

Economic Studies

**The Effect of Inflation Rates on Long-Run Economic Growth
in Arab Countries**

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**صندوق النقد العربي
ARAB MONETARY FUND**



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The Effect of Inflation Rates on Long-Run Economic Growth in Arab Countries

Abstract

The recent upward inflation trends around the globe have raised concerns about the economic implications of such inflationary waves. In this regard, the study examines the impact of inflation rates on the long-run economic growth in Arab countries. In addition, the study uses the pooled mean group as an estimation method. Data covers 21 Arab countries for the period from 1990 to 2020 is used. The findings present evidence that inflation rates below certain threshold levels positively affect the long-run economic growth. Nonetheless, beyond the threshold higher inflation rates lead to negative impact on economic growth. Moreover, the estimation shows that the inflation threshold varies after controlling for extreme inflation rates and heterogeneity in the sample.

1. Introduction

Sustained economic growth and price stability are of great importance to all countries as they contribute to the total progress of the economy. Maintaining price stability is essential in achieving inclusive and sustainable economic growth and development. The price instability and higher inflation rates adversely impact long-run economic growth and reduces GDP per capita (Andrés and Hernando, 1997; Andrés and Hernando, 1999). Undoubtedly, high unstable inflation is perceived as a growth-hindering element (Barro, 2013), as it affects the economy through various channels. First, changes in price levels influence consumers' ability to pay for goods and services. When prices of essential goods and services, such as food and fuel, rise, it can push up the overall price level. If wages remain stable and the cost of commodities rises, the consumer will not be able to bear the high expenses. Consequently, the aggregate demand for goods and services declines and that may reduce GDP and economic growth. Second, inflation leads to increase in interest rate which may hinder consumption and investment and thus aggregate demand. Third, uncertainty about high inflation rate may negatively impact the economy, leading to instability in the market, preventing companies from taking major investment decisions, and more hoarding of goods and necessary commodities by individuals, leading to lower GDP growth rates.

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In many countries, monetary policy has focused on maintaining the inflation rate within a specific range given the undesirable impact of a high level of price instability. There is a consensus among economists that low and stable inflation is beneficial for sustainable growth. There is a growing body of literature that recognises the nonlinear effect of inflation rate on economic growth (Burdekin et al., 2004; Vinayagathan, 2013; Baharumshah et al., 2016; Živkov et al., 2020). It is suggested that the inflation-growth nexus may be nonlinear with regard to the development stage of each country (Burdekin et al., 2004; Baharumshah et al., 2016). Moreover, only when the inflation rate exceeds a certain level it will have a detrimental impact on economic growth (Vinayagathan, 2013). In addition, other researchers have argued that inflation and its level of uncertainty play an important role as growth determinants (Baharumshah et al., 2016; Živkov et al., 2020).

It is crucial to assess if inflation affects the rate of economic growth and whether the effect is linear or nonlinear. It's also intriguing to identify the probable tipping point in the inflation-growth relationship. Exposure to inflationary waves has been linked to negative consequences on the economy's growth rates, according to research. But only once it reaches a certain rate may inflation start to slow down economic growth. As a result, the purpose of this essay is to investigate how inflation affects economic growth in the long-run in 21 Arab nations. The study employs the pooled mean group (PMG) or panel autoregressive distributed lag (panel-ARDL) for the data from 1990 to 2020.

To look at the consumer price inflation rate in Arab countries, in Figure 1 below, we plot the average inflation rates from 1990 to 2020 for Arab countries together with the world's average. The figure shows relatively moderate inflation rates, though it's been quite volatile and high in some of these countries during the early 1990s, before it shows sudden jump in 2020¹. Expectations indicate that inflation rates in the Arab countries will continue to rise, on average, by 7.5 percent in 2022 before it slightly drops to 7.1 percent in 2023 (AMF, 2022). This expected high inflation rates reflects the impact of the challenges facing international supply chains and the recorded increases in the prices of agricultural and industrial commodities and energy materials, as a result of the current global developments, in addition to the impact of the increase in aggregate demand levels, raising consumption tax rates in some Arab countries, and the resulting pass-through effect (AMF, 2022). On the other hand, Figure 2 illustrates the data for GDP per capita growth from 1990 to 2020, on average, for Arab countries. The

