Inflation and Sustainable Human Development: Assessing the Role of Public Expenditures in Threshold Effect

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Abstract

Economic growth is limited to raising GDP, whereas the choices made by individuals influence human development. Several economic needs to be proved to hamper economic growth. Throughout history, determining the ideal degree of inflation has been crucial to achieving the best potential results in human advancement. The relationship between inflation and human development in Pakistan is analyzed to see if a threshold effect exists. To address the following question, public social service regulation can modify the threshold effect of inflation for sustainable human growth, even in the case of public expenditure restriction. Using annual data from 1972 to 2022, Khan & Senhadji's (2001) methodology is utilized for threshold estimation, and the Error Correction Mechanism (ECM) approach is used for co-integration. In order to understand the threshold impact between inflation and human development, it is imperative to address the holes in current research on the subject. Several studies indicate a threshold level of 9% for inflation and economic growth in Pakistan, which is significantly lower than the empirical data. Human development is negatively affected by inflation beyond this threshold. The report suggests that an inflation rate of more than 3% negatively impacts Pakistan's sustainable human development. Inflation and human progress can intersect at different points when government social services increase purchasing power. To calculate the threshold level of 14%, the current analysis uses public spending on social services. Improved provision of social services such as drinking water, sanitation, health care, and education can mitigate inflation's adverse effects.

Keywords: *Inflation, Public Expenditure, Human Development, Threshold, Pakistan*

JEL: *E31, H50, O1*

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1. INTRODUCTION

Monetary policy aims to achieve price stability, but it refers to such a price level which does not harm human development. Human development enlarges people's choices (United et al., 1990). Consistent increase in Inflation is harmful to economic growth and human development. It discourages long-term planning, reduces saving and capital accumulation, curbs investment, affects aggregate income, and promotes inefficient use of resources, which causes uncertainty and continuous disturbance to other socioeconomic indicators. It reduces the purchasing power of some sections of the society. Consequently, higher Inflation adversely affects sustainable human development by restricting people's choices. A lower rate of Inflation promotes economic activity, but more than the threshold level, it has adverse consequences for economic activity and growth (Nawab et al.,2023; Akay & Oskonbaeva,2022; Fishcer, 1993; Mubarak, 2005). However, stable Inflation has auspicious effects on the economy. It reduces unemployment and ameliorates spending and investment. The threshold level of Inflation favours economic growth and development (Mubarik, 2005; Sarel, 1996; Khan & Senhaji, 2001). Single-digit Inflation favours economic growth (Donald, 2013; Hussain & Malik, 2011). The relationship of Inflation with economic growth below the threshold level is positive and above negative (Ansari, 2010; Khan & Senhadiji, 2001; Ali, 2012; Qayyum, 2006).

Although long-term relationships and threshold levels of inflation have not been examined in the literature, the literature does show some evidence that they exist. It is important to note that income per capita conceals a wide range of socioeconomic characteristics about a society. Per capita income does not always reflect the socioeconomic conditions of a society, as Dasgupta Weale (1992) explains. In Anand's (1994) view, assessing a society's progress and measuring its members' well-being using income is a limited process. He believes that all development initiatives must result in people and their lives.The standard of living is not solely determined by income, although it contributes significantly to it. According to Sen (1988), development and growth are two separate concepts. GDP per capita is primarily considered when measuring economic growth; the distribution of GDP is not taken into account. The income distribution of a nation or community may still be uneven even if its GDP per person has increased more significantly. The impoverished segment of society may be impacted little by an increase in GDP per capita. The goal of all development efforts is not GDP in and of itself but rather achieving well-being through it.

The concept of development encompasses everything. There are many things that people can do and be. According to him, development must be distinguished fundamentally between means and ends. Development focuses primarily on the lives of individuals. Several social problems, such as child mortality, malnutrition, and hunger, are closely associated with the development process. Haq (1995) contends that human progress serves both as a means and an end. Since physical capital and other factors of production are essential components of the production process, economists often discuss them when discussing means of development. While many societies possessed a wealth of physical capital, they were unable to

achieve satisfactory levels of economic development.

The growth of per capita income cannot, therefore, be used as a measure of development. Through the use of other methods, income-based approaches can be overcome in order to study a society's growth. A composite measure of human development is the Human Development Index (HDI). In terms of human development, the UNDP (UNDP, 1990) created an index that is superior due to its comprehensive approach to its formulation. Human development encompasses a wide range of activities. Individuals are given more options through this method. Human development is measured by three fundamental components, which the UNDP developed an index to measure.A country's development is measured by how well it performs in three areas of human development: knowledge, health, and living standards. In accordance with UNDP (2011), the HDI measures progress in each area by a geometric mean of normalized indices. Human development and inflation were examined in the current study to see if there were threshold effects. A study conducted by economists has examined whether public spending affects the inflation threshold needed for sustained human development by regulating public spending.

