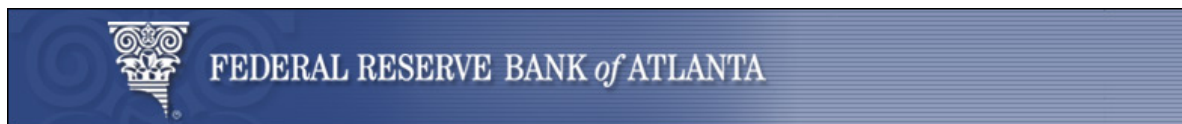


Core Inflation for Emerging Economies



Global Interdependence Center

Michael F. Bryan*

Vice President and Senior Economist
Federal Reserve Bank of Atlanta

**Co-authored with Brent Meyer (Federal Reserve Bank of Cleveland)
and Ellyn Terry (Federal Reserve Bank of Atlanta)*

Core Inflation for an Emerging Economy

- 1. Food represents a huge share of the consumers' marketbasket in an emerging economy**
- 2. The “ex-food and energy” approach to core inflation is probably not an efficient guide for an inflation minded central bank and probably more so for a central bank in an emerging economy.**
- 3. Some food items are actually “good” inflation indicators—some non-food goods are not.**
- 4. Various techniques can be used to improve the signal-to-noise of a high-frequency (monthly) inflation statistic, giving the central bank the opportunity to spot worsening/improving inflation trends earlier than they might otherwise.**
- 5. Trimmed-mean estimators offer a extremely simple technique for improving the inflation signal in the inflation data.**

Important Cautions

- 1. I do not necessarily represent the views of the Federal Reserve Board, or the Federal Reserve Bank of Atlanta.**
- 2. This work is still incomplete—I cannot match the official Zambian CPI exactly using the component data I have.**
- 3. I have only a very limited knowledge of Zambian monetary policy (but hope to have greater knowledge on this subject before I return home.)**

What's the Problem that a "Core" Inflation Measure is the Answer?

Federal Reserve "Monetary" Policy

Set the funds rate so to achieve two objectives: 1) maximum sustainable employment and 2) price stability.

$$i^{ff} = (r^* + \pi) + 0.5 (y - y^*) + 0.5 (\pi - \pi^*)$$

Zambian Monetary Policy

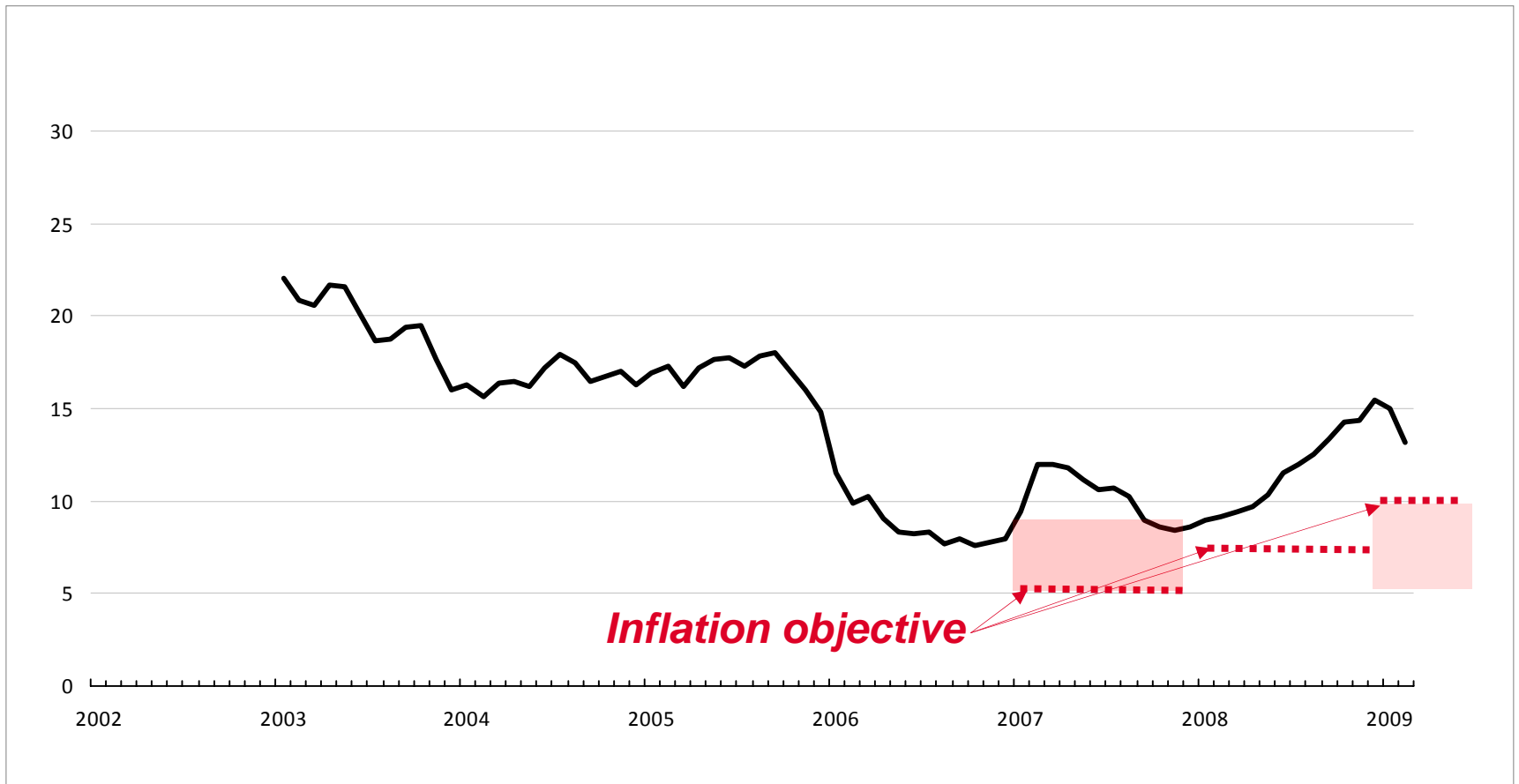
Establish a level of reserves that produces the broad money growth consistent with an inflation objective.

In either case...

Policy action  Inflation result

Zambian Inflation

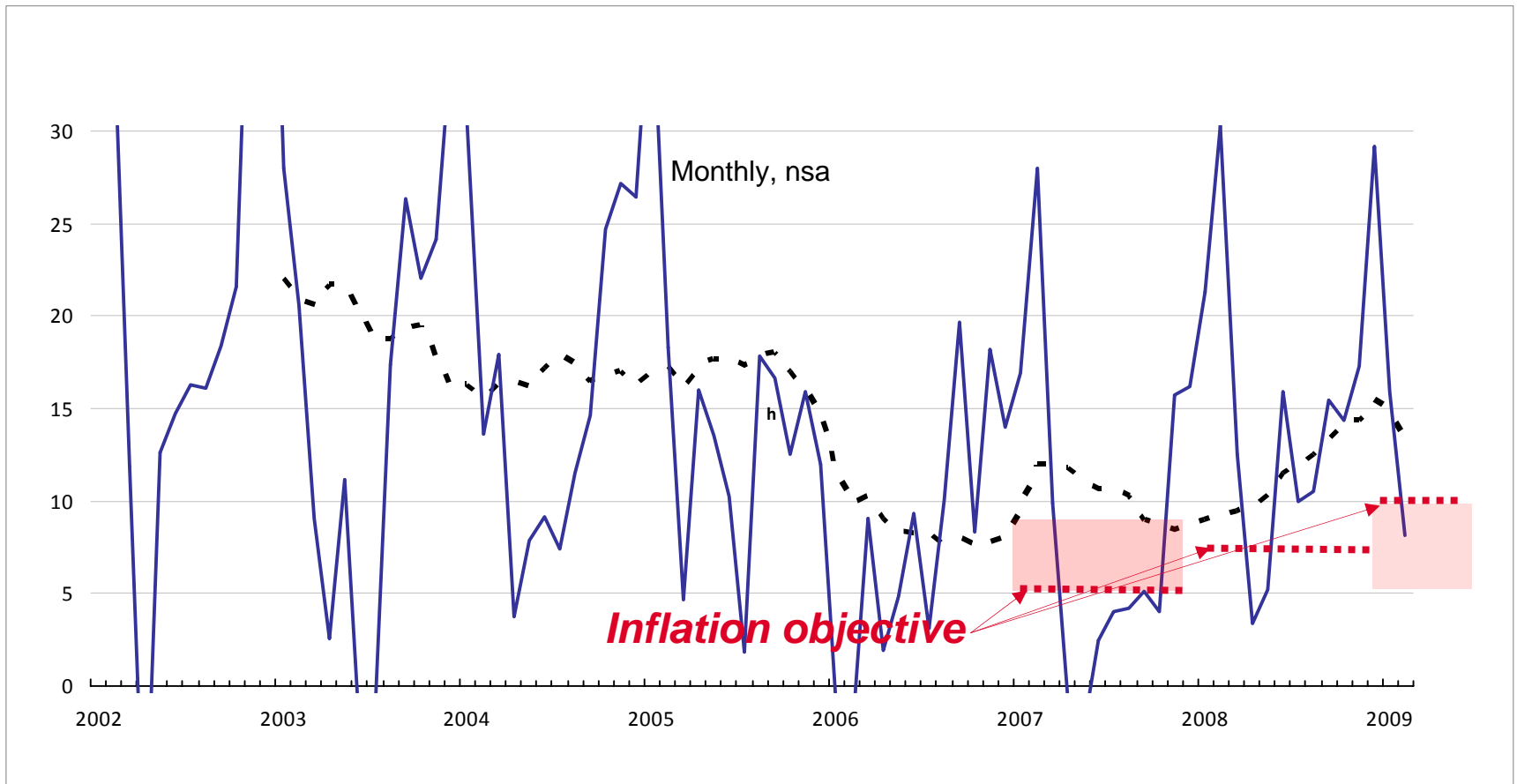
(12-month percent change)



— Overall CPI

Zambian Inflation

(12-month percent change)



— Overall CPI

How Does a Central Bank Deal with the Volatility in the High-Frequency Price Data?

Computes (12-month) Trends

Trends are, of course, very backward looking and can only tell the central bank when it has gone off course, not when it is going off course.

Core Inflation Statistics

An attempt to preserve the timeliness of the data by reducing the noise in the data by “statistical” techniques.

Alternative “Core” Approaches

Variance Weighted Price Statistics

Reweight the price statistic on the (inverse) basis of its volatility.

Dynamic Factor/Kalman Filter Statistics

Have the data identify a common component in the price data.

Reweight the price statistic such that the most volatile components get no weight

This is the most common approach—the CPI excluding something.