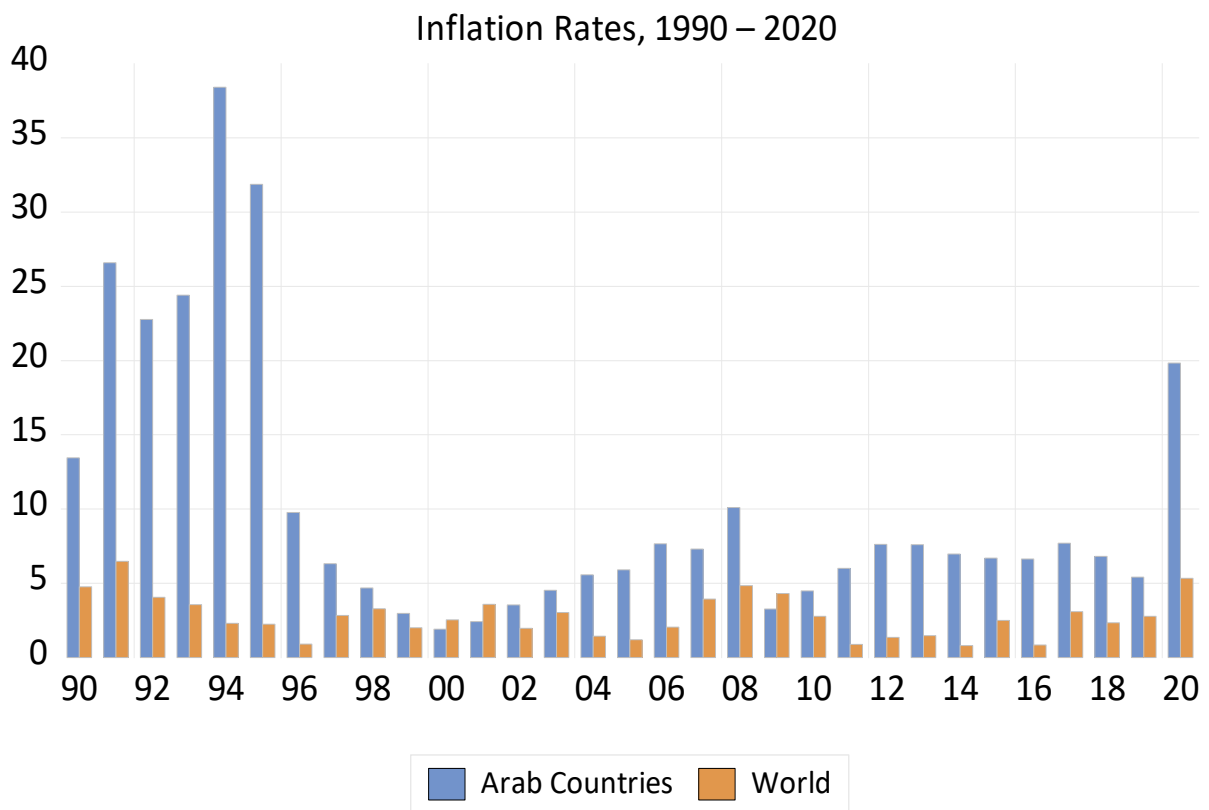
¹ The high number is due to the inclusion of highly instable inflationary and least-developed countries.

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common feature is that the growth rates have fluctuated over the past three decades, before we see the huge drop in 2020 due to the COVID-19 crisis. Note that the short-term fluctuations in the real GDP growth rate normally reflect economic cycles. Although the growth rates of Arab economies are expected to decline in the coming year, the individual characteristics of countries may affect to extent the growth rate of the economy will decrease.

The remainder of the paper is organised as follows. Section 2 provides an overview of the theoretical framework and surveys the relevant empirical literature. Section 3 describes the estimation method and data. Section 4 shows the findings of the study. Finally, section 5 contains the conclusion and policy recommendations.

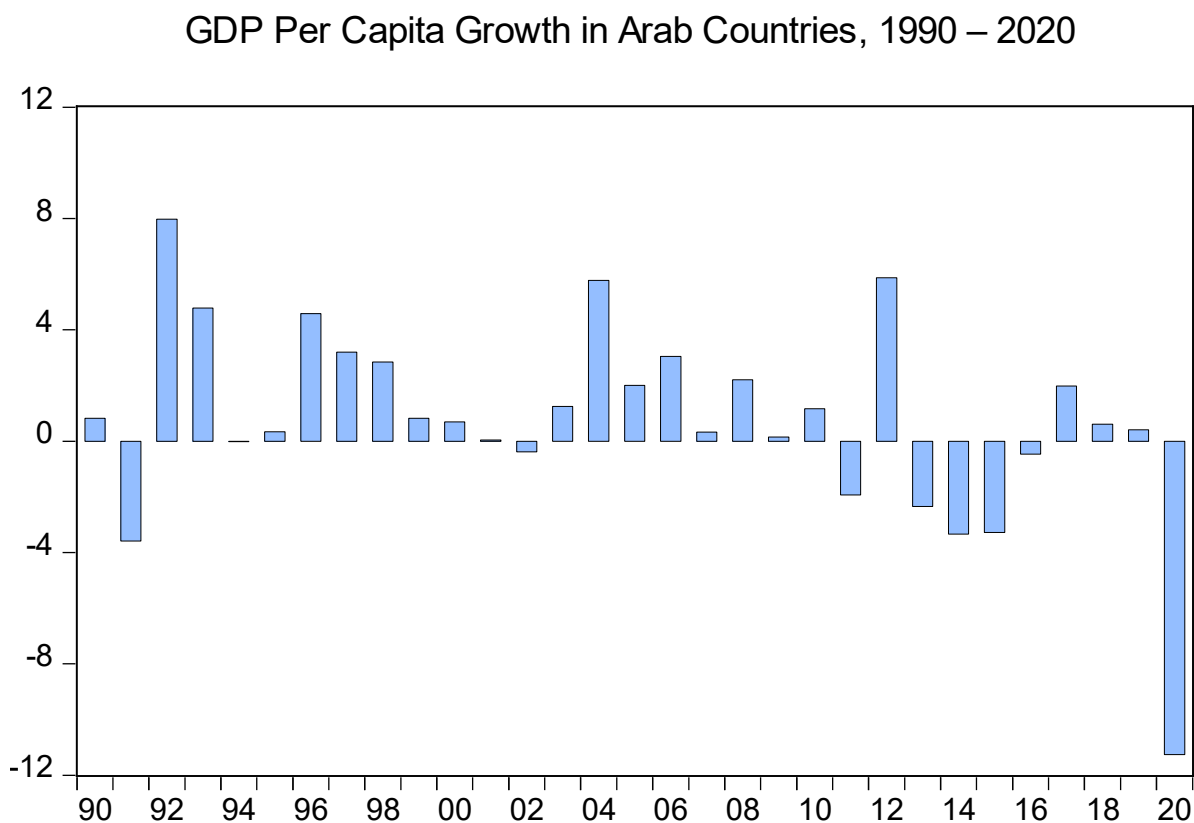
Figure 1. Inflation Rates in Arab Countries, 1990 – 2020



