Inflation and Its Effects on Economic Growth – Evidence from 45 Countries

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Abstract
Inflation is a pressing issue that is commonly affiliated with numbers of social and economic consequences. It is gaining increasingly higher attention, especially at the world scale, after the COVID-19 pandemic. The study aims to analyse the current inflation situation all over the world and re-examine its relationship with economic growth, using the sample of 45 countries for the period 2010 - 2021. To achieve the results, Ordinary least squares (OLS), fixed effects and random effects models are applied to overhaul its impacts on economic growth and how those effects differ across two groups of countries including developed countries and developing countries. We provide evidence that the inflation rate not only has a negative but also a positive impact on the economic growth rate and the results are robust in all groups of countries.

Research purpose:
The goal of the study is to investigate the current state of global inflation and its relationship to economic development using a sample of 45 nations for the years 2010 through 2021.

Research motivation:
The motivation of this research paper is to fill the gap with previous studies, providing an overview and more objective results for the inflation situation as well as its impact on economic growth.

Research design, approach, and method:
To assess the most accurate figures, we applied the Ordinary least squares (OLS), fixed effects and random effects models to analyse the inflation's impact on economic growth.

Main findings:
There was a negative impact of inflation on the economic growth in both 45 countries and each group of countries in the period from 2010 to 2021. In contrast, inflation remained a positive relationship with economic growth during the COVID-19 pandemic period from 2019 to 2021.

Practical/managerial implications:
The research paper provides empirical evidence in 45 countries around the world, from different regions rather than being limited like most studies and we divide into 2 main groups of countries for a more comprehensive view between 2010 and 2021.

Keywords: inflation, economic growth, developed countries, developing countries, COVID-19

1. INTRODUCTION

Inflation has long been recognized as one of the most pressing issues facing the global economy and concerns about its potential impact on economic growth have continued to be a topic of debate. Inflation has been linked to a range of factors such as changes in interest rates, unemployment, and foreign direct investment (FDI). Understanding the relationship

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between inflation and economic growth is critical for economists, researchers, and policy makers. As a result, a large body of literature has examined the impact of inflation on economies as well as economic growth.

In recent years, many countries have experienced moderate levels of inflation, driven by a variety of factors such as supply chain disruptions, higher commodity prices, and increased demand for goods and services. However, some countries have seen significantly higher levels of inflation. According to data from the World Bank, as of 2021, the countries with the highest inflation rates were Sudan (382.8%), Lebanon (154.8%), and Zimbabwe (98.5%). On the other hand, the countries with the lowest inflation rates were Chad (-0.8%), Bahrain (-0.6%), and Rwanda (-0.4%). The causes of inflation can vary depending on the specific economic conditions of a country and the impact of inflation can have wide-ranging consequences for its economies, businesses, and citizens. There are several lines of literature that reflect the causes of inflation. Factors such as fiscal policy, monetary policy, exchange rate movements, supply shocks, structural factors (Adam, C., & Cobham, D., 2007), and changes in aggregate demand (Galí, J., 2015) that can contribute to inflationary pressures in developing economies.

To examine the impact of inflation on economic growth, two competing hypotheses are developed. The first hypothesis argues that inflation has a potential positive impact on economic growth (Fischer, 1983; Barro, 1995; Gylfason et Herbertsson, 2001; Burdekin et al., 2004; Gillman et al., 2004; Gillman and Kejak, 2005; Kremer et al., 2013). Using cointegration and error correction models, Malik, and Chowdhury (2001) found a positive long-run relationship between GDP growth rates and inflation, which results that moderate inflation is beneficial to growth and that higher economic growth entails inflation. Moreover, a low but positive inflation rate can help overcome nominal rigidities, facilitate relative price adjustments, and provide flexibility in monetary policy (Sims, C. A., 2013). Conversely, the alternative hypothesis is that there is a negative impact of inflation on economic growth, and it outweighs any potential positive ones. High inflation rates hinder investment, reduce productivity, and distort resource allocation (Rahman, M. Z. ,2019), and negatively affect savings (Kamaiah, B., & Venkateswarlu, Y., 2018). According to Ansari, M. I., & Tag El-Din, S. I. (2016), inflation can exacerbate income inequality by eroding the purchasing power of lower-income groups and redistributing wealth towards those with more bargaining power. Furthermore, high inflation rates can lead to increased unemployment through various channels, such as wage-setting behavior, labor market frictions, and the impact on investment decisions (Pissarides, C. A.,2009). It can be easily seen that the differences in economic theories, methodological approaches, and empirical data leading to the existence of competing hypotheses regarding the impact of inflation on economic growth. Hence, the complexity of the issue and the various factors that can influence the relationship were emphasised. Researchers use different theories, methods, and data to investigate this relationship, leading to a range of findings in previous research. As a result, the debate continues among economists, policymakers, and academics regarding the precise nature and magnitude of the relationship between inflation and economic growth.

Strikingly, however, little is known about whether and how inflation today actually impacts economic growth. This research will fill the gap of former research as most of them ceased at data of 2020 without latest updated data, and they mostly focused on analysing data in one country or several countries in the same region without wide-scaled comparison (Barro, 1995; Mario Švigir and Josipa Miloš, 2017; Kremer et al., 2013; etc.). To test these hypotheses, we analyse the current situation in the world with data up to 2021 of 45 different countries, which is divided into the groups of developed and developing countries. Besides, we will show the relationship between inflation and economic growth.

