

**THE RELATIONSHIP BETWEEN INFLATION
AND ECONOMIC GROWTH: EVIDENCE FROM
TURKEY**

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BEEM115

Student ID No. 630053259

Candidate No. 031668

**I certify that all material in this dissertation which is not my own work has been
identified and that no material is included for which a degree has previously
been conferred upon me.**

.....(Student's signature)

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Abstract

Despite significant research and debate, academics and researchers have failed to agree upon a conclusive definition for inflation in an economic context. Similarly, the relationship between economic growth and inflation is also well documented but inconclusive. Numerous studies point to both positive and negative relations between these two economic variables, with some strains of research investigating the existence of threshold values of inflation at which the relationship may switch from positive to negative, or vice versa.

In this study, we examine the relationship between inflation and economic growth in Turkey between 1988 and 2014. During part of this period, the Turkish economy suffered extreme hyperinflation and so understanding the link between these two variables is key for policy makers to enable them to enact the correct decisions to ensure stability and growth of the Turkish economy.

Specifically, we use Pearson correlation and OLS methods to understand the linkages between inflation and economic growth, finding that a negative correlation of 0.21 exists, supported by results of OLS estimations, that a 1% increase in CPI causes a 2.2% decrease in GDP. Results of Granger causality analysis however, are insignificant, indicating there to be no causal relationship between inflation and growth levels for the dataset analysed.

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1. Introduction

Inflation and economic growth are important concepts in the economics literature. From the past to the present there has been a discussion around whether these two economic factors have a relation or not. This dissertation will examine what kind of relation exists and whether inflation plays a role in the growth rate which occurred in Turkey without other socio-economic factors during the period 1988 to 2014.

One of the most important issues to consider is that all countries strive to solve the challenge of inflation. Every country aims to grow in terms of economic output in order to enhance its welfare level. According to some arguments inflation causes backwardness for societies and prevents economic growth, whilst others claim that it constitutes the root of that growth. In this context, owing to a lack of strong theoretical approaches on the relation of inflation and economic growth, it emerges as one of the significant economic issues which a large number of economists constitute econometric models and obtain empirical findings on. A large majority of studies that have been conducted on this subject found that inflation and economic growth have a negative relation, however it is indicated in alternative studies that inflation has a positive effect on economic growth. Moreover, some studies exist which found no relationship between them. Some studies indicate thereby a proportionate threshold value level is determined and until this level, inflation favorably effects the growth, however an inflation rate occurring over the threshold value has negative effects. As seen the difference of opinions exists towards the relationship between inflation and economic growth.

The results of studies that have been conducted about the relation between inflation and economic growth in Turkey are generally point towards a negative relation between them. Having said that, since the 1970s inflation had started to become a big problem in the Turkish economy and this problem was determined as the main objective indicator in all economic politics, which were imposed. Until the beginning of the 2000s, Turkey experienced a chronic and high rate inflation, while also at this period, occasional high growth figures occurred and these growth rates were claimed to originate from inflation (Turhan, 2007).

The main purpose of this dissertation is to contribute to the debate of inflation and economic growth by performing econometric analysis on the data from 1988 to 2014 in Turkey. The structure of this dissertation then, is as follows. Section 2 identifies various types of inflation and reasons for their existence. Their relative magnitudes and negative effects on the economy are explained and wide information is given about the concept of inflation. Section 3 defines the term of economic growth and related fundamental conceptions. Section 4 introduces the relations between inflation and economic growth in accordance with empirical literature. In Section 5, we examine inflation and the development of economic growth with specific reference to the Turkish economy during the period 1988-2014. Section 6 provides the methodology by which we examine the relationship between inflation and growth in the Turkish economy. Summary statistics and data analysis are also presented in this chapter. Section 7 outlines the empirical results of our analysis and Section 8 concludes.

2. Inflation

Even though the true scope of the concept of inflation is controversial in economic literature, it is generally related to the constant increases of price levels and losses in the value of domestic currencies (Frisch, 1983). Ambiguity in the bounds of the concept led to several definitions each of which addresses separate perspectives of the economic framework. Inflation is broadly termed as a monetary increment in the value of services and the price of goods (Romer, 2012). Such increments will happen either when the aggregate demand for goods and services is more than aggregate supply or when the real value of income does not meet the levels of designated income at existing price levels (Enc, 1993). This definition implies that any increment would be considered as inflation irrespective of the extent and the nature of the increase of price levels. Nevertheless, it is necessary to distinguish the concept of inflation from small and temporary changes in prices as the latter frequently takes place in relation to both economic and political reactions.

In order to circumscribe the extent of the increase at the price levels, a detailed definition of inflation is needed. According to Laidler and Parkin (1975, p.741), *“inflation is a process of continuously rising prices, or equivalently, of continuously falling value of money.”* The type of activities that cause the inflation whether the

relevant increase in price levels is high or small is irrelevant in determining the definition. The increase at the general level of price should be continuous and systematic. The increase can be high in a limited time period or very small in a longer run. As implicating systematic and continuous price behaviour, the increase is to be considered as inflation. A one-time increase at the general price level or a one-time increase in the price of any goods or services is not enough to be accepted as inflation. The following section describes common types of inflation, analysing their cause and potential effects.

2.1 Types of Inflation

There are several types of inflation that can be identified according to their reason of origin and magnitude. Inflation may be caused by several factors, which result in different price behaviours. Accordingly, there are three types of inflation that can be characterised by their cause:

- Demand-pull inflation,
- Cost-pull inflation,
- Imported inflation.

Demand-pull inflation occurs when aggregate demand of relevant goods or services is higher than the level of existing supply. The excessive demand results in supply shortages, which in turn drives the prices up. The increases in revenues bring about an increase in the total demand (Pass, Lowes and Davies, 1993). In this case, people may request more goods or they may be willing to pay higher prices for the goods they have requested. In addition, the rapid expansion of credit volume may increase inflationary pressures in the economy.

Cost-push inflation can take place when the increase in the costs at the production or upstream level such as increases in the prices of raw materials or energy costs leads to prices increases in final products or services (Pass, Lowes and Davies, 1993). Rises in profit rates at the wholesale or retail markets, increases in wages and exchange rates can be introduced as examples to illustrate the types of inflation caused by price increases in costs (Ulusoy, 2006).

Finally, the inflation is not necessarily caused by conditions and changes in the internal market but can also be imported through products or services that are supplied outside the national markets. International trade may lead to prices increases in internal markets. When prices are increased as a result of new products and services supplied through imports, this type of inflation taking place in the national markets is termed as imported inflation (Altinok, 2004).

Inflation can also be characterised by their magnitude, respective price behaviours in relation to the conditions and changes in domestic markets. Such classification involves three types of inflation:

- Creeping inflation,
- Walking inflation,
- Runaway inflation.

When the pace of relevant increases in the price of goods or services is slow, the inflation is considered as creeping inflation. Limits and the extent of the price increase is important to determine whether the inflation is creeping or not. Accordingly, an annual price increase no more than 2.5% of the price of the relevant product or service is considered as creeping inflation (Ammer and Ammer, 1977). According to Hansen (1941), creeping inflation is inescapable for economic growth and is a propulsive force to employment. The idea that creeping inflation has the positive impact on national markets and economic growth is also supported by scholar in the Chicago school who asserted that when prices show a steady movement as in the case of creeping inflation, the development of national economies will continue (Ammer and Ammer, 1977).

‘Walking inflation’ occurs when the annual rate of increase in prices stays between 3 and 1%. When the relevant price increases in products and services can be characterized as walking inflation, the situation in the market conditions can be considered as a threat to the well-being of the economy. Walking inflation illustrates imbalances in the markets and the price increases for products and services can be evolved into runaway inflation, which is not desirable from the economic perspective (Amadeo, 2015).