Source: The World Bank Database (2022) and A Cross-Country Database of Inflation (2021).

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Figure 2. GDP Per Capita Growth in Arab Countries, 1990 – 2020



Source: The World Bank Database (2022)

2. Literature Review

2.1 Inflation Transmission Channels

Although price stability is undoubtedly a vital growth determinant, there is no theoretical and empirical clear-cut view on the impact of inflation on economic growth. According to Mundell (1965) and Tobin (1965), higher inflation rates would push economic agents to hold assets rather than money, in turn raising investment levels and thereby leading to more economic activities. On the other hand, an alternative view argues that higher inflation may negatively affect economic growth through increasing macroeconomic uncertainty and instability, which may likely offset the effect hypothesised by Mundell-Tobin. The higher cost of capital due to inflation may reduce capital accumulation and productivity, thereby slowing economic growth (De Gregorio, 1993; Baharumshah et al., 2016). Moreover, the negative effect of inflation on growth due to uncertainty could arise from the drop in aggregate demand because of fall in consumption.

Fischer (1993) suggests a nonlinear relationship between inflation and economic growth. Up to a certain threshold, the effect of inflation on economic growth is positive, while above that

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threshold, the relationship turns negative. Choi et al. (1996) shows that low inflation rates will be good for economic growth, but high inflation rates will harm the economic growth because of credit rationing. To explain this mechanism, suppose there is a financial market with lenders and borrowers. When inflation increases in a high rate, lenders become reluctant to provide credit since the real return on assets (credit) will decrease, which leads to a decline in the available funds for lending. At the same time, high inflation rates encourage borrowers to demand more of loans, and thus adverse selection problem may arise and the risk of default increase which leads banks to cut their lending. This cut in lending by banks due to the high inflation rates will affect economic growth negatively, according to Choi et al, while low rates of inflation will not lead to a cut in lending, and economic growth will not be affected through this mechanism.

There are different schools of thought regarding the effect of inflation on economic growth. Among those is the structuralist view, which supports the positive relationship between inflation and economic growth. The supporters of this view claim that a moderate inflation rate is efficient for economic mobilization or reallocation of income and wealth between economic sectors (Doguwa, 2013; Enejoh and Tsauni, 2017; Mankiw, 2010). On the other hand, Monetarists and Keynesians underline that inflation has serious effects as it weakens domestic production in favor of foreign products, which may lead to a deterioration in external balance and hamper economic growth (Kasidi and Mwakemela, 2015; Manoel, 2010; Mkhathshwa et al., 2015).

In conclusion, the relationship between inflation and economic growth is not definitive, and to know it, there is a need for empirical research that take into account the economic and social characteristics of the country.

2.2 The Empirical Literature

How inflation and economic growth are practically related vary across countries. In this regard, Paul et al. (1997) investigate the causal relationship between inflation and economic growth in a sample of 70 countries. They argue that inflation and GDP growth nexus follows different pattern across economies. They find that inflation is causing and/or caused by growth in two-thirds of the sampled countries, and there is no causation in the remaining one-third. In addition, they imply that low inflation waves are not equally beneficial and advanced economies are most likely to gain the most compare to less-developed ones. Also, Burdekin et al. (1994) show that inflation has a negative impact on the growth rates of advanced and developing countries, with higher magnitude in developing economies. Similarly, Al Exander

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(1997) investigates the inflation–growth nexus in a sample of OECD countries and shows a negative association between the variables.

Applying cointegration analysis, Saaed (2007) argues that higher economic growth can be achieved via price stability, as he finds a negative association between inflation and GDP growth rate. Bittencourt (2011) examines to what extent inflation explains the changes in GDP growth rate in a small sample of hyperinflationary Latin American countries. The findings of the research show evidence of a harmful inflation impact on economic growth in the region. Another empirical work by Chowdhury (2002) reveals the irrelevance of price stability to the growth rate of GDP in a developing country like Indonesia. Moreover, Fari and Carneiro (2001) study the long- and short-run effects of inflation on economic growth in Brazil. Their results suggest the absence of a significant association between the two variables in the long run, but a significant impact of inflation on growth exists in the short run.