2021 has seen numbers of upheaval events that could undermine the commonly documented relationship between inflation and economic growth. The most notable one is the COVID-19 pandemic which has greatly affected the global economy. Firstly, the pandemic caused disruptions in supply chains, causing shortages and higher prices for certain items, which contributed to inflation. However, as the pandemic led to widespread economic shutdowns, the demand for goods and services decreased, leading to a deflationary impact on prices. The pandemic has caused a significant drop in GDP and has negatively affected economic growth. Governments worldwide have introduced different policies to boost their economies, including interest rate cuts and stimulus packages. Nonetheless, it is still uncertain how long and severe the pandemic's economic repercussions will be. The COVID-19 pandemic has had a significant impact on inflation and economic growth, and it is still uncertain how long and how severe the effects will be. It is also unclear what strategies will be the most effective in reducing the impact.

In our study, we use Ordinary least squares (OLS), fixed effects and random effects model to examine whether and how inflation has impacts on economic growth in detail. Using data from 45 countries over the world, we documented that the coefficient of inflation impacts on GDP in 45 countries is negative in all cross-countries, developed and developing countries. Therefore, if inflation increases, economic growth will decrease and vice versa. In contrast, the subsample in the COVID-19 pandemic period from 2019 to 2021 showed a positive impact of inflation on economic growth, this is opposed to our previous findings. If inflation increases, economic growth will also develop and vice versa. As Figure 1 showing the impacts of inflation on economic growth in the world context from 2010-2021 period. In Figure 1, we can see that there are both positive and negative relationships between inflation and economic growth. The positive relationship is concisely shown in the year of 2012, 2015, 2017, 2019, 2020 and 2021 while the negative relationship occurred in the year of 2011, 2013, 2014, 2016 and 2018. The highest GDP and CPI figures are 5.87% and 4.82% while the lowest GDP and CPI figures are -3.11% and 1.43%, respectively.

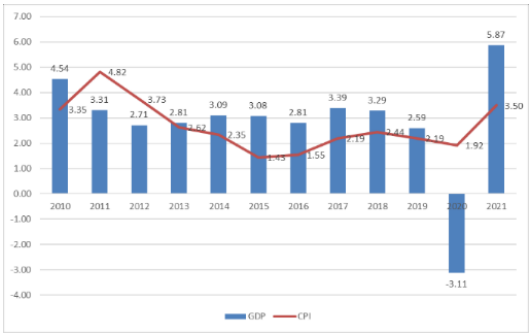

Fig. 1. The graph of the relationship between GDP and CPI on average in the world context from 2010-2021 (World Bank)

This study contributes to the extant literature that has broad implications for research in inflation and its relationship with economic growth. First, it provides new empirical evidence on the relationship between inflation and economic growth in a larger sample of 45 countries over the period 2010-2021, which are divided into two main groups of countries. Previous studies have often focused on a limited number of countries, which may not provide a representative picture of the global situation (Ivohasina F. Razafimahefa, 2012; Malik and Chowdhury, 2001; Svigir Mario and Milos Josipa, 2017). By including many countries, this study can provide a more comprehensive understanding of the relationship between inflation and economic growth. Second, this research incorporates several control variables that may influence the relationship between inflation and economic growth, including inflation rate, unemployment rate, FDI, economic openness, lending rate, and population growth. By controlling for these factors, we can better isolate the effect of inflation on economic growth and provide more accurate estimates of its impact.

The remainder of this research paper is structured as follows: Section 2 reviews the literature and develops the hypothesis. Section 3 describes the data tables with variables and research methodology. Our findings and research results are provided in section 4. Finally, section 5 contains our summary and conclusions.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Literature review

According to the International Monetary Fund, inflation is the rate of price growth over a certain time. It generally refers to a broad metric, like the general rise in prices or the rise in a nation's cost of living. But it may also be reckoned more precisely for some products like food, or for services, like a hairstyle, for example. Whatever the environment, inflation represents how much more precious the applicable set of goods and or services has come over a certain period. Believing that inflation is expensive, central bankers and most other observers see price stability as a worthwhile goal (Barro, 1995). Boyd and Champ (2006) suggested that policymakers need to be aware of when inflation starts to have a negative impact while Erbaykal and Okuyan (2008) found a one-way causal link connecting inflation and economic growth.
The relationship between inflation and economic growth has already been analysed in many previous research papers. Theoretically, inflation can affect economic growth on both sides: positive and negative. High growth, lower inflation and lower inflation has made the economy grow higher. Dotsey and Sarte (2000) applied the theoretical framework to show that inflation had a positive impact through precautionary savings in the short term. Baharumshah (2016) stated that low inflation promotes high economic growth and there was a positive relationship between inflation uncertainty and economic growth (Ozdemir, 2010). Inflation rate below the examining threshold had a positive effect on growth, 3.89% of the inflation rate threshold was found in Malaysia (Mansur and Munir, 2009) and 13% of the inflation rate threshold was examined in case of Azerbaijan (Hasanov and Hasanli, 2011). Koki Kyo (2018) has stated that sometimes there are positive impacts of GDP on the CPI if the impacts become stronger during the expansion phase. Therefore, a country can endure inflation at a certain level to obtain positive impacts on economic growth.