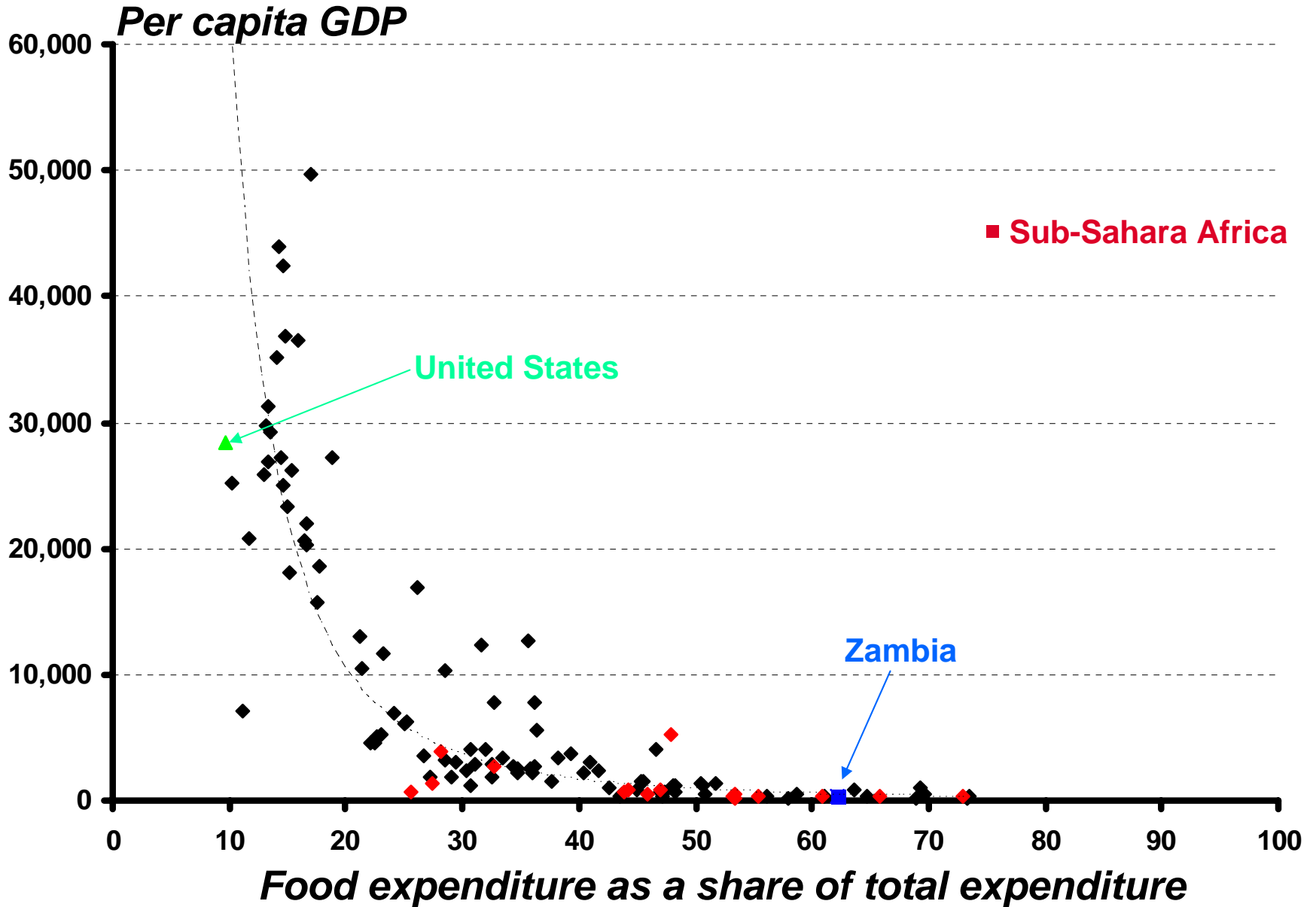
CORE INFLATION STATISTICS OF SELECTED CENTRAL BANKS

(* Inflation targeting countries ** Core statistic used as a target or objective)

Country	Core Inflation Statistic
Australia**	CPI less mortgage interest payments, government controlled prices, and energy items.
Belgium	CPI less energy, potatoes, and fruit and vegetables.
Canada**	CPI less indirect taxes, food and energy items.
Finland**	CPI less housing capital costs, indirect taxes, and government subsidies.
France**	CPI excluding changes in taxes, energy prices, food prices, and regulated prices.
Greece	CPI excluding food and fuels.
Israel*	CPI less government goods, housing, fruit and vegetables.
Japan	CPI less fresh foods.
Netherlands	CPI less vegetables, fruit, and energy.
New Zealand**	CPI less commodity prices, government controlled prices, interest and credit charges.
Philippines	A statistical trend line.
Portugal	10% trimmed mean of the CPI.
Spain*	CPI less mortgage interest payments.
Sweden*	CPI excluding housing mortgage interest and effects of taxes and subsidies (UND1), UND1 excluding petroleum goods (UND2), and UND1 less mainly imported goods (UNDINH).
United Kingdom**	Retail Price Index less mortgage interest payments.
United States	CPI less food and energy items.

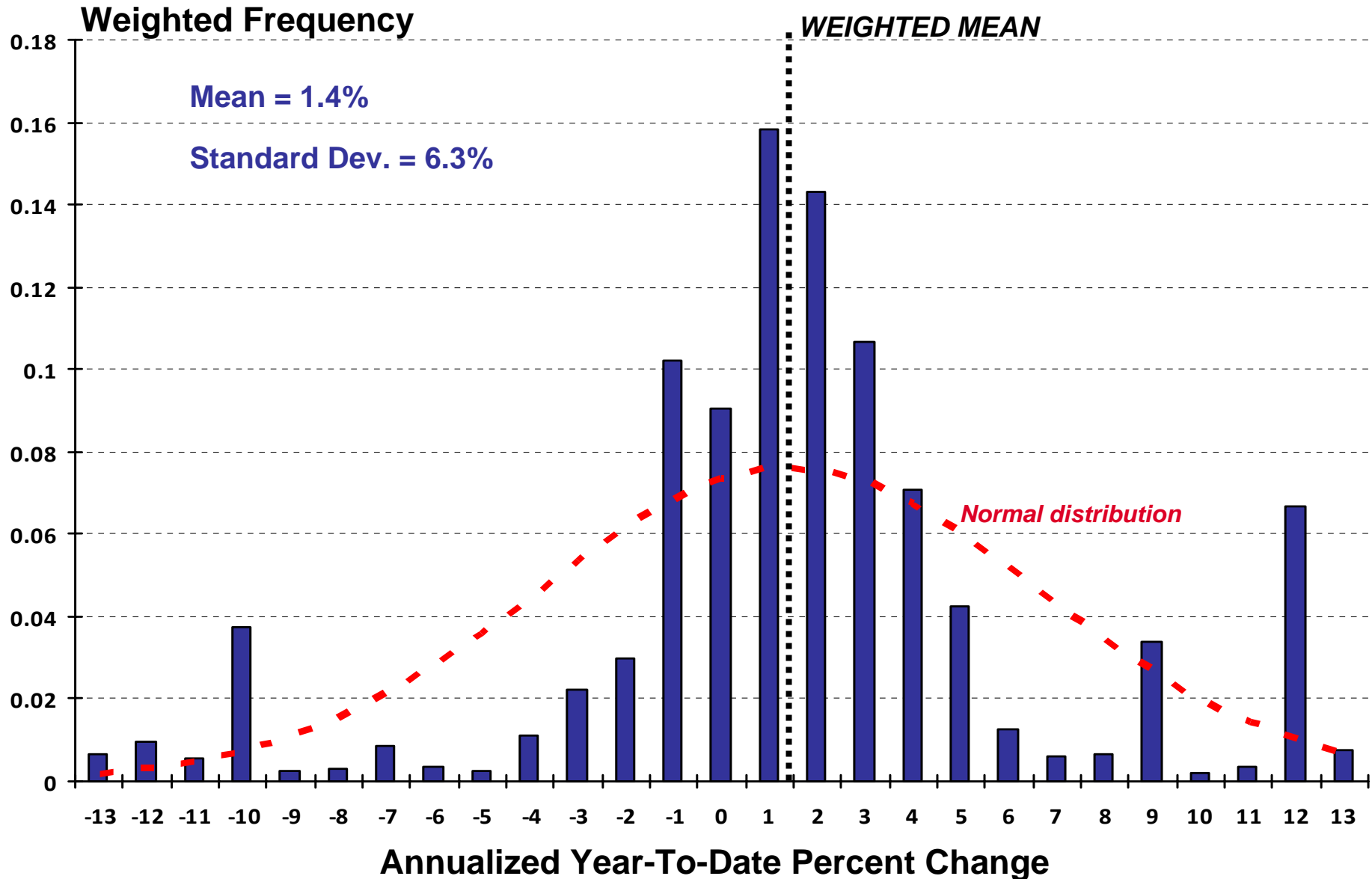
Income and Food Expenditure

(sample of 114 nations, 1996 data)



Zambian Retail Price Changes

February 2009 (NSA, annualized)



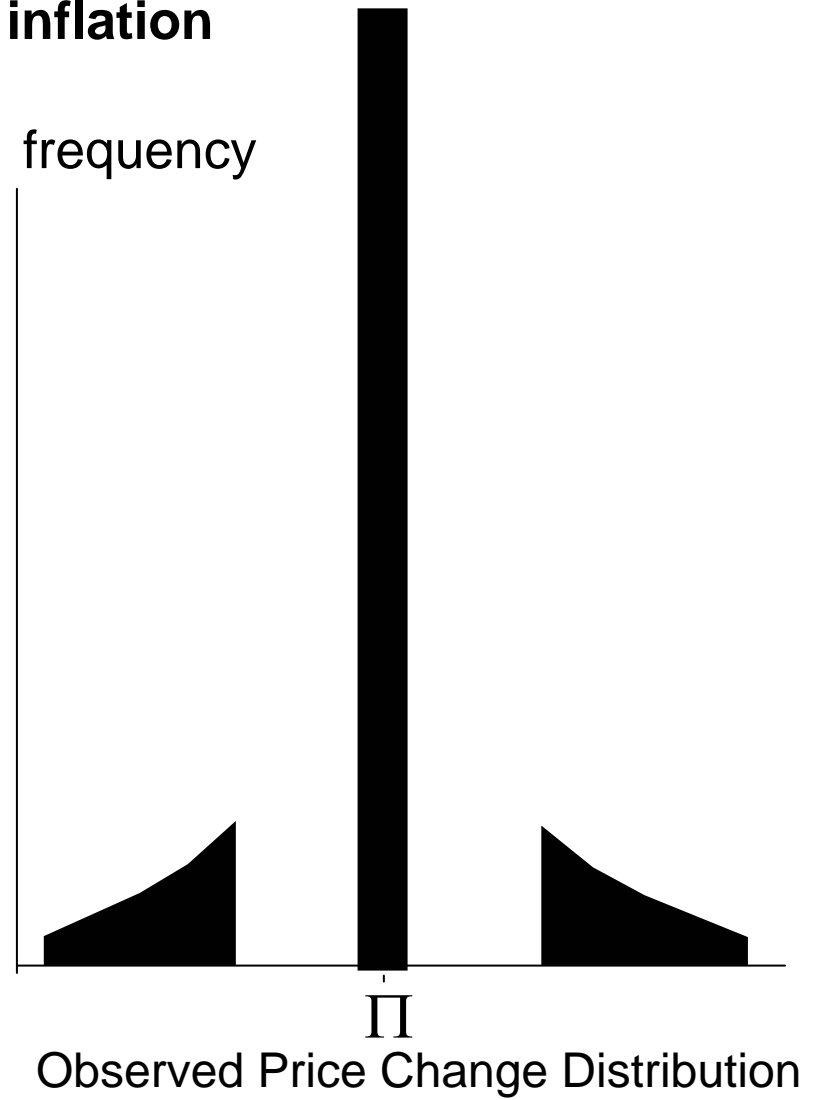
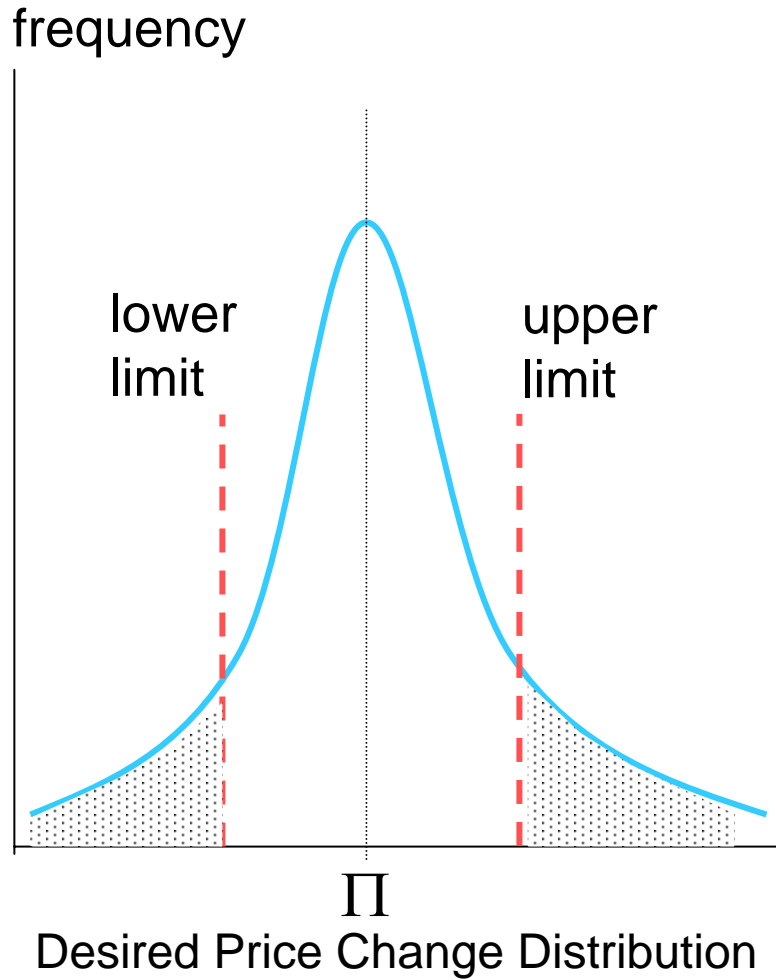
Retail Price Change Distribution Characteristics

(Arranged by average inflation, annualized)

Monthly	Mean	St. Dev.	Skew	Kurt
Brazil	206.2	4.0	0.6	14.6
Argentina	123.2	6.3	1.2	11.0
Mexico	42.8	5.1	2.6	46.2
Colombia	23.2	2.4	1.0	10.1
South Africa	12.0	1.7	1.6	13.1
Israel	10.0	1.6	0.1	10.6
UK	8.1	1.9	0.8	20.1
Sweden	6.1	1.9	1.1	19.1
New Zealand*	7.2	1.9	0.7	6.9
<u>US</u>	<u>5.2</u>	<u>0.7</u>	<u>0.3</u>	<u>11.6</u>
Japan	4.5	1.9	0.8	32.9
Canada	3.4	1.5	0.4	22.0
Germany	2.8	1.2	0.0	26.3

* Data for New Zealand are not available on a monthly basis, so we report values computed from quarterly data.

