December 2007

Quantile Inferences for Inflation and Its Variability: Does a Threshold Inflation Rate Exist?

WenShwo Fang
Feng Chia University

Stephen M. Miller
University of Nevada, Las Vegas, and University of Connecticut

Chih-Chuan Yeh
Overseas Chinese Institute of Technology, Taichung

University of Connecticut

Department of Economics Working Paper Series

Quantile Inferences for Inflation and Its Variability: Does a Threshold Inflation Rate Exist?

WenShwo Fang
Feng Chia University

Stephen M. Miller
University of Nevada, Las Vegas, and University of Connecticut

Chih-Chuan Yeh
The Overseas Chines Institute of Technology, Taichung

Working Paper 2007-45

December 2007

---

341 Mansfield Road, Unit 1063
Storrs, CT 06269–1063
Phone: (860) 486–3022
Fax: (860) 486–4463
http://www.econ.uconn.edu/

Abstract

Using quantile regressions and cross-sectional data from 152 countries, we examine the relationship between inflation and its variability. We consider two measures of inflation - the mean and median - and three different measures of inflation variability - the standard deviation, coefficient of variation, and median deviation. Using the mean and standard deviation or the median and the median deviation, the results support both the hypothesis that higher inflation creates more inflation variability and that inflation variability raises inflation across quantiles. Moreover, higher quantiles in both cases lead to larger marginal effects of inflation (inflation variability) on inflation variability (inflation). Using the mean and the coefficient of variation, however, the findings largely support no correlation between inflation and its variability. Finally, we also consider whether thresholds for inflation rate or inflation variability exist before finding such positive correlations. We find evidence of thresholds for inflation rates below 3 percent, but mixed results for thresholds for inflation variability.

Journal of Economic Literature Classification: C21; E31

Keywords: inflation, inflation variability, inflation targeting, threshold effects, quantile regression

1. Introduction

Uncertainty emanates from the difficulty of knowing the future values of the variable of interest. Higher uncertainty reflects higher volatility of the variable's expected value or a higher variability of the variable around a given mean. In his Nobel lecture, Friedman (1977) suggests that higher inflation creates nominal uncertainty, which lowers welfare and output growth. Johnson (1967) and Okun (1971) argue that although desirable, achieving and maintaining steady inflation proves problematic because of political factors or policy differences. That is, inflation variability is unavoidable. Using quantile regression analysis, this paper reexamines empirically the relationship between aggregate inflation and its variability, especially the issue whether a threshold inflation rate exists.

The linkages, if any, between inflation and inflation variability received considerable attention over the past forty years. Friedman (1977) outlines an informal argument regarding how an increase in inflation raises inflation variability. Ball (1992) formulates Friedman's hypothesis in a model of monetary policy, where high inflation creates uncertainty about future monetary policy and, thus, higher inflation variability. Ungar and Zilberfarb (1993) argue, however, that with rising inflation agents may invest more resources in forecasting inflation, thus, reducing inflation variability.

Cukierman and Meltzer (1986), on the other hand, consider the reverse linkage. To wit, they argue that increases in inflation uncertainty raise inflation by increasing the incentive for the policy maker to create inflation surprises to stimulate output growth in a game-theory framework. Thus, inflation variability leads to higher inflation. In contrast, Holland (1995) suggests that higher inflation variability lowers inflation, if the monetary authorities succeed in stabilizing the economy.

Using annual cross-section data on 17 OECD countries for the period 1951 to 1968, Okun (1971) reports a positive association between the average inflation rate and its standard deviation, supporting the Friedman-Ball hypothesis. In a comment, Gordon (1971) notes that the elimination of the data from the 1950s causes the significant positive correlation to disappear. Logue and Willett (1976) find similar results for 41 countries across the period 1948 to 1970, but note that this strong relationship breaks down when disaggregating the sample. Foster (1978) uses average absolute changes in the inflation rate rather than the standard deviation as a measure of variability for 40 countries from 1954 to 1975 and obtains results similar to those of Okun (1971) and Logue and Willett (1976). Davis and Kanago (1998) employ survey data for 44 countries over 20 years, finding a robust, strong, positive relationship between inflation and its variability across countries, but the support for Okun's hypothesis weakens considerably for intracountry data. Similar findings emerge in Davis and Kanago (2000), who use squared forecast-errors from OECD inflation forecasts for 24 countries, They find a significant, positive cross-section relationship across countries between inflation and inflation uncertainty, but the time-series relationship within countries proves weak, at best. Regarding this weak link at the individual country level, Katsimbris and Miller (1982) and Davis and Kanago (1996) find, on a country-by-country basis for OECD and high-inflation countries, a less pervasive, positive relationship between the inflation rate and its variability than suggested by Okun's (1971) original findings.

Most recent empirical studies that examine the relationship between inflation and its variability focus on time-series analysis of a specific economy, since Engle (1982, 1983) applied the autoregressive conditional heteroskedasticity (ARCH) model to this issue. Inflation variability decomposes into predictable and unpredictable components. ARCH models estimate the relationship between inflation and its unpredictable variability, as emphasized by Grier and Perry

(1998). This approach produces mixed evidence, however. For example, the Friedman-Ball hypothesis receives support from Ball and Cecchetti (1990), Grier and Perry (1998), Fountas (2001), Kontonikas (2004), Conrad and Karanasos (2005), Daal et al. (2005), and Thornton (2007) for a positive relationship for the G7 and other developed and emerging-market countries. Engle (1983), Cosimano and Jansen (1988), and Evans (1991) find no support for the hypothesis, where they focus only on the US.

The Cukierman-Meltzer hypothesis receives support from Baillie et al. (1996) only for a few high inflation countries. Grier and Perry (1998), Daal et al. (2005), and Thornton (2007) report mixed evidence to support the hypothesis and even uncover some support for Holland's counter hypothesis in developed and developing countries. Hwang (2001) discovers no statistical evidence for a relationship in the US.

In contrast to time-series tests in individual countries, we apply quantile regressions to the unconditional inflation and inflation-variability relationships for a cross-section of 152 countries over 1993 to 2003, returning to the cross-section sampling approach of Okun (1971) and Gordon (1971). Our cross-section analysis exhibits several differences from previous studies. First, we use more sample countries. That is, we employ 152 countries as compared to 17 in Okun (1971), 41 in Logue and Willett (1976), 40 in Foster (1978), 44 in Davis and Kanago (1998), or 24 in Davis and Kanago (2000). A larger sample size can minimize the chances of spurious results from relatively few observations.

Second, the sample period of 1993 to 2003 provides analysis for more recent data that captures several improvements. One, we maximize the number of countries within the sample with more recent inflation data. Two, the sample period avoids the issue of potential structural change in inflation variability due to the Great Moderation. That is, inflation increased globally and became more volatile in the 1970s, but since the 1980s, inflation rates fell and became substantially less volatile, as a pattern across many countries. Three, inflation targeting became an increasingly popular monetary policy strategy, since New Zealand's first adoption in 1990. Now, over twenty countries (industrial and emerging market) target inflation with other countries considering the possibility. That is, lower inflation, lower persistence, and lower volatility exist in inflation-targeting countries (Mishkin 1999, King 2002, Mishkin and Schmidt-Hebbel 2007). Our sample period captures the inflation-targeting era.

Third, we implement quantile regression analysis that permits the calculation of the cross-sectional correlations between the inflation and its variability at different levels of inflation and various degrees of variability. This approach to the issues constitutes an innovation in that prior studies examine Pearson product-moment correlations or ordinary least squares (OLS) regression analysis. Moreover, conventional cross-section studies examine the Friedman-Ball or Okun hypothesis only. The present paper considers the Cukierman-Meltzer hypothesis as well.

Fourth, we introduce two measures of inflation – the mean and median – and three measures of its variability – the standard deviation, coefficient of variation, and median deviation – to examine the robustness of the relationships, if any. The positive correlation does not prove robust across the different measures of level and variability.

Finally, Davis and Kanago (1998, 2000) note that some researchers (Logue and Willet, 1976 and Hafer and Heyne-Hafer, 1981) find that the positive correlation between inflation and its variability does not hold for low inflation countries. Logue and Willett (1976) report insignificant correlation for highly industrialized countries or for those with modest inflation rates between two to four percent over the period 1948-1970.[1] Hafer and Heyne-Hafer (1981) conclude that the

[1] Gale (1981) reports that a clerical error may explain the insignificant correlation for industrialized countries in the

threshold level of inflation above which the positive correlation emerges rose from around 4 percent for data in the 1950 to 1970 sample period to around 9 percent for their sample from 1970 to 1979. We split the sample into two different sets of sub-samples. First, we split the sample at the median (i.e., just over 6 percent) and show that, across countries, a significant positive relationship exists between the mean inflation rate and its variability, for both low and high inflation countries. That is, we reject the notion of a threshold effect at 6 percent. Moreover, we find that frequently the marginal effects prove larger for low inflation countries. Second, we split the low inflation sample (i.e., countries less than the median) at its median (i.e., just under 3 percent), creating low and moderate inflation countries. Now, the low inflation countries do not exhibit the positive correlation between inflation variability and its level.

We also split the sample of countries into two different sets of sub-samples based on the inflation variability. First, we split the sample at the median (i.e., just over 4.25 percent) and show that, across countries, a significant positive relationship exists between the inflation variability and its mean, for both low and high inflation variability countries. That is, we, once again, reject the notion of a threshold effect. Moreover, we find that the marginal effects prove larger for low inflation variability countries. Second, we split the low inflation variability sample (i.e., countries less than the median) at its median (i.e., just under 1.75 percent), creating low and moderate inflation variability countries. Now, the low and high inflation variability countries exhibit mixed findings. Sometimes a positive relationship exists for some quantiles while for other quantiles no relationship exists.

Quantile regression, developed by Koenker and Bassett (1978) and popularized by Buchinsky (1998), extends estimation of ordinary least squares (OLS) of the conditional mean to

---

1949 to 1970 sample.

different conditional quantile functions. Conditional quantile regressions minimize an asymmetrically weighted sum of absolute errors. Many areas of applied econometrics -- such as investigations of wage structure, earning mobility, educational attainment, value at risk, option pricing, capital structure, and economic development – now employ quantile regressions for some of its empirical work. Koenker (2000) and Koenker and Hallock (2001) provide an excellent discussion of the intuition behind quantile estimators and various empirical examples.

We provide the first application of the quantile regression method to cross-country relationship between inflation and its variability. Our empirical findings support both the Friedman-Ball and Cukierman-Meltzer hypotheses when we use the mean and the standard deviation of inflation or the median and the median deviation. Moreover, higher inflation and higher inflation variability exhibit larger marginal effects. Using the measure of mean inflation and the coefficient of variation, however, such correlation disappears. In sum, the positive correlation between inflation and its variability does not prove robust to alternative definition of inflation and its variability. Finally, using the mean and its standard deviation, we also find evidence of threshold effects for inflation rates under 3 percent. But, we do not find consistent evidence of a threshold effect for the effect of inflation variability on inflation.

The rest of the paper flows as follows. Section 2 presents a brief review of the quantile regression method and its properties. Section 3 discusses the data and the results. Section 4 considers the possibility of threshold effects. Section 5 concludes.

2. Quantile regressions in inflation and inflation variability

Quantile regression is outlined as follows:

$$y_i = x_i'\beta_\tau + u_{\tau i} \text{ and} \tag{1}$$

$$Quantile_\tau(y_i \mid x_i) = x_i'\beta_\tau \text{ ,} \tag{2}$$

where y_i equals the dependent variable (i.e., inflation or inflation variability), x_i' equals a vector of independent variables (i.e., inflation variability or inflation, respectively), β_τ equals the vector of parameters associated with the τ^{th} quantile (percentile), and $u_{\tau i}$ equals an unknown error term. Unlike ordinary least squares (OLS), the distribution of the error term $u_{\tau i}$ remains unspecified in equation (2). We only require that the conditional τ^{th} quantile of the error term equals zero, that is, $Quantile_\tau(u_{\tau i}|x_i)=0$. $Quantile_\tau(y_i|x_i)=x_i'\beta_\tau$ equals the τ^{th} conditional quantile of y given x with $\tau\in(0,1)$. By estimating β_τ, using different values of τ, quantile regression permits different parameters across different quantiles of inflation or inflation variability. In other words, repeating the estimation for different values of τ between 0 and 1, we trace the distribution of y conditional on x and generate a much more complete picture of how explanatory variables affect the dependent variable.