In contrast, there is a negative impact of inflation on economic growth and investment (Barro, 1995). Malla (1997) has also stated that inflation had a significant negative impact on economic growth for Asian countries. High inflation can cause a decrease in bank lending and return on real estate through real interest rates (Boyd and Champ, 2006). Erbaykal and Okuyan (2008), who used cointegration and causality test, bounds test and WALD test, has shown that there was a negative significant impact in the short term between real GDP and CPI variances. There is a detrimental inflation-growth impact, which is more pronounced at lower inflation rates. For the OECD nations, inflation had a considerable negative impact and was the same as with APEC countries (Gillman, 2004). Muhammad Ayyoub (2011) found that the growth of Pakistan's GDP is adversely affected by inflation. This statistically significant finding suggests that a continuous rise in the overall price level is detrimental to the expansion of the economy. In the threshold model, an inflation rate which is above the inflation rate threshold according to different countries or areas will have negative impacts on economic growth. Higher than 9% inflation rate has a detrimental effect on economic expansion (Mubarik, 2005), a rate of inflation

exceeding 3.89% had a negative effect on economic expansion (Mansur and Munir, 2009) and a inflation rate which is between 10 percent to 20 percent will have negative impacts on economic growth (Gylfason and Herbertsson, 2001).

Moreover, it has also been proved that there is no significant relationship between inflation and economic growth. Khan and Senhadji (2001) used the nonlinear least square model (NLLS) to show that a threshold for inflation rate of 1 to 3 percent for developed nations, and 7 to 11 percent for developing nations was proposed. The economic growth was unaffected by percentages below the range and negatively affected by percentages beyond it. Opposite to inflation and growth theories, there was no relationship between inflation and growth in OECD countries (Malla, 1997). Erbaykal and Okuyan (2008) has stated that inflation and economic growth have no significant long-term relationship in Turkey.
Previous researchers have used diverse methods, theories, and models to analyse the relationship among inflation, economic growth, and other variances. Boyd and Champ (2006) and Dotsey and Sarte (2000) applied the theoretical framework in their papers. Gillman (2004) used cointegration, fixed and random effect methods with GDP at constant prices, annual rate of inflation, ratio of gross domestic investment to GDP variances contributing to the research results. In addition, the threshold model was widely applied to most research to find the inflation rate threshold affecting economic growth. Hasanov and Hasanli (2011) used the threshold model to analyse real GDP per capita, CPI, gross fixed capital formation variances while Mubarik (2005) used real GDP, population growth, CPI, investment growth rate variances. Otherwise, Erbaykal and Okuyan (2008) applied cointegration and causality test, bounds test and WALD test with real GDP, CPI variances.

2.2 Hypothesis development

Based on above analysis, we propose the following hypothesis:

H1: There is a negative impact of inflation on economic growth.

H2: There is a positive impact of inflation on economic growth.

Some research shows that the relationship is negative in countries that are not able to maintain price stability in the case of high inflation (Fischer, 1993; Alexander, 1997; Bruno and Easterly, 1998; Ghosh and Phillips, 1998; Barro, 1999;). However, these studies are generally based on the assumption that the relationship is linear. According to the research of Khan and Senhadji, the relationship between economic growth and inflation is a long-term relationship. By analysing the relationship between inflation and economic growth using the VECM model based on the push response function and the variance decomposition, Khan & Senhadji (2001) found a new inflation threshold for developing countries, industrialized countries and suggested that if inflation exceeds this new threshold, it will have a negative impact on economic growth. We can say that high inflation will slow down economic growth, or in other words, the change in inflation is higher than the change in economic growth. Specifically, the inflation threshold in developing countries is 11-12%/year; industrial countries about 1-3%/year.

The first hypothesis suggests that high levels of inflation negatively impact economic growth. Inflation erodes the purchasing power of consumers and reduces their disposable income, leading to decreased consumption. Furthermore, high inflation rates often create uncertainty and instability in the economy, discouraging long-term planning and investment. Contrary to the first hypothesis, the second hypothesis posits that moderate inflation can actually stimulate economic growth under certain circumstances. According to this view, a mild level of inflation encourages consumer spending as people tend to spend more today if they believe prices will rise in the future. This increased consumption can drive up demand and stimulate production, leading to economic growth. This hypothesis acknowledges that there is a threshold beyond which inflation becomes detrimental to economic growth, but believes that within that limit, a certain degree of inflation can be beneficial.

It is possible that an economy can experience low growth and high inflation. A situation where there is a decrease in economic growth and a rise in inflation can arise due to cost-push inflation. This type of inflation happens when prices increase due to rising costs, such as oil prices. As a result, businesses face higher costs, and individuals have less disposable income. This ultimately leads to a slow economy and high inflation, which is also referred to as stagflation.

Inflation is the gradual rise in the prices of goods and services. It is generally agreed that inflation has a negative impact on economic growth. According to Forbes, there are several ways in which inflation can hurt the consumers and economic growth. Firstly, high inflation creates uncertainty in the economy, which makes it challenging for businesses to plan and invest for the long term. Secondly, high inflation results in a reduction in consumer purchasing power, which lowers the demand for goods and services. Thirdly, inflation may lead to a decrease in real income, which can lower the standard of living for people in the economy. Lastly, high inflation can discourage foreign investment, resulting in a decline in the foreign exchange rate, which can affect the balance of payments.