The Menu-Cost Model of Observed Price Changes with expected inflation



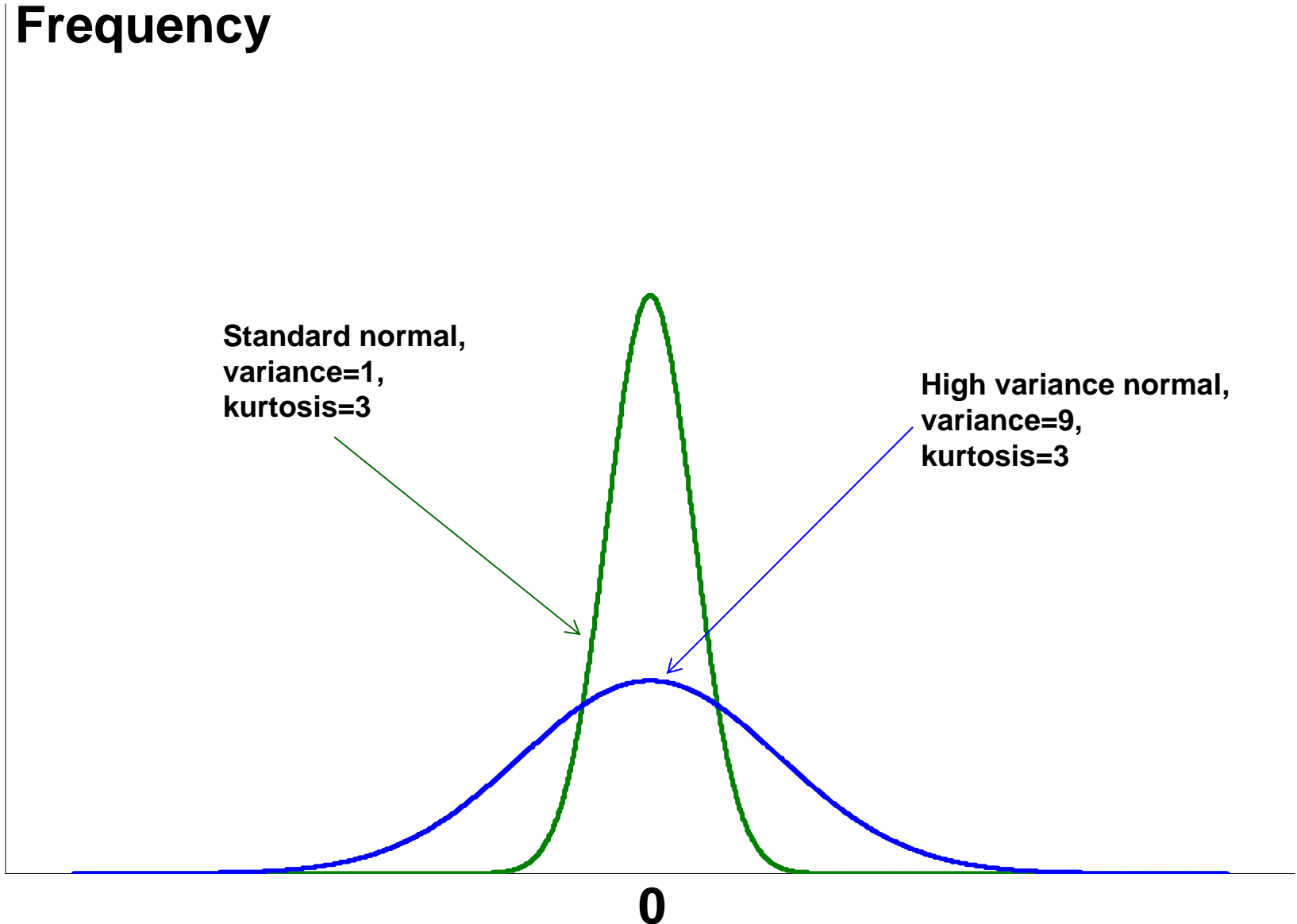
Hypothetical Mixed Normal Distribution

Frequency

Standard normal,
variance=1,
kurtosis=3

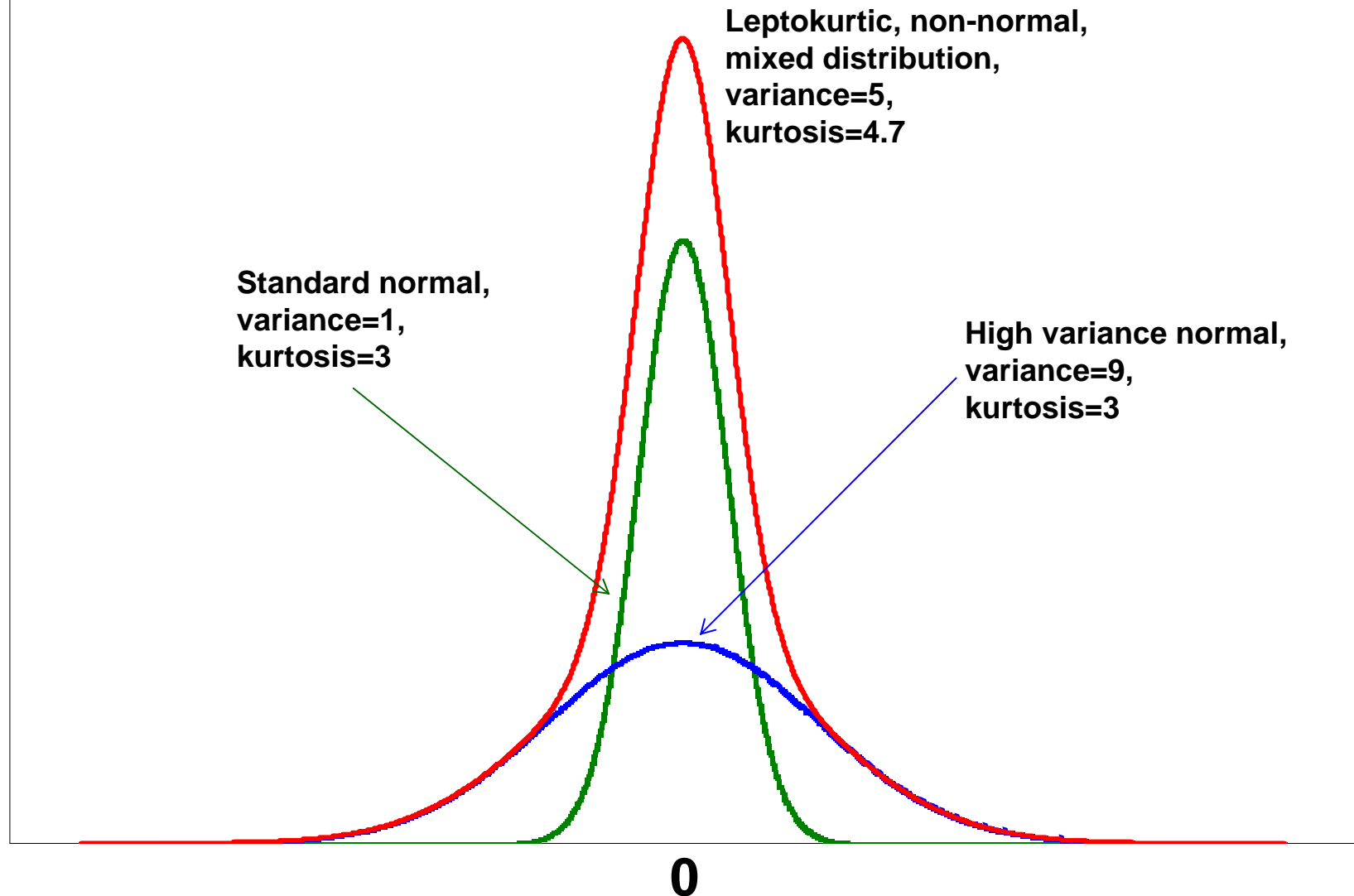
High variance normal,
variance=9,
kurtosis=3

