Core Inflation in Thailand: Issues, Measurement and Policy Implications

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1. Why Measure Core Inflation?

As inflation targeting has grown in acceptance across the world, greater attention is being paid to the measurement and definition of inflation. Many inflation targeting countries have introduced measures of core inflation—which can be defined as the *permanent* component of the change in overall prices, that part of the change in prices that can be effectively influenced by monetary policy—either to help assess underlying inflationary pressures, or as part of the definition of their inflation target (Table 1.1). This paper looks at the contribution that core inflation can make to the successful adoption of inflation targets, applies alternative definitions of core inflation and compares their properties in the case of Thailand, and considers the different roles that core inflation could play if Thailand were to adopt an inflation targeting regime.

There are three main reasons why a central bank concerned with price stability should monitor core inflation.

First, core inflation is a more accurate measure of *underlying* inflation, and so will often be superior when forecasting future inflation. Because monetary policy only affects the economy with long and variable lags, an inflation targeting central bank has to make its best assessment of future inflation when deciding monetary policy. When future inflation is expected to exceed target, monetary policy should be tightened; when future inflation is expected to come in below target, monetary policy should be loosened. Once credibility has been gained, this decision rule itself can anchor private sector expectations of inflation, which will in turn make it easier to meet the inflation target. The problem is that headline inflation rates are often volatile, and thus unreliable predictors of the true inflationary trend. Since core inflation better captures this underlying inflation trend, it may be a more reliable predictor of future inflation, and thus a useful weapon in the quest for price stability.

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[1] International Monetary Fund and Bank of Thailand. The views expressed in this paper are those of the authors, and do not necessarily represent those of the Fund or of the Bank of Thailand.

Table 1.1 :- Measures of Core Inflation in Inflation Targeting Countries

Country	Measures of Core Inflation	
	Headline inflation adjusted for	Alternative measures
Australia	- Energy, mortgage interest, controlled items	
Canada	- **CPIxFET**: food, energy, indirect taxes - CPIX: fruits, vegetables, gasoline, fuel oil, natural gas, mortgage interest costs, inter-city transportation, tobacco products	- CPIW: multiply the initial CPI basket weights by the reciprocal of the historical standard deviation of the relative price change (to give non-zero but lesser weights to items with volatile price movements) - MEANTSD: trimmed mean (1.5 standard deviations from average) - Wmedian: trimmed mean 50%
Czech Republic	- Food, energy, indirect taxes	
Finland	- **IUI**: Capital costs in owner-occupied housing, indirect taxes, subsidies	
New Zealand	- Interest services* - With an escape clause for "unusual events" concerning commodity, indirect taxes, controlled items	
Spain	- IPSEBENE: energy, unprocessed food - Case-by-case: indirect taxes, exogenous prices	
Sweden	- UND1: interest costs for owner-occupied housing, indirect taxes, subsidies, depreciation after float - UND2: UND1 plus heating oil and propellants	
United Kingdom	- **RPIX**: mortgage interest payments - RPIY: mortgage interest payments, indirect and local taxes - RPIXFE: RPIX plus food, fuel, light - TPI: direct taxes - THARP: indirect and local taxes	

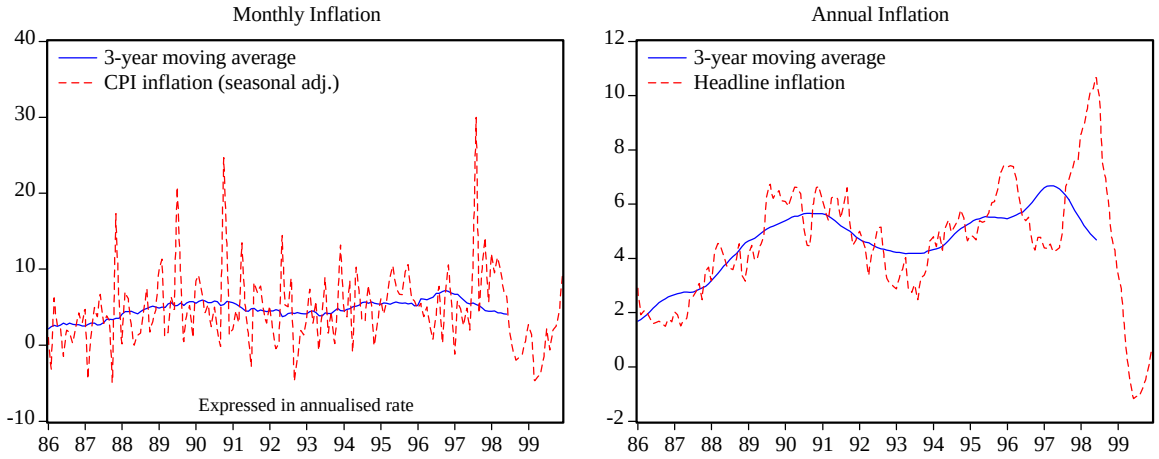
Notes: Target choices are in bold font.