There are various perspectives on the impact of inflation on economic growth. Some argue that a moderate level of inflation can have positive effects on economic growth. One way in which inflation can stimulate growth is through the wealth effect. When prices rise, the value of assets, such as stocks and real estate, also increases. This increase in wealth can lead to higher consumer spending and investment, which in turn fuels economic growth. Inflation can also incentivize

borrowing and investment. When prices are expected to rise, individuals and businesses may be motivated to borrow money at lower interest rates to make purchases or investments before prices increase further. This increased borrowing and investment can spur economic activity and contribute to overall growth.

Furthermore, inflation can help facilitate necessary adjustments in wages and prices. In a dynamic economy, some sectors may need price and wage increases to maintain equilibrium. Inflation allows for these adjustments, which can help to reallocate resources more efficiently and improve productivity, leading to economic growth. Therefore, while moderate inflation can have positive effects on economic growth by stimulating consumer spending, investment, and facilitating necessary adjustments, it is crucial for policymakers to manage inflationary pressures to avoid the detrimental effects of high inflation.

To summarize, a high level of inflation can have numerous adverse impacts on the economy's growth, including a decline in investments, a decrease in purchasing power, a reduced demand for products and services, a lower real income, and a drop in foreign investment. It is crucial for leaders and decision-makers to take necessary steps to tackle inflation by implementing effective monetary and fiscal policies, which are essential in maintaining a stable economy that facilitates long-term growth.

3. METHODOLOGY

3.1 Data

The study uses a dataset of 195 countries from 2010 to 2021 obtained from World Development Indicators (WDI). From this database, we have selected 45 countries that have all the necessary data. This includes 35 developing countries and 10 developed countries.

We follow Koki Kyo (2018) and Hala Hjazeen, Mehdi Seraj and Huseyin Ozdeser (2021) by defining the relationship between inflation (measured by CPI), unemployment (measured by unemployment rate) and economic growth (measured by GDP).

We found that FDI and trade openness have been investigated in numerous studies on economic growth. For instance, using data from Pakistan covering the years 1980–2011, Sadia Bibi and Syed Tauqeer Ahmad (2014) showed the negative effects of trade openness and the positive impacts of foreign direct investment on economic growth. Another study by Mutinda, Daniel M. (2014) found a negative correlation between interest rates and economic growth during a ten-year period, from 2003 to 2012, using data gathered from the Central Bank of Kenya. As a variable influencing economic growth in this research, we also take the lending interest rate into consideration. Furthermore, Robin Barlow's (1994) three-variable model, which uses data from 86 nations, demonstrated that per capita income increase was adversely correlated with current population growth. The last independent variable we include in our research is population growth.

3.2 Methodology

To test the relationship between inflation and economic growth of 45 countries for the period 2010-2021, we estimate the following regression:

$$GDP_{it} = \alpha + \beta_1 * CPI_{it} + \beta_2 * UR_{it} + \beta_3 * FDI_{it} + \beta_4 * TO + \beta_5 * LR + \beta_6 * PG_{it} + \varepsilon_{it} \quad (1)$$

where i denotes countries, t denotes years, CPI denotes Consumer Price Index, UR denotes Unemployment Rate, FDI denotes Foreign Direct Investment, TO denotes Trade Openness, LR denotes Lending Rate and PG denotes Population Growth.

Since GDP (Gross domestic product) is one of the most common measures to assess the economic growth rate of a country at a given time, we choose GDP as the dependent variable. We include several control variables that can affect GDP. In particular, we use consumer price index (Consumer Price Index), measured by tracking the change in the prices of a fixed basket of goods and services; unemployment rate (Unemployment Rate), measured as the percentage of unemployed workers at 15 years of age and above over the population; foreign direct investment (Foreign Direct Investment), measured in USD and as a share of GDP; trade openness (Trade Openness), measured as the ratio of total trade to GDP; lending rate (Lending Rate), measured by the GDP deflator; and population growth (Population Growth), measured by the net recruitment rate of individuals to the population.

Following earlier research, we successively incorporate a variety of fixed effects into our model specification to help alleviate certain endogeneity problems. These fixed effects include country fixed effects, region fixed effects and country group fixed effects. In general, these fixed effects models assist us in controlling for covariate variations in institutional quality between various years as well as unobserved variability that differs among nations and regions (Lohmann and Lechtenfeld, 2015). To reduce the simultaneous bias problem, we also delayed all right-side variables by one year in accordance with other research (Iwasaki and Suzuki, 2012). Finally, it is the error term and is clustered at the national level to account for the data's serial correlation (Bertrand and Mullainathan, 2003).

Table 1. Variables used and expected signs based on the theories.

Dependant variable	Independent variables	Expected relationship based on the theories
Gross Domestic Product (GDP)	Consumer Price Index (CPI)	-
	Unemployment Rate (UR)	-
	Foreign Direct Investment (FDI)	+
	Trade Openness (TO)	+
	Lending Rate (LR)	-
	Population Growth (PG)	-

3.3 Descriptive statistics

Summary statistics of our sample are shown in Table 2. Specifically, Table 2 Panel A reports summary statistics by countries with the number of country-year observations, their mean value of GDP and CPI over the 2010-2021 period and the country group. Table 2 Panel A consists of 11 country-year observations, 45 unique countries, 10 developed countries and 35 developing countries. According to the United Nations Organization, developed countries are those that have advanced economies, extensive technical infrastructure, and high standards of living while developing countries are those with an industrial base that is less developed and have Human Development Index (HDI), including high GDP, that is lower than those of developed countries. The highest average GDP belongs to China with 7.26% and the lowest average GDP belongs to Italy with 0.04%. Nigeria had the highest CPI figure with 12.35% and Argentina did not find any CPI data available in this period.

