

The Impact of Inflation on Industrial Production: An Econometric Study on Low Income Economies

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Abstract

This study aims at showing the impact of inflation on industrial production in the low income economies according to the classification of the World Bank, where the Gross National Income (GNI) per capita is less than 4037 USD for the period from 1965 to 2014.

To achieve this objective, the data of a sample of 24 countries has been studied through designing an Econometric model that links the inflation rate with the industrial production.

The study found that there is no statistically significant impact of inflation on industrial production, based on the results of the statistical analysis of the data of 75% of the countries of the sample. Even the countries whose data showed that there is a statistically significant effect, this impact was not a strong one, in addition to the clear variance in the direction of that impact.

Keywords: Inflation, Industrial Production, low income economies, GNI per capita

1. INTRODUCTION

Inflation is the continuous rise in the general level of prices. This phenomenon is usually produced as the overall demand exceeds the total supply as a result of the population increase or the increase in money supply, with insufficient flexibility in production, sometimes due to higher production costs such as higher prices of raw materials, labor wages or energy prices (al-Wadi , 2013, pp 181-186).

Inflation is seen as a problem because its impact on the distribution of incomes and wealth due to the effect of prices on the real values of incomes and wealth, where some people benefit while others are badly affected. Inflation leads to instability in the real macroeconomic variables, On the short term, there is a positive impact on increasing production and reducing unemployment rates, however, this subsequently turns into a negative impact, leading to a reduced efficiency of using resources through allocating resources for less efficient uses (Parkin, 2010, pp 116-117).

This theoretical framework, which emphasizes that inflation is a problem, has been confirmed by a number of recent studies. Joan Hamo (Hamo, 2011), has stressed, in his study of the Syrian economy, that there is a negative impact of inflation on economic growth. (Joudaki & others, 2014) study, of the Iranian economy, has agreed with Hamo. Also, in the (Bittencourt, M., van Eyden, R. and Seleteng, M., 2015) study, which was conducted in 15 sub-Saharan African countries from 1980 to 2009, the researchers found that inflation has a negative impact on economic growth, which is reflected on the development process in these countries, which are in a dire need for it.

This theoretical legacy of inflation as an economic problem is not compatible with all contemporary studies. The study of (OZDEMIR ,2010), which was conducted on the UK economy over a long period of time from 1957 to 2006, found that there is no link between inflation and economic growth. In the same direction, the (Bhaduri , 2016) study of the Indian economy concluded that although inflation has a negative impact on economic growth on the short term, however, inflation has no impact on economic growth on the long term.

It should be noted that most studies believe that the effect of inflation on the economic activity, represented by economic growth, is a nonlinear relationship. The study (CHANG, K.-L. and HE, C.-W, 2010) found that inflation has a negative impact on economic growth at high levels of inflation, but on low levels, inflation has no significant impact on economic growth. Other studies have confirmed this finding, adding that inflation at the lower levels is positive and demanded. The study of (Hwang, J.-T. and Wu, M.-J., 2011), on the Chinese

economy, suggests that the relationship between inflation and economic growth is a non-linear one, as the economic growth is positively affected by inflation at inflation levels of less than 2.5%. At these levels, each 1% increase in the inflation rate leads to an increase of 0.53% in the economic growth. While high rates of inflation have a negative impact on economic growth, as a 1% rise in inflation leads to a 0.61% decline in economic growth.

The turning point of this relationship has not been agreed upon. While the (Hwang, J.-T. and Wu, M.-J., 2011) study on the Chinese economy found the point to be 2.5%, the (CrespoCuaresma, J. and Silgoner, 2014) study, conducted on 14 EU countries in the period preceding the monetary union, found that there is a positive relationship of inflation at low levels - specifically at levels below 1.6% -. The (Al-Marai and Al-Mushaib, 2013) study on the Saudi economy set that at a much higher point at 8.9%.

Studies which dealt with a specific sector have been somewhat scarce, yet they have proved that the impact of inflation varies from one sector to another. The (Ning, 2014) study on the Chinese economy has shown that the effect of inflation will be positive on primary industries such as agriculture and mining, negative on the services sector and neutral on manufacturing industries.

This study aims at showing the effect of inflation on production in the industrial sector. The study is especially important in the low income economies for several reasons, including:

- The variables of the study are important as: the rate of inflation is the most prominent indicators of economic stability, and the level of industrial production is one of the most prominent indicators of economic progress.
- The study was conducted on low income economies according to the classification of the World Bank, which are in a dire need to overcome the difficulties and solve any problems that faces the industrial production in order to raise the level of incomes.
- This study comes in the context of sectoral studies based on the hypothesis that says each sector has its own characteristics, therefore, its interaction with other variables will be different from other sectors.