 Khan and Senhadji (2001) consider how inflation can impact human development at a threshold. Co-integration among variables has been estimated using the Error Correction Mechanism (ECM).

The work thus provides a strong foundation for understanding the relationship between inflation and economic growth. Furthermore, the current study provides a more comprehensive view of human development by examining the relationship between government spending and it. Human development indexes are rarely used to measure inflation. In the next section, we will review earlier research on this topic.

2. LITERATURE REVIEW

There have been numerous studies looking at the relationship between inflation and development in the literature. As a proxy for development, GDP per capita and its growth have been used in most studies (Azam & Khan, 2022; Ehigiamusoe et al., 2019). Human development threshold levels and causal relationships between inflation and human development have very little research in the literature. Nevertheless, both international and domestic academics have determined what level of inflation is required for economic growth. Khan Senhadji (2001) examined threshold effects between inflation and economic growth for 140 developed and emerging nations.The study looked at inflation thresholds of 1 to 3% for rich countries and 11 to 12% for underdeveloped countries, above which inflation significantly hinders growth. The correlation between growth and inflation was clear and negative. The robustness of the estimation method was demonstrated using the stage least square approach (TSLA). There is a connection between inflation and financial growth in several nations (Watchel ,2002).

As well as discovering a threshold for inflation, they also discovered a rate of inflation. For this purpose, they used regression analysis for 84 nations with data spanning 1960 to 1995. Based on the results, inflation thresholds ranged from 13 to 15 per cent. Growth in economic activity was negatively affected by an increase in inflation above the threshold. Relationships vary based on size, economy, and room for expansion of the country. Economic development and inflation in South African countries are influenced by threshold effects (Danlade 2013). To determine the inflation threshold level, we used the Ordinary Least Squares (OLS) method. South African countries need to meet an inflation threshold of 9% for economic growth.

Specific research computed the threshold impact in the country-specific relationship between inflation and economic growth. Nigeria's inflation threshold for economic growth was measured by Salami Kelikume (2010). They concluded that Nigeria's inflation rate should be at most 8% by using time series data. Ajide and Lawanson (2012) proposed a 9 per cent threshold for inflation in order to support economic growth in Nigeria. Doguwa (2012) used quarterly data from 2005 to 2012 and an Integrated Moving Average Model to determine the threshold amount of inflation for economic growth in Nigeria. To verify the results' sensitivity and robustness, he used three distinct models.To establish the threshold level of inflation, he employed the theories and methods of Khan Senhadji (2001), Druker et al. (2009), and Sarle (1996). Results showed that Nigeria's inflation threshold level was between 10.5% and 12%. Mubarik (2005) determined the threshold inflation level for economic growth in Pakistan using Khan Senhadji's (2001) methodology. An illustration of the relationship between inflation and economic growth was provided by him using a graph. Economic expansion and inflation have a one-way causal relationship, according to the causality analysis. To determine the inflation threshold, the Ordinary Least Square (OLS) method was used, and the Two Stage Ordinary Least Square (2SLS) method was used to assess the robustness of the results.An inflation threshold of 9% was found to be necessary for Pakistani economic growth. The inflation threshold of Pakistan was established by Hussain (2005), and its relationship to economic growth was discussed. A time series of data was collected from 1973 to 2005. A nonlinear approach was used to establish Pakistan's inflation threshold level for economic growth. It was found that Sing (2003) observed economic growth in India at a threshold inflation level of 4% to 7%, while Mubarik (2005) found it at a threshold inflation level of 2% to 4%.

Mehrara (2007) found a correlation between the Iranian economy's growth and inflation. Analyses were conducted from 1959 to 2004. To determine the inflation threshold, we used the Structural Breakpoint approach. A threshold level of inflation is defined as between 9 and 12 percent based on the results of the study. The growth of the economy was adversely affected by inflation once it exceeded that threshold. In order to prevent detrimental effects on economic growth, he believes inflation should be kept below the threshold level. Pakistani inflation and monetary policy were examined by Anwar (2012). He believes there is a long-term relationship between inflation and money supply. Between 1960 and 2006, data were collected. The unit root problem was assessed using a Dickey-Fuller augmented test.

Inflation and money supply have long- and short-term relationships. The same conclusion is reached by Qayyum (2006). The relationship between inflation and economic growth was investigated by Farooq et al. (2011) in Pakistan. A negative correlation was found between inflation and economic growth using the ordinary least squares (OLS) method. Among industrialized and emerging economies, Espinoza (2010) determined that 1% is the threshold level for industrialized economies. The countries with industrialized economies accounted for 3% of GDP, and those with low incomes accounted for 17%. Additionally, Eggoh & Khan (2014), Kartaev & Klochkova (2015), and Ibarra & Trupkin (2016) found that established economies and developing economies have thresholds of 3% and 10-12%, respectively.

