

The Threshold Effect of Inflation on Growth Performance in South Asian Economies

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ABSTRACT

One of the broad goals of policymakers is to achieve rapid and sustainable economic growth. Despite the fact that the determinants of economic growth are a long list of factors, the focus of this study is on the role of inflation in the growth process. Macroeconomic policy's objective is to achieve higher growth rates while maintaining low inflation. The relationship between these two macroeconomic variables prompts us to consider the optimal inflation rate that has a promoting (or detrimental) effect on economic growth. The current study examines the existence of a threshold effect in the relationship between inflation and economic growth in a sample of South Asian economies from 1980 to 2017. The empirical findings indicate that the relationship between inflation and economic growth in Asian economies is non-linear. The study's findings also indicate that there is a structural break in the relationship between inflation and economic growth at 6% inflation. The inflation rates higher than the threshold level (6 percent) impedes the growth process. It is recommended that South Asian economies should formulate policies aimed at containing and stabilizing inflation in order to stimulate economic growth.

KEYWORDS Inflation; Economic Growth; Threshold Level; South Asian countries

INTRODUCTION

One of the many objectives of policymakers is to achieve rapid and sustainable economic growth while maintaining price stability. Researchers and policy analysts have demonstrated a keen interest in the existence and nature of a nexus between inflation and economic growth (Umaru and Zubairu, 2012; Thouraya and Kamel, 2017). The empirical evidence on the impact of inflation on economic growth is inconclusive; previous research yielded mixed results, and there is no clear agreement. Some studies support a positive impact (Benhabib, & Spiegel, 2009; Mallik, & Chowdhury, 2001; Rapach, 2003), while other have found negative impact (Friedman, 1956; Stockman, 1981; Fischer, 1983; Barro, 1995; Valdovinos, 2003). Furthermore, several researchers have pointed out that the relationship between these two macroeconomic variables is non-linear, meaning that the impact of inflation on economic growth changes after a certain threshold level is reached (Aydin *et al.*, 2016; Bruno & Easterly, 1998; Drukker, *et al.*, 2005; Ghosh & Philips, 1998; Khan *et al.*, 2001; Kremer, *et al.*, 2009; Vinayagathan, 2013). It is therefore critical for policymakers to understand the relationship between inflation and economic growth in order to implement sound policies. More specifically, if lower (higher) inflation

stimulates (hinders) economic growth, it is reasonable to wonder what the optimal level of inflation for an economy would be (Khoutem et.al., 2019).

Obviously, the answer to this question is dependent on the nature and structure of the economy. Recent research has focused on the nonlinear relationship between inflation and economic growth. That is, at lower inflation rates, the relationship is significantly positive, but at higher levels, it has a significantly negative impact on economic growth. If there is a non-linear relationship between inflation and economic growth, it should be possible to estimate a threshold level (structural break point) at which the sign of the relationship between the two variables changes.

Fischer's seminal work (1993) established a non-linear relationship between inflation and growth. The study examined a panel of 93 economies and concluded that lower inflation promotes economic growth, whereas higher inflation impedes the growth process. Consequently, a substantial amount of researches has been conducted in recent years to unveil the non-linear relation between inflation and economic growth (Baglan & Yoldas, 2014; Ghazouani, 2012; Omay and Kan, 2010; Wai, 1959). In group of countries several researchers have probed the non-linear impact of inflation on economic growth. The studies confirmed the non-linear impact of inflation on growth process (Sarel, 1996; Ghosh and Phillips, 1998; Bruno and Easterly, 1998; Judson and Orphanides, 1999). Christoffersen and Doyle (2000) and Gylfason and Herbertsson (2001), for example, discovered that inflation rates above a certain threshold, i.e., 13% and 10%, respectively, stifle economic growth. Inflation is the primary cause of economic development instability as well as economic growth in developing countries (Tung L, & Thanh P, 2015).