0



Hypothetical Mixed Normal Distribution

Frequency



Hypothetical Mixed Normal Distribution

Frequency

Leptokurtic, non-normal,
mixed distribution,
variance=5,
kurtosis=4.7

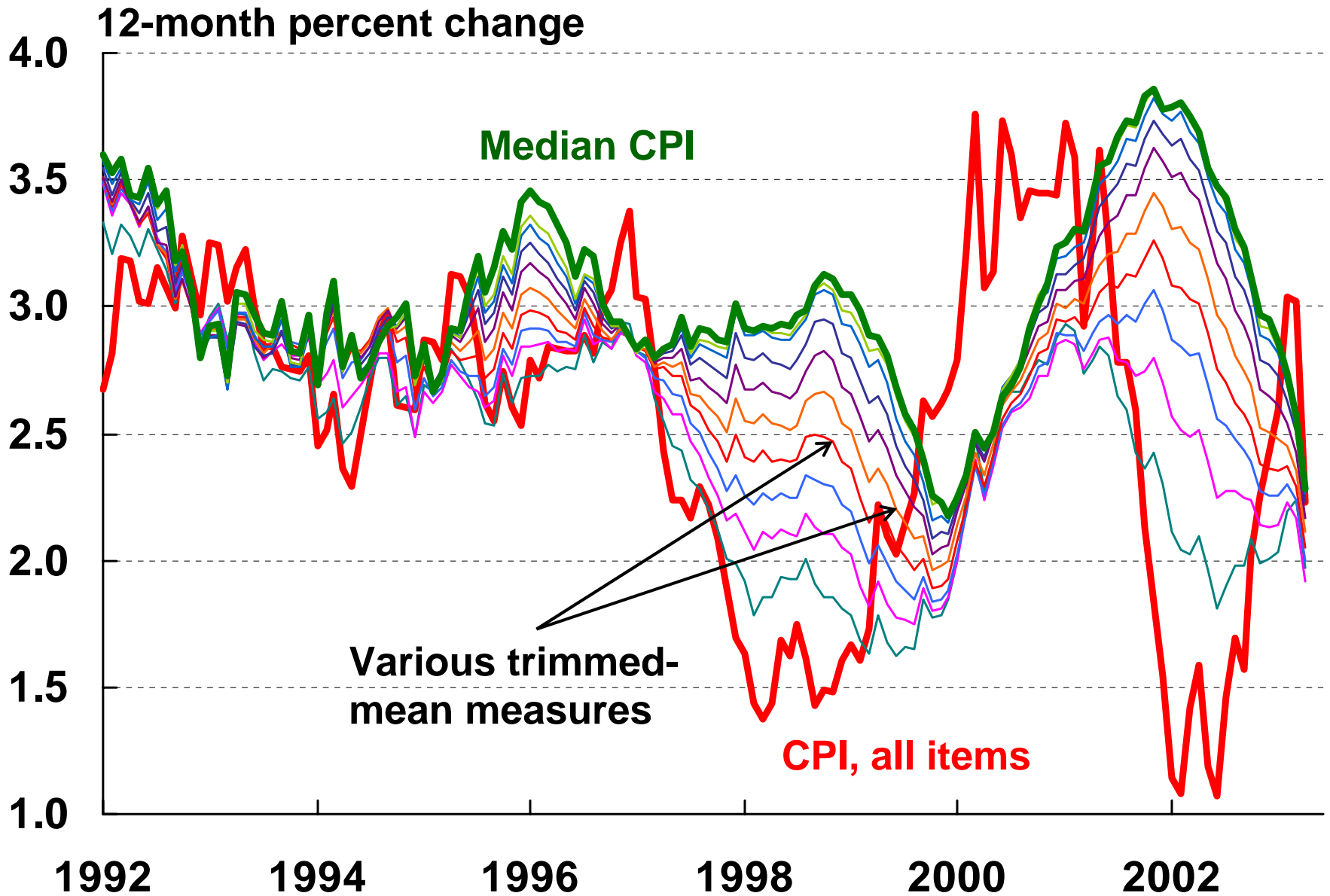
0



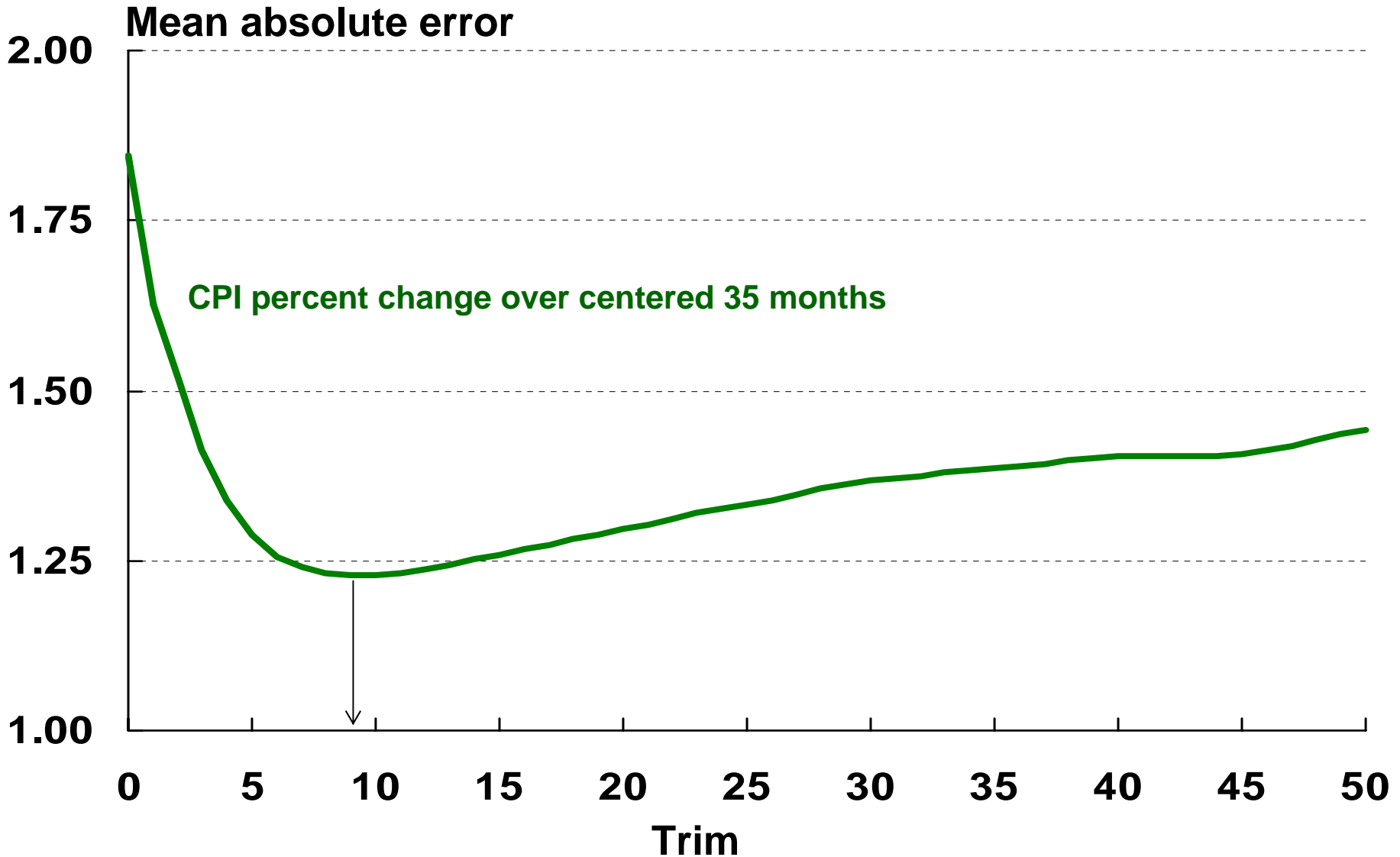
TRIMMED MEAN ESTIMATORS

$$\bar{x}_\alpha = \frac{1}{1 - 2\left(\frac{\alpha}{100}\right)} \sum_{i \in I_\alpha} w_i x_i$$

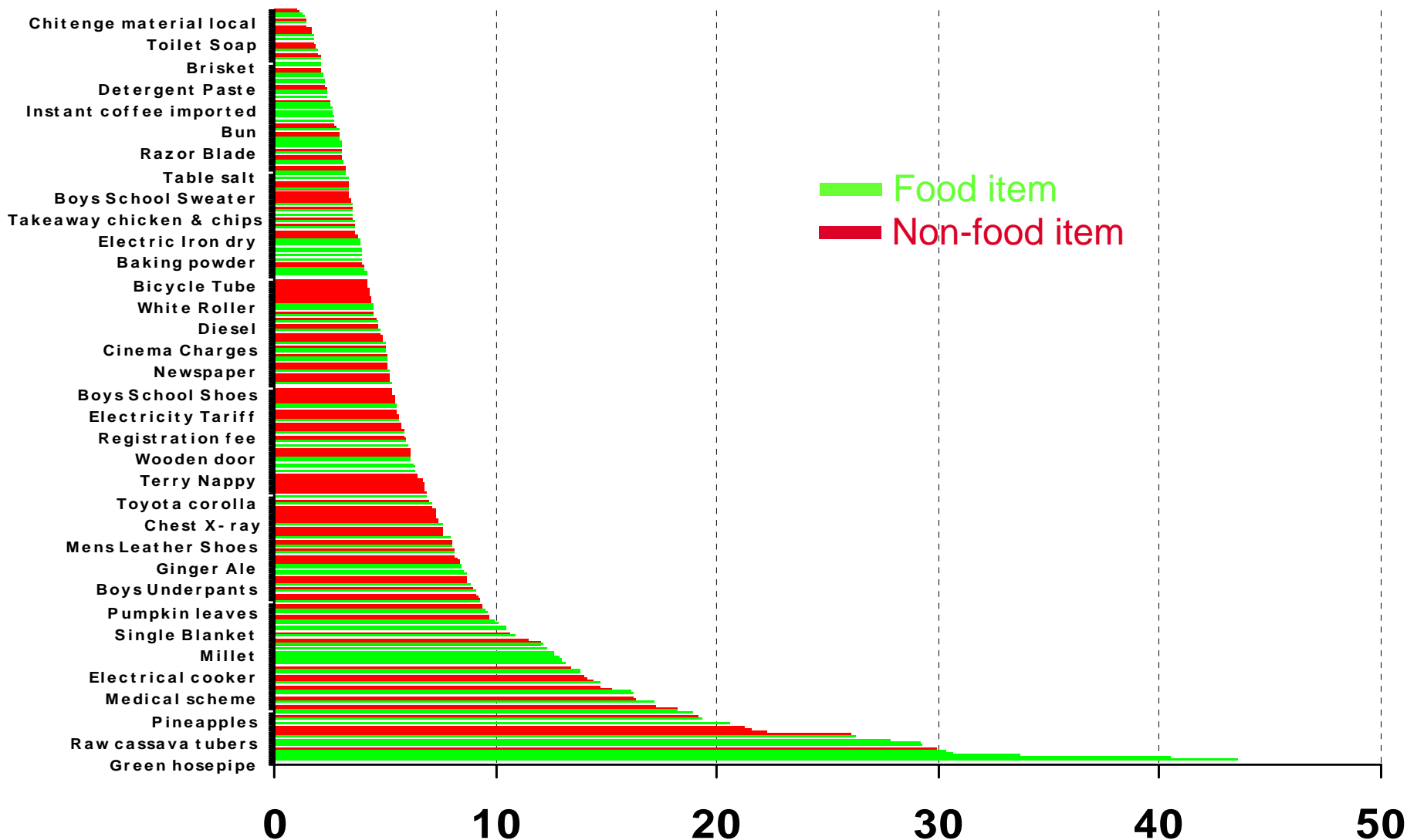
CONSUMER PRICE INDEX



EFFICIENCY OF VARIOUS CPI TRIMMED-MEAN ESTIMATORS



STANDARD DEVIATION OF CPI COMPONENTS: ZAMBIAN CPI, s.a., 2002-2009



CHARACTERISTICS OF THE 40 LARGEST ITEMS IN THE ZAMBIAN CPI*

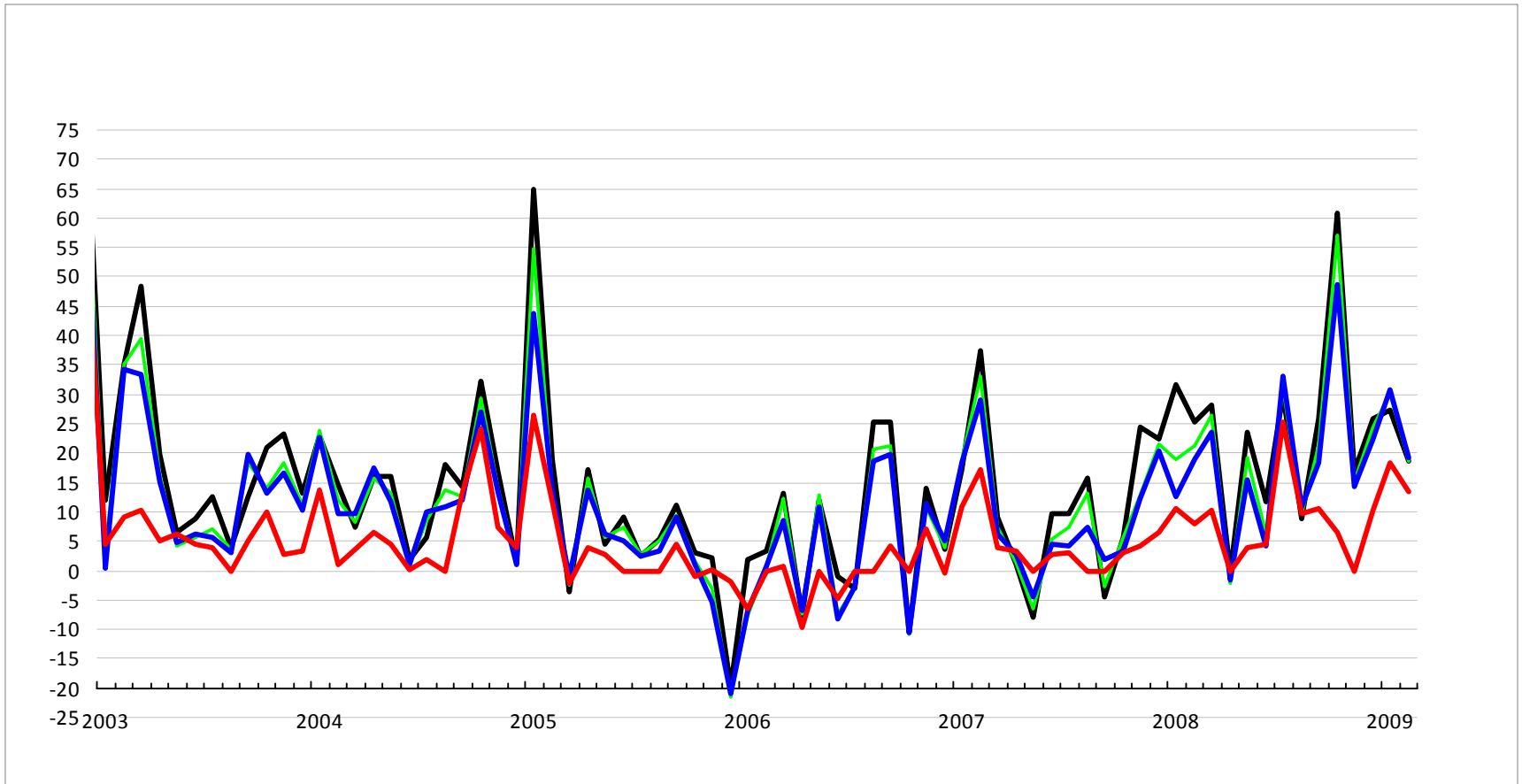
(Representing 63% of total expenditure for high-income urban consumers)

<u>Commodity</u>	<u>Mean</u>	<u>Varian.</u>	<u>Weight</u>	<u>Commodity</u>	<u>Mean</u>	<u>Varian.</u>	<u>Weight</u>
House rent (medium cost)	1.9	15.3	4.5%	Rhino Lager	1.2	2.7	1.1%
White breakfast	0.7	3.5	3.7%	Castle Lager	1.1	2.5	1.1%
Toyota hilux	0.8	6.8	3.2%	Beef Sausages	1.0	3.3	1.1%
Toyota corolla	1.4	7.1	3.2%	Dried beans	1.4	5.0	1.0%
Nissan sunny	1.6	8.4	3.2%	Rape	1.4	10.5	1.0%
Nissan pick_up	1.1	6.5	3.2%	Water & Sewerage charges	0.3	7.6	1.0%
Mixed Cut	1.1	2.1	3.2%	Water & Sewerage charges	0.6	8.2	1.0%
Dressed chicken	0.9	4.2	3.0%	Laundry	0.9	3.0	0.9%
Bread	1.1	1.4	2.9%	Dry Clean	0.9	3.7	0.9%
White sugar	1.0	4.1	2.2%	Dried Kapenta	1.6	6.3	0.8%
House rent (low cost)	1.5	7.3	1.6%	Dried Kapenta	1.3	4.1	0.8%
Tomatoes	1.5	12.3	1.6%	Refrigerator	0.4	5.7	0.8%
Cooking oil Imported	1.1	2.5	1.4%	Television B&W	1.2	5.0	0.7%
Cooking oil Local	1.2	2.6	1.4%	Television Colour	0.0	3.3	0.7%
Mini Bus Fare Town/Chilenje	1.3	5.3	1.4%	Detergent Powder	0.7	3.0	0.7%
Coach Fare Lusaka/Kitwe	0.9	5.5	1.4%	Shake shake	0.7	4.0	0.6%
Petrol	0.8	4.9	1.3%	3 piece lounge suit low price	1.5	6.2	0.6%
Diesel	0.7	4.7	1.3%	3 piece lounge suit high price	2.0	17.3	0.6%
Bun	1.7	2.9	1.2%	Charcoal	1.3	3.6	0.6%
Mosi	1.2	2.3	1.1%	Radio cassette Recorder	0.3	9.4	0.6%

*characteristics computed on seasonally adjusted data over the 2002-2009 subperiod.

