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Papers on Relationship between Inflation and Relative Price Variability: Case of Pakistan

By

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Executive Summary

This dissertation explores different dimensions of the relationship between inflation and relative price variability in Pakistan. The period covered for this study is from July 2001 to June 2011, as this is the complete period for which data on new base (2000-01) is available. Incidentally, this period has both the low and high inflation episodes.

This is the only study in case of Pakistan, which uses detailed data on prices at city level and commodity group level. The dissertation has analyzed relationship between inflation and relative price variability in three aspects. First, we have examined the behavior of price setting agents as reflected in relative price changes in response to demand and supply factors; second, we studied the effect of relative price variability on inflation by estimating fixed effects regression model using panel data of inflation in different cities of Pakistan; and third, we have examined convergence of prices changes in 35 cities of Pakistan, and also looked at how location of cities affects the convergence.

The result of our first study suggests that changes in real income have insignificant impact on relative price variability. The results make sense as changes in income (with given preferences) almost evenly affect demand for all consumer items, which may lead to relatively proportional changes in their prices. It can be a case particularly in a developing economy like Pakistan, having a large informal sector, where response of firms is less constrained by wage contracts; and where capacity issues are less heterogeneous. On the other hand, unanticipated inflation, which usually comes from item-specific supply factors,

may affect prices of different items unevenly. From the second study, the results show that inflation, both food and non-food inflation, is significantly and positively affected by relative price variability. The results imply that supply side factors, as exhibited in dispersion of relative price changes, are robust determinant of inflation in a developing economy, like developed economies. From our third study, we found that there is bilateral price-level convergence for only food group with speed of convergence (measured by half-life) is around 3 months. On the other hand, prices of non-food commodities have very low speed of adjustment with 20 month half-life. Consequently, relative prices of overall commodities group have half-life of 8 month – a moderate speed of convergence.

We have also identified differences in the behavior of relative prices within and across provinces of Pakistan. The relative prices between two cities located in the same province show lower variability compared with cites pair located in different provinces. However, if at least one of city associated with a relative price series is located in one province, standard deviation of relative prices rises in case of overall and food group. While exploring the impact of distance between cities of a pair, we have found that the standard deviation of relative prices increase significantly with the distance. This result accords well with the findings of some previous studies e.g. Engle and Rogers (1996).

The policy implications from my study is; as the supply side factors are found to be dominant in affecting economic activity and inflation rate in Pakistan, therefore, monetary authority needs to be careful while taking decisions on monetary policy instrument. For instance, in 2008 when inflation rate was approximately 20 percent, SBP increased discount rate to give a signal of tight monetary policy stance. This badly affected economic activity at that time and GDP growth rate turned out to be zero. Therefore, cost push inflation should be dealt with much care while taking monetary policy decisions. Another implication of this research is that monetary policy may target a narrow measure of general price level. For instance, core inflation can be targeted. Moreover, an index of general price level can be constructed that is in control of monetary policy with minimum control error.

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I would further like to take this opportunity to thank all my friends and colleagues who offered me all the needed assistance.

Saghir Pervaiz Ghauri

To my late - Father, Mother and Sister

Chapter 1

Introduction

1.1 Background

The role of monetary policy is to contribute to sound economic performance and improved living standard of general public by keeping inflation low, stable and predictable. For these reasons, the relationship between inflation rate and relative price variability is important to explore and this piece of information is important for efficient monetary and fiscal policies. As Friedman (1977) made clear in his Nobel lecture, relative price variability is a direct means by which inflation can induce welfare-diminishing resource misallocation. However, research on general price level usually focuses on the mean of individual price changes, despite the fact that there is strong evidence that the mean of this distribution is in some way associated with its variance. Moreover, some important economic information is contained in the variability of individual prices and in the relationship between mean and variability. Particularly, the relationship of mean of price changes (commonly referred to as general inflation) and higher moments of the distribution of individual price changes (also termed as relative price changes) is very important to explore and it has significantly attracted the attention of economic research (see for instance, Park 1978; Debelle and Lamont 1996).

There are several reasons that the relationship between relative price variability and inflation rate is an interesting subject for economic research. First is the possible impact of relative price shifts on the macro economy. There may be conditions under which relative price shocks – coming from domestic factors like fluctuations in agricultural supplies or international factors like changes in oil and commodity prices, financial events, and exchange rate fluctuations – affect overall prices or output. Thus any analysis of macroeconomic aggregates will also need, among other insights, an understanding of the changes in relative prices. Secondly, the allocation of resources among competing uses is generally believed to be directed by relative prices. Relative price instability, therefore, may impose additional costs to producers as well as consumers. It implies that policy responses to macroeconomic shocks or policy objectives of efficient resource allocation should explicitly consider the relative price variability and its relationship with inflation and output.

The relationship between inflation rate and relative price variability has been explored in a variety of ways and there is a range of conclusions. Some studies have used standard deviation of relative prices (levels), computed from deviations from a simple average across commodities, as a measure of relative price variability. Others have used the same measure with averaging by weight, computed by expenditure shares. There are also a number of other studies that use the variance of changes in relative prices as a measure of relative price variability. Similarly, there are differences in measuring overall inflation rate. The differences in measuring techniques have some implications on results obtained. Results also vary for same country due to different sample periods. Thus, a conclusive verdict on the relationship of relative price variability and overall inflation rate is difficult to offer. Therefore, results obtained for one or a group of countries are not necessarily valid for other countries.

The relationship between RPV and inflation may be nonlinear because of the fact that industries and sectors may differ in their speed of adjustment to nominal shocks. As price change is a costly process, individual commodity prices change only at discrete intervals. The fact that these intervals start at different points in time, create divergence in relative prices. Moreover, there are differences in short-run supply elasticities across industries. If the short-run supply elasticity in one industry is smaller than that in another but the long-run elasticities are similar, then a demand shift may result in a change in both aggregate and relative prices in the short run.

Despite importance of the topic there is dearth of studies in this area with reference to Pakistan. There are only two studies available Akmal (2011) and Mohsin and Gilbert (2010). Akmal (2011) found U-shaped relationship between RPV and inflation in case of Pakistan using threshold regression technique. However the study used data on overall inflation and 12 broad groups of CPI; the study does not focus on disaggregated data at item level. Moreover, the study ignored the impact of unanticipated inflation on RPV. Mohsin and Gilbert (2010) examined city price convergence using large city price as numeraire but does not deal with the effect of RPV on inflation rate.

To fill the gap in the empirical literature with reference to Pakistan, this dissertation aims to study the distribution of relative price changes and its relation to overall price movement in the context of Pakistan. It examines the issue in three aspects: the first aspect is related with the behavior of price setting agents as reflected in relative price changes in response to demand and supply factors. For this, Park (1978) model have been used on monthly data of consumer price index of Pakistan. Our study is completely different from the two studies available with reference to Pakistan and it is more comprehensive. The second issue that is explored is the effect of relative price variability on inflation rate by estimating fixed effects regression model using panel data of prices in different cities of Pakistan. The distribution of relative price changes is taken as an indicator of supply shock (*a la* Ball and Mankiw, 1995). The third issue which is examined deals with convergence of price changes in 35 cities of Pakistan and also explores how location of cities affects the convergence. According to the law of one price (LOP), the efficient market arbitrage and trade will keep the prices of identical commodities same in two or more markets. However, the transport and transaction costs may prevent the LOP to hold.

1.2 Objectives of Dissertation

The specific objectives of the dissertation are:

- The first objective is related with the behavior of price setting agents as reflected in relative price changes in response to demand and supply factors.
- The second objective is to explore the effect of relative price variability on inflation rate by estimating fixed effects regression model using panel data of prices in different cities of Pakistan.

- The third objective is to examine convergence of price changes in 35 cities of Pakistan and also to explore how location of cities affects the convergence.

1.3 Structure of the Dissertation

Thus core of the dissertation is three distinct but interrelated studies as presented in Chapters 4, 5, and 6. After introducing the dissertation, the Chapter 2 gives a comprehensive review of literature on the subject while Chapter 3 presents an analysis of inflation in Pakistan in historical context, which serves as a background of our core studies.

Chapter 2

Literature Review

While we have presented review of the relevant studies separately in our core chapters (i.e., Chapters 4, 5, and 6), we review some of the additional literature on the topic in this chapter, in order to have a consolidated view of the existing literature.

Glejser (1965) did a pioneer work on relative price changes by using a measure that compute the standard deviation of relative price (levels) weighted by expenditure shares. He compared the average value for the year 1953–1959 of a given price index with an average of the whole consumer price index and found that the rate of inflation was the most important determinant of changes in relative prices.

Vining and Eltowerski (1976) examined price data for the period 1947-1974, and found that the variance of the changes in relative prices, covered in wholesale and consumer price indices, in the US was related to general inflation variability. They calculated the variance of relative price changes by taking every sub-index of the main series and working out a variance for each point in time. Although this is a classic article, it has two questionable aspects: first, the relative price variability is measured by variance which assigns same weights to all expenditure items; and second their study could not give a clear measure of inflation variability.

Logue and Willett (1976) made an internatioal comparison over the period 1949-70 for a total of 41 countries. They found a nonlinear relationship between the inflation rate and the inflation variability, and found that the relationship was stronger for countries that had relatively high rate of inflation. Foster (1978) confirmed many of these findings using absolute changes rather than variance as measure of inflation. Mullineaux (1980) conducted tests on Livingston survey data, investigating the proposition (suggested by Friedman) that the natural rate may be positively associated with the variability of the inflation rate. Using a moving standard deviation of the expected inflation rate, he found that unemployment was positively associated with inflation variability in the short run.

Milton Friedman (1977) suggested that the inflation, not appropriately projected by economic agents, may lead to incorrect output levels and misallocation of resources. His empirical work found a positive (stable and statistically significant) relationship between the inflation rate and measures of the dispersion of relative price change. However, the opposite nature of relationship was also found by other studies, like Hesselman (1983) and Silver (1988) who investigated negative relationships for the United Kingdom and Buck (1990) who found a negative relationship for Germany and a positive one for the United States. Vining and Elwertowski (1976) concluded that they could not find any relationship in case of England on the basis of commodity prices data during the middle 1800s. Reinsdorf (1994) investigated a negative relationship for 65 categories of goods in nine U.S. cities, though this pertained to price levels.

Sheshinski and Weiss (1977) considered a monopolistic firm which adjusted nominal prices at discrete intervals. The main focus of their article was the effect of expected inflation rate on the frequency and magnitude of price changes. The firm fixed the nominal price of its output over intervals of constant duration. The size of adjustment, its turn out, was proportional to the length of the period. The real price fluctuations between two bounds had been decreasing continuously each period, as inflation eroded the real price. They found that higher inflation rate resulted in increased variance of relative prices, if the period of firms' adjustments was independent. Hence the inflation level, rather than its variability, causes increased relative price variability.

Balk (1978) explored the inflation variability in Netherlands covering the period 1952 to 1975 and found results similar to those in U.S. The monthly data of price index numbers was used with total 235 commodities (of which 141 items of CPI and 94 items of WPI). In order to compute annual growth rate, he estimated a regression with natural logarithms of the price indices as regressand and time as a regressor. He concluded that there was a link between the average growth rate and its standard deviation, which measures the dispersion of relative price changes.

Cukierman (1979) claimed and demonstrated three important issues in his article that. First, there was positive relationship between individual price change dispersion and general price change dispersion; this finding is consistent with many markets stochastic model presented by Lucas. Second, the Barro model should not be interpreted as a rationale for "a chain of causality running from general price level change instability to relative price change instability". It should rather be viewed as a conceptual framework in which both the variances of general price change and individual price change are influenced by some common exogenous variance, like the variance of overall excess demand shocks and the variance of relative excess demand shocks. Third, within a framework in which both the variances of general price change and relative price change are determined endogenously, the equation regarding the direction of causality between those two variances becomes ambiguous.

Blejer and Lederman (1980) used a cumulative weighted measure of relative price dispersion, concluding that output and employment were negatively related to relative price dispersion and positively related to unanticipated inflation rate. They found that anticipated inflation rate had an insignificant coefficient in all regressions, except one. They suggested that a cumulative measure was consistent with a buildup of lagged effects output that occured as a result of increased relative price dispersion.

Taylor (1981) proposed an explanation of relative price variability by utilizing contracting practices and supply shocks as an important source of relative price variability. In his model, both relative price variability and inflation variability react in the same positive direction to supply shocks by invoking rational expectations with no aggregate / local confusion. The variance of monetary policy shocks does not appear in Taylor's model to be responsible for relative price variability. This model, in contrast to that of Lucas, stressed supply shocks, and although constructed very differently, it suggests a positive relationship between the relative price variability and the inflation variability.

Amihud and Mendelson (1982) suggested that the relative price dispersion was caused by the variance of aggregate economic shocks. They relied on the inventory adjustment policy of firms to show that relative price dispersion depends on the variability of aggregate demand shocks and the variability of industry specific shocks. They obtained their results on the basis of different pricing responses of each industry to the aggregate shock, even with no confusion between aggregate and relative shocks. They concluded that economic shocks affected each industry's inventories to a different extent, and price responses may also vary across industries.

Cuikerman and Wachtel (1982) used a framework that built on Parks' model except that they allowed inflationary expectations to vary across markets. Since equilibrium prices (and their rates of change) in different markets may differ, inflationary expectations across markets may also vary. They showed that there may be a positive relationship between the relative price variability and the variance of inflationary expectations of economic agents. Moreover, changes in the variance of either aggregate demand or supply shocks will cause increased relative price variability. They also found some supporting empirical evidence by utilizing the survey data from Carlson (1977).

Blejer and Lederman (1982) studied the determinants of relative price variability in Mexico, which is an open economy with fixed-exchange rate, for the period 1951 to 1976, by making difference in tradable and non-tradable goods.

They suggested decomposing the overall relative price variability in three components: the variability between the two sets and within each set of goods. They concluded that a large part of the overall variability in Mexico was explained by the within tradable goods variance. On the other hand, an insignificant share was found for between-sectors variance. General implication of their result was that the Mexican's total relative price variability was affected considerable by expected changes in the tradable/non-tradable price ratio, external variability within tradable goods, growth in real money supply, and unexpected inflation rate.

Fisher (1983) explored the relationship between relative price variability and inflation rate on the basis of data of Germany and US. He tried to explain the nature and direction of the relationship between both variables with the objective to examine the linkage between inflationary process and its associated social costs. He found a robust relationship between RPV and unanticipated inflation rate for both the economies. There were weak relationship between RPV and the aniticipated inflation rate, while unanticipated negative inflation shocks, though statistically insignificantly, also appeared to increase RPV. For both countries, the vactor autoregressive model showed that relative price variability coud play an independent role. These results were consistent with the view that link between RPV and inflation rate comes from policy responses to shocks.

Hesselman (1983), while studying the relationship between RPV and inflation rate, showed that diverse theories can have different relevance across countries and over time in explaining the varying nature of the association. By modeling across numerous countries and including a set of macroeconomic variables, he showed that failure to completely anticipate inflation was not the only factor behind this relationship.

Pagan et al (1983) tried to define "inflation variability" that could be used in analyzing the behavior of inflation. They used a multi-market model of Lucas (1973) and found that their definition was consistent with conventional analysis of RPV and inflation; however, the errors did not show normal OLS properties. The errors in the Lucas model show economic shocks, and uncertainty about absolute price levels and relative price variance. They applied their framework to Australian data and also found the evidence of impact of variance of these shocks to the inflation rate.

Sellekaerts and Sellekaerts (1984) showed that both unanticipated and anticipated inflation rates were key determinants of relative price variability in the post war period in the US. Some of the adjustments of relative prices to unanticipated inflation rate occur with a lag, due to costs of price adjustment. Their results have two policy implications: First, the neoclassical foundations of the natural rate hypothesis are seriously eroded; second, money is not neutral and monetary policy has an impact on relative prices and, hence, on real variables in the economy, thus preserving a place for an active discretionary monetary policy.

Balk (1985) again addressed the same issue as in his earlier article where he concluded that relationship between the inflation rate and dispersion of the relative-price change cannot be found for the Netherland over the period 1951-71. In this paper, he worked on Dutch data and suggested that statistical specification of the concept of inflation variability affected the conclusion about the rejection and acceptance of a relationship between inflation variability and relative-price change dispersion. He also found a strong relationship in case of Netherland with a new specification of the model. However, they have found inconclusive result regarding the direction of causality.

Assarsson (1986) explored this relationship for Swedish economy by using annual prices data for 1951 to 1979 in a multi-market partial information equilibrium model. The model incorporated raw materials on the supply side, open economy characteristics, and different supply responses across markets. He found that expected inflation played a key role in determining RPV. He also used two alternative assumptions for the formation of expectations, i.e., extrapolative and adaptive expectations. However, there are no significant differences in the results.

Nugent (1986) reproduced Parks' model by removing its key shortcomings by using a different mechanism for defining price expectations. He also used multi-market model to derive some theoretical foundation for the relationship between unexpected inflation rate and changes in relative prices. He was able to improve substantially the illustrative power of the model and level of significance of the parameter for unexpected rate of inflation. Domberger (1987) studied the determinants of intra-market variability of relative price movements in case of UK. He found that relative price variability was strongly related to the rate of inflation in UK at both aggregated and disaggregated levels. His work provided further support for the hypothesis that macroeconomic disturbances have impact on price mechanism. Moreover, contrary to previous suppositions, he suggested that the impact of shocks extended to the relative price variability within markets. He also concluded that in an intense market, the impact of macroeconomic shocks on variability of relative price eased comparing to that in a more disintegrated market.

Mizon (1991) explored the relationship of relative price variability with aggregate inflation rate for the UK economy by emphasizing on complete evaluation of models, and looking for encompassing and congruence. He demonstrated the importance of the recursive estimation techniques in evaluating the model adequacy and noticed the potential limitations of models with single equation, and uni-variate analysis of time series data. He instead used co-integration technique which is based on successive elimination of a congruent VAR. Bomberger and Makinen (1993), re-examined the Parks' study. Their results showed that Parks' findings for 1948-75 depend on an outlier –observation in 1974 – an oil price-shock year. By removing this year, the failure of Parks' equations was shown with no robust relationship. Even by using revised set of data up to 1989, these specifications fail to give valid results in the presence of years 1974 and 1980 with oil-shocks. They concluded that there was no robust causal relationship between general inflation rate and relative price variability and there existed a robust relationship between supply shocks and general inflation rate.

Reinsdorf (1994) found that there was a weak relationship between inflation rate and price dispersion when tested at micro-level data during the

Volcker's disinflation and it was negative in nature. His result was contrary to the general presumption of the existence of a positive relationship. This result was, however, consistent with theory that unexpected inflation rate induced more search due to consumers' incomplete information about price distribution. Furthermore, decomposing inflation rate into expected and unexpected components revealed that declines in price dispersion followed unexpected inflation, while expected inflation seemed to have a positive impact on price dispersion. However, his results are not necessarily contrary to the menu cost models.

There is extneisve body of literature on menu-cost hypotheses for adjustment of commodity prices. For example, Ball and Mankiw (1995) developed a theoretical model to explain the reasons of shifts in the short-run aggregate supply schedule. Their findings have been discussed in subsequent core chapters of this dissertation. Parslay (1996) contributed to this subject in two aspects. First, there exists a positive relationship between inflation rate and relative prices variability and relative rates of inflation on the basis of sectoral US data for the period from 1975 to 1992. Moreover, there was inverse relationship of information content of a given shock to inflation rate in case of response of relative prices and relative inflation rates to aggregate inflation. Second, he offered evidence on the tenacity of the effects of inflation rate on relative prices. His results challenged the traditional interpretation of the relationship between inflation and relative prices, i.e., long run impact of inflation rate on relative prices. His VAR analysis showed that there were some implications related to social welfare due to effect of inflation rate on relative prices. He also estimated IRF (impulse response functions) which showed a larger effect of inflation on relative prices as compared to that on relative inflation rates.

Woznaik (1997) estimated the degree of the influence of relative price changes on the general price level in case of Poland for 1989-97 on the basis of a model built upon menu costs and trend inflation. He estimated a set of three different specifications to explore the effects of relative price changes in a setup that controls for real and nominal economic shocks. He found that most of the dramatic relative price shifts occurred during 1989-91, the initial years of reforms. Since 1992, relative prices for most goods controlled by the government have been reasonably stable with low fluctuations. This suggests that the mechanism of upward movement was seriously slowed down or even stopped in recent years and administrated price increases just make up for inflation.

Debelle and Lamont (1997) tested the existence of correlation between inflation rate and relative prive variability within a set of markets in case of US cities in panel data. By using two sets of balanced panel (from 1954-86 for 19 cities and from 1977-86 for 24 cities), they found a strong correlation between the two, inflation rate and relative price dispersion, in cities which was considerably higher than their averages in the national economy. They also found that this correlation existed for various time periods and in case of different categories of commodiites. They also concluded that monetory factors could not explain a component of the relationship between relative price variability and inflation rate.

Loy and Weaver (1998) studied the effects of unanticipated and anticipated inflation rate and inflation ambiguity on relative price variations of agricultural commodities in case of markets in Russia. They showed that variation in relative prices were the result of anticipated inflation and not of the unanticipated inflation or inflation ambiguity.

Bryan and Cecchetti (1999) found a minor bias in the relationship between inflation and its moments of higher orders. By experimenting with Monte Carlo, they showed that the observed relationship between inflation and its moments had a small-sample bias. It means they established that a generally accepted stylized fact about aggregate dynamics of prices, i.e., a positive relationship between inflation and the skewness of the distribution of price change variation, may not necessarily hold. They showed that asymmetrical distribution of price changes will show a small-sample bias in the mean-higher moment correlation.

Aarstol M (1999), tested three models of the relationship between relative price variability changes and some aspects of inflation, namely the menu cost, signal-extraction model of the Lucas-Barro (LB), and extended Lucas-Barro model, that is, Hercowitz-Cukierman model (HC) for US data in 1948:01 – 1997:05. They found that these models did not fully explain the US data. Their results, obtained in case of full sample and also for sub-samples of pre and post 1972:12, suggested rejection of HC extension of LB model (this is the only model that suggests a positive relationship). However, some support for the menu-cost and LB models could be found on the basis of full sample estimation and the post

1972:12 period, which provided a partial explanation of the relationship between inflation rate and relative price variability.

Fielding and Mizen (2000) presented new insights on the relationship of inflation rate and relative price variability (RPV) in Europe. They used data from ten countries and fifteen commodity groups to explore the variety in RPV and inflation linkages, where significant difference in behavior would have key lesson for the practicability of monetary integration of these countries. They used same measures of RPV as used by Debelle and Lamont (1997) and Parsley (1996). The existence of stationarity was verified by a test of persistence in RPV measures which rejected the null hypothesis of unit root, while showing some persistence for many of the ten countries and all fifteen commodity groups. It was shown that there was a rapid decay in the memory of these series, implying a fast decay of RPV in the countries. This also implies that shocks to RPV are eliminated after twelve months. Interestingly, the evidence of relationship between RPV and inflation rate was not found as symmetric in case of countries of Europe as it was observed in case of cities of US. Among the commodity groups, there was, however, more even support for a significantly negative relationship, consistent on demand side. It also showed the power of menu-cost model of price-setting behavior of economic agents.