A new trend of research regarding the link between inflation and economic growth suggests that the adverse effect of inflation on growth may start to kick in when certain threshold is reached. It is indicated that a low or moderate inflation rate could stimulate or have no impact on GDP growth, but when changes in price level exceed a specific threshold, the adverse effect begins (Burdekin et al. 2004; Pollin and Zhu, 2006). In this context, Andrew (2013) finds an inflation threshold of about 22.5%, indicating that a moderate level of inflation is not damaging to economic growth of a country like Zambia. In the same vein, Vinayathan (2013) reveals a 5.4% as inflation threshold level beyond which the economic growth of Asian economies is negatively affected. Also, Azam and Khan (2020) estimate the threshold of inflation to be 12.3% in developing countries and 5.4% in developed countries.

Eggho and Khan (2014) examine the nonlinear effect of inflation on economic growth using relatively large sample of heterogeneous countries. Their empirical outcomes provide strong support for the nonlinearity between inflation and growth. Additionally, they argue that the estimation of the threshold level is sensitive to the method used, the sample, income differences, and the group of explanatory variables included in the model. Also, Karahan and Çolak (2020) verify the nonlinearity the variables of our interest in the long run using the nonlinear autoregressive distributed lag (NARDL) approach.

It is important to mention that not only inflation affects economic growth in a nonlinear fashion, but also there are negative consequences on growth due to the uncertainty in the macroeconomic environment created by the fluctuations in inflation rates. Khan and Hanif

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(2020) argue that the nonlinearity between inflation and economic growth might be contingent on factors such as institutional quality. Moreover, Baharumshah et al. (2016) aim to answer the question of how inflation and its uncertainty influence economic growth in emerging and developing economies. The results indicate that inflation is harmful to growth and uncertainty is not in low inflationary regimes. They show that there is a nonlinear relationship between inflation and economic growth, implying that inflation enhances growth initially but impedes it eventually at a higher level of price instability. The positive effect of inflation uncertainty is true only with moderate inflation rates (5.6 – 15.9%). Similarly, Živkov et al. (2020) examine the impact of inflation and its uncertainty on economic growth in some Eastern European economies using quantile regression. Their results reveal a negative link between inflation and growth. Unlike Baharumshah et al. (2016), their findings suggest that inflation uncertainty has a negative and higher impact on growth than inflation. Importantly, smaller economies experience more adverse growth impact due to inflation and its uncertainty level.

3. Methodology

3.1 Model Specification

A dynamic panel model is employed in the following form:

$$y_{it} = v_i + \beta\pi_{it} + \rho'x_{it} + \varepsilon_{it} \quad (1)$$

where the dependent variable y_{it} is the real growth rate of GDP per capita of country i at time t , v_i is the individual-specific effect, π_{it} inflation rate, x_{it} is a vector of independent variables, such as physical capital (GCF), years of schooling (YS), foreign direct investment (FDI), and population growth (PG); and ε_{it} is the error term. The independent variables are included based on theoretical and empirical considerations. The exogenous and endogenous growth theories emphasise the importance of physical capital as a major growth determinant, here it is measured through gross capital formation (see, Eggoh and Khan, 2014). Also, the population growth rate is a key variable as stated by both theoretical and empirical literature (see, Vinayagathan, 2013; Eggoh and Khan, 2014; Baharumshah et al., 2016). Moreover, the human capital is a vital ingredient that stimulates economic growth rate. In this study, expected year of schooling is used as a proxy for human capital. Finally, foreign direct investment is believed, by many theoretical and empirical studies, to play a significant role in the economic progress of a country (see, Jouini et al., 2022).

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We intend to examine the potential nonlinear effect of inflation on economic growth in 21 Arab countries using panel data analysis. Specifically, we utilise the pooled mean group (PMG) method, according to Pesaran et al. (1999). The PMG allows short-run heterogeneity but imposes homogeneity in the long-run. The ARDL (p, q, q, \dots, q) model can be specified as

$$\begin{aligned}
 EG_{it} = & \alpha_i EG_{i,t-1} + \beta_{1i} INFLATION_{i,t-1} + \beta_{2i} INFLATION_{i,t-1}^2 + \delta_i \mathbf{x}_{i,t-1} + \sum_{j=1}^{p-1} \gamma_{ij} \Delta EG_{i,t-1} \\
 & + \sum_{j=0}^q \beta_{3ij} \Delta INFLATION_{i,t-1} + \sum_{j=0}^q \beta_{4ij} \Delta INFLATION_{i,t-1}^2 + \sum_{j=0}^q \theta_{ij} \Delta \mathbf{x}_{i,t-j} \\
 & + \mu_i + \varepsilon_{it}
 \end{aligned} \tag{2}$$

The *EG* is GDP per capita growth rate as a measure of economic growth,² *INFLATION* denotes consumer price index inflation, *INFLATION*² is inflation squared, \mathbf{x} is a set of explanatory regressors that include; gross capital formation as a percentage of GDP, years of schooling as a proxy for human capital, foreign direct investment, and population growth. Note that we will estimate the full-sample model followed by an outlier-free model. We consider an inflation rate equals 50% and above to be a case of hyper-inflation. Therefore, in a “No outliers” all the values above 50% are excluded. In addition, we divide the countries into high-income and non-high-income groups according to the income classification of the World Bank. The purpose of the two preceding steps is to reduce the heterogeneity across countries. Also, we try to control for oil production especially in high-income countries.