2.1 Theoretical Background

It is still debated how Inflation affects economic growth and development theoretically. In addition to monetarists and structuralists, there are other schools of thought. According to the structural school of thought, Inflation is essential for economic expansion and progress. Monetarists, however, considered Inflation detrimental to economic growth. Structure vs. monetarism can be divided into two main categories. What is the actual nature of the relationship? In which direction is causality heading? As Friedman stated in 1973, "Throughout history, every possible combination has happened: inflation with and without development, as well as no inflation with and without development." According to the economic theory of Inflation and development, these variables are related in different ways. It is beneficial to derive views from theory based on observed phenomena. Barro & Gordon (1983) postulate that an economy where real effects and expectations of Inflation can influence aggregate supply. These effects can be captured by assuming that aggregate supply is given by the Lucas-type supply curve Romer (2001).

$$Y = y + \beta(\pi - \pi_e)$$
$$\beta > 0 \quad\quad\quad (1)$$

As seen in equation (1), Y is the output log, Y is the y-intercept of the flexible price level, while * and *e are actual and expected Inflation, respectively. A flexible output price level is assumed to be lower than optimal. The marginal cost of Inflation increases with Inflation above some level. Keynesians used aggregate demand (AD) and aggregate supply (AS) curves as part of their initial model, with the AS curve being upward-sloping instead of vertical. Prices change due to changes in the economy caused by AD.

An increase in AD that is upward-sloping also negatively impacts output and pricing. According to Keynes, monetary and fiscal policies affect output and Inflation in the short term. A positive correlation exists initially between Inflation and output, but this relationship declines over time (Dornbusch et al., 1996). Monetarists emphasize the long-run supply side to refute short-run dynamics (Dornbusch et al., 1996). Friedman focused his research on the quantity theory of money. According to him, money supply and velocity drive Inflation, which occurs everywhere and always.

An increase in AD that is upward-sloping also negatively impacts output and pricing. According to Keynes, monetary and fiscal policies affect output and Inflation in the short term. Dornbusch et al. (1996) found that Inflation and output initially correlated positively. Over time, they became negatively correlated (Dornbusch et al., 1996). Several aspects of the long-run supply side are emphasized by monetarists in order to refute short-run dynamics (Dornbusch et al., 1996). Friedman's research focused on the quantity theory of money. He believes that Inflation is driven by the money supply and velocity, which are monetary phenomena that occur everywhere and always.

3. DATA AND METHODOLOGY

Human development and inflation are affected by threshold effects. This study applied cointegration and causality approaches to estimate short-term and long-term causality. For this empirical analysis, time series data have been considered. These sections comprise the methodological framework.

3.1 Estimation of Threshold Level

Many studies in the literature used cross-sectional and panel data to calculate the threshold level of Inflation for economic growth and GDP per capita. Khan and Senhadji (2001) and Burdekin (2000) analyzed cross-sectional data in different countries. For various countries, Singh (2003) and Mubarik (2005) have used time series data to estimate threshold levels of Inflation, unlike Fischer (1993) and Barro (1996), who employed panel data. Utilizing Khan & Senhadji's (2001) methodology, the present study estimates the threshold effects of Inflation in the relationship between Inflation and human development over time. Following is the conditional equation for estimating inflation thresholds:

$$HDI_t = \gamma_1 \pi_t + \gamma_2 d_t (\pi_t - \pi^*) + \chi_t \beta + v_t \quad \text{...} \quad (2)$$

As a measure of variation in human development across a period, the human development index (HDIt) is taken. At the same time, the inflation rate at a given time represents the threshold level of Inflation. In contrast, the disturbance term represents the vector of significant control variables in human development literature. By choosing a dummy variable, the following can be achieved.

$$d_t = \begin{matrix} d_t = 1 \, if \, \pi_t \\ 0 \, if \, \pi_t \end{matrix} \quad \begin{cases} > \pi * \\ \square \\ \leq \pi * \end{cases} \quad \text{……………………………………………} \quad (3)$$

If Inflation is below the threshold level or equal to it, the equation is equal to zero; otherwise, it is equal to one. Consequently, Inflation will have an effect when it is lower than the chosen threshold level and higher than the chosen threshold level. Based on Khan and Senhadji's (2001) analysis of the threshold level of Inflation in industrialized and developing countries, we developed our model to determine the threshold level of Inflation. The threshold level of Inflation was also determined by Mubarak (2005) using the same model. Four variables determine inflation

threshold levels. Investment, population, Inflation, and government expenditure are control variables. Literature on economic development and Inflation shows that both variables are highly influenced by population and investment. The previous studies show that an increase in population significantly affects aggregate demand and growth. Public expenditures have been controlled in this model to investigate the role of public provision of social services in the threshold effects between Inflation and human development. Typically, public expenditures on the provision of education and health enhance the purchasing power of people. As a threshold level of Inflation, the sum of squared residuals with the lowest value and the highest R2 value is considered. It is possible to maximize R2 or adjust R2, excluding constant terms if there is more than one variable.