Ghazouani (2012) investigated the relationship between inflation and economic growth in 19 MENA countries. They asserted that an inflation rate of less than 10% accelerates economic growth. Similarly, Aydin (2017) investigated the relationship between inflation and economic growth in the D-8 countries of Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan, and Turkey. According to the study's findings, inflation rates above 12.8 percent negatively affect the economic growth. Kremer et al. (2013) and Baglan and Yoldas (2014), estimated the 12 percent of the threshold level of inflation in developing countries. In case of developed economies, Drukker et al., (2005) pointed out that the inflation rate has threshold level effect at 2.5 percent. Similarly, Omay and Kan (2010) concluded that 2.4 percent of the threshold level for group of developed economies.

A substantial amount of studies has been dedicated to analyze the non-linear relationship between inflation and economic growth at country level. For example, Fabayo and Ajilore (2006) for Nigeria, Munir et al. (2009) for Malaysia, Akgül and Özdemir (2012) for Turkey, Seleteng, *et al.*, (2013) for Africa and Hasanov (2010) for Azerbaijan. In case of Pakistan, Mubarik (2005) and Saleem (2016) investigated the relation between inflation rate and economic growth. They confirmed a non-linear relationship but different threshold level (9 and 7 percent). In line to this argument, Ahmed and Mortaza (2005) found threshold level of 6 percent for Bangladesh. In a recent study by Thouraya and Kamel (2017), examined the impact of inflation on the economic growth for Tunisia. They show that inflation rate lower than 3.48 percent promotes economic growth.

Table 1 depicts the rate of inflation in South Asian countries from 1980 to 2018. South Asian economies vary greatly in terms of their level of economic development, inflation rate, and per capita income. In 2018, Bangladesh experienced the highest inflation rate of 5.54 percent, while Sri Lanka experienced the lowest rate of 2.13 percent. However, during the 1980's, Sri Lanka experienced the highest rate of inflation (17.97%) and Bhutan experienced the lowest rate of inflation (9.93%).

Table 1. Inflation rate in South Asian Countries

	1981	1991	2001	2005	2010	2015	2016	2017	2018
Bangladesh	14.55	6.36	2.01	7.05	8.13	6.19	5.51	5.70	5.54
Bhutan	9.93	12.28	3.41	5.31	7.04	4.55	4.31	3.86	2.72
India	13.11	13.87	3.78	4.25	11.99	5.87	4.94	2.49	4.86
Nepal	11.14	15.56	2.69	6.84	9.33	7.87	8.79	3.63	4.15
Pakistan	11.88	11.79	3.15	9.06	13.88	2.53	3.77	4.09	5.08
Sri Lanka	17.97	12.19	14.16	11.64	6.22	3.77	3.96	7.70	2.13

Source: Author calculated using the data from WDI

It has been noted that empirical studies on the non-linear relationship between inflation and economic growth are available for single countries in South Asian economies, for example, Mubarik (2005) and Saleem (2016) for Pakistan, and Ahmed and Mortaza (2005) for Bangladesh. Few studies have focused on South Asian economies; for example, Aydin (2017) studied D-8 economies and included Pakistan and Bangladesh in their sample. There have been few studies on the non-linear relationship between inflation and economic growth in the South Asian region. Therefore, this study aims to hypothesize the existence of a non-linear relationship between inflation and growth in the South Asian economies. It designs to test the hypothesis by empirically assessing threshold level of inflation in the South Asian economies, namely Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka. By using a panel data of the Asian economies over the period of 1980-2017, we adopt the Panel regression model developed by Khan and Senhadji (2001) to estimate the threshold level of inflation.

The remaining paper is structured as follow; section 2 provides the econometric models and other techniques. Section 3 includes the estimated results and the final section represents the conclusion and discussion of the study.

RESEARCH METHOD

2.1. Econometric Modeling

According to Barro (1997), economy is designed in such a way where inflation real effects and expectations have impact on aggregate supply. If we assume the aggregate supply by Lucas-type supply curve Romer, these impacts can be captured by;

$$Y = \bar{y} + \beta(\pi - \pi^e) \quad \beta > 0 \quad (1)$$

Where y is the log of output & $\bar{y}$ is the log of its flexible price level; π is actual inflation and π^e is expected inflation. It is assumed that social optimal level is greater than flexible price level of output. This could occur due to positive marginal tax rates or form imperfect competition, one important assumption is that inflation about some level is expensive and that the marginal cost of increases as inflation rises. Hence in order to capture it, social welfare quadratic in both inflation and output is designed. Therefore, the goal of the monetary authority is the minimization of the loss function.

$$L = \frac{1}{2}(Y - Y^*)^2 + \frac{1}{2}\alpha(\pi - \pi^*)^2 \quad y^* > \bar{y}, \alpha > 0 \quad (2)$$

Where α shows the relative importance of inflation and output in social welfare. The behavior and the aggregate demand is determined by the money growth of an economy and is controlled by the monetary authorities. Under the assumptions of no uncertainty, the monetary authority chooses inflation directly, subject to the constraint that inflation & output are related by the aggregated supply curve.