Runaway inflation is also termed as '*galloping*' inflation or '*hyperinflation*'. (Ammer and Ammer, 1977). Accordingly runaway inflation takes place when the rate of inflation is high and immeasurable. When this type of inflation is present, markets can be monitored in a way that people lose trust in the value of money and the currency is insignificant. While consumers try to buy more to avoid future higher prices, businesses begin to accumulate their products and wait for the right time to sell them at higher prices. As a result, runaway inflation reflects monetary collapse accompanied by political and social disorder (Ammer and Ammer, 1977). The economic conditions in China after World War II or in Germany after the outset of World War I can be considered as examples, in which the runaway inflation is present in national economies.

2.2 Effects of Inflation

At the forefront of negative effects caused by inflation is income distribution inequality. Civil servants and the working class are unable to act in accordance with changing prices as their fixed income is not flexible enough to meet the demands of a fragile market, whereas the self-employed can make adjustments to the price of goods and services they supply however they wish. If this situation results, fixed income employees such as civil servants and the working class become poorer while the rich become richer. Therefore, the greatest impact of inflation on distribution of income is on those people with fixed incomes (Turk, 1997).

The other economic variable which is affected by negative inflation, is investment. Individuals avoid saving due to high inflation. Moreover, the size of investment does not increase in the country as a result of high investment costs (Turhan, 2007).

In addition to this, due to monetary depreciation in an economy and economic uncertainties, economic agents shift their savings from long-term productive investments to short-term non-productive investments (Artan, 2006). In this sense, Frenkel and Mehrez (1996), examined the economies 28 countries covering the period between 1972 and 1995. In this study, they found that when the inflation rate raises from 20% to 40%, employment in the manufacturing sector decreases about 3% (Frenkel and Mehrez, 1996).

Domestic currency is affected negatively by inflation in countries with high inflation. In countries where there is inflation, while domestic currency often decreases in value, foreign currency increases in value. In this case, imports increase and foreign trade deficit arises which causes economic imbalance as imported goods are cheaper than domestically produced goods (Turk, 1997).

Inflation also has a negative impact on tax revenues. Some taxes lose value due to time differences in the assessment and collection process. Particularly, income taxes are paid during the year following their implementation. In the present case, especially in high inflation the real value of the collected tax is reduced. The public loss of revenue by the reason of this phenomenon is known as the Olivera-Tanzi effect (Paya, 2001).

3. Economic Growth

Defining the meaning of economic growth is also devoid of a common approach. In economic literature, there are a variety of definitions, each of which tackles different perspectives of economic conditions in national markets. According to Gould (1972), economic growth can be identified as increases in real output per capita. Lipsey and Chrystal (2007), give a more detailed definition providing that economic growth is the most important parameter that indicates welfare of society and living standards of people within a defined market. Accordingly, the economic growth analysis involves both the existing market conditions and potential economic growth that the relevant economy can generate. While the concept of “*actual*” gross domestic product (GDP) assesses the existing levels of production generated by the relevant economies, “*potential*” GDP evaluates what the production levels could be, when all means of production available are generated and employed (Lipsey and Chrystal, 2007).

Another definition provides that, economic growth can be identified through two different ways. On the one hand, it can be referred to as a result derived from short term increases and cyclical fluctuation in domestic production, which are aimed at reducing the levels of unemployment. On the other hand, the economic growth can also take place when the existing capacity of production and technology are increased, whilst the levels of employment remain stable, which overall results in long term growth in the domestic economies (Turkish Economic Association, 2003).

As it is hard to refer a common approach with respect to the definition of economic growth, the criterion, according to which the economic growth is evaluated, is also diverse. The increments in production, changes in the inflation rate, population surplus or increases in social spending can be considered as indicators of economic growth. Even though these criteria do not constitute an exhaustive list of factors, gross national product (GNP) and GDP are of great significance for the evaluation of economic growth, since they directly refer to the extent of income and output available in national markets. As the former addresses the entire monetary value of the goods and services produced and provided annually by the nationals or legal entities incorporated within the boundaries of a country, the latter indicates the total monetary value of the output generated within the country in a given period of time irrespective of the identity and nationality of producers of goods or suppliers of services (Acar, 2002).

4. The Relationship between Inflation and Economic Growth

The relationship between inflation and economic growth can be both positive and negative as has been widely reported in previous literature. Sarel (1995) stated that low inflation values have positive effects on economic growth based on empirical studies conducted before 1970. Increases in inflation after 1970 however, are thought to correlate to negative growth. Recent studies include nonlinear and structural fluctuation concepts in order to show a clear correlation between these two economic factors. To the first approximation, these studies point to a distinct feature of positive or negative growth with respect to a threshold inflation value. Although the results may vary, the threshold value was shown to be an effective research approach in understanding inflation effects on economic growth (Sweidan, 2004).

The following section discusses the relationship between inflation and economic growth in detail, examining the results of relevant literature. First, we look at those studies which conclude a positive relationship, before examining those studies which conclude the relationship to be negative. As part of this analysis, we also examine literature which attempts to determine the threshold value of inflation at which the relationship changes, before investigating the same criteria, with specific reference to the Turkish economy.

4.1 Research Concluding Inflation Positively Affects Economic Growth

Thirlwall and Barton (1971) analysed a cross-sectional dataset of 51 countries between 1958 and 1967 but found no relationship between inflation and economic growth. Following this, they repeated analysis on 17 high level welfare countries, finding a significant and positive relationship in statistical terms.

Lucas (1973) built an Ordinary Least Squares (OLS) model to analyse data from 18 countries between 1951 and 1967, proving a positive correlation between inflation and economic growth with the exception of countries like Argentina where the prices are unstable and thus this type of a relationship is rare.

Feldstein (1996) performed econometric analysis of US data between 1970 and 1994, he stating that continued proportions of inflation at low levels have positive influences on economic growth.

Romer (1996) conducted econometric analysis of US data between 1884 and 1994 (except 1942-1951). Consequently, he stated that inflation and economic growth have a positive correlation and a 0.10% increase in inflation caused 1% raise in economic growth, finding these results at the 95% significance level.

As a result of time-series analysis of data from 1960 to 1999 in South Africa, Nell (2000) claimed that inflation can have favourable effects on economic growth in the territories which have single digit inflation.

Following cross-sectional analysis of the period between 1963 and 1989¹ Black, Dowd and Keith (2001) reached the conclusion that there is a positive relation between inflation and economic growth in the periods of moderate inflation. Wallich (1969), found after analysing cross-section and time-series data in 43 countries that inflation and economic growth have a positive relation.

Mallik and Chowdhury (2001) report positive correlations between inflation values and economic growth for Bangladesh in 1974 - 1997, India in 1961 - 1997, Pakistan 1957 - 1997, and Sri-Lanka in 1966 - 1997 periods. Deviations in the inflation are shown to be more responsive on economic growth compared to the responsiveness of

¹ They also use different time period, between 1983 and 1994, for a robustness test.

the deviations in the growth of inflation, based on the equal conditioned and error corrected annual results. Accordingly, mild inflations are reported to have positive effects on economic growth while rapid growth may increase inflation.

Heylen, Pozzi and Vandewege (2004) studied the effect of inflation on human capital and economic growth in 86 countries in the period 1975-2000. According to the research, the authors stated that economic crises have affirmative effects on human capital, so an increase in human capital results in the increase of economic growth. Additionally, they pointed out that a 25-40% inflation level would have positive effects on human capital as well as economic growth.

4.2 Research Concluding Inflation Negatively Affects Economic Growth

There are numerous of studies which find negative correlations when analysing the relationship between rates of inflation and economic growth. The following section details these studies, which use varying data sets taken from different economies and time periods, additionally using varying methods of economic and econometric analysis to conclude similar results.