Nathan and Wynne (2000) observed similar relationship between mean and skewness of the sector-wise distribution of technological shocks and sector-wise changes in commodity prices. They revealed that positive mean-standard deviation and mean-skewness correlation in sector-wise price changes can easily be replicated through a simple model of general equilibrium with perfectly flexible prices: this was a blow to the common perception that these properties were considered as key for an evidence of sticky prices. In general, they concluded that, inflation rate had a positive correlation with the relative price variability, which is commonly measured as standard deviation and/or skewness (third moment) of the cross sectional distribution of price changes. While conventionally, these were interpreted as the lethargy in price adjustments in response to exogenous shocks.

Silver et al (2001) provided some other proofs about existence of a robust relationship between inflation rate and relative price variability on the basis of a consistent data set of consumer price index for nine European countries for the period 1981-89. They tested the impact of economic variables on the relationship between inflation rate and price change dispersion by incorporating adjustments for timeliness in the definition of inflation and variability and by using suitable formulas and proxies. The resulting models, estimated as seemingly unrelated regression and a robust systems estimator, clearly showed the characteristics of the economy to have an effect on the sensitivity of price dispersion to anticipated and unanticipated inflation rate. They also showed that the extent and nature of the effect of unanticipated inflation rate on variability of relative price vary across countries. And finally, they showed a consistent negative relationship of unexpected inflation rate with relative price variability.

Nath (2002) estimated fixed effect regression model using panel data to test Ball and Mankiw proposition for supply-side inflation theory by using US cities price data. His findings indicated a positive and robust correlation between dispersion of relative price changes and inflation rate. That strong experimental regularity gave confidence to the supply-side inflation theory. During the period of early 1980s this relationship weakened, which indicate prevalence of shocks coming from monetary side to explain aggregate price level changes. On the other side, inflation rate and skewness of price changes were found not to have a robust correlation when the effects of the country-wide macroeconomic factors were controlled. Moreover, there was considerable evidence for a negative relationship when measures of inflation and dispersions were used in the form of weighted average.

Caglayan and Filiztekin (2003) studied the relatojship between relative price variability and inflation rate together with the impact of structural changes in the behaviour of inflation. They used techniques of panel data to control for aggregate economic shocks. Their study indicated a non-neutral effect of inflation rate on relative price variability, which was lower in amount during the periods of high inflation. They also found that the variability in relative prices increased in inflationary as well as deflationary periods. Nath (2004) used latest developments in the techniques to measure correlation to study the relationship between relative price variability and inflation. In order to investigate this relationship, he used correlation coefficients of Vector Autoregressive forecast errors at different forecast horizons. His findings indicated a positive correlation between the two which not only holds in the short-run but also in a time horizon of long-run. These findings have important and useful implications for those models which intend to explain the nature of this relationship, that is, models should contain features that could produce positive relationship between the variables that holds even in the long-run.

Lastrapes (2006) examined the relationship between inflation rate and relative prices with keeping a focus on exogenous economic factor affecting this relationship. Particularly, he used Vector Autoregressive model to explore shocks coming from productivity at aggregate level and supply of monetary aggregate. He estimated the dynamic reaction of prices of individual commodities and aggregate price level to these shocks. The results of his work showed that prices of commodities do not react in a uniform manner to the shocks, neither in the short run or in the long run. A key result was that shocks related to money supply had permanent effects on the dispersion of relative prices of commodities.

Fielding and Mizen (2008) discussed the functional form problem in the case of the relationship between inflation rate and relative price variability. They used data of personal consumption expenditures for the period 1967 to 2003 to form the measures for inflation and RPV. They used non-parametric technique to distinguish between the different functional forms without imposing in advance some specific parametric restriction. The result showed existence of non-linearity, with a quadratic functional form (approximately) at low expected rate of inflation to moderate rate, which was consistent with models of menu cost. Their result was strong enough to alternative kernel density functions (bounded). It implied the existence of an optimal inflation rate when RPV approached to its minimum. Alexander and Dieter (2008) introduced a customized form of Hansen's panel threshold model to study the relationship between relative price variability (RPV) and inflation rate in cities of US. They found two important inflation thresholds and both negative and positive effects of inflation on relative price variability. The least effect of inflation rate on RPV was guaranteed when inflation rate was low but not zero. Their results revealed that, for monetary policy to keep the impact of inflation rate on relative prices at a minimum level, the US inflation rate should be in the range of 1.8 percent to 2.8 percent.

Caraballo et al (2008) analysed the relationship between inflation rate and the relative price variability (RPV) in Argentina, which have a high and volatile inflationary environment for the period 1960 to 1993. The main focus was on the role of inflation regimes (moderate, stable and very changing) in explaining the changes in the determinants of RPV. They have divided the whole sample in two main periods 1960 – 1975 (moderate and stable inflation) and 1975 – 1993 (volatile inflation rate), and concluded that the determinants of RPV change not only with the regime but also with the inflationary context. Particularly, moderate inflation changes from first period of stable inflation to second period with a changing inflation environment. Moreover, results were not sensitive to the forcast equation of inflation, i.e., in all regimes, inflation had social welfare cost through its influence on the relative price variability. But there was not a unique theoretical model to explain how and why inflation rate affected RPV. Infact they found the evidence that favors the menu-cost model for moderate rgime in stable inflation period and singnal extraction model for same regime in changing inflation period.

As the above review of the literature shows, the relationship between inflation rate and relative price variability has been explored in a variety of ways and there is a range of conclusions. Some studies have used standard deviation of relative price (levels), simple average across commodities, as a measure of relative price variability, while others have used the same measure with averaging by weight, computed by expenditure shares. There are also a number of other studies that use variance of the changes in relative prices. Similarly, there are differences in measuring overall inflation rate. The differences in measuring techniques have some implications for the results obtained. Results also vary for a same country due to different sample periods. Thus, a conclusive verdict on the relationship of relative price variability and overall inflation is difficult to offer. Therefore, results obtained for one or a group of countries are not necessarily valid for other countries. This is particularly true when the case of a developing country, like Pakistan comes.

Therefore, in order to understand this relationship in the case of Pakistan, it is important to explore its own data set. Currently, we could find two studies for Pakistan, i.e., Akmal (2012) and Mohsin and Gilbert (2010). As mentioned earlier, Akmal (2012) focused on the nature of the relationship between RPV and inflation rate, and found it as U-shaped, while Mohsin and Gilbert (2010) estimated relative price convergence. They found speed of convergence, as measured by half-life, less than 5 months, which varies from 1.3 to 68 months in the case of individual cities. However, we have used a large set of data related to all the cities included in CPI basket and at commodity level.

Chapter 3

Overview of Inflation in Pakistan

Inflation is a rise in the average price of a basket of goods and services, which represents and affects consumption pattern of a typical household in a country. It is one of the most important variables which economists continuously track to understand the dynamics of an economy. A number of factors affect the movements of prices, which are categorized into demand pull and supply push factors. A deep understanding of inflationary trends and the underlying factors is inevitable for an appropriate macroeconomic policy.

It is generally believed that a stable and moderate inflation rate is good for the economic activities. High inflation is harmful as it makes people worse off if their income does not increase with the same pace. It also adversely affects savers by reducing the real value of their returns. Moreover, a sustained inflation has also longer-term effects. If money is losing its value, investors refrain from making long-term plans. Low investment rate, in turn, results in to stagnant productive capacity of the country.

On the other hand, deflation, i.e., falling prices result in slowdown of economic activities and ultimately to loss of incomes. These unique features of inflation make it a subject of utmost importance. As different consumers' goods and services have different prices and their units, it is challenging to have one single price representing the whole economy. Economists have developed a number of measures of average inflation.

Inflation in Pakistan is measured through three indices namely, consumer price index (CPI), wholesale price index (WPI), and sensitive price index (SPI). The first two indices are compiled on monthly basis and reflect a larger basket of goods, while the last index, i.e., SPI is a limited item weekly index.

Table 3.1: Inflation Trends

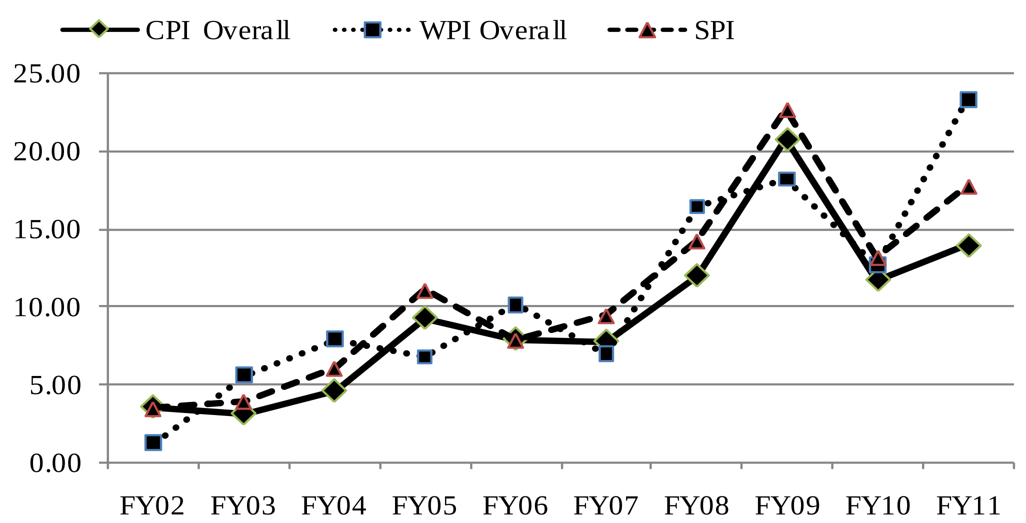
percent

	GDP Deflator	CPI	WPI	SPI
FY02	2.5	3.54	1.21	3.42
FY03	4.4	3.10	5.57	3.90
FY04	7.7	4.57	7.91	6.03
FY05	7.0	9.28	6.75	11.05
FY06	10.5	7.92	10.10	7.83
FY07	7.2	7.77	6.94	9.42
FY08	12.9	12.00	16.41	14.24
FY09	20.7	20.77	18.19	22.72
FY10	10.7	11.73	12.63	13.18
FY11	19.5	13.92	23.32	17.77

The monetary authority of Pakistan usually focuses on movements in consumer price index for its monetary policy formulation, though it gives some weight to other indices as well. This chapter presents a review of inflationary trends in the country during FY02 to FY11. The earlier part of this period is unique as the country experienced a prolonged period of low inflation, with an annual inflation CPI inflation of as low as 3.5 percent in FY02. Low GDP growth, stable global commodity prices and exchange rate helped inflation to remain at lower trajectory (See Table 3.1 & Figure 3.1).

During FY03, although CPI inflation continued to fall, WPI increased primarily due to rise in energy prices during the first eight months of FY03. The relatively higher GDP deflator during this year can be attributed to the commodity-producing sector as inflationary pressures clearly seem to have declined in services sector. Within the commodity-producing sector, the largest contribution to inflationary pressures was from agriculture-sector, which appears consistent with the price development in the sector.

Figure 3.1: Inflation Trends - YoY from FY02 to FY11



In FY04 inflation increased slightly, yet it was lower than historical average. Particularly, CPI food inflation increased sharply (See Table 3.2) mainly due to increase in international commodity prices and mismanagement of domestic supply of staple food, especially wheat. Further, an increase in the WPI sub-indices for manufacture, building materials and the CPI sub-groups for house rent index, fuel & lighting and transport & communication were largely the result of imported inflation. Moreover, persistently easy monetary policy also started its influence on aggregate demand which put pressure on inflation.

Table 3.2: Seggregated Inflation Trends

percent

	CPI		WPI	
	Food	Non-food	Food	Non-food
FY02	2.46	4.27	0.88	1.46
FY03	2.87	3.25	3.50	7.08
FY04	6.01	3.62	6.98	8.56
FY05	12.5	7.10	10.65	4.05
FY06	6.9	8.63	7.00	12.37
FY07	10.3	6.01	8.88	5.58
FY08	17.6	7.89	18.95	14.57
FY09	23.7	18.45	23.24	14.39
FY10	12.5	11.11	11.92	13.20
FY11	17.95	10.53	19.64	26.26

Inflationary pressures continued to prefund in FY05, which were mainly contributed by issues related to increase in domestic demand, market structure and specifically supply shortages of key food commodities and minor contribution from international commodity prices. The same is reflected in the increase in all measures of inflation like CPI, SPI and GDP deflator in the country during that year. Monthly data show that inflationary pressures during November and December 2004 eased. However, increase in the domestic POL prices in December 2014 fueled inflationary expectations, causing second round inflationary impact. But the policy response to high inflation succeeded to curb this pressure, which coupled with measures taken by the government to ensure the availability of major food items, resulted into inflation coming down in FY06 from last year's level. Inflation also remained tamed in the next fiscal year, i.e. FY07.

However, the prices of food commodities increased sharply in FY07, showing the indirect impact of international food prices and the damage of minor crops like tomato, onions, citrus fruit, etc. due to the rain and flood in the country.

A degree of speculative & collusive practices of industry and distributors, as well as the inability of agriculture production to keep pace with the rising demand following sustained high economic growth recorded in preceding years, had also contributed to high food inflation.

During FY08 and onwards, sharp increase in global inflation due to international financial crisis along with domestic factors (like, increase in prices of fuel and wheat, law and order situation, speculative hoarding, expansionary fiscal policy) led to a increase in domestic inflation as shown by upward movements in all price indices, i.e., CPI, WPI, SPI and GDP deflator. Whereas food inflation was mainly responsible for increase in CPI and SPI, WPI inflation came from both food and non-food inflation. While inflationary pressures started increasing during the early months of FY08, a sharp rise was witnessed during the last four months. During the earlier part of the year, the inflationary pressure was largely driven by food prices. On the other hand, the later part of the year experienced inflationary pressures due to global commodity prices, oil price hike in the world market, and rise in wheat support price coupled with speculative attack on wheat prices.

Moreover, rupee also depreciated sharply during this period, as forex reserves stared experiencing pressures, which also fueled inflationary expectations. The inflationary pressures continued in FY09 when CPI inflation was the highest of the period, i.e., 20.8 percent. Other price indices also witnessed higher inflation rate. Within CPI basket, all the sub-groups of consumer commodities showed double digit inflation during FY09, which was a rare case in inflationary experience of the period under review (See Table 3.3). Similarly, sub-groups of Wholesale

Price Index also showed high inflation (see Annexure A)

Table 3.3 : Inflation Trends in Sub-groups of CPI Basket

percent

	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
Food & Beverages	2.48	2.87	6.00	12.49	6.92	10.29	17.65	23.67	12.49	17.97
Apparel, Textile & Footwear	3.23	3.44	2.72	3.00	4.07	5.21	8.15	14.23	6.32	12.00
House Rent	2.80	0.72	4.50	11.29	9.92	6.69	9.39	17.11	13.81	7.29
Fuel and Lighting	9.46	7.63	2.96	3.68	9.00	9.01	6.06	25.53	14.06	15.32
H. Hold Furniture & Equipment etc.	3.93	2.86	3.54	6.01	5.17	6.67	7.17	13.11	6.38	10.18
Transport & Communication	5.96	5.32	3.43	8.40	16.60	2.10	4.42	23.79	6.02	14.38
Recreation & Entertainment	6.30	0.85	-1.06	-0.14	-0.26	0.10	1.99	11.26	5.90	9.87
Education	4.97	4.71	3.89	2.93	6.37	7.03	5.27	17.32	12.38	6.13
Cleaning Laundry & Per. Appearance	2.50	4.75	3.65	4.14	3.10	4.23	11.03	18.00	10.63	12.54
Medicare	2.37	3.14	1.23	0.99	2.51	9.27	9.36	11.35	6.64	15.06

However, with a strong policy reaction by the central bank, improvements in domestic supplies of food items, and stability in global commodity prices helped inflation coming down in subsequent years. The overall CPI inflation came down to 11.7 percent in FY10 from 20.8 percent during the preceding year. Other indices, i.e., GDP deflator, WPI and SPI, also followed suit, although all indices still showed double digit growth rates.

Summarizing the discussion, we can say that headline inflation in Pakistan measured by CPI (2000-01 base) showed significant increase from FY08 to FY11 (ranges from 11.73 to 20.77 on YoY basis). During that period CPI food inflation as well as CPI non-food inflation also recorded significant rise. Interestingly, during this period, real GDP growth was less than 3 percent and growth in money supply was lower than nominal GDP growth (see Annexure A for a series of real and nominal GDP and M2 stock). It is surprising to have high inflation in the presence of depressed aggregate demand and money supply growth. Therefore, in order to explain these high inflationary trends, we need to explore commodity-level micro data, because macroeconomic variables do not help in this regards. The subsequent chapters do exactly this, that is, they analyze inflation in Pakistan on the basis of micro data at city level and commodity level.

Table 3.4 shows the city-wise inflation for major cities i.e. Lahore, Islamabad, Karachi, Peshawar, and Quetta during FY03 to FY11 (for inflation of other 30 cities – see Annexure A) with overall inflation. A comparison of overall inflation with major cities shows that inflation in major cities moved in tandem with overall inflation, with both increasing witnessing a generally increasing trend between FY03 to FY09. After showing a peak in FY09, both the overall inflation and inflation in major cities eased slightly, though a slight uptick can be witnessed in FY11. Similar trends are also visible in food and non-food groups while comparing overall inflation with major cities.

Table 3.4: CPI Inflation Trends of Overall & Major Cities from FY03 - FY11

percent

Cities	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
					Overall				
Overall	***3.10***	***4.57***	***9.28***	***7.92***	***7.77***	***12.00***	***20.77***	***11.73***	***13.48***
Lahore	3.04	3.73	8.67	8.89	8.04	10.58	18.74	11.39	12.21
Islamabad	3.02	4.30	10.33	11.39	9.56	10.51	18.45	10.24	11.91
Karachi	2.48	4.74	9.03	6.48	7.56	11.66	20.59	11.05	12.85
Peshawar	3.46	4.76	10.04	8.04	7.78	12.67	22.74	10.52	15.35
Quetta	3.45	5.25	11.07	7.05	8.29	12.75	22.80	10.15	14.21
					Food Group				
Overall	***2.87***	***6.01***	***12.49***	***6.92***	***10.28***	***17.64***	***23.70***	***12.47***	***17.95***
Lahore	3.76	5.51	12.22	7.28	11.01	17.30	21.00	12.90	16.04
Islamabad	4.56	4.18	11.42	9.61	12.42	14.02	20.40	12.62	18.49
Karachi	1.93	6.90	11.92	3.56	10.08	17.78	23.02	11.00	17.94
Peshawar	1.33	6.66	15.14	6.92	10.36	19.31	25.72	9.25	18.97
Quetta	2.78	7.18	13.86	4.77	12.07	19.39	28.79	8.54	18.49
					Non-food Group				
Overall	***3.25***	***3.62***	***7.10***	***8.63***	***6.01***	***7.89***	***18.45***	***11.11***	***10.53***
Lahore	2.66	2.76	6.69	9.84	6.33	6.54	17.25	10.35	9.55
Islamabad	2.19	4.37	9.73	12.39	8.00	8.53	17.29	8.78	7.75
Karachi	2.77	3.59	7.45	8.14	6.19	8.20	19.10	11.08	9.62
Peshawar	4.59	3.78	7.35	8.67	6.34	8.84	20.86	11.35	13.01
Quetta	3.80	4.23	9.55	8.34	6.22	8.93	19.02	11.25	11.36

Chapter 4

How Relative Price Variability is related with Unanticipated Inflation and Real Income?

4.1 Introduction

The relative price variability (RPV) and its relationship with other variables like inflation rate, income, and monetary expansion have got considerable attention in economic research, both theoretical and empirical, as the subject has important lessons for welfare cost of inflation and neutrality of monetary policy. While theoretical models, like menu-cost theory and model with asymmetric information, predict a positive association between inflation and RPV, the empirical evidence is mixed; some studies find insignificant while others find positive and significant relationship. Similarly some of the studies hypothesize a linear relationship while others find non-linear relationship. Cukierman (1983) has presented a comprehensive analytical survey of the subject.

A typical explanation[1] to support the relationship between RPV and inflation is that industries and sectors may differ in their speed of adjustment to nominal shocks. As changing prices is a costly process, individual commodity prices change only at discrete intervals. The fact that these intervals start at different points in time create divergence in relative prices. A second approach is based on differences in short-run supply elasticities across industries. If the short-run supply elasticity in one industry is smaller than that in another but the long-

[1]See Caraballo an Dabus (2008) for an account of various theoretical explanations on the relationship and a review of empirical studies.

run elasticities are similar, then a demand shift may result in a change in both aggregate and relative prices in the short run. The hypothesis of imperfect information for the relationship can be explained on the basis of the argument that the firms do not have access to full information for general price level, so they may signal extraction problem and may wrongly perceive changes in relative prices.

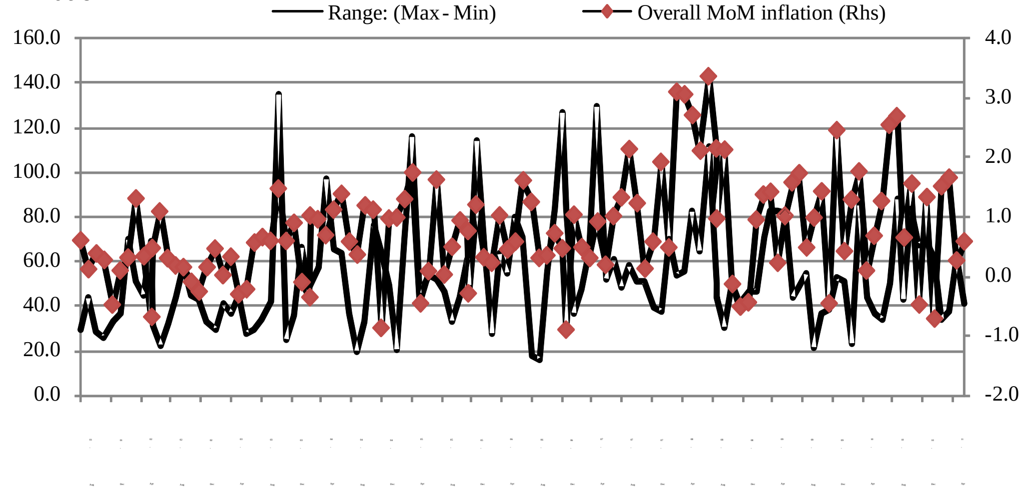
Apart from the nature of the relationship between RPV and inflation, the empirical studies also explored which component of inflation, expected inflation, unexpected inflation, or inflation variability, had more explanatory power for RPV. Park (1978), for example, found a positive relationship between RPV and unexpected inflation, while Lach and Tsiddon (1992) found that expected inflation had a stronger effect on price variability than unexpected inflation had. Grier and Perry (1996), on the other hand, showed that only ex-ante inflation uncertainty increased relative price variability.