3.2 Method of Estimation

3.2.1. Panel Unit Root Test

In panel data analysis, it is essential to start with a unit root test to avoid spurious regression. Employing the stationarity test in panel data is increasingly important, especially if the time dimension (T) is large. The main purpose of using the panel unit root test is to identify whether the series integrated of order zero (stationary $I(0)$) or integrated of order one (non-stationary $I(1)$) or integrated of order two (non-stationary $I(2)$). The main idea is to avoid an $I(2)$ series in the regression model. In this study, the IPS^3 panel unit root test according to Im et al. (2003) is used. The test has the null hypothesis of unit root and the alternative that at least some countries have a unit root.

² According to endogenous and exogenous economic growth theories as well as several empirical studies, the GDP per capita is the measure of economic growth.

³ IPS refers to Im, Pesaran, and Shin (2003).

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3.2.2. Panel Cointegration Test

The Pedroni (2004) panel cointegration test is used to test whether the variables are related in the long run. Similar to the panel unit root, the importance of the cointegration test comes from the worries of nonsense or meaningless regression (Baltagi, 2012). The Pedroni cointegration test proposed several test statistics with the null hypothesis of no cointegration. The test statistics are classed into two. The first class entails averaging test statistics for cointegration of the time series across countries. While the second class gets the average in the sample. The two classes use three tests: rho-statistic, PP-statistic, and ADF-statistic. The rejection of at least PP-statistic and ADF-statistic indicates the presence of cointegration among variables.

3.2.3. Pooled Mean Group

The estimation method used by the study is the pooled mean group (PMG), according to Pesaran et al. (1999). The PMG assumes the homogeneity of the slope parameters in the long run, whereas it permits the short-run coefficients to differ across the countries. One advantage of using the PMG method is that it simultaneously estimates the error correction (short-run) and long-run models. The error correction model does not only explain the short-run dynamics, but also contains the information from the long-run equation embedded in the error correction term (ECT), which implies the speed of the adjustment toward the equilibrium. Another advantage of employing the PMG technique is its ability to accommodate mixture of I(0) and I(1).

3.3 The Data

The real GDP per capita growth rate is used to represent the economic growth indicator. This dependent variable is collected from the World Bank database of the world development indicators (WDI) and the United Nations Conference on Trade and Development (UNCTAD) statistics database. The main independent variable, headline inflation, is measured using the percentage change in the consumer price index (CPI). The CPI inflation rate for the sampled countries is obtained from A Cross-Country Database of Inflation of the World Bank that developed by Ha et al. (2021). Moreover, gross capital formation as a percentage of GDP is used as an indicator for physical capital. Another important explanatory variable is expected years of schooling (YS), which represents the number of years that a child is anticipated to spend in school or at a university, including years spent repeating a course, is used as a proxy for human capital and it is collected from the United Nations Development Program (UNDP). Similarly, the net inflows of foreign direct investment as percent of the GDP is included as an independent variable. Lastly, the population growth rate is used to control for the demographic

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dimension in the economic growth equation. The foreign direct investment and population growth are retrieved from the WDI.

4. Results of the Analysis

Starting with some descriptive analyses, Table 1 shows the descriptive statistics of the variables included in the model for the full sample. The average annual GDP per capita growth rate (EG) for the Arab countries between 1990 and 2020 is about 0.9 percent, while the annual inflation rate is about 9.7 percent on average during the same period. Gross capital formation (GCF) accounts for about 27.7 percent of GDP in the Arab countries on average during 1990-2020. The average expected years of schooling (YS) is about 11 years. Foreign direct investment (FDI) as a percent of GDP is about 2.5 percent on average, and the average growth rate of the Arab countries' population (PG) is 2.9 percent annually between 1990 and 2020. It is interesting to note that population growth rate has the least variation among the variables and averaged about 2.2 standard deviation. Whereas the highest variations are recorded by cross capital formation and inflation rate with 30.3 and 29.9 standard deviation. the descriptive statistics of the variables for high-income group and non-high-income (middle- and low-income) group are shown in the Appendix (Table I and II).

Table (1). Descriptive Statistics

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
EG	0.9028	1.0152	123.3395	-68.0548	11.3339	629
INFLATION	9.6819	3.5110	448.5	-16.1	29.9568	629
GCF	27.7099	23.65	363.411	-12.8801	30.2586	629
YS	11.0406	11.5118	16.4151	2.5719	2.9559	629
FDI	2.4871	1.1406	33.5660	-11.1990	4.0233	629
PG	2.8570	2.4603	17.5122	-3.1046	2.1602	629

Table 2 provides the correlation between the variables in the model. As the table shows, the highest correlation coefficient is only -0.19 (between years of schooling and inflation), which is very far from being a high correlation, and thus no multicollinearity between the independent variables.

