INFLATION ANALYSIS

WORKSHOP ON MONETARY AND EXCHANGE RATE POLICY

BANGKOK, THAILAND
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Inflation—Why It Matters

- **Inflation** refers to an increase in the price level that is sustained over a significant period of time.
- High and/or volatile inflation **hampers economic growth**, and generates **volatility** in the **ER**.
- Aiming for low and stable inflation is typically a key objective for **monetary policy**.

Outline

1. **Indices of the Price Level**
2. Measuring and Analyzing Inflation
3. Determinants of Inflation

Consumer Price Index (CPI)

- All price indices take a value of **100** in the **base year**.
- The CPI is the **most widely used** measure of the aggregate price level, for indexation (bonds, wages, etc.) and for monetary policy.
- An index of the cost, at a point of time, of a **fixed basket of goods and services**, purchased by a **typical household** for consumption.
- Basket is derived from detailed expenditure survey information provided by households. Basket is updated periodically (every 5 years or so).

Measuring the Consumer Price Index

- The CPI is a **Laspeyres index** (**base-weighted index**) using weights based on **historical quantities**:

$$\mathrm{CPI}_t = \frac{\sum_{i=1}^{N} p_t^i q_0^i}{\sum_{i=1}^{N} p_0^i q_0^i} \times 100.$$

q^i_0 is the base-period quantity of good i.
p^i_0 is the base-period price of good i.
p^i_t is the price of good i at time t.

What is Included in the CPI?

- Basket derived from *expenditure survey* info, provided by families and individuals on what goods and services they purchased

- Wide subset of goods and services
  - US: prices of ~80,000 items surveyed each month
  - China: CPI survey teams check for a representative sample of goods spread across 50,000 locations in 500 towns

What is Included in the CPI?

- Example of CPI “baskets”

Singapore		Philippines		Thailand		Korea	
Food	22.05	Food	50	Food and beverages	33.01	Food & Non-alc. Bev.	14.04
Clothing & footwear	3.41	Clothing	3	Apparel and footwear	2.96	Alcoholic beverages & tobacco	1.46
Housing	25.48	Housing and repairs	16.8	Housing and furnishing	23.48	Clothing & footwear	5.84
Transport	15.53	Fuel, Light, and water	6.9	Medical and personal care	6.87	Housing, water, electricity, & other fuel	17.04
Communication	4.75	Services	15.9	Transportation and communication	26.8	Furnishing, & household equipments	4.17
Education & Stationary	7.35	Other	7.3	Recreation and education	5.21	Health	5.16
Recreation & other	15.57			Tobacco and alcoholic beverages	1.66	Transport	10.9
Health Care	5.86					Communication	6.02
						Recreation, & culture	5.63
						Education	11.09
						Restaurants, & hotels	13.27
						Other	5.38

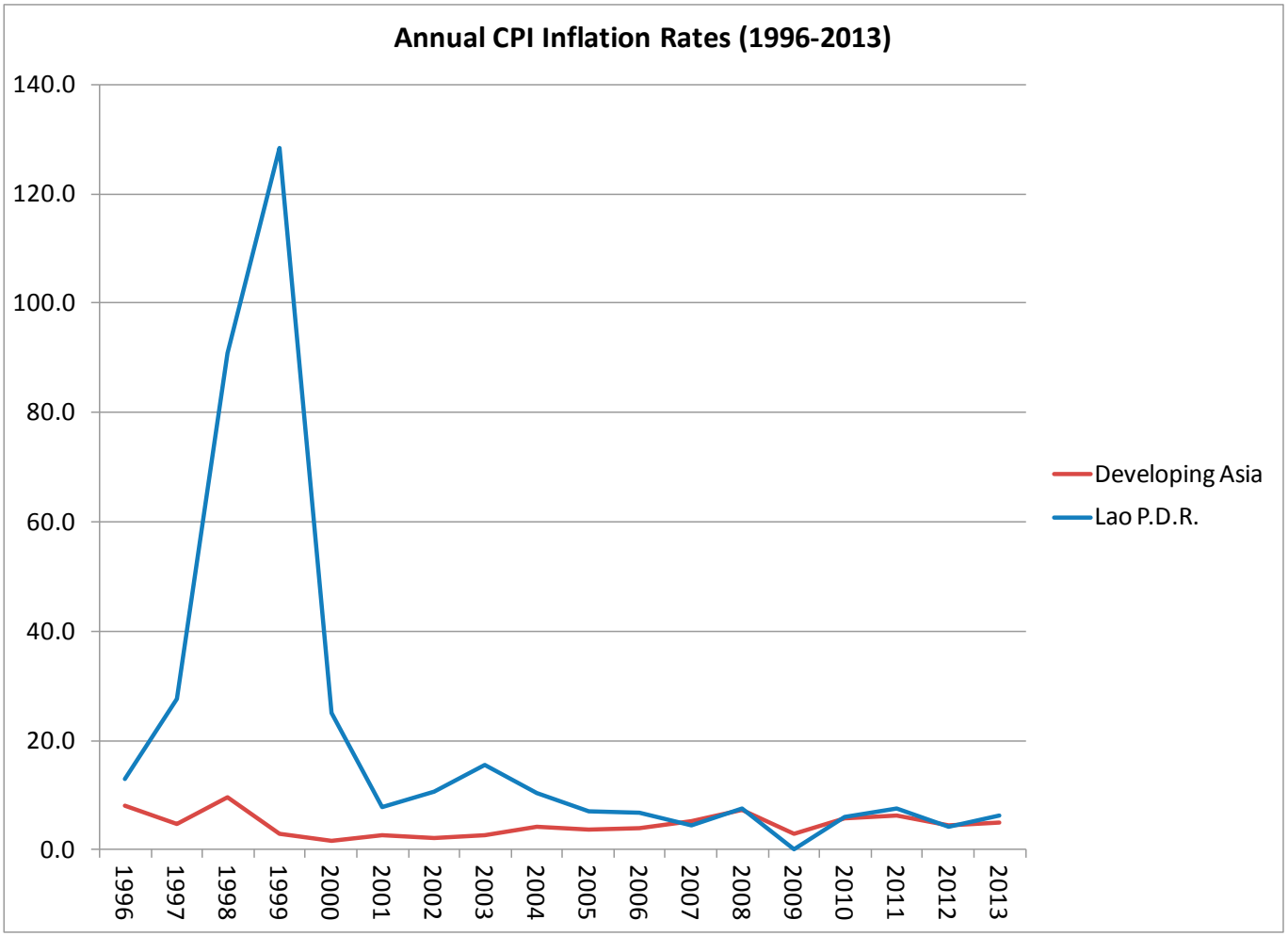
Composition of CPI Basket in Lao PDR

GROUP	Weight
FOOD AND NON-ALCOHOLIC BEVERAGES	36.5
ALCOHOLIC BEVERAGES AND TOBACCO	4.6
CLOTHING AND FOOTWEAR	3.2
HOUSING, WATER, ELECTRICITY AND FUELS	5.3
FURNISHINGS, HOUSEHOLD EQUIPMENT	5.6
HEALTH	2.9
TRANSPORT	24.2
COMMUNICATIONS	3.6
RECREATION AND CULTURE	3.1
EDUCATION	3.6
RESTAURANTS & HOTELS	4.9
MISCELLANEOUS GOODS AND SERVICES	2.5