A preliminary examination of price data in Pakistan also shows a link between the inflation and RPV. As shown in Figure 4.1, on average, overall CPI inflation in a given month and range of individual commodity price changes move together. However, despite the importance of the area and the fact that the issue has some relevance with regards to Pakistan, the literature on the subject is limited. Within this context this chapter of the thesis aims at estimating the relationship between RPV and inflation rate. More specifically, following Park (1978) [2], the relationship between unexpected inflation and real income is

[2] He used his framework to analyze the movements in consumer prices in United States during 1929-75 and Netherlands during 1921-63.

explored. Initially, a measure of changes in relative prices is constructed, using monthly data, and then its relationship is estimated with demand and supply factors, identified on the basis of a standard macroeconomic framework.

Figure 4.1: Range of Price Changes of Individual Commodities and Overall Inflation



For the case of Pakistan, a significant association between overall inflation and RPV was already documented by Akmal (2011); however, we have extended the work to examine the impact of unanticipated inflation and real income on RPV on the basis of a larger set of disaggregated price data.

In the next section of the chapter, we shall give a brief review of some papers having similarity with Park work for different countries and in different time periods. After that, we present the methodology, used in this chapter, in section 4.3. Results are explained in section 4.4 while the last section concludes the chapter.

4.2 Literature Review

Park's study prompted the debate on relationship between relative price changes and inflation, though a number of authors addressed this issue even before Park's study in 1978. For example, Glejser (1965) found inflation an important determinant of relative price changes (measured by weighted standard deviation) for 15 OECD countries during 1953-1959. A similar study was done by Okun (1971) that compared 17 OECD countries for the period 1951-68 and found a positive associatin between a country's average inflation and standard deviation of GDP deflator. Vining and Eltowerski (1976) concluded that variance of relative price changes was associated with general inflation variability (during 1947-1974) in US. They found such association for both wholesale and consumer price indices and calculated variance of relative price changes by taking every sub-index of the main series and calculating a variance for each point in time. However, their study was criticized for weaknesses in measures of both general price inflation and relative price variability.

Motivated by Park's study, Ashley (1981) used Granger causality tests to conclude that fluctuations in the inflation help cause fluctuations in relative prices, but not vice-versa. Cukierman and Wachtel (1982) used a framework that was also built on Park's work except that they allowed inflation expectations to vary across markets. Since equilibrium prices (and their rates of change) in different markets may differ, inflation expectations across markets may also vary. They showed that there may be a positive relationship between relative price variability and the variance of inflation expectations. They also showed that changes in the variance of either aggregate demand or supply shocks would cause increased relative price variability.

Frenkel (1982) studied the nature and direction of causality between relative price variability and inflation for Germany and US economies in order to understand the underlying process behind inflation and its social welfare cost. He found, while the link between unanticipated inflation and relative price variabilitywas strong in both the economies, it was weak in case of aniticipated component of inflation and relative price variability. By estimating a small VAR model, he also concluded that the relationship between relative variability and inflation stemmed mainly from policy responses to supply shocks.

Blejer(1983) examined the experience of Argentina having high inflation coupled with trade liberalization policies;and studiedthe response of relative commodity prices to inflationary pressures. He undertook a detailed analysis of monthly pricesof 61 componets of consumer price index between 1977 and 1981 and concluded that individual commodity prices hadfluctuated over a much wider range than the overall CPI – possibley implying menu-cost of inflation.He also noted a clear upward trend in the relative price of services, with a consequent reduction in the relative price of goods and food products. Among the factors affecting relative price variability, his study found that only unxpected components of inflation and monetary growth hadsignificant impacts, while the expected parts of these variables had insignificant coefficients.

Lach and Tsiddon (1992) analysed the effects of inflation on the dispersion of food prices in Isreal by using disaggregated data of 1978-84.

Contrary to other studies, they found that the effect of expected inflation on intramarket price variability was stronger than that of unexpected inflation. A similar result was obtained by Loy and Weaver (1998) in case of Russian food markets who showedthat it was anticipated inflation which induced distortions in relative prices instead of unanticipated inflation or inflation uncertainty.

Chang and Cheng (2000) examined a disaggregated data set of US prices in post-war period to explore the link between inflation and relative price variability. As a first step, they used a model to estimate inflation variability conditional on past unexpected inflation and past inflation variability. Then they related it to relative price variability; and found a positive relationship of RPV with both the inflation rate and inflation variability. They also concluded that the relation remained robust to oil-price shocks.

Ukoha (2007) estimated this relationship in case of Nigeria with a focused study of relative price volatility of agriculture commodities during 1970 to 2003. He also found a positive significant impact of overall inflation on relative price variability of agricultural commodities – both in the short run and the long run. On the basis of his results, he also suggested policies to prevent agriculture sector from adverse implications of inflation.

Recently, Choi (2010) presented new theoretical and empirical insights relating to the relationship between inflation and RPV on the basis of disaggregated CPI data for US and Japan. He found a non-linear and U-shape relationship between inflation and RPV. However, the relationship was not stable over time; instead it varied quite significantly with the changes in inflationary episodes or monetary policy regimes. Thus his findings are against the popular theoretical models of price setting like menu cost or imperfect information models which typically predict a positive association between inflation and RPV. Nonetheless, his result can be in line with an alternative theoretical explanation, i.e., Calvo sticky price model that incorporates sectoral heterogeneity in price rigidity.

A similar U-shape relationship between RPV and inflation was also found by Akmal (2011) in case of Pakistan. He also found that threshold level of inflation in terms of RPV varied with general inflationary phases, i.e., in period of high inflation, the threshold inflation is also high and vice versa. There is hardly any other study on this subject in case of Pakistan. We have re-examined this relationship; however, our study is different from Akmal (2011) in three aspects: (a) we have used more detailed data, i.e., 92 composite items of monthly consumer price index compared with 12 broad groups used in Akmal (2011); (b) we have examined the impact of unanticipated inflation as well as overall inflation on RPV; and (c) we have also studied the impact of real income, as a demand factor, under macroeconomic framework as suggested by Park (1978).

4.3 Methodology

For the analysis we have taken prices of composite commodities (92 in CPI of Pakistan) as ratio of overall CPI. The rate of change of the i^{th} commodity's relative price is calculated as $Dp_{it} - DP_t$; where p_{it} is the index of the i^{th} commodity in time period t, P_t is overall consumer price index, which is a weighted average of individual price indices (i.e., $P_t = \sum_{i=1}^{92} w_i \; p_{it}$), w_i is weight assigned to i^{th} commodity in the CPI basket (such that $\sum w_i = 1$), and D represents the first difference of natural logarithm of the indices.

While the average of rates of change in relative prices is zero, by definition, we take, following Park (1978), the variance of these changes as a measure of the degree of relative price variability. It is calculated as a weighted sum of the squared deviations of the individual rates of price change around the average, that is:

$$V_t = \sum_{i=1}^{92} w_i (Dp_{it} - DP_t)^2 \qquad (4.1)$$

V_t (variance of relative price changes) is also a measure of non-proportionality of the price movements; if all prices change by the same rate then the variance of relative price changes will be zero. Moreover, its values will be higher, the more non-proportional the price changes are across commodities. We calculated both the DP_t (overall inflation) and V_t from the data set of monthly indices of 92 composite commodities. Our data set covering a ten year period contain episodes of rising and lowering prices. Different items in CPI may respond differently to changing overall inflationary conditions. For instance, prices of food items are, more or less, equally flexible upward and downward but that of industrial products are more rigid in the downward direction. Therefore, two different specifications are used to estimate relationship between relative price variability and the overall inflation rate, as given below:

$$V_t = a + b(DP_t)^2 + u_t \quad (4.2)$$

[3]

$$V_t = a + b_+\left(DP_t{}^+\right)^2 + b_-(DP_t{}^-)^2 + u_t \quad (4.3)$$

Where $DP_t{}^+$(or $DP_t{}^-$) represents positive (or negative) price change. The second specification allows us to differentiate the degrees of response to inflation (positive price changes) and deflation (negative price changes).

The above model is supposed to present preliminary evidence of the (non)existence of certain kind of association between relative price variability and inflation. To understand more deeply the nature of relationship between unexpected inflation and income a rather rigorous model is needed. To derive this model, let's assume that q_{it} is the quantity of the i^{th} commodity supplied in period *t;* the supply function of this commodity can be written as follows:

$$\ln q_{it} = a_i + b_i ln(p_{it}/P_t^*) + c_i T \quad (4.4)$$

WhereP_t^* is anticipated level of overall consumer price index, and T represents trend variable. a_i , b_i and c_i represent supply side parameters. For a positively sloped supply function, $b_i > 0$.

The demand function is specified as below:

$$\ln q_{it} = d_i + e_{ii} \ln(p_{it}) + f_{io} \ln(m_t) \quad (4.5)$$

[3] Before estimating quadratic form of the relationship, we have estimated linear form of the relationship and then using plot of observed value against predicted values, we have determined nonlinearity of the relationship.

Where $m_t$is nominal income, e_{ii} is the own-price elasticity, and f_{io} is the income elasticity of demand. For simplicity, we ignore cross-price elasticities and assume the sum of income elasticity and own price elasticity is zero to maintain homogeneity. For negatively sloped demand function, $e_{ii} < 0$.

By taking first differences of the logarithmic forms of the above supply and demand functions and solving for reduced form equations under market clearing assumption, we obtain the following:

$$Dp_{it} = k_i(-e_{ii}Dm_t + b_iDP_t^* - c_i) \quad (4.6)$$

$$Dq_{it} = e_{ii}k_i(-b_iDm_t + b_iDP_t^* - c_i) \quad (4.7)$$

Where $k_i = 1/(b_i - e_{ii})$. The above model implies that anticipated overall inflation positively affects price changes of individual commodities and negatively affects quantities, while income has positive effect on both price and quantity. However, the magnitude of any specific effect depends on the size of supply and demand elasticities.

From equation (4.6), we can obtain the relative price changes for individual commodities by subtracting DP_t (overall inflation) from both sides of the equation; i.e.

$$Dp_{it} - DP_t = k_i(-e_{ii}Dm_t + b_iDP_t^* - c_i) - DP_t \quad (4.8)$$

$$Dp_{it} - DP_t = k_i((-e_{ii}Dm_t + b_iDP_t^* - c_i) - \left(\frac{1}{k_i}\right)DP_t)$$

$$Dp_{it} - DP_t = k_i((-e_{ii}Dm_t + b_iDP_t^* - c_i) - (b_i - e_{ii})DP_t)$$

$$Dp_{it} - DP_t = k_i(-e_{ii}Dm_t + b_iDP_t^* - c_i - b_iDP_t + e_{ii}DP_t)$$

$$Dp_{it} - DP_t = k_i(-e_{ii}(Dm_t - DP_t) - b_i(DP_t - DP_t^*) - c_i)$$

$$Dp_{it} - DP_t = k_i(-e_{ii}\, g_t - b_i\, n_t - c_i) \quad (4.8a)$$

Where $g_t = (Dm_t - DP_t)$ is real income growth and $n_t = (DP_t - DP_t^*)$ is unanticipated inflation.

By combining equations (4.1) and (4.8a), we can decompose the determinants of relative price variance into supply and demand parameters involving real growth and unanticipated inflation, as given below:

$$V_t = \sum w_i \, (Dp_{it} - DP_t)^2 = \sum w_i \, k_i^2 (-e_{ii} \, g_t - b_i \, n_t - c_i)^2 \qquad (4.9)$$

The equation (4.9) gives us the following quadratic equation (linear in parameters) which can be estimated through ordinary least squares method:

$$V_t = \alpha_0 + \alpha_1 g_t^2 + \alpha_2 n_t^2 + \alpha_3 \, g_t n_t + \alpha_4 g_t + \alpha_5 n_t \qquad (4.10)$$

The coefficients of the above equation (i.e.,α_0, α_1, α_2, α_3, α_4, α_5) are function of weights of individual commodities (w_i) and parameters of the model (e_{ii}andb_i).

While we have detailed price data for computing variance of relative prices (V_t) and real income as discussed above, we need some operational definition of unanticipated inflation (n_t) in order to estimate the above equation. Park uses a simple time series model of the form $DP_t = DP_{t-1} + \mu + \varepsilon_t$ to get a measure of unanticipated inflation.

4.3.1 Measurement of Anticipated Inflation Rate

We have developed a uni-variate ARIMA model on actual price level and used its fitted values as a measure of anticipated inflation. Difference between the actual and the fitted values is un-anticipated inflation. We take log of overall CPI, food and non-food price indices from July 2001 to June 2011. In order to find the stationarity property of time series, we apply Augmented Dickey Fuller (ADF) test to all three series (see Annexure E) and found that at level, all series are non-stationary but at first difference they are stationary. Thus all the series are integrated of order one [i.e. I(1)]. So we have constructed ARIMA instead of ARMA model.

The ARIMA model has been used extensively in time series analysis ever since the publication of "Time Series Analysis: Forecasting and Control" by Box and Jenkins. The popularity of this model, also known as the Box- Jenkins methodology, is based on the philosophy "let the data speak for itself". Stevenson and Mcgarth (2003) considered the model as theoretical, implying that it ignores all other potential theories except the ones that are related to the variable under study. The generalized ARIMA model with p, d, q (ARIMA(p,d,q)) has the following specification:

$$\Delta y_t = \alpha + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \cdots \dots\dots . + \beta_p y_{t-p} + \gamma_1 \in_{t-1} + \gamma_2 \in_{t-2} + \cdots \dots\dots . + \gamma_q \in_{t-q}$$

Where α and ∈ denotes the constant and error term respectively. The lagged autoregressive (AR) process are symbolized by p and that of a moving average (MA) process are symbolized by q, and d being the integrating order of the series.

We have selected the parsimonious models (on the basis of AIC) as ARIMA(3,1,3) for log of overall CPI, ARIMA(3,1,2) for log of food price index and ARIMA(4,1,4) for log CPI of non-food group (see Annexure D).

Estimated ARIMA model for log of Overall CPI (Lo) is:

$$D(Lo) = 0.01 - 0.84Lo_{t-1} + 0.33Lo_{t-2} + 0.33Lo_{t-3} + 1.06 \in_{t-1} + 0.01 \in_{t-2} - 0.57 \in_{t-3}$$

Estimated ARIMA model for log of CPI of food group (Lf) is:

$$D(Lf) = 0.01 - 0.69Lf_{t-1} + 0.62Lf_{t-2} + 0.89Lf_{t-3} + 0.77 \in_{t-1} - 0.73 \in_{t-2} - 0.99 \in_{t-3}$$

Estimated ARIMA model for log of CPI of non-food items (Lnf) is:

$$D(Lnf) = 0.01 + 0.36Lnf_{t-1} + 0.36Lnf_{t-4} + 0.39 \in_{t-3} - 0.36 \in_{t-4}$$

We have taken care of time series properties of the variables included in the model and found them appropriate to be used in ordinary least square regressions (see Annexure E & F).

4.4 Data

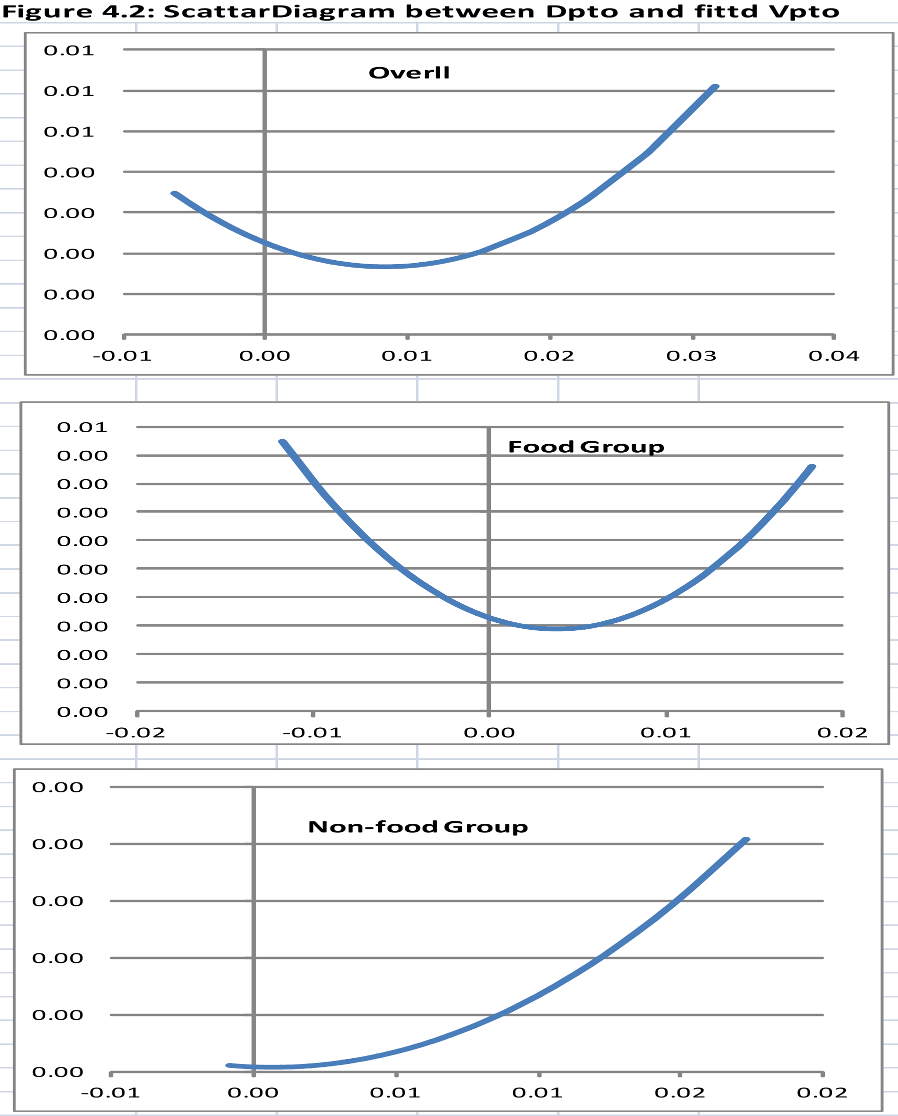
The price data have been obtained from Pakistan Bureau of Statistics (PBS), which releases two sets of price data; prices of 374 commodities in consumer basket (2000-01 base), and 92 composite indices whereby similar commodities are grouped together. PBS published prices of 374 commodities by city level, but weights of these commodities are not made public, whereas weights of 92 composite commodities are published. Since for our work, we need both price indices as well as their respective weights, so we have used 92 composite indices for overall, food and non-food groups (see Annexure B & C). The data used in this study span over the period of July 2001 to June 2011. We have used large scale manufacturing (LSM) index as a proxy of real income.[4]

[4] GDP or other components of GDP are not available in monthly frequency in Pakistan. However, LSM has close proximity as it has strong backward linkages with agriculture sector and forward linkages with services sector – including trade, transport and financial services.

4.5 Results

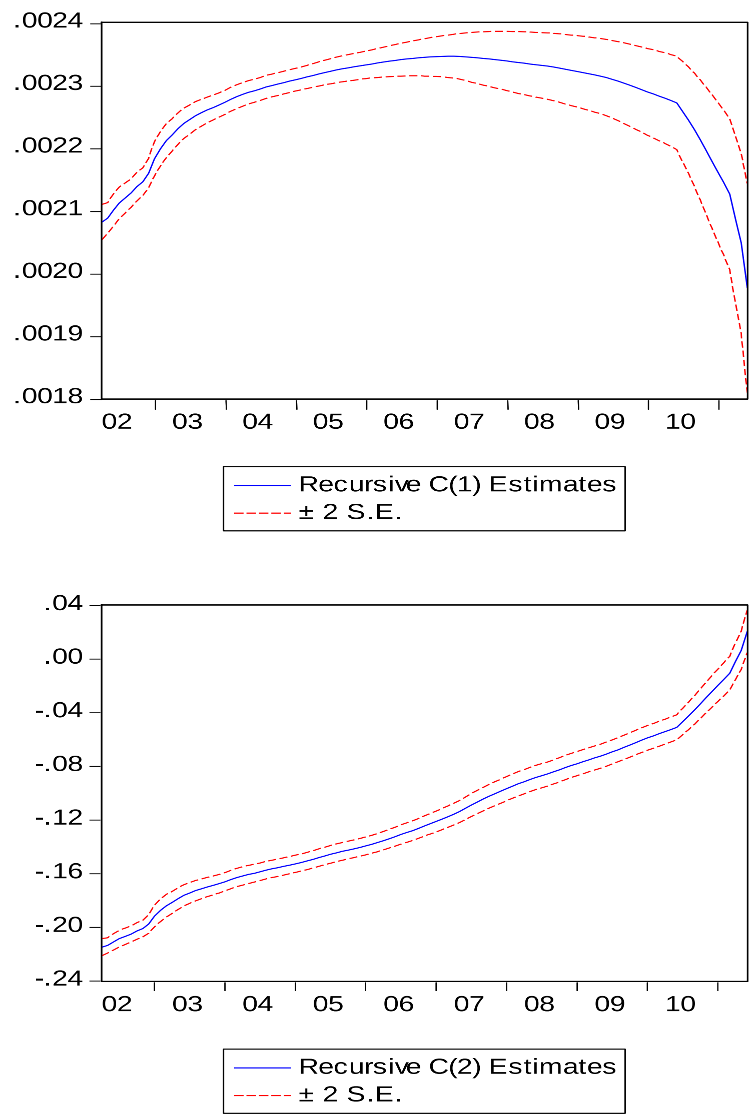
Before estimating the relationship given equations 4.2 and 4.3 we have estimated linear form of the relationship between inflation rate and RPV and then plotted fitted values of RPV against the observed values of inflation rate. Result in figure 4.2 clearly indicates that the relationship is u-shaped and RPV changes nonlinearly with respect to different values of inflation rate. Similarly we found nonlinear relationship in case of food and non-food groups.

Figure 4.2: ScattarDiagram between Dpto and fittd Vpto



As an additional measure, we have also estimated the recursive estimates of the coefficient of squared inflation rate in the linear regression. Results in figure 4.3 indicate that this coefficient is not stable over the sample period and varied in different samples due to different inflation rate in that sample period. The constant is also not stable over the sample period.

Figure 4.3: Recursive Estimates of Regression Coefficients



We have estimated relationship between relative price variability and inflation, based on models (4.2) and (4.3), and results are summarized in Table 4.1[5]. Interestingly, consistent with Park (1978) evidence for Netherland, we have also found that the association between relative price variability and the inflation rate is stronger in periods of price declines than that for the periods of price increase. It is noteworthy however, that price decreases are less common in our sample – only 17 instances of negative price changes out of 119 observations – which indicates downward price rigidity. However, their impact on relative price variance is high. One possible explanation of this finding is that most price decreases are related to food items which have strong seasonality in prices, whereas, other prices do not adjust proportionally. As a result, relative price variance becomes higher.[6] This explanation is substantiated by estimating the same equations (4.2 and 4.3) for food and non-food groups separately. The impact of price deflation on the variance reduces sharply (the coefficient reduces from 110.49 for overall basket to 30.16 for food group), which indicates seasonal price declines in food items bring proportional change in prices of the whole food group and thus have lesser impact on the group's relative price variance. In a sharp contrast to it, the coefficient of price deflation in case of non-food group increases sharply (from 110.49 to 337.51), which indicates lackluster proportional declines in prices of such items.

