-0.4662 (0.0000)	-0.4689 (0.0000)	-0.5133 (0.0000)	-0.01399 (0.1482)	-0.0220 (0.0403)	-0.0 (0.2
R^2	0.95	0.95	0.95	095	0.95	0.94	0.95	0.

*(Probability values are in parenthesis); *. Significant at 10 percent level.*

Table 5. The Results of Granger Causality Test Based on Toda-Yamamoto (1995

Dependent Variable	DCs Group				LDC	
	GINI	π	π^{hp}	π^{gap}	GINI	π
GINI	-	1.6558	-	-	-	1.0380
	-	(0.4370)	-	-	-	(0.7920)
π	0.3932	-	-	-	6.2577	-
	(0.8215)	-	-	-	(0.0997) *	-
GINI	-	-	4.7613	-	-	-
	-	-	(0.3127)	-	-	-
π^{hp}	0.6598	-	-	-	9.9114	-
	(0.9562)	-	-	-	(0.0778) *	-
GINI	-	-	-	0.3822	-	-
	-	-	-	(0.8260)	-	-
π^{gap}	1.0620	-	-	-	1.4615	-
	(0.5880)	-	-	-	(0.4815)	-

**. Significant at 10 percent level.*

Table 6. The Results of Granger Causality Test Based on VECM Appro

Dependent Variable	DCs Group						
	Short-run		Long-run	Joint (Short-run/Long-run)		Short-run	
	D (GINI)	D (π)	ECT (-1)	D (GINI), ECT (-1)	D (π), ECT (-1)	D (GINI)	D (π)
D (GINI)	-	0.8066 (0.4469)	16.6818 (0.0012)	31.7009 (0.0000)	3.5806 (0.0138)	-	0.6273 (0.5340)
D (π)	0.1544 (0.8570)	-	73.7102 (0.0000)	26.3547 (0.0000)	45.9969 (0.0000)	0.1575 (0.8543)	-
	D (GINI)	D (π^{hp})	ECT (-1)	D (GINI), ECT (-1)	D (π^{hp})ECT(-1)	D (GINI)	D (π^{hp})
D (GINI)	-	0.3441 (0.8481)	14.4621 (0.0000)	17.5532 (0.0000)	3.5199 (0.0391)	-	1.3660 (0.2554)
D (π^{hp})	0.1665 (0.9554)	-	0.0353 (0.8511)	0.1365 (0.9838)	57886.64 (0.0000)	0.0228 (0.9774)	-
	D (GINI)	D ((π^{gap})	ECT (-1)	D (GINI), ECT (-1)	D (π^{gap}), ECT(-1)	D (GINI)	D ((π^{gap})
D (GINI)	-	0.9178 (0.4000)	2.2357 (0.1355)	28.3821 (0.0000)	0.8302 (0.4776)	-	1.7287 (0.1779)
D (π^{gap})	0.4072 (0.6657)	-	82.0050 (0.0000)	29.0833 (0.0000)	49.2955 (0.0000)	0.5929 (0.5529)	-

**. All figures are the calculated F-statistics. **. Significant at 5 percent level.*

NOTES

1. The effects of the money injection on the structure of prices depending on its resources and its impact on recipients (Rima, 2009).
2. It includes mild inflation, strato-inflation and hyper-inflation.
3. In economics, the Phillips curve is a historical inverse relationship between rates of unemployment and corresponding rates of inflation (Phillips, 1958).
4. A widely used definition is that of the World Bank, dividing the MICs in an upper and lower segment based on *per capita* gross national income. In the United Nations (UN) system the category of MICs is often utilized to refer to developing and transition economies not categorized as LDCs.
5. The developed countries (by the World Bank three-letter country codes) included in the present article are: AUS, AUT, BEL, HRV, CZE, DNK, EST, FIN, FRA, DEU, GRC, IRL, ITA, LVA, NLD, NOR, POL, SVK, SVN, ESP, SWE, CHE, GBR, USA.
6. The developing countries include: ARG, ARM, AZE, BGD, BLR, BOL, BWA, BRA, BGR, BFA, BDI, KHM, CAF, CHN, COL, CRI, DOM, ECU, EGY, SLV, ETH, GEO, GTM, HND, HUN, IND, IDN, IRN, JOR, KAZ, KEN, KGZ, LAO, LSO, MKD, MDG, MWI, MYS, MLI, MRT, MEX, MDA, MNG, MAR, NAM, NPL, NIC, NGA, PAK, PAN, PRY, PER, PHL, RWA, SEN, ZAF, LKA, TZA, THA, TUN, TUR, UGA, UKR, URY, VNM, ZMB.
7. It is a graphical representation of wealth distribution developed by Max Lorenz (1905).
8. Weak covariance.
9. The results are not reported in this article but are available upon request.
10. In column (2), the coefficient of GDP gap *per capita* is significant at 10 percent level.