Fry (1981) analysed the data of developing countries, which are located in the Pacific Basin, including Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand by using OLS methods and separating the data into two periods. The time period of the entire data was between 1962 and 1981, separated as 1962-1971 and 1972-1981. According to the results obtained, there is a negative correlation between inflation rates and real growth rate in the long term for the selected countries.

Edwards (1983) found that, covering the 1954-1974 periods, results of OLS method analysis for five Latin American countries (Brazil, Chile, Colombia, Mexico and Peru), indicated that there is a negative correlation between the inflation rates and real growth rate in Brazil and Chile.

Kormendi and Meguire (1985) concluded that there is a negative correlation between the inflation rates and real growth rate based on their cross section analysis sourced by 47 countries' annual data.

Jung and Marshall (1986) discovered that inflation affects economic growth negatively for selected periods in Australia, Austria, Canada, Germany, Sweden,

Switzerland, United Kingdom (1951-1980), Italy (1960-1981), Spain (1954-1979), Kenya (1966-1980), Greece (1953-1980), Turkey (1953-1978), Israel (1950-1978), Brazil (1963-1980), Jamaica (1960-1981) and Peru (1963-1981) based on annual data and Granger causality test method.

Barro (1995) illustrated that the inflation rate has considerably negative impacts on economic growth and investments based on the data from period of 1960-1990 in 103 countries. According to this study; it is indicated that a 10% annual rate of inflation causes a fall in GDP per capita by a range of 0.2-0.3%. However, he stated that the inflation variable coefficient was negative but statistically significant for countries which have an inflation rate above 20% and statistically insignificant for inflation rates below 10%.

Gomme (1991) found that, covering the 1949-1989 periods in 82 countries, the results of correlation analysis indicate that there is a negative correlation between the inflation rate and economic growth rate in 62 countries.

Fischer (1993) indicated that there is a statistically significant and negative correlation between growth and inflation rates based on cross-sectional and time series analysis of 93 countries' annual data. Based on this study, a 10% rise in inflation rates causes a 0.4% reduction in the economic growth rate.

Motley's (1998) study, based on cross section analysis method in 78 developed or developing countries, showed that 5% reduction in the annual rate of inflation causes a rise in the economic growth by a range of 0.1-0.5%.

Chari, Jones and Manuelli (1996) founded that there is a negative correlation between the long-term inflation rates and long-term growth rates based on annual data of United States for the periods of 1960-1987. Based on this study, a 10% rise in inflation rates causes a 0.4% reduction in economic growth rate.

De Gregorio's (1996) study, which is based on cross section analysis of 84 developed and developing countries for the period 1960-1985, showed that the inflation rate affects the economic growth rate negatively in Organization for Economic Cooperation and Development (OECD) countries. However, De Gregorio indicates that estimated results differ when changing the economic model analysed.

Specifically, De Gregorio first estimated a holistic model including all countries, but found different results when excluding, Argentina, Bolivia and Peru. According to this case, a one unit increment in inflation rate causes a 0.0036 unit reduction in economic growth. Also, for the first case, including all countries, a one unit increment in inflation rate causes a 0.0047 unit reduction in economic growth.

Alexander (1997) concluded that inflation affects the growth negatively for the period of 1974-1991 in 20 OECD countries. The study was based on cross-sectional and pooled time series analyses with annual data.

Andres and Hermando's (1997) study, which is based on cross section analysis and causality tests in OECD countries for the period of 1960-1985, showed that there is a negative correlation between the inflation rate and economic growth. According to this study, 5% reduction in inflation causes raise in economic growth by range of 0.5-2%. In addition, the study demonstrated that inflation affects investments and the efficiency of the productive resources negatively. However, according to the causality test results, a unidirectional causality from economic growth to inflation was found.

Clark (1997) divided OECD countries into two groups in his study, which is based on cross-sectional analysis with annual data of 85 developed and developing countries for the period of 1960-1985. He defined that inflation has a statistically insignificant and negative impact on economic growth in OECD1 countries in which Iceland and Luxembourg are included. However, when these two countries are excluded, the related relation is explained as; negative but statistically significant. Besides, it was found that the results that are obtained for the period of 1960-1985 and 1968-1985 differ in OECD1 countries. Clark also indicates that results of the second period lose their meaning. Lastly, the study suggested that there is a negative and statistically insignificant relation between inflation and economic growth in OECD1 countries for the period of 1950-1970 and statistically significant for 1960-1985.

Dotsey and Sarte (1997) found that there is a negative correlation between inflation and economic growth in the long-term based on cross-sectional analysis. Additionally they found, there is a negative correlation between economic growth

and a 10% inflation rate in developed countries and 60% for less developed countries.

Ghosh (1997) studied the level and necessity of inflation in transition economies. The study indicated that there is no specific relation between economic growth and inflation in countries that have less than 10% inflation. However, there is a specific and negative correlation in countries which have more than 10% inflation.

Paul, Kearney and Chowdhury (1997) studied causality between 70 countries' annual inflation rates and economic growth by using Granger causality tests for the period of 1960-1989. According to this study, 26 countries have unidirectional causality from inflation to economic growth, 16 countries have bidirectional causality and the rest have no causal relation. One important point is that those countries, which do not have any causal relation, are mostly developed countries.

Gylfason (1999) concluded that high inflation rates have a negative impact on economic growth rates based on their cross sectional analysis sourced by 160 countries' annual data the period of 1985-1994.

Gillman, Kejak and Valentinyi (1999) found that there is a systematic, meaningful aspect of statistical and nonlinear relations between the inflation rate and economic growth based on the data from period of 1951-1997 in 24 OECD countries.

Andres et al. (1999) studied the effects of inflation on the financial development and growth based on time series and cross sectional data of 21 OECD countries for the period of 1961-1993. According to the results of the research, while there is a negative relationship between inflation and economic growth, there is a positive relationship between financial development and economic growth.

Ericsson, Irons and Tryon (2000) analysed as specified in the G-7 (Canada, France, Germany, Britain, Italy, Japan and the United States) countries' data between 1960 and 1989. As a result of econometric analysis, for these countries there is a negative correlation between inflation and growth rate in the short-term and there is no correlation in the long-term.

Gylfason and Herbertsson (2001) examined a panel data methodology of 170 countries' data for the period of 1960-1992 utilizing data of the World Bank. According to the results of this analysis, they found that there is a strong and statistically significant relationship between inflation and growth rates. In addition, when the inflation rate increase from 5% to 50%, the economic growth rate decreases 0.6% based on World Bank data.

Between 1961 and 1997, as a result of analysing panel data of 29 OECD countries and 19 Asia Pacific Economic Cooperation (APEC) countries a negative relation was found between inflation and economic growth (Gillman, Harris and Matyas, 2001).

Caporin and Di Maria (2002) studied 171 countries affiliated to International Monetary Fund (IMF) countries and 227 countries affiliated to World Bank countries. There is a negative and nonlinear relationship between inflation and economic growth in mentioned countries for period of 1979-1997.

Valdovinos (2003) examined the yearly data of Brazil, Bolivia, Chile, Colombia, Costa Rica, Mexico, Paraguay and Peru for period of 1970-2000. He stated that there is a negative relationship between inflation and economic growth in the long-term by using a filter method.

Arai, Kinnwall and Thoursie (2004) indicated that there is a negative effect of inflation on economic growth due to the shock in oil price based on panel data analysis 115 countries' data within the periods for 1960-1995.

Burdekin et al. (2004) examined the effects of inflation on economic growth based on time-series analysis sourced by 21 developed and 51 developing countries within the period 1965-1992. According to this study, there is a nonlinear relation between inflation and economic growth. Also it has been found that when the inflation rate begins to rise, economic growth is affected negatively.