To achieve this goal, the researcher tested the validity of the hypothesis that says "the rate of inflation has a negative impact of statistical significance on industrial production in low-income economies" by designing An Econometric model that determines the impact of inflation – represented by the rate of annual growth in the GDP deflator - on production in the industrial sector - represented by the value added to industry of the GDP. The study was applied during the period (1965 – 2014).

2. DATA DESCRIPTION:

2.1 Inflation in low income economies:

After studying the inflation data in the low income economies during the 50 years from 1965 to 2014, see Table 1, we can notice that the average of inflation rate ranged between (4.09%) in Burkina Faso to (47.12%) in Indonesia. While the average of Inflation rate for all these countries during the years of the study reached (10.83%). It is also clear that all the countries of the sample suffered from inflation rates of more than 2% for most of the study years. The years in which the rate of inflation has fallen below this rate are limited (230 out of 1200 observations), which means that the problem of inflation in these countries is a chronic one.

In fact, a number of countries of the sample suffered from Hyper Inflation that exceeded (50%) in a number of years of the study. Eight out of the 24 countries of the study have suffered from that, especially Zambia and Sierra Leone which suffered from Hyper Inflation for many years.

2.1 The Value added of Industry in low income economies :

The industry sector, as defined by the World Bank, includes manufacturing industry, mining, construction, electricity, water and gas. While the value added is the net output of a sector after adding all outputs and subtracting intermediate inputs (World Bank, 2017). It is well known that the industrial sector is one of the most important productive sectors in addition to agriculture and services sector.

After studying the ratio of the value added of the industrial sector to the GDP in the low income economies during the 50 years from 1965 to 2014, see Table 2, we can notice that the average of this ratio ranged from (14.22%) in Chad to (47%) in Congo, with a relative stability over time, excluding: Zambia, where this ratio was consistently decreasing during the years of study as the regression coefficient reached ($\beta = -0.617$). And in Congo, in an opposite direction, the regression coefficient reached ($\beta = +1.21$).

Table (1) Inflation rate in low income economies

Descriptive Statistics

Inflation, GDP deflator (annual %)	N	Minimum	Maximum	Mean	Std. Deviation
Bangladesh	50	-17.63-	80.57	9.9456	15.22457
Benin	50	-4.88-	35.03	5.2367	6.43934
Burkina Faso	50	-6.35-	18.66	4.0910	4.99834
Cameroon	50	-2.39-	23.63	5.7301	5.79913
Central African Republic	50	-4.44-	34.15	6.1515	8.35130
Chad	50	-16.93-	43.54	5.4365	9.44597
Congo, Rep.	50	-29.17-	47.04	6.8568	13.77214
Cote d'Ivoire	50	-4.52-	46.39	5.9787	9.23801
Guyana	50	-5.78-	162.62	16.5742	30.46524
Honduras	50	-2.78-	30.82	8.9472	7.57303
Indonesia	50	-.10-	1195.41	47.1217	170.76568
Kenya	50	-9.22-	41.99	9.3517	8.01936
Lesotho	50	-9.15-	41.46	9.1944	7.69221
Malawi	50	-2.08-	112.69	17.7861	19.30197
Mauritania	50	-7.09-	41.41	7.9252	7.37849
Nepal	50	-5.67-	27.52	8.7619	5.84003
Niger	50	-6.39-	35.84	5.0360	8.22543
Pakistan	50	1.14	25.44	9.5159	5.79680
Philippines	50	1.96	53.34	9.5328	8.58078
Rwanda	50	-9.19-	87.97	10.2755	15.55529
Sierra Leone	50	-6.93-	165.68	25.8973	34.17746
Sri Lanka	50	-1.80-	24.38	10.2150	5.90906
Togo	50	-12.30-	42.03	5.3332	9.30379
Zambia	50	-14.17-	165.53	28.4242	36.45495
Valid N (listwise)	50				

Table (2) Ratio of the value added of the Industrial sector to the GDP in the low income economies

Descriptive Statistics

Industry, value added, % of GDP	N	Minimum	Maximum	Mean	Std. Deviation
Bangladesh	50	6.06	27.64	19.7549	6.19387
Benin	50	7.98	32.82	17.9292	7.50178
Burkina Faso	50	16.22	28.09	21.8159	2.62169
Cameroon	50	15.96	37.47	27.4237	5.96870
Central African Republic	50	13.09	27.75	18.3634	4.62207
Chad	50	8.91	47.12	14.2170	5.30646
Congo, Rep.	50	18.93	77.41	46.9978	19.36436
Cote d'Ivoire	50	15.16	26.27	20.6744	2.79524
Guyana	50	18.35	40.28	30.2164	5.69355
Honduras	50	18.76	32.46	26.1952	3.44143
Indonesia	50	11.94	48.06	36.9336	9.97332
Kenya	50	16.02	21.88	19.1648	1.40916
Lesotho	50	5.46	48.53	28.2300	10.71408
Malawi	50	13.28	31.53	19.5377	3.89535
Mauritania	50	21.23	48.39	32.0247	6.90962
Nepal	50	8.18	22.92	15.2202	4.33509
Niger	50	3.47	22.94	15.0826	5.21919
Pakistan	50	19.68	27.10	22.9140	1.72782
Philippines	50	30.20	39.23	33.9185	2.34110
Rwanda	50	6.77	24.62	15.7197	4.98422
Sierra Leone	50	6.79	41.02	20.8856	9.25949
Sri Lanka	50	19.99	32.32	27.0532	2.64594
Togo	50	15.54	33.14	20.7153	3.18510
Zambia	50	25.78	68.15	42.9353	10.86415
Valid N (listwise)	50				