[5] We have tested stationary of residuals in all regressions. In all cases residuals are found to be stationary. Therefore, the results in the table are not spurious.

[6] There were 30 instances of negative price changes in food index while only 5 in non-food index.

Table 4.1: Regession Results: Dependent Variable = VPt
(Equation 4.2 and 4.3)

	For Overall		For Food Group		For Non-food Group	
Constant	0.002	0.002	0.002	0.001	0.00002	0.00001
	(11.181)	(10.020)	10.026)	(9.362)	(0.633)	(0.395)
(DP)^2	2.702		7.289		6.612	
	(3.235)		(3.945)		(9.259)	
(DP+)^2		3.330		7.084		6.692
		(4.333)		(3.929)		(9.436)
(DP-)^2		110.492		30.164		337.511
		(5.211)		(4.794)		(1.216)
DW	1.789	1.636	1.663	1.516	1.821	1.822
$\bar{R}^2$	0.082	0.250	0.117	0.213	0.423	0.430
F-statistics	10.467	19.283	15.565	15.729	85.720	43.725

Note: Student t-values are in parentheses

R^2On the other hand, price increases (as well as overall inflation) have more profound impact on relative price variance in case of food group compared with non-food. It implies increase in certain food prices cause relatively less proportional changes in prices of other items while increases in non-food prices drive other prices upward with a higher proportion.

The relationship between RPV and inflation very much depends on state of the economy, especially the stages of business cycle. During the sample period of this thesis, Pakistan economy passed through phases of boom and recession. Therefore, the estimated relationship may depend on the stage of business cycle. The results of above regression, therefore, may face omitted variable bias. To avoid this bias and to control the effect of business we have included output gap variable in the regression. Results in table 4.2 indicate that the effect of output gap on RPV is insignificant. Moreover, the important point to note is that the coefficient of squared inflation rate does not change even after controlling the effect of business cycle. The reason for this finding could be that inflation in Pakistan is less affected by output gap and it predominated by past values of inflation rate. Moreover, a significant number of prices in CPI is controlled by government and that does not reflect market conditions. Therefore, the weak relationship between inflation rate and output gap make coefficient of squared inflation unchanged.

Table: 4.2 Result of relationship between VPt & DPt with GAP

Dependent Variable: VPTO
Method: Least Squares
Date: 11/11/16 Time: 19:06
Sample: 2001M08 2011M06
Included observations: 119

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0018	0.0002	11.1168	0.0000
DPTO^2	2.7130	0.8415	3.2241	0.0016
GAP	-0.0005	0.0034	-0.1610	0.8724

R-squared	0.0823	Mean dependent var	0.0021
Adjusted R-squared	0.0665	S.D. dependent var	0.0015
S.E. of regression	0.0015	Akaike info criterion	-10.1576
Sum squared resid	0.0003	Schwarz criterion	-10.0875
Log likelihood	607.38	Hannan-Quinn criter.	-10.1291
F-statistic	5.2029	Durbin-Watson stat	1.7915
Prob(F-statistic)	0.0069		

To make sure, we have also constructed a dummy variable indicating boom and recession on the basis of positive and negative values of output gap. We estimated the regression again by using interaction term of squared inflation rate and dummy for boom and recession. Results in table 4.3 indicate that the coefficient in case of recession is somewhat higher than that in recession. However, the difference between the two coefficients seems insignificant. We, therefore, applied test of equality of coefficients and results indicate that the difference between coefficients of squared inflation rate in boom and recession is statistically insignificant. This reconfirms the finding in table 4.2.

Table: 4.3 Results of relationship between VPt & Dpt for Boom and Recession

Dependent Variable: VPTO
Method: Least Squares
Date: 11/11/16 Time: 19:03
Sample: 2001M08 2011M06
Included observations: 119

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0018	0.0002	10.9017	0.0000
DPTO^2*DRESS	2.8963	1.5067	1.9223	0.0570
DPTO^2*DBOOM	2.6489	0.9052	2.9263	0.0041
R-squared	0.0823	Mean dependent var		0.0021
Adjusted R-squared	0.0665	S.D. dependent var		0.0015
S.E. of regression	0.0015	Akaike info criterion		-10.1576
Sum squared resid	0.0003	Schwarz criterion		-10.0875
Log likelihood	607.37	Hannan-Quinn criter.		-10.1291
F-statistic	5.2019	Durbin-Watson stat		1.7928
Prob(F-statistic)	0.0069			

Wald Test:
Equation: EQ01

Test Statistic	Value	df	Probability	
F-statistic	0.024139	(1, 116)	0.8768	(equality accept)
Chi-square	0.024139	1	0.8765	

Null Hypothesis Summary:
Normalized Restriction (= 0)

C(2) - C(3)	Value	Std. Err.
Restrictions are linear in coefficients.	0.247409	1.592417

The above results do not help us figuring out the effects of unanticipated inflation and real variables in a standard demand-supply framework. However, estimation results of equation (4.10) give important insights in this regard, as reported in Table 4.4. The coefficients of real income are statistically insignificant for all the three equations, i.e., for variance of relative prices of overall CPI basket, food group and non-food group. Nonetheless, the unanticipated inflation strongly affects relative price variations. The nature of relationship between RPV and unexpected inflation is the same U-shape as found by Akmal (2011) for actual inflation and RPV. In case of overall CPI, unanticipated inflation, when it is below 0.6 percent, affects RPV negatively while the effect is positive for higher than 0.6 percent unanticipated inflation rate. The turning points for food and non-food groups are -0.3 percent and -0.7 percent, respectively.

Moreover, the supply side factors, represented by the intercept, also have significant positive effect on relative price variability, though the impact is not very strong.

Table 4.4: Regression Results: Dependent Variable=VPt (Equation 4.10)

	Overall	Food Group	Non-food Group
Constant	0.0019	0.0016	0.0004
	(10.996)	(9.731)	(7.031)
g_t^2	-0.0013	0.0031	-0.0026
	-(0.076)	(0.205)	-(0.678)
$g_t \hat{n}_t$	6.6931	14.3839	7.7038
	(3.744)	(5.161)	(4.230)
$g_t n_t$	-0.2199	-0.1030	0.0844
	-(0.865)	-(0.373)	(0.582)
g_t	0.0008	-0.0020	0.0007
	(0.319)	-(0.908)	(1.031)
n_t	-0.0779	0.0962	0.1010
	-(2.519)	(3.230)	(8.818)
DW	1.598	1.477	1.859
R^2	0.169	0.242	0.430

Note: Student t-values are in parentheses

4.6 Conclusion

The study of relative price variability has been the subject of considerable interest for past several decades as it not only gives insights into price setting mechanism in an economy but also is considered as an indicator of supply shocks. Moreover, the nature of relationship between inflation and relative price variability has useful policy implications. For the case of Pakistan, a significant association between overall inflation and RPV was already documented by Akmal (2011); however, we have extended the work to examine the impact of unanticipated inflation and real income on RPV on the basis of a larger set of disaggregated price data. In this study, we have followed Park (1978) methodology which has been developed over a macroeconomic framework.

We have found that changes in real income have insignificant impact on relative price variability. The results make sense as changes in income (with given preferences) almost evenly affect demand for all consumer items, which may lead to relatively proportional changes in their prices. It is possible particularly in a developing economy like Pakistan, having a large informal sector, where response of firms is less constrained by wage contracts and where capacity issues are less heterogeneous. On the other hand, unanticipated inflation, which usually comes from item-specific supply factors, may affect prices of different items unevenly before it is fully transmitted to general inflation.

The results suggest a careful macroeconomic policy for price stability, as the impact of inflation (determined by demand management) on relative price variability is not found significant. However, the results do not exclude the possible influence of demand factors on rate of inflation as such. This research can be extended further to estimate the impact of specific supply factors, like administered prices and exchange rate movements, along with demand factors on relative price variability.

Chapter 5

Effects of Relative Price Changes on Inflation: Evidence from Panel Data of Pakistani Cities

5.1 Introduction

According to the classical theory, inflation is determined primarily by demand factors (like money supply) and it has hardly any association with relative price changes. However, supply shocks of 1970s, accompanied with higher inflation rate and lower economic growth rate lead economists to explore other determinants of price changes. The subsequent research established a positive relationship between inflation rate and distribution of relative price changes. However, there is still no conclusive empirical or theoretical exposition regarding casual relationship between the two. The nature of the relationship between the relative price variability and inflation rate are categorized into three groups viz. inflation rate affects relative price variability; relative price variability is exogenous and it affects inflation rate; and both the variables affect each other. There are a number of papers in support of all the three possibilities.[7]

While establishing the relationship between these two variables, most of the studies use time series data on overall prices, some have used panel data at more disaggregated level. For example, Nath (2004) take US cities data to show the positive correlation between inflation rate and relative price variability.

[7] See for example Glejser (1965), Wolozin (1959), Parks (1978), Ashley (1981), Assarsson (1986), Reinsdorf (1994), Ball L & Mankiw N G (1999), Chang & Cheng (2000), Nautz el at (2006), Chi-Yong Choi (2010), and etc.

Similarly, Ball and Mankiw (1995) also worked on city-level prices data of US to test supply-side theory of inflation. They took relative price changes as indicator of supply shocks, and found a typical nature of the relationship between inflation rate and relative price variability. Moreover, large shocks affect price levels disproportionately due to costly price adjustment. Therefore, overall inflation rate depends on the distribution of relative-price changes such that inflation rate rises when the distribution is skewed to the right, and falls when it is skewed to the left. They argued that the existence of such relationships is "a novel empirical prediction" of a menu costs model. Ball and Mankiw (1995) estimated several regressions with the aggregate inflation rate as the dependent variable and lagged inflation rate, standard deviation of relative price changes, skewness of price changes, and the interaction of standard deviation and skewness as explanatory variables. They found significantly positive effects of standard deviation and skewness of relative price changes on overall inflation rate.

In Pakistan there are studies available on determinants of inflation rate. For instance, Akbari and Rankaduwa (2005) highlighted the role of transparency, independence and reduction in fiscal deficit as determinant of inflation rate. Khan and Schimmelpfennig (2006) find that monetary factors have played a dominant role in inflation and changes in the wheat support price influence inflation in the short run, but not in the long run. Khan et al (2007) finds that the most important determinants of inflation in Pakistan are adaptive expectations, private sector credit and rising import prices and fiscal policy contributes little to inflation rate. Bashir et al (2011) find that in the long run consumer price index is positively influenced by money supply, gross domestic product, imports and government expenditures while government revenues reduce price level in Pakistan. Aurangzeb and Haq (2012) put forward that exchange rate, interest rate, fiscal deficit and unemployment have positive effect on inflation rate in Pakistan. Ahmed et al (2013) find that GDP, M2, energy crises, imports and current government expenditures, output gap and adaptive expectation generate inflation; however, development expenditures negatively affect inflation. Ahmed et al (2014) explores the short and long run dynamics of inflation in Pakistan and found that Consumer Price Index, Exchange Rate, Government Borrowing, Non-Government Borrowing, Real GNP, Indirect Taxes, Growth Rate of Money Supply, Import Price Index, Real Demand relative to Real Supply and Wheat Support Price are cointegrated. Ghumro and Memon (2015) find money supply, exchange rate, total reserve, and the gross national expenditure as significant determinants of inflation in Pakistan.

However, there is not a single study that relates inflation rate in Pakistan with the distribution of relative price changes. Therefore, keeping in view the importance of the topic this study contributes to existing empirical literature on determinants of inflation rate in Pakistan. Following Ball and Mankiw (1995), we attempt in this chapter to explain the impact of distribution of relative price changes on inflation rate (which is also referred to supply-side theory of inflation) in case of a developing country, like Pakistan. It will help us to determine if the response of inflation rate to price distribution is more general or specific to a particular economy.

We have also shown that unanticipated inflation affects relative price changes (Ghauri et al, 2014). In this study we test the other direction of causality, effect of relative price changes distribution on overall inflation rate, and highlight the mechanism through which unanticipated inflation affects actual inflation; unanticipated inflation affects relative price changes, which in turn has influence on actual inflation rate.

5.2 Methodology

Let $P_{j,t}$ be the consumer price index (weighted average of all 92 composite items) in city *j*, and time *t*. Inflation rate in a city is defined as:

$$DP_{j,t} = \ln P_{j,t} - lnP_{j,t-1} \qquad (5.1)$$

Relative price variability (RPV) for the city *j* in time *t* is defined as:

$$VP_{j,t} = \sqrt{\sum_{i=1}^{n} w_{i,j}\left(DP_{i,j,t} - \overline{DP}_{j,t}\right)^2} \qquad (5.2)$$

Where $\overline{DP}_{j,t} = \sum_{i=1}^{n} w_{i,j} DP_{i,j,t}$ is the mean price change (averaged across consumption items, represented by *i*) in city *j* in period *t*. This variable is essentially the standard deviation of price changes. Skewness of price changes for city j in period *t* is defined as follows:

$$SP_{j,t} = \sum_{i=1}^{n} w_{i,j}\left(\frac{DP_{i,j,t} - \overline{DP}_{j,t}}{VP_{j,t}}\right)^3 \qquad (5.3)$$

Where $w_{i,j}$is the relative weight of item i and city j and $\sum_{i=1}^{n} w_{i,j} = 1$.

Before explaining the model, which has been estimated, it is noteworthy that both the inflation rate as well as relative price changes are influenced by overall macroeconomic factors. Therefore, researchers preferably remove their impacts before using these variables in their models. For example, Debelle and Lamont (1997) and Nath (2004) use this data in deviation form by subtracting the US national values of inflation rate and the measures of relative price variability from the corresponding city level values for each year. While we have also experimented with this approach in case of Pakistan, we preferred adding macroeconomic control variables (real GDP growth rate, M2 and exchange rate) to the basic model with variables without deviation forms. The reason for this preference is large differences in level of developments in Pakistani cities whereby macroeconomic factors are less likely to have uniform effects across cities.

The following model has been used to estimate the impact of dispersion and skewness of relative price changes on inflation rate:

$$DP_{j,t} = \sum_{j}^{m} \gamma_j + \sum_{t=1}^{T-1} \tau_t + \beta_1 VP_{j,t} + \beta_2 SP_{j,t} + \beta_3 VP_{j,t} * SP_{j,t} + \beta_4 \Delta Exh_{j,t} + \beta_5 \Delta Lsm(-1)_{j,t} + \beta_6 \Delta M2_{j,t} \qquad (5.4)$$

Where $DP_{j,t}$, $VP_{j,t}$ and $SP_{j,t}$ are, respectively, inflation rate, relative price variability and skewness of inflation rate. Lsm, *Exh* and *M2* are, respectively, percent changes in monthly Large Scale Manufacturing index (a proxy for growth rate), exchange rate and broad money supply. γs are the city-specific dummies and *m* is the number of cities; τs are the monthly dummies with *T* number of months. The interaction term is included in order to allow for the possible effect of interaction between RPV and skewness of relative price changes on inflation. This model has been estimated separately for overall inflation rate, food inflation rate, and non-food inflation rate by using fixed effect model technique. The selection of fixed effect model is made by applying Hausman[8] Test. This test is developed to explore the choice between fixed effects and random effects models. The null hypothesis (Ho) of no correlation, both OLS and GLS are consistent, but OLS is inefficient, against the alternative hypothesis (Ha) that OLs is consistent whereas GLS is not. The advantage of the use of the fixed effect estimator is that it is consistent even when the estimators are correlated with the individual effect. The Hausman test uses the following test statistics:

$$H = (\hat{\beta}^{FE} - \hat{\beta}^{RE})'[Var(\hat{\beta}^{FE}) - Var(\hat{\beta}^{FE})]^{-1}(\hat{\beta}^{FE} - \hat{\beta}^{RE}) \sim \chi^2(\mathrm{k}) \quad \text{…………(5.5)}$$

If the value of the statistics is large, the difference between estimates is significant, so we reject the Ho concluding that the use of fixed effect estimator is appropriate. Alternatively, a small value for the Hausman statistic implies that the random effects estimator is more appropriate[9]. The result of Hausman test revealed that we can use fixed effect model in order to estimate model 5.4 and others (for result see annexure G).

Besides estimating full forms of the above model (5.4), we have also attempted some other specifications by changing combinations of regressors as follows:

$$DP_{j,t} = \sum_{j}^{m} \gamma_j + \sum_{t=1}^{T-1} \tau_t + \beta_1 VP_{j,t}$$

……………………………………………………………………………(5.4a)

$$DP_{j,t} = \sum_{j}^{m} \gamma_j + \sum_{t=1}^{T-1} \tau_t + \beta_1 SP_{j,t}$$

……………………………………………………………………………(5.4b)

[8] Hausman(1978), Specification tests in econometrics, Econometrics, Vol. 46, No. 6, pp 1251 - 1271

[9] This theoretical concept is taken from Applied Econometrics, 2nd Edition, by Dimitrios Asterious and Stephen G. Hall

$$DP_{j,t} = \sum_{j}^{m} \gamma_j + \sum_{t=1}^{T-1} \tau_t + \beta_1 VP_{j,t} + \beta_2 SP_{j,t}$$
……………………………………………………………………(5.4c)

$$DP_{j,t} = \sum_{j}^{m} \gamma_j + \sum_{t=1}^{T-1} \tau_t + \beta_1 VP_{j,t} + \beta_2 SP_{j,t} + \beta_3 VP_{j,t} * SP_{j,t}$$
……………………………………………………………………(5.4d)

$$DP_{j,t} = \sum_{j}^{m} \gamma_j + \sum_{t=1}^{T-1} \tau_t + \beta_1 VP_{j,t} + \beta_2 SP_{j,t} + \beta_3 VP_{j,t} * SP_{j,t} + \beta_4 \Delta Exh_{j,t} + \beta_5 \Delta Lsm(-1)_{j,t}$$
……………………………………………(5.4e)

$$DP_{j,t} = \sum_{j}^{m} \gamma_j + \sum_{t=1}^{T-1} \tau_t + \beta_1 VP_{j,t} + \beta_2 SP_{j,t} + \beta_3 VP_{j,t} * SP_{j,t} + \beta_4 \Delta Exh_{j,t} + \beta_5 \Delta Lsm(-1)_{j,t} + \beta_6 \Delta M2_{j,t}$$
…………………………………(5.4f)

$$DP_{j,t} = \sum_{j}^{m} \gamma_j + \sum_{t=1}^{T-1} \tau_t + \beta_1 VP_{j,t} + \beta_2 SP_{j,t} + \beta_3 VP_{j,t} * SP_{j,t} + \beta_4 \Delta M2_{j,t}$$
…………………………………………………………..(5.4g)

$$DP_{j,t} = \sum_{j}^{m} \gamma_j + \sum_{t=1}^{T-1} \tau_t + \beta_1 VP_{j,t} + \beta_2 SP_{j,t} + \beta_3 VP_{j,t} * SP_{j,t} + \beta_4 \Delta Lsm(-1)_{j,t} + \beta_5 \Delta M2_{j,t}$$
…………………………………………..(5.4h)

$$DP_{j,t} = \sum_{j}^{m} \gamma_j + \sum_{t=1}^{T-1} \tau_t + \beta_1 VP_{j,t} + \beta_2 SP_{j,t} + \beta_3 VP_{j,t} * SP_{j,t} + \beta_4 \Delta Exh_{j,t} + \beta_5 \Delta M2_{j,t}$$
…………………………………………..……(5.4i)

The regression results have been reported in Table 5.2 to Table 5.4 for overall inflation rate, food inflation rate, and non-food inflation rate.

5.3. Data

The city level monthly prices of consumer items, included in CPI basket were obtained from the Pakistan Bureau of Statistics (PBS). The CPI basket consists of 374 commodities for 35 cities. While PBS publishes city-wise prices of these 374 items, it does not release their individual weights in the basket. On the other hand, it publishes composite indices of 92 commodities along with their weights but these indices are not available at city level. For this research, we need city-wise price information of consumer items along with their weights. Thus we first compiled 92 composite indices from prices of 374 items for all cities following the same structure as used by the PBS (see Annexure B for list of 374 commodities and 92 composite indices). Then these city-wise composite indices with weights were used in the analysis (see Annexure C & D for list of 92 composite items with weights and cities). The period for this study is from July 2001 to June 2011.

An account of summary statistics of these variables is given in Table 5.1. The table shows that average inflation rate of food group has been considerably higher than that of non-food group during the period of study. Moreover, the food inflation rate has higher variation than that of the non-food inflation rate. Therefore, the relative price changes of food items have higher RPV and lower skewness than those in non-food items. It is found that relative price changes of non-food items are generally skewed left.

Table 1 - Summary Statistics of Inflation, Relative Price Variability and Skewness of Price Changes July 2001 to June 2011

	Overall for Pakistan			Average of 35 Pakistan Cities		
	Inflation	Relative Price Variability	Skewness of Price Changes	Inflation	Relative Price Variability	Skewness of Price Changes
Overall Group						
Mean	0.0074	0.0475	0.1592	0.0076	0.0638	0.2970
Standard Deviation	0.0081	0.0158	4.6333	0.0104	0.0225	4.3345
Minimum	-0.0135	0.7459	-0.0286	-0.0246	0.0129	-13.0266
Maximum	0.0321	0.0964	10.2590	0.0586	0.1715	14.1763
Observations	119	119	119	4165	4165	4165
Food Group						
Mean	0.0090	0.0709	0.0265	0.0090	0.0907	0.1112
Standard Deviation	0.0173	0.0244	3.1127	0.0208	0.0321	3.0113
Minimum	-0.0441	0.7818	0.0142	-0.0523	0.0164	-9.0122
Maximum	0.0490	0.1504	7.6914	0.1024	0.2404	8.6317
Observations	119	119	119	4165	4165	4165
Non-food Group						
Mean	0.0064	0.0134	1.6464	0.0064	0.0197	2.3151
Standard Deviation	0.0050	0.0106	3.4548	0.0060	0.0142	3.6986
Minimum	-0.0015	3.0761	-0.2884	-0.0199	0.0013	-16.9185
Maximum	0.0289	0.0779	11.7680	0.0396	0.1767	24.9980
Observations	119	119	119	4165	4165	4165

Note: Price changes are calculated by taking first log differences of CPIs.

5.4 Empirical Results

The results give evidence of positive relationships between relative price changes and inflation rate for all the three groups (i.e., overall CPI, food group and non-food group). In case of overall inflation (based on full CPI basket), an increase in one standard deviation of relative price variability ($VP_{j,t}$) leads to 0.11 percent points increase in inflation rate as per first specification of the model, having only one regressor.[10] However, the impact is robust to different specifications of the model, i.e., models including skewness, interaction of skewness and relative price variability, and macroeconomic variables. On the other hand, the coefficients of skewness become insignificant when interaction term and macro variables are introduced in the models. However, the skewness still affects overall inflation rate through interaction with relative price variability.

Among the nine specifications, the one reported in column 7 of the Table 5.2 has the highest explanatory power. The results of this model show that one standard deviation increase in relative price variability causes 0.13 percentage points increase in overall inflation rate, after taking into account the impact of macroeconomic variables.[11] Interestingly, this model shows that exchange rate changes and M2 growth have significant positive effect on inflation rate, while production growth (represented by LSM) negatively affects the inflation rate.