Panel regression model is utilized in this paper as Khan and Senhadji (2001) used to estimate the threshold level of inflation to South Asian Countries. The following conditional equation form help to estimate threshold level of inflation.

$$\text{GDPGR}_{it} = y_1\pi_{it} + y_2d_{it}(\pi_{it} - \pi^*) + X_{it}\beta + u_i + v_{it} \quad (3)$$

Where GDPGR_{it} is the GDP growth rate of i^{th} Country at time t ; π_{it} is the inflation rate of i -th country at time t ; π^* is the threshold level of inflation, X_{it} is the vector of significant control variables. That can be found in growth literature. u_i is the country-specific effect & v_{it} is the error term, y_1 and y_2 are the parameters. Dummy variable (d_{it}) chosen such that;

$$d_t = 1 \text{ if } \pi_{it} > \pi^*$$

$$d_t = 0 \text{ if } \pi_{it} \leq \pi^*$$

Hence, $y_2 d_{it} (\pi - \pi^*)$ is equal to 0, if inflation is below or equal to threshold level & 1 if inflation is above the threshold level. Thus the effect of inflation will be y_1 , if the inflation is less than threshold level, & $y_1 + y_2$ if inflation is higher is highly than the chosen threshold level. The basic model to be estimated is as follow;

$$GDPG_{it} = \beta_0 + \beta_1 \pi_{it} + \beta_2 d_{it} (\pi_{it} - \pi^*) + \beta_3 inv_{it} + \mu_{it} \quad (4)$$

Where, $GDPG_{it}$ shows the Economic growth, π_{it} means Inflation, π^* represents Expected Inflation while, Inv_{it} express the investment and μ_{it} means Error Term.

2.2. Description Of The Variable

The variables which are used in this study are; Economic Growth, Inflation and Investment.

GDP is the market value of all officially recognized final goods and services produced within a country in a year, or other given period of time. Economic growth is the dependent variable of the study and it is measured by the growth rate of real GDP. The data is taken from World bank database.

Inflation is the rate at which the general level of prices for goods and services is rising, and, subsequently, purchasing power is falling. Inflation is the first explanatory variable and it is also the main concern of this study. Inflation data has been taken from World Bank database.

Investment rate is the second explanatory variable. The data has been taken from the World Bank database.

2.3. Data Collection and Sources

The Scope of this study spans the period from 1980 to 2017 for South Asian countries. In order to facilitate this panel data analysis data is gathered from World Bank; World developer's indicator and (WDI). Panel data is chosen because it exploits both time series and cross sectional information and it gives large number of observations, increasing the degree of freedom and reducing the collinearity among explanatory variables. It allows for considerably more flexibility modeling the behavior of cross-sectional units than convectional time series analysis.

The dataset of the present study includes 6 South Asian countries and covers the period from 1980 to 2017. Due to unavailability of data for Afghanistan and Maldives, these two countries are excluded, while encompassed countries are Bangladesh, Bhutan, India, Nepal, Pakistan, SriLanka.

RESULTS AND DISCUSSION

The descriptive statistics of variables inflation, investment, and GDP growth is shown in the Table 1. The results in table 1 reported the maximum value of GDP, Inflation, and Investment are 28.69, 26.14, and 67.91 respectively and the mean values of respective variables are 5.50, 8.06 and 27.88. Similarly, standard deviation is 2.93, 4.35 and 10.91 respectively. The variables GDP growth, and investment are positive skewed while inflation is negatively skewed.