Gillman and Nakov (2004) examined the relationship between inflation and economic growth in Poland and Hungary with quarterly data using Vector Auto Regression (VAR) and Granger causality analysis. According to results, it can be understood that inflation negatively affects economic growth.

Shamim and Mortaza (2005) studied the relationship between inflation and economic growth for Bangladesh within the period 1980-2005. As a result of their study using cointegration and error correction models, it was determined to be statistically significant and that there is a negative relationship between inflation and economic growth in the long-term.

Artan's (2006) study, which is based on cross-sectional and panel data analyses in 23 developed countries and 40 developing countries for period of 1977-2001, showed that the inflation rate affects economic growth negatively in the long term. As a result of this study, it is indicated that the negative effect of inflation on growth is higher in developing countries compared to developed countries.

Caglayan and Jiang (2006) analysed British data between February 1957 and May 2005 based on Granger causality tests. As a result of this analysis, they found out that there is a negative and statistically insignificant relationship between inflation uncertainty and economic growth.

4.3 The Relationship between Inflation and Growth within the Framework of Threshold Value

Scott and McKean (1964) examined the relationship between inflation and economic growth by using OLS analysis of 13 developed countries between 1949 and 1959. They have found that when the inflation rate goes beyond 2%, economic growth is affected negatively.

Using data of 17 developed countries covering 1958-1967, Thirlwall and Barton (1971) studied yearly data with cross-sectional analysis. They determined that in 17 developed countries where the inflation rate is below 8%, inflation affects economic growth negatively. However, in 7 developing countries, 10% inflation affects economic growth positively.

Levine and Zervos (1993) found that there is no connection between inflation and growth rates when the inflation rate is over 80% by using yearly data of 102 countries between 1960 and 1989. On the contrary, when the inflation threshold value is 40%, there is a negative relationship between inflation and growth rates. In addition, an agreed position is that the inflation threshold value is 80% and when the inflation decreases from 10% to 5%, the economic growth rate increases by 2%. For

example, Italy has a 30 year inflation average of more than 10%. However, while the inflation threshold value is 40%, there is no connection in this way.

Sarel (1995) has investigated 87 countries' economy with panel data analysis using yearly data covering 1970-1990. The analysis indicates that when the inflation is under 8%, there is no negative impact of inflation on the growth rate. Moreover, he asserted that it actually influences economic growth in a slightly positive manner. On the contrary, when inflation is over 8%, it affects economic growth negatively.

Using the data of the US covering 1955-1990 with an OLS method and simulation methods Bange et al. (1997) found that each unit increase above the inflation rate of 4%, causes a decrease of the ratio below the natural level of 3.1% of economic growth.

Ghosh (1997) examined 17 transition economies using yearly data covering 1990-1996 with the OLS method. He stated that when inflation is above 10%, it has a negative impact on economic growth.

Haslag (1997) found that the threshold point of 10% is what inflations effect on economic growth in 82 countries encompassing the period between 1965 and 1990 is.

Bruno and Easterly (1998) defined a 40% annual inflation rate as a crisis situation in their study which was conducted to exhibit the signifiers of economic growth by using a non-linear approach. As a result of this definition, in their study using the data between 1961 and 1994, they determined that in an economic crisis the growth decreases 2.4% and after the crisis the growth increases to 3.3% therefore showing a 0.9% increase. They used 31 countries' data for this study.

Ghosh and Philips (1998) showed that inflation and economic growth have a negative correlation. They used panel data from 140 countries between 1960 and 1996. Through this study they argued that there is not only statistical negative correlation between growth and inflation but also that inflation is one of the primary determinants of economic growth. In this study under the presence of 2-3% or less inflation, the relationship is considered to be positive and under a rate of inflation greater than 3%, the relationship is determined to be negative, albeit concave.

Moreover, in the study 2.5% is calculated as a threshold and any relations between inflation and growth is determined to be negative above this rate.

Judson and Orphanides (1999) analysed 142 developed and developing countries using yearly data with panel data analysis. Their study indicates that when the inflation rate is over 10%, inflation has an unfavourable effect on the growth rate.

Burdekin et al. (2004) examined 21 developed countries and 51 developing countries using yearly data between 1967 and 1992. In this study they reached the level of a break point: 3% for developing countries and 8% for developed countries and determined that this rate is the starting point for a negative connection between inflation and economic growth.

By selecting different periods in the 1964-1989 period, Black, Dowd and Keith (2001) investigated 48 US states using yearly data with panel data analysis. In this study, it is indicated that there is a positive relationship between inflation and economic growth during the 1980's and that inflation is showing a decreasing trend. On the contrary, when the inflation is in an increasing trend like in the 1960's and 1970's, there is a negative relationship between inflation and economic growth.

Dungey and Pitchford (2001) examined the US, Canadian and Australian economies with time series analysis using data between 1960 and 2000. They found that inflation rates are 3% in the United States and Canada for growth and for Australia it is 4%. In another study they found that as a result of the data analysis in Australia, an annual inflation rate of 4% is the required threshold for economic growth.

Using the yearly data of 136 developed and developing countries covering 1960-1994 with cross sectional analysis Engelbrecht and Langley (2001) identified that 40% and 8% two different threshold.

Heylen, Dobbelaere and Schollaert (2001) analysed 89 countries' economies with OLS analysis using data between 1970 and 2000. They determined that the increasing of the inflation rate affects capital and economic growth positively.

IMF economists Khan and Senhadji (2001) used linear and nonlinear OLS methods to test data between 1960 and 1998. They found the threshold level of inflation to be

approximately between 1-3% for developed countries and 11-12% for developing countries.

Using yearly data of 97 developed and developing countries with panel data analysis covering 1979-1997 Caporin and Di Maria (2002), found that in countries where inflation is below 10%, a one unit increase in the inflation rate reduces economic growth by 12%. Conversely in countries where inflation is between 10-30%, a one unit increment in inflation rate reduces economic growth by 5%. Nonetheless, in this study through using additional variables it was found that there is a negative correlation between inflation and economic growth.

As a result of econometric analysis of 84 countries' between 1960 and 1995, Rousseau and Wachtel (2002) determined that 6-8% walking inflation has a positive effect on the growth rate.

Yilmaz, Akcay and Alper (2003) studied Turkey and 28 other developing countries using yearly data covering 1970-2000. They concluded that there is a nonlinear relationship between inflation and economic growth. According to their results, when the threshold level of inflation is over 13%, the increase in the rate of inflation adversely affects economic growth.

According to results, using time series analysis covering 1970-2003, Gokal and Hanif (2004) determined that an inflation rate over 5% in Fiji has a negative impact on economic growth.

Sepehri and Moshiri (2004) examined a total of 96 countries including 24 OECD countries, 14 upper-middle income countries, 26 lower-middle income countries and 28 low income countries using data covering 1960-1996. They found different thresholds that are 15% for lower-middle-income countries, 11% for low-income countries and 5% for upper-middle countries. In this study, panel data analyses were used with yearly data.

Sweidan (2004) also tried to estimate the threshold level of inflation for Jordan. He found a 2% threshold level of inflation and indicated that there is a significant relationship between inflation and growth.

Using the yearly data of Bangladesh covering 1980-2005 Shamim and Mortaza (2005) found that there is a negative relationship between inflation and economic growth in the long term. They used cointegration and error correction methods and the inflation threshold level was calculated by structural break testing. According to results, when inflation is over 6%, inflation adversely affects economic growth.

The estimated value of the threshold has been determined as 19.16% for 138 developed and developing countries covering between 1950 and 2000 (Drukker, Porqueras and Verme, 2005). Their results indicate that there are two different threshold levels at 2.57% and 12.61% for developed countries. When the inflation rate is under 19.16%, an increment in inflation does not have a statistical impact on growth. On the contrary, if the inflation rate is over 19.16%, more increments in inflation will decrease long run growth.