* Statistics New Zealand is proceeding to exclude interest services from the CPI so that headline inflation becomes the same as core inflation.

Second, core inflation can be useful in the *ex post* assessment of whether the inflation target has been met. Headline inflation is often subject to random shocks: temporary, unforeseen, or which affect the price level but not the underlying inflation rate. In practice, this can make it difficult to meet the inflation target.[2] As a result, many countries exclude such price movements from their inflation target, through using core inflation. The alternative is for the central bank to use these shocks when explaining why the target was missed. But this is *ad hoc* and difficult to verify. Instead, developing a measure of core inflation (which would exclude such shocks), ideally constructed by an agency outside of the central bank, would allow for a truly objective assessment of whether the inflation target had been met. In this way, use of core inflation could increase the accountability of the central bank.

Third, since core inflation is a better measure of underlying inflation, it should be easier to predict, and easier to explain in terms of changes in monetary policy within an econometric model. Because headline inflation tends to be quite volatile (noisy), it is hard to predict, and hard to explain in an empirical economic model. But since it better captures the underlying inflation trend, using core inflation may make it possible to find more reliable models of inflation in Thailand.

Figure 1.1 :- Inflation, Actual vs. Three-Year Centred Moving Average



These arguments suggest that core inflation can be a useful supplement to the measures of headline inflation already in use in Thailand. Figure 1.1 illustrates this by showing the volatility of monthly headline inflation compared to its longer-run underlying trend. It plots the monthly change in (seasonally adjusted) consumer prices, together with its

[2] It would also typically be unwise for monetary policy to attempt to offset such shocks, as this might require excessive interest rate (and exchange rate) volatility. Also, offsetting the price effect of supply shocks will cause monetary policy to be procyclical.

centered three-year moving average (used as a measure of underlying inflation). Both are calculated at an annualized rate. The volatility in monthly inflation can be seen from the frequency with which it differs from the underlying trend, and from how regularly these deviations from trend are later reversed. Quantifying this effect, the standard deviation of the difference between the two series is 4.8, implying that the monthly inflation rate tends to be a poor indicator of the underlying inflation trend.

This remainder of the paper focuses the measurement of core inflation in Thailand, and the role it can play under inflation targeting. Section 2 reviews the main approaches to measuring core inflation, emphasizing methods which fully utilize currently available data. Based on these approaches, Sections 3 and 4 then develop the alternative measures of core inflation for Thailand. Section 5 evaluates the measures of core inflation, highlights the advantages and disadvantages of each, and stresses the complementary nature that each of the different measures can play. Section 6 concludes the paper with suggestions on the role of core inflation as the monetary authority moves to adopt inflation targeting as its policy regime.

2. Various Approaches to Measuring Core Inflation

There are two main approaches to measuring core inflation.

The first, more technical approach, estimates a VAR model and then uses the long-run restrictions implicit in the definition of core inflation to identify core inflation.[3] The appealing feature of this approach is the attempt to establish a link between core inflation and its underlying economic determinants, most importantly monetary policy variables. Identification of such a link then provides a clear rationale why monetary authorities should care about core inflation, and also describes the extent to which they can control it. The main problem with this approach is that it is model-specific. Identification of core inflation depends on assumptions used in the VAR model, including price flexibility, formation of inflation expectations, the nature of price shocks. As a result, since estimates of the VAR model will change as new data arrives and the sample period is extended, estimates of earlier observations of core inflation may change. A different specification of the VAR model could give different results. Because of this underlying subjectivity, as well as its highly technical nature, this approach to measuring core inflation has been rarely applied in practice. The less obvious the connection between core and headline inflation, the less well understood the calculation of core inflation, the less credible and transparent it becomes in the eyes of the public. This undermines its usefulness as a policy target for the monetary authorities.

The second approach attempts to extract core inflation from existing information on the sub-components of headline inflation. Within this approach there are two main branches, discussed more fully in the following two sections: (1) core measures which use

[3] Quah and Vahey (1995)

time series properties of the data, and (2) core measures which use the cross-sectional distribution of the data.