Table 2 reports the correlation matrix of the variables. Reported results indicates that economic growth has a negative correlation with inflation. Apart from this, there is negative correlation between Inflation and Investment. The result of a negative correlation between Inflation and Investment is supported by Fisher (1993) argument that inflation is detrimental to investment.

Table 1: Descriptive statistics

	GDP	INFLATION	INVESTMENT
Mean	5.50	8.06	27.88
Median	5.11	7.69	25.29
Maximum	28.69	26.14	67.91
Minimum	-2.97	-18.10	14.12
Std. Dev.	2.93	4.35	10.91
Skewness	2.426	-0.038	1.384
Kurtosis	20.51	9.58	4.85
Observations	228	228	228

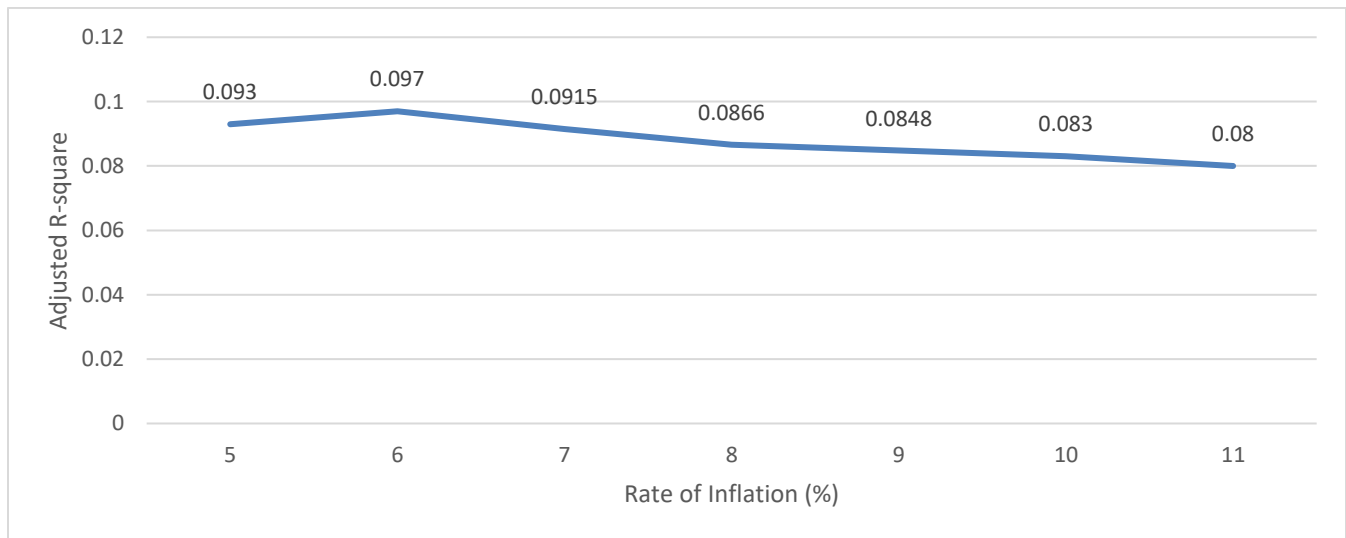
Source: Calculated by author

Table 2: Correlation Matrix

	GDP	INFLATION	INVESTMENT
GDP	1		
INFLATION	-0.102	1	
INVESTMENT	0.299	-0.168	1

Source: Calculated by author

Figure A: Adjusted R-squared at different threshold levels of inflation



3.1. Regression Results

As stated earlier, to find the threshold level of inflation, equation (4) is estimated for various annual levels of π^* in the range of [5-11]. After each estimation, corresponding values of adjusted- R^2 are collected, and the optimal threshold is identified as

3.2 Inflation Threshold and Transition Parameter

In the next phase of the study, we quest to acquire the threshold level by using the Panel regression model which is developed by Khan and Senhadji (2001). The optimal threshold level is there where that maximize the value of R -square. Table 3 shows the regression results for the threshold level as well as provide the information about the variables. Where $adj R^2 (\pi)$ depend on the chosen threshold level of inflation. The result shows the final estimation output, with threshold level of inflation identified at 6% annually. The *adjusted* R^2 statistic reached its maximum at the level of $\pi^* = 6\%$. The threshold level of inflation at 6% means that this level of inflation is the break-even level of inflation, above which inflation has a negative impact on the growth rate of output.