Zambian Inflation

(Measured by various n.s.a. CPI trims, annualized monthly percent change)



— High-Income CPI

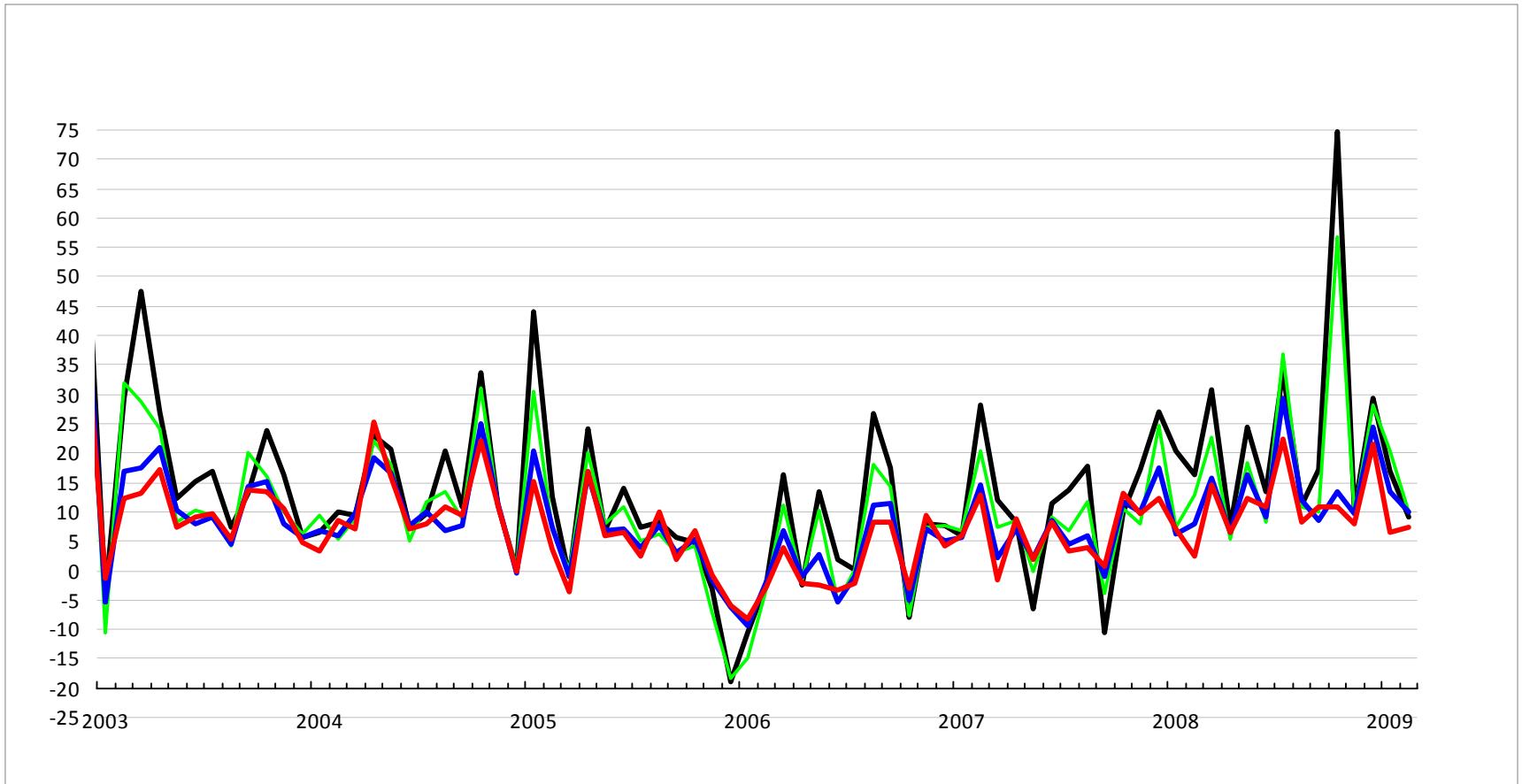
— 4% Trim

— 10% Trim

— Median CPI

Zambian Inflation

(Measured by various s.a. CPI trims, annualized monthly percent change)



— High-Income CPI

— 5% Trim

— 21% Trim

— Median CPI

EFFICIENCY OF VARIOUS ZAMBIAN CPI TRIMMED-MEAN ESTIMATORS

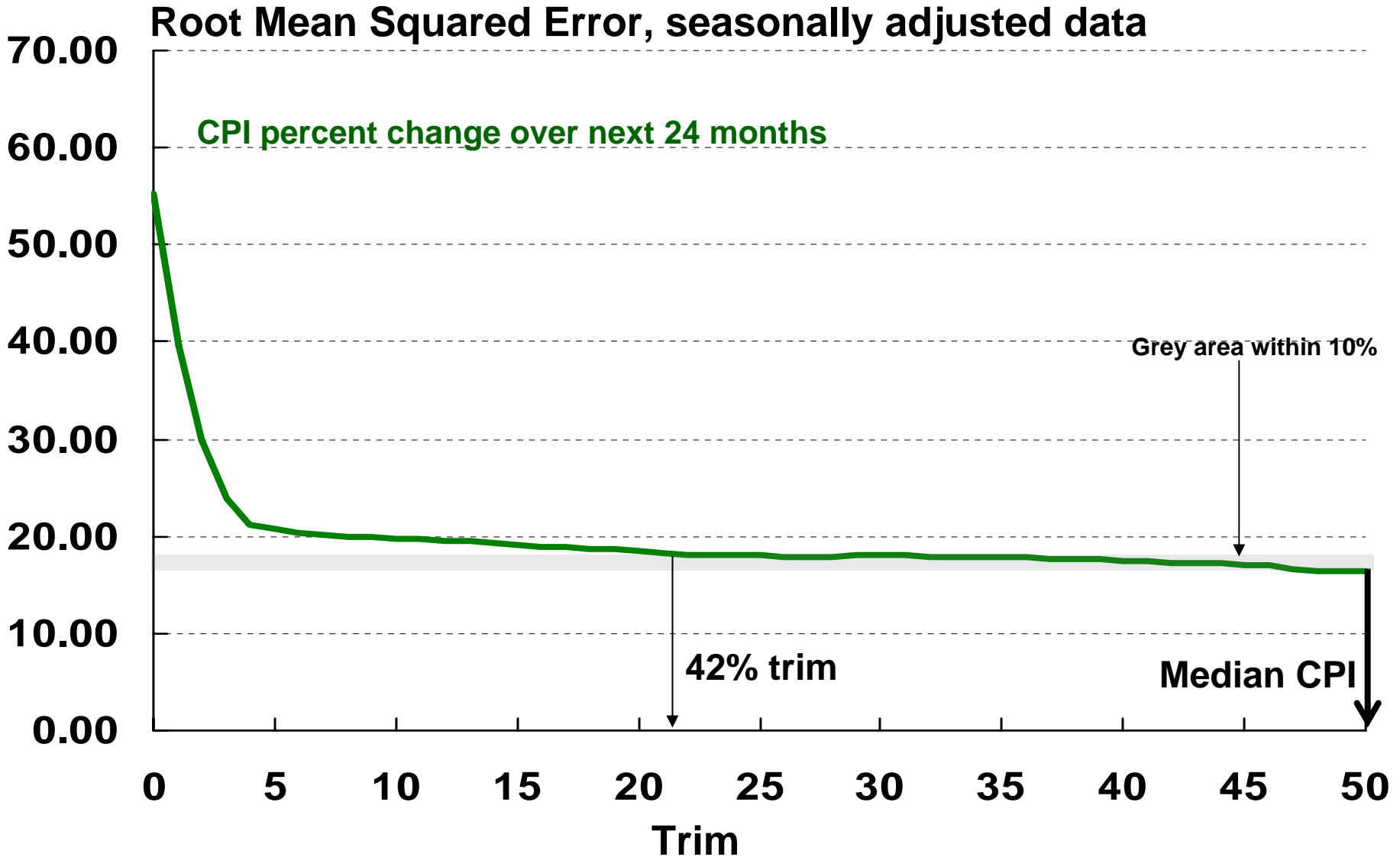
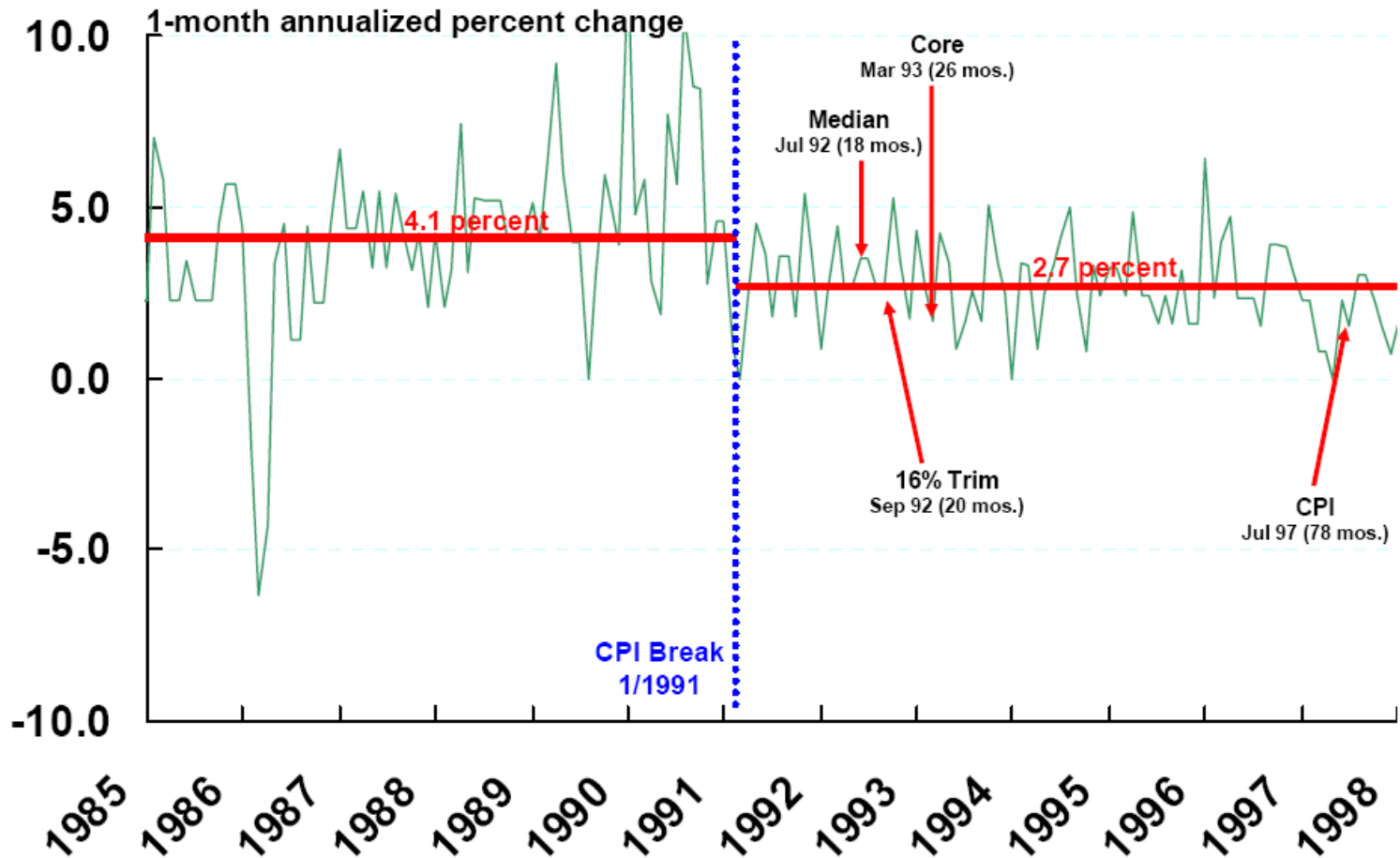


Figure 3b: HISTORICAL CPI BREAK IDENTIFICATION

(monthly data, break = 1.4 percentage points)



Source: *Monitoring Inflation in a Low-Inflation Environment* (Bryan and Higgins, 2007)

Remaining Issues

(That perhaps the Zambian Central Bank can advise me on?)