Lee and Wong (2005) investigated the threshold point where the inflation rate affects economic growth and financial development under different inflation regimes in Japan and Taiwan. The threshold point in Taiwan between 1965 and 2001 is found out to be 7.25% whereas for Japan the threshold points between 1970 and 2001 have been found out to be 9.66%.

Mubarik (2005) studied to estimate the structural break point of inflation for Pakistan with Granger causality method using data covering 1973-2000. According to analysis' results, he detected a threshold point of inflation, which is 9% but there is no significant relationship under the threshold point. He also indicates a one-way direction connection from inflation to growth by Granger causality methods.

Pollin and Zhu (2005) studied a total of 80 countries including high, middle and low income countries as well as 21 OECD countries using data covering 1960-2000. They identified that the level of the break point is between 15.2-18.6%. Using yearly panel data analysis, when inflation is under the level of the break point, a rise in inflation by 1% results with an economic growth of 0.10-0.15%. However, if the inflation is above the threshold value, inflation has a restrictive impact on economic growth.

As a result of OLS analysis of South Africa, covering 1950-2002 and 1970-2003

Hodge (2006) determined that the threshold point is between 3% and 6% that is the effect on economic growth.

Li (2006) investigated the data of 90 developing countries and 28 developed countries between 1961 and 2004. As a result, when the relationship between inflation and economic growth is nonlinear, there are two threshold points that are establishing the relationship between inflation and economic growth for developing countries. The first one is 14% in a year and the second one is 38% in a year. According to this, when the inflation remains below the first threshold, inflation affects economic growth positively. If inflation remains between the first and the second threshold, it negatively affects economic growth. The threshold level has been found to be 24% for developed countries. As long as the inflation remains below this point, it has been concluded that economic growth has been negatively affected.

Using with the data of 160 countries covered with linear estimate methods Vaona and Schiavo (2007) calculated the level of threshold values for developed and developing countries. According to this study, they have alleged that when the threshold point is over 10% for developed countries and 15% for developing countries, inflation has a negative effect on economic growth. In spite of that, when the threshold point is under these values, inflation has no considerable effect on economic growth.

4.4 The Relationship between Inflation and Growth in Turkey

Although there have been many studies which have examined the relationship between levels of inflation and economic growth in Turkey, the results are far from conclusive. Authors have examined varying data sets over different frequencies and time periods, and used differing methods of economic and econometric analysis in attempts to determine the exact relationship between inflation and growth. In this section, we review the previous literature, providing short analysis of results, to summarise the findings of this research directly relating to the Turkish economy.

Koray (1993) has claimed that the inconstancy of inflation has negative effects on economic growth according to the results of vector autoregression analysis which was carried out based on monthly data for the period of 1981:3-1989:12.

As a result of analysing data from 1968-1994 in terms of an econometric model, Asirim (1995) has asserted that when the inflation rate increases, it has negative effects on the economic growth in Turkey.

Based on the method of cross sectional and time series analyses between 1982 and 1998, Kalkan (1999) clarified that when inflation is decreased for a long term, it contributes to the economic growth.

Kirmanoglu (2001) has found that threshold value at which the effects of inflation on economic growth become negative is 13% that the effects of inflation on economic growth based on the econometric analysis data between the years of 1964-2002.

Karaca (2003) found that there is a negative causal relationship between inflation and economic growth and that a 1% increase in inflation causes a 0.37% decrease in economic growth based on the time series analysis of monthly data between the years of 1987-2002.

Berber and Artan (2004) examined data between 1987 and 2003 using Granger causality analysis, finding that there is an inverse relationship between the inflation and the economic growth. They have claimed that 10% inflation causes a 1.9% decrease in economic growth.

Terzi (2004) used data between 1924-2002 to analyse causality of the relationship between economic growth and inflation with Granger causality analysis. As a result of this analysis, he found that there is a negative relationship moving from inflation to growth.

Cetin (2004) analysed data between 1985:01 and 2003:11 in terms of causality. Based on the results, it was shown that a high inflation rate has negative effects on the economic growth.

Keskek and Ozhan (2004) carried out econometric analysis of data between 1950 and 2002. According to that analysis, it was found that the increase in inflation affects the economic growth negatively and a 10% rise in inflation rate is resulted with a drop at the rate between 1.6% and 2.3 % in economic growth.

Terzi and Oltulular (2004) made sectoral analysis of inflation and economic growth using econometric methods between 1923 and 2003 finding that there is a negative causal relationship between inflation and economic growth.

Artan (2006) examined the relationship between inflation, inflation uncertainty and economic growth in the period 1987:1 and 2003:3. As a result of econometric analysis, it was found that the negative effects of inflation uncertainty are higher than those of inflation on economic growth. According to that information, it was claimed that while a 1% increase in the inflation uncertainty produces a 3.95% decrease in economic growth, a 1% rise in inflation leads to a 0.56% decline in economic growth.

Kaya and Yilmaz (2006) analysed the relationship between inflation and economic growth regionally. They made the analysis of data from seven regions of Turkey between 1983 and 2001 in terms of panel data, cointegration and causality tests. According to their results, inflation had a negative effect on economic growth in all regions except for Marmara region. Moreover, it was asserted that there was a negative and statistically significant relationship between inflation and economic growth.

Yapraklı (2007) clarified that economic growth is effected negatively because of inflation in the long term period and there is one-way causal relationship from inflation through economic growth according to results of Granger causality tests based on the error correction model (ECM) in her study. This was carried out based on quarterly data between 1987:1 and 2007:1.

Turhan (2007) analysed the relationship between inflation and economic growth using quarterly data from the Turkish economy between the period of 1988:1 and 2005:4 based on Granger causality analysis. He found a one-way negative relationship between the rates of inflation and growth.

Uysal, Mucuk and Alptekin (2008) showed that there is no relationship between variables in the long-term period in the study, by using vector autoregression (VAR) analysis and cointegration method based on annual data from 1950-2006. In addition, they claimed that there is a causal relationship from inflation through economic

growth.

Taban (2008) examined the term of 1970-2006 using the unit root test, cointegration test and bounds test and showed that inflation has significantly negative effects on the economic growth for both short and long term data.

Erbaykal and Okuyan (2008) found that there is a significant causal relationship between inflation and economic growth in the short term but not long term in their study which utilised quarterly data between 1987:1 and 2006:2 based on cointegration tests, bounds tests and the Toda Yamamoto causality test. Moreover, they concluded that there is one-way causal relationship from inflation through the economic growth.

Karacor, Seylan and Ucler (2009) analysed quarterly data between 1990 and 2005 based on cointegration and causality analysis and found that inflation is a variable which has a negative impact on the economic growth in their study.

Telatar and Abiyev (2010) concluded that there was an inverse relationship between inflation and economic growth in the term of 1987 and 2006, additionally that relationship became strong in 2001.

5. Historical Evolution of the Relationship between Inflation and Economic Growth in Turkey

The following section details the historical evolution of the relationship between inflation and economic growth in Turkey from 1980 to the present day. This follows the wave of new economic measures introduced by the Government of Turkey on 24th January 1980, aimed at improving the state of the Turkish Economy.

5.1 Between 1980-1993

In the 1980's, the Turkish economy was plagued with inflation, debt crisis, lack of production and an inability to deliver sustainable growth. These conditions were the result of an inability to counter the effects of an oil price shock in the previous decade and the constraints imposed by the use of a fixed exchange rate mechanism (Emsen, Turan and Aksu, 2012).

In the second half of the 1970's the Turkish Lira (TL) became overpriced and, coupled with increases in real wages this led to a deficit in financial transactions and the need for increasing financial lending. Since this need could not be met, reserves and the exports decreased (Yukseler, 2004).