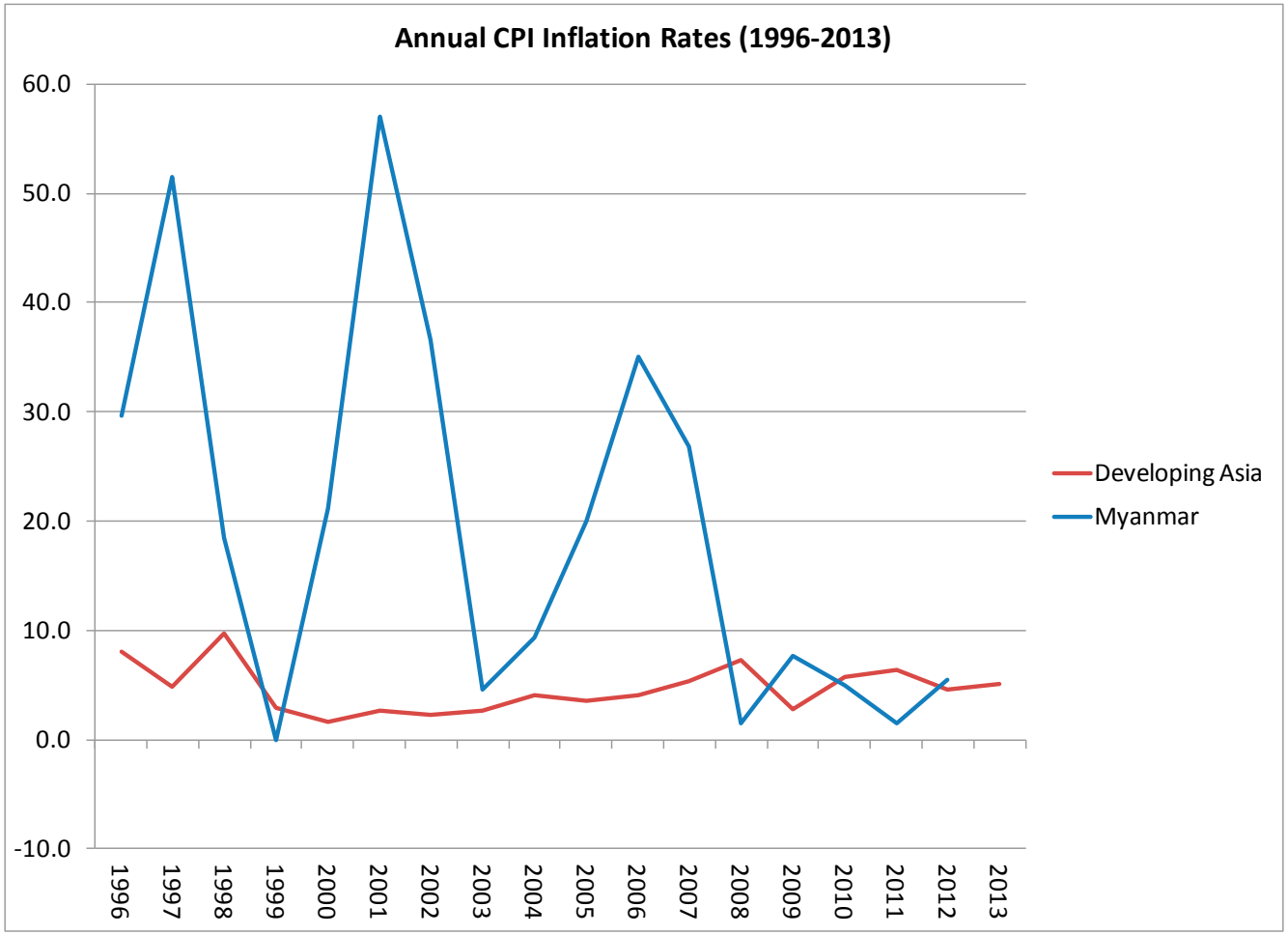
Composition of CPI Basket in Myanmar

GROUP	Weight
Food	68.3
Clothing & Apparel	4.7
Rent & Repair	2.7
Fuel & Light	8.6
Miscellaneous Goods & Service	15.9

Inflation Developments: Lao P.D.R.



Inflation Developments: Myanmar



Alternative Price Indices: The GDP deflator

- Index of the price level for **all final goods and services** that make up the GDP.

- It includes all that it is **produced in the economy** (including investment goods), but not imports.

- It is a **Paasche Index** (current-weighted index):

$$(\text{GDP Deflator})_t = \frac{(\text{GDP at current prices})_t}{(\text{GDP at constant prices})_t} \times 100 = \frac{\sum_{i=1}^{N} p_t^i q_t^i}{\sum_{i=1}^{N} p_0^i q_t^i} \times 100.$$

Outline

1. Indices of the Price Level
2. **Measuring and Analyzing Inflation**
3. Determinants of Inflation

Measuring and Analyzing Inflation

You may want to consider:

A. Computing different rates of inflation (monthly, quarterly, annual....)

B. Analyzing main components of inflation

C. Core inflation

A. Measuring Inflation

- Annual average (or y-o-y)

$$= \left(\frac{CPI_{2007}}{CPI_{2006}} - 1 \right) \times 100$$

- End-of-year

$$= \left(\frac{CPI_{\text{Dec., 2007}}}{CPI_{\text{Dec., 2006}}} - 1 \right) \times 100$$

- 12-month

$$= \left(\frac{CPI_{\text{Feb., 2008}}}{CPI_{\text{Feb., 2007}}} - 1 \right) \times 100$$

- Monthly / quarterly

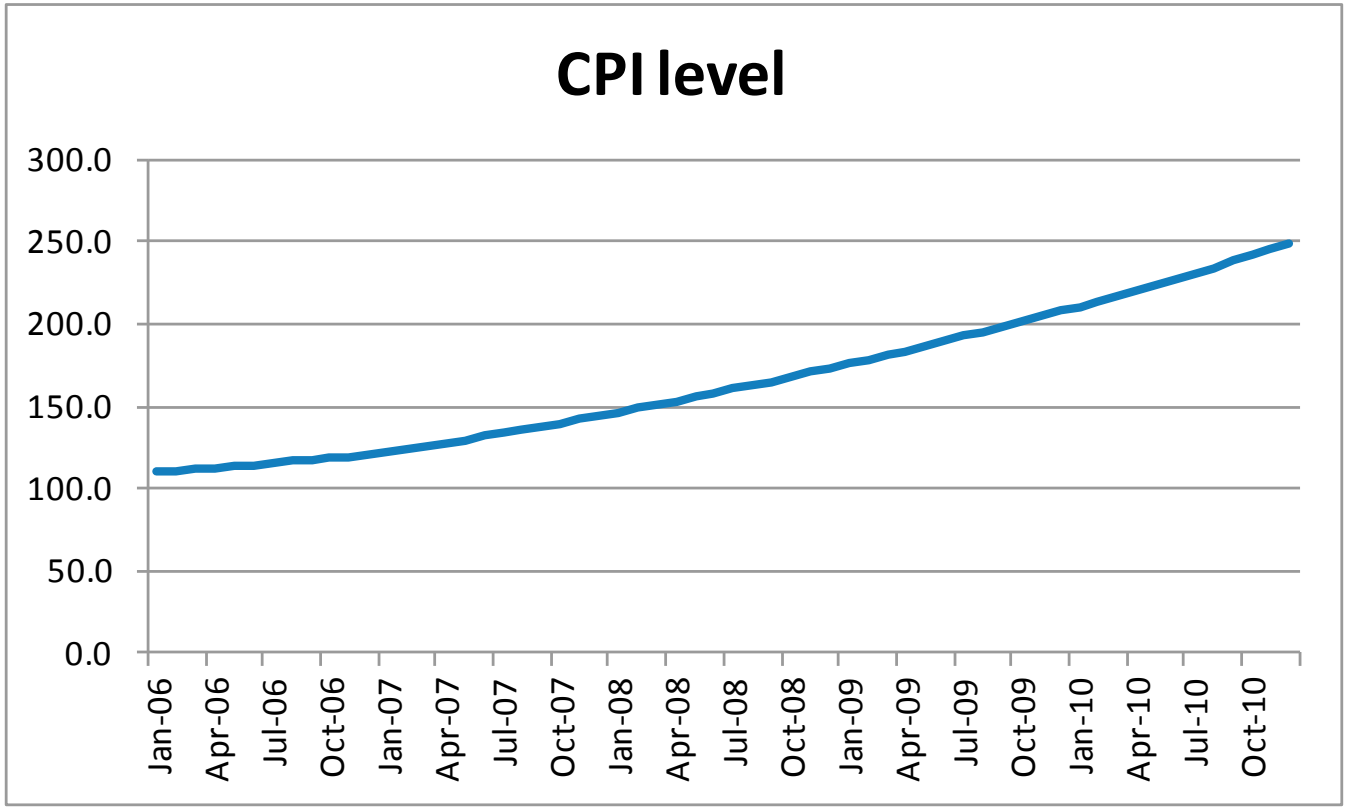
$$= \left(\frac{CPI_{\text{Feb., 2008}}}{CPI_{\text{Jan., 2008}}} - 1 \right) \times 100$$

- Annualized monthly/quarterly

$$= \left(\left(\frac{CPI_{\text{Feb., 2008}}}{CPI_{\text{Jan., 2008}}} \right)^{12} - 1 \right) \times 100$$