Furthermore, instead of minimizing the sum of squared residuals to obtain the OLS (mean) estimate of β, the τ^{th} quantile regression estimate β_τ solves the following minimization problem:

$$\min_\beta\left[\sum_{i\in\{i:y_i\geq x_i'\beta\}}2\tau|y_i-x_i'\beta| + \sum_{i\in\{i:y_i<x_i'\beta\}}2(1-\tau)|y_i-x_i'\beta|\right]. \qquad (3)$$

That is, the quantile approach minimizes a weighed sum of the absolute errors, where the weights depend on the quantile estimated. Thus, the estimated parameter vector remains less sensitive to outlier observation on the dependent variable than the ordinary-least-squares method. The solution involves linear programming, using a simplex-based algorithm for quantile regression estimation as in Koenker and d'Orey (1987). The median regression occurs when $\tau=0.5$ and the coefficients of the absolute values both equal one.[2] When $\tau=0.75$, for example, the weight on the positive

[2] That is, the least or minimum absolute deviation (LAD or MAD) estimator occurs with $\tau = 0.5$. We insert the twos so that the value of the function equals the LAD or MAD function value when $\tau = 0.5$. Some references exclude the twos,

errors equals 1.5 and the weight on the negative errors equals 0.5, implying a much higher weight associates with the positive errors and leads to more negative than positive errors. In fact, the optimization leads to 75-percent (25-percent) of the errors less (greater) than zero.

One additional comment distinguishes quantile regression from within quantile OLS regressions. That is, some analysts think that results similar to quantile regression occur when one segments the dependent variable's unconditional distribution and then uses OLS estimation on these subsamples. Koenker and Hallock (2001) argue that such "truncation on the dependent variable" generally fails precisely because of the sample selection issues raised by Heckman (1979).

To conduct parameter tests, we employ the design matrix bootstrap method to obtain estimates of the standard errors, using STATA, for the parameters in quantile regression (Buchinsky, 1998). In every case, we use 10,000 bootstrap replications. This method performs well for relatively small samples and remains valid under many forms of heterogeneity. More conveniently, these bootstrap procedures can deal with the joint distribution of various quantile regression estimators, allowing the use of the F-statistic to test for the equality of slope parameters across various quantiles (Koenker and Hallock, 2001).

We estimate the following two simple linear quantile regression models:

$$V_i = \gamma_\tau + \delta_\tau \prod_i + \nu_{\tau i} \text{ and} \quad (4)$$

$$\prod_i = \alpha_\tau + \beta_\tau V_i + u_{\tau i}, \quad (5)$$

where V_i equals the measure of the inflation-rate variability – the standard deviation, coefficient of variation, or median deviation -- over 1993 to 2003, $\prod_i$ equals the measure of the inflation

since the estimates prove invariant to its inclusion or exclusion.

rate – mean or median -- over 1993 to 2003, γ_τ, δ_τ, α_τ, and β_τ equal unknown parameters that are estimated for different values of τ, and $\nu_{\tau i}$ and $u_{\tau i}$ equal the random error terms. By varying τ from 0 to 1, we trace the entire distribution of inflation variability (or inflation), conditional on inflation (or inflation variability). Friedman and Ball predict that $\delta_\tau > 0$ and Cukierman and Meltzer, that $\beta_\tau > 0$.

3. Data and empirical results

Annual inflation rates equal the percentage change in the logarithm of consumer price index (base year in 2000) gathered from the International Monetary Fund (IMF) *International Financial Statistics* for 152 countries from 1993 to 2003. We proxy the inflation-rate variability by the standard deviation, coefficient of variation, or median deviation of the inflation rate.[3] Average and median values of the inflation rates and the three measures of the inflation rate variability in each country comprise 152 sample observations. Table 1 presents the summary statistics as well as statistics for the five countries with the highest and lowest mean and median inflation rates. Both the mean and the median exhibit highly right-skewed distributions with outliers, as evidenced by a larger mean than the median. Quantile regression proves robust to departures from normality with skewed tails.

Geometrically, the mean of a variable equals its center of gravity. In Table 1, the mean inflation ranges from 0.1341 percent in Japan to 68.6939 percent in Turkey, and responds significantly to extreme values. The highly skewed distribution (skewness=2.3257) suggests that the median may provide a better alternative to measure central location. The median, a positional

[3] We note that inflation variability measured by the standard deviation will equal inflation uncertainty, when the expected inflation rate of the sample period equals the average inflation rate over that period. That is, inflation uncertainty typically equals the variability of the actual inflation rate around its expected value. So, if average inflation equals the expected inflation, then the standard deviation of the inflation rate will equal the inflation uncertainty as well.

value, divides the observations on the inflation rate into two equal parts. It does not equal the mean, and does not respond to extreme values. Different measures of inflation and its variability, that is, the mean and standard deviation versus the median and median deviation, should not influence the relationship between the two variables for a robust relationship. Additionally, in Table 1, the five countries with the highest inflation rates face higher standard deviations, while countries with the lowest inflation rates face lower standard deviations. The mean value also influences its standard deviation. To avoid this issue, we also consider the standard deviation of the mean or the coefficient of variation to measure variability in our analysis.

Table 2 presents results of estimating the Friedman-Ball hypothesis with quantile regressions, using the mean and standard deviation of the inflation rate, for $\tau = 0.05, 0.25, 0.50, 0.75$ and 0.95, an OLS regression, and F-statistics testing for equality of the estimated slope parameter between various quantiles. The homogeneity test considers whether the five slope coefficients equal each other across the five quantiles. Such tests provide a robust alternative to conventional least-squares-based test of heteroskedasticity, because we can construct them to remain insensitive to outlying response observations. The OLS regression results show that higher inflation creates more inflation variability, which closely coincides with Friedman's (1977) argument that "the most fundamental departure is that…the higher the (inflation) rate, the more variable it is likely to be." (p. 465). The quantile regression results illustrate that the marginal effect of inflation on inflation variability increases as one moves from lower to higher inflation variability quantiles. That is, with a higher inflation variability quantiles, inflation exerts a larger effect on inflation variability. This evidence suggests that potential information gains associate with the estimation of the entire conditional distribution of the variable concerned, as opposed to the conditional mean only.

More specifically, the OLS regression generates positive and significant coefficients of inflation at the 1% level, supporting the Friedman-Ball hypothesis that inflation generates inflation variability. The five-quantile regression estimates of inflation, conditional on inflation variability, all prove positive and significant at the 1% level. Moreover, higher quantiles associate with a larger coefficient. In the bottom panel of Table 2, significant F-statistics suggest that inflation affects inflation variability differently across the distribution of inflation uncertainty, except between the 0.50^{th} and 0.95^{th}, and 0.75^{th} and 0.95^{th} quantiles. In addition, the homogeneity test rejects the null hypothesis that all five slope coefficients equal each other. Inflation exhibits a larger effect on inflation variability for the upper tail distribution of inflation uncertainty than the lower tail. Moreover, the intercept term does not change across quantiles and does not differ significantly from zero, except at the 25^{th} and 50^{th} quantiles. The evidence supports the Friedman-Ball hypothesis.

Figures 1 and 2 illustrate the findings. Figure 1 shows that the quantile regression lines rotate to a higher slope with a relatively constant intercept as the estimates move from lower to higher quantiles. Figure 2 reinforces Figure 1, plotting the slope coefficient with 5-percent significance bands, where the horizontal dashed line represents the OLS estimate. The slope coefficient starts below the OLS estimate for low quantiles and rises above the OLS estimate for high quantiles.

Table 3 reports the results of estimating the Cukierman-Meltzer hypothesis, using the mean and standard deviation of the inflation rate. All estimates of inflation variability prove positive and significant at the 1% level. In addition, the marginal effects of inflation variability on inflation rise significantly across quantiles except at the 0.95^{th} quantile tail, as the F-statistics, testing for equality of slope estimates across quantiles, demonstrate. In addition, the homogeneity test, once again, rejects the null hypothesis that all five slope coefficients equal each other. In addition, the intercept term, which proves significantly positive, increases significantly across quantiles. That is, the evidence supports the Cukierman-Meltzer hypothesis.

Figures 3 and 4 illustrate the findings. Once again, the quantile regression lines rotate to a higher slope with a relatively constant intercept as the estimates move from lower to higher quantiles. The slope coefficient also starts below the OLS estimate for low quantiles and rises above the OLS estimate for high quantiles.

Tables 4 and 5 report the quantile estimates for the Friedman-Ball and Cukierman-Meltzer hypotheses, using the mean and coefficient of variation of the inflation rate. The OLS regressions do not find a significant relationship between inflation and its variability, or vice versa. Rather, the constant terms prove significant. Examining the quantile results, inflation positively affects inflation variability at the 25th and 50th quantiles in Table 4, but the coefficients prove small in magnitude. Similarly, inflation variability negatively affects the inflation rate at the 5th and 95th quantiles in Table 5.[4] Finally, the constant terms rise across the quantiles as expected when the slope coefficient does not generally prove significant. Thus, the use of the coefficient of variation, rather than the standard deviation, eliminates the significance of the Friedman-Ball and Cukierman-Meltzer hypotheses in the OLS specifications. The quantile findings provide weak support for the Friedman-Ball hypothesis, but weak support for reversing the Cukierman-Meltzer hypotheses to a negative effect. Thus, our empirical results show that the widely agreed positive association between inflation and its dispersion do not prove robust to the relative measure. Thus,

[4] The F-statistics testing for the equality of the slope coefficients across quantiles cannot reject equality, except for the 95th quantile in the Friedman-Ball model. Here, the slope coefficient proves significantly different from those at the 5th, 25th, 50th, and 75th quantiles at the 1-, 5-, or 10-percent levels. At the same time, the slope coefficient at the 95th quantile does not prove significantly different from zero, however. Furthermore, the homogeneity test cannot reject the null hypothesis that all five slope coefficients equal each other.

this study raises one issue that deserves further attention: which measure more appropriately captures variability -- absolute or relative dispersion.

Traditionally, researchers use the standard deviation, based on deviations from the mean, to measure dispersion in the inflation rates. This absolute deviation measure proves misleading when some data exist far away from the mean, such as the inflation rates of the five highest and lowest countries reported in Table 1. We may conclude that more dispersion exists in the inflation rates of the higher mean inflation countries because of their much higher standard deviations, since the means are so far apart. When we convert the statistics to coefficients of variation, less variations in four of the five highest mean inflation countries occurs. For example, the standard deviation of the mean equals 6.4228 in Japan, the country with the lowest inflation rate in our sample, and only 0.3361 in Turkey, the one with the highest rate. The relationship between inflation and its variability in high- or low-inflation countries cannot be seen simply as shown by the statistics.

Alternatively, what explains this change in findings? Intuitively, it implies that the variability of a series rises proportionately with the mean of the series, leading to no correlation between the mean and its coefficient of variation. To get a positive correlation between the mean and its coefficient of variation, the variation of the series must rise more than proportionately with the mean and median. Viewed differently, we can convert the Friedman-Ball specification with the standard deviation and mean into the specification with the coefficient of variation and the mean by dividing the initial specification by the mean inflation. Thus, one gets the following outcome:

$$\frac{V_i}{\Pi_i} = \gamma_\tau \frac{1}{\Pi_i} + \delta_\tau + \frac{\nu_{\tau i}}{\Pi_i}. \qquad (6)$$

Thus, the intercept term in the Freidman-Ball regression with the coefficient of variation as the dependent variable (i.e., δ_τ) approximates the slope coefficient in the Friedman-Ball specification with the standard deviation as the dependent variable. Moreover, the slope coefficient in the

Freidman-Ball regression with the coefficient of variation as the dependent variable (i.e., γ_τ) approximates with the opposite sign the intercept term in the Friedman-Ball specification with the standard deviation as the dependent variable.[5] Comparing Tables 2 and 4, we see the correspondence.

Figures 5, 6, 7, and 8 illustrate the findings. Here, the slope coefficients generally prove insignificant and the movements in the quantile regression lines largely reflect changes in the intercepts.

Tables 6 and 7 report the quantile estimates for the Friedman-Ball and Cukierman-Meltzer hypotheses, using the median and median deviation of the inflation rate. The OLS regressions find a significant positive relationship between inflation and its variability, the same as using the mean and standard deviation of the inflation rate in Table 2. Moreover, inflation significantly affects inflation variability at each of the quantiles.[6] In addition, the constant terms prove significantly positive at the higher tails of 75^{th} and 95^{th}. Similarly, inflation variability significantly affects the inflation rate at each of the quantiles matching the findings in Table 3.[7] Finally, the pattern in the intercepts matches the pattern seen in Tables 2 and 3. Thus, the use of the median and the median deviation produces a positive correlation, supporting the Friedman-Ball and Cukierman-Meltzer hypotheses and matching the findings for the mean and standard deviation. The quantile findings confirm a positive relationship.

---

[5] These comments, of course, ignore issues related to the new error term in the transformed model.

[6] The F-statistics testing for the equality of the slope coefficients across quantiles rejects equality for the 75^{th} and 95^{th} quantiles relative to the 5^{th}, 25^{th}, and 50^{th} quantiles in the Friedman-Ball model at the 1-, 5-, or 10-percent levels. In addition, the homogeneity test rejects the null hypothesis that all five slope coefficients equal each other.

[7] The F-statistics testing for the equality of the slope coefficients across quantiles rejects equality for the 75^{th} and 95^{th} quantiles relative to the 5^{th} and 25^{th} quantiles in the Cukierman-Meltzer model at the 1-, 5-, or 10-percent levels. In addition, the homogeneity test, once again, rejects the null hypothesis that all five slope coefficients equal each other.