The following equations have been used to determine the threshold level of Inflation.

$$HDIt = \beta_{0+}\beta_1(\pi_t) + \beta_2 dt(\pi t - \pi*) + \beta_3(Pg_t) + \beta_4(Inv_t) + Vt \text{............}$$ [4]

$$HDIt = \beta_{0+}\beta_1(\pi_t) + \beta_2 dt(\pi t - \pi*) + \beta_3(Pg_t) + \beta_4(Inv_t) + \beta_5(Gex_t)Vt \text{............}$$ [5]

Variable transformed by the following method.

$\pi_t = Inflation$

$Inv_t = Investment$

$Pg_t = Population\ growth$

$HDI_t = Human\ development\ index$

$Gex_t = Governement\ Expenditures$

$t = Time$

$V = Error\ term$

The threshold level has been determined by using different dummy variables on different inflation levels. These dummy variables express the threshold level of Inflation. The range of dummy variables used a 2% to 15% level of Inflation.

3.2. Co-integration and Causality

Granger (1981) introduced co-integration, which was further elaborated by Engle and Granger (1987), Engle and Yoo (1987), Phillips and Ouliaris (1990), Stock and Watson (1988), Phillips (1986 and 1987) and Johansen (1988, 1991, 1995a). A co-integration and causality study of inflation in Pakistan has been conducted using the Error Correction Mechanism (ECM) and Granger Causality test. Based on the human development index (HDI), we calculated the rate of human development growth. Consider the case in which inflation and human development growth are cointegrated by definition. We can express the relationship between inflation and human development growth using an ECM specification.

$$\Delta HDI_t = \alpha_0 + \beta_1 \Delta \inf_t - \pi\mu^{\wedge}_{t-1} + u_t \quad \text{...} \quad (6)$$

Based on Granger (1969), causality is defined as follows: When inflation can be predicted more accurately if past values of human development growth are used instead of not using such past values, it is said that the variable is Granger-cause inflation. All other terms remain the same. Human development growth and inflation are two stationary variables in the Granger causality test, and the first step is to estimate a VAR model as follows.

$$HDI_t = \alpha_1 + \sum_{i=1}^{n} \beta_i Inf_{t-i} + \sum_{j=1}^{m} \gamma_i HDI_{t-j} + e_{1t} \quad \text{..} \quad (6)$$

$$Inf_t = \alpha_2 + \sum_{i=1}^{n} \theta_i Inf_{t-i} + \sum_{j=1}^{m} \delta_j HDI_{t-j} + e_{2t} \quad \text{...} \quad (7)$$

3.3. Data Collection

This empirical analysis uses time series data from 1972 to 2022. United Nations Development Program (UNDP) arranges data for the Human Development Index (HDI). The World Development Indicator (WDI) database provides information on other variables such as investment, population, government spending, and inflation.

4.EMPIRICAL FINDINGS AND DISCUSSION

It is determined in this study that the level of Inflation in Pakistan is crucial for human development. According to the study's findings, there is also a causal relationship between Inflation and human development. Table 1 of appendix-A presents the results of model 1, calculated 3% of Inflation as the threshold level. At this level, the R-square 0.8411 is greater, and the residual sum of squares 0.1390 is smaller, suggesting an adverse and significant relationship between Inflation and human development. A value below 3% indicates a positive and significant association. According to the results, Pakistan's economic growth depends on a contradictory level of Inflation. Previous studies have found that 7% of Inflation and above harm economic growth in Pakistan, as found by Mubarak (2005), Hussain & Malik (2011), Mohsan (2007), and Farooq et al. (2011). The threshold inflation levels for economic growth in other developing economies are also different than those estimated in this study for Pakistan's human development. Khan & Sehnadiji (2001) calculated 11-12 percent, Kremer, Bick, Nautz (2013) 17 percent, Eggoh & Khan (2014) 10-12 percent, Kartaev & Klochkova (2015) 9% and Ibarra & Trupkin (2016) estimated 19%. It indicates that more than 3% inflation is detrimental to human development in Pakistan. Due to poverty and high inequality in developing economies, As the price of goods and services decreases in Pakistan, people's purchasing power is reduced, which results in reduced spending on education and health. The average level of human capital declines when people reduce their expenditures on education and health. Sustainable human development in Pakistan is adversely affected by low human capital.

As a result, 3% is the optimal inflation rate for Pakistani human development. Human development is negatively impacted by inflation rates higher than this calculated threshold level. Meanwhile, Inflation does not hinder human development when it is below the threshold level. Several researchers have found and discussed in the literature that public social services positively impact human development. Based on an analysis of fifteen states of India, Mukherjee and Banerjee (2010) examined the relationship between educational and health services and their outcomes. A positive correlation exists between literacy rate chi,ld survival rate, and educational and health services. Different education outcomes are positively correlated with health services, while health outcomes are weakly correlated with educational services. Sanchez & Sbrana (2009), Odawara & Loayza (2010), Patra & Acharya (2011), Kusharjanto & Kim (2011), Roskruge, Grimes, McCann & Poot (2012), Sahoo, Dash & Nataraj (2012), Tripathi & Pandey (2012) have described that public provision of social services has positive impacts on development. It shows that government intervention through expenditures on social services like educational and health infrastructure helps enhance human development in a society. Many people in developing economies like Pakistan have demanded quality education and health. However, high poverty and inequality in these nations restrict the choices of many people. Due to the lower living standard, people prefer to consume other basic needs like food and shelter.