When the level of threshold set at 5%, Inflation is insignificant as shown by probability value. The impact of inflation on GDP is positive. Similarly impact of investment is also positive and it is significant. The dummy variable is significant but impact is negative. The estimated RSS is 1753.81 and Adjusted R square is 0.093.

Consequently, when the level of threshold set at 6%, Inflation, Investment and dummy variable is significant as shown by probability value. The impact of inflation on GDP is positive. Similarly, impact of investment is also positive. The dummy variable impact is negative. The estimated RSS is 1746.04 and Adjusted R-squared is 0.097.

When the level of threshold set at 7%, Inflation is significant as shown by probability value. The impact of inflation on GDP is negative. But impact of investment is positive and it is significant. The dummy variable is significant but impact is negative. The estimated RSS is 1758.08 and Adjusted R-square is 0.091. As evident from table 3 above, when the level of threshold set at 8%, Inflation is significant as shown by probability value. The impact of inflation on GDP is negative. But the impact of investment is positive and it is significant. The dummy variable is insignificant and impact is negative. The estimated RSS is 1767.50 and Adjusted R-square is 0.0866. When the level of threshold set at 9%, Inflation and dummy variables are insignificant as shown by probability value. The impact of inflation on GDP is positive. Similarly impact of investment is also positive and it is significant. The impact of dummy variable is negative on GDP. The estimated RSS is 1771.02 and Adjusted R-square is 0.0848.

However, if the level of threshold set at 10%, Inflation and dummy variables are insignificant as shown by probability value. The impact of inflation on GDP is positive. Similarly impact of investment is also positive and it is significant. The impact of dummy variable is negative on GDP. The estimated RSS is 1773.63 and Adjusted R-square is 0.083. When the level of threshold set at 11%, Inflation and dummy variables are insignificant as shown by probability value. The impact of inflation on GDP is negative. But impact of investment is positive and it is significant. The impact of dummy variable is negative on GDP. The estimated RSS is 1778.86 and Adjusted R-square is 0.080.

Therefore, the results show that inflation rate of 6% annually is the optimal level of inflation for South Asian countries on the data spanning from 1980 to 2017, since inflation rates higher than this calculated threshold level positively but insignificantly affect output growth. Meanwhile for inflation rates less than the threshold level, inflation does not hinder growth, and has an insignificant effect on growth of the economy. That is, for inflation levels less than optimal, the effect is insignificant but as inflation passes the threshold, the effect becomes strongly significant and negative. This finding supports findings are similar to Danladi (2013) for West African Sub-Region and Khan and Senhadji (2001) for a panel of developing countries. They found that the optimal level of inflation for developing countries is 9% and 11%, respectively, for an average country from the panel. For the relationship between output growth and investment, the result shows a positively significant.

Table 3. Regression results

5%				
VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTICS	PROB.
C	2.771	0.809	3.423	0.001
INFLATION	0.164	0.116	1.415	0.158
INVESTMENT	0.083	0.017	4.754	0.000
(INF>5)*(INF-5)	-0.257	0.139	-1.858	0.065
	RSS 1753.81		Adj R-squared 0.093	
6%				
VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTICS	PROB.
C	2.643	0.811	3.260	0.001
INFLATION	0.161	0.100	1.611	0.100
INVESTMENT	0.083	0.017	4.793	0.000
(INF>6)*(INF-6)	-0.275	0.130	-2.113	0.036
	RSS 1746.04		Adj R-squared 0.097	
7%				
VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTICS	PROB.
C	2.871	0.800	3.589	0.000
INFLATION	-0.101	0.091	1.105	0.07
INVESTMENT	0.082	0.017	4.689	0.000
(INF>7)*(INF-7)	-0.214	0.126	-1.703	0.090
	RSS 1758.08		Adj R-squared 0.0915	
8%				
VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTICS	PROB.
C	3.089	0.785	3.935	0.000
INFLATION	-0.054	0.082	0.661	0.05
INVESTMENT	0.080	0.017	4.614	0.000
(INF>8)*(INF-8)	-0.161	0.124	-1.300	0.195
	RSS 1767.50		Adj R-squared 0.0866	
9%				
VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTICS	PROB.
C	3.212	0.765	4.200	0.000
INFLATION	0.030	0.073	0.405	0.686
INVESTMENT	0.080	0.017	4.575	0.000
(INF>9)*(INF-9)	-0.138	0.124	-1.114	0.267
	RSS 1771.02		Adj R-squared 0.0848	
10%				
VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTICS	PROB.
C	3.300	0.751	4.396	0.000
INFLATION	0.013	0.067	0.191	0.849
INVESTMENT	0.079	0.017	4.555	0.000
(INF>10)*(INF-10)	-0.122	0.128	-0.953	0.341
	RSS 1773.63		Adj R-squared 0.083	
11%				
VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTICS	PROB.
C	3.459	0.741	4.671	0.000
INFLATION	-0.013	0.062	-0.201	0.841
INVESTMENT	0.079	0.017	4.516	0.000
(INF>11)*(INF-11)	-0.071	0.136	-0.522	0.602
	RSS 1778.86		Adj R-squared 0.080	