Figures 9, 10, 11, and 12 illustrate the findings. We return to the situation where the quantile regression lines rotate to a higher slope with a relatively constant intercept as the estimates move from lower to higher quantiles. Moreover, the slope coefficient, once again, start below the OLS estimates for low quantiles and rise above the OLS estimates for high quantiles.

4. Does a Threshold Inflation Rate Exist?

Most researchers find a positive relationship between inflation and its variability across countries. A few authors, however, do find that for low inflation countries, the positive relationship does not prove significant (Logue and Willet, 1976 and Hafer and Heyne-Hafer, 1981). This section explores the issue of whether a threshold level of inflation exists before finding the positive correlation between inflation and its variability. The analysis considers the Friedman-Ball and Cukierman-Meltzer hypotheses using only the mean and standard deviation of the inflation rate. That is, we must consider a specification for which we find a positive correlation in order to determine if a low-inflation threshold exists.

The Appendix Table reports the average annual inflation over 1993 to 2003 for all 152 countries. Generally, developed and developing countries exhibit low average inflation rates, other countries, which do not develop over time, exhibit high inflation rates. We split the full sample into two sub-samples, low-inflation countries and high-inflation countries, at the median inflation (i.e., 6.1471 percent), and test for the equality of the relationship between mean inflation and its standard deviation for each sub-group (76 countries in each group), using the dummy-variable technique.[8] That is, we define a dummy variable as D=1 for the high-inflation countries and 0 otherwise in the Friedman-Ball regression model as follows:

[8] The dummy-variable approach has an advantage over splitting the sample of the Chow test, namely, we can individually test the intercept or slope of the regression coefficients for equality (or structural change) rather than the entire relation.

$$V_i = \gamma_\tau + \gamma_{\tau D} D_i + (\delta_\tau + \delta_{\tau D} D_i)\Pi_i . \qquad (7)$$

The estimated individual models bifurcate as follows:

$$\hat{V}_i = \hat{\gamma}_\tau + \hat{\gamma}_{\tau D} + (\hat{\delta}_\tau + \hat{\delta}_{\tau D})\Pi_i \text{, (high-inflation countries), and} \qquad (8)$$

$$\hat{V}_i = \hat{\gamma}_\tau + \hat{\delta}_\tau \Pi_i \text{, (low-inflation countries).} \qquad (9)$$

Testing whether $\gamma_{\tau D}$ or $\delta_{\tau D}$ prove significant will determine whether the intercept or the slope differ between the high- and low-inflation countries. The null hypothesis $\gamma_{\tau D} = \delta_{\tau D} = 0$ indicates that no structural change occurs between the two groups. Table 8 reports each of the tests using the mean and standard deviation of the inflation rate, with p-values in parentheses. In the OLS regression, the insignificant intercept dummy estimate and the significant interaction term imply that no significant difference exists in the intercept between the high- and low-inflation countries, but a significant difference does exist in the slope coefficients. Moreover, the significant F-statistic rejects the null hypothesis of no structural change (i.e., $\gamma_{\tau D} = \delta_{\tau D} = 0$), suggesting that on the average, the high inflation countries exhibit a different response to variability than the low inflation countries. For the quantile regressions, although the individual estimates of $\gamma_{\tau D}$ and $\delta_{\tau D}$ prove insignificant in all five quantiles, except the intercept dummy in the 25th quantile, the significant F-statistics, however, unanimously reject the joint test of equality, suggesting difference in the relationship between the high- and low-inflation countries. Generally, the power of a joint test is stronger than that of an individual test.

Panels A and B of Table 9 present the results of estimating the Friedman-Ball hypothesis from the high- and low-inflation country samples, respectively.[9] All slope parameters of inflation

[9] Precisely the same results emerge from Tables 8 and 9. We provide Table 9 so that the reader can more easily see the relationships between the models for low- and high-inflation countries. Also in the process, elimination of the insignificant dummy variable leads some estimates to become significant.

in the OLS and quantile regressions prove positive and significant. Also, the slope parameter rises as we move from lower to higher quantiles. That is, for the Friedman-Ball hypothesis, the same basic pattern of effects occurs across the quantiles for the high and low inflation country samples. Moreover, the slope parameters at the 0.5^{th}, 0.75^{th}, and 0.95^{th} quantiles in the high-inflation countries (Panel A) appear less than those in the low-inflation countries (Panel B).

This decomposition of our 152-country sample at the median inflation rate shows that inflation variability and the level of inflation positively relate across countries in each group. Thus, no evidence of a threshold effect emerges from this analysis. Policymakers may want to know the inflation rate above which significant increases in variability occur, lowering welfare and output growth. Previous studies provide only limited and mixed evidence on the sensitivity of inflation variability to its level in high-, low-, or moderate-inflation regimes. Logue and Willett (1976) find insignificant correlation for countries with moderate inflation between two to four percent. Hafer and Heyne-Hafer (1981) discover the upper bound of the threshold increases sharply from four to nine percent in the 1970s. Ram (1985) argues that although the average inflation rate rises during the 1970s, the level-variability correlation falls in the 1970s. Moreover, a significant positive correlation emerges only when inflation rates exceed eight percent in the 1960 to 1970 sample and twenty percent in the 1972 to 1981 sample. Edmonds and So (1993) discover significant relationships for a group of high- and low-inflation countries, but not for a group of moderate-inflation between six and ten percent. Hess and Morris (1996), on the other hand, demonstrate a significant positive relation for countries with low- and moderate-inflation less than fifteen percent a year. Davis and Kanago (1996) find a significant positive relation in ten high inflation countries, however, the coefficients are no longer significant when David and Kanago (2000) restrict OECD countries with inflation under eight percent.

How low (moderate or high) is a low (moderate or high) inflation rate? No theory or empirical analysis gives a definite answer. That is, although sample dates, countries, measures of variability, and sources of data may lead to different results, the relevant policy question for most industrialized countries and many emerging market countries in recent years concerns the benefits from reducing inflation from high or moderate levels to low levels. Our sample period, 1993-2003, encompasses the inflation-targeting era and the period of the Great Moderation. Thus, we search for a threshold level of inflation, if any, based on the inflation targets adopted by inflation-targeting countries. Inflation targeting provides an operational framework for monetary policy to attain price stability. Typically, inflation targets correspond to an annual rate of inflation in the low single digits (Bernanke et al. 1999, Batini and Yates 2003). Table 10 (International Monetary Fund 2005) lists 21 countries that use inflation targets, their inflation-targeting adoption years and their current inflation targets. The Table includes 8 industrial countries and 13 emerging market countries.

The numerical inflation target typically reflects an annual rate for the CPI in the form of a range, such as one to three percent (e.g., New Zealand and Canada). Alternatively, the inflation rate target equals a point target with a range, such as a two-percent target plus or minus one percent (e.g., Sweden) or a point target without any explicit range, such as a two-percent target (e.g., the United Kingdom). For industrial countries, the targets range between zero and three percent. For emerging market countries, they all adopt a target range or a point target with a range. The middle of the range or the point target generally exceeds that in the industrial countries. The range runs from zero and six percent (except for seven percent in Brazil), which nearly matches the range from zero to median inflation rate (6.1471 percent) in our sample. We saw in Panel B of Table 9 that inflation variability positively and significantly relates to the inflation rate for the sample of inflation rates between zero and 6.1471 percent. The practice of inflation targeting in the world leaves open the question of whether inflation variability differ in high or low inflation-targeting regimes, even at the already lower level of inflation. Thus, we further break our sample at a lower inflation rate to look for a threshold. An examination of our sample data, the median inflation of our 76 low-inflation countries (or, equivalently, the 25 percent of our 152 countries) equals 2.9349 percent, which matches the edge of the three percent rate target for the industrial countries. We, thus, split our 76 low-inflation countries at its median inflation (2.9349 percent) into two groups (38 countries in each) – low and moderate inflation rate countries. Table 11 reports the estimation results, where the dummy variable *D=1* for the moderate-inflation countries and *0* otherwise, testing for equality of estimates between the two regimes.

In the OLS regression, although $\gamma_{\tau D}$ or $\delta_{\tau D}$ do not test significantly different from zero, the F-statistic significantly rejects the null hypothesis of equality (i.e., $\gamma_{\tau D} = \delta_{\tau D} = 0$), suggesting that the countries with moderate inflation rates (i.e., three to six percent) exhibit different behavior from the countries with low inflation rates (i.e., zero to three percent). All the quantile regressions strongly support this conclusion. Four estimates of $\gamma_{\tau D}$ and two estimates of $\delta_{\tau D}$ prove significant in the five quantiles and the significant F-statistics reject the joint test of equality for all five quantiles. Generally, we conclude that differences exist in the relationship between the moderate- and low-inflation countries.

Panels A and B of Table 12 present the estimation results from the moderate- and low-inflation country samples, respectively. In Panel A, for the moderate-inflation countries, all slope parameters of inflation in the OLS and quantile regressions prove positive and significant, except at the 0.50th quantile. That is, the Friedman-Ball hypothesis holds in countries with moderate inflation rates. In Panel B for the low-inflation countries, however, all slope parameters in the OLS and quantile regressions appear insignificant, except at the 0.05th quantile, where marginal effect of inflation proves much lower than the similar effect in the moderate countries. In sum, different effects occur across quantiles for the moderate and low inflation country samples.

Considerable evidence exists that inflation and its variability positively correlate across countries. Our findings demonstrate that a threshold level of inflation does exist before the positive correlation emerges. The threshold occurs around the three percent inflation rate. Countries with inflation rates below the threshold, such as those industrial countries adopting and achieving inflation targets of less than three percent, generally find no association between inflation and its variability. Countries that achieve their inflation rate targets above the threshold, such as most emerging market countries, face the fact that higher inflation associates with higher inflation variability. This evidence suggests that if the authorities want to eliminate the uncertainty of inflation, then inflation targets must not exceed the threshold of three percent.

Similar evidence emerges when estimating and testing the Cukierman-Meltzer hypothesis. In this case, we split the full sample at the median standard deviation (i.e., 4.3639 percent) into two sub-samples, low- and high-inflation-variability countries. Thus, we define a dummy variable as *D=1* for high-inflation-variability countries and *0* otherwise in the Cukierman-Meltzer regression model as follows:

$$\Pi_i = \alpha_\tau + \alpha_{\tau D} D_i + (\beta_\tau + \beta_{\tau D} D_i) V_i + u_{\tau i} . \quad (10)$$

The estimated individual models bifurcate as follows:

$$\hat{\Pi}_i = \hat{\alpha}_\tau + \hat{\alpha}_{\tau D} + (\hat{\beta}_\tau + \hat{\beta}_{\tau D}) V_i \text{, (high-inflation-variability countries), and} \quad (11)$$

$$\hat{\Pi}_i = \hat{\alpha}_\tau + \hat{\beta}_\tau V_i \text{, (low-inflation-variability countries).} \quad (12)$$

Table 13 reports test results regarding whether no difference exists in the relationships between groups. The significant F-statistics suggest that different inflation behavior appears in the high-inflation-variability and low-inflation-variability countries, using either the OLS or the quantile regression. Similar to our findings in Table 8, all coefficients associated with the dummy variable prove insignificant, save the slope in the OLS and the intercept in the 0.25^{th} quantile. Nonetheless, the F-tests all reject no structural change.

Table 14 presents the estimated results of the Cukierman-Meltzer hypothesis for the high- and low-inflation-variability countries, respectively. All the significant positive slope parameters in the high-inflation-variability countries (Panel A) prove less than those in the low-inflation-variability countries (Panel B). This consistent pattern does not match the findings reported in Table 9.

We also examine whether a threshold level of inflation variability exists in low-variability countries. We split the 76 low-inflation-variability countries at its standard deviation (i.e., 1.7284 percent) into two sub-samples and define $D=1$ for the moderate-inflation-variability countries and 0 otherwise to test this issue. Table 15 reports the test results. Again, the significant F-statistics suggest different behavior in the moderate- and low-inflation-variability countries. Table 16 presents the estimated results for the two subsamples separately. Although the significant OLS estimate of the slope proves less in the moderate-inflation-variability countries (Panel A) than in the low-inflation-variability countries (Panel B), the latter is significant only at the 10-percent level. The quantile regressions provide diverse, non-systematic results. At low quantiles (i.e., 0.05^{th}, 0.25^{th}, and 0.50^{th}), the significant positive slope parameters suggest that the moderate-inflation-variability countries exhibit higher marginal effects of inflation variability than low-inflation-variability countries. The situation reverses at high quantiles (0.75^{th} and 0.95^{th}), however. Higher marginal effects emerge in the low-inflation-variability countries. The evidence of a threshold level of inflation variability in the Cukierman-Meltzer model proves weaker than that in Table 12 of the Friedman-Ball model.

5. Conclusion

Using cross-sectional data on 152 countries over the period 1993 to 2003 our empirical results support both hypotheses of Friedman-Ball and Cukierman-Meltzer from the parametric quantile model when we use the mean and standard deviation or the median and median deviation of the inflation rate to measure inflation and its variability. First, inflation and inflation variability positively relate across quantiles. Second, higher inflation creates more inflation variability, supporting the Friedman-Ball hypothesis. Third, inflation variability raises inflation, supporting the Cukierman-Meltzer hypothesis.