Table 1 Empirical Estimation of Threshold Effect of Inflation on Human Development

K	Variable	Coefficient	Standard Error	t-statistic	Probabili-ty-Value	Adjusted R-Squared
2	INF	-0.003464	0.001896	-1.82647	0.0754	
	LINV	-0.078022	0.031269	-2.49519	0.0169	
	LPOP	-1.352542	0.095861	-14.1094	0.0000	0.8324
	C	-0.193912	0.057388	-3.37896	0.0017	
	INF	0.234340	0.134307	1.744800	0.0891	
	LINV	-0.082420	0.030547	-2.69808	0.0103	
	LPOP	-1.386821	0.095325	-14.5482	0.0000	
	INF3	-0.238613	0.134752	-1.77075	0.0846	0.8411
3	C	-0.879825	0.391365	-2.24809	0.0305	
	INF	0.055320	0.043495	1.271875	0.2111	
	LINV	-0.082178	0.031093	-2.64293	0.0119	
	LPOP	-1.367975	0.095540	-14.3183	0.0000	
	INF4	-0.059574	0.044038	-1.35277	0.1841	
4	C	-0.409966	0.169507	-2.41857	0.0205	0.8358

5	INF	0.025476	0.023977	1.06251	0.2947	0.8343
	LINV	-0.083004	0.031355	-2.64725	0.0117	
	LPOP	-1.360470	0.095518	-14.2430	0.0000	
	INF5	-0.029873	0.024673	-1.21072	0.2335	
	C	-0.320604	0.119182	-2.69003	0.0106	
6	INF	0.011932	0.015180	0.786040	0.4367	0.8326
	LINV	-0.083174	0.031655	-2.62755	0.0123	
	LPOP	-1.352726	0.095806	-14.1194	0.0000	
	INF6	-0.016357	0.016002	-1.02221	0.3131	
	C	-0.271461	0.095104	-2.85434	0.0069	
7	INF	0.007938	0.010677	0.743463	0.4618	0.8331
	LINV	-0.080825	0.031305	-2.58188	0.0138	
	LPOP	-1.351971	0.095645	-14.1353	0.0000	
	INF7	-0.012633	0.011642	-1.08505	0.2847	
	C	-0.260147	0.083694	-3.10829	0.0036	
8	INF	0.005089	0.008286	0.614172	0.5428	0.8329
	LINV	-0.076444	0.031255	-2.44584	0.0192	
	LPOP	-1.362141	0.096136	-14.1689	0.0000	
	INF8	-0.010062	0.009490	-1.06024	0.2957	
	C	-0.248200	0.076842	-3.23000	0.0026	
9	INF	0.003426	0.006727	0.509303	0.6135	0.8330
	LINV	-0.074673	0.031370	-2.38038	0.0224	
	LPOP	-1.372833	0.097560	-14.0716	0.0000	
	INF9	-0.008725	0.008175	-1.06737	0.2925	
	C	-0.238045	0.070649	-3.36941	0.0017	
10	INF	0.004269	0.005258	0.812021	0.4218	0.8384
	LINV	-0.074573	0.030773	-2.42335	0.0202	
	LPOP	-1.381240	0.095852	-14.4100	0.0000	
	INF10	-0.010787	0.006859	-1.57272	0.1241	
	C	-0.243283	0.064490	-3.77241	0.0006	

	INF	0.003123	0.005173	0.603660	0.5497	
	LINV	-0.072785	0.031164	-2.33557	0.0249	
	LPOP	-1.373706	0.096070	-14.2990	0.0000	
11	INF11	-0.010022	0.007335	-1.36626	0.1799	0.8360
	C	-0.240626	0.066263	-3.63136	0.0008	
	INF	0.002694	0.004573	0.589204	0.5592	
	LINV	-0.072647	0.031022	-2.34181	0.0245	
	LPOP	-1.372546	0.095414	-14.3851	0.0000	
12	INF12	-0.010431	0.007070	-1.47545	0.1483	0.8373
	C	-0.239104	0.064304	-3.71831	0.0006	
	INF	0.002635	0.003908	0.674167	0.5043	
	LINV	-0.071996	0.030636	-2.35004	0.0241	
	LPOP	-1.371373	0.093943	-14.5979	0.0000	
13	INF13	-0.011671	0.006591	-1.77070	0.0846	0.8409
	C	-0.241124	0.061914	-3.89450	0.0004	
	INF	0.000268	0.002840	0.094495	0.9252	
	LINV	-0.069153	0.030924	-2.23621	0.0313	
	LPOP	-1.354492	0.093502	-14.4862	0.0000	
14	INF14	-0.010526	0.006079	-1.73154	0.0915	0.8405
	C	-0.232559	0.060258	-3.85939	0.0004	
	INF	-0.000149	0.002801	-0.05318	0.9579	
	LINV	-0.069821	0.031116	-2.24385	0.0307	
	LPOP	-1.351916	0.094063	-14.3724	0.0000	
15	INF15	-0.010715	0.006769	-1.58290	0.1217	0.8386
	C	-0.229749	0.060692	-3.78548	0.0005	