Table 1. Data Description

Data	**Description**
GINI	The GINI Index
GDP	GDP *Per Capita* (Constant 2005 U.S. Dollars)
GDP^{hp}	HP-filtered GDP *Per Capita* (Long-run GDP Trend)
GDP^{gap}	GDP Gap *Per Capita* (Short-run GDP or Business Cycles)
π	Inflation, Consumer Price Index (Annual Percent)
π^{hp}	HP-filtered Inflation (Long-run Inflation Trend)
π^{gap}	Inflation Gap (Short-run Inflation or Inflation Cycles)
OPEN	Openness to International Trade (Percent of GDP)
UR	Urbanization Index measured as a Percentage of Population Living in U
UN	Unemployment Rate, Total (Percent of Total Labor Force) (Modeled IL

Table 2. Descriptive Statistics

Variables	DCs Group					LD		
	Obs.	Mean	Max	Min	Std. Dev.	Obs.	Mean	Max
GINI	600	3.4393	3.7612	2.9699	0.1469	1650	3.7299	4.3457
GDP	600	10.079	11.1432	7.8971	0.7120	1650	7.1677	9.3833
GDP^{hp}	600	10.068	11.1773	8.2669	0.6670	1650	7.1677	9.3941
GDP^{gap}	600	0.0115	1.1911	-1.2397	0.2248	1650	4.85E-12	1.6979
π	600	1.0237	7.3132	-4.0739	1.1391	1650	2.0347	8.9202
π^{hp}	600	1.0345	3.4792	-0.4560	0.7096	1650	2.0347	5.7784
π^{gap}	600	-0.0109	3.8340	-4.7124	0.7989	1650	-3.03E-12	5.4254
OPEN	600	4.3103	5.2511	2.9824	0.4714	1650	4.1751	5.3955
UR	600	4.2795	4.5831	3.9059	0.1566	1650	3.7218	4.5555
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GDP^{hp}	-0.2454 (0.1142)	-0.1417 (0.3499)	-0.1692 (0.3100)	-0.1654 (0.3047)	-0.2773* (0.0929)	0.0590* (0.1077)	0.0623* (0.1005)	0.06 (0.0
$(GDP^{hp})^2$	0.0204 (0.0087)	0.0143* (0.0607)	0.0171 (0.0389)	0.01664 (0.0383)	0.0223 (0.0065)	-0.0062 (0.0025)	-0.0060 (0.0214)	-0.0 (0.0
GDP^{gap}	0.1966 (0.0000)	0.1717 (0.0000)	0.2079 (0.0000)	0.1880 (0.0000)	0.1814 (0.0000)	-0.0332 (0.0000)	-0.0290 (0.0003)	-0.0 (0.0
π	-0.0042 (0.0256)	0.0002 (0.9209)	-	-	-	-0.0054 (0.0003)	-0.0122 (0.0000)	
π^2	-	-0.0029 (0.0002)	-	-	-	-	0.00128 (0.0035)	
π^{hp}	-	-	0.0038 (0.4023)	0.0044 (0.3352)	0.0315 (0.0044)	-	-	-0.0 (0.0
$(\pi^{hp})^2$	-	-	-	-	-0.0095 (0.0217)	-	-	
π^{gap}	-	-	-	-0.0066 (0.0024)	-0.0069 (0.0035)	-	-	
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UN	0.0329 (0.0000)	0.0294 (0.0000)	0.342 (0.0000)	0.0294 (0.0000)	0.0323 (0.0000)	0.0212 (0.0004)	0.0206 (0.0006)	0.0 (0.0
UR	-0.4183 (0.0000)	-0.3664 (0.0000)	-0.4662 (0.0000)	-0.4689 (0.0000)	-0.5133 (0.0000)	-0.01399 (0.1482)	-0.0220 (0.0403)	-0.0 (0.2
R^2	0.95	0.95	0.95	095	0.95	0.94	0.95	0.

*(Probability values are in parenthesis); *. Significant at 10 percent level.*

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π	0.3932	-	-	-	6.2577	-
	(0.8215)	-	-	-	(0.0997) *	-
GINI	-	-	4.7613	-	-	-
	-	-	(0.3127)	-	-	-
π^{hp}	0.6598	-	-	-	9.9114	-
	(0.9562)	-	-	-	(0.0778) *	-
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	-	-	-	(0.8260)	-	-
π^{gap}	1.0620	-	-	-	1.4615	-
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	D (GINI)	D ((π^{gap})	ECT (-1)	D (GINI), ECT (-1)	D (π^{gap}), ECT(-1)	D (GINI)	D ((π^{gap})
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D (π^{gap})	0.4072 (0.6657)	-	82.0050 (0.0000)	29.0833 (0.0000)	49.2955 (0.0000)	0.5929 (0.5529)	-

. All figures are the calculated F-statistics.* *. Significant at 5 percent level.*

Inflation and Income Inequality in Developed and Developing Countries

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