Source: Calculated by author

CONCLUSION

One of the extensive aim of policy makers is to achieve rapid and sustainable economic growth of the economy. Even though the determinants of economic growth consist of a list of factors, but the concern of this study is directed towards the role of inflation in growth process. This study aims to examine the threshold level of inflation in the framework of growth-inflation relationship in the context of South Asian countries over the period 1980–2017. The empirical results found that there exists a statistically significant structural break in the relationship between inflation and economic growth at 6 per cent. The study suggests that if inflation exceeds beyond the threshold point (6 per cent) is detrimental to economic growth. Below the threshold, the relationship is found to be positive and insignificant.

Finding of the study would be used as a useful tool at the disposal of the monetary authorities of the countries in the region for formulating policies that would track inflation and keep it in check. With this finding, the authorities could strive towards the attainment of the highest possible level of output without fear of high price prevalence if the threshold level can be sustained.

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APPENDIX

Table A1: Descriptive Statistics

	Pol. Glob.				Govt. Effect.			
	Mean	Min.	Max.	SD	Mean	Min.	Max.	SD
Australia	87	83	89	1.74	1.70	1.53	2.01	0.114
Brazil	87	83	92	2.84	-0.11	-0.45	0.20	0.15
Canada	91	90	92	0.78	1.83	1.71	1.99	0.09
China	86.22	77.47	91.88	4.21	0.09	-0.35	0.48	0.23
Denmark	92.23	90.73	93.34	0.72	2.01	1.76	2.35	0.18
France	97.39	95.99	98.49	0.74	1.50	1.25	1.78	0.14
Germany	96.48	94.98	97.72	0.86	1.64	1.42	1.88	0.133
India	88.65	81.22	93.50	3.58	-0.036	-0.206	0.28	0.119
Indonesia	81.94	74.88	89.39	4.58	-0.28	-0.705	0.18	0.24
Italy	96.18	91.68	98.65	2.12	0.57	0.19	0.87	0.19
Japan	84.42	79.26	88.73	2.79	1.43	0.91	1.86	0.29
Mexico	77.15	68.34	87.82	6.45	0.19	-0.16	0.36	0.11
Netherland	94.59	92.05	97.01	1.62	1.89	1.69	2.09	0.124
New Zealand	75.25	69.64	77.56	2.193	1.77	1.59	1.96	0.09
Norway	87.94	85.72	90.02	1.30	1.91	1.83	2.08	0.06
Poland	91.013	89.30	93.27	1.06	0.59	0.373	0.75	0.10
South Africa	82.93	57.72	91.48	9.29	0.51	0.19	1.02	0.21
South Korea	85.63	74.57	92.19	4.93	0.97	0.36	1.25	0.27
Spain	94.47	91.31	96.94	2.11	1.27	0.80	1.88	0.37
Thailand	76.79	65.80	81.76	4.72	0.28	0.06	0.45	0.09
Turkey	89.73	84.15	93.50	2.73	0.13	-0.26	0.41	0.18
UK	96.64	95.83	97.65	0.50	1.69	1.39	1.93	0.16
US	92	92	93	0.25	1.48	1.22	1.92	0.18