 High Inflation in these economies adversely affects the purchasing power of their people, which further has detrimental effects on the human development of these economies. Government expenditures on public provision of social services can reduce these detrimental effects by improving the purchasing power of people. Free access to basic needs like education and health improves human capital. Parents would prefer to educate their children in different fields. So, the present study has explored the answer to this question: Is the level of inflation used to measure human development affected by public provision of social services? Empirical findings of the second model support this perception reported in Table 2; after controlling public expenditures on the provision of social services in the threshold model, we have found a 14% threshold level with a higher R-square of 0.9313 and a lower residual sum of square of 0.0740. It indicates that increasing government expenditures on social services can reduce the harms of Inflation on human

development by improving the purchasing power of people. Without controlling government expenditures in the econometric model, a 3% per cent threshold level of Inflation for human development originated in this study. However, after controlling government expenditures in the same model, we found 14% per cent, much higher than 3%.

Table 2 Threshold Effect of Inflation on Human Development after Controlling Public Expenditures

K	Variable	Coefficient	Standard Error	t-statistic	Probability-Value	Adjusted R-Squared
2	LINK	-0.041661	0.021366	-1.94988	0.0586	
	LPOP	-1.344382	0.063611	-21.1345	0.0000	
	INF	-0.002320	0.001268	-1.82885	0.0753	
	GEX	0.143439	0.020165	7.113280	0.0000	0.9262
	C	-0.587418	0.067157	-8.74699	0.0000	
3	LINV	-0.044259	0.021668	-2.04259	0.0483	
	LPOP	-1.356165	0.065365	-20.7476	0.0000	
	INF	0.077646	0.094839	0.818713	0.4182	
	GEX	0.139029	0.020907	6.650035	0.0000	0.9256
	INF3	-0.080273	0.095195	-0.84325	0.4045	
	C	-0.806074	0.267921	-3.00862	0.0047	
4	LINV	-0.043998	0.021692	-2.02833	0.0498	
	LPOP	-1.350581	0.064451	-20.9552	0.0000	
	INF	0.020660	0.029755	0.694347	0.4918	
	GEX	0.140636	0.020594	6.828828	0.0000	
	INF4	-0.023311	0.030156	-0.77302	0.4444	
	C	-0.664270	0.120175	-5.52752	0.0000	0.9254
5	LINV	-0.044603	0.021732	-2.05241	0.0473	
	LPOP	-1.348243	0.064021	-21.0593	0.0000	
	INF	0.011265	0.016196	0.695542	0.4911	
	GEX	0.141076	0.020437	6.903064	0.0000	0.9256
	INF5	-0.014042	0.016689	-0.84137	0.4055	
	C	-0.640490	0.092324	-6.93744	0.0000	

6	LINV	-0.044186	0.021924	-2.01545	0.0512	0.9250
	LPOP	-1.344551	0.064133	-20.9649	0.0000	
	INF	0.003965	0.010225	0.387782	0.7004	
	GEX	0.141795	0.020503	6.915882	0.0000	
	INF6	-0.006691	0.010801	-0.61952	0.5394	
	C	-0.614632	0.080709	-7.61542	0.0000	
7	LINV	-0.043042	0.021719	-1.98171	0.0550	0.9248
	LPOP	-1.344286	0.064213	-20.9349	0.0000	
	INF	0.001518	0.007228	0.210041	0.8348	
	GEX	0.141730	0.020601	6.879904	0.0000	
	INF7	-0.004267	0.007909	-0.53954	0.5927	
	C	-0.605105	0.075301	-8.03576	0.0000	
8	LINV	-0.041487	0.021547	-1.92545	0.0619	0.9249
	LPOP	-1.348223	0.064449	-20.9191	0.0000	
	INF	0.001001	0.005584	0.179183	0.8588	
	GEX	0.141701	0.020531	6.901712	0.0000	
	INF8	-0.003923	0.006421	-0.61088	0.5450	
	C	-0.603815	0.072843	-8.28929	0.0000	
9	LINV	-0.040826	0.021592	-1.89074	0.0665	0.9249
	LPOP	-1.352229	0.065462	-20.6565	0.0000	
	INF	0.000297	0.004532	0.065521	0.9481	
	GEX	0.141692	0.020542	6.897553	0.0000	
	INF9	-0.003332	0.005535	-0.60191	0.5509	
	C	-0.599477	0.070628	-8.48779	0.0000	
10	LINV	-0.041288	0.021441	-1.92563	0.0619	0.9257
	LPOP	-1.355543	0.065111	-20.8189	0.0000	
	INF	0.000601	0.003606	0.166644	0.8686	
	GEX	0.139721	0.020683	6.755387	0.0000	
	INF10	-0.004116	0.004755	-0.86557	0.3923	
	C	-0.596055	0.068114	-8.75084	0.0000	