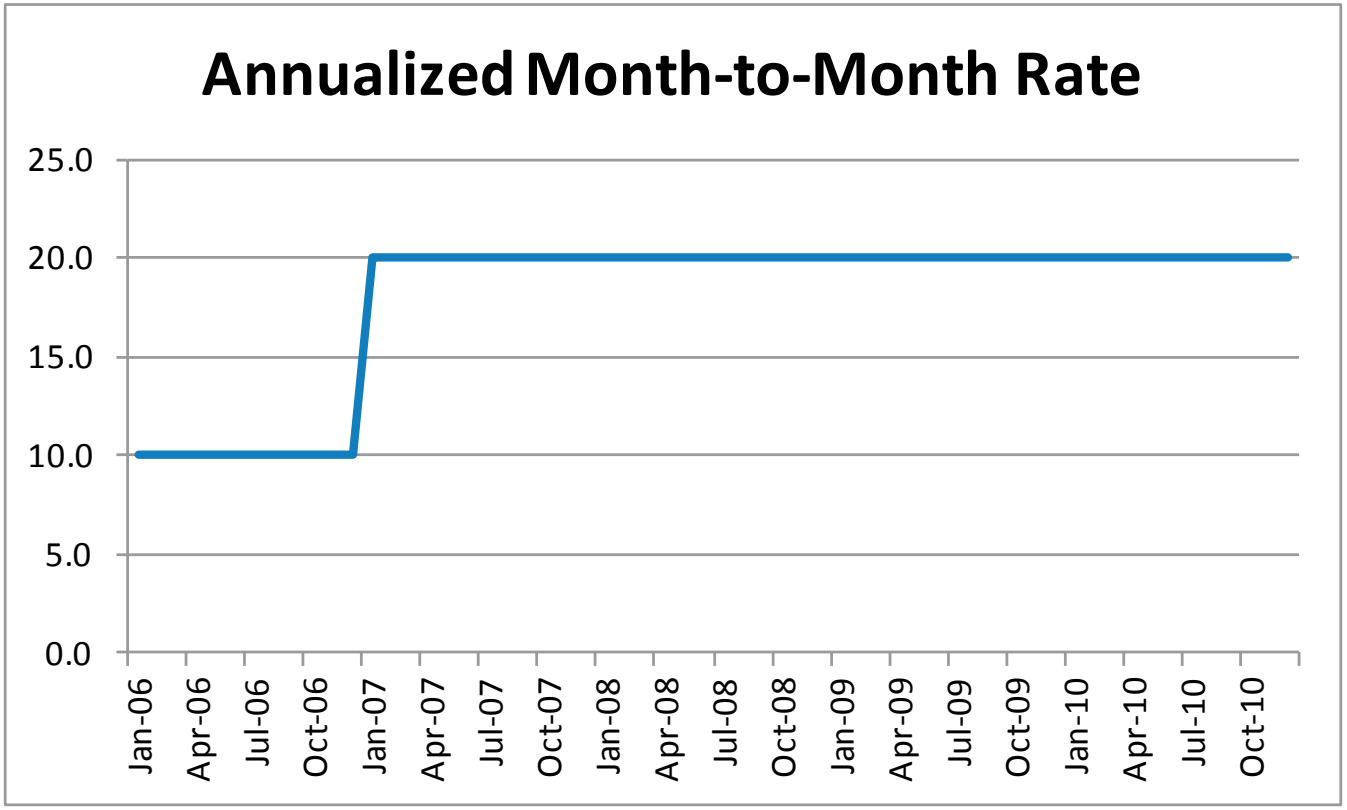
Measuring Inflation: Using Different Inflation Rates

Example: consider a case where the annual inflation rate shifts up from 10% to 20% in January 2007



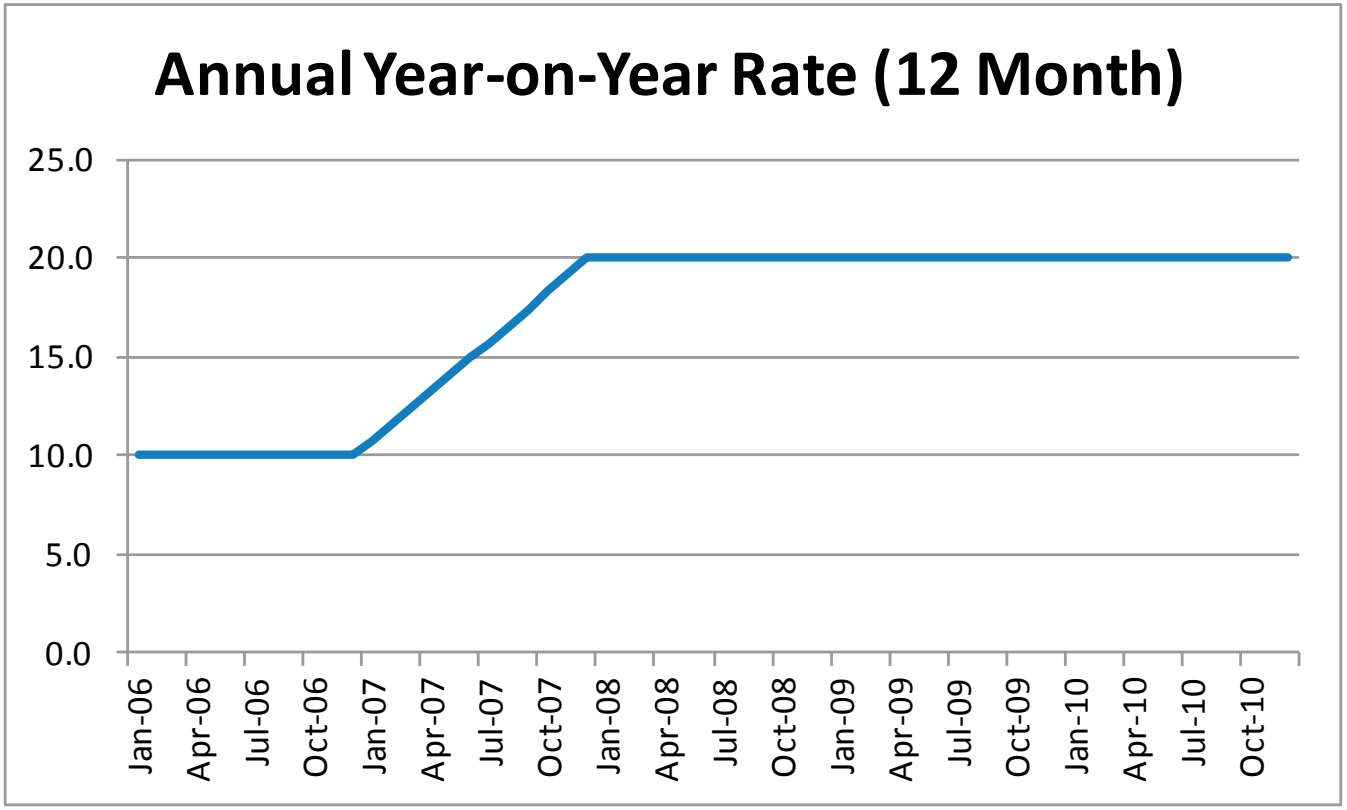
Measuring Inflation: Using Different Inflation Rates

This upward shift is easily visible in the annualized monthly inflation rates …



Measuring Inflation: Using Different Inflation Rates

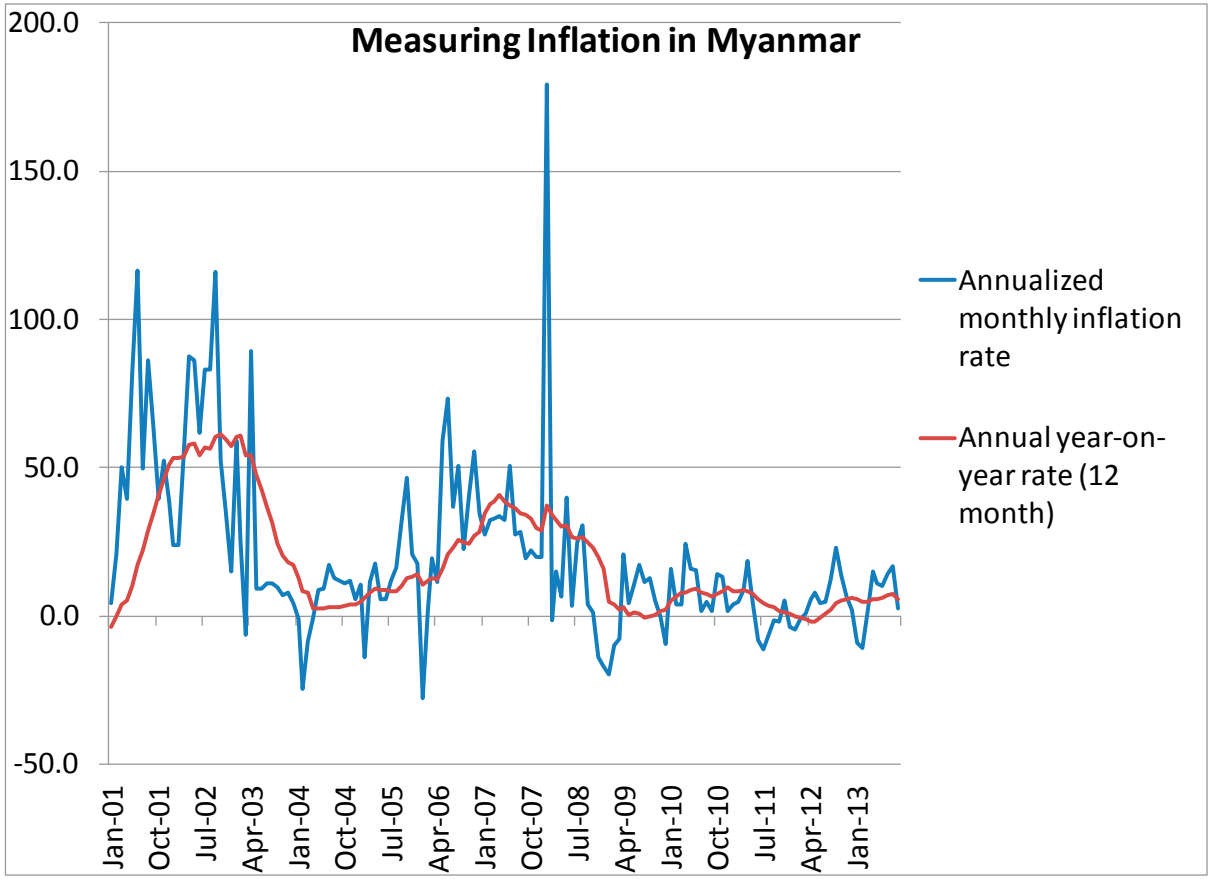
… the much more common 12-month inflation rate (year-on-year) shows a longer transition:



Measuring Inflation: Using Different Inflation Rates

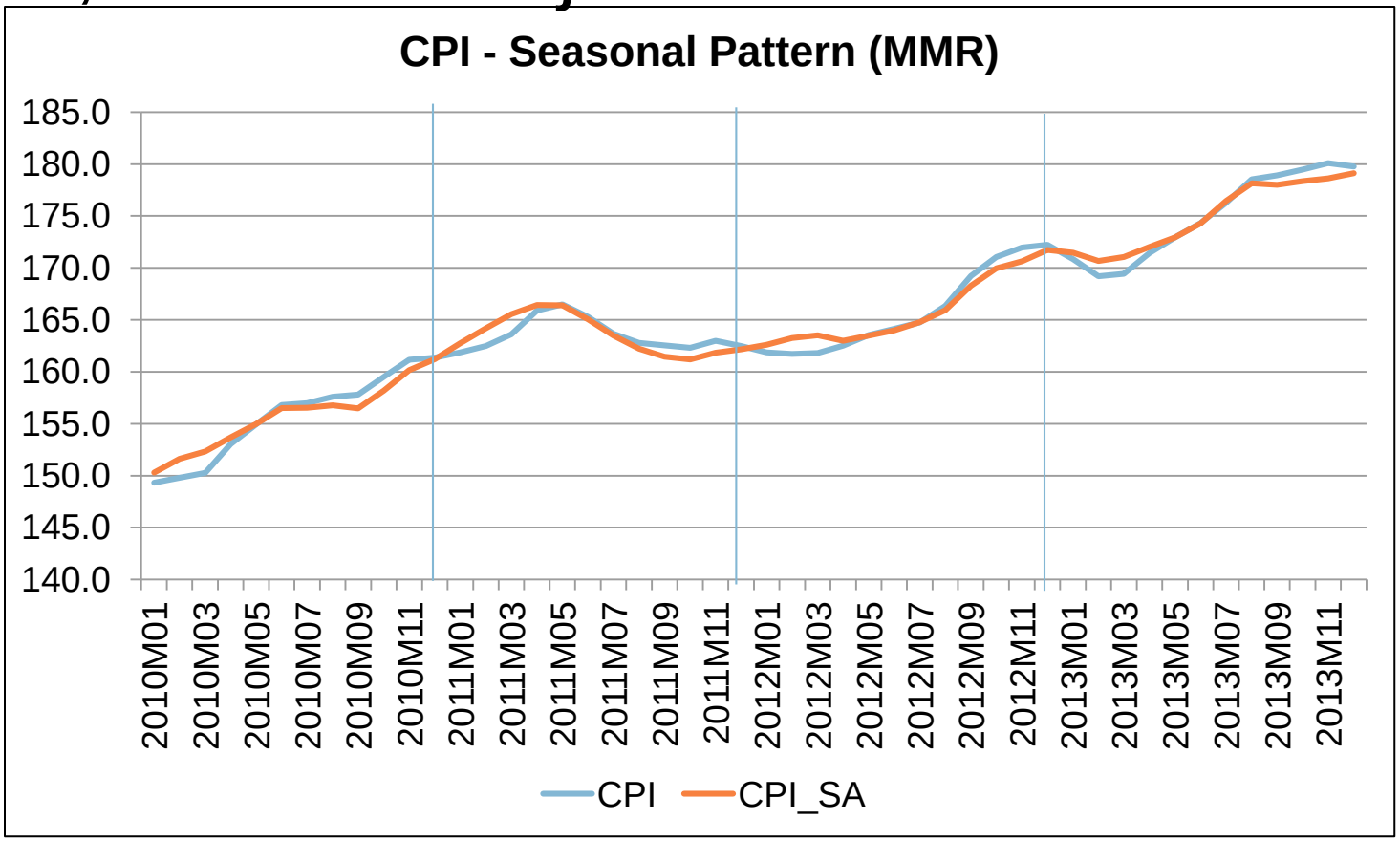
Monthly inflation rates are useful for analyzing inflation momentum and turning points:

Their drawback is that they tend to be very noisy, whereas annual inflation is much smoother.

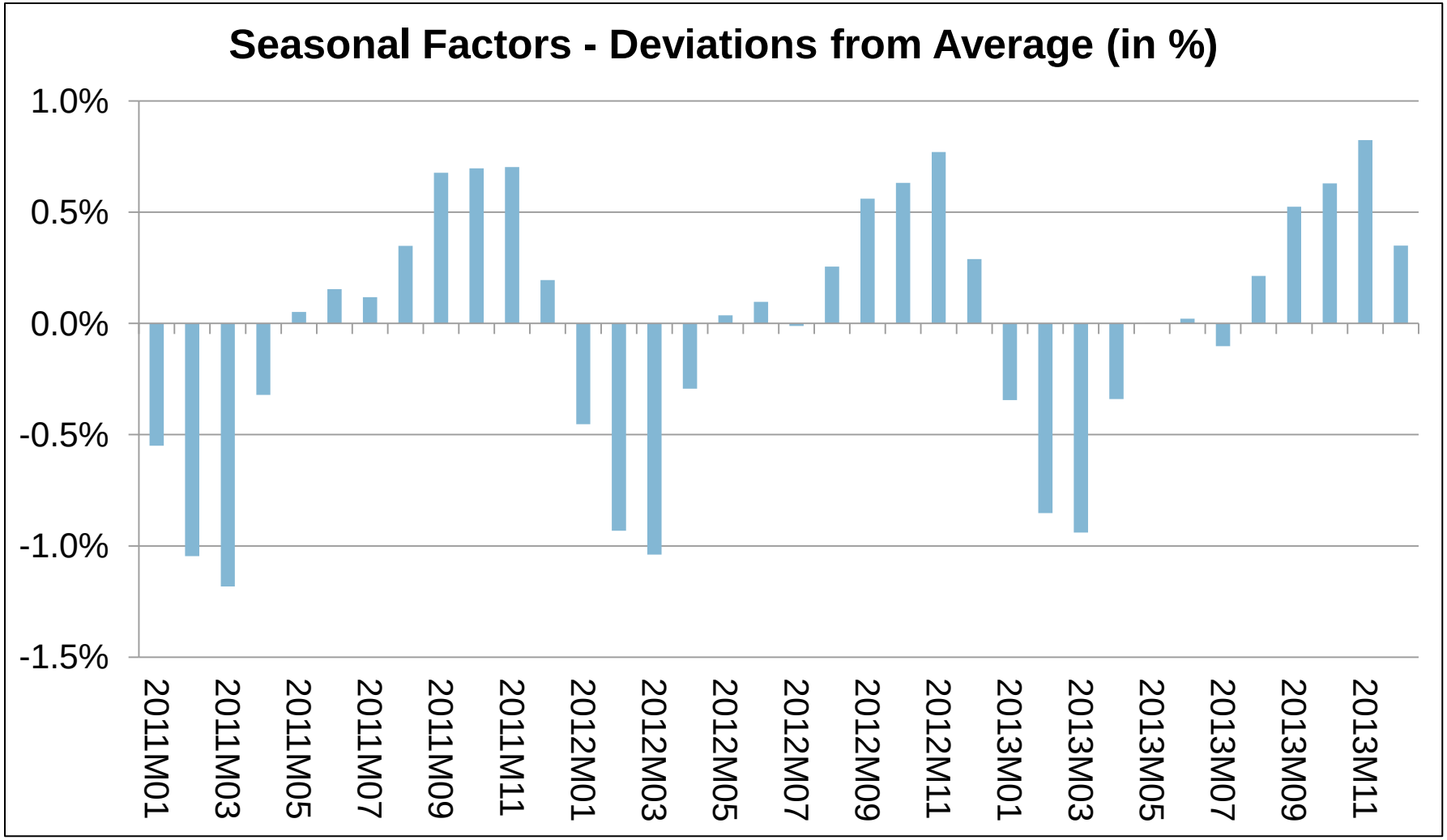


Measuring Inflation: Seasonal Adjustment

When working with monthly or quarterly data, seasonal adjustment is useful:



Measuring Inflation: Seasonal Adjustment

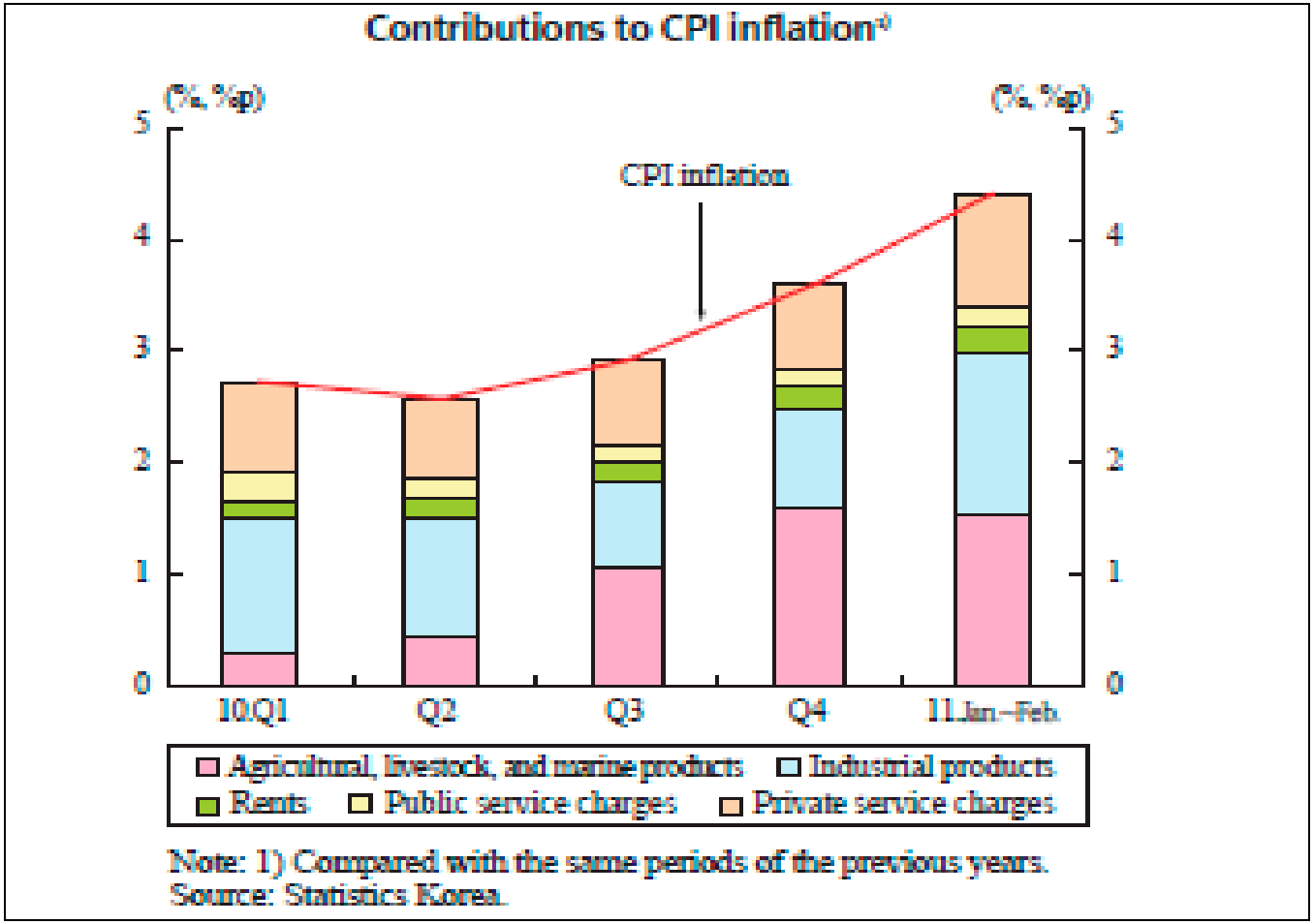


B. Analyzing Main Components of Inflation

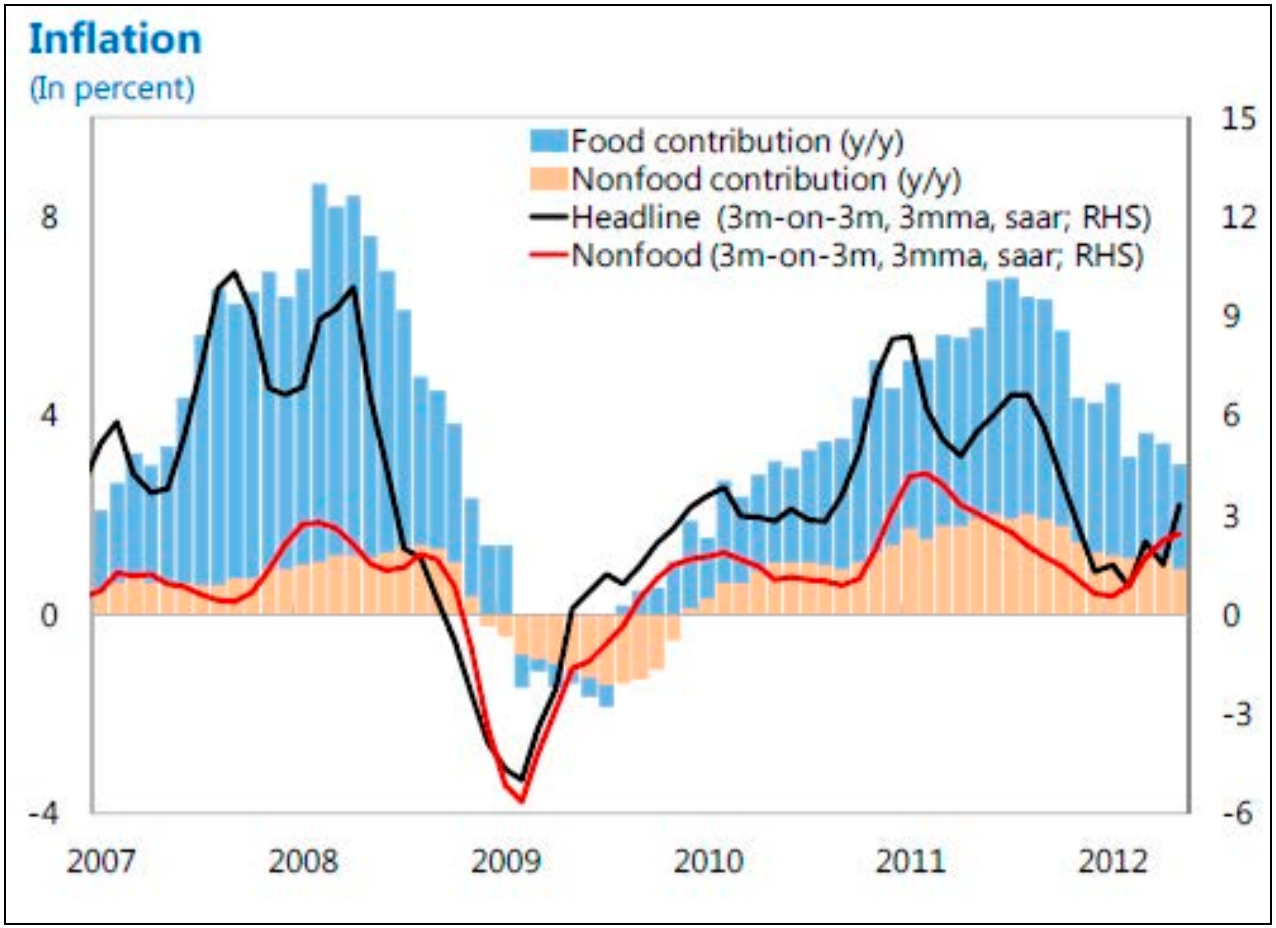
What are the key drivers of inflation? One approach is to disaggregate inflation into is main components and determine the most important ones:

- compute % changes for each component
  - Highlights those components where the price change was greatest
  - But component may be small part of basket
- compute the contribution made by each component to the overall inflation rate
  - Captures both the size of the price change and importance of that component

Example:
Contributors to Inflation in Korea



Example:
Contribution of Food Inflation in China



Formula:
Computing Inflation Contribution

Formula for inflation:

$$\pi_t^{Total} = \frac{CPI_t^{Total} - CPI_{t-1}^{Total}}{CPI_{t-1}^{Total}}$$

Rewrite as a function of Food- and Nonfood-CPI:

$$\pi_t^{Total} = \frac{\left(weight_{Food} \cdot CPI_t^{Food} + weight_{Nonfood} \cdot CPI_t^{Non-food}\right) - \left(weight_{Food} \cdot CPI_{t-1}^{Food} + weight_{Nonfood} \cdot CPI_{t-1}^{Nonfood}\right)}{CPI_{t-1}^{Total}}$$

Formula:
Computing Inflation Contribution

Rewrite inflation formula in terms of food & non-food inflation:

$$\pi_t^{Total} = weight_{Food} \cdot \frac{CPI_t^{Food} - CPI_{t-1}^{Food}}{CPI_{t-1}^{Total}} + weight_{Non-food} \cdot \frac{CPI_t^{Nonf\ ood} - CPI_{t-1}^{Nonf\ ood}}{CPI_{t-1}^{Total}}$$

Contribution of food inflation to total inflation:

$$\pi_t^{Food} = weight_t \cdot \frac{CPI_t^{Food} - CPI_{t-1}^{Food}}{CPI_{t-1}^{Total}}$$

C. Core Inflation:
Distinguishing Between Noise and Trend

- It is important to separate noise from trend, as **monetary policy** should respond **only to trend**.
- Examples for noise/temporary events:
  - ✓ Prices of food products that are sensitive to **weather conditions**.
  - ✓ **One-off events**, e.g., changes in indirect taxes, or in administratively-set prices.
- In principle, "**core inflation**" is the trend component of overall CPI inflation, i.e., the part that is not affected by transitory price fluctuations.

Core Inflation: Exclusion Measures

Permanent exclusion approaches: Exclude components of basket that are subject to frequent but temporary price shocks.

For example:

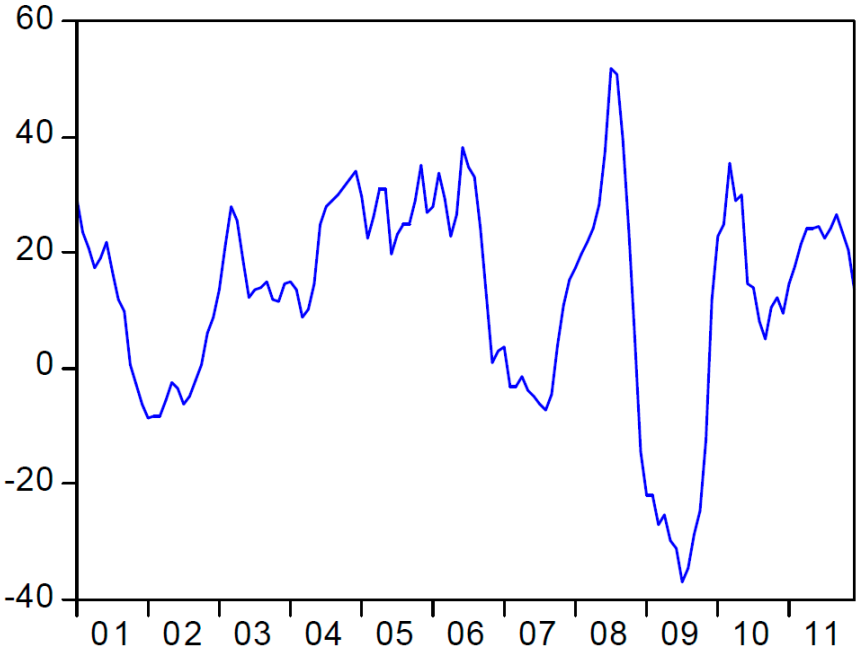
- Regulated prices
- Energy prices
- Food prices

But: is it practical to exclude food prices? Consider that food is a large part of overall basket (especially in Myanmar).

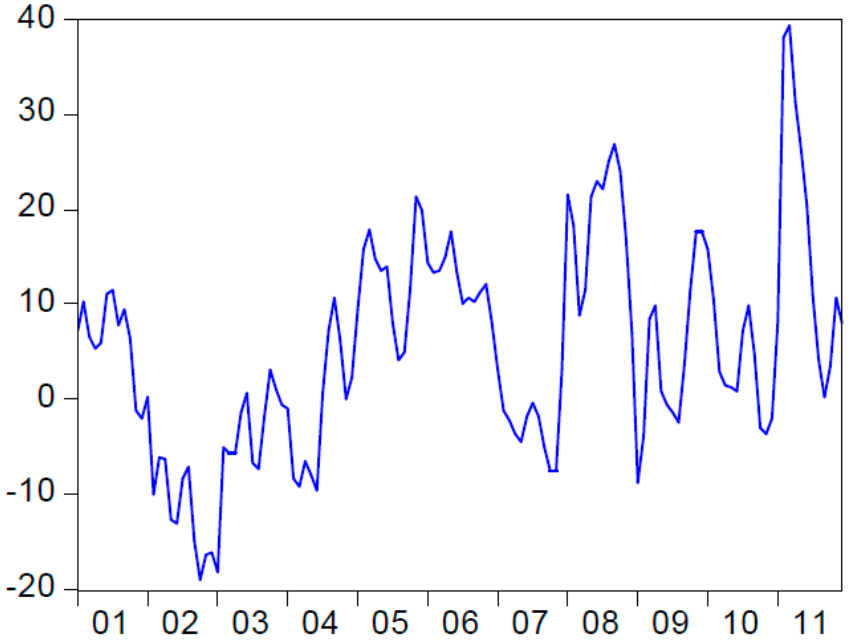
Why Exclude Fuel & Food Prices?

Philippines:

Gas oils for motor vehicles



Vegetables cultivated for their roots, fresh or dried



Source: BSP Inflation Report, 2012 Q2

Core Inflation: Trimmed-Mean

- Trimmed mean removes from overall CPI inflation the largest price changes in each month
- Set of excluded components changing from month to month
  - Excludes % changes in price that rank among the smallest or largest changes for the month
- Problem: arbitrary thresholds & important to know source of shocks

Core Inflation: Other Measures

- Volatility weights: most volatile components given lowest CPI weight (Bank of Canada)
- Persistence weights: most persistent components given the largest weight
- Model-based core inflation measurements

Core Inflation: Examples in Practice

Examples: Core inflation in some countries.

Country	Official Core Measure	Other Measures Used Internally by Central Banks
Thailand	CPI excluding Fresh Food and Energy (23%)	Trimmed Mean (10%)
Australia	Treasury's "underlying" or core CPI	Trimmed mean, and Weighted Median
New Zealand	CPI excluding interest charges	
Singapore	CPI excluding costs of private road transport and costs of accommodation	CPI excluding volatile items (30%), Weighted Median, Trimmed Mean (15%), and Structural Vector Autoregression (VAR) Model Estimate
Japan	CPI excluding Fresh Food	

Which Measure to Choose for Core Inflation?

It depends:

- For historical analysis, trimmed mean methods or variable exclusion methods of items are often OK.
- But before settling on a choice, various measures should be considered in order to find those that offer the most insight on the underlying inflation trend for a specific country. No need to focus only on one measure—for analytical (but not communication) purposes, several measures can be considered in parallel.
- For communication with the public, use of core CPI is often not successful. (The public barely understands the concept of headline inflation.)