We next report the descriptive statistics of the main variables in our study for the whole sample in Table 1 Panel B, for two subsamples of developed countries and developing countries in Panel C and Panel D, respectively. Panel B presents the summary statistics of cross-countries output measures, country characteristics and the sample consist of 530 country-year observations and 45 unique countries. The maximum GDP and CPI is 12.31982% and 18.31226% while the minimum is -9.77299% and -1.14391%, respectively. Panel C presents the summary statistics of developed countries output measures, country characteristics and the sample consist of 118 country-year observations and 10 unique countries. The maximum GDP and CPI is 14.51975% and 8.542933% while the minimum is -6.8423% and -2.425265%, respectively. Panel D presents the summary statistics of developing countries output measures, country characteristics and the sample consist of 412 country-year observations and 35 unique countries. The maximum GDP and CPI is 11.64892% and 18.67773% while the minimum is -9.94324% and -0.90042%, respectively.

Table 2. Sample Description

Panel A: Lists of Countries in the Research over the 2010-2021 period

No.	Country	Obs.	ΔGDP	ΔCPI	Country group
1	Albania	11	2.58	2.08	Developing
2	Argentina	11	1.19	0.00	Developing
3	Armenia	11	3.60	3.57	Developing

4	Azerbaijan	11	1.61	5.18	Developing
5	Belarus	11	1.66	17.79	Developing
6	Bolivia	11	3.65	3.73	Developing
7	Brazil	11	1.26	5.81	Developing
8	Bulgaria	11	2.04	1.76	Developing
9	Colombia	11	3.40	3.61	Developing
10	Costa Rica	11	3.44	2.83	Developing
11	Czechia	11	1.92	1.99	Developed
12	China	11	7.26	2.44	Developing
13	Dominican Republic	11	5.16	3.90	Developing
14	Egypt, Arab Rep.	11	3.74	11.29	Developing
15	Georgia	11	4.36	4.31	Developed
16	Hong Kong SAR, China	11	2.37	2.87	Developed
17	Hungary	11	2.56	2.77	Developing
18	Iceland	11	2.18	3.22	Developed
19	Indonesia	11	4.65	4.25	Developing
20	Italy	11	0.04	1.12	Developed
21	Jamaica	11	0.13	6.15	Developing
22	Jordan	11	2.08	2.48	Developing
23	Korea, Rep.	11	3.06	1.69	Developed
24	Kyrgyz Republic	11	3.07	6.04	Developing
25	Malaysia	11	4.26	1.89	Developing
26	Mauritius	11	2.22	3.02	Developing
27	Mexico	11	1.95	4.06	Developing
28	Mongolia	11	6.29	7.63	Developing
29	Namibia	11	2.17	4.81	Developing

30	Nigeria	11	3.20	12.35	Developing
31	North Macedonia	11	2.02	1.56	Developing
32	Pakistan	11	3.79	7.89	Developing
33	Paraguay	11	3.87	4.03	Developing
34	Peru	11	3.95	2.89	Developing
35	Qatar	11	4.57	0.99	Developed
36	Romania	11	2.70	2.97	Developing
37	Russian Federation	11	1.87	6.55	Developing
38	Singapore	11	4.45	1.56	Developed
39	South Africa	11	1.34	4.96	Developing
40	Switzerland	11	1.78	0.01	Developed
41	Thailand	11	2.64	1.35	Developing
42	Ukraine	11	0.08	11.48	Developing
43	United States	11	2.14	1.97	Developed
44	Uruguay	11	2.26	8.15	Developing
45	Vietnam	11	5.93	5.49	Developing

Panel B: Cross-countries sample

	Obs.	Mean	Std. dev.	Min	Max
	Dependent variable				
GDP	530	2.912	3.376	-9.773	12.319
	Control variables				
CPI	518	4.165	3.480	-1.144	18.312
FDI	530	270.50	153.142	6	535
TO	530	91.516	62.760	22.772	402.223

PG	530	0.832	1.006	-0.926	6.591
UR	504	227.30	127.958	4	448
LR	530	259.115	140.834	6	499

Panel C: Developed Countries sample

	Obs.	**Mean**	**Std. dev.**	**Min**	**Max**
	Dependent variable				
GDP	120	2.626	3.551	-6.842	14.519
	Control variables				
CPI	120	1.964	1.953	-2.425	8.542
FDI	119	-5.27e+08	5.40e+10	-2.09e+11	1.36e+11
TO	120	146.003	117.218	25.481	430.568
PG	120	0.879	1.764	-2.648	8.426
UR	119	57.227	33.465	2	113
LR	120	5.403	2.893	2.328	14.995

Panel D: Developing Countries sample

	Obs.	**Mean**	**Std. dev.**	**Min**	**Max**
	Dependent variable				
GDP	412	2.995	3.430	-9.943	11.648
	Control variables				
CPI	400	4.840	3.646	-0.900	18.677
FDI	412	-6.59E+09	1.77E+10	-1.76e+11	2.26e+10
TO	412	78.721	36.651	22.576	165.648