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[10] The impact is calculated as a product of average standard deviation of relative price variability (average of 35 Pakistani cities) as given in Table 5.1 and the estimated coefficient of $VP_{j,t}$ as given in Table 5.2 (column 2).

[11] As this specification of the model also includes an interaction term ($VP_{j,t} * SP_{j,t}$), the impact is calculated by multiplying standard deviation of relative price variability with the sum of estimated coefficients of $VP_{j,t}$ and $VP_{j,t} * SP_{j,t}$, with the later multiplied with mean skewness.

Table 5.2 - Fixed Effects Regression Results - Overall Group: Dependent Variable = DPj,t
(Equations 5.4a to 5.4 I)

(1)	(2)	(3)	(4)	**(5)**	**(6)**	(7)	**(8)**	(9)	(10)
VPj,t	0.0509 a		0.0597 a	0.0739 a	0.0538 a	0.0533 a	0.0736	0.0740 a	0.0524
	(7.6823)		(10.1213)	(12.6982)	(9.6916)	(9.6582)	(12.7140)	(12.8706)	(9.4773)
SPj,t		0.0010 a	0.0010 a	-0.0001	0.0001	0.0000	-0.0001	-0.0001	0.0000
		(32.2157)	(33.0336)	(1.1194)	(0.7456)	(0.1869)	(1.6182)	(0.9410)	(0.2258)
$VP_{j,t} \times SP_{j,t}$				0.0158 a	0.0134 a	0.0137 a	0.0162	0.0157 a	0.0139
				(15.0857)	(13.4593)	(13.8663)	(15.4937)	(15.0805)	(14.1022)
ΔExhj,t					0.2368 a	0.2430 a			0.2503
					(21.5178)	(22.1707)			(22.9639)
ΔLsm(-1)j,t					-0.0149	-0.0117 a		-0.0185 a	
					(6.4877)	(5.0249)		(7.5713)	
ΔM2j,t						0.0410 a	0.0396	0.0319 a	0.0461
						(7.5443)	(6.9695)	(5.5667)	(8.5961)
Cities Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R - Squared	0.2088	0.3590	0.3746	0.4074	0.4697	0.4769	0.4065	0.4145	0.4738
Standard Error of Regression	0.1997	0.3517	0.3673	0.4003	0.0075	0.2261	0.0079	0.0078	0.0074
Number of Observations	4165	4165	4165	4165	4165	4165	4165	4165	4165
F_{city}	0.45	0.37	0.54	0.60	1.49	0.47	0.50	0.57	0.42
F_{month}	97.60	52.77	53.17	54.79	59.31	63.82	57.28	57.20	62.13
$F_{city\ and\ month}$	30.35	76.01	16.85	16.65	19.10	20.46	17.73	17.86	20.00

Notes: t-statistics are calculated by dividing the estimated coefficients by heteroskedasticity cosistent standard errors and are shown in parentheses

a :Significant at the 1 percent level c :Significant at the 5 percent level

F_{city} is the F-statistics for testing the restriction that the city-specific components are not different across cities. F_{month} is the F-statistics for testing the joint significance of month-specific components and $F_{city\ and\ month}$ is the F-statistics for testing the joint significance of city and month-specific components.

In case of food inflation, both the relative price variability and skewness of price changes are found significantly affecting inflation rate in all nine specifications of the model, as reported in Table 5.3. Again the model given in column 7 of the Table 5.3 has the highest explanatory power, which included macroeconomic variables. The results show that one standard deviation increase in relative price variability increases food inflation rate by 0.26 percentage points and one standard deviation increase in skewness of relative price changes increases it by 0.78 percentage points. (As mentioned in footnotes 7 and 8, the impact is calculated by using respective coefficient reported in Table 5.3 and statistical values of relative price variability and skewness given in Table 5.1).

Table 5.3 - Fixed Effects Regression Results - Food Group: Dependent Variable = DPj,t
(Equations 5.4a to 5.4 I)

(1)	(2)	(3)	(4)	**(5)**	**(6)**	(7)	**(8)**	(9)	(10)
VPj,t	0.0852 a		0.0918 a	0.0979 a	0.0801 a	0.0803 a	0.0988 *	0.0982	0.0802
	(9.2575)		(11.2860)	(12.0948)	(10.0648)	(10.2207)	(12.3523)	(12.3117) *	(10.1944)
SPj,t		0.0028 a	0.0028 a	0.0011 a	0.0013	0.0012 a	0.0010 *	0.0010	0.0011
		(33.3387)	(34.1038)	(4.6833)	(5.7515)	(5.3235)	(4.3270)	(4.6376)	(5.1524)
$VP_{j,t} \times SP_{j,t}$				0.0179 a	0.0155 a	0.0159 a	0.0183 *	0.0180 *	0.0160
				(8.5690)	(7.6151)	(7.9087)	(8.8679)	(8.7508)	(7.9590)
ΔExhj,t					0.3104 a	0.3268 a			0.3356
					(14.1982)	(15.0874)			(15.6124)
ΔLsm(-1)j,t					-0.0229	-0.0143		-0.0234	
					(4.9909)	(3.1077)		(4.9916)	
ΔM2j,t						0.1094 a	0.1070 *	0.0973 *	0.1155
						(10.1578)	(9.8230)	(8.8237)	(10.8996)
Cities Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R - Squared	0.2457	0.3936	0.4117	0.4219	0.4543	0.4676	0.4350	0.4382	0.4664
Standard Error of Regression	0.0175	0.0157	0.0155	0.0153	0.0149	0.8889	0.0151	0.0151	0.0147
Number of Observations	4165	4165	4165	4165	4165	4165	4165	4165	4165
F_{city}	0.70	3.78	0.48	0.38	0.37	0.51	0.67	0.60	0.55
F_{month}	127.37	69.97	81.10	81.38	80.12	90.34	90.24	87.55	90.81
$F_{city\ and\ month}$	33.35	45.03	20.83	20.66	20.73	23.33	22.94	22.41	23.39

Notes: t-statistics are calculated by dividing the estimated coefficients by heteroskedasticity cosistent standard errors and are shown in parentheses

a :Significant at the 1 percent level

F_{city} is the F-statistics for testing the restriction that the city-specific components are not different across cities. F_{month} is the F-statistics for testing the joint significance of month-specific components and $F_{city\ and\ month}$ is the F-statistics for testing the joint significance of city and month-specific components.

The response of non-food inflation to distribution of relative price changes is not as high as in case of food inflation rate. As Table 5.4 shows, model specifications given in columns 6 and 7 give the similar results for non-food inflation. On the basis of estimated coefficients, it is calculated that one standard deviation increase in relative price variability increases non-food inflation rate by 0.25 percent points and one standard deviation increase in skewness of relative price changes increases it by 0.18 percentage points.

Table 5.4 - Fixed Effects Regression Results - Non-food Group: Dependent Variable = DPj,t
(Equations 5.4a to 5.4 I)

(1)	(2)	(3)	(4)	**(5)**	**(6)**	(7)	**(8)**	(9)
VPj,t	0.0102 c		0.0152 a	0.0755 a	0.0634 a	0.0634 a	0.0755 a	0.0756 a
	(1.9707)		(3.1150)	(19.7518)	(16.8969)	(16.8945)	(19.7306)	(19.8397)
SPj,t		0.0006 a	0.0006 a	-0.0005 a	-0.0005 a	-0.0005 a	-0.0005 a	-0.0005 a
		(22.4712)	(22.6133)	(17.7553)	(17.9911)	(17.8497)	(17.6191)	(17.3954)
$VP_{j,t} \times SP_{j,t}$				0.0503 a	0.0476 a	0.0476 a	0.0502 a	0.0498 a
				(56.2633)	(54.4621)	(54.2716)	(56.0756)	(55.5566)
ΔExhj,t					0.1149 a	0.1145 a		
					(17.0964)	(16.9925)		
ΔLsm(-1)j,t					-0.0048	-0.0051		-0.0079
					(3.4730)	(3.5880)		(5.4648)
ΔM2j,t						-0.0031	-0.0037	-0.0069
						(0.9542)	(1.1029)	(2.0383)
Cities Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R - Squared	0.0130	0.1200	0.1219	0.5035	0.5392	0.5392	0.5035	0.5070
Standard Error of Regression	0.0066	0.0062	0.0062	0.0047	0.0045	0.0833	0.0047	0.0047
Number of Observations	4165	4165	4165	4165	4165	4165	4165	4165
F_{city}	6.88	5.96	4.89	3.95	4.23	3.59	3.44	3.72
F_{month}	7.96	6.77	7.16	9.08	15.51	15.07	7.15	7.15
$F_{city\ and\ month}$	38.15	45.93	23.31	24.06	27.25	26.25	23.79	24.46

Notes: t-statistics are calculated by dividing the estimated coefficients by heteroskedasticity cosistent standard errors and are shown in parentheses

a :Significant at the 1 percent level c :Significant at the 5 percent level

F_{city} is the F-statistics for testing the restriction that the city-specific components are not different across cities. F_{month} is the F-statistics for testing the joint significance of month-specific components and $F_{city\ and\ month}$ is the F-statistics for testing the joint significance of city and month-specific components.

Interestingly, the coefficient of skewness itself is negative in case of non-food inflation rate (although the overall impact is still positive due to coefficient of interaction term). As Ball and Mankiw (1995) argued, if the distribution of price changes is skewed towards left, it will affect inflation negatively. As the prices of non-food items generally remain stable (as against food items which experience high seasonal volatility), the relative price changes in this group are skewed left – which explains its negative coefficient.

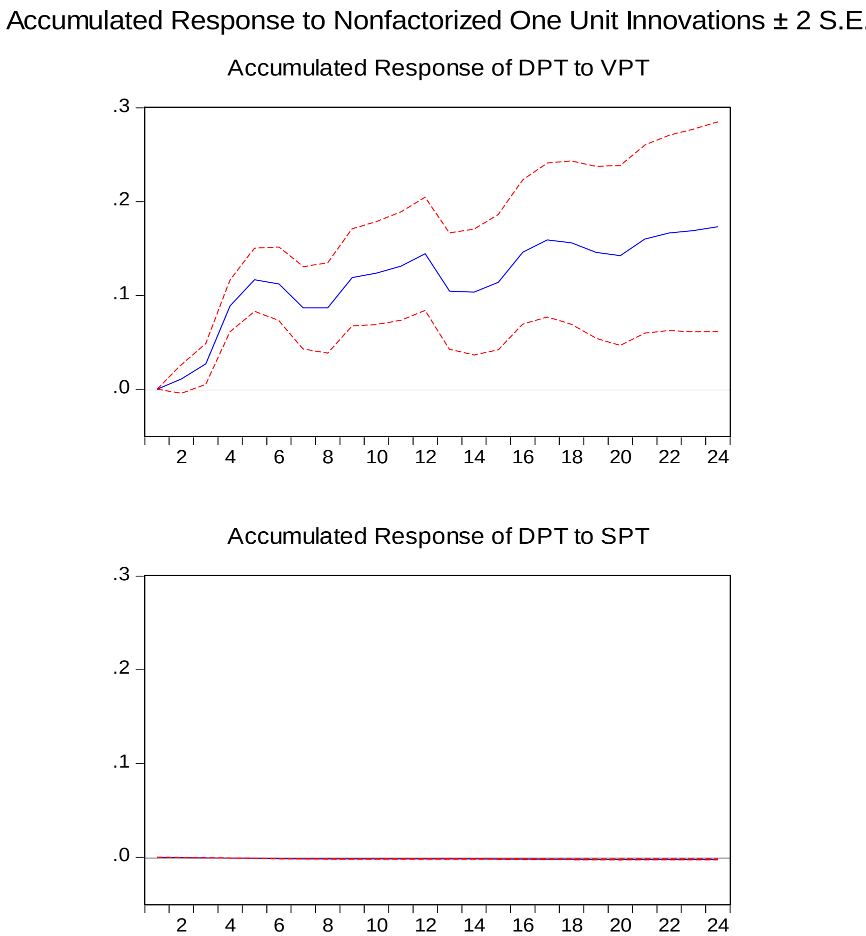
The direction of causality is not very clear in the case of RPV and inflation rate. Therefore, using one variable as independent while the second as dependent variable is a risky choice. To check this issue we have found Granger Causality between inflation and RPV in overall CPI basket, food group and non-food group. We have found bi-directional causality in case of overall basket and non-food basket but in case of food group causality runs only from inflation rate to variability of prices.

Table 5.5: Result of Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
VPTO does not Granger Cause DPTO	118	2.80535	0.0967
DPTO does not Granger Cause VPTO		7.39519	0.0076
VPTF does not Granger Cause DPTF	118	2.38774	0.1250
DPTF does not Granger Cause VPTF		5.28059	0.0234
VPTNF does not Granger Cause DPTNF	118	12.5944	0.0006
DPTNF does not Granger Cause VPTNF		4.63567	0.0334

To avoid the problem of endogeneity, we have used Vector Autoregressive (VAR) Model in which all variables are taken as endogenous. The results of impulse response functions confirm the results found in above analysis that variability of prices positively affect inflation rate while effect of skewness is negligible.

Figure 5.1: Accumulated Response to Non-factorized of DPt to VPt



5.5 Conclusion

The relationship between inflation rate and relative price changes, though has been the subject of interest since long, attracted economists' attention particularly after the supply shocks of 1970s. However, most of the literature on this topic is available for developed economies. This paper is a first attempt to examine this relationship on the basis of commodity-wise panel data of 35 cities of Pakistan, a developing economy. We have followed Ball and Mankiw (1995) approach which takes the distribution of relative price changes as supply shocks and reflects on supply-side theory of inflation.

Our results show that inflation rate, both food and non-food inflation, is significantly and positively affected by relative price variability. The results imply that supply side factors, as exhibited in dispersion of relative price changes, are robust determinants of inflation rate.

Chapter 6

Price Level Convergence: Evidence from Pakistan Cities

6.1 Introduction

According to the law of one price (LOP), the efficient market arbitrage and trade will keep the prices of identical commodities same in two or more markets. However, the transportation and transaction costs may prevent the LOP to hold. A number of studies have shown that the distance between the two markets has positive relationship with deviation from LOP (see for example Crucini and Shintani 2006). Earlier, Engel and Rogers (1996), in their pioneer work on CPI data of US and Canadian cities, found that both distance between two cities and having common borders matter for relative price variability and thus the law of one price.

The LOP to hold also depends on the nature of the commodities: tradable goods' prices are more likely to converge, whereas, prices of services and non tradable goods are less likely to converge. Another dimension, that occupies space in the literature on the topic, is the convergence of prices within cities of one country and that across countries. Low transportation cost and less restrictive trade barriers make prices converge faster in cities of one country than in cities of different countries. Moreover, the convergence mechanism of prices is found to be nonlinear as prices respond differently to big and small shocks.

Empirical evidence in this regard is mixed. For instance, Parslay and Wei (1996), using quarterly price data of goods and services in 48 US cities, found much faster convergence of prices to purchasing power parity in case of US than typically found in cross-country data. They also found that tradable goods converge very fast to price parity with around 4 to 5 quarters half-life of the price gap compared with 15 quarters for services. On the other hand, Cecchetti et al. (2002), using panel econometric methods, found that relative price levels among cities mean revert at an exceptionally slow rate – with a half-life of convergence about 9 years. This slow rate of convergence was found because of transportation costs, varying speeds of adjustments to large and small shocks, and presence of non-traded goods prices in the overall price index.

Crucini and Shintani (2006) studies the behavior of prices in a cross-country set up examining the dynamics of commodity-wise real exchange rates using a panel of 270 prices taken from major cities of 63 countries and 258 prices taken from 13 US cities. They found an average commodity had a similar pattern of convergence in organization for economic co-operation and development (OECD), least developed countries (LDC) and within US with about 1 year of half-life of deviations from the law of one price. The average non-traded good has a half-life higher than traded goods for the OECD, with lesser differences elsewhere.

In case of Pakistan, however, there is dearth of studies on this topic; we find only one study, Mohsin and Gilbert (2010), which estimates relative city price convergence in overall CPI of 35 cities from Pakistan. They considered Lahore and Karachi as numeraire cities and found speed of convergence, as measured by half-life, less than 5 months but it varies from 1.3 to 68 months in the case of individual cities. Their results, however, crucially depend on the choice of econometric technique used to estimate the convergence and on the choice of numeraire city.

In these studies, price level convergence across regions is tested jointly by using panel unit root tests, and most of the studies use benchmark or numeraire for calculating relative prices. However, Crucini and Shintani (2006) and Pesaran (2007) used a different technique which does not use arbitrary benchmark. In this study, we used Pesaran (2007) methodology.

6.2 Methodology

We have used pair-wise approach developed by Pesaran (2007) to study the convergence analysis of relative prices across cities. Convergence requires prices to be co-integrated with a vector of the form (1, -1), i.e., the difference between them, $r_t^{ij} = p_t^i - p_t^j$, with i = 1, ……N-1 and j = i+1, …..,N, should be stationary for all N(N-1)/2 possible relative prices in 35 cities. We have applied this test on 595 relative price pairs. Formally we estimate the following ADF test:

$$\Delta r_t^{ij} = \alpha_o^{ij} + \gamma^{ij} r_{t-1}^{ij} + \sum_{k=1}^{p} \beta_k^{ij} \Delta r_{t-k}^{ij} + \varepsilon_t^{ij} \qquad (6.1)$$

where α_o^{ij} represents the intercept, p is the appropriate lag length, and ε_t^{ij} is the white noise error term. For the sake of consistency with the theory of purchasing power parity, we exclude the deterministic trend from the equation. With the null hypothesis of non-convergence, i.e., the existence of a unit root, the significance of the coefficient, γ^{ij} in the above equation for every pair of relative prices is tested.[12] Rejection of the null for a particular pair implies convergence of prices in the two cities. To analyze the speed of convergence, the conventional half-life of a shock to r_t^{ij} is calculated as $-\ln(2)/\ln(1+\gamma^{ij})$ for each of the commodity group, i.e., overall CPI, food and non-food groups using 595 possible relative pairs.

We also estimated the effect of provincial location of cities on the behavior of relative prices by introducing province specific dummy variables. The province dummies are defined as follows:

REG = 1 when both cities of a relative price pair belong to the same province; 0 otherwise;

REGP = 1 when both cities are located in the Punjab province; 0 otherwise;

REGB = 1 when both cities are located in Balochistan; 0 otherwise;

REGS = 1 when both cities are located in Sindh; 0 otherwise;

REGKP= 1 when both cities are located in Khyber Pakthunkhwa; 0 otherwise;

P = 1 when at least one of the cities in a relative price pair is located in the Punjab; 0 otherwise;

B = 1 when at least one city is located in Balochistan; 0 otherwise;

S = 1 when at least one city is located in Sindh; 0 otherwise;

KP = 1 when at least one city is located in Khyber Pakthunkhwa ; 0 otherwise;

The basic model to estimate the province effect is as follows:

$$y_i = \beta_o + \beta_1 RD_i + \varepsilon_i \quad (6.2)$$

[12] The lag length (p) is selected through general to specific approach beginning with the maximum lag of 11 and coming down to a suitable lag by using Schwartz Criterion (SIC).

Where the dependent variable, y_i is standard deviation of relative prices (r_t^{ij}) for each of 595 pairs representing short-run relative price behavior; β_o is intercept; RD_i is a vector of provincial dummies in the set {REG, REGP, REGB, REGS, REGKP, P, B, S, KP}; β_1 is the corresponding vector of coefficients and ε_i is the error term for i = 1, 2, 3………..595.

6.3 Data

We used item-wise and city-wise data of consumer price index (CPI) collected and disseminated by Pakistan Bureau of Statistics (PBS). PBS publishes two series of CPI: item-wise and city-wise price data of 374 individual commodities and 92 indices of composite items.[13] The data set used in this study includes CPI indices of 92 composite commodities for 35 cities for period from July 2001 to June 2011 using 2000-01 as the base year (for list of cities, See Annexure **A**). We undertake the analysis not only for a full sample of 92 commodities but also for its two sub-groups, viz., food group (including 40 items and having weight of 40.34 percent in the overall CPI) and non-food group (including the remaining 52 items and residual weight of 59.66 percent). The analysis could have been done for tradable goods and non-tradable goods but in case of Pakistan we have data limitation which does not allow such disaggregation. Moreover, in case of Pakistan, SBP – the authority responsible for controlling inflation – differentiates inflation for food and non-food groups.

[13] PBS has recently re-based CPI to year 2007-08; however, we use earlier data which is available for a longer period.

6.4 Empirical Results

Summary statistics of relative price behavior are presented in Table 6.1. In the 595 city pairs, 33 percent belong to the same province and the rest are from different provinces. The mean standard deviation of relative prices is smaller if the corresponding city pairs belong to the same province compared to different provinces for all the commodity groups, i.e., overall, food and non-food groups.

Table 6.1: Selected summary statistics

	City Pairs	Mean standard deviation of relative prices			No. of relative price series for which unit root null is rejected		
		Overall	Food group	Non-food group	Overall	Food group	Non-food group
Full sample of city pairs	595	0.0250	0.0322	0.0283	158 (26.6%)	441 (74.1%)	31 (5.2%)
City pairs in the same region	197 (33.1%)	0.0220	0.0260	0.0270	46 (23.4%)	144 (73.1%)	15 (7.6%)
City pairs in different regions	398 (66.9%)	0.0265	0.0353	0.0289	112 (28.1%)	297 (74.6%)	16 (4.0%)
Median speed of convergence in months (Half-life)					8	3	21

Note: percentages are in brackets.

The results of unit root test for convergence, i.e., the (in)validity of the law of one price (LOP), show that only 27 percent of the total city pairs conform to the LOP. However, interestingly most of the city pairs that show convergence are cities from different provinces. There are total 197 city pairs that belong to the same province – of these only 46 showed convergences (i.e., 23 percent). On the other hand, out of 398 pairs of cities which belong to different provinces, prices in 112 pairs converge (i.e., 28 percent). However, in both cases, the percentage of pairs that confirm price convergence is quite low. The median speed of convergence measured by half-life is around 8 months which is considered to be reasonable. Crucini and Shanitani, (2006) found less than one year convergence period for 63 countries, while Parlse and Wei (1996) found convergence period of 4-5 quarters. So our results indicate reasonable convergence as for as median half-life is concerned. However, on the basis of unit root test results, the percentage of prices that confirm to LOP is low. From these results we can say that LOP is verified for small portion of overall commodity group of CPI basket. The reasons for this low percentage may be the differences in development level, social behavior, rural and urban divisions, cost of living and transportation among cities of Pakistan.