More specifically, the Friedman-Ball quantile regressions reveal that at high (low) inflation variability, changes in inflation create larger (smaller) effects. The Cukierman-Meltzer quantile regressions reveal that at high (low) inflation, changes in inflation variability generate larger (smaller) effects.

Using the mean and the coefficient of variation to measure inflation and its variability does not produce a similar pattern of effects of inflation variability on inflation or vice versa. Employing the mean and coefficient of variation, the OLS findings suggest no relationship between inflation and its variability, or vice versa. The quantile results provide weak support for the Friedman-Ball hypothesis, but weak support for reversing the Cukierman-Meltzer hypothesis.

We also consider whether low- and high-inflation countries exhibit different relationships in the Friedman-Ball specification. We find evidence of significant differences between low- and high-inflation countries. The pattern of differences, however, does not tell a consistent story across quantiles. In other words, the intercept and slope coefficients for low-inflation countries sometimes exceed and other times falls short of those for high-inflation countries. When we consider the possible differences in the Cukierman-Meltzer specification between low- and high-inflation-variability countries, we also find evidence of significant structural change. Here, unlike the Freidman-Ball specification, we find a consistent pattern that low-inflation variability countries exhibit a larger slope coefficient than high-inflation-variability countries. The intercept terms, however, do not display a consistent patter.

Finally, when considering the possibility of threshold effects, we find evidence of a threshold effect in the Friedman-Ball hypothesis. That is, for inflation rates under 3 percent, higher inflation does not associate with higher inflation variability. This finding proves consistent with those of Logue and Willett (1976) and Hafer and Heyne-Hafer (1981), who find threshold inflation rates of 4 and 9 percent, respectively. Given differences in average inflation rates in the differing sample periods, our 3 percent threshold seems in the ballpark for the sample period that includes the Great Moderation. We do not find similar evidence of a threshold effect for inflation variability in the Cukierman-Meltzer hypothesis.

In sum, the Friedman-Ball and Cukierman-Meltzer hypotheses do not receive uniform support for alternative measures of the inflation rate and its variability. In other words, the findings for the mean and standard deviation of the inflation rate only prove robust to the median and the median deviation, but not to the mean and the coefficient of variation.

Prior cross-section studies examined the relationship between inflation and its variability using data from the 1950s, the 1960s, the 1970s, and the 1980s. Logue and Willett (1976) argue that cross-section tests prove valuable as long as the governments do not alter their long-run inflation objectives within the sample period. Our current analysis of the 1993 to 2003 sample period covers a period of time when many countries adopted inflation targeting. As such, our findings provide new evidence for a different inflation regime.

References

Baillie, R., Chung, C., and Tieslau, M., 1996. Analyzing inflation by the fractionally integrated ARFIMA-GARCH model. *Journal of Applied Econometrics* 11, 23-40.

Ball, L., 1992. Why does high inflation raise inflation uncertainty. *Journal of Monetary Economics* 29, 371-388.

Ball, L. and Cecchetti, S., 1990. Inflation and uncertainty at short and long horizons. *Brookings Paper on Economic Activity* No.1, 215-245.

Batini, N. and Yates, A., 2003. Hybrid inflation and price-level targeting. *Journal of Money, Credit and Banking* 35, 283-300.

Bernanke, B. S., Laubach, T., Mishkin, F. S., and Posen, A. S., 1999. Inflation targeting: Lessons from the international experience. Princeton, N.J.: Princeton University Press.

Buchinsky, M., 1998. Recent advances in quantile regression models: a practical guideline for empirical research. *Journal of Human Resources* 33, 88-126.

Conrad, C. and Karanasos, M., 2005. On the inflation-uncertainty hypothesis in the USA, Japan and the UK: a dual long memory approach. *Japan and the World Economy* 17, 327-343.

Cosimano, T. and Jansen, D., 1988. Estimates of the Variance of US inflation based on the ARCH model. *Journal of Money, Credit and Banking* 20, 409-421.

Cukierman, A. and Meltzer, A., 1986. A theory of ambiguity, credibility, and inflation under discretion and asymmetric information. *Econometrica* 54, 1099-1128.

Daal, E., Naka, A. and Sanchez, B., 2005. Re-examining inflation and inflation uncertainty in developed and emerging countries. *Economics Letters* 89, 180-186.

Davis, G.. and Kanago, B., 1996. The missing link: intra-country evidence on the relationship between high and uncertain inflation from high-inflation countries. *Southern Economic Journal* 63, 205-222.

Davis, G.. and Kanago, B., 1998. High and uncertain inflation: results from a new data set. *Journal of Money, Credit and Banking* 30, 218-230.

Davis, G.. and Kanago, B., 2000. The level and uncertainty of inflation: results from OECD forecasts. *Economic Inquiry* 38, 58-72.

Engle, R.F., 1982. Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica* 50, 987-1007.

Engle, R.F., 1983. Estimates of variance of US inflation based on ARCH model. *Journal of Money, Credit and Banking* 15, 286-301.

Evans, M., 1991. Discovering the link between inflation rates and inflation uncertainty. *Journal of Money, Credit and Banking* 23, 169-184.

Foster, E., 1978. The variability of inflation. *Review of Economics and Statistics 60*, 346-350.

Fountas, S., 2001. The relationship between inflation and inflation uncertainty in the UK: 1885-1998. *Economics Letters* 74, 77-83.

Friedman, M., 1977. Nobel lecture: inflation and unemployment. *Journal of Political Economy* 85, 451-472.

Gale, W. A., 1981. Temporal variability of United States consumer price index. *Journal of Money, Credit and Banking* 13, 273-297.

Gordon, R. J., 1971. Steady anticipated inflation: Mirage or oasis?" *Brookings Papers on Economic Activity*, 499-510.

Grier, K. B. and Perry, M. J., 1998. On inflation and inflation uncertainty in the G7 countries. *Journal of International Money and Finance* 17, 671-689.

Hafer, R. W., and G. Heyne-Hafer. "The Relationship between Inflation and Its Variability: International Evidence from the 1970s." *Journal of Macroeconomics* 3, 571-77.

Heckman, J. J., 1979. “Sample Selection Bias as a Specification Error.” *Econometrica* 47, 153-61.

Holland, A. S., 1995. Inflation and uncertainty: tests for temporal ordering. *Journal of Money, Credit and Banking* 27, 827-837.

Hwang, Y., 2001. Relationship between inflation rate and inflation uncertainty. *Economics Letters* 73, 179-186.

International Monetary Fund, 2005. Does inflation targeting work in emerging markets? IMF *World Economic Outlook*. Washington D.C.: International Monetary Fund.

Johnson, H. G.., 1967. *Essays in Monetary Economics.* Cambridge, Mass: Harvard University Press.

King, M., 2002. The inflation target ten years on. Speech delivered to the London School of Economics. 19 November, London, England.

Katsimbis, G. M. and Miller, S. M., 1982. The relation between the rate and variability of inflation: further comments. *Kyklos* 35, 456-467.

Koenker, R., 2000. Galton, Edgeworth, Frisch, and prospects for quantile regression in econometrics. *Journal of Econometrics* 95, 347-374.

Koenker, R. and Bassett, G., 1978. Quantile regression. *Econometrica* 46, 33-50.

Koenker, R. and d’Orey, V., 1987. Computing regression quantiles. *Applied Statistics* 36, 383-393.

Koenker, R. and Hallock, K. F., 2001. Quantile regression. *Journal of Economic Perspectives* 15, 143-156.

Kontonikas, A., 2004. Inflation and inflation uncertainty in the United Kingdom, evidence from GARCH modelling. *Economic Modelling* 21, 525-543.

Logue, A. M. and Willett, T. D., 1976. A note on the relation between the rate and variability of inflation. *Economica* 43, 151-158.

Mishkin, F. S., 1999. International experiences with different monetary policy regimes. *Journal of Monetary Economics* 43, 579-605.

Mishkin, F. S. and Schmidt-Hebbel, K. 2007. Monetary policy under inflation targeting: An introduction. In *Monetary Policy Under Inflation Targeting*, ed. F. Mishkin and K. Schmidt-Hebbel. Santiago, Chile: Banco Central de Chile.

Okun, A. M., 1971. The mirage of steady inflation. *Brookings Papers on Economic Activity*, 485-498.

Thornton, J., 2007. The relationship between inflation and inflation uncertainty in emerging market economies. *Southern Economic Journal* 73, 858-870.

Ungar, M., Zilberfarb, B., 1993. Inflation and its unpredictability-theory and empirical evidence. *Journal of Money, Credit and Banking* 25, 709-720.

Table 1: Summary Statistics

	Mean	Median	Standard Deviation	Minimum	Maximum
Mean Inflation	10.4803	6.1471	11.5342	0.1341	68.6939
Median Inflation	7.7287	4.5901	8.9223	-0.1267	66.0971
Standard Deviation	8.8951	4.3639	10.3310	0.4108	50.1844
Coefficient of Variation	0.9008	0.7143	0.7358	0.1685	6.4218
Median Deviation	9.4901	4.5462	11.2509	0.4220	54.1824

Five Countries with Lowest Mean Inflation:

Variable	Japan	Saudi Arabia	Bahrain	Panama	Switzerland
Mean Inflation	0.1341	0.4251	0.7144	1.0299	1.0831
Median Inflation	-0.1267	0.2301	0.5292	1.2472	0.8248
Standard Deviation	0.8613	1.7184	1.4749	0.4108	0.8697
Coefficient of Variation	6.4228	4.0423	2.0644	0.3988	0.8030
Median Deviation	0.9037	1.7305	1.4877	0.4697	0.9109

Five Countries with Highest Mean Inflation:

Variable	Venezuela	Zimbabwe	Sudan	Romania	Turkey
Mean Inflation	40.9447	47.5610	50.9852	58.5441	68.6939
Median Inflation	35.7827	29.7040	31.8777	42.2479	66.0971
Standard Deviation	25.5075	38.0382	50.1844	47.7647	23.0884
Coefficient of Variation	0.6230	0.7998	0.9843	0.8159	0.3361
Median Deviation	26.0758	42.4406	54.1824	50.7596	23.2485

Note: Inflation equals the annual rate calculated as the percentage change in the logarithm of consumer price index. The standard deviation, coefficient of variation, and median deviation of the inflation rate proxy for inflation variability.

Table 2: Estimates of Friedman-Ball Regression Model, $V_i = \gamma_\tau + \delta_\tau \prod_i + v_{\tau i}$ -- Mean and Standard Deviation of the Inflation Rate

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
γ_τ	0.9770 (0.23)	-0.2755 (0.33)	-0.4388** (0.02)	-0.5396** (0.03)	0.7216 (0.38)	3.7429 (0.18)
δ_τ	0.7555*** (0.00)	0.3401*** (0.00)	0.5555*** (0.00)	0.8162*** (0.00)	1.0410*** (0.00)	1.1950*** (0.00)

F-Statistics Testing for Slope Equality across Quantiles

Quantile					
0.25th	4.76** (0.03)				
0.50th	31.89*** (0.00)	8.28*** (0.00)			
0.75th	48.60*** (0.00)	18.68*** (0.00)	8.02*** (0.01)		
0.95th	9.12*** (0.00)	4.80** (0.03)	1.91 (0.17)	0.32 (0.57)	
Homogeneity F-Test	11.82*** (0.00)				

Note: *V* equals the standard deviation of the inflation rate and *Π* equals the mean inflation rate. F-statistics test for the equality of the slope estimate across quantiles. The homogeneity F-statistic tests for the equality of the slope coefficient across all quantiles. Numbers in parentheses equal p-values. We use 10,000 bootstrap replications to obtain estimates of the standard errors, using STATA, for the parameters in quantile regression (Buchinsky, 1998).

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 3: **Estimates of Cukierman-Meltzer Regression Model,** $\Pi_i = \alpha_\tau + \beta_\tau V_i + u_{\tau i}$
-- Mean and Standard Deviation of the Inflation Rate

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
α_τ	2.1032*** (0.00)	0.7271* (0.07)	0.8615** (0.01)	1.5311*** (0.00)	2.1072*** (0.00)	5.9568 (0.22)
β_τ	0.9418*** (0.00)	0.4093*** (0.00)	0.7135*** (0.00)	0.9249*** (0.00)	1.1776*** (0.00)	1.4698*** (0.00)

F-Statistics Testing for Slope Equality across Quantiles

Quantile						
0.25th		11.33*** (0.00)				
0.50th		27.50*** (0.00)	5.14** (0.02)			
0.75th		46.48*** (0.00)	16.75*** (0.00)	7.84*** (0.01)		
0.95th		3.89*** (0.00)	1.97 (0.16)	1.06 (0.31)	0.32 (0.57)	
Homogeneity F-Test		12.98*** (0.00)				

Note: See Table 2. *Π* equals the mean inflation rate and *V* equals the standard deviation of the inflation rate.