PG	412	0.829	0.860	-0.730	2.764
UR	389	176.270	99.976	3	350
LR	412	206.959	114.950	5	402

4. RESULTS AND DISCUSSION

4.1 Underlying reason and Impact of recent Inflation rates

After many years remaining at very low, or moderate levels, by the end of 2021, inflation, in the world context, has reached its highest level. This could be happening for two main reasons: the world economy is reopening rapidly, and energy prices are higher. First, economies in the world are rebounding. As soon as the covid-19 pandemic restrictions are lifted, people have regained normal activities. They tend to buy more and spend a large amount of money that was suspended during the blockade. As a result, companies are having a hard time keeping up with the rapidly increasing demand as they restructure the supply chains hit hard by the pandemic. The challenges put pressure on companies that they would probably raise prices higher. Second, higher energy prices are pushing up inflation. The energy crisis came after a year of declines in coal, oil, and gas mining. Gas prices have tripled since the beginning of the year. Oil prices rose more than 40%, hitting their highest levels since 2014. Coal prices climbed about 60%. Energy scarcity, along with inflationary pressure when the consumer price index (CPI) skyrocketed, exerted a heavy impact on people's lives. This is what the world has been witnessing in 2021 when most countries are embracing safe adaptation measures for the post-pandemic period9 and reopening their economies.

The impact of inflation on economic growth in 2021 has been mixed. On one hand, rising prices can lead to increased profits for businesses, which can then lead to higher investment and job creation. Additionally, inflation can encourage consumers to make purchases sooner rather than later, which can stimulate economic activity. However, high, and persistent inflation can also have negative consequences for economic growth. It can reduce consumer purchasing power and lead to lower investment and job creation, as businesses become more cautious in their spending. It can also lead to higher interest rates, which can make it more expensive for businesses and individuals to borrow money and invest.

4.2 Regression result

This session presents the results of our baseline model by running regression (1) with three panel data techniques including ordinary least squares (OLS), fixed effects, and random effects. Using different testing techniques helps to provide the robustness of our findings. The details are shown in Table 3.

The results for cross-country analysis are presented in the Table 3, column (1) showing the result of OLS model, column (2) showing the result of fixed effects model and column (3) showing the result of random effects model. We can see a sign of inflation coefficient is consistently negative across models but OLS model. Inflation coefficient is statistically significant when applied to the fixed effects model and the random effects model, but the OLS model shows an insignificant result. Moreover, our estimated inflation coefficient showed in the Table 1 is negative, therefore, there is a negative inflation-economic growth relationship (Gillman, 2004; Barro 1995). In conclusion, since inflation has a negative impact on economic growth in those countries, we deny H2 and accept H1.

While FDI coefficient is consistently negative and statistically significant in all specifications and coefficient value is only around -0.003 that has a negative impact on economic growth. In contrast, our expected FDI coefficient in the Table 1 is positive, which is opposed to our findings. Trade openness coefficient is not statistically significant in all specifications which implies trade openness indicator has no impact on economic growth in these whole countries. Population growth coefficient shows a positive result in all models and is also statistically significant in all models, therefore, population growth has a positive and great impact on economic growth. In contrast, our expected population growth coefficient tended to be negative based on theories. Unemployment rate coefficient shows a low and negative value, and it is not statistically significant in all specifications which means unemployment rate has no impact on economic growth. Moreover, lending rate coefficient also shows low and negative results, and it is also not statistically significant in all model's, therefore, lending rate does not have any impact on economic growth in those countries.

Table 3. Results of Cross-countries Analysis

This table shows the relationship between GDP and other variables over cross-country through coefficient figures. The independent variable is GDP. The key variable is CPI and other control variables are FDI, TO, PG, UR and LR. All variables are defined in the Appendix. The figures in parentheses "()" imply the P-value of each variable. The symbols

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

Model	GDP		
	OLS model (1)	Fixed effects (2)	Random effects (3)
CPI	0.030	-0.091**	-0.081**
	(0.536)	(0.020)	(0.039)
FDI	-0.003***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.000)
TO	-0.001	-0.001	-0.001
	(0.836)	(0.584)	(0.604)
PG	0.489***	0.439***	0.442***
	(0.003)	(0.001)	(0.001)
UR	-0.000	-0.000	-0.0001
	(0.733)	(0.896)	(0.881)
LR	0.000	-0.000	-0.0001
	(0.693)	(0.793)	(0.845)

4.3 Developed countries

This session presents the results of our baseline model by running regression (1) with three panel data techniques including ordinary least squares (OLS), fixed effects, and random effects. Using different testing techniques helps to provide the robustness of our findings. The details are shown in Table 4.

The results for developed countries analysis are presented in the Table 4, column (1) showing the result of OLS model, column (2) showing the result of fixed effects model and column (3) showing the result of random effects model. We can also see a sign of inflation coefficient is consistently negative in all specifications that have a negative impact on economic growth in developed countries. Inflation coefficient is only statistically significant when applied to fixed effects model but OLS and random effects model. In conclusion, inflation continues to have a negative impact on economic growth in developed countries, we deny H2 and accept H1.

Trade openness coefficient is consistently positive in all models and statistically significant in the OLS and fixed effects model but random effects model. Compared to the Table 1, trade openness coefficient follows our expected relationship between trade openness and economic growth. Population growth coefficient continues to show positive results in all specifications and its value ranged from 0.448 to 0.657 in developed countries. Population growth indicator is statistically significant in all specifications; therefore, population growth also maintained a positive and strong relationship with economic growth against our expectation. In addition, lending rate coefficient shows positive results in all specifications while it is only statistically significant in OLS model but fixed and random effects model. Lending rate in this case has a positive impact on economic growth for developed countries contrary to our expected relationship in Table 1.