However, when we examine the sub-groups of food and non food, the results are surprisingly different. In the food group, prices of 441 city pairs converge (which is 74 percent of total pairs). Of these, 144 are from the same province and 297 belong to different provinces. Median speed of price convergence for food group is around 3 months, which shows faster convergence than that in developed countries (Cecchetti et al. 2002). Thus, it can be concluded that LOP holds for food group in Pakistan. Again, it is interesting to note that distance matters to a great extent for convergence. For example Attock and DG Khan are both from Punjab province but price convergence does not hold in this pair because of distance (they are 704 kilometers apart). Price convergence also does not hold in the pair of Gujranwala and Turbat – located in different provinces – as distance between them is 1693 kilometers. There are also some pairs in which distance matters less and the extent of convergence depends on other factors. For example, Islamabad & Rawalpindi, the distance between these two cities is only 17 kilometers, but the pries are non-convergent. The reason may be the differences in living style, education level, consumption pattern, and structure of markets.

On the other hand, in case of non-food group, we could not find any significant level of convergence. Prices in only 31 city pairs (i.e., only 5 percent) converge, of which 15 are from same province and 16 are from different provinces. Speed of convergence measured by half-life is 21 months which is very slow (see Table 6.1).

6.4.1 Regressions with province dummies only

In order to explore the province-specific features of the behavior of relative prices, following Pesaran (2007), we have estimated the following specific equations, results of which are reported in Table 6.2:

$$SD_i = \beta_o + \beta_1 REG_i + \epsilon_i \qquad (6.3a)$$

$$SD_i = \beta_o + \beta_1 REGP_i + \beta_2 REGB_i + \beta_3 REGS_i + \beta_4 REGKP_i + \epsilon_i \qquad (6.3b)$$

$$SD_i = \beta_o + \beta_1 P_i + \beta_2 B_i + \beta_3 S_i + \beta_4 KP_i + \epsilon_i \qquad (6.3c)$$

Results of equation (6.3a) are reported in column 1, 4 & 7 of Table 6.2 for three commodity groups, viz. overall CPI, food and non-food. It is found that average relative price variability is observed significantly smaller if the city pairs belong to the same province. Moreover, among three groups of prices, the coefficient of food group is smaller indicating that food prices converge relatively faster if the city pairs are from the same province. This is interesting result in case of Pakistan as here distance matters less while hurdles in inter-provincial matter much. For instance, on many food items provincial governments put hurdles in inter-provincial trade. And the main reason of price convergence is arbitrage. Therefore, prices are more likely converge if cities are from same province.

However, results of equation (6.3b) for overall group (column 2 of Table 6.2) reveal that relative prices behave differently in different provinces. For example, in case of Balochistan, the coefficient of province-specific dummy is the lowest, indicating higher speed of convergence compared with other provinces. The results of equation (6.3c) (column 3 of Table 6.2) show that standard deviation of relative prices of overall commodities group increase when one of the two cities is located in one province and other in a different province.

Table 6.2: Regression results with region dummies

Dependent variable \ Independent variables	Standard deviation of relative prices								
	Overall			Food group			Non-food group		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	2.66 ***	2.65 ***	2.00 ***	3.53 ***	3.50 ***	2.08 ***	2.89 ***	2.91 ***	2.72 ***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
REG	-0.50 ***			-0.93 ***			-0.19 *		
	(0.00)			(0.00)			(0.07)		
REGP		-0.50 ***			-1.04 ***			-0.18	
		(0.00)			(0.00)			(0.15)	
REGB		-0.96 ***			-0.29			-0.59	
		(0.00)			(0.18)			(0.16)	
REGS		-0.31 *			-0.41 **			-0.68 ***	
		(0.08)			(0.03)			(0.00)	
REGKP		-0.51 ***			-1.01 ***			-0.37	
		(0.02)			(0.00)			(0.22)	
P			0.23 **			0.56 ***			0.09
			(0.02)			(0.00)			(0.51)
B			0.13			0.81 ***			0.11
			(0.16)			(0.00)			(0.48)
S			0.67 ***			1.07 ***			0.14
			(0.00)			(0.00)			(0.23)
KP			0.10			0.49 ***			-0.14
			(0.23)			(0.00)			(0.25)
R-sequared	0.08	0.08	0.12	0.29	0.30	0.31	0.01	0.02	0.01

Note: Probabilities values are in brackets. ***significant at 1% level, **significant at 5% level, *significant at 10% level.

For food group, the results of equation (6.3b) are given in column 5 of Table 6.2, which show that the standard deviation of relative prices is lower if both cities of a pair are located in same province. Interestingly, variations in relative prices of food group are lower than those of non-food group if the city pairs belong to Punjab and KPK. On the other hand, when city pairs belong to Sindh or Balochistan, non-food relative prices show lower variations.

6.4.2 Regressions with dummies of province and distance

While the location within an administrative unit (province in case of Pakistan) has bearing on the extent of convergence, the distance by itself can be an explanatory variable as two cities can be closer despite being in different provinces. For example, Attock is in the Punjab province while Mardan is in the Khyber Pakhtunhawa but they are only 65 kilometers apart, while Turbat and Laoralai both belong to Balochistan but they are 1007 kilometers apart.; The importance of distance (as a proxy for transportation cost) in variation in relative prices has also been documented by Engle and Rogers (1996) and Parsley and Wei (1996).

We have estimated the following specific equations to explore the role of distance in relative prices while controlling for location in an administrative unit.

$$SD_i = \beta_o + \beta_1 LDIST_i + \beta_2 REG_i + \epsilon_i \quad (6.4a)$$

$$SD_i = \beta_o + \beta_1 LDIST_i + \beta_2 REGP_i + \beta_3 REGB_i + \beta_4 REGS_i + \beta_5 REGKP_i + \epsilon_i \quad (6.4b)$$

$$SD_i = \beta_o + \beta_1 LDIST_i + \beta_2 REGP_i + \beta_3 REGB_i + \beta_4 S_i + \beta_5 REGKP_i + \beta_6 (LDIST_i * REGP_i) + \beta_7 (LDIST_i * REGB_i) + \beta_8 (LDIST_i * REGS_i) + +\beta_9 (LDIST_i * REGKP_i) + \epsilon_i$$

(6.4c)

$$SD_i = \beta_o + \beta_1 LDIST_i + \beta_2 P_i + \beta_3 B_i + \beta_4 S_i + \beta_5 KP_i + \epsilon_i \qquad (6.4d)$$

$$SD_i = \beta_o + \beta_1 LDIST_i + \beta_2 REG_i + \beta_3 (LDIST_i * REG_i) + \epsilon_i \qquad (6.4e)$$

$$SD_i = \beta_o + \beta_1 LDIST_i + \beta_2 P_i + \beta_3 B_i + \beta_4 S_i + \beta_5 KP_i + \beta_6 (LDIST_i * P_i) +$$

$$\beta_7 (LDIST_i * B_i) + \beta_8 (LDIST_i * S_i) + +\beta_9 (LDIST_i * KP_i) + \epsilon_i \qquad (6.4f)$$

LDIST is log of distance between cities and other variables are same as defined earlier. Table 6.3 reports the results: a statistically significant and positive effect of distance on standard deviation of relative prices has been found. This result is consistent with Engle and Rogers (1996). The results show that the distance continues to have a significant impact on variability of relative prices even after controlling for location of cities of a pair. However, some province-specific diversity is also found. For example, when one of the two cities belongs to Sindh, the standard deviation goes up in case of overall commodity group. Similar results are found in case of all provinces for food group. However, no particular pattern can be found in case of non-food group. The results show that the distance continues to have a significant impact on variability of relative prices even after controlling for location of cities which belongs to same province (result of column 6 in Table 6.3). However, some province-specific diversity is also found only in food group. For example, when one of the two cities belongs to Punjab, the standard deviation goes up in case of food group. However, no particular pattern can be found in case of overall commodity group and non-food group.

Table 6.3: Regression results with distance, regional dummies, and interactions

Dependent variable \ Independent variables	Standard deviation of relative prices (Overall)						Standard deviation of relative prices (Food group)						Standard deviation of relative prices (Non-food group)					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	1.76 ***	1.57 ***	1.24 ***	1.30 ***	0.84	1.27	2.36 ***	2.03 ***	1.25 ***	2.94 ***	-2.79 ***	2.18	1.45 ***	1.94 ***	1.44 ***	1.22 *	3.14 ***	1.58
	(0.00)	(0.00)	(0.00)	(0.00)	(0.45)	(0.00) ***	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00) ***	(0.00)	(0.00)	(0.00)	(0.06)	(0.03)	(0.01) ***
LDIST	0.14 ***	0.16 ***	0.16 ***	0.21 ***	0.23	0.21	0.18 ***	0.22 ***	0.17 ***	0.09	0.83 ***	0.20	0.22 ***	0.15 **	0.26 ***	0.25 ***	0.00	0.20
	(0.01)	(0.00)	(0.00)	(0.00)	(0.21)	(0.00) ***	(0.00)	(0.00)	(0.00)	(0.15)	(0.00)	(0.00) ***	(0.01)	(0.04)	(0.00)	(0.01)	(0.99)	(0.03) ***
REG	-0.36 ***			0.85			-0.73 ***			-1.96 ***			0.05			0.54		
	(0.00)			(0.18)			(0.00)			(0.00)			(0.69)			(0.57)		
REGP		-0.33 ***				0.60		-0.80 ***				-1.25 **		-0.03				1.03
		(0.00)				(0.42)		(0.00)				(0.05)		(0.85)				(0.34)
REGB		-0.91 ***				1.94		-0.22				-0.63		-0.54				7.32
		(0.00)				(0.65)		(0.31)				(0.86)		(0.21)				(0.24)
REGS		-0.09				-0.08		-0.13				-0.29		-0.48 **				-0.87
		(0.62)				(0.95)		(0.54)				(0.80)		(0.02)				(0.65)
REGKP		-0.32				1.46		-0.75 ***				-1.41		-0.19				2.35
		(0.16)				(0.55)		(0.00)				(0.50)		(0.54)				(0.51)
P			0.12		0.32				0.44 ***		2.83 ***				-0.09		-1.15	
			(0.26)		(0.73)				(0.00)		(0.00)				(0.53)		(0.33)	
B			-0.05		-0.04				0.62 ***		3.97 ***				-0.19		-3.12 *	
			(0.65)		(0.97)				(0.00)		(0.00)				(0.25)		(0.10)	
S			0.49 ***		0.24				0.88 ***		5.42 ***				-0.16		-3.46 ***	
			(0.00)		(0.81)				(0.00)		(0.00)				(0.25)		(0.01)	
KP			0.01		1.50 **				0.39 ***		3.07 ***				-0.29 ***		1.29	
			(0.87)		(0.04)				(0.00)		(0.00)				(0.02)		(0.19)	
REG x LDIST				-0.20 **						0.21 **						-0.08		
				(0.05)						(0.03)						(0.61)		
P x LDIST					-0.04						-0.38 ***						0.14	
					(0.77)						(0.01)						(0.45)	
B x LDIST					0.00						-0.53 ***						0.45	
					(0.98)						(0.00)						(0.12)	
S x LDIST					0.04						-0.71 ***						0.51 ***	
					(0.82)						(0.00)						(0.01)	
KP x LDIST					-0.24 **						-0.43 ***						-0.26	
					(0.05)						(0.00)						(0.11)	
REGP x LDIST						-0.16						0.08						-0.18
						(0.21)						(0.48)						(0.32)
REG B x LDIST						-0.45						0.06						-1.26
						(0.51)						(0.91)						(0.20)
REGS x LDIST						0.01						0.02						0.09
						(0.97)						(0.91)						(0.81)
REGKP x LDIST						-0.32						0.12						-0.46
						(0.48)						(0.76)						(0.48)
R-sequared	0.09	0.09	0.13	0.09	0.14	0.10	0.30	0.32	0.32	0.31	0.37	0.03	0.02	0.03	0.03	0.02	0.05	0.03

Note: Probabilities values are in brackets. ***significant at 1% level, **significant at 5% level, *significant at 10% level.

Table 6.4 reports the *F*-test results for joint significance of distance and its interactions with province dummies. The results show a significant effect of distance on standard deviation of relative prices in case of overall commodities group when one of the cities of a pair belongs to the Punjab and Sindh province. The same result is found in case of non-food group. In case of food group, the results show the significant effect on the standard deviation of relative prices for all provinces dummies and their interaction with distance.

Table 6.4: F-test results for joint significamce

Variables of which joint significance is tested	Standard deviation of relative prices		
	Overall	Food group	Non-food group
	(1)	(2)	(3)
REG, REG * LDIST	25.11	130.86	2.68
	(0.00)	(0.00)	(0.07)
P, P * LDIST	19.95	115.95	3.75
	(0.00)	(0.00)	(0.02)
B, B * LDIST	0.68	10.11	2.15
	(0.51)	(0.00)	(0.12)
S, S * LDIST	41.52	61.47	7.40
	(0.00)	(0.00)	(0.00)
KP, KP * LDIST	2.21	3.73	2.01
	(0.11)	(0.02)	(0.13)

Note: *p* -values are in brackets An intercept term is included in the regressions.

6.5 Conclusion

In this chapter, we try to examine two aspects of the behavior of relative prices (for overall consumer prices, food prices and non-food prices) across 35 Pakistani cities. We have found that there is bilateral price-level convergence for only food group and speed of convergence measured by half-life is around 3 months. On the other hand, prices of non-food commodities have very low speed of adjustment with 20 month half-life. Resultantly, relative prices of overall commodities group have half-life of 8 month – a moderate speed of convergence.

We have also identified differences in the behavior of relative prices within and across provinces of Pakistan. The relative prices between two cities located in the same province show lower variability compared with cites pair located in different provinces. However, if at least one of city associated with a relative price series is located in different province, standard deviation of relative prices rises in case of overall and food group. While exploring the impact of distance between cities of a pair, we have found that the standard deviation of relative prices increase significantly with the distance. This result accords well with the findings of some previous studies e.g. Engle and Rogers (1996).

Chapter 7

Conclusions and Policy Implications

7.1 Conclusion

The objectives of this dissertation are: (i) examining the behavior of price setting agents as reflected in relative price changes in response to demand and supply factors; (ii) exploring the effect of relative price variability on inflation by estimating fixed effects regression model using panel data of prices in different cities of Pakistan; and (iii) examining convergence of price changes in 35 cities of Pakistan and also looking at how location of cities affects the convergence. These objectives have been addressed in three chapters as presented in chapters 4, 5, and 6 of this dissertation.

Regarding first objective, we found that changes in real income had insignificant impact on relative price variability. The results make sense as changes in income (with given preferences) almost evenly affect demand for all consumer items, which may lead to proportional changes in their prices. It can be a case particularly in a developing economy like Pakistan, having a large informal sector, where response of firms is less constrained by wage contracts and where capacity issues are less heterogeneous. On the other hand, unanticipated inflation, which usually comes from item-specific supply factors, may affect prices of different items unevenly before it is fully transmitted to general inflation.

The second objective focuses on the relationship between inflation and relative price changes. This relationship, though has been the subject of interest since long, has attracted economists' attention particularly after the supply shocks of 1970s. However, most of the literature on this topic is available for developed economies. This paper is a first attempt to examine this relationship on the basis of commodity-wise panel data of 35 cities of Pakistan, a developing economy. We have followed Ball and Mankiw (1995) approach which takes the distribution of relative price changes as supply shocks and reflects on supply-side theory of inflation. Our results show that inflation, in both food and non-food groups, is significantly and positively affected by relative price variability. The results imply that supply side factors, as exhibited in dispersion of relative price changes, are robust determinant of inflation in Pakistan.

Related to third objective, we try to examine two aspects of the behavior of relative prices (in overall consumer prices, food prices and non-food prices) across 35 Pakistani cities. We have found that there is bilateral price-level convergence for only food group and speed of convergence measured by half-life is around 3 months. On the other hand, prices of non-food commodities have very low speed of adjustment with 20 months half-life. Consequently, relative prices of overall commodities group have half-life of 8 months – a moderate speed of convergence. We have also identified differences in the behavior of relative prices within and across provinces of Pakistan. The relative prices between two cities located in the same province show lower variability compared with cites pair located in different provinces. However, if at least one of city associated with a relative price series is located in one province, standard deviation of relative prices rises in case of overall and food group. While exploring the impact of distance between cities of a pair, we have found that the standard deviation of relative prices increase significantly with the distance. This result accords well with the findings of some previous studies e.g. Engle and Rogers (1996).

7.2 Policy Implication

As the supply side factors are found to be dominant in affecting economic activity and inflation rate in Pakistan, therefore, monetary authority needs to be careful while taking decisions on monetary policy instrument. For instance, in 2008 when inflation rate was approximately 20 percent, SBP increased discount rate to give a signal of tight monetary policy stance. This badly affected economic activity at that time and GDP growth rate turned out to be zero. Therefore, cost push inflation should be dealt with much care while taking monetary policy decisions. Another implication of this research is that monetary policy may target a narrow measure of general price level. For instance, core inflation can be targeted. Moreover, an index of general price level can be constructed that is in control of monetary policy with minimum control error.

7.3 Limitation & Extension

This research can be extended further to estimate the impact of specific supply side factors, like administered prices and exchange rate movements, along with demand factors on relative price variability. Moreover, there are two limitations in the price data: First, currently data are available as average of different outlets in a city. As the Pakistan Bureau of Statistics (PBS) collects outlet-wise data of prices, it can provide more insight into the price setting behavior of economic agents at micro level. So if PBS starts publishing this type of data and a time series is available, these studies can be updated. Second, we have indirectly measured anticipated inflation by using econometric model. Recently, State Bank of Pakistan has started measuring anticipated inflation directly through country-wide survey. Going forward, when sufficient data points of directly measured anticipated inflation become available, these studies can be further improved.

Further, we used ten years data on CPI index from July 2001 to June 2011, having base year 2000-01 covering 35 urban cities. PBS has re-based the CPI index with 2007-08 as base year for 40 urban cities of Pakistan. This new setup data can be used for the assessment of supply or demand factors on inflation.

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Annexure A

Inflation Trends in Sub-groups of WPI Basket

percent

	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
General	1.21	5.57	7.91	6.75	10.10	6.94	16.41	18.19	12.63	23.32
Food	0.88	3.50	6.98	10.65	7.00	8.88	18.95	23.24	11.92	19.64
Raw materials	-3.73	14.42	16.98	-18.08	10.16	13.87	12.76	17.81	29.09	57.26
Fuel, lighting & lubricants	3.79	12.48	2.83	15.76	26.48	5.46	21.32	15.95	14.52	17.41
Manufactures	1.42	1.73	7.87	1.09	2.92	3.07	7.02	9.62	10.15	27.39
Building materials	0.25	1.70	22.90	13.71	0.27	5.35	16.64	20.21	-5.44	12.52

Macroeconomic series - growth rates

percent

	Real GDP	Nominal GDP	M2	GDP Deflator	CPI
FY02	3.18	5.68	15.43	2.50	3.54
FY03	4.45	9.36	18.01	4.40	3.10
FY04	7.29	15.80	19.58	7.70	4.57
FY05	8.28	16.61	19.12	7.00	9.28
FY06	7.70	16.92	15.07	10.50	7.92
FY07	5.54	13.22	19.32	7.20	7.77
FY08	4.99	18.54	15.35	12.90	12.00
FY09	0.36	21.12	9.56	20.70	20.77
FY10	2.58	13.60	12.46	10.70	11.73
FY11	3.62	23.86	15.89	19.50	13.92
Average FY02 - 07	6.07	12.93	17.76	6.55	6.03
Average FY08 - 11	2.89	19.28	13.32	15.95	14.61
Average FY02 - 11	4.80	15.47	15.98	10.31	9.46

City -Wise CPI Overall Inflation Trends from FY03 - FY11

percent

S.No	Cities	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
	Overall	***3.10***	***4.57***	***9.28***	***7.92***	***7.77***	***12.00***	***20.77***	***11.73***	***13.48***
1	Lahore	3.04	3.73	8.67	8.89	8.04	10.58	18.74	11.39	12.21
2	Faisalabad	2.36	5.13	10.44	7.71	6.30	12.26	19.04	13.09	12.96
3	Rawalpindi	2.75	4.07	9.85	10.46	9.06	10.39	20.14	11.93	13.21
4	Multan	2.64	5.05	9.24	7.61	9.78	11.71	18.35	12.71	15.05
5	Gujranwala	3.46	5.40	9.96	8.66	10.04	14.70	18.46	12.40	13.15
6	Islamabad	3.02	4.30	10.33	11.39	9.56	10.51	18.45	10.24	11.91
7	Sargodha	4.99	5.15	10.87	8.58	8.09	11.21	21.16	12.49	16.10
8	Sialkot	2.81	3.77	10.05	7.88	6.72	11.10	20.28	12.83	11.96
9	Bahawalpur	3.90	6.26	9.48	8.32	8.73	11.60	17.17	13.28	16.71
10	Jhang	3.13	5.71	10.86	8.03	8.26	13.10	20.13	12.94	16.96
11	Okara	3.81	5.02	8.84	9.44	9.63	10.15	22.21	13.77	14.64
12	D.G. Khan	3.60	6.39	10.18	7.24	8.44	12.78	21.05	12.70	15.82
13	Jehlum	3.04	4.15	10.30	9.13	8.66	12.03	19.78	11.88	13.88
14	Bahawalnagar	3.59	6.86	9.48	9.09	8.49	14.63	19.21	14.13	17.82
15	Vehari	3.72	7.07	10.84	8.95	9.10	13.83	20.22	13.77	14.81
16	Mianwali	3.06	4.25	9.72	8.45	9.07	13.30	20.69	13.28	16.28
17	Attock	2.61	4.30	9.83	9.49	9.42	11.58	20.08	12.40	13.42
18	Samundari	2.58	6.93	11.54	6.84	7.18	15.03	18.96	12.85	15.70
19	Karachi	2.48	4.74	9.03	6.48	7.56	11.66	20.59	11.05	12.85
20	Hyderabad	2.72	4.80	6.31	5.16	7.89	14.52	21.09	11.61	15.41
21	Sukkur	3.02	5.03	8.47	6.34	6.26	14.54	22.79	10.19	15.41
22	Larkana	6.10	5.97	8.37	5.68	6.88	13.32	20.94	9.93	15.74
23	Mirpur Khas	4.09	4.14	7.11	6.88	8.01	13.21	22.76	12.03	16.03
24	Nawabshah	2.88	5.21	7.11	4.74	7.79	16.59	25.61	12.84	15.87
25	Shahdadpur	2.13	5.82	8.27	6.30	8.00	14.74	25.70	13.23	15.27
26	Kunri	3.40	3.01	7.40	6.77	8.82	12.90	22.20	12.34	17.14
27	Peshawar	3.46	4.76	10.04	8.04	7.78	12.67	22.74	10.52	15.35
28	Mardan	2.76	5.76	11.55	7.76	8.54	14.36	24.46	9.58	15.68
29	Abbotabad	3.88	3.14	8.62	7.38	6.98	12.17	22.53	11.42	15.20
30	D.I.Khan	4.64	5.41	9.05	7.44	7.62	11.89	22.55	10.01	16.91
31	Bannu	4.38	5.07	8.70	6.44	9.29	15.15	23.00	10.01	16.60
32	Quetta	3.45	5.25	11.07	7.05	8.29	12.75	22.80	10.15	14.21
33	Khuzdar	2.96	4.70	11.37	7.18	8.21	14.44	24.08	11.13	16.87
34	Turbat	3.73	4.59	10.23	8.74	7.57	13.53	22.64	11.59	14.50
35	Loralai&Cantt	4.45	5.42	10.28	8.63	6.69	14.36	23.13	10.25	14.70