11	LINV	-0.041023	0.021648	-1.89503	0.0659	
	LPOP	-1.349185	0.065243	-20.6792	0.0000	
	INF	-0.000878	0.003557	-0.24678	0.8064	
						0.9246
	GEX	0.141382	0.020926	6.756303	0.0000	
	INF11	-0.002219	0.005106	-0.43458	0.6664	
	C	-0.592119	0.068741	-8.61372	0.0000	
12	LINV	-0.041381	0.021663	-1.91024	0.0639	
	LPOP	-1.346890	0.065172	-20.6667	0.0000	
	INF	-0.001585	0.003183	-0.49799	0.6214	
	GEX	0.141974	0.021227	6.688287	0.0000	0.9243
	INF12	-0.001264	0.005012	-0.25226	0.8022	
	C	-0.588878	0.068245	-8.62884	0.0000	
13	LINV	-0.041487	0.021644	-1.91680	0.0630	
	LPOP	-1.346494	0.064924	-20.7395	0.0000	
	INF	-0.001685	0.002776	-0.60689	0.5476	
	GEX	0.141592	0.021634	6.544873	0.0000	0.9244
	INF13	-0.001244	0.004818	-0.25819	0.7977	
	C	-0.587384	0.067997	-8.63839	0.0000	
14	LINV	-0.035989	0.020824	-1.72826	0.0923	
	LPOP	-1.346035	0.061393	-21.9247	0.0000	
	INF	0.000423	0.001865	0.226810	0.8218	
	GEX	0.139837	0.019548	7.153669	0.0000	0.9313
	INF14	-0.007816	0.004008	-1.94991	0.0588	
	C	-0.606237	0.065524	-9.25211	0.0000	
15	LINV	-0.036434	0.021015	-1.73370	0.0913	
	LPOP	-1.344100	0.061934	-21.7020	0.0000	
	INF	8.66E-05	0.001845	0.046974	0.9628	
	GEX	0.140334	0.019713	7.118899	0.0000	0.9300
	INF15	-0.007859	0.004474	-1.75641	0.0873	
	C	-0.605186	0.066165	-9.14667	0.0000	

Descriptive statistics, correlation, co-integration and causality estimates have been reported in in Tables (3), (4), (5) and (6), respectively. Table (3) depicts 0.5250, 0.3472, 0.1130, and 0.0728 standard deviations of Inflation, investment, population, and HDI, respectively. Comparatively, Inflation has a higher standard deviation.

Correlation among the variables in Table (4) postulates that the population has a -0.8995 higher degree negative correlation with HDI, whereas -0.0409, -0.2146 and 0.3743 are estimated correlations of Inflation, investment and government expenditures. Population has significant impacts on development among the countries and within a country. Economic and human development outcomes can be shaped by population growth, which in turn can influence the fertility rate (Solow, 1956; Barro, 1991; Mankiw et al., 1992; Cutler et al., 1990; Mcdonald & Guest, 2002; Guest, 2006; Heijdra & Ligthart, 2006; Hondroyiannis & Papapetrou, 2005; Lee, 1997). Pakistan might be able to significantly increase human capital through capital formation despite a negative investment sign. Due to the relatively poor endowment of complementary human capital in poor countries, Lucas (1990) argues that physical capital does not flow to these countries. It is possible to achieve sustainable human development through a higher supply of educational inputs and a shift in occupations toward skill-intensive sectors (Rocha et al., 2017).

Table 3 Descriptive Statistics

STATISTICS	LNINF	LINK	LPOP	LNHDI
Mean	2.2064	1.1846	0.3888	0.4342
Median	2.2010	1.1597	0.4165	0.4431
Maximum	3.2361	1.7698	0.5262	0.5523
Minimum	0.9014	-0.1546	0.2029	0.3222
Std. dev.	0.5250	0.3472	0.1130	0.0728
Skewness	0.0130	-1.1806	-0.3318	0.0101
Kurtosis	2.9754	6.5668	1.5554	1.6961
Jarque-Bera	0.0023	32.7851	4.5283	3.0464
Probability	0.9988	0.0000	0.1039	0.2180

Table 4 Correlation Matrix

	LNHDI	LINV	LPOP	INF	LNGEX
LNHDI	1.000000	-0.214674	-0.899548	-0.040995	0.374316
LINV	-0.214674	1.000000	0.074751	-0.094553	-0.233631
LPOP	-0.899548	0.074751	1.000000	-0.067131	-0.036180
INF	-0.040995	-0.094553	-0.067131	1.000000	-0.101762
LNGEX	0.374316	-0.233631	-0.036180	-0.101762	1.000000

Unit root test for residual has been performed in table (5) (ADF), This implies an integration of order zero, I (0), for the residual. Human development and inflation are co-integrated. Assuming that the variables involved are cointegrated, the ECM incorporates both long-run and short-run effects. Furthermore, the model is stationary when cointegration is assumed so standard regression techniques are valid (Ahmed & Mortaza, 2005). According to the error correction value of -0.8614,

there is an adjustment in error of 86% from the short to the long run.