3. THE ECONOMETRIC STUDY:

3.1 Variables:

1. The independent variable is inflation: measured by the annual growth rate of the GDP deflator (inflation, GDP deflator, annual%). This ratio is calculated according to the following rule:

$$Inflation\ Rate\ (\%)_t = \left(\frac{GDP\ Deflator_t - GDP\ Deflator_{t-1}}{GDP\ Deflator_{t-1}} \right) * 100\%$$

$$GDP\ Deflator = \frac{Nominal\ GDP}{Real\ GDP}$$

2. The dependent variable is production in the industry sector: measured by the value added of industry to the GDP (Industry, value added, %of GDP). The value added is the net output of a sector after adding all outputs and subtracting intermediate inputs.

3.2 The Study community:

The study community includes all low income economies that represent low income countries as well as lower-middle-income countries according to the World Bank classification. The World Bank classifies the countries regarding the GNI per capita into four categories (World Bank, 2017):

- Low-Income Economies: are countries where GNI per capita reaches \$ 1,025 and less. This category includes 31 countries.
- Lower-Middle- Income-Economies: are countries where the GNI per capita ranges between \$ 1,025 and \$ 4,036. This category includes 52 countries.
- Upper-middle-income Economies: are countries with GNI per capita ranges between \$ 4,035 and \$ 12476, including 56 countries.
- High-Income Economies: are countries with GNI per capita of \$ 12476 and more. This category includes 79 countries.

The community of the study consists of 83 countries. The sample included all countries that had continuous data over their economies for the period of the study (1965-2014) and was published on the World Bank website (World Bank, 2017). The sample size was 24 countries, constituting 28.9% of the size of the study community. According to this ratio, it is statistically acceptable to circulate the results reached after studying the sample on the study community.

3.3 The Econometric Model:

The researcher has created a simple linear regression model represented by the following functions:

$$IND = f (INF)$$

$$IND_{i1} = \alpha + \beta INF_{i1} + \mu_{i1} \dots \dots \dots (1)$$

$$IND_{i2} = \alpha + \beta INF_{i2} + \mu_{i2} \dots \dots \dots (2)$$

.

$$IND_{in} = \alpha + \beta INF_{in} + \mu_{in} \dots \dots \dots (n)$$

Whereas:

IND: Ratio of value added of the industry to the GDP to: State 1, State 2, ..., State n.

INF: inflation rate: in state 1, in state 2, ..., in state n.

μ: random variable.

3.4 Summary of Findings:

The researcher assessed (β 1, β2, ..., βn) using the Ordinary Least Squares (OLS) method, and its significance was tested using the T test, assuming that the results were significant if α is less than 0.05, the Statistical Package for the Social Sciences (SPSS) was used. Results were as in Table (3).

Table (3) Statistical results that show the impact of Inflation on Industrial production

Country	β	α	Country	β	α	Country	β	α
Bangladesh	-0.102	0.078	Guyana	-0.022	0.424	Niger	-0.013	0.89
Benin	-0.181	0.28	Honduras	0.242	0.000	Pakistan	-0.011	0.802
Burkina Faso	0.072	0.342	Indonesia	-0.029	0.000	Philippines	0.12	0.001
Cameroon	0.159	0.283	Kenya	-0.003	0.905	Rwanda	-0.006	0.905
Central African Republic	0.064	0.424	Lesotho	0.199	0.323	Sierra Leone	0.014	0.715
Chad	-0.028	0.728	Malawi	0.004	0.902	Sri Lanka	0.134	0.035
Congo, Rep.	0.253	0.211	Mauritania	-0.16	0.236	Togo	0.109	0.023
Cote d'Ivoire	-0.105	0.014	Nepal	-0.057	0.599	Zambia	0.037	0.385

3.5 Analysis of the results:

The results can be explained by the following points:

- The data of 18 out of 24 countries indicates that there is no statistically significant impact of inflation on industrial production.
- The data of 6 countries (Ivory Coast (Cote d'Ivoire), Honduras, Indonesia, Philippines, Sri Lanka, Togo) - representing 25% of the sample size - indicates that there is a statistically significant impact of inflation on industrial production, using the Pearson correlation coefficient R, look at table (4), we find the following:
 - The nature of the impact varies. The effect of inflation on industrial production in Ivory Coast (Cote d'Ivoire) and Indonesia is negative, which is consistent with the study hypothesis, while the data of economies of Honduras, the Philippines, Sri Lanka and Togo indicates a positive effect.
 - Even though there is an impact of statistical significance, the correlation coefficient indicates that the strength of the relationship ranged between medium to weak.