City -Wise CPI Food Inflation Trends from FY03 - FY11

percent

S.No	Cities	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
	Overall	***2.87***	***6.01***	***12.49***	***6.92***	***10.28***	***17.64***	***23.70***	***12.47***	***17.95***
1	Lahore	3.76	5.51	12.22	7.28	11.01	17.30	21.00	12.90	16.04
2	Faisalabad	2.18	7.31	14.40	6.20	9.40	20.54	18.79	15.98	17.16
3	Rawalpindi	2.05	4.36	12.63	9.47	11.92	13.75	22.44	13.98	17.35
4	Multan	2.29	7.03	13.10	6.44	11.55	18.29	20.51	15.04	18.86
5	Gujranwala	2.82	7.02	13.29	8.43	12.75	20.15	18.89	14.65	17.25
6	Islamabad	4.56	4.18	11.42	9.61	12.42	14.02	20.40	12.62	18.49
7	Sargodha	5.39	5.75	13.56	8.17	11.28	15.12	24.00	13.33	18.87
8	Sialkot	2.78	4.52	14.26	7.94	9.37	17.27	22.75	14.33	13.79
9	Bahawalpur	3.22	8.73	12.89	7.14	11.91	17.81	18.40	16.18	20.23
10	Jhang	1.46	6.42	13.85	7.14	11.19	17.89	20.78	15.61	19.31
11	Okara	3.48	6.30	12.78	8.23	11.85	14.22	23.61	15.26	17.38
12	D.G. Khan	3.59	8.67	14.51	7.54	10.79	16.90	20.06	13.45	19.36
13	Jehlum	3.10	4.72	12.88	8.27	10.39	16.23	22.39	13.62	18.05
14	Bahawalnagar	3.39	7.94	11.63	9.31	10.33	18.17	21.47	15.02	18.77
15	Vehari	3.34	9.51	14.22	9.16	9.90	19.30	22.33	16.20	17.49
16	Mianwali	1.84	4.47	13.20	7.88	11.27	17.90	22.83	16.67	19.45
17	Attock	1.81	3.63	12.59	7.89	12.99	16.23	22.67	13.64	18.32
18	Samundari	1.49	7.06	14.71	5.41	10.19	21.48	18.98	14.22	18.38
19	Karachi	1.93	6.90	11.92	3.56	10.08	17.78	23.02	11.00	17.94
20	Hyderabad	2.16	7.99	8.72	4.19	9.90	19.89	24.12	11.54	18.21
21	Sukkur	3.78	6.33	10.14	6.05	6.17	21.07	26.78	7.70	19.30
22	Larkana	8.61	7.57	10.12	5.12	8.34	18.76	22.68	9.10	19.83
23	Mirpur Khas	4.66	5.82	9.53	6.30	10.01	17.49	24.24	12.01	19.93
24	Nawabshah	2.23	7.32	9.09	2.59	8.79	23.06	30.67	12.97	18.38
25	Shahdadpur	0.82	8.44	11.39	5.76	8.58	19.70	30.38	13.14	17.75
26	Kunri	3.27	4.67	10.10	5.90	12.29	17.45	23.70	13.75	21.29
27	Peshawar	1.33	6.66	15.14	6.92	10.36	19.31	25.72	9.25	18.97
28	Mardan	0.87	6.99	16.62	7.35	10.27	19.67	27.47	8.63	18.28
29	Abbotabad	4.54	4.48	12.48	7.58	8.70	17.78	25.26	10.41	18.78
30	D.I.Khan	3.84	8.27	12.45	4.76	10.55	16.95	27.85	8.66	21.33
31	Bannu	2.81	6.57	12.33	5.54	10.17	18.75	28.75	8.92	18.48
32	Quetta	2.78	7.18	13.86	4.77	12.07	19.39	28.79	8.54	18.49
33	Khuzdar	2.15	5.03	14.59	6.74	10.77	17.22	28.31	11.47	20.65
34	Turbat	4.72	4.04	12.12	8.45	7.48	15.78	27.13	11.40	17.50
35	Loralai&Cantt	6.11	5.97	9.98	9.20	8.15	18.34	27.63	8.77	17.76

City -Wise CPI Non-food Inflation Trends from FY03 - FY11

percent

S.No	Cities	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
	Overall	***3.25***	***3.62***	***7.10***	***8.63***	***6.01***	***7.89***	***18.45***	***11.11***	***10.53***
1	Lahore	2.66	2.76	6.69	9.84	6.33	6.54	17.25	10.35	9.55
2	Faisalabad	2.45	3.97	8.26	8.59	4.55	7.34	19.21	11.16	10.06
3	Rawalpindi	3.13	3.92	8.34	11.01	7.46	8.43	18.73	10.64	10.55
4	Multan	2.82	3.99	7.11	8.29	8.77	7.85	16.96	11.18	12.44
5	Gujranwala	3.79	4.55	8.17	8.79	8.52	11.53	18.19	10.98	10.48
6	Islamabad	2.19	4.37	9.73	12.39	8.00	8.53	17.29	8.78	7.75
7	Sargodha	4.77	4.83	9.39	8.81	6.27	8.88	19.37	11.95	14.27
8	Sialkot	2.82	3.36	7.74	7.85	5.18	7.36	18.65	11.81	10.67
9	Bahawalpur	4.26	4.94	7.59	9.00	6.91	7.88	16.37	11.35	14.27
10	Jhang	4.03	5.34	9.27	8.52	6.65	10.36	19.73	11.31	15.45
11	Okara	3.99	4.34	6.67	10.14	8.36	7.75	21.34	12.82	12.85
12	D.G. Khan	3.60	5.18	7.80	7.07	7.07	10.29	21.68	12.23	13.55
13	Jehlum	3.01	3.84	8.89	9.61	7.69	9.62	18.19	10.79	11.18
14	Bahawalnagar	3.70	6.28	8.31	8.96	7.46	12.59	17.84	13.58	17.22
15	Vehari	3.92	5.77	8.97	8.83	8.64	10.62	18.88	12.18	13.00
16	Mianwali	3.73	4.13	7.86	8.77	7.85	10.66	19.38	11.14	14.18
17	Attock	3.04	4.66	8.38	10.37	7.52	8.97	18.53	11.64	10.33
18	Samundari	3.17	6.86	9.86	7.64	5.55	11.37	18.94	12.00	14.01
19	Karachi	2.77	3.59	7.45	8.14	6.19	8.20	19.10	11.08	9.62
20	Hyderabad	3.01	3.12	4.98	5.72	6.76	11.40	19.20	11.65	13.59
21	Sukkur	2.62	4.33	7.55	6.50	6.31	10.91	20.37	11.78	13.02
22	Larkana	4.74	5.07	7.36	6.02	6.03	10.06	19.81	10.47	13.07
23	Mirpur Khas	3.79	3.24	5.78	7.21	6.89	10.72	21.86	12.04	13.59
24	Nawabshah	3.23	4.10	6.03	5.93	7.26	13.06	22.60	12.76	14.28
25	Shahdadpur	2.82	4.46	6.57	6.61	7.68	11.93	22.86	13.29	13.68
26	Kunri	3.47	2.13	5.93	7.27	6.88	10.23	21.25	11.44	14.45
27	Peshawar	4.59	3.78	7.35	8.67	6.34	8.84	20.86	11.35	13.01
28	Mardan	3.77	5.13	8.86	8.00	7.57	11.29	22.60	10.19	14.03
29	Abbotabad	3.53	2.42	6.51	7.27	5.98	8.83	20.78	12.09	12.86
30	D.I.Khan	5.07	3.91	7.17	8.98	6.00	8.95	19.26	10.92	14.03
31	Bannu	5.23	4.26	6.72	6.95	8.79	13.08	19.53	10.73	15.40
32	Quetta	3.80	4.23	9.55	8.34	6.22	8.93	19.02	11.25	11.36
33	Khuzdar	3.39	4.53	9.65	7.42	6.78	12.83	21.54	10.91	14.46
34	Turbat	3.20	4.90	9.20	8.91	7.61	12.28	20.07	11.71	12.69
35	Loralai&Cantt	3.58	5.12	10.44	8.32	5.90	12.15	20.49	11.17	12.84

Annexure B

CPI Basket of 374 Individual Items and 92 Composite Items

Group No.	Item No.	Composite Items	Individual Items	Weights
I.	**FOOD & BEVERAGES**			**40.3418**
	01	Wheat	Wheat	0.4830
	02	Wheat Flour		5.1122
			Wheat Flour Fine/Superior.	
			Wheat Flour Bag	
	03	Maida	Maida	0.1059
	04	Besan	Besan	0.1320
	05	Rice		1.3369
			Rice Basmati Sup. Qlty.	
			Rice Basmati 385/386	
			Rice Basmati Broken Av.Qlty	
			Rice Irri-6 (Sindh/Punjab)	
	06	Pulse Masoor	Pulse Masoor	0.2214
	07	Pulse Moong	Pulse Moong	0.2230
	08	Pulse Mash	Pulse Mash	0.2017
	09	Pulse Gram	Pulse Gram	0.4272
	10	Gram Whole	Gram Whole	0.1491
	11	Mustard Oil	Mustard Oil	0.0456
	12	Cooking Oil	Cooking Oil	0.6858
	13	Vegetable Ghee		2.6672
			Vegetable Ghee Tin	
			Vegetable Ghee (Loose)	
	14	Sugar	Sugar	1.9467
	15	Gur	Gur	0.0735
	16	Tea		1.2559
			Tea Brookbond Supreme 250Gm.	
			Tea Lipton Yellow Label 200Gm.	
			Tea Loose Kenya Av.Qlty 250Gm.	
			Coffee-Nescafe 75 Gm.	
	17	Milk Fresh		6.6615
			Milk Fresh (Unboiled)	
			Milk Tetra Pack 1/2 Ltr.	
	18	Milk Powder		0.1105
			Lactogen 400 Grams	
			Powder Milk Nido 400Gm.	
			Milk Powder Loose/Packed	
			Milo 200 Gm.	

(continued)

(continues)

Group No.	Item No.	Composite Items	Individual Items	Weights
	19	Milk Products		0.5607
			Curd	
			Butter Local Packed	
	20	Honey	Honey	0.0358
	21	Cereals		0.0878
			Cornflaks Fauji 225 Gm.	
			Vermicelli	
			Custard Powder Rafhan 300 Gm.	
	22	Jam,Tomato,Pickles & Vinegar		0.2472
			Jam Ahmed/Mitchelles	
			Tomato Ketchup Ahmed/Mitchl	
			Pickles Ahmed/Mitchelles	
			Vinegar Synthetic (Sirka)	
	23	Beverages		0.7286
			Squash-Mitchelles	
			Rooh Afza	
			Cold Drink (Standard Siz)	
			Fruit Juice Tetra Pack	
			Ice Cream Walls	
			Ice	
	24	Condiments		0.3392
			Cinamon Loose Av. Qlty	
			Cuminseed White National	
			Pepper Black National	
			Cloves Loose Av.Qlty	
			Curry Powd. National 200 Gm	
			Corriander Seed Powd.National	
	25	Spices		0.6008
			Cardamom Large Loose Av.Qlty	
			Cardamom Small Av.Qlty	
			Salt-Powdered (Lahori) Loose	
			Chillies Powd.National 200Gm	
			Turmeric Powd.National 50Gm	
	26	Dry Fruit		0.2760
			Coconut Dry Av.Qlty.	
			Dates Av.Qlty.	
			Pistachio Av.Qlty.	
			Almonds Whole Av.Qlty.	
			Raisins Av.Qlty.	
			Groundnuts (With Shell)	

(continued)

(continues)

Group No.	Item No.	Composite Items	Individual Items	Weights
	27	Bakery & Confectionary		2.9837
			Bread Plain Medium Size	
			Rusk (Papay)	
			Biscuits-Packed	
			Biscuit-Bakery (Loose)	
			Toffee (Hilal)	
			Chowkelate Candy (Small Size)	
			Pastry Av.Qlty.	
			Patties (Vegatables)	
	28	Cigarettes		0.9527
			Cigarettes K-2 10'S	
			Cigarettes Capstan 10'S	
			Cigarettes Gold Leaf 20'S	
			Cigarettes Morven Gold 20'S	
	29	Betel Leaves & Nuts		0.1851
			Betel Leaves	
			Betel Nuts	
	30	Readymade Food		1.6833
			Bread Tandoori St. Size	
			Cooked Mutton (Av. Hotel)	
			Cooked Beef (Av. Hotel)	
			Cooked Dal (Av. Hotel)	
			Tea Prepared (Ordinary)	
	31	Sweetmeat & Nimco		0.3846
			Samosa (Vegatable)	
			Sweetmeat (Mixed)	
	32	Fish	Fish	0.2703
	33	Meat		2.6981
			Beef With Bone Av.Qlty.	
			Mutton Av.Qlty.	
	34	Chicken Farm	Chicken Farm	0.9158
	35	Eggs	Eggs	0.4119
	36	Potatoes	Potatoes	0.5806
	37	Onions	Onions	0.6237
	38	Tomatoes	Tomatoes	0.4833

(continued)

(continues)

Group No.	Item No.	Composite Items	Individual Items	Weights
	39	Vegetables		1.8377
			Turnip	
			Radish	
			Cabbage	
			Cauliflower	
			Brinjal	
			Pumpkin	
			Bottlegourd	
			Lady Finger	
			Peas	
			Spinach	
			Tinda	
			Turai	
			Karaila	
			Arvi	
			Chillies Green	
			Carrot	
			Ginger	
			Garlic	
			Cocumber (Kheera)	
	40	Fresh Fruits		1.6158
			Malta/Mosambi	
			Kinnu	
			Apple	
			Aloo Bukhara	
			Pomegranate (Annar)	
			Grapes	
			Bananas	
			Mango Kalmi	
			Guava	
			Watermelon (Turbooz)	
			Muskmelon (Kharbooza)	
			Sweetmelon (Sarda)	
			Sweetmelon (Garma)	
II.	**APPAREL, TEXTILE & FOOTWEAR.**			**6.0977**
	41	Cotton Cloth		1.6197
			Long Cloth Av.Qlty.	
			Shirting Av.Qlty.	
			Pant Cloth W & Wear Av.Qlty	
			Lawn Av.Qlty.	
			Voil Av.Qlty.	
			Lungi/Dhoti(Cotton) Avg. Qlty	

(continued)

(continues)

Group No.	Item No.	Composite Items	Individual Items	Weights
	42	Silk,Linen,Woolen/Cloth		0.5766
			Georgette Av.Qlty	
			Linen Av.Qlty	
			Heavy Wt. Suiting Law.Pur	
			Tropical Suiting Law.Pur	
	43	Tailoring Charges		0.8636
			Tailoring Shirt	
			Tailoring Coat-Pant Suit	
			Tailoring Awami-Suit (Male)	
			Tailoring Suit Female	
	44	Hosiery		0.1528
			Brassier Av.Qlty.	
			Underwear Av.Qlty Medium Size	
			Vest For Men Av.Qlty.	
			Socks Nylon (Pakistani)	
	45	Readymade Garments		1.2038
			Dopatta Georgette Av.Qlty.	
			Chaddar (W/Wear) (2X2.5 Mtr)	
			Pant Boy 24"/26" Length.	
			Shirt Boy 24"/26" Length	
			School Uni. Pant,Shirt Boys	
			School Uni. Kameez,Shal.Boys	
			School Uni. Kameez,Shal.Girl	
			Frock W/Wear Girls	
			Awami-Suit W & W(Boy) 24"/26	
			Awami-Suit W&W (Gents)Av.Qlty	
	46	Woolen Readymade Garments		0.1485
			Pullover Gents Oxford/Bon.	
			Pullover Ladies Oxford/Bon.	
			Pullover (Gents) Others A.Qty	
			Second-Hand Coat For Men	
	47	Footwear		1.5327
			Gents Shoes Paul Bata	
			Gents Sandal Bata	
			Gents Spoung Chappal Bata	
			Ladies Sandal Bata	
			Ladies Spoung Chappal Bata	
			Child Shoe Power Lite Bata	
			Gents Shoe, Art 1109 Service	
			Nylon Jogger 27 Size 2-5	
			Boot Polish Cherry/Kiwi 50Ml	
			Shoe Repair Half Sole	

(continued)

(continues)

Group No.	Item No.	Composite Items	Individual Items	Weights
III.	**HOUSE RENT.**			**23.4298**
	48	House Rent Index	House Rent Index	23.4298
IV.	**FUEL AND LIGHTING.**			**7.2912**
	49	Kerosene	Kerosene	0.1366
	50	Firewood	Firewood	0.4778
	51	Match Box	Match Box	0.1301
	52	Bulb & Tube		0.1311
			Bulb Philips 100-Watts	
			Tube Light Philips 40 Watts	
	53	Electricity		4.3698
			Elect.Charges Upto 50 Units	
			Elect.Charges 01 - 100 Unit	
			Elect.Charges 101 - 300 Unit	
			Elect.Charges 301 - 1000 Unit	
			Elect.Charges Above 1000 Unit	
	54	Natural Gas		2.0458
			Gas Chrg Upto 3.3719	
			Gas Chrg 3.3719 - 6.7438	
			Gas Chrg 6.7438 - 10.1157	
			Gas Chrg10.1157 - 13.4876	
			Gas Cylinder Stand. Size	
V.	**H.HOLD.FURNITURE & EQUIPMENT ETC.**			**3.2862**
	55	Utensils		0.3690
			S.Steel Deghchi Medium Size	
			S.Steel Plate A.Qlty.(M.Size)	
			Tea-Set S.Steel 3 Pcs. M.Size	
			Table Spoon S.Steel Sup.Qlty.	
			Water-Set S.Steel Sup.Qlty	
			Tea Set Pak. Chinaware 21 Pcs.	
	56	Plastic Products		0.1055
			Dinner Set Plastic 35 Pcs.	
			Hotpot Set Plastic 3 Pcs.	
			Bucket(Balti) Plastic Med.Siz	
	57	Suitcase	Suitcase	0.0470
	58	House Hold Equipments		0.0953
			Presure Cooker 4 Ltr.	
			Electric Juicer For Apple	
			Water Cooler 9/10 Ltr.Plastic	
			Thermos Starvac 1 Ltr	

(continued)

(continues)

Group No.	Item No.	Composite Items	Individual Items	Weights
	59	Furniture (Ready Made)		0.3054
			Chair Shesham Wood With Arms	
			Table Shesham Wood (4X2X5")	
			Sofaset Wooden With Foam Seat	
			Cot Iron (With Niwar)Av.Qlty.	
			Almirah (Steel) 6'X3' 20 Guage	
			Dinning Table 6 Chairs A.Qlty	
			Single Bed Without Foam Med.	
			Matress Single(4"Thick)	
	60	Furnishing		0.6362
			Quilt (Lihaf) 3 Kg. Cotton	
			Blanket (90" X 54")	
			Bedsheet Single Bed Sup.Qlty	
			Dari Cotton (6'X2 1/2') Av.Ql	
			Farshi Dari 12'X9' Av.Qlty	
			Carpet Plain Av. Qlty	
			Towel(3'X2') Av. Qalty	
			Gas Burner Double Spfy.Brand	
			Elect. Iron Philips Mdl.1120	
	61	Elect.Iron Fans & Washing Machine		0.1889
			Celing Fan 48" Super Qlty	
			Pedestal Fan 22" Super Qlty	
			Washing Machine Singer	
	62	Sewing Machine,Clock And Needles		0.1270
			Sewing Machine(Singer)	
			Wall Clock Quartz Av.Qlty	
			Hand Stitching Needle M.Size	
			Sewing Thread/Reel(Asli Pari)	
	63	Refrigerator & Airconditioner		0.1756
			Refg. Dawlence 10 Cft. D.Door	
			D-Freezer Waves 8 Cft.	
			Airconditioner 1.5 Ton Pel	
			Aircooler Super Asia	
	64	Marriage Hall	Marriage Hall	0.0445
	65	House Hold Servan	House Hold Servant	1.1918
VI.	**TRANSPORT & COMMUNICATION.**			**7.3222**
	66	Petrol	Petrol	1.7253
	67	Diesel	Diesel	0.2070
	68	Cng. Filling Charge	Cng. Filling Charges	0.1649

(continued)

(continues)

Group No.	Item No.	Composite Items	Individual Items	Weights
	69	Service Charges		0.3835
			Motor Cycle Service Charges	
			Car Service Charges	
	70	Vehicles		0.2596
			Motorcycle Honda Cd-70.	
			Motorcycle Yamaha 100Cc.	
			Car Suzuki 800 Cc (W/O. A/C)	
			Bicycle With Tyres & Tubes	
	71	Tyre & Tube		0.2831
			Tyre Car With Tube General	
			Tyre Motor Cycle Without Tube	
			Tyre Cycle Specify Brand Name	
	72	Transport Fare/Charges		2.1236
			Auto Rickshaw Fares	
			Full Tonga Charges	
			Taxi 4 Seater Fare	
			Bus Fare Min (Within City)	
			Bus Fare Max (Within Cit	
			Bus Fare Outside City	
			A/C Bus Fare Outside City	
			Minibus Fare Min.With In City	
			Minibus Fare Max.With In City	
			Suzuki Fare Min.With In City	
			Suzuki Fare Maximum W.In City	
	73	Train Fare		0.1514
			Train Fare Eco. 1-100 Km.	
			Train Fare Eco. 101-500 Km.	
			Train Fare Eco. > 500 Km.	
			Train Fare Ist Slp. 1-100Km	
			Train Fare Ist Slp.101-500 Km	
			Train Fare Ist Slp. > 500 Km	
			Train Fare A/C Slp. 1-100Km.	
			Train Fare A/C Slp.101-500Km	
			Train Fare A/C Slp > 500Km.	
			Plateform Ticket	
	74	Air Fare	Air Fare	0.0983

(continued)

(continues)

Group No.	Item No.	Composite Items	Individual Items	Weights
	75	Communication		1.9255
			Postal Envelope Domestic	
			Postal Registration Charges	
			Aerogram For Saudi Arabia	
			U.M.S. Reg Charges Min.	
			T.C.S. Ch. Min.With In Zone	
			Telephone Charges Local Call	
			Car Tax For 800Cc To 1300Cc	
			Tel Charges Out Side City	
			Internet Charges	
VII.	**RECREATION & ENTERTAINMENT.**			**0.8259**
	76	Recreation		0.3399
			Daily "Dawn"	
			Daily "Jang"	
			Daily "Nawa-E-Waqt"	
			Weekly "Akhbar-E-Jahan"	
			Weekly "Mag"	
			Monthly "Naunehal Digest"	
	77	Entertainment		0.4860
			Radio With C.Player National	
			Dry Cell 1.5 Volt(Local)	
			T.V. 20" Colored Wega H-A21.	
			Video Game Sega 16 Byte	
			V.C.P. Panasonic/Lg/Nat	
			Vid. Cassette Blk. Tdk/Sony	
			Tape Recorder Cassette Blank	
			Cinema A/C. High Class	
			Cinema Non-A/C High Class	
			Tv.Licence Fee Domestic	
VIII.	**EDUCATION.**			**3.4548**
	78	Tution Fees		2.3629
			School Fee Primary Eng.Med.	
			School Fee 2Nd-Ry Eng.Med.	
			Govt. College Fee Ist. Year	
			Govt. College Fee 4Th. Year	
			Govt. University Fee Msc.	
			Govt. Med. College Fee Mbbs	
			Govt. Engg. Coll. Fee I Year	

(continued)

(continues)

Group No.	Item No.	Composite Items	Individual Items	Weights
	79	Stationery		0.3500
			Paper Foolscape (27"X17")	
			Exercise.Book Lined 80/100 Pgs	
			Pencilgoldfish/Deer	
			Fountin Pen Youth China	
			Pen Ink Dollor 57 Ml Bottle	
			Ball Pen (Local)	
	80	Text Books		0.6894
			English Book Class V1	
			English Book Class Ix Or X	
			Eng. Book Ist.Yr Complete Set	
			Urdu Book Class V (T.B.Bord)	
			Urdu Book Class Ix/X(T.B.B)	
			Urdu Book Ist.Year/Inter	
			Maths Book Calss V (T.B.B)	
			Maths Book Class Ix Or X	
			Maths Book Ist.Year (T.B.B)	
	81	Computer & Allied	Products	0.0525
			Comp. With Printer & Speaker	
			Com. C.D. (Tdk/Imation)	
IX.	**CLEANING LAUNDRY & PER.APPEARANCE.**			**5.8788**
	82	Washing Soap & Detergent		1.5535
			Washing Soap	
			Surf (Medium) 100 Grm	
			Washing Powder 1000 Grm	
			Cleanser Powder Vim 1000 Gm	
			Finis 500 Ml	
			Robin Blue (35 Grams)	
			Tissu Paper Perfumed 100 Pcs.	
			Toilet Paper Roll (R.Petel)	
	83	Toilet Soap		0.7436
			Toilet Soap Lux 95 Grams	
			Toilet Soap Lifebouy 140 Grm	
	84	Tooth Paste		0.4036
			Toothpaste Macklines 70 Grm	
			Toothbrush Sheild A/Plauque	
			Toothpowder Dentonic 90 Grm	
	85	Shaving Articles		0.3480
			Blade Treet Ordinary 10'S	
			Blade 7-O-Clock Stain. 5'S	
			Disposable Razor Gillet-Ii	
			Shaving Cream Touch-Me/Adm.	