1. The Zambian CPI distribution appears to be positively “skewed”.

These (and other) estimators will need to be asymmetrically trimmed (or rebalanced) so that the core inflation indicator is an unbiased estimate of the object the central bank is trying to control.

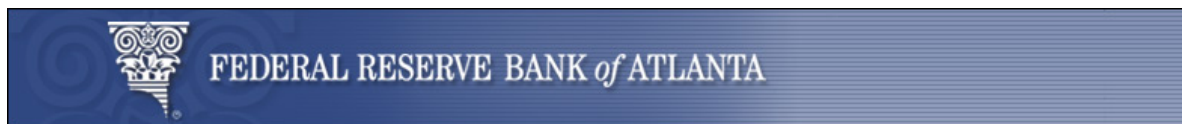
2. The “efficient” trim estimate can be judged in several different ways.

You may wish to identify the trimmed-mean on the basis of its correlation to broad money (M3).

3. Inflation is always and everywhere a monetary phenomenon.

... but what are the driving sources of inflation when a nation's GDP is heavily influenced by a world inflation hedge (i.e. copper)?

Core Inflation for Emerging Economies



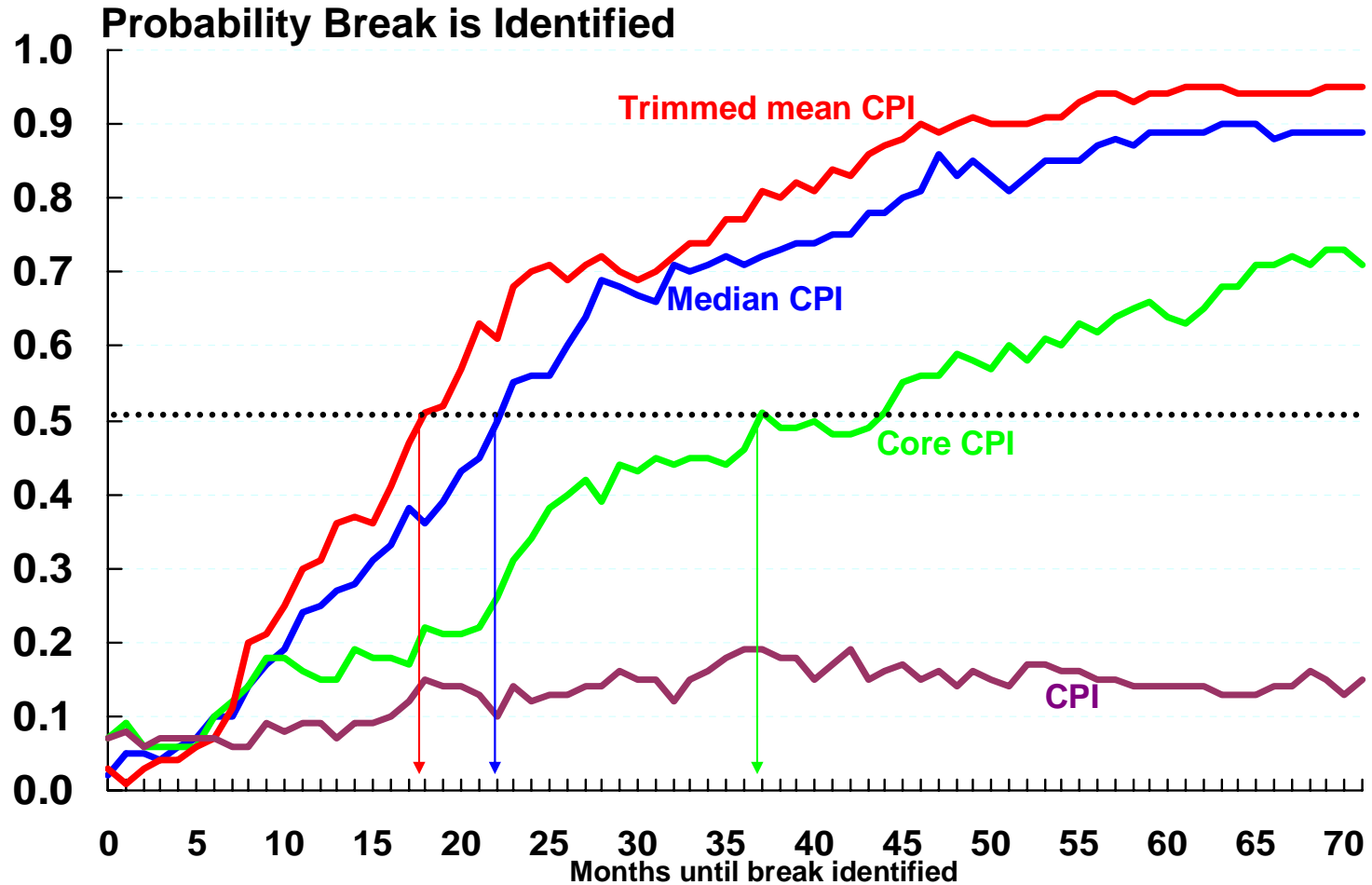
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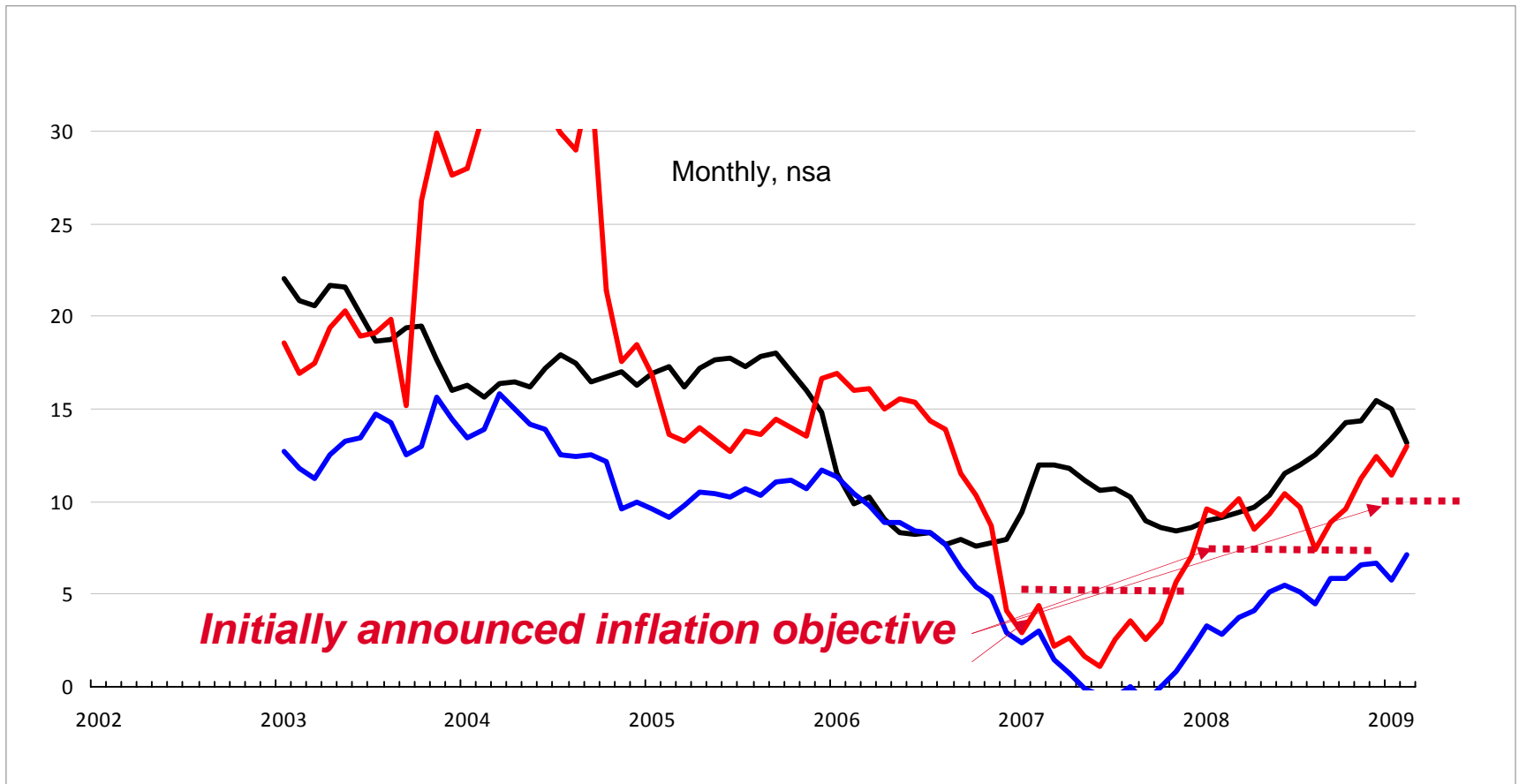
Figure 2c: Identifying Breaks in the Inflation Trend
(monthly data, break = 0.5 percentage point)



Source: *Monitoring Inflation in a Low-Inflation Environment* (Bryan and Higgins, 2007)

Zambian Inflation

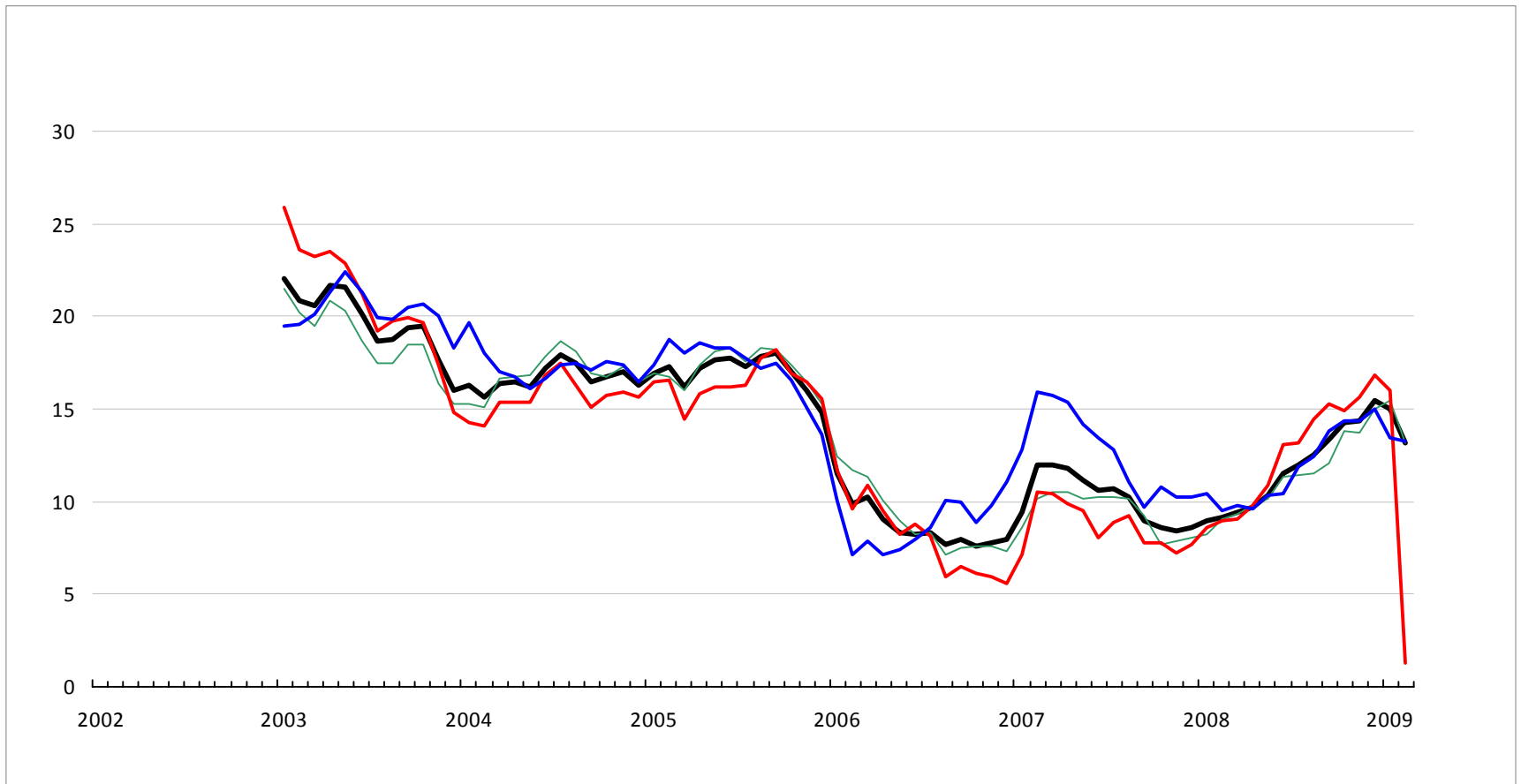
(12-month percent change)