On 24th January 1980, the Turkish government proposes new bills for the following reasons: High inflation was causing stress to the economic system, insufficient exports put a strain on public finances and lack of savings caused a reduction in investment. In addition, issues were raised by a problem of foreign debt, lack of resources including oil and other fuels, and the failure of government policy to introduce a strategy to tackle a lack of import products. Finally, the insufficiency and inefficiency of the private sector put strain on public sector operations, as the government attempted to manage the Turkish economy (Sarac, 2009).

The foundation of the 24th of January stability policy was to reduce the foreign deficit and encourage foreign investment, to encourage the private sector in exports and production, to control inflation, to increase economic growth by maximizing capacity and adjusting the interest rates (Kepenek and Yenturk, 1994).

Following the announcement of these policies, the TL devaluated 49% percent against the US Dollar with the Dollar exchange rate changing from 47 to 70 TL, giving exporters special privileges. Also, the Turkish economy was liberalized and set on course with the market conditions; price controls were ended (Turhan, 2007).

These decisions created a great change in the Turkish economy, notably being the catalyst for the free market economy. The government's role in the economy decreased and private sector involvement was encouraged, import substitution industrialization was replaced by a free foreign trade. This should be considered as a milestone in Turkish economy (Akguc, 1991).

The lack of foreign currency can be seen as the reason of imbalance of all the stability policies prior to 1980. A change in foreign rates alone cannot sufficiently help exports. As a result the new policy measures should be defined as opening Turkey up to foreign currency, encouraging exports, decreasing tariffs and stopping any restrictions on foreign currency (Turhan, 2007).

As mentioned, after 1980, inflation in Turkey increased. The reasons for this included the attempts to reduce the financial deficit by printing money and the inability to implement austerity due to political concerns (Parasiz, 2001).

5.2 Between 1994-2001

In 1993, the future for the Turkish economy seemed bleak as a result of fluctuation of the exchange rates, imbalances in financial markets and high inflation. Liquidity increased in 1994 as the Central Bank covered the deficit of the public sector and inside debt was not allowed. To stop this increasing liquidity to pressure prices, foreign currency was sold and since the interest rates did not act according to the market, the exchange rate was over pressured and banks started to produce a big deficit deteriorating the reserves of the Central Bank of Turkey (Peker, 2004).

As a result of all this negativity, a new stability policy was implemented on 5th of April 1994. This policy aimed to stabilize the financial market, to stop the increasing of prices, to provide a balance for the public sector, to privatize the Government Business Enterprises (GBE) and to decrease the gap of payments and budget deficit. Through these aims, the Turkish government sought to create a long-term sustainable economic climate (Taban, 2008).

The flexible exchange rate regime was adopted as part of the implementation of the new stability policy. Due to this new regime, the over-valued TL had started losing its value against the USD and the value of one USD soared to equal 32,000 TL [Table 1]. Since the new regime brought many disadvantages, the Turkish government imposed new rules to increase the value of TL including raising the price of goods which were produced by GBE, and the cessation of payment of wages and fees in order to decrease the purchasing power of citizens (thereby decreasing consumer spending). This serious shrink in demand affected all sectors. For example, the utilization ratio dropped by 18% in the manufacturing sector and recorded as 64% for that year. As a result, the Turkish economy was seriously weakened, and entered into a serious recession (Sahin, 1995).

Table 1: Value of the US Dollar in April 1994

Date	Value of US Dollar (TL)
01/04/1994	22,335
04/04/1994	22,662
05/04/1994	23,078
06/04/1994	32,053
07/04/1994	39,933
08/04/1994	36,945
11/04/1994	33,628
12/04/1994	33,723
13/04/1994	35,290
14/04/1994	35,528
15/04/1994	36,242
18/04/1994	35,181
19/04/1994	32,469
20/04/1994	31,652
21/04/1994	30,813
22/04/1994	29,703
25/04/1994	30,720
26/04/1994	33,993
27/04/1994	34,713
28/04/1994	32,542
29/04/1994	33,475

Source: Central Bank of Turkey, 2015a

In November of 2000 a new medium ranged program was undertaken as it was determined that the previous policy implementations were not being managed effectively. Reforms to the banking sector were insufficient, the changing coalition governments were causing instability, public debts caused a push on the government's budget and economic indicators still looked very unpromising. Following numerous failures in previous programs with the IMF, negative expectation for the new policy implementations was significantly high. The proposed economic program was unsuccessful in countries which had the same development level as Turkey such as Brazil, Thailand and Argentina. Capital went outside of Turkey, a rise in the number of bankruptcies in the banking sector occurred, rapid increase in the current account deficit began which was with external debt rather than foreign investment (Uygur, 2001).

As expected, the program did not produce positive results because banks which were taken over by Saving Deposit Insurance Fund (SDIF) have become smaller, interests rates increased dramatically, exchange rates increased, inflation targets were not reached and the expectations of devaluation could not be prevented. As a result, the stable exchange rate was replaced by the floating rate regime (Dogruel and Dogruel, 2005).

5.3 Between 2002-2014

On 14th of April 2001 the program to change into a powerful economy was undertaken as a result of the crisis of 2001 and as an alternative to the program devised in 2000. This new program of policy measures sought to increase confidence particularly due to a change in exchange rate policies and to stop their instability therefore allowing other reforms to take place in the public sector (Central Bank of Turkey, 2015b)

With the start of the program there was a significant change in monetary policy and the interest rate was used to control to inflation rate and vice versa along with a hidden inflation goal. The markets adapted to the floating rate regime in time and inflation goals were reached, trust developed to the market and the fears were gone. (Sarac, 2009).

The Turkish economy decreased in 2001 by 5.7% but then experienced a huge increase until 2008. Turkey has become an attractive market around the world due to high real interest rates during the period of expanding liquidity in the world economy. This attraction brought a good opportunity and the impact of the economic crisis in 2001 was eliminated in 2002 and the economy recovered with 6.2% growth rate. The highest growth rate was recorded in 2004 between the period of 2002 and 2007. In 2005, 2006 and 2007 the growth rate was recorded as 8.4%, 6.9% and 4.7%, respectively [Table 2]. As a result of the policies implemented after the crisis of 2001, the Turkish economy started to grow and had an average growth rate of 7% between 2002 and 2007. However, the global economic crisis of 2008, which started in the USA, affected Turkey as well and as a result in 2008 the growth rate was only 0.7%. In 2009, the effects of the crisis were felt the most as the Turkish economy decreased 4.8% (Taban, 2011).

Table 2: Expenditure on GDP (at 1998 prices)

Years	GDP Growth Rate (%)
1999	-3.37
2000	6.77
2001	-5.70
2002	6.16
2003	5.27
2004	9.36
2005	8.40
2006	6.89
2007	4.67
2008	0.66
2009	-4.83
2010	9.16
2011	8.77
2012	2.13
2013	4.19
2014	2.91

Source: Turkstat.gov.tr, 2015

With the policies implemented after the crisis, there was a relative stability which caused the growth of 2010 and 2011. In 2011, the Turkish economy became the second largest growing economy in the world with an 8.5% growth rate just slower than China with 9.2% (Karagol, 2013). Economic growth for 2012,2013 and 2014 was 2.1%, 4.2% and 2.9% respectively [Table 2].

According to OECD projections Turkey will be the fastest growing OECD country with a 6.7% growth between the period of 2011 and 2017. Also, the report prepared in 2012 by OECD, stated that Turkey had a good economic performance except during the global crisis' worst years 2008 and 2009, in ten years. It was pointed out that with a 2.9% growth rate Turkey would be the country with the biggest growth rate (Padoan, 2010).