(continued)

(continues)

Group No.	Item No.	Composite Items	Individual Items	Weights
	86	Cosmetics		1.4272
			Nail Polish S.Miss/Medora	
			Lipstick S.Miss/Medora	
			Perfume Med.Size Medora/Broach	
			Shampoo Plain Medora 200 Ml.	
			Facecream Ponds (Medium)	
			Talc Powder Vice Roay,B.Cat	
			Hair-Oil Amla/Chambeli	
			Brylcreem 210 Ml.	
			Hair-Colour Begin (6 Gms)	
	87	Watches		0.0552
			Wrist Watch Gents Citizen	
			Wrist Watch Ladies Citizen	
	88	Jewellery		0.3936
			Gold Tezabi 24 Ct	
			Silver Tezabi 24 Ct	
			Artificial Jewellary Set	
	89	Laundry Charges		0.2207
			Washing Ch. Shirt	
			Dry Cleaning Suit Coat Pant	
			Washing Ch. (Kamiz-Shalwar)	
	90	Hair Cut & Beauty Parlour Charges		0.7334
			Haircut Charges For Men	
			Beauty Porl Hair Styl Charge	
X.	**MEDICARE.**			**2.0728**
	91	Drugs & Medicines		1.0752
			Septran Tablets	
			Brufen Tabs 200-Mg.	
			Panadol Tab. Extra/Plain	
			Disprin Tab.	
			Flagyl Tab. 200 Mg.	
			Ventolin Tab. 2Mg.	
			Daonil Tab. 5 Mg.	
			Entox Tab.	
			Renitec Tab. 5 Mg.	
			Cac. 1000 Tab	
			Amoxil Capsole 250 Mg.S	
			Calcium Syrup Sandoz	

(continued)

(continues)

Group No.	Item No.	Composite Items	Individual Items	Weights
			Lederplex Syrup	
			Sancos Syrup (50 Ml.)	
			Phenergan Syrup 120 Ml.	
			Calpol Syrup 60 Ml.	
			Hydryllin Syrup 120 Ml.	
			Polyfax Eye Ointment	
			Betnesol Eye Drops	
			Betnovate-N Ointment 5 Gms	
			Burnol Cream 30 Grm	
			Galxos-D (450 Grms)	
			Gripe-Water Woodwards	
			O.R.S. (Nimcol)	
			Dettol (Medium)	
			Cotton Bandage 2" - 4"	
			Thermometer China	
			Jouhar Joshanda	
	92	Doctor's Fee	Doctor's Fee	0.9976
Total Weight				**100.0012**

(concludes)

Source: http://www.sbp.org.pk/publications/Inflation_Monitor/2007/Jul/IM_Jul_07.pdf

Annexure C

List of CPI 92 Composit items with weights

	Food & Beverages	**40.3415**		**Fuel and Lighting**	**7.2912**
1	Wheat	0.483	49	Kerosene	0.1366
2	Wheat Flour	5.1122	50	Firewood	0.4778
3	Maida	0.1059	51	Match Box	0.1301
4	Besan	0.132	52	Bulb & Tube	0.1311
5	Rice	1.3369	53	Electricity	4.3698
6	Pulse Masoor	0.2214	54	Natural Gas	2.0458
7	Pulse Moong	0.223		**H. Hold Furniture & Equipment etc.**	**3.2862**
8	Pulse Mash	0.2017	55	Utensils	0.369
9	Pulse Gram	0.4272	56	Plastic Products	0.1055
10	Gram Whole	0.1491	57	Suitcase	0.047
11	Mustard Oil	0.0456	58	House Hold Equipments	0.0953
12	Cooking Oil	0.6858	59	Furniture (Ready Made)	0.3054
13	Vegetable Ghee	2.6672	60	Furnishing	0.6362
14	Sugar	1.9467	61	Elect.Iron Fans & Washing Machine	0.1889
15	Gur	0.0735	62	Sewing Machine,Clock And Needles	0.127
16	Tea	1.2559	63	Refrigerator & Airconditioner	0.1756
17	Milk Fresh	6.6615	64	Marriage Hall	0.0445
18	Milk Powder	0.1105	65	House Hold Servant	1.1918
19	Milk Products	0.5607		**Transport & Communication**	**7.3222**
20	Honey	0.0358	66	Petrol	1.7253
21	Cereals	0.0878	67	Diesel	0.207
22	Jam,Tomato,Pickles & Vinegar	0.2472	68	Cng. Filling Charges	0.1649
23	Beverages	0.7286	69	Service Charges	0.3835
24	Condiments	0.3392	70	Vehicles	0.2596
25	Spices	0.6008	71	Tyre & Tube	0.2831
26	Dry Fruit	0.276	72	Transport Fare/Charges	2.1236
27	Bakery & Confectionary	2.9837	73	Train Fare	0.1514
28	Cigarettes	0.9527	74	Air Fare	0.0983
29	Betel Leaves & Nuts	0.1851	75	Communication	1.9255
30	Readymade Food	1.6833		**Recreation & Entertainment**	**0.8259**
31	Sweetmeat & Nimco	0.3846	76	Recreation	0.3399
32	Fish	0.2703	77	Entertainment	0.486
33	Meat	2.6981		**Education**	**3.4548**
34	Chicken Farm	0.9158	78	Tution Fees	2.3629
35	Eggs	0.4119	79	Stationery	0.35
36	Potatoes	0.5806	80	Text Books	0.6894
37	Onions	0.6237	81	Computer & Allied Products	0.0525
38	Tomatoes	0.4833		**Cleaning Laundry & Per. Appearance**	**5.8788**
39	Vegetables	1.8377	82	Washing Soap & Detergent	1.5535
40	Fresh Fruits	1.6155	83	Toilet Soap	0.7436
	Apparel, Textile & Footwear	**6.0977**	84	Tooth Paste	0.4036
41	Cotton Cloth	1.6197	85	Shaving Articles	0.348
42	Silk,Linen,Woolen/Cloth	0.5766	86	Cosmetics	1.4272
43	Tailoring Charges	0.8636	87	Watches	0.0552
44	Hosiery	0.1528	88	Jewellery	0.3936
45	Readymade Garments	1.2038	89	Laundry Charges	0.2207
46	Woolen Readymade Garments	0.1485	90	Hair Cut & Beauty Parlour Charges	0.7334
47	Footwear	1.5327		**Medicare**	**2.0728**
	House Rent	**23.4298**	91	Drugs & Medicines	1.0752
48	House Rent Index	23.4298	92	Doctor's Fee	0.9976
					100.0009

Annexure D

List of Cities in CPI basket (2000-01 baase)

01	Lahore	19	Karachi
02	Faisalabad	20	Hyderabad
03	Rawalpindi	21	Sukkur
04	Multan	22	Larkana
05	Gujranwala	23	Mirpur Khas
06	Islamabad	24	Nawabshah
07	Sargodha	25	Shahdadpur
08	Sialkot	26	Kunri
09	Bahawalpur	27	Peshawar
10	Jhang	28	Mardan
11	Okara	29	Abbotabad
12	D.G. Khan	30	D.I.Khan
13	Jehlum	31	Bannu
14	Bahawalnagar	32	Quetta
15	Vehari	33	Khuzdar
16	Mianwali	34	Turbat
17	Attock	35	Loralai&Cantt
18	Samundari		

Annexure E

Null Hypothesis: LO has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=12)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			**3.3851**	**1.0000**
Test critical values:	1% level		-3.4861	
	5% level		**-2.8859**	
	10% level		-2.5798	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LO)				
Method: Least Squares				
Date: 12/18/14 Time: 07:15				
Sample (adjusted): 2001M08 2011M06				
Included observations: 119 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LO(-1)	0.0088	0.0026	3.3851	0.0010
C	-0.0362	0.0130	-2.7871	0.0062
R-squared	0.08920	Mean dependent var		0.007687
Adjusted R-squared	0.08142	S.D. dependent var		0.008446
S.E. of regression	0.00810	Akaike info criterion		-6.77848
Sum squared resid	0.00767	Schwarz criterion		-6.73177
Log likelihood	405.32	Hannan-Quinn criter.		-6.75951
F-statistic	11.46	Durbin-Watson stat		1.60
Prob(F-statistic)	0.00			

Null Hypothesis: D(LO) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=12)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			**-8.0811**	**0.0000**
Test critical values:	1% level		-3.4866	
	5% level		**-2.8861**	
	10% level		-2.5799	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LO,2)				
Method: Least Squares				
Date: 12/18/14 Time: 07:16				
Sample (adjusted): 2001M09 2011M06				
Included observations: 118 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LO(-1))	-0.7205	0.0892	-8.0811	0.0000
C	0.0055	0.0010	5.4426	0.0000
R-squared	0.36019	Mean dependent var		-4.6E-06
Adjusted R-squared	0.35468	S.D. dependent var		0.01018
S.E. of regression	0.00818	Akaike info criterion		-6.75795
Sum squared resid	0.00776	Schwarz criterion		-6.71099
Log likelihood	400.72	Hannan-Quinn criter.		-6.73888
F-statistic	65.30	Durbin-Watson stat		2.09
Prob(F-statistic)	0.00			

Null Hypothesis: LF has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=12)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			**1.5772**	**0.9994**
Test critical values:	1% level		-3.4861	
	5% level		**-2.8859**	
	10% level		-2.5798	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LF)				
Method: Least Squares				
Date: 12/18/14 Time: 07:55				
Sample (adjusted): 2001M08 2011M06				
Included observations: 119 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LF(-1)	0.0069	0.0044	1.5772	0.1174
C	-0.0255	0.0220	-1.1607	0.2481
R-squared	0.02082	Mean dependent var		0.009079
Adjusted R-squared	0.01245	S.D. dependent var		0.016414
S.E. of regression	0.01631	Akaike info criterion		-5.37725
Sum squared resid	0.03113	Schwarz criterion		-5.33054
Log likelihood	321.95	Hannan-Quinn criter.		-5.35828
F-statistic	2.49	Durbin-Watson stat		1.80
Prob(F-statistic)	0.12			

Null Hypothesis: D(LF) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=12)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			**-9.5028**	**0.0000**
Test critical values:	1% level		-3.4866	
	5% level		**-2.8861**	
	10% level		-2.5799	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LF,2)				
Method: Least Squares				
Date: 12/18/14 Time: 07:55				
Sample (adjusted): 2001M09 2011M06				
Included observations: 118 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LF(-1))	-0.8754	0.0921	-9.5028	0.0000
C	0.0079	0.0017	4.5734	0.0000
R-squared	0.43772	Mean dependent var		-6.8E-05
Adjusted R-squared	0.43287	S.D. dependent var		0.021805
S.E. of regression	0.01642	Akaike info criterion		-5.36371
Sum squared resid	0.03128	Schwarz criterion		-5.31675
Log likelihood	318.46	Hannan-Quinn criter.		-5.34464
F-statistic	90.30	Durbin-Watson stat		2.00
Prob(F-statistic)	0.00			

Null Hypothesis: LNF has a unit root				
Exogenous: Constant				
Lag Length: 3 (Automatic - based on SIC, maxlag=12)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			**1.4722**	**0.9992**
Test critical values:	1% level		-3.4876	
	5% level		**-2.8865**	
	10% level		-2.5802	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LNF)				
Method: Least Squares				
Date: 12/18/14 Time: 07:55				
Sample (adjusted): 2001M11 2011M06				
Included observations: 116 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNF(-1)	0.0030	0.0021	1.4722	0.1438
D(LNF(-1))	0.2361	0.0929	2.5417	0.0124
D(LNF(-2))	0.1211	0.0948	1.2776	0.2041
D(LNF(-3))	0.2824	0.0941	3.0024	0.0033
C	-0.0124	0.0098	-1.2698	0.2068
R-squared	0.3732	Mean dependent var		0.0068
Adjusted R-squared	0.3506	S.D. dependent var		0.0054
S.E. of regression	0.0043	Akaike info criterion		-8.0035
Sum squared resid	0.0021	Schwarz criterion		-7.8848
Log likelihood	469.20	Hannan-Quinn criter.		-7.9553
F-statistic	16.52	Durbin-Watson stat		1.9521
Prob(F-statistic)	0.00			

Null Hypothesis: D(LNF) has a unit root				
Exogenous: Constant				
Lag Length: 2 (Automatic - based on SIC, maxlag=12)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			**-2.8390**	**0.0560**
Test critical values:	1% level		-3.4876	
	5% level		**-2.8865**	
	10% level		-2.5802	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LNF,2)				
Method: Least Squares				
Date: 12/18/14 Time: 07:55				
Sample (adjusted): 2001M11 2011M06				
Included observations: 116 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNF(-1))	-0.2642	0.0931	-2.8390	0.0054
D(LNF(-1),2)	-0.4666	0.1058	-4.4086	0.0000
D(LNF(-2),2)	-0.3144	0.0920	-3.4175	0.0009
C	0.0019	0.0007	2.6285	0.0098
R-squared	0.3751	Mean dependent var		0.0001
Adjusted R-squared	0.3584	S.D. dependent var		0.0054
S.E. of regression	0.0044	Akaike info criterion		-8.0014
Sum squared resid	0.0021	Schwarz criterion		-7.9065
Log likelihood	468.08	Hannan-Quinn criter.		-7.9629
F-statistic	22.41	Durbin-Watson stat		1.9710
Prob(F-statistic)	0.00			

Annexure F

Dependent Variable: D(LO)				
Method: Least Squares				
Date: 12/18/14 Time: 08:14				
Sample (adjusted): 2001M11 2011M06				
Included observations: 116 after adjustments				
Convergence achieved after 47 iterations				
MA Backcast: 2001M08 2001M10				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0079	0.0016	4.7803	0.0000
AR(1)	-0.8378	0.1282	-6.5349	0.0000
AR(2)	0.3307	0.2053	1.6108	0.1101
AR(3)	0.8214	0.1256	6.5385	0.0000
MA(1)	1.0639	0.1744	6.0993	0.0000
MA(2)	0.0122	0.2898	0.0420	0.9666
MA(3)	-0.5658	0.1726	-3.2788	0.0014
R-squared	0.1666	Mean dependent var		0.0078
Adjusted R-squared	0.1207	S.D. dependent var		0.0085
S.E. of regression	0.0080	Akaike info criterion		-6.76
Sum squared resid	0.0070	Schwarz criterion		-6.60
Log likelihood	399.18	Hannan-Quinn criter.		-6.69
F-statistic	3.63	Durbin-Watson stat		1.96
Prob(F-statistic)	0.0025			

Dependent Variable: D(LF)				
Method: Least Squares				
Date: 12/18/14 Time: 11:02				
Sample (adjusted): 2001M11 2011M06				
Included observations: 116 after adjustments				
Convergence achieved after 31 iterations				
MA Backcast: 2001M08 2001M10				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0118	0.0013	8.9946	0.0000
AR(1)	-0.6920	0.0394	-17.5552	0.0000
AR(2)	0.6223	0.0376	16.5699	0.0000
AR(3)	0.8909	0.0436	20.4301	0.0000
MA(1)	0.7706	0.0318	24.2620	0.0000
MA(2)	-0.7320	0.0249	-29.3644	0.0000
MA(3)	-0.9858	0.0328	-30.0187	0.0000
R-squared	0.1318	Mean dependent var		0.0091
Adjusted R-squared	0.0840	S.D. dependent var		0.02
S.E. of regression	0.0159	Akaike info criterion		-5.39
Sum squared resid	0.03	Schwarz criterion		-5.22
Log likelihood	319.47	Hannan-Quinn criter.		-5.32
F-statistic	2.7587	Durbin-Watson stat		1.894611
Prob(F-statistic)	0.015534			

Dependent Variable: D(LNF)				
Method: Least Squares				
Date: 12/18/14 Time: 12:30				
Sample (adjusted): 2001M12 2011M06				
Included observations: 115 after adjustments				
Convergence achieved after 7 iterations				
MA Backcast: 2001M08 2001M11				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0074	0.0015	4.9451	0.0000
AR(1)	0.3567	0.0855	4.1726	0.0001
AR(4)	0.3597	0.1259	2.8559	0.0051
MA(3)	0.3885	0.0887	4.3803	0.0000
MA(4)	-0.3626	0.1294	-2.8018	0.0060
R-squared	0.3700	Mean dependent var		0.0069
Adjusted R-squared	0.3471	S.D. dependent var		0.0053
S.E. of regression	0.0043	Akaike info criterion		-8.0099
Sum squared resid	0.0021	Schwarz criterion		-7.8905
Log likelihood	465.57	Hannan-Quinn criter.		-7.96
F-statistic	16.15	Durbin-Watson stat		2.06
Prob(F-statistic)	0.00			

Annexure G

For Overall Group
Equation 5.4a
Correlated Random Effects - Hausman Test
Pool: POOL01
Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.1458	1	0.7026
Period random	0.5308	1	0.4663
Cross-section and period random	0.3821	1	0.5365

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
VPT_?	0.0182	0.0172	0.0000	0.7026

Equation 5.4b
Correlated Random Effects - Hausman Test
Pool: POOL01
Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	1.3105	1	0.2523
Period random	7.1069	1	0.0077
Cross-section and period random	3.1047	1	0.0781

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
SPT_?	0.0010	0.0010	0.0000	0.2523

Equation 5.4c
Correlated Random Effects - Hausman Test
Pool: POOL01
Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.9733	2	0.6147
Period random	8.2585	2	0.0161
Cross-section and period random	4.1034	2	0.1285

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
VPT_?	0.0235	0.0226	0.0000	0.7013
SPT_?	0.0010	0.0010	0.0000	0.3641

Equation 5.4d
Correlated Random Effects - Hausman Test
Pool: POOL01
Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	1.653365	3	0.6474
Period random	6.5101	3	0.0893
Cross-section and period random	3.1278	3	0.3723

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
VPT_?	0.0322	0.0302	0.0000	0.3347
SPT_?	-0.0001	-0.0001	0.0000	0.9536
VPT_?*SPT_'	0.0153	0.0152	0.0000	0.7415

For Food Group
Equation 5.4a
Correlated Random Effects - Hausman Test
Pool: POOL01
Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	2.6585	1	0.1030
Period random	0.6481	1	0.4208
Cross-section and period random	3.5900	1	0.0581

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
VPT_?	0.0330	0.0283	0.0000	0.1030

Equation 5.4b
Correlated Random Effects - Hausman Test
Pool: POOL01
Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	2.3913	1	0.1220
Period random	9.6703	1	0.0019
Cross-section and period random	4.2820	1	0.0385

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
SPT_?	0.0027	0.0026	0.0000	0.1220

Equation 5.4c
Correlated Random Effects - Hausman Test
Pool: POOL01
Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	4.9365	2	0.0847
Period random	10.9025	2	0.0043
Cross-section and period random	6.7418	2	0.0344

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
VPT_?	0.0356	0.0318	0.0000	0.1268
SPT_?	0.0027	0.0026	0.0000	0.1431

Equation 5.4d
Correlated Random Effects - Hausman Test
Pool: POOL01
Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	3.530032	3	0.3169
Period random	9.0356	3	0.0288
Cross-section and period random	4.8007	3	0.1870

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
VPT_?	0.0405	0.0374	0.0000	0.2175
SPT_?	0.0005	0.0005	0.0000	0.5386
VPT_?*SPT_	0.0227	0.0227	0.0000	0.8858

For Non-food Group

Equation 5.4a

Correlated Random Effects - Hausman Test

Pool: POOL01

Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	8.1681	1	0.0043
Period random	0.0408	1	0.8400
Cross-section and period randor	4.8497	1	0.0277

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
VPT_?	0.0082	0.0108	0.0000	0.0043

Equation 5.4b

Correlated Random Effects - Hausman Test

Pool: POOL01

Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	21.8700	1	0.0000
Period random	21.1109	1	0.0000
Cross-section and period randor	0.8500	1	0.3566

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
SPT_?	0.0004	0.0004	0.0000	0.0000

Equation 5.4c

Correlated Random Effects - Hausman Test

Pool: POOL01

Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	23.1694	2	0.0000
Period random	20.2823	2	0.0000
Cross-section and period randor	15.9623	2	0.0003

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
VPT_?	0.0065	0.0105	0.0000	0.0000
SPT_?	0.0004	0.0004	0.0000	0.0000

Equation 5.4d

Correlated Random Effects - Hausman Test

Pool: POOL01

Test cross-section and period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0	3	1
Period random	0	3	1
Cross-section and period randor	0.0000	3	1.0000

* Cross-section test variance is invalid. Hausman statistic set to zero.
* Period test variance is invalid. Hausman statistic set to zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
VPT_?	0.0224	0.0223	0.0000	0.8604
SPT_?	-0.0004	-0.0004	0.0000	0.0000
VPT_?*SPT_?	0.0383	0.0381	0.0000	NA