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Table (2). Correlation matrix

Variables	EG	INFLATION	GCF	YS	FDI	PG
EG	1					
INFLATION	-0.0797	1				
GCF	-0.1689	0.0499	1			
YS	-0.0592	-0.1945	0.1596	1		
FDI	0.0378	-0.0507	-0.0026	0.0027	1	
PG	-0.0754	0.0259	-0.0599	0.0897	0.0693	1

Table 3 shows the unit root test developed by IPS in 2003. The test reveals that the variables used in the model are stationary at levels or $I(0)$, except for GCF and YS, which are stationary in first-difference $I(1)$. This result is not a surprise since all variables (except for YS) are either growth rates or shares of GDP. Regarding years of schooling, it is almost a stable variable and does not change much from year to year. The Cointegration analysis in table 4 provides the results obtained from the Pedroni (1999 and 2004) cointegration analysis. What stands out in the table is the clear evidence of a long-run relationship between the variables since the PP-Statistic and ADF-Statistic are statistically significant. Once we have confirmed the presence of cointegration, the fear of spurious estimation fades away, and one may proceed to the PMG analysis.

Table (3). IPS Unit Root Test

Variables	level		1 st Difference	
	Intercept	Intercept&Trend	Intercept	Intercept&Trend
EG	-3.8109***	-4.0512***	-7.305***	-7.2869***
INFLATION	-2.7822***	-3.3019***	-6.459***	-6.588***
GCF	-1.6582	-2.5596**	-5.181***	-5.7078***
YS	-1.2816	-2.2703	-3.6834***	-4.1432***
FDI	-2.7499***	-3.0857***	-6.6918***	-6.5862***
PG	-2.867***	-2.8827***	-2.9322***	-3.2189***

Note: *** and ** denote significant at 1% and 5%, respectively. The critical values of t -bar statistic according to Im et al. (2003) for regression with intercepts only are -1.99, -1.85, and -1.78 for 1%, 5%, and 10%, respectively. The critical values for regression with intercepts and trends are -2.61, -2.48, and -2.41 for 1%, 5%, and 10%, respectively.

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Table (4). Pedroni Cointegration Test

	<i>Within-dimension</i>			
	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-1.6439	0.9499	-2.7138	0.9967
Panel rho-Statistic	-3.7356	0.0001	-1.0680	0.1428
Panel PP-Statistic	-21.4828	0.0000	-14.0599	0.0000
Panel ADF-Statistic	-19.5610	0.0000	-12.4660	0.0000
	<i>Between-dimension</i>			
	Statistic	Prob.		
Group rho-Statistic	-0.2969	0.3832		
Group PP-Statistic	-17.0437	0.0000		
Group ADF-Statistic	-13.2285	0.0000		

Table 5 provides the results of PMG regression for the full sample (all countries) and the sample after excluding the outliers (countries that suffered from hyperinflation or greater than 50 percent, specifically: Iraq, Lebanon, Sudan, Syria, and Yemen). Although for the full sample, the coefficient of inflation is positive and its squared term is negative, both are statistically insignificant. However, for the full sample (no outliers), inflation appears to be positively related to economic growth in the long-run, as the coefficients of inflation is significant at 10 percent level. The squared-inflation rate is negative and significantly related to GDP per capita growth. The significance of inflation and its squared-term coefficients with negative and positive signs, respectively, indicate the existence of a nonlinear relationship between inflation and growth. These results suggest that lower inflation rate has positive effect on economic growth, but higher inflation rate negatively influence growth. This is consistent with the findings of many previous studies.

The interesting result of the regression is the threshold values of the effect of inflation on economic growth. The threshold value for the full sample is 3 percent, but this cannot be considered as a valid turning point since the coefficients of inflation and inflation-squared are insignificant. But after removing the countries with hyperinflation the coefficients of inflation and its quadratic term are significant and the estimated threshold value is about 13.4 percent, which represents the turning point of the relationship between inflation economic growth. In particular, lower than the threshold (13.4) there is a positive relationship between inflation and economic growth, but beyond the threshold the relationship is negative, i.e., high inflation is playing a dampening role in per capita economic growth.

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On the other hand, for both samples, foreign direct investment plays a positive significant long-run role in GDP per capita economic growth, while population growth is playing a negative significant long-run role in per capita growth. Gross capital formation and years of schooling are insignificant. The error correction term (ECT) is negative and significant.

Table (5). The Pooled Mean Group Results

Variable	Full sample	Full sample – No outliers
<i>Long-run</i>		
INFLATION	0.0012 (0.0216)	0.1640* (0.0838)
INFLATION ²	-0.0002 (0.0001)	-0.0061* (0.0033)
Threshold	3	13.4426
GCF	0.0852*** (0.0001)	0.0536** (0.0239)
YS	-0.0391 (0.3226)	-0.3400*** (0.1076)
FDI	0.2675*** (0.0414)	0.2519*** (0.0469)
PG	-0.7069*** (0.1073)	-0.7485*** (0.1118)
<i>Short-run</i>		
ECT	-0.9318*** (0.0720)	-0.8556 (0.0710)
D(INFLATION)	-0.2664 (0.2453)	-0.2471 (0.2207)
D(INFLATION ²)	-0.0100 (0.0284)	-0.0164 (0.0259)
D(GCF)	0.0952 (0.1233)	0.1797 (0.1529)
D(YS)	-1.7281 (1.7461)	0.4329 (1.3217)
D(FDI)	-0.1907 (0.6225)	-0.1841 (0.6126)
D(PG)	-2.2407 (5.1257)	-2.1536 (4.7909)
Intercept	3.1524*** (1.0851)	3.7359 (0.5616)

In another layer of analysis, we divided the sample into three groups, the first is a sample containing the high-income Arab countries, the second is the middle- and low-income countries, and the third is the medium and low-income countries excluding those with very high rates of inflation (more than 50 percent). Table 6 below provides the PMG regression results.