Table 5 Augmented Dickey-Fuller (ADF) Test for Unit Root

Null Hypothesis: UT has a unit root

Augmented Dickey-Fuller	t-statistic	Probability-Value
test statistic	-5.532251	0.0000

Dependent Variable: LHDI

Variable	Coefficient	Standard Error	t-statistic	Probability-Value
LNINF	-0.216704	0.112903	-1.919376	0.0619
C	2.066181	0.255915	8.073693	0.0000

Dependent Variable: D (LHDI)

Variable	Coefficient	Standard Error	t-statistic	Probability-Value
D(LNINF)	0.007328	0.091018	0.080514	0.9362
UT(-1)	-0.868412	0.146877	-5.912501	0.0000
C	-0.006711	0.055717	-0.120442	0.9048
R-squared				0.472674
Adjusted R-squared				0.445632
Durbin-Watson stat				1.941852
F-statistic	17.47902		**Prob(F-statistic)**	0.000004

On the other hand, co-integration estimates of ECM and Granger causality suggest that Inflation and human development both have long-run and causal associations. Unidirectional causality from Inflation to human development has been observed and reported in Table (6).

Table 6 Estimates of Granger Causality Tests

Null Hypothesis	F-Statistic	Probability Value
LINV does not Granger Cause LNHDI LNHDI does not Granger Cause LINV	0.25182 0.28343	0.7787 0.7549
LNINF does not Granger Cause LN-HDI LNHDI does not Granger Cause LNINF	2.73651 0.09821	0.0783 0.9067

LPOP does not Granger Cause LNHDI		0.82199	0.4476
LNHDI does not Granger Cause LPOP	|	6.72024	0.0033
LNGEX does not Granger Cause LN-HDI		0.90950	0.4118
		0.26058	0.7720
LNHDI does not Granger Cause LNGEX	|		

Variance Inflation Factors (VIFs) indicated no problematic multicollinearity among the variables examined in Table 7. There is also no evidence of problematic multicollinearity in the correlation matrix.

Table 7 Variance Inflation Factors (VIF)

Variable	Coefficient Variance	Un-centred VIF	Centred VIF
LINK	0.000433	13.91671	1.077699
LPOP	0.003835	13.24702	1.010068
INF	1.53E-06	4.506558	1.029969
LNGEX	0.002066	31.62687	1.076143
C	0.003523	74.36795	NA

CONCLUDING REMARKS

Pakistani human development thresholds are calculated in the present study. Human development is associated with threshold effects in inflation based on time series data. Empirical estimates of threshold equations suggest a 3% threshold level of Inflation for human development. Inflation of more than 3% hinders human development in Pakistan, whereas below 3% inflation has positive impacts on human development. This estimated threshold level of Inflation is comparatively lower than calculated for developing economies by Khan & Sehnadiji (2001) 11-12%, Kremer et al. (2013)17%, Eggoh & Khan (2014) 10-12%, Kartaev & Klochkova (2015) 9% and Ibarra &Trupkin (2016) estimated 19%. It shows that human development is more profound than economic growth regarding the consequences of Inflation. Sustainable human development, comparatively to economic growth, claims a lower rate of Inflation for consistent enlargement.

Higher Inflation in developing economies like Pakistan may restrict human choices related to human capital development by reducing purchasing power because many people have poor living standards. Poor living standard forces them to consume other necessities like food, shelter and clothing instead of education and health. Fewer expenditures on education and children's health further adversely affect human development. An optimum inflation rate is required to enlarge human

development in developing economies. However, the second equation postulates a 14% Inflation threshold level when government spending is controlled in the econometric model of human development, which is higher than 3%. It concludes that optimum fiscal policy can compensate for the harms of Inflation for human development by providing free social services of education and health to poor people. Increasing government expenditures on education and health supports and encourages poor people to develop their children. Governments of developing economies like Pakistan should enhance public expenditures on the provision of social services to achieve sustainable human development because increasing public expenditures can reduce the harms of Inflation for human development. Inflation and human development are co-integrated over the long run with convergence from the short to the long term. The long-term impact of inflation on human development is negative and significant. Inflation is causally related to human development from a unidirectional perspective. Public expenditures on social services in developing economies like Pakistan can help reduce the harms of inflation for human development.

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