— Overall CPI

Zambian Inflation

(by major demographic subgroup, 12-month percent change)



— Overall CPI

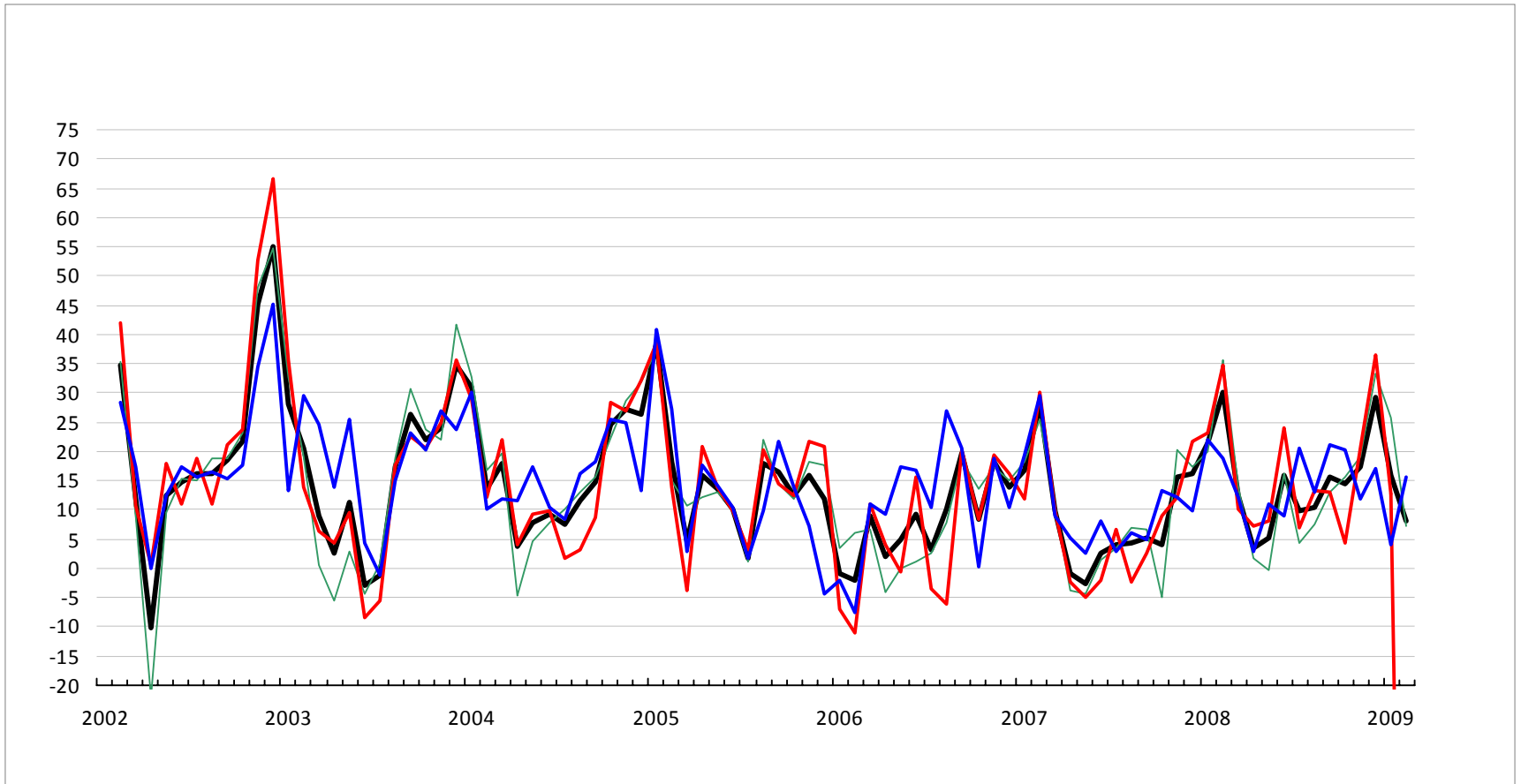
— Rural

— High Income Urban

— Low Income Urban

Zambian Inflation

(by major demographic subgroup, annualized monthly percent change)



— Overall CPI

— Rural

— High Income Urban

— Low Income Urban

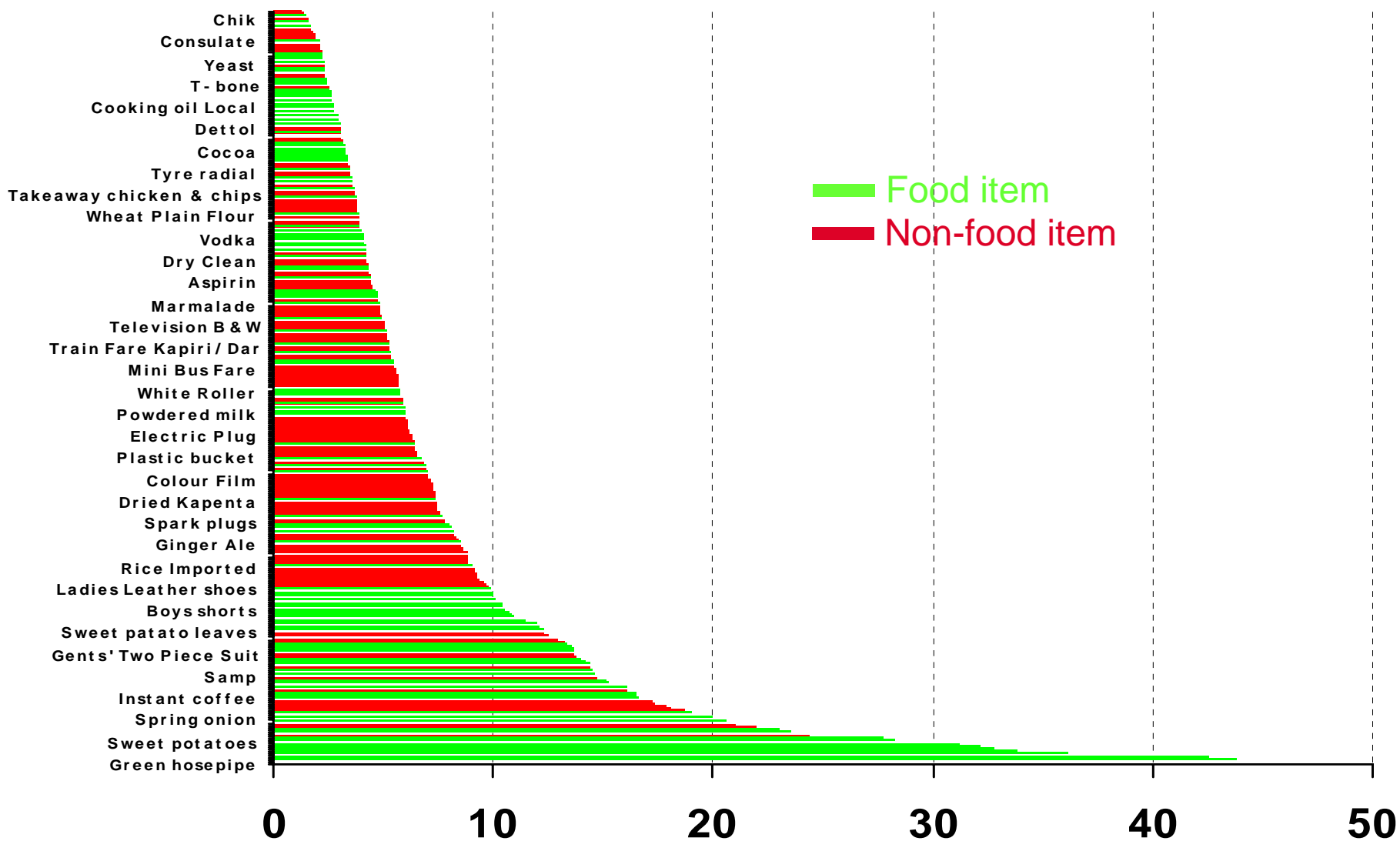
The Most Volatile Commodities in the Zambian CPI

(Arranged by average inflation, annualized)

Commodity	Mean	St. Dev.	Weight	Cum. Wt.
Green hosepipe	12.44823384	71.61848918	0.000552	0.000552
Salted peanuts	5.241725361	43.79150285	0.00002	0.000572
Watermelon	7.423151079	42.51392153	0.000184	0.000756
PTA Contribution	5.723105927	37.54348891	0.003257	0.004013
Peas	5.804479272	36.18308369	0.000247	0.00426
Pawpaw	5.78843851	33.77371163	0.000109	0.004369
Lettuce	6.817777767	32.72386727	0.000186	0.004555
Pineapple chunks	3.792698665	32.11631734	0.000036	0.004591
Spinach	4.673422205	31.19553659	0.000234	0.004825
Pipe tobacco	2.997283256	29.32643098	5.00E-06	0.00483
Sweet potatoes	5.38065539	28.27511114	0.00255	0.00738
Raw cassava tubers	4.953983048	27.7418862	0.000073	0.007453
Plasters	1.570540052	25.05923256	0.000111	0.007564

* Calculations based on data from 2002-2009 (February)