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2. Measuring and Analyzing Inflation
3. **Determinants of Inflation**

Determinants of Inflation

A. Demand Factors
B. Monetary Factors
C. Cost Factors
D. Inflation Expectations

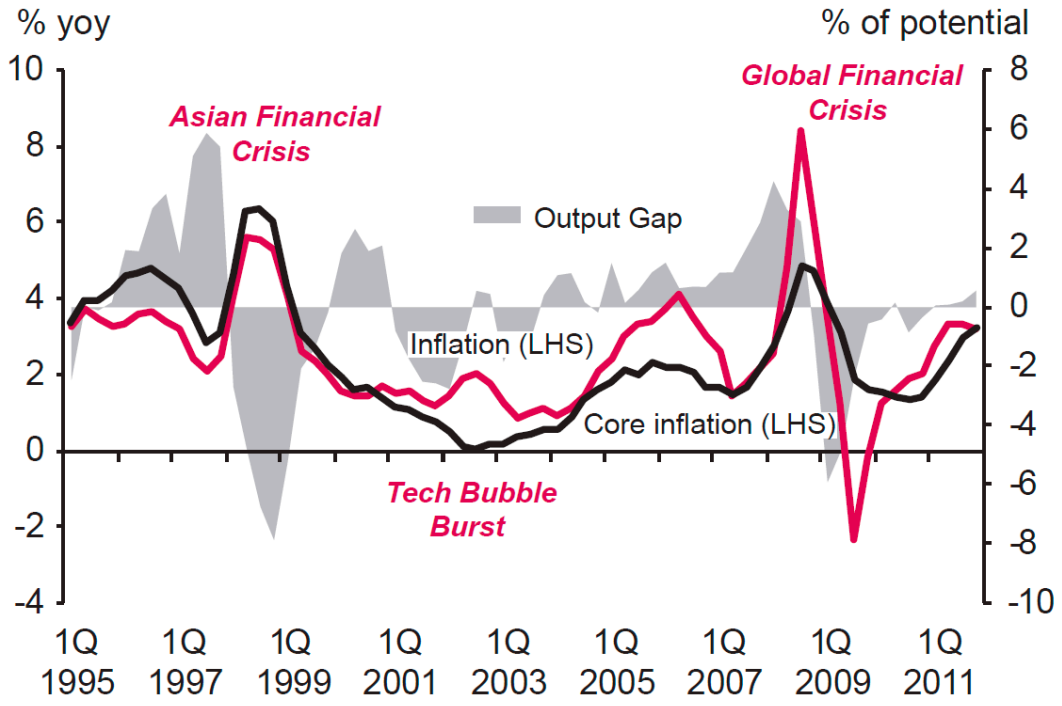
A. Demand Factors

Demand effects on inflation are often modeled via a so-called Phillips curve:

- A Phillips curve relates price or wage inflation to some measure of excess demand, either an unemployment, output or capacity utilization gap
- Consider the output gap: a positive output gap means output is above its potential because demand is strong
- High demand, as measured by the positive output gap, implies higher inflationary pressures
- However, this is only a temporary effect because the output gap will close eventually

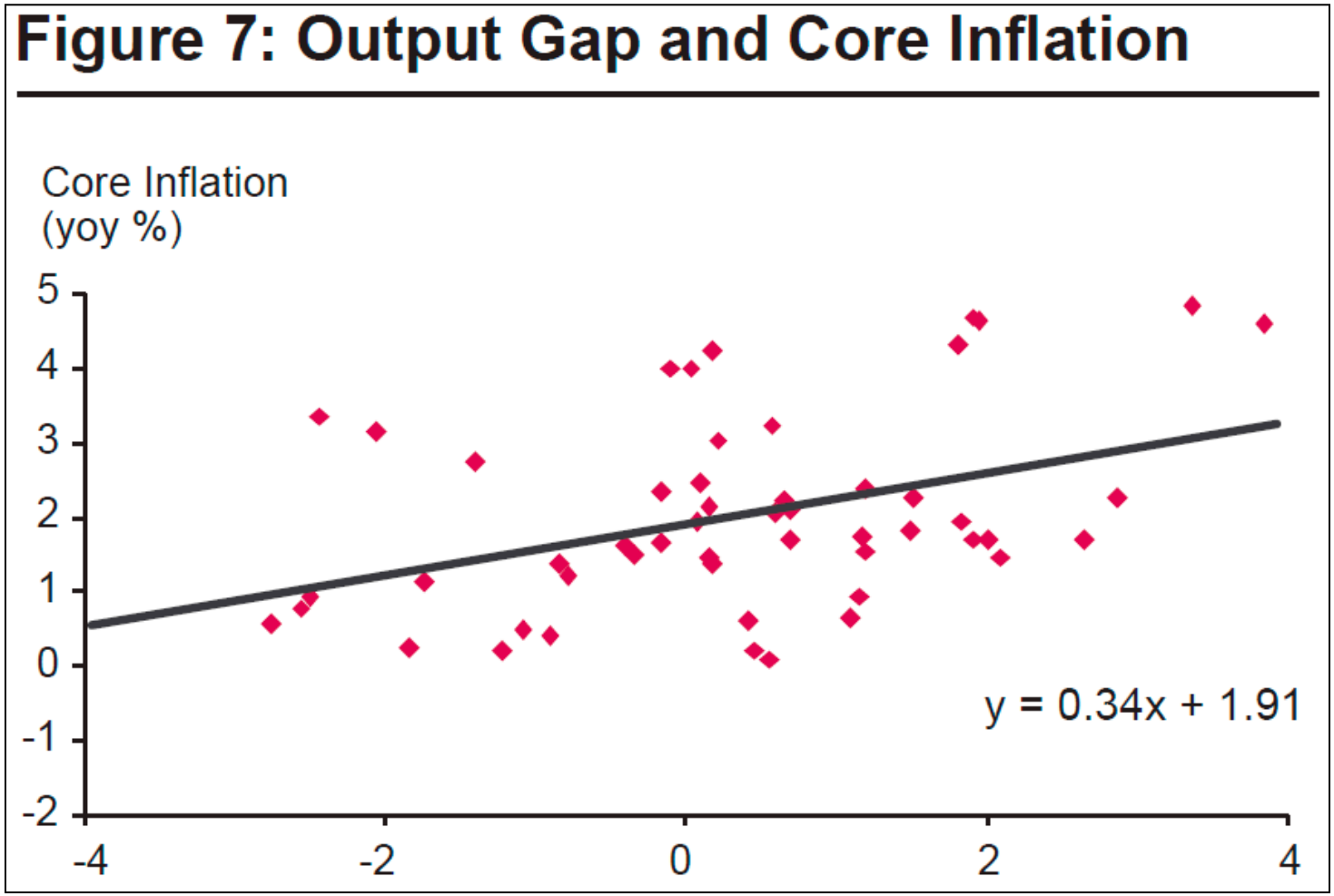
Output Gap and Inflation in Malaysia

Figure 6: Output Gap and Inflation



Source: Authors' calculations and Department of Statistics Malaysia

Output Gap and Inflation in Malaysia



Phillips Curve Models—Other Ingredients

Besides excess demand, Phillips curve models often include:

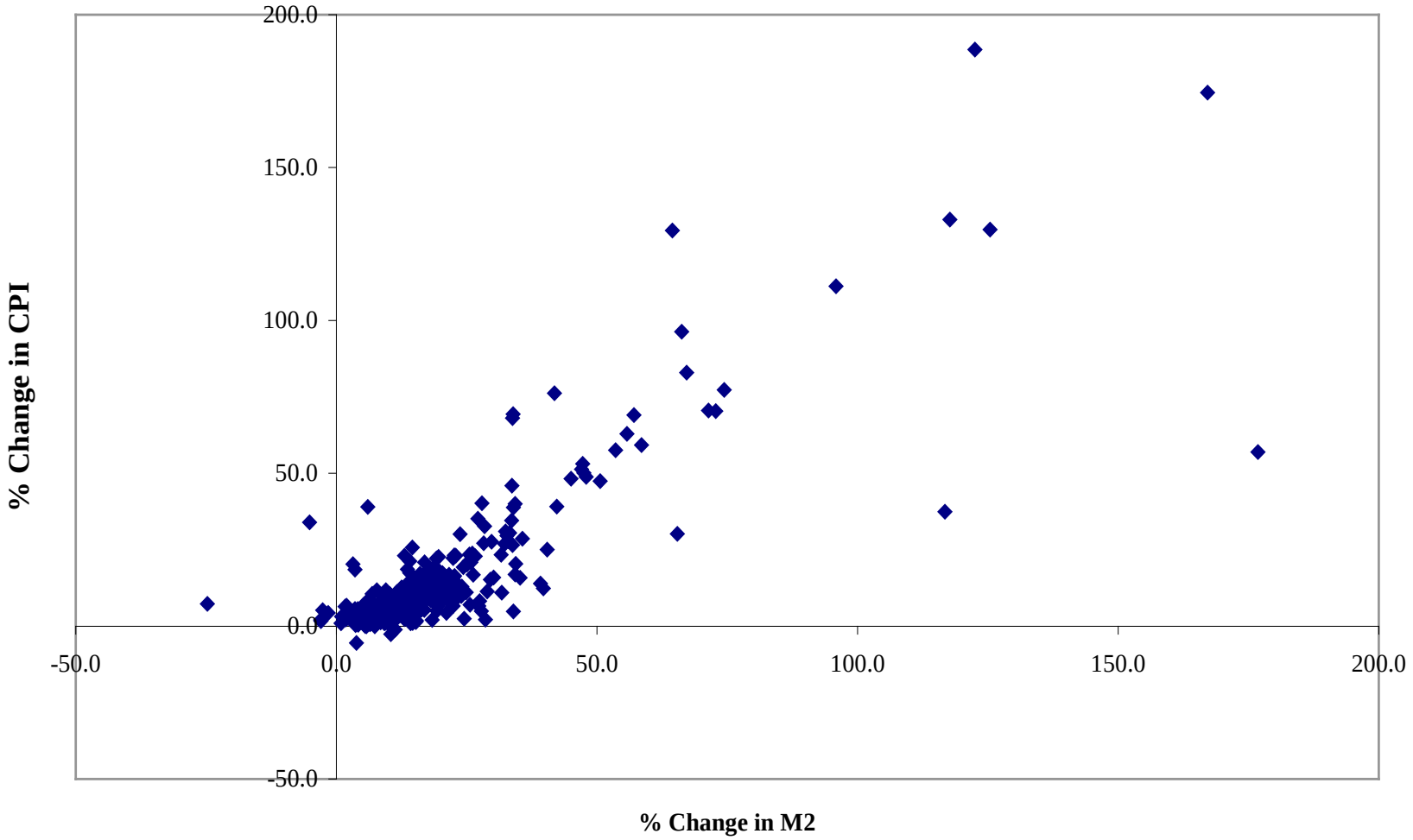
- **Inflation inertia:** captures sluggish adjustment of inflation to excess demand
- **Speed-limit effects:** besides the size of the output or unemployment gap, the speed with which the gap changes can also matter for inflation. For example, if a negative output gap closes very fast—i.e., the economy recovers very rapidly—this may push up inflation because there is a speed-limit to the pace of economic recovery beyond which inflation increases (even though the overall output gap might still be negative)
- **Supply shocks:** Oil prices, taxes or terms of trade shocks can affect the output gap and inflation.

B. Monetary Factors

Basic idea: if money supply exceeds money demand, this excess money will drive up prices.

- **Money demand**: domestic output and the nominal interest rate affect the demand for real money balances. Nominal money demand equals real money demand times prices.
- **Money supply**: determined by the central bank and financial sector
- **Adjustment mechanism**: if money supply is not aligned with money demand, the **price level** will adjust to restore equilibrium between the two (for example, if money supply exceeds money demand, a rise in prices will raise nominal money demand until nominal money demand and supply are equal again).

Figure 3. 2 Correlation between Money and Inflation



Source: Author's calculations. Data are the decadal (10-year) average growth rate in M2 and the 10 year average inflation rate from 1950 through 2000. Countries with inflation rates or money growth rates in excess of 200 percent are excluded. Data are from IMF *International Financial Statistics* and the sample includes all IMF member countries for which both data points were available for a total of 480 observations.

C. Cost Factors—Energy Prices

A large, permanent increase in energy prices is likely to cause:

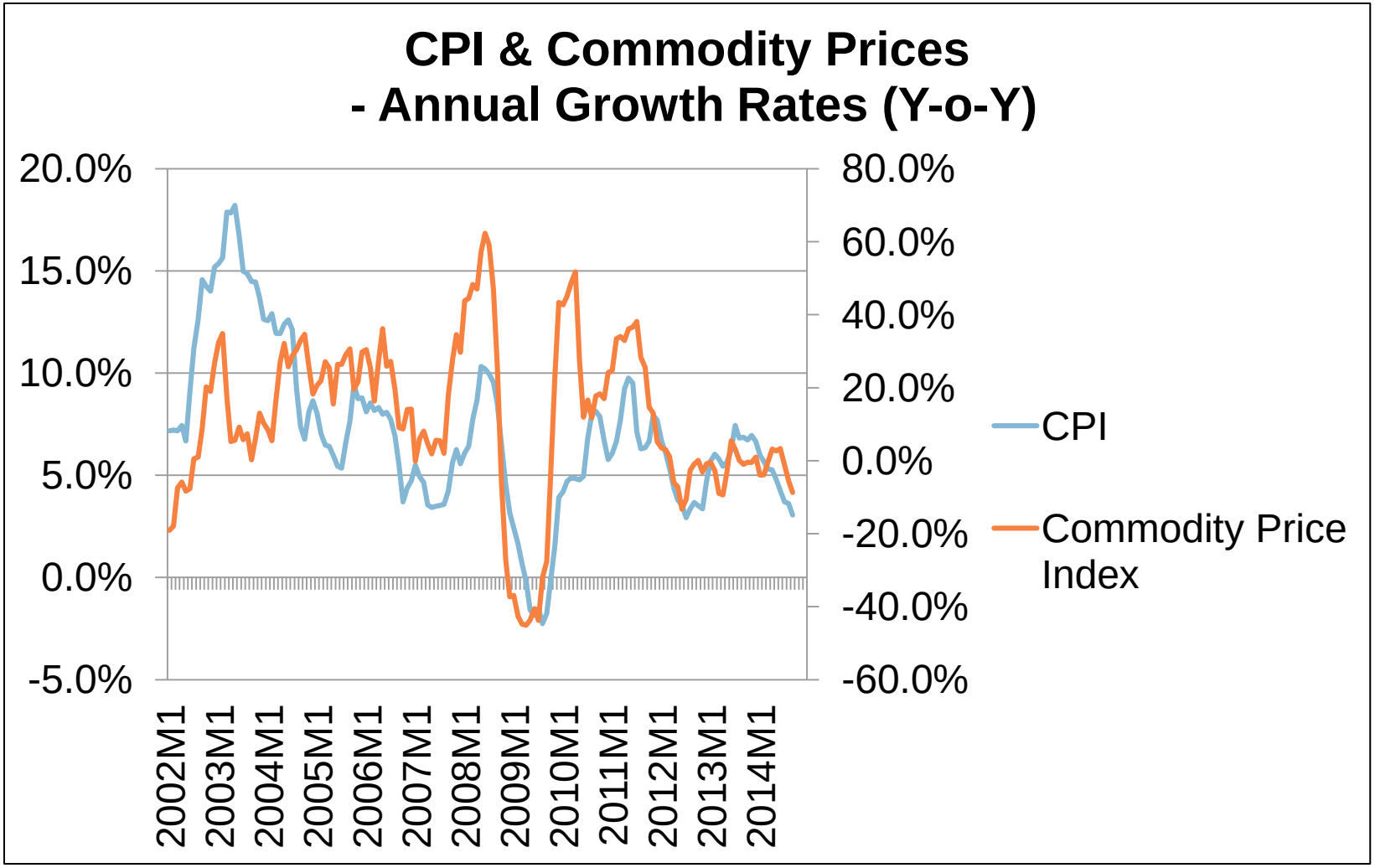
- A direct but temporary increase in CPI inflation (1st-round effect), and also …
- … trigger cost increases in goods and services (second-round effects)
- Contraction in demand: income / wealth effects

C. Cost Factors—Import Prices

Changes in foreign prices:

- **Law of one price:** By arbitrage, in absence of transaction costs and taxes, domestic prices of identical tradable goods cannot deviate substantially from foreign prices expressed in local currency
- Extending this principle to a basket of tradable goods or the general price level is called **purchasing power parity (PPP)** condition.
- But PPP often does not hold empirically

International Commodity Prices & Inflation in Lao PDR



Cost Factors—Exchange Rate Pass Through

Factors for exchange rate pass through:

- Pricing strategies, which in turn depend on
  - the degree of competition (e.g., high end manufacturing with imperfect competition: firms absorb in margins)
  - Excess capacity
  - Availability of domestic substitutes
- Foreign currency-indexed contracts in the economy
- Cost of adjusting prices
- Role of imports as inputs into domestic production processes (incl. non-tradables)

D. Inflation Expectations

• Inflation expectations influence actual pricing decisions by businesses (as well as wage demands) and therefore have a tendency to become self-fulfilling.

• Anchoring inflation expectations is arguably the most important task of central banks (nominal anchor).

- Determined by:
  - Credibility of monetary policy—success in anchoring long-run inflation expectations
  - Credibility of fiscal policy
  - Recent inflation

Thank You!

We will practice many of the concepts introduced in this presentation by applying them to your country in the afternoon.