Table 4. Results of Developed Countries Analysis

This table shows the relationship between GDP and other variables in developed countries through coefficient figures. The independent variable is GDP. The key variable is CPI and other control variables are FDI, TO, PG, UR and LR. All variables are defined in the Appendix. The figures in parentheses "()" imply the P-value of each variable. The symbols ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

	GDP		
Model	**OLS model**	**Fixed effects**	**Random effects**
	(1)	**(2)**	**(3)**
CPI	-0.120	-0.380**	-0.155
	(0.425)	(0.025)	(0.319)
FDI	2.79e-12	1.75e-12	2.93e-12
	(0.524)	(0.684)	(0.487)
TO	0.005**	0.065***	0.007
	(0.013)	(0.001)	(0.060)
PG	0.448***	0.657***	0.528***
	(0.003)	(0.001)	(0.002)
UR	-0.004	-0.009	-0.009
	(0.574)	(0.379)	(0.361)
LR	0.286***	0.101	0.214
	(0.005)	(0.758)	(0.160)

4.4 Developing countries

This session presents the results of our baseline model by running regression (1) with three panel data techniques including ordinary least squares (OLS), fixed effects, and random effects. Using different testing techniques helps to provide the robustness of our findings. The details are shown in Table 5.

The results for developing countries analysis are shown in the Table 5, column (1) showing the result of OLS model, column (2) showing the result of fixed effects model and column (3) showing the result of random effects model. We continue to see the negative values of inflation coefficient ranging from -0.059 to -0.168. Except for the OLS model, inflation coefficient is statistically significant in both fixed and random effects models. We can conclude that inflation has a negative impact on economic growth in developing countries following our expectation in Table 1. In conclusion, inflation maintains a negative relationship with economic growth in developing countries, so we deny H2 and accept H1.

FDI coefficient is as a sign of negative impact on economic growth and its value ranged from -1.82e-11 to -1.93e-11. Same as with inflation coefficient, FDI coefficient is only statistically significant in fixed and random effects models but OLS models. In this case, FDI has a negative impact on economic growth in developing countries contrary to our expected positive result in Table 1. Trade openness coefficient shows positive figures, and it is statistically significant in all specifications with the values ranging from 0.009 to 0.015. Therefore, trade openness contributes a positive indicator to economic growth in developing countries following our expectation. As the same with trade openness, population growth coefficient also shows positive results. Its value is high and ranges from 0.745 to 0.852 and population growth coefficient is all statistically significant in all models. Therefore, population growth also maintains a strong and positive relationship with economic growth in developing countries against our expected negative relationship in Table 1.

Table 5. Result of Developing Countries Analysis

This table shows the relationship between GDP and other variables in developing countries through coefficient figures. The independent variable is GDP. The key variable is CPI and other control variables are FDI, TO, PG, UR and LR. All variables are defined in the Appendix. The figures in parentheses "()" imply the P-value of each variable. The symbols ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

	GDP		
Model	**OLS model**	**Fixed effects**	**Random effects**
	(1)	**(2)**	**(3)**
CPI	-0.059	-0.168***	-0.136***
	(0.239)	(0.000)	(0.002)
FDI	-1.82e-11	-1.93e-11***	-1.90e-11***
	(0.054)	(0.010)	(0.017)
TO	0.015***	0.009**	0.011**
	(0.008)	(0.038)	(0.023)
PG	0.852***	0.745***	0.775***
	(0.000)	(0.000)	(0.000)
UR	-0.000	0.000	-0.000
	(0.762)	(0.958)	(0.950)
LR	-0.002	-0.002	-0.002
	(0.207)	(0.193)	(0.200)

4.5 Subsample of COVID-19 pandemic period (2019-2021)

This session presents the results of our baseline model by running regression (1) with three panel data techniques including ordinary least squares (OLS), fixed effects, and random effects. Using different testing techniques helps to provide the robustness of our findings. The details are shown in Table 6.

The results for cross-countries in the COVID-19 pandemic period are shown in the Table 6, column (1) showing the result of OLS model, column (2) showing the result of fixed effects model and column (3) showing the result of random effects model. We can see the change in the relationship between inflation and economic growth. Inflation coefficient shows positive figures in all specifications ranging from 0.509 to 0.933. Moreover, inflation coefficient is statistically significant in all models, so inflation has a great and positive impact on economic growth (Dotsey and Sarte, 2000; Ozdemir, 2010) in the COVID-19 pandemic period, which is against our negative expectation in the Table 1. This positive relationship was also clearly shown in the Figure 1, which means an increase in inflation would be beneficial for economic growth in this period. Since inflation has a positive impact on economic growth, we accept H2 and deny H1.

Trade openness coefficient is positive and statistically significant in only fixed effects model but OLS and random effects model. In this period, trade openness has a positive impact on economic growth. Compared to the Table 1, trade openness coefficient satisfies our expected positive relationship between trade openness and economic growth based on theories.