STANDARD DEVIATION OF CPI COMPONENTS: ZAMBIAN CPI, n.s.a., 2002-2009



EFFICIENCY OF VARIOUS ZAMBIAN CPI TRIMMED-MEAN ESTIMATORS

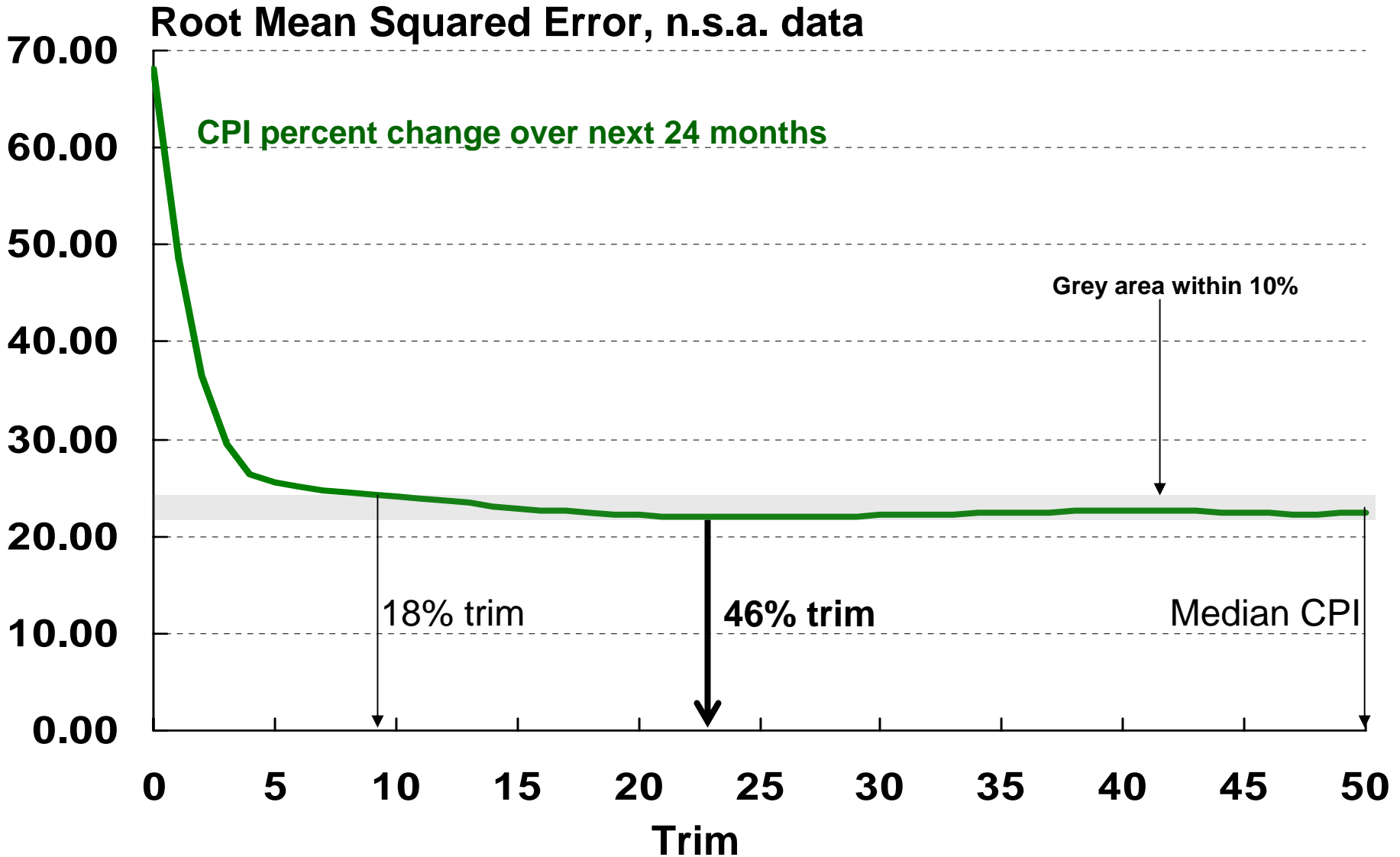


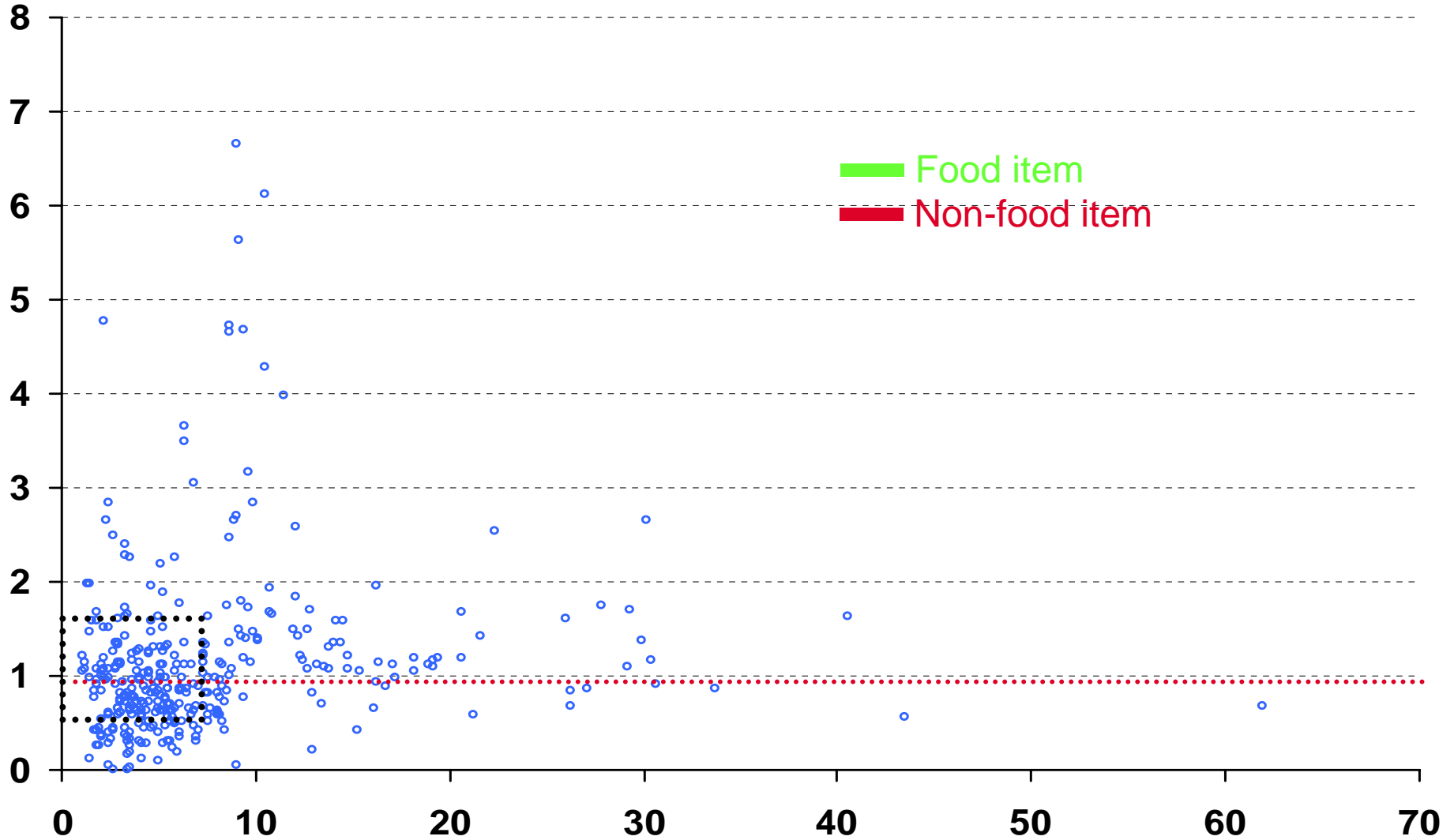
Table 1: Cross-sectional Distribution Characteristics of Monthly CPI Data
Seasonally and nonseasonally adjusted components (annualized percent, 1998-2007)

	<u>Mean</u>	<u>Variance</u>	<u>Skewness</u>
Unadjusted Component Data	2.74	34.2	0.45
Seasonally Adjusted Data	2.66	20.9	0.85

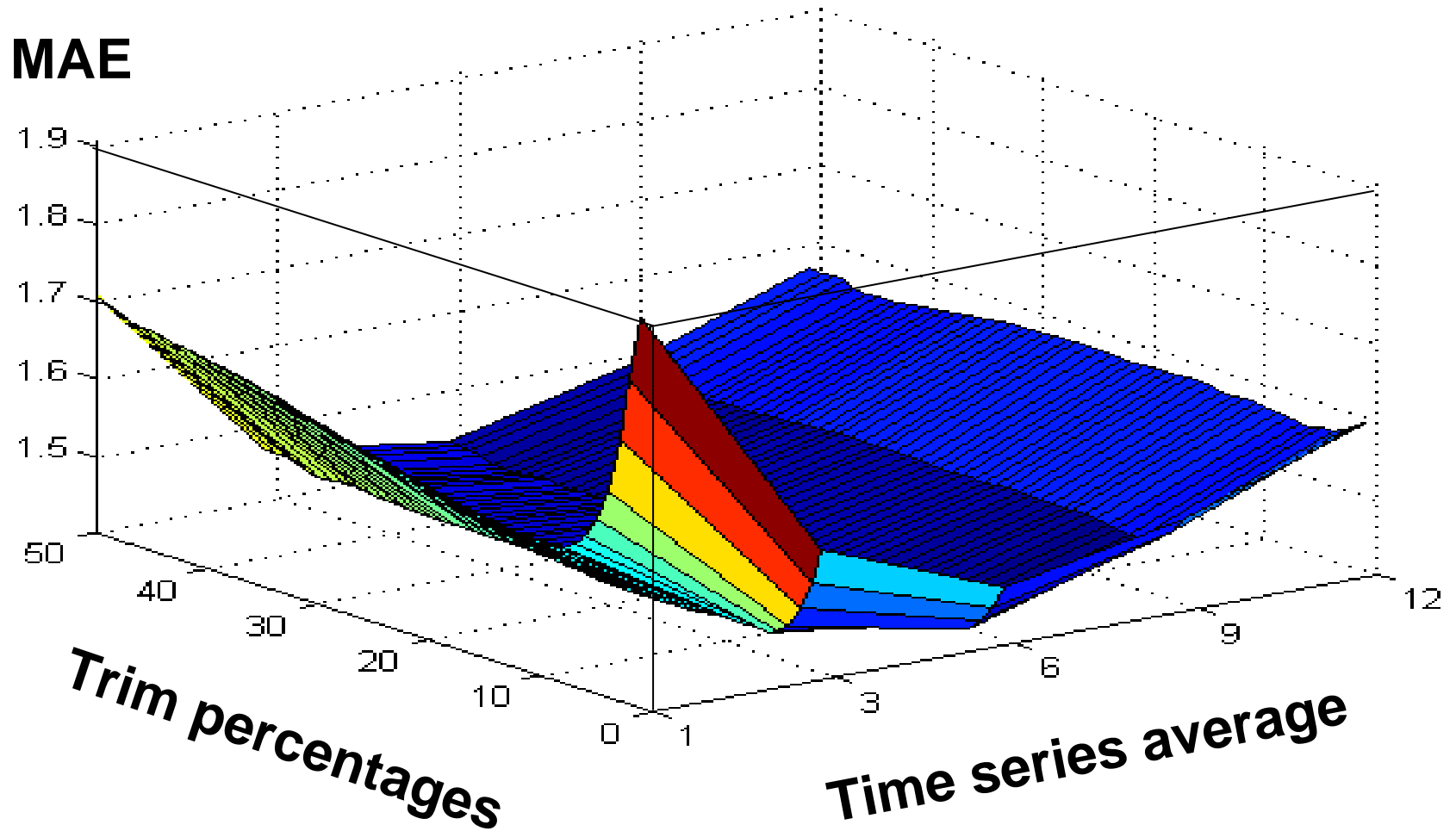
Table 2: Monthly Time-Series Variance of Alternative Inflation Measures
Seasonally and nonseasonally adjusted component data (percent, 1998-2007)

	<u>Unadjusted</u>	<u>Seasonally adjusted</u>	<u>Variance reduction from seasonal adjustment</u>
CPI	16.95	10.40	6.55
Core CPI	6.06	1.11	4.95
16% Trim	1.82	0.69	1.13
Median	0.79	0.66	0.13

MEAN and ST. DEVIATION OF ZAMBIAN CPI COMPONENTS: Seasonally adjusted, 2002-2009



TRIMMED-MEAN FORECAST ACCURACY (NAÏVE FORECAST OF CPI, NEXT 12 MONTHS)



Retail Price Change Distribution Characteristics

(Arranged by average inflation, annualized)

Monthly	Mean	St. Dev.	Skew	Kurt
Brazil	206.2	4.0	0.6	14.6
Argentina	123.2	6.3	1.2	11.0
Mexico	42.8	5.1	2.6	46.2
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* Data for New Zealand are not available on a monthly basis, so we report values computed from quarterly data.

2. (Core) Inflation Estimation

“The core rate is the trend increase of the cost of the factors of production [that originates in the long-term expectations of inflation.”

Eckstein (1981)

Is “Core” Inflation a Sensible Concept?

... "It is evident... that prices must constantly change relatively to each other, whatever happens to their general level. It would be idle to expect a uniform movement in prices as to expect a uniform movement for all bees in a swarm. On the other hand, it would be as idle to deny the existence of a general movement of prices ... all move alike, as to deny a general movement of a swarm of bees because the individual bees have different movements."

Irving Fisher (1922)

Is “Core” Inflation a Sensible Concept?

"We mean by the rise or fall 'in the value of money' the hypothetical movement which would have been brought about if the 'changes on the side of money', i.e. the changes which tend to affect all prices equally, had been the only changes operating and there had been no forces present 'on the side of the things' tending to change their prices relatively to one another."

Irving Fisher (1922)

Is “Core” Inflation a Sensible Concept?

"I venture to maintain that such ideas...are root-and-branch erroneous. ... There is no bull's eye. There is no moving but unique centre, to be called the general price level or the objective mean variation of general prices, round which are scattered the moving price levels of individual things. There are all the various, quite definite, conceptions of price-levels of composite commodities appropriate for various purposes ... There is nothing else. Jevons was pursuing a mirage."

J. M. Keynes (1930)