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 4: Estimates of Friedman-Ball Regression Model, $V_i = \gamma_\tau + \delta_\tau \prod_i + v_{\tau i}$ -- Mean and Coefficient of Variation of the Inflation Rate

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
γ_τ	0.9441*** (0.00)	0.2780*** (0.00)	0.3979*** (0.00)	0.6390*** (0.00)	1.2185*** (0.00)	2.1028*** (0.02)
δ_τ	-0.0041 (0.32)	0.0008 (0.42)	0.0062** (0.03)	0.0061* (0.07)	-0.0052 (0.48)	-0.0219 (0.56)
F-Statistics Testing for Slope Equality across Quantiles						
Quantile						
0.25th		2.22 (0.14)				
0.50th		2.22 (0.24)	0.00 (0.98)			
0.75th		1.21 (0.27)	5.40 (0.02)	6.23 (0.01)		
0.95th		4.50** (0.03)	7.04*** (0.01)	6.73*** (0.01)	2.67* (0.10)	
Homogeneity F-Test		3.01** (0.02)				

Note: See Table 2. *V* equals the coefficient of variation of the inflation rate and *Π* equals the mean inflation rate.

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 5: Estimates of Cukierman-Meltzer Regression Model, $\Pi_i = \alpha_\tau + \beta_\tau V_i + u_{\tau i}$ -- Mean and Coefficient of Variation of the Inflation Rate

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
α_τ	11.3940***	1.9122***	3.1960***	6.7674***	14.7498***	39.6580***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
β_τ	-1.0143	-0.3679**	-0.3396	-0.7949	-0.2604	-6.1546*
	(0.20)	(0.02)	(0.66)	(0.32)	(0.86)	(0.07)

F-Statistics Testing for Slope Equality across Quantiles

Quantile	0.05th	0.25th	0.50th	0.75th
0.25th	0.00			
	(0.96)			
0.50th	0.28	0.50		
	(0.59)	(0.48)		
0.75th	0.00	0.00	0.06	
	(0.96)	(0.97)	(0.80)	
0.95th	0.63	0.63	0.54	0.70
	(0.43)	(0.43)	(0.46)	(0.40)
Homogeneity F-Test	0.28			
	(0.89)			

Note: See Table 2. *Π* equals the mean inflation rate and *V* equals the coefficient of variation of the inflation rate.

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 6: **Estimates of Friedman-Ball Regression Model, $V_i = \gamma_\tau + \delta_\tau \prod_i + v_{\tau i}$ -- Median and Median Deviation of the Inflation Rate**

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
γ_τ	3.6033*** (0.00)	-0.3312 (0.22)	-0.0152 (0.97)	0.2991 (0.51)	3.4637** (0.04)	11.5234** (0.02)
δ_τ	0.7617*** (0.00)	0.3567*** (0.00)	0.4765*** (0.00)	0.7417*** (0.00)	1.2889*** (0.00)	2.0668*** (0.00)

F-Statistics Testing for Slope Equality across Quantiles

Quantile				
0.25th	1.35 (0.25)			
0.50th	5.84 (0.02)	4.05** (0.05)		
0.75th	11.84*** (0.00)	10.42*** (0.00)	5.30** (0.02)	
0.95th	6.70*** (0.01)	5.98** (0.02)	4.19** (0.04)	1.53 (0.22)
Homogeneity F-Test	3.75*** (0.01)			

Note: See Table 2. *V* equals the median deviation of the inflation rate and *Π* equals the median inflation rate.

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 7: Estimates of Cukierman-Meltzer Regression Model, $\Pi_i = \alpha_\tau + \beta_\tau V_i + u_{\tau i}$
-- Median and Median Deviation of the Inflation Rate

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
α_τ	3.1828*** (0.00)	0.7898*** (0.01)	1.3728*** (0.00)	2.0893*** (0.00)	3.5524*** (0.00)	5.7856 (0.23)
β_τ	0.4790*** (0.00)	0.0384*** (0.00)	0.2528*** (0.00)	0.4568*** (0.00)	0.6538*** (0.00)	1.3066*** (0.00)
F-Statistics Testing for Slope Equality across Quantiles						
Quantile						
0.25th		13.98*** (0.00)				
0.50th		19.27*** (0.00)	6.60*** (0.01)			
0.75th		14.62*** (0.00)	6.83*** (0.01)	1.93 (0.17)		
0.95th		7.62*** (0.01)	5.32** (0.02)	3.50* (0.06)	2.29 (0.13)	
Homogeneity F-Test		7.16*** (0.00)				

Note: See Table 2. *Π* equals the median inflation rate and *V* equals the median deviation of the inflation rate.

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 8: Estimates of Friedman-Ball Regression Model with Dummy Variable, $V_i = \gamma_\tau + \gamma_{\tau D} D_i + (\delta_\tau + \delta_{\tau D} D_i)\Pi_i$ -- Mean and Standard Deviation of the Inflation Rate

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
γ_τ	-0.6827 (0.12)	-0.4202 (0.32)	-0.4416 (0.30)	-0.4416 (0.38)	-0.8877 (0.59)	1.0100 (0.86)
δ_τ	1.1149*** (0.00)	0 .4351*** (0.00)	0.6317*** (0.00)	0 .8276*** (0.00)	1.6226*** (0.00)	1.6663 (0.27)
$\gamma_{\tau D}$	3.0479 (0.16)	-0.4716 (0.44)	-2.0238*** (0.00)	-0.7239 (0.25)	2.9819 (0.13)	5.1572 (0.50)
$\delta_{\tau D}$	-0.4101* (0.06)	-0.0860 (0.27)	0.0515 (0.66)	0.0082 (0.95)	-0.6794 (0.14)	-0.6090 (0.69)
F-Statistics	86.19*** (0.00)	17.07*** (0.00)	29.03*** (0.00)	70.65*** (0.00)	67.19*** (0.00)	39.02*** (0.00)

Note: See Table 2. V equals the standard deviation of the inflation rate and Π equals the mean inflation rate. F-statistics test for the equality of the intercept and slope estimates across low- and high-inflation countries.

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 9: Estimates of Friedman-Ball Regression Model, $V_i = \gamma_\tau + \delta_\tau \prod_i + v_{\tau i}$ -- Mean and Standard Deviation of the Inflation Rate

Panel A: High-Inflation Countries

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
γ_τ	2.3651 (0.12)	-0.8919 (0.18)	-2.4655* (0.06)	-1.1654 (0.55)	2.0942 (0.38)	6.1672 (0.15)
δ_τ	0.7048*** (0.00)	0.3491*** (0.00)	0.6832*** (0.00)	0.8358*** (0.00)	0.9432*** (0.00)	1.0573*** (0.00)

F-Statistics Testing for Slope Equality across Quantiles

Quantile				
0.25th	5.05** (0.03)			
0.50th	9.71*** (0.00)	1.25 (0.27)		
0.75th	11.77*** (0.00)	2.44 (0.12)	0.78 (0.38)	
0.95th	5.28*** (0.02)	1.41 (0.24)	0.56 (0.46)	0.15 (0.70)
Homogeneity F-Test	3.35*** (0.01)			

Panel B: Low-Inflation Countries

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
γ_τ	-0.6828 (0.20)	-0.4203 (0.00)	-0.4416* (0.10)	-0.4416 (0.25)	-0.8877 (0.414)	1.0100 (0.33)
δ_τ	1.1149*** (0.00)	0.4351*** (0.00)	0.6317*** (0.00)	0.8276*** (0.00)	1.6226*** (0.00)	1.6663*** (0.00)

F-Statistics Testing for Slope Equality across Quantiles

Quantile				
0.25th	2.65 (0.11)			
0.50th	5.29** (0.02)	1.80 (0.18)		
0.75th	8.92*** (0.00)	6.86*** (0.01)	5.09** (0.03)	
0.95th	21.72*** (0.00)	15.02*** (0.00)	8.87*** (0.00)	0.01 (0.92)
Homogeneity F-Test	7.16*** (0.00)			

Note: See Table 2. *V* equals the standard deviation of the inflation rate and *Π* equals the mean inflation rate.

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 10: Countries that Target Inflation

	Inflation Targeting Adoption Year*	Current Inflation Target (percent)
Emerging market countries		
Israel	1997	1-3
Czech Republic	1998	3(+/-1)
Korea	1998	2.5-3.5
Poland	1999	2.5(+/-1)
Brazil	1999	4.5(+/-2.5)
Chile	1999	2-4
Colombia	1999	5(+/-0.5)
South Africa	2000	3-6
Thailand	2000	0-3.5
Mexico	2001	3(+/-1)
Hungary	2001	3.5(+/-1)
Peru	2002	2.5(+/-1)
Philippines	2002	5-6
Industrial countries		
New Zealand	1990	1-3
Canada	1991	1-3
United Kingdom	1992	2
Australia	1993	2-3
Sweden	1993	2(+/-1)
Switzerland	2000	<2
Iceland	2001	2.5
Norway	2001	2.5

Note: IMF, World Economic Outlook, 2005.

* This year indicates when countries de facto adopted inflation targeting. Official adoption dates may vary.

Table 11: Estimates of Friedman-Ball Regression Model with Dummy Variable, $V_i = \gamma_\tau + \gamma_{\tau D} D_i + (\delta_\tau + \delta_{\tau D} D_i)\Pi_i$, for the Low-Inflation Sample -- Mean and Standard Deviation of the Inflation Rate

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
γ_τ	0.2334 (0.72)	0.2969** (0.04)	0.5892* (0.09)	0.8467 (0.12)	1.3292 (0.27)	0.9164 (0.71)
δ_τ	0.6301 (0.14)	0.1106 (0.28)	0.0740 (0.65)	0.1089 (0.68)	0.1084 (0.86)	1.8866 (0.25)
$\gamma_{\tau D}$	-1.5822 (0.34)	-1.5788*** (0.00)	-2.4885*** (0.00)	-1.8637* (0.07)	-6.5831*** (0.00)	-0.1599 (0.95)
$\delta_{\tau D}$	0.6342 (0.26)	0.5823*** (0.00)	0.8544*** (0.00)	0.8706 (0.01)	2.5125 (0.00)	-0.1765 (0.92)
F-Statistics	19.48*** (0.00)	18.02*** (0.00)	11.91*** (0.00)	3.37** (0.02)	14.60*** (0.00)	20.75*** (0.00)
Obs.	76					

Note: See Table 2. V equals the standard deviation of the inflation rate and Π equals the mean inflation rate. F-statistics test for the equality of the intercept and slope estimates across low- and high-inflation countries.

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 12: Estimates of Friedman-Ball Regression Model, $V_i = \gamma_\tau + \delta_\tau \Pi_i + v_{\tau i}$, for the Low-Inflation Sample -- Mean and Standard Deviation of the Inflation Rate

Panel A: Moderate-Inflation Countries

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
γ_τ	-1.3488 (0.37)	-1.2819*** (0.00)	-1.8992* (0.07)	-1.0170 (0.77)	-5.2539** (0.02)	0.7565 (0.14)
δ_τ	1.2644*** (0.00)	0.6929*** (0.00)	0.9284*** (0.00)	0.9794 (0.19)	2.6209*** (0.00)	1.7101*** (0.00)
Obs.	38					

F-Statistics Testing for Slope Equality across Quantiles

Quantile				
0.25th	1.02 (0.32)			
0.50th	0.22 (0.64)	0.01 (0.93)		
0.75th	5.18** (0.03)	4.30** (0.05)	3.84* (0.06)	
0.95th	2.02 (0.16)	1.21 (0.28)	0.72 (0.40)	0.97 (0.33)
Homogeneity F-Test	6.81*** (0.00)			

Panel B: Low-Inflation Countries

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
γ_τ	0.2334 (0.72)	0.2969*** (0.00)	0.5892*** (0.01)	0.8467* (0.07)	1.3292 (0.18)	0.9164 (0.67)
δ_τ	0.6301 (0.14)	0.1106*** (0.00)	0.0740 (0.46)	0.1089 (0.63)	0.1084 (0.82)	1.8866 (0.19)
Obs.	38					

F-Statistics Testing for Slope Equality across Quantiles

Quantile				
0.25th	0.05 (0.83)			
0.50th	0.00 (0.99)	0.04 (0.84)		
0.75th	0.00 (1.00)	0.01 (0.92)	0.00 (1.00)	
0.95th	2.72 (0.11)	2.95* (0.09)	2.96* (0.09)	3.46* (0.07)
Homogeneity F-Test	0.78 (0.57)			

Note: See Table 2. *Π* equals the mean inflation rate and *V* equals the standard deviation of the inflation rate.