Adoption of the floating exchange rate regime, the independence of the central bank and protection of financial discipline helped to stop the increase of inflation in 2001. With the crisis of 2001, hidden inflation aims were chosen as the target for policy measures, instead of the foreign exchange rate (Bastug, Ocakverdi and Varol, 2004).

Inflation decreased from nearly 30% in 2002 to single digit figures in 2004 whereas in 2005 it was 7.7%, 9.7% in 2006 and 8.4% in 2007 [Table 3].

In 2008 the global economic crisis had a negative impact on inflation. The inflation rate, which was 10.1% at that time, dropped back to single digits in 2009 and 2010; for instance inflation rate recorded as 6.4% in 2010. Due to supply shocks in gold and oil prices, inflation had increased to 10.45% in 2011; however, a year later the lowest inflation rate in the last decade was observed, at 6.16%. Afterwards, the inflation rate has begun to increase again and recorded as 7.4% and 8.4% in 2013 and 2014, respectively [Table 3].

Table 3: Inflation Targets

Years	Target	Realization
2002	35	29,7
2003	20	18,4
2004	12	9,3
2005	8	7,7
2006	5	9,7
2007	4	8,4
2008	4	10,1
2009	7,5	6,5
2010	6,5	6,4
2011	5,5	10,4
2012	5	6,2
2013	5	7,4
2014	5	8,2

Source: Central Bank of Turkey, 2015c

6. Methodology

6.1 Data Description

The following section details the econometric methodology used in this research to examine the relationship between inflation levels and growth rates in Turkey, as described previously. Descriptive statistics are provided as part of an introduction to the data set used and the methodology is described in relation to the current question posed.

The Federal Reserve Bank of St Louis (FRED) is used as the source for quarterly Consumer Price Index (CPI) and GDP between 1988:1 and 2014:4. FRED is a widely used database which is incorporated with the OECD (2010) Main Economic Indicators database. There are some other variables, such as Producer Price Index (PPI) and a GDP Deflator which have been used in previous literature instead of CPI (Turhan, 2007). CPI and GDP are shown as the percentage change of the previous period. One of the main concerns when using quarterly data is that of seasonality. This issue is already taken away for GDP by FRED database, but the necessary seasonality arrangement for CPI has been completed using moving average methodology tool in E-views software program.

6.2 Descriptive Statistics

Table 4 presents the summary statistics of the variables, GDP and CPI. It gives a brief overview about the data set. Mean, standard deviation, min, max, skewness and kurtosis values of each variable are shown in Table 4.

Table 4: Summary Statistics

Variable	# of Obs.	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
GDP	108	4.022	5.398	-13.091	12.932	-0.973	3.654
CPI	108	8.828	7.067	-0.295	38.445	0.733	3.982

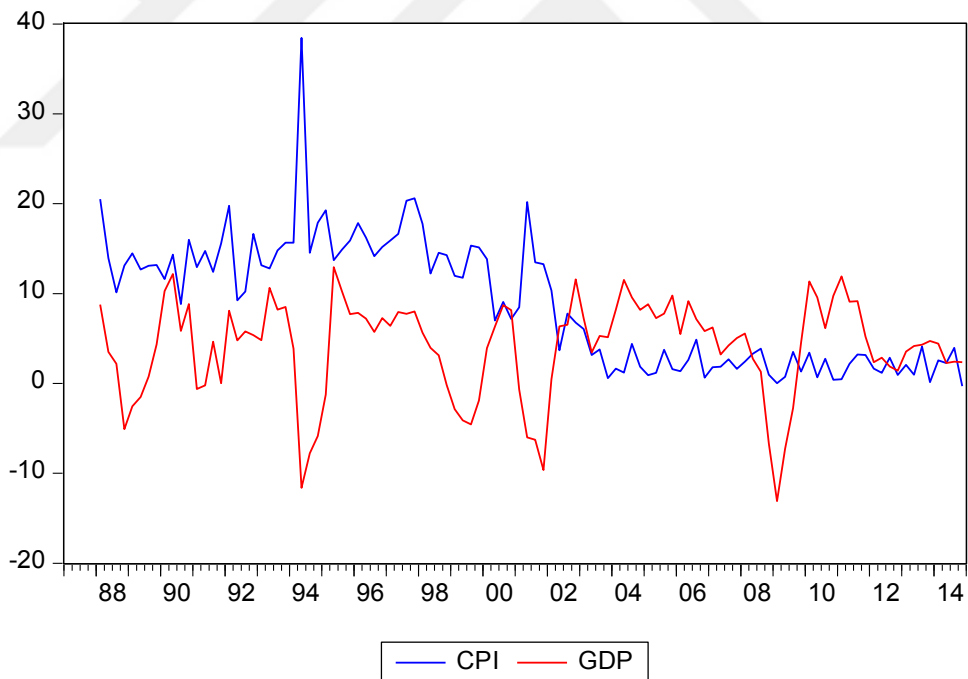
Each variable contains 108 observations, which make up the data set. The mean of GDP is positive, at 4.02, which indicates that Turkey is a growing country. On the other hand, the mean of CPI is higher (at 8.28), which is higher than most economists indicate as desirable for a developed country (2-3% is generally considered as an acceptable range for a developed country). Other important statistics to be considered

are those of skewness and kurtosis. Skewness is an indicator of the symmetry of distribution of a data set and kurtosis is an indicator of the shape of the distribution. A normal distribution is indicated with a skewness of 0 and kurtosis of 3. Table 4 indicates that both skewness and kurtosis are in the acceptable range for this research, and so there is no requirement to perform any transformation of the variables (such as a logarithmic transformation).

Table 5: Correlation Analysis

Variable	GDP	CPI
GDP	1.00	-0.21
CPI	-0.21	1.00

Table 5 shows the correlation results between two variables. Correlation does not give any causal information between variables but it gives an intuition about the direction of the relation. As we see in the above table GDP and CPI are negatively correlated.



Graph 1: CPI and GDP (%) (Seasonally Adjusted)

Graph 1 is an indicator to see the relation between variables. We can see that CPI and GDP are mostly moving different direction, especially around the period 1999 and 2002.

7. Empirical Results

Following outline of the methodology used and data employed, we now present and analyse the empirical results of our econometric estimations. As a first analysis, a simple OLS regression has been estimated. Any issues that might exist within this analysis have not yet been controlled for but the results give a basic indication of how GDP and CPI affect each other.

Table 6 presents the result of OLS regression where the dependent variable is the first difference of GDP and the independent variable is the first difference of CPI. R-Squared and Durbin-Watson results are also presented in addition to t-statistics.

Table 6: OLS Result

Dependent Variable: ΔGDP			
	Coefficient	Std. Dev	t-stat
Constant	-0.103	0.388	-0.265
ΔCPI	-0.222***	0.087	-2.543
R-Square	0.058	Durbin-Watson	1.824

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

Results of the OLS regression indicate that there is a negative relation between the variables by supporting correlation analysis and graphical illustration of the data. Keeping everything else constant, a 1% increase in CPI corresponds to a -2.2% decrease in GDP. The R-squared of the regression is very small indicating that there are likely lots of omitted variables which also have an impact on GDP. Durbin-Watson results indicate that there is no autocorrelation problem within this analysis.

One should keep in mind that these OLS results are inconsistent and therefore unreliable. It is difficult to draw significant conclusions from this analysis. Further analyses must be completed to identify the relation between variables. One thing that can be done is to find other explanatory variables and another is to find an instrument to fix the endogeneity problem within this analysis. Moreover, we can see in the graph that there are jumps in some years, hence we can create dummy variables and control these changes.

There are different methods which give us the causal relation between two variables. One of the most widely used methods is the Granger (1969) causality approach due

to the ease of implementing this method. However, in order to use this methodology we need to check whether the variables are stationary or not. For this reason, first of all we have used a unit root test to test that the variables are stationary, then we have examined the Granger causality test.