For the two groups, inflation still significantly affects per capita GDP growth in the long-run, and the relationship is nonlinear. Note that in the sample of middle- and low-income Arab countries, inflation and its squared-term are insignificant. The threshold for high-income Arab countries is about 5.1 percent, which is much lower than the threshold of the full sample-no outliers that shown in Table 5. For middle- and low-income countries, the threshold is now

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equal to 28.5 percent, but it cannot be considered due to the insignificant coefficients of inflation and inflation-squared, which could be due to the inclusion of all countries. For the middle- and low-income countries without inflation outliers, the threshold is 11.5 percent compared with 13.4 percent in the total sample without outliers shown in Table 5.

Regarding the control variables in the long-run, GCF is positively related to economic growth but only significant in the first group. While YS is insignificant in the first two groups, but significant at 5 percent level for the group of middle- and low-income countries without outliers. FDI is significant for the three groups, with a negative sign in high-income group. PG is insignificant for high-income countries but significant and negative for the other two groups.

Table (6). The Pooled Mean Group Results – Income differences

Variable	High-income	Non-high-income	Non-high-income – No outliers
<i>Long-run</i>			
INFLATION	0.6233** (0.2435)	0.0114 (0.0254)	0.1374* (0.0819)
INFLATION ²	-0.0608** (0.0295)	-0.0002 (0.0002)	-0.0058** (0.0028)
Threshold	5.1258	28.5	11.8448
GCF	0.1707*** (0.0603)	0.0490 (0.0393)	0.0282 (0.0271)
YS	0.6739 (0.4617)	-0.6351 (0.5709)	-0.7659** (0.1413)
FDI	-0.2544** (0.0986)	0.2708*** (0.0513)	0.2713*** (0.0468)
PG	0.0086 (0.1662)	-0.9216*** (0.1710)	-0.9365*** (0.1577)
<i>Short-run</i>			
ECT	-1.3217*** (0.2182)	-0.9690*** (0.0936)	-0.8887*** (0.1219)
D(EG(-1))	0.3511*** (0.1004)	-	-
D(INFLATION)	-0.7514* (0.3778)	-0.2116 (0.1938)	-0.1856 (0.2082)
D(INFLATION(-1))	0.3236 (0.6513)	-	-
D(INFLATION ²)	0.0421 (0.0776)	0.0035 (0.0163)	0.0045 (0.0168)
D(INFLATION ² (-1))	-0.0369 (0.1110)	-	-
D(GCF)	-0.1190 (0.0937)	0.3139*** (0.0984)	0.3964*** (0.1153)
D(GCF(-1))	0.0487 (0.0734)	-	-
D(YS)	1.1223 (1.7953)	13.0779* (7.5943)	14.3783*** (5.4853)
D(YS(-1))	-2.7341** (1.3668)	-	-
D(FDI)	0.0781 (0.4408)	-0.3096 (0.8278)	-0.5373 (0.8212)
D(FDI(-1))	0.2031 (0.2488)	-	-
D(PG)	5.5407* (2.8218)	-5.6551 (6.6106)	-8.4186 (5.5874)
D(PG(-1))	0.2885 (3.6429)	-	-
Intercept	-11.3881*** (4.0025)	4.2694* (2.4077)	3.4733*** (1.1529)

Note: ***, **, and * denote significant at 1%, 5%, and 10%, respectively. The values within () refer to the standard errors. ECT is the error correction term. The threshold is calculated as $|\beta_1 / 2 * \beta_2|$. In the model with “No outliers” the values of inflation rates higher than 50% are considered as outliers and have been removed.

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Also, we control for oil production in resource rich countries or high-income countries. Table III in the appendix shows the findings of high-income countries after including oil production. The positive and negative signs of inflation and its squared term are detected with a threshold of 8.7 percent. The oil production is revealed to have a positive impact on economic growth of the high-income Arab countries.

Regarding the inflation threshold values, our findings suggest that inflation is detrimental for economic growth after exceeding 13.4 percent and 11.8 percent for all the sampled-countries and non-high-income countries, respectively. This is consistent with the evidence shown by Kremer et al. (2013), López-Villavicencio and Mignon (2011), and Baharumshah et al. (2016). For high-income countries, the estimated threshold was 5.1 percent indicating that growth is negatively affected by inflation above this level. This threshold is not surprising and similar turning points have been documented in the literature. For instance, Thanh (2015) and Baharumshah et al. (2016) found inflation thresholds 7.8 percent and 5.6 percent, respectively. All in all, the estimation of threshold is sensitive to the heterogeneity and the outlier in the sample.