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 13: Estimates of Cukierman-Meltzer Regression Model with Dummy Variable, $\Pi_i = \alpha_\tau + \alpha_{\tau D} D_i + (\beta_\tau + \beta_{\tau D} D_i) V_i + u_{\tau i}$ -- Mean and Standard Deviation of the Inflation Rate

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
α_τ	0.8411**	-0.0655	0.5306	0.7623	1.2080	3.8657
	(0.02)	(0.94)	(0.32)	(0.37)	(0.27)	(0.14)
β_τ	1.6120***	0.8342***	1.1869***	1.4376***	1.7695***	2.0898*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.06)
$\alpha_{\tau D}$	1.2530	0.8905	-2.1700***	-1.3761	1.1037	3.9829
	(0.38)	(0.49)	(0.00)	(0.22)	(0.47)	(0.60)
$\beta_{\tau D}$	-0.6722***	-0.4280	-0.3460	-0.4215	-0.6112	-0.7923
	(0.01)	(0.11)	(0.14)	(0.27)	(0.21)	(0.56)
F-Statistics	82.74***	13.48***	39.17***	62.31***	71.79***	5.26***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: See Table 2. *Π* equals the mean inflation rate and *V* equals the standard deviation of the inflation rate. F-statistics test for the equality of the intercept and slope estimates across low- and high-inflation-variability countries.

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 14: Estimates of Cukierman-Meltzer Regression Model, $\Pi_i = \alpha_\tau + \beta_\tau V_i + u_{\tau i}$ -- Mean and Standard Deviation of the Inflation Rate

Panel A: High-Inflation-Variability Countries

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
α_τ	2.0941 (0.13)	0.8250 (0.30)	-1.6393 (0.14)	-0.6138 (0.78)	2.3117 (0.34)	7.8486 (0.26)
β_τ	0.9397*** (0.00)	0.4063*** (0.00)	0.8409*** (0.00)	1.0162*** (0.00)	1.1584*** (0.00)	1.2975*** (0.00)

F-Statistics Testing for Slope Equality across Quantiles

Quantile					
0.25th	7.20*** (0.01)				
0.50th	11.00*** (0.00)	1.85 (0.18)			
0.75th	13.37*** (0.00)	3.87** (0.05)	1.10 (0.30)		
0.95th	1.39 (0.24)	0.36 (0.55)	0.14 (0.71)	0.03 (0.85)	
Homogeneity F-Test	3.58*** (0.01)				

Panel B: Low-Inflation-Variability Countries

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
α_τ	0.8411** (0.02)	-0.0655 (0.91)	0.5306 (0.15)	0.7623 (0.12)	1.2080* (0.09)	3.8657 (0.30)
β_τ	1.6120*** (0.00)	0.8342*** (0.00)	1.1869*** (0.00)	1.4376*** (0.00)	1.7695*** (0.00)	2.0898*** (0.00)

F-Statistics Testing for Slope Equality across Quantiles

Quantile					
0.25th	1.15 (0.29)				
0.50th	2.85* (0.10)	1.29 (0.26)			
0.75th	2.94* (0.09)	1.56 (0.21)	0.67 (0.42)		
0.95th	1.20 (0.28)	0.65 (0.42)	0.35 (0.55)	0.08 (0.78)	
Homogeneity F-Test	0.99 (0.42)				

Note: See Table 2. *Π* equals the mean inflation rate and *V* equals the standard deviation of the inflation rate.

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 15: Estimates of Cukierman-Meltzer Regression Model with Dummy Variable $\Pi_i = \alpha_\tau + \alpha_{\tau D} D_i + (\beta_\tau + \beta_{\tau D} D_i) V_i + u_{\tau i}$, for the Low-Inflation-Variability Sample -- Mean and Standard Deviation of the Inflation Rate

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
α_τ	0.6712 (0.42)	1.2199 (0.11)	1.5252* (0.10)	1.0782 (0.31)	0.9979 (0.35)	0.4377 (0.85)
β_τ	1.6457* (0.10)	-0.4625 (0.33)	0.0873 (0.92)	0.9991 (0.30)	2.0190** (0.04)	4.1159 (0.16)
$\alpha_{\tau D}$	1.4367 (0.41)	-1.1572 (0.40)	-2.3144* (0.09)	0.7400 (0.66)	4.2652*** (0.01)	4.9459 (0.23)
$\beta_{\tau D}$	-0.4301 (0.70)	1.2668** (0.03)	1.6118* (0.08)	0.1635 (0.88)	-1.4991 (0.16)	-2.384 (0.43)
F-Statistics	27.63*** (0.00)	4.57*** (0.01)	15.51*** (0.00)	18.11*** (0.00)	9.35*** (0.00)	26.20*** (0.00)
Obs.	76					

Note: See Table 2. *V* equals the standard deviation of the inflation rate and *Π* equals the mean inflation rate. F-statistics test for the equality of the intercept and slope estimates across low- and high-inflation-variability countries.

*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

Table 16: **Estimates of Cukierman-Meltzer Regression Model ,** $\Pi_i = \alpha_\tau + \beta_\tau V_i + u_{\tau i}$ **, for the Low-Inflation-Variability Sample -- Mean and Standard Deviation of the Inflation Rate**

Panel A: Moderate-Inflation Variability Countries

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
α_τ	2.1079 (0.18)	0.0627 (0.95)	-0.7892 (0.53)	1.8183 (0.36)	5.2631* (0.10)	5.3837** (0.03)
β_τ	1.2155** (0.03)	0.8043*** (0.00)	1.6991*** (0.00)	1.1626* (0.09)	0.5199 (0.62)	1.7311*** (0.01)
Obs.				38		

F-Statistics Testing for Slope Equality across Quantiles

Quantile				
0.25th	1.97 (0.17)			
0.50th	0.21 (0.65)	0.85 (0.36)		
0.75th	0.05 (0.83)	1.00 (0.32)	0.40 (0.53)	
0.95th	0.43 (0.51)	0.00 (0.98)	0.21 (0.65)	0.90 (0.35)
Homogeneity F-Test	3.24** (0.02)			

Panel B: Low-Inflation Variability Countries

		Quantile				
	OLS	**0.05th**	**0.25th**	**0.50th**	**0.75th**	**0.95th**
α_τ	0.6712 (0.42)	1.2199** (0.04)	1.5252** (0.03)	1.0782* (0.08)	.9979 (0.16)	.4377 (0.78)
β_τ	1.6457* (0.10)	-.4625 (0.19)	0.0873 (0.89)	0.9991* (0.08)	2.0190*** (0.00)	4.1159** (0.05))
Obs.				38		

F-Statistics Testing for Slope Equality across Quantiles

Quantile				
0.25th	0.33 (0.57)			
0.50th	2.19 (0.15)	1.67 (0.20)		
0.75th	3.35* (0.08)	3.02* (0.09)	1.26 (0.27)	
0.95th	5.45** (0.03)	4.93** (0.03)	3.20* (0.08)	1.58 (0.22)
Homogeneity F-Test	1.45 (0.23)			

Note: See Table 2. *Π* equals the mean inflation rate and *V* equals the standard deviation of the inflation rate.
*** denote significance at the 1-percent level.
** denote significance at the 5-percent level.
* denote significance at the 10-percent level.

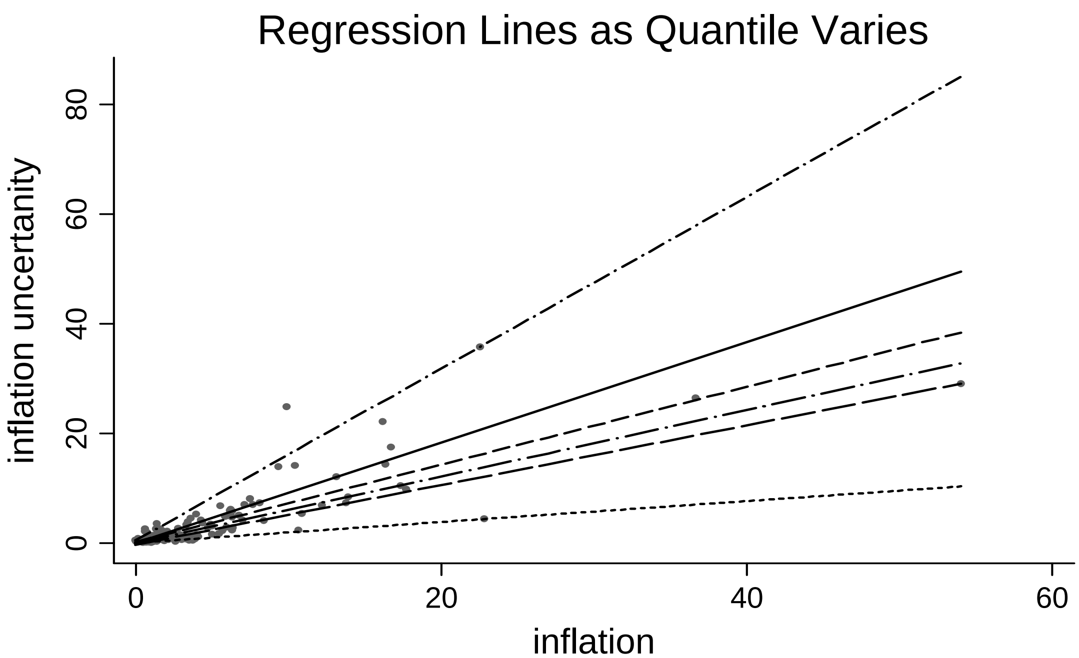

Figure 1: Quantile Regressions of Mean Inflation on Its Standard Deviation (Plots of Results in Table 2)

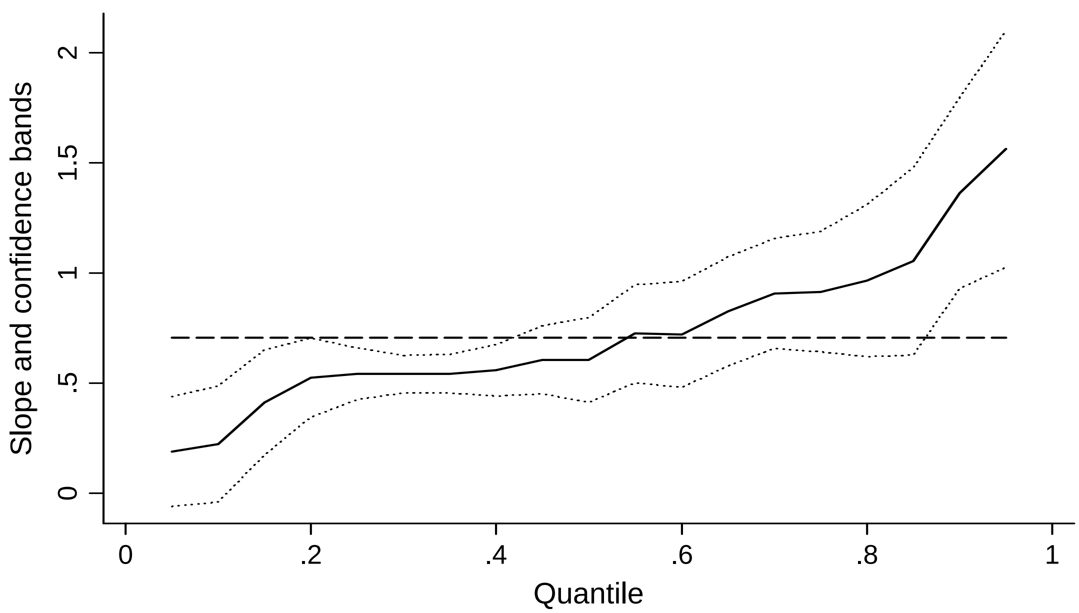

Figure 2: Plot of Slope Coefficient on the Standard Deviation in Quantile Regressions (Quantiles Run from 0.05 to 0.95 in Increments of 0.05).