Table (4) The correlation coefficient between the two variables for some sample countries

Country	Cote d'Ivoire	Honduras	Indonesia	Philippines	Sri Lanka	Togo
R	-0.346	+0.532	-0.489	+0.440	+0.298	+0.321

Based on the results of the statistical analysis of the data of 75% of the sample countries, we find that there is no impact of statistical significance of Inflation on Industrial production. Even the countries whose data showed a statistically significant effect, this impact did not rise to be a strong one, in addition to the clear variance to the effect.

4. CONCLUSION:

Low income economies have suffered from inflation rates of more than 2% for most of the relatively long years of the study, which means that the problem of inflation is a chronic problem in these countries.

Through examining the impact of inflation rates on the industrial production, it becomes clear that there is no impact of statistical significance of Inflation on Industrial production, based on the results of the statistical analysis of 75% of the sample countries. Even the countries whose data showed a statistically significant impact, this impact did not rise to be a strong one, in addition to the clear variance to that impact. Accordingly, we reject the hypothesis that says "Inflation has a negative impact of statistical significance on the industrial sector in the low income economies."

The null hypothesis was based on the theoretical analysis which indicates that the impact of the rise in the general level of prices on the industry sector will be negative as it is a real threat to economic stability and the reasonable Certainty, on which investment decisions in real sectors- mainly Industry- are based, and this is what this study did not prove. Overall, the impact of inflation on production is uncertain and needs further studies.

REFERENCES

- Al-Marai, M., and Emad Al-Din A.(2013), The Impact of Inflation on Economic Growth in Saudi Arabia: An Empirical Study using the GARCH method, *Economic Aafaq Journal*, Volume 33, No. 124, pp. 13-59.
- Al-Wadi, Mahmoud Hussein, and others(2013) , *Macroeconomics*, Third Edition, Dar al-Masirah, Amman.
- Bhaduri, S. (2016), Revisiting the Growth–Inflation Nexus: A Wavelet Analysis. *Economic Notes*, 45: 79–89. doi:10.1111/ecno.12049.
- Bittencourt, M., van Eyden, R. and Seleteng, M. (2015), Inflation and Economic Growth: Evidence from the Southern African Development Community. *S Afr J Econ*, 83: 411–424. doi:10.1111/saje.12075.
- CHANG, K.-L. and HE, C.-W. (2010), DOES THE MAGNITUDE OF THE EFFECT OF INFLATION UNCERTAINTY ON OUTPUT GROWTH DEPEND ON THE LEVEL OF INFLATION?. *The Manchester School*, 78: 126–148. doi:10.1111/j.1467-9957.2009.02162.x.
- Crespo Cuaresma, J. and Silgoner, M. (2014), Economic Growth and Inflation in Europe: A Tale of Two Thresholds. *J Common Mark Stud*, 52: 843–860. doi:10.1111/jcms.12117.
- Hamo, J. (2011), The Impact of the Exchange rate on the GDP and Inflation in Syria, unpublished Master thesis, *Aleppo University*.
- Hwang, J.-T. and Wu, M.-J. (2011), Inflation and Economic Growth in China: An Empirical Analysis. *China & World Economy*, 19: 67–84. doi:10.1111/j.1749-124X.2011.01259.x
- Joudaki , H. , Mohammad H.(2014) , Causal Relationship between Inflation and Economic Growth in Iran during the Years 1978 - 2011, *Kuwait Chapter of Arabian Journal of Business and Management Review* ,Vol.3 Issue 6 , pp. 190 – 201

- Ning, G. U. O. (2014), "The Impact of Inflation on Industrial Structure Upgrading in China." *Journal of Finance and Economics* 4 : 011.
- OZDEMIR, Z. A. (2010), DYNAMICS OF INFLATION, OUTPUT GROWTH AND THEIR UNCERTAINTY IN THE UK: AN EMPIRICAL ANALYSIS. *The Manchester School*, 78: 511–537. doi:10.1111/j.1467-9957.2009.02153.x.
- Parkin, M.(2010), *Macroeconomics*, Pearson Education, tenth edition, 2010.
- The World Bank*(2017), the website of the World Bank: <http://data.worldbank.org/indicator/NV.IND.TOTL.ZS> (2-5-2017).
<https://datahelpdesk.worldbank.org/knowledgebase/articles/906519> (8-2-2017)