5. Conclusion

This empirical investigation aimed to assess how inflation affects economic growth and if this effect is linear or nonlinear in Arab countries. In particular, we are interested in testing the inflation–growth nexus where low inflation does not harm economic growth, but higher inflation does, as advocated in literature. Also, it is important for economic authority to be aware of the inflation threshold beyond which inflation negatively impact growth. In doing so, we utilise time series and cross-sectional data from 21 countries in the Arab region to estimate the growth model. In addition, we adopt the PMG estimating procedure since it is more appropriate when using a panel with a relatively long time series dimension (1990 – 2020). Although the econometric technique we use in this study partially address the cross-country differences, we conduct further analysis that classify countries into to groups based on their income level.

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The results of the PMG analysis show that inflation and inflation-squared have positive and negative long-run effects on economic growth, respectively, in all estimated models. The findings indicate the existence of a long-run relationship between inflation and economic growth. This is similar to the majority of previous studies that suggest low inflation rate is associated with a positive effect on economic growth and vice versa. In addition, the relationship between inflation rate and economic growth is found to be nonlinear. Also, the relationship between the variables is contingent on a certain threshold level of inflation rate beyond which the positive effect turns to negative. The study's findings suggest that high values of inflation rate result in a higher turning point (threshold). In particular, we find the inflation threshold is about 13.4 percent for low- and middle-income countries which suffered from high inflation. On the other hand, the inflation threshold is approximately 5.1 percent for the high-income countries who are characterised by low inflation for most of the period.

Regarding the control variables, the findings indicate that gross capital formation is positive and significantly related to GDP per capita growth in three models. But we find no evidence of a positive and significant link between years of schooling and economic growth. Similarly, foreign direct investment inflows have a positive and significant effect on economic growth, except in high-income group. Whereas population growth appears to be negative and significantly associated with GDP growth rate in all models.

Our findings have important implications for Arab countries. Maintaining inflation rate below the threshold level supports economic growth in the long-run. However, this requires adopting the appropriate economic policies. Although maintaining price stability is the responsibility of central banks in Arab countries, other policies that preserve macroeconomic stability should be strengthened. For instance, running high fiscal deficit would undermine the ability of central banks in pursuing monetary stability objective. Future studies should pay attention to the nonlinear relationship between inflation and economic growth. Finally, estimating the inflation threshold on a country level could be beneficial to economic policymaking and a potential contribution by future studies.

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Appendix

Table I. Descriptive Statistics (High-income)

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
EG	0.1524	-0.2011	94.1723	-39.1476	9.7889	185
INFLATION	2.4909	2.041	15.798	-4.876	3.1561	185
GCF	24.8581	24.166	49.4867	7.9052	7.6443	185
YS	12.7074	12.9915	16.4151	7.2506	1.7856	185
FDI	2.3169	1.1303	33.566	-5.2881	3.8122	185
PG	4.1226	3.0907	17.5122	-3.1046	3.3067	185

Table II. Descriptive Statistics (Non-High-income)

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
EG	1.2059	1.6596	123.3395	-68.0548	12.1858	407
INFLATION	12.9095	4.496	448.5	-16.1	36.216	407
GCF	29.3422	23.5639	363.411	-12.8801	37.0988	407
YS	5.3309	5.0786	10.4466	0.362	2.2810	407
FDI	2.5743	1.2532	27.652	-11.1990	4.1495	407
PG	2.2728	2.2679	6.5591	-1.3228	1.0281	407

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Table III. The Pooled Mean Group Results – controlling for oil production

Variable	High-income
	<i>Long-run</i>
INFLATION	0.6087*** (0.2201)
INFLATION ²	-0.0351 (0.0221)
Threshold	8.6709
GCF	-0.1108* (0.0662)
YS	2.5795*** (0.9039)
FDI	-0.3051* (0.1818)
PG	-0.3881*** (0.1399)
OILP	0.0047*** (0.0012)
	<i>Short-run</i>
ECT	-1.3207*** (0.3833)
D(EG(-1))	0.3577*** (0.1022)
D(INFLATION)	-0.4797 (0.6463)
D(INFLATION(-1))	0.7884 (0.8715)
D(INFLATION ²)	-0.0699 (0.1587)
D(INFLATION ² (-1))	-0.1326 (0.1168)
D(GCF)	0.1046 (0.1242)
D(GCF(-1))	0.2633* (0.1372)
D(YS)	-0.1239 (2.0078)
D(YS(-1))	-3.2231*** (1.1211)
D(FDI)	0.2278 (0.6139)
D(FDI(-1))	0.2938 (0.2162)
D(PG)	13.9451 (12.6908)
D(PG(-1))	-4.6284 (3.8144)
D(OILP)	-0.0018 (0.0041)
D(OILP(-1))	-0.0129 (0.0119)
Intercept	-41.9148** (19.7966)

Note: ***, **, and * denote significant at 1%, 5%, and 10%, respectively. The values within () refer to the standard errors. ECT is the error correction term. The threshold is calculated as $|\beta_1/2 * \beta_2|$. In the model with “Non-high-income – No outliers” the values of inflation rates higher than 50% are removed from the sample.



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