Researchers assume that covariance and mean of the variables are constant and not dependent on time when they use traditional econometric methods. However, unit root analyses, which have been applied to macroeconomic data, claims that this is not always the case. Non-stationary data presents different variance and mean over time. Basic OLS methodology may give us incorrect results if we have non-stationary variables in our regression.

In this analysis we have employed two different unit root tests: the Augmented Dickey Fuller Test (ADF) and the Phillips-Perron Test (PP). The equations calculated are as follows:

$$\Delta GDP_t = \alpha + \beta_t + \gamma GDP_{t-1} + \sum_{i=1}^n \gamma_i \Delta GDP_{t-1} + \varepsilon_t \quad (1)$$

$$\Delta GDP_t = \alpha + \gamma GDP_{t-1} + \sum_{i=1}^n \gamma_i \Delta GDP_{t-1} + \varepsilon_t \quad (2)$$

$$\Delta CPI_t = \alpha + \beta_t + \gamma CPI_{t-1} + \sum_{i=1}^n \gamma_i \Delta CPI_{t-1} + \varepsilon_t \quad (3)$$

$$\Delta CPI_t = \alpha + \gamma CPI_{t-1} + \sum_{i=1}^n \gamma_i \Delta CPI_{t-1} + \varepsilon_t \quad (4)$$

where α is a constant, β_t is a time trend variable, and ε_t is an error term.

Equation 1 is the unit root test for GDP including constant and trend variables as well as equation 2 which does not have trend variable. Equation 3 and 4 are similar tests for the CPI variable.

Schwarz Information Criteria (SIC) are used to identify the lag operator. ADF and PP critical test statistics are based on MacKinnon (1996) critical values. The number of lag operators is shown in the parenthesis.

Table 7: ADF and PP Unit Root Test Results

VARIABLES	Augmented Dickey-Fuller (ADF)		Phillips-Perron (PP)	
	Constant, Trend	Constant, no-Trend	Constant, Trend	Constant, no-Trend
GDP	-3.484** (4)	-3.511*** (4)	-3.158*	-3.184**
CPI	-3.849** (1)	-1.384 (2)	-6.518***	-3.118**
Δ GDP	-10.012*** (3)	-10.059*** (3)	-19.036***	-19.067***
Δ CPI	-11.965*** (1)	-12.027*** (1)	-54.502***	-54.149***

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

Table 7 presents the result of the unit root analysis. GDP and CPI indicate the level of the variables and Δ GDP and Δ CPI show first difference of the variables. In level form the significance level of the variables are different. We can see that GDP is statistically significant at 5% in the ADF test with constant and trend, but in the PP test it is significant only at 10% level. Another point is that under the ADF test with constant and no-trend for CPI, it is not statistically significant. Due to these different results it is worthwhile to take first differences for all variables and repeat the same tests again. When we have done ADF and PP analysis using first differences of the variables, we have statistically significant results at the 1% level. Therefore, we can conclude that the order of integration is one or in technical representation the order of integration for both variables are I (1) processes.

Since we have the same order of integration for both variables we can use the Granger causality test to identify a causal link between the variables. The Granger causality test gives important information about the relation between variables. First the test identifies that whether there is a causal link or not, then if there exists a causality, it will also give the direction of the relation. The matrix representation of Granger causality test is as follows:

$$\begin{pmatrix} d.GDP_t \\ d.CPI_t \end{pmatrix} = \begin{pmatrix} c_1 \\ c_2 \end{pmatrix} + \sum_{i=1}^{P-1} \begin{pmatrix} \phi_{11}^i & \phi_{12}^i \\ \phi_{21}^i & \phi_{22}^i \end{pmatrix} \begin{pmatrix} d.GDP_{t-1} \\ d.CPI_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix}$$

The null hypothesis: $H_0 = \text{CPI does not Granger cause GDP}$ is examined against its alternative: $H_1 = \text{CPI does Granger cause GDP}$. Mathematical representation can be stated as follows:

Null is $\phi_{12}^1 = 0$

Alternative is $\phi_{12}^1 \neq 0$

Similarly we can test whether GDP Granger causes CPI. The null hypothesis: $H_0 = \text{GDP does not Granger cause CPI}$ is examined against its alternative: $H_1 = \text{GDP does Granger cause CPI}$ or,

Null is $\phi_{21}^1 = 0$

Alternative is $\phi_{21}^1 \neq 0$

SIC is used to identify the lag operator. Number of lag operator is shown in the parenthesis.

Table 8: Granger Causality Tests

Dependent Variable	Explanatory Variable	F-Statistics	P-Value	Causality Result
ΔGDP	$\Delta\text{CPI (1)}$	0.226	0.636	NO
ΔCPI	$\Delta\text{GDP (1)}$	1.226	0.264	NO

Table 8 represents the result of causality tests, which are used to address the causality of variables and if it exists, determines the direction of this causality. Results of the analysis indicate that there is no causality between GDP and CPI, p-values are higher than the acceptable range to reject the hypothesis. As stated above, the null hypothesis is that there is no causality between GDP and CPI and results approve that we cannot reject the null hypothesis, hence we can conclude that there is no causality between GDP and CPI.

8. Conclusion

In conclusion, this research has investigated the relationship between levels of inflation and economic growth in Turkey during the period 1988-2014. Despite much research over previous decades, academics and other experts have failed to agree on a definitive definition of the term ‘inflation’ in the economic context. Along a similar vein, the definition of economic growth is also not conclusive and this has contributed to conflicting research into the relationship between these two macroeconomic variables.

The Turkish economy suffered severe hyperinflation in previous years after failed government attempts to create sustainable economic growth. Complex dynamics of the private and public sectors, coupled with difficulties posed by the fixed exchange rate mechanism make this an interesting and important area for research.

We used correlation, OLS and Granger causality analysis to examine the interactions between inflation and growth levels in Turkey between 1988 and 2014, using quarterly data. Correlation and OLS analysis indicated a negative relationship between the two variables but results of Granger causality testing were inconclusive and not sufficient to reject the null hypothesis of no causal relationship.

Specifically, Section 1 introduced the purpose of this research and provided justification of its importance in the context of existing debate on the definition of inflation. Section 2 detailed various types of common inflation including their causes and potential economic impact. In Section 3 we briefly defined the term of economic growth before discussing its relationship with the level of inflation in Section 4. Here we also reviewed a large amount of economic literature on the subject, discussing both studies which conclude positive relationships between inflation and growth levels, and also those which conclude negative relationships. In Section 5 we presented a more specific examination of this relationship in the context of the Turkish economy between 1988 and 2014. The precise data and econometric methodology used to conduct the present research was outlined in Section 6 and empirical results were given in Section 7. The concluding section (Section 8) summarizes the results of this paper and further justifies the purpose of this research.

This research is by no means conclusive and a number of alterations, improvements and additions could be made in future studies. The use of quarterly data can reduce the significance of the results of econometric analysis and so further studies could attempt to recreate our models using higher frequency data (e.g. monthly data). In this instance it may be necessary to use a proxy variable in place of GDP however, which is only reported on a quarterly basis. This trade-off may weaken results of any analysis but it is a useful exercise nonetheless.

Secondly, alternative analysis methods could be used. In this study, we employed correlation, OLS and Granger causality methods in answering the question posed, but further research could re-use the current dataset to perform VAR and Vector ECM analysis, before comparing the results to determine if the outcome is the same under varying econometric models.

Finally, this paper made no attempt to determine the threshold level of inflation for the Turkish economy, at which the relationship between inflation and economic growth changes significantly. Previous and existing literature provides guidance on how this might be achieved and so further research could perform this analysis on the current dataset to determine the threshold value of inflation for the Turkish economy.

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