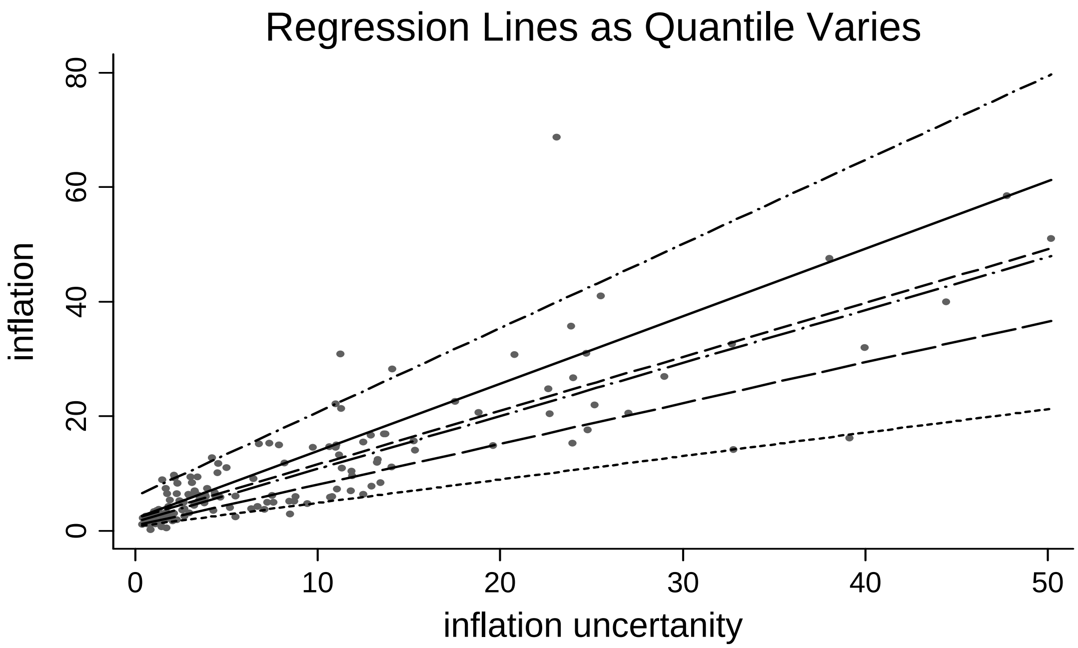

Figure 3: Quantile Regressions of the Standard Deviation onto Mean Inflation (Plots of Results in Table 3)

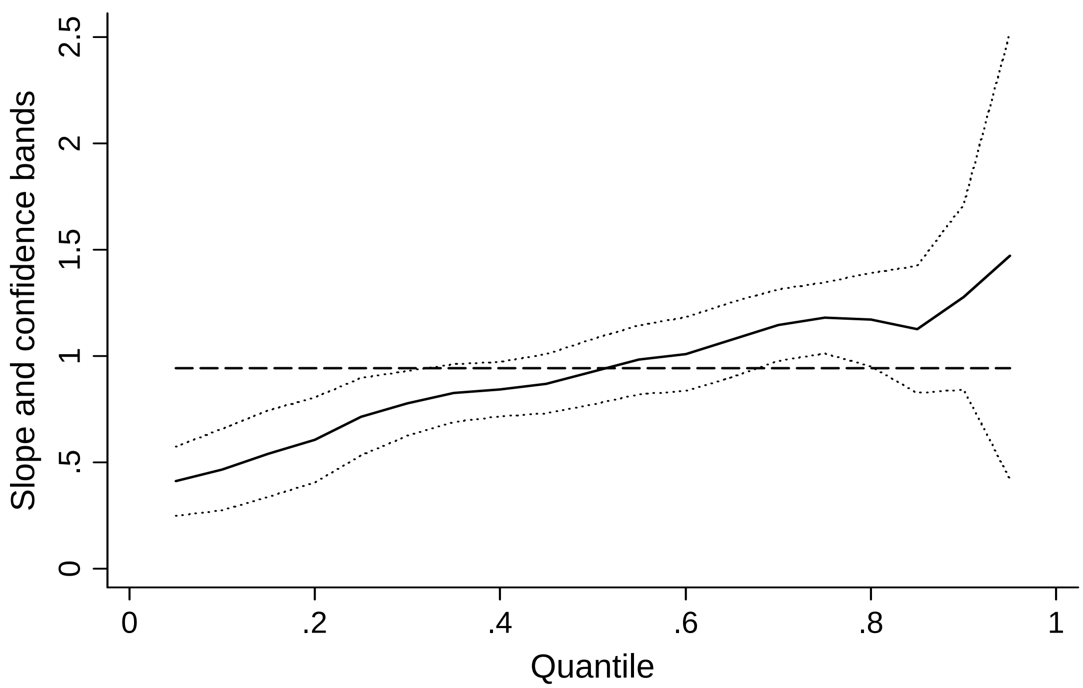

Figure 4: Plot of Slope Coefficient in Mean Inflation Quantile Regressions (Quantiles Run from 0.05 to 0.95 in Increments of 0.05).

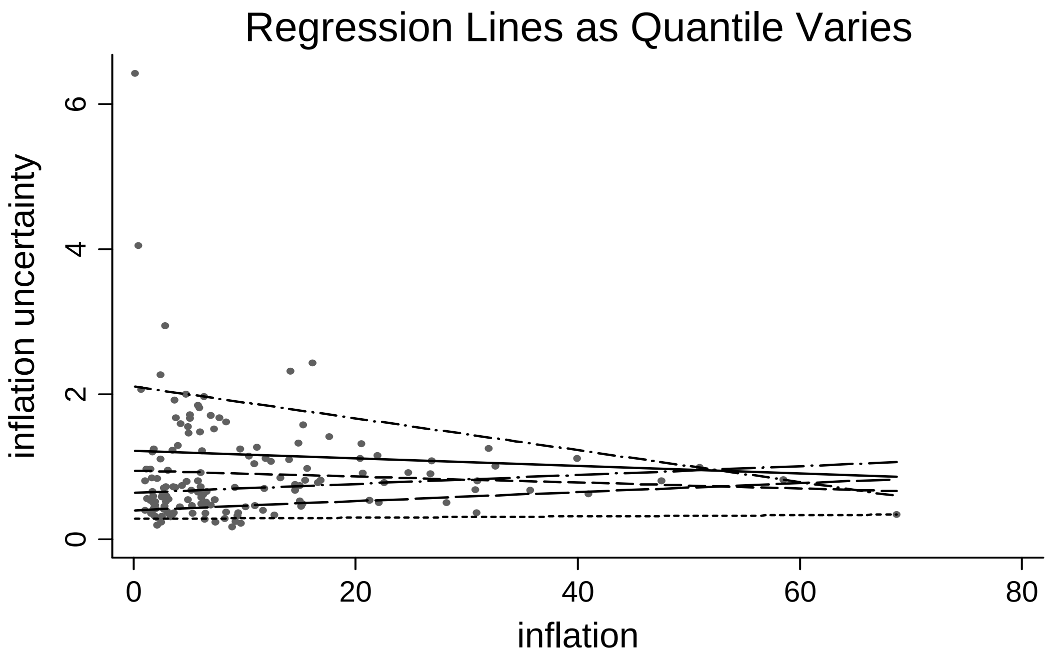

Figure 5: Quantile Regressions of Mean Inflation on Its Coefficient of Variation (Plots of Results in Table 4)

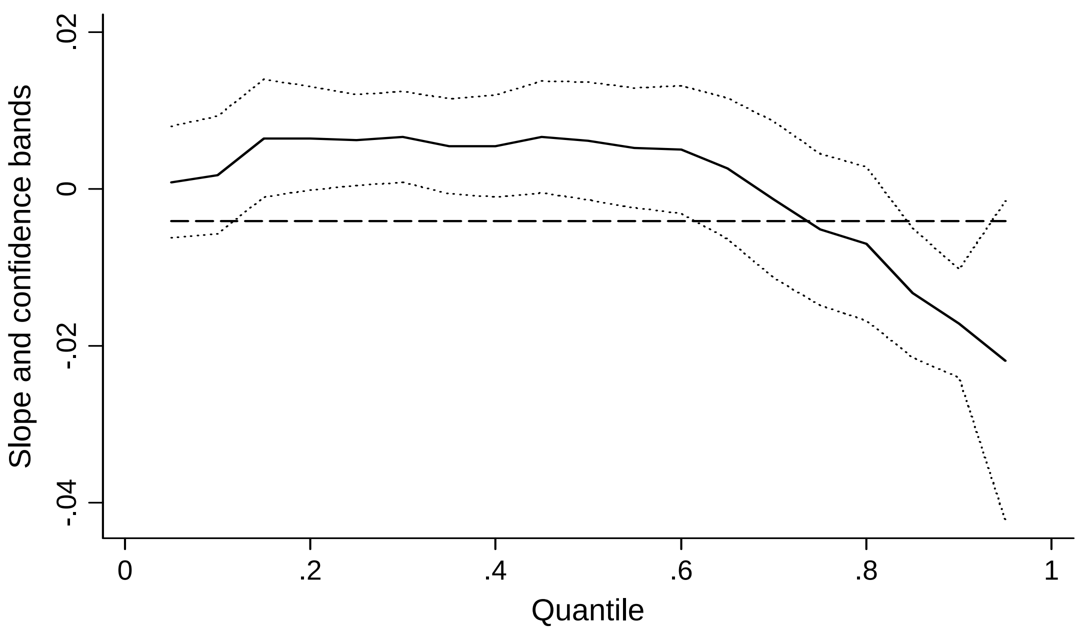

Figure 6: Plot of Slope Coefficient on the Coefficient of Variation in Quantile Regressions (Quantiles Run from 0.05 to 0.95 in Increments of 0.05).

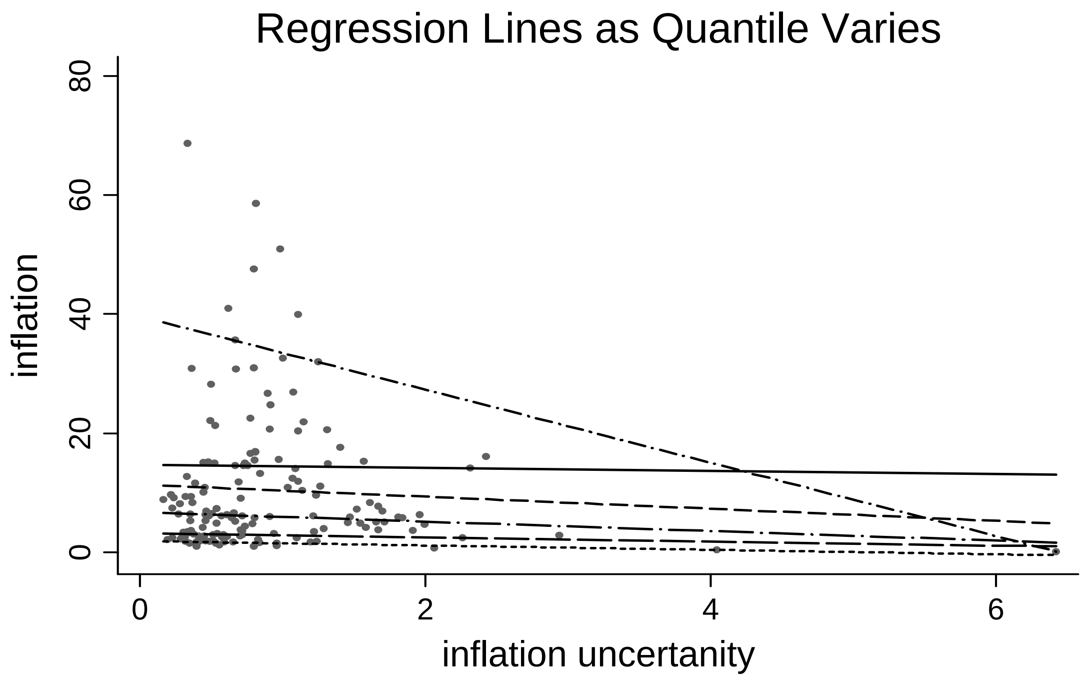

Figure 7: Quantile Regressions of the Coefficient of Variation onto Mean Inflation (Plots of Results in Table 5)

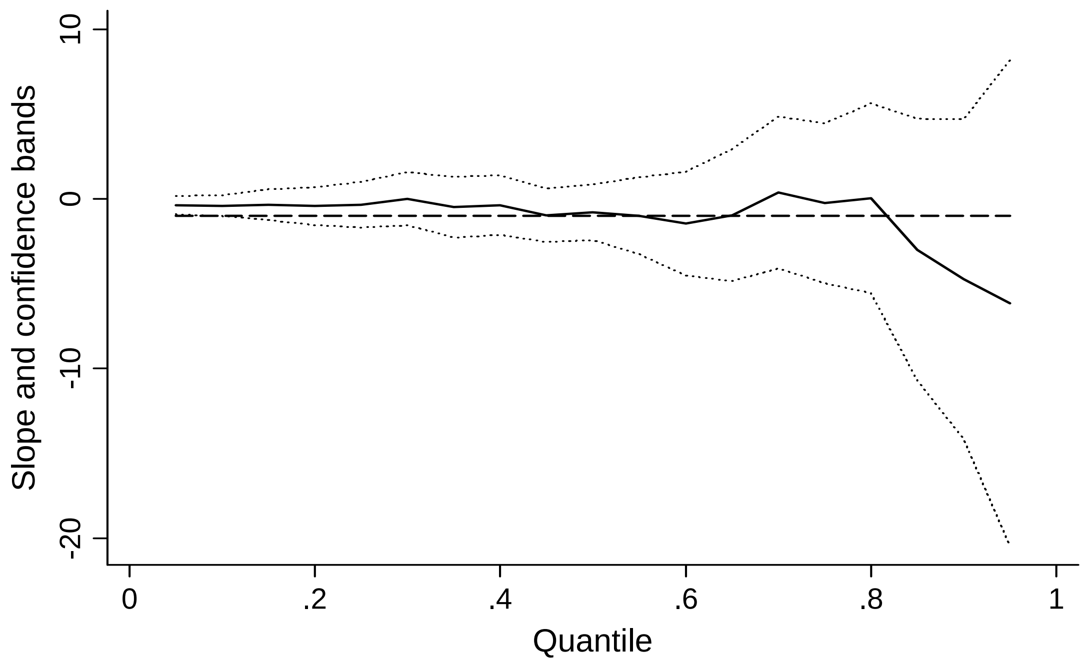

Figure 8: Plot of Slope Coefficient in Mean Inflation Quantile Regressions (Quantiles Run from 0.05 to 0.95 in Increments of 0.05).