Table 6. Result of Cross-countries in the COVID-19 pandemic period (2019 - 2020)

This table shows the relationship between GDP and other variables in the COVID-19 pandemic period from 2019 to 2020 through coefficient figures. The independent variable is GDP. The key variable is CPI and other control variables are FDI, TO, PG, UR and LR. All variables are defined in the Appendix. The figures in parentheses "()" imply the P-value of each variable. The symbols ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

	GDP		
Model	**OLS model**	**Fixed effects**	**Random effects**
	(1)	**(2)**	**(3)**
CPI	0.509***	0.933***	0.509***
	(0.003)	(0.002)	(0.002)
FDI	-2.14e-11	-1.46e-11	-2.14e-11
	(0.092)	(0.367)	(0.089)
TO	0.002	0.404***	0.002
	(0.724)	(0.000)	(0.724)
PG	-0.299	0.261	-0.299
	(0.523)	(0.757)	(0.522)
UR	-0.017	-0.011	-0.017
	(0.214)	(0.742)	(0.211)
LR	2.01e-06	-2.62e-06	2.01e-06
	(0.446)	(0.561)	(0.444)

5. CONCLUSION

5.1 Discussion and Conclusion

Inflation has long been a topic of interest, especially in the context of the covid 19 pandemic and the period of economic recovery. This study examines the context of inflation and its impact on economic growth of 45 different countries around the world in the period 2010-2021 by applying Ordinary least squares (OLS), fixed effects and random effects model to analyse the theoretical content and the influence of variables: inflation rate, unemployment rate, FDI, trade openness, lending rate, and population growth. Empirical results show that inflation has a negative impact on economic growth, in which developed countries tend to be more severely affected. These findings are consistent with previous studies by Fischer (1993), Barro (1996), and Bruno and Easterly (1998).

In comparison with our expected relationship between GDP and other variables in the Table 1, our finding does not always follow exactly as theories. In the period from 2010 to 2021, while inflation and trade openness figures follow the expected relationship based on theories, FDI, population growth and lending rate figures show the opposite side. FDI coefficient showed negative results instead of positive ones as expected in cross-country and developing countries. In contrast, population growth has a positive impact on economic growth rather than a negative impact as in theories in all analysis. The increase in lending rate is also expected to be negative for economic growth but we found it positive someway while analysing developed countries. In the COVID-19 pandemic period from 2019 to 2021, inflation in contrast has a positive relationship with economic growth, which is not only against expected relationship on theories but also against our previous findings. Inflation would be beneficial to economic growth in some ways to develop in this period.

In the period from 2010 to 2021, the world's economic growth has been undergoing negative effects from inflation rate especially in developed countries. This is not a good sign for the world' economy because the inflation rate is getting higher due to multi-layered crises. Negative effects of inflation can lead to an increase in lending rate, low income, imbalance between the rich and the poor and heavy impact on a country's debt. Countries, organizations, and enterprises need to be aware of this situation and have precautions for the upcoming unexpected situation in the economy. Besides inflation, there are also other factors that have significant impacts on economic growth such as FDI, trade openness and population growth. While the FDI factor seems to have negative impacts on cross-countries evidence, trade openness and population growth tend to be more positive for economic growth. In contrast, unemployment rate and lending rate didn't have much impact on economic growth in this period, but they are the factors which need to be paid attention to soon if the inflation rate keeps going higher.

In conclusion, inflation generally has a negative impact on economic growth in the period of 2010 - 2021. Developed countries tend to suffer heavier damage from inflation than developing ones. In this time, increase in FDI did not benefit economic growth while enhancing trade openness and population growth would contribute to the development of economy. In contrast, there is also a positive relationship between inflation and economic growth occurring in the specific period of COVID-19 pandemic (2019-2021). Inflation was preferred to increase for a country's economic growth in this time. In short, we can be more certain that inflation can affect economic growth both negatively and positively.

5.2 Contributions and Implications of the Study

The motivation of this research paper is to fill the gap with previous studies, providing an overview and more objective results for the inflation situation as well as its impact on economic growth. The contribution of this study is quite important. It provides empirical evidence in 45 countries around the world, from different regions rather than being limited like most studies and we divide into 2 main groups of countries for a more comprehensive view. That evidence was collected between 2010 and 2021. A newer step forward is the variables we identified in the article: inflation rate, unemployment rate, FDI, trade openness, lending rate, and population growth to help visualize clearly, more precisely the impact of inflation.

5.3 Limitations and Future Research of the Study

While doing this study, there are some limitations that need to be mentioned. First, although variances' data is large and easy to collect, data from many countries were not well updated and still lack some variances. Therefore, it is not possible to compare the effects of inflation on economic growth in more countries and give better results. Second, the data is not updated to 2022 that is not closest to the current situation. In 2022, there seems to be more changes in the economy due to some unexpected situations occurring all over the world. This study would be more significant if the data were updated to the year of 2022. Contrary to this, selecting a time frame from 2010 to 2021 helps ensure the accuracy and relevance of the data. There is a worthy-mentioned world issue occurring in this period known as COVID-19 pandemic which lasted from 2019 to 2021. Therefore, we prefer the period with data availability and worthy research. Lastly, while solving the data, it didn't show the expected results at the first step. Therefore, the data had to be well checked and clarified meanwhile trying more methods to solve the data.

In the future research, the authors need to use more advanced methods to have a deeper understanding of the effects of inflation and other factors on economic growth. Moreover, the data needs to be updated to the period between 2022-2023 in which the world's economy seems to experience some unexpected situations due to multi-layered crises. On the other hand, the authors can do research on the factors affecting inflation rate to have a better understanding of inflation and give out the concise solutions to reduce inflation rate.

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