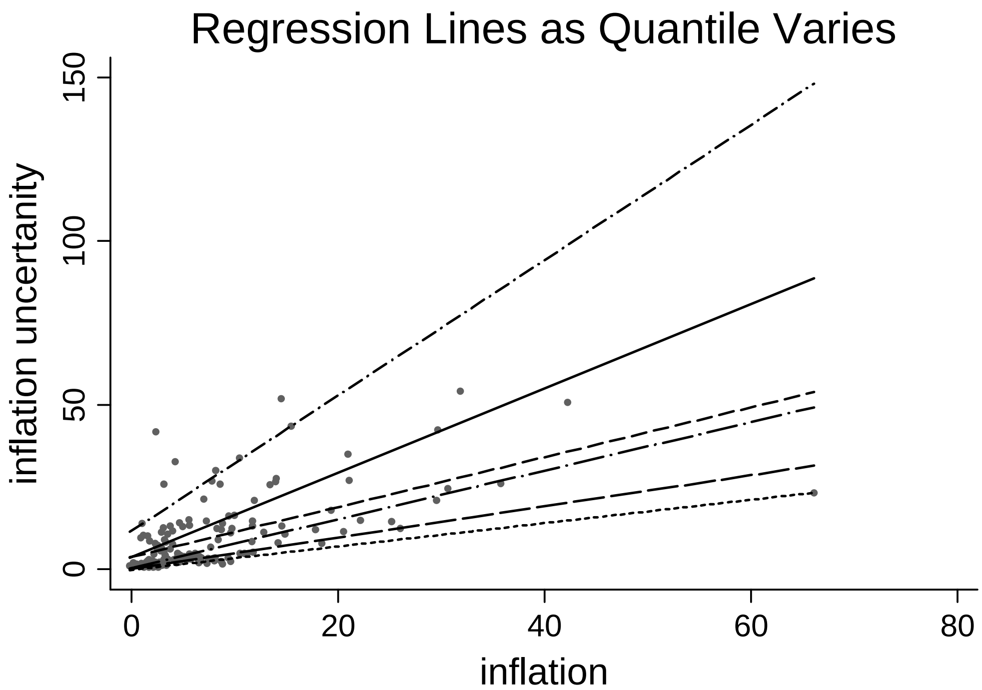

Figure 9: Quantile Regressions of Median Inflation on Its Median Deviation (Plots of Results in Table 6)

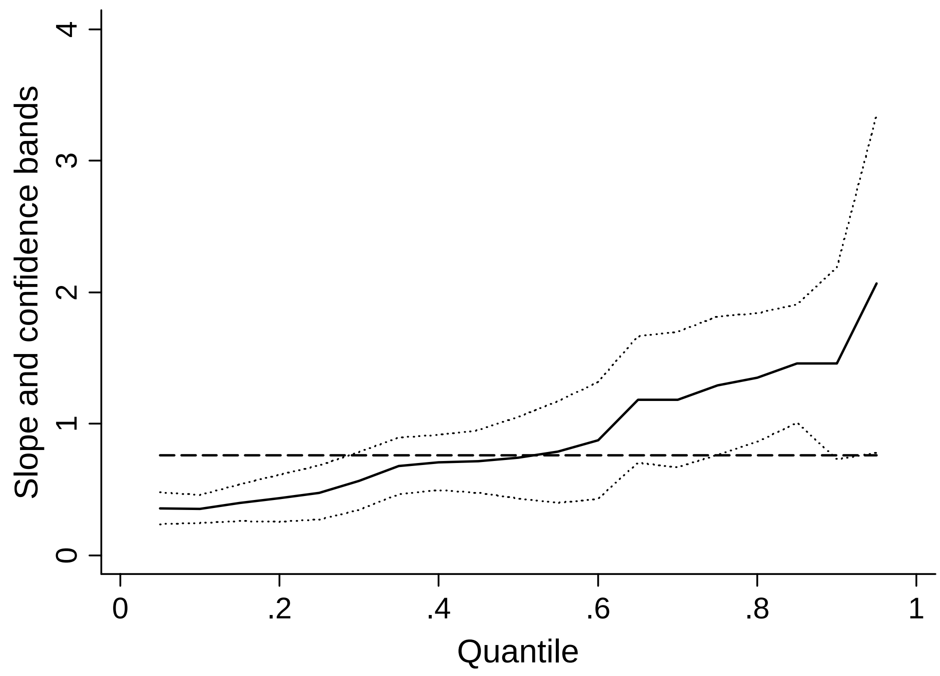

Figure 10: Plot of Slope Coefficient on the Median Deviation in Quantile Regressions (Quantiles Run from 0.05 to 0.95 in Increments of 0.05).

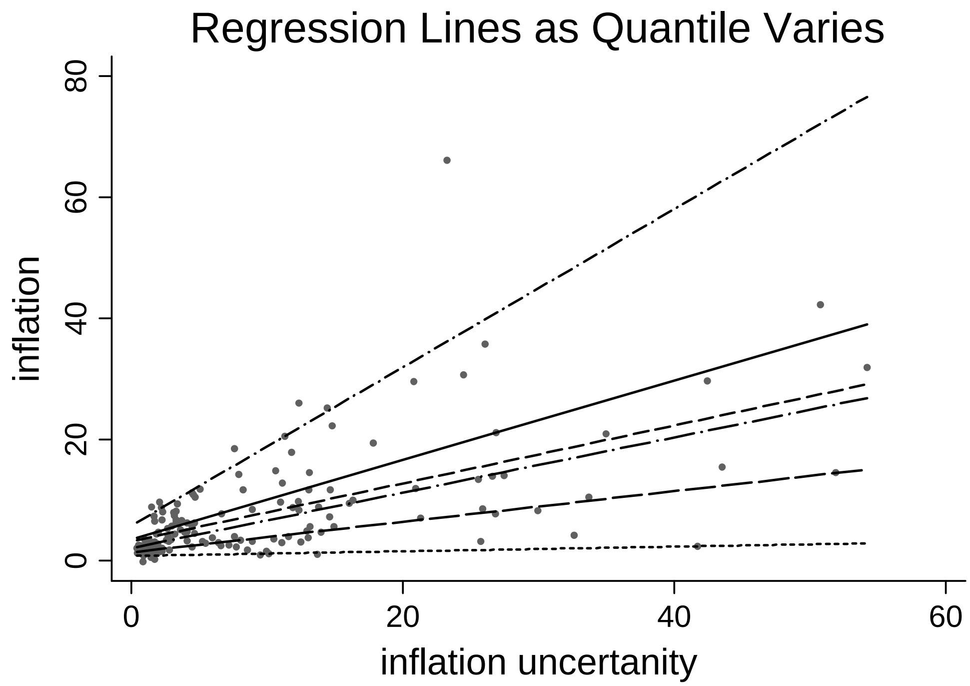

Figure 11: Quantile Regressions of the Median Deviation onto Median Inflation (Plots of Results in Table 7)

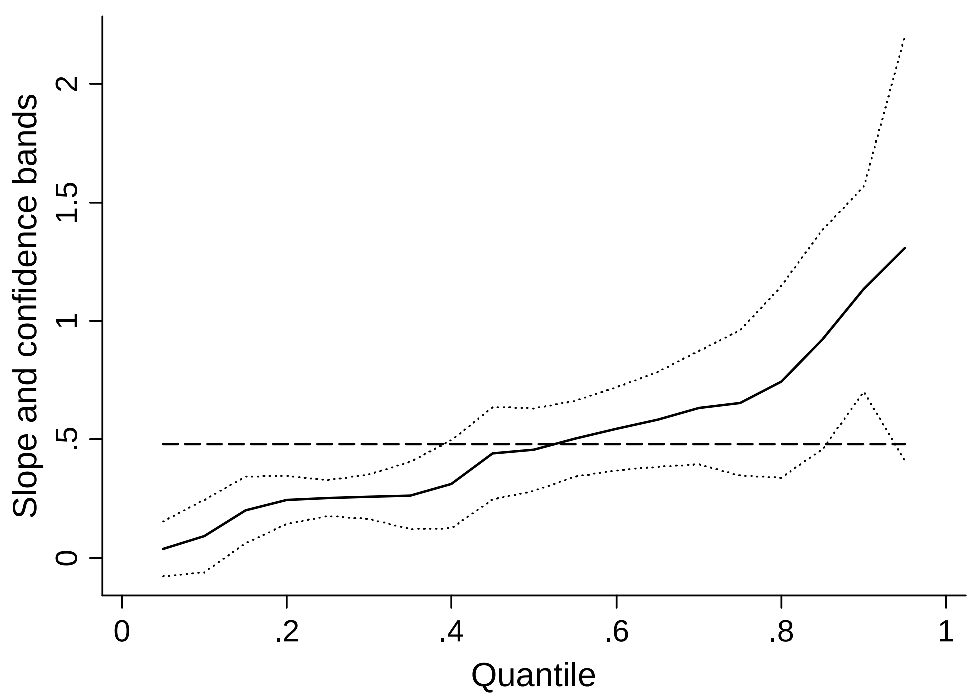

Figure 12: Plot of Slope Coefficient in Median Inflation Quantile Regressions (Quantiles Run from 0.05 to 0.95 in Increments of 0.05).

Appendix Table: Average Annual Inflation (Percent) in Sample Countries: 1993-2003

Country	Π	Country	Π	Country	Π	Country	Π
Albania	17.61	Ecuador	35.72	Latvia	10.40	Saudi Arabia (L)	0.43
Algeria	10.90	Egypt, Arab Rep.	6.09	Lesotho	9.62	Senegal	4.72
Argentina	5.08	El Salvador	6.04	Lithuania	15.26	Seychelles	2.46
Australia	2.56	Estonia	20.55	Luxembourg	2.03	Sierra Leone	16.88
Austria	1.97	Ethiopia	3.71	Macedonia	16.12	Singapore	1.16
Azerbaijan	2.89	Fiji	2.96	Madagascar	15.64	Slovak Republic	8.37
Bahamas	1.78	Finland	1.54	Malawi	30.79	Slovenia	11.81
Bahrain (L)	0.71	France	1.57	Malaysia	2.79	Solomon Islands	9.67
Bangladesh	4.91	Gabon	6.37	Maldives	3.81	South Africa	7.40
Barbados	1.84	Gambia, The	3.79	Mali	4.89	Spain	3.34
Belgium	1.87	Georgia	11.93	Malta	2.76	Sri Lanka	9.42
Belize	1.72	Germany	1.78	Mauritania	5.32	St. Kitts and Nevis	2.95
Benin	7.27	Ghana	28.21	Mauritius	6.44	St. Lucia	2.11
Bhutan	6.53	Greece	6.28	Mexico	14.97	St. Vincent	1.56
Bolivia	5.82	Grenada	1.86	Moldova	16.85	Sudan (H)	50.99
Botswana	9.18	Guatemala	8.21	Mongolia	26.86	Suriname	32.61
Brazil	14.87	Guinea-Bissau	20.42	Morocco	2.76	Swaziland	9.39
Bulgaria	39.95	Guyana	6.14	Mozambique	24.73	Sweden	1.65
Burkina Faso	4.95	Haiti	21.28	Namibia	8.91	Switzerland (L)	1.08
Burundi	14.63	Honduras	15.22	Nepal	6.30	Syrian Arab Rep.	4.23
Cambodia	4.02	Hong Kong	2.43	Netherlands	2.59	Tanzania	14.55
Cameroon	5.96	Hungary	14.97	New Zealand	1.99	Thailand	3.61
Canada	1.85	Iceland	3.19	Nicaragua	10.11	Togo	6.94
Cape Verde	4.37	India	6.98	Niger	5.80	Tonga	4.81
Central African Rep.	5.09	Indonesia	14.04	Nigeria	26.73	Trinidad and Tobago	5.27
Chad	7.76	Iran, Islamic Rep.	22.10	Norway	2.22	Tunisia	3.50
Chile	6.10	Ireland	2.92	Pakistan	7.32	Turkey (H)	68.69
China	5.97	Israel	6.62	Panama (L)	1.03	Uganda	5.20
Colombia	15.12	Italy	3.08	Papua New Guinea	10.96	Ukraine	21.96
Congo, Rep.	8.33	Jamaica	14.57	Paraguay	11.66	United Kingdom	2.48
Costa Rica	12.71	Japan (L)	0.13	Peru	11.13	United States	2.49
Cote d'Ivoire	6.16	Jordan	2.64	Philippines	6.45	Uruguay	22.56
Croatia	14.15	Kazakhstan	13.23	Poland	15.49	Vanuatu	2.56
Cyprus	3.24	Kenya	12.41	Portugal	3.66	Venezuela (H)	40.94
Czech Republic	5.97	Korea	4.16	Romania (H)	58.54	Vietnam	3.13
Denmark	2.16	Kuwait	1.71	Russian Federation	30.95	Yemen, Rep.	20.67
Dominica	1.21	Kyrgyz Rep.	16.62	Rwanda	5.81	Zambia	30.88
Dominican Republic	9.12	Lao PDR	31.96	Samoa	3.51	Zimbabwe (H)	47.56

Note: L and H mean the 5 lowest and 5 highest inflation rates.