(1) Core measures using time-series properties of the data. The first branch attempts to identify transitory components of inflation ("noise") that typically reflect seasonal movements, volatile supply shocks, or once-and-for-all relative price shocks. It then excludes them from headline inflation to derive core inflation. But the identification of such components relies on hindsight, or from practice in other countries which have adopted this approach. Therefore, the implicit assumption of this approach is that the components of inflation exhibit similar behavior in the future as in the past.

This approach is widely adopted by monetary authorities around the world. For example, the Bank of Canada excludes food, energy, and indirect taxes in its calculation of core inflation, which it adopts as its target of monetary policy. The Reserve Bank of Australia and Bank of England also follow a similar approach. Even countries that do not explicitly adopt inflation targeting as a policy regime often publish their measures of core inflation and use them as monitoring tools. The United States excludes food and energy prices from its core inflation measure—and this now receives more attention from markets than headline inflation itself.

(2) Core measures using cross-sectional distribution of the data. The second branch approach also attempts to exclude "noise" from headline inflation. However, instead of defining the more volatile components that are to be excluded *a priori*, for each observation it looks at the cross-sectional distribution of price changes to identify outliers. The two tails of the distribution of price changes are identified as idiosyncratic movements, and excluded from headline inflation to derive core inflation for that time period.[4] This method excludes the high variance components of the general price index, but instead of fixing the excluded components as in the previous method, it allows the components to vary from period to period.

Within this second approach, each of these two method have a number of advantages. First, they utilize existing price data to the fullest extent. Second, the derivation of core inflation is straightforward and generally easy to explain to the public.

The following sections discuss the two branches of the practical approach in greater details and apply them to the case of Thailand.

3. Core Measures Using Time-Series Properties of the Disaggregated Price Data

[4] Sometimes the idiosyncratic movements are downweighted rather than totally excluded.

The most common approach to measuring core inflation is to exclude certain irregular items from the CPI basket. Table 3.1 categorizes the main items that are typically omitted, together with the justifications for their exclusion.

The first category is made up of items with volatile price movements such as food (raw food in particular), commodities, and energy. These volatile price movements are caused by supply factors that either are highly seasonal and hence are soon to be reversed, or that are unforeseen. Including highly seasonal movements in the price measure would introduces noise which can cloud the true inflation trend. In addition, it may be inappropriate for the monetary authority to react to these price movements, because they will soon correct themselves. As for unforeseen events such as oil shocks or natural calamities, there is also theoretical support for why monetary policy should not offset their price effect. First, there is essentially nothing monetary policy can do to influence the causes of such price changes. And attempts to offset their immediate impact on the price level may lead to excessive volatility in monetary policy. Second, such supply shocks already have adverse effects on output: using monetary policy to fight off the price increase would only aggravate the volatility in output. Instead, monetary policy should ensure that such shocks only effect the price *level*, and are not allowed to feed through into a higher inflation *rate*.

Table 3.1 :- Frequently Excluded Items in the Calculation of Core Inflation

Excluded Items	Justifications
Food Commodities Energy	- Greatly influenced by supply shocks, leading to volatile but soon reversed price movements - Offsetting supply shocks would aggravate the impact on output
Indirect taxes	- Infrequent, once-and-for-all changes have no long-run effects on inflation - Offsetting the effect on prices would aggravate the impact on output
Controlled prices Government subsidies	- Possible conflicts between monetary and fiscal policy - Price target could be met artificially by changing controlled prices
Interest charges Mortgage interest Housing capital costs	- Perverse response: prices of these items rise when monetary policy is tightened

The second category includes items such as indirect taxes which have only a transitory effect on inflation. Since indirect taxes are usually changed only infrequently, increases raise the price level but *not* trend inflation. In addition, though the price level increases in the short run, the increase in taxes lowers aggregate demand, and so will tend to have a later deflationary effect.[5] Also, an increase in indirect taxes can be seen as having similar output and price effects as an adverse supply shock; again, responding with a tightening of monetary policy would exacerbate the negative impact on output. For these reasons, the contribution of changes in indirect taxes should be excluded from the core measure and not offset by monetary policy.

The third category is administered and subsidized prices. Price controls and subsidies often serve a distinct purpose such as income distribution; for instance, the government may choose to support farm prices to raise farmers' income. Monetary policy should not attempt to offset these price movements, save to ensure that these do not feed through into a higher inflation rate. Also there is the risk that the government may attempt to meet its inflation objective by reducing administered prices. This is misleading for it can only have a short run impact on the price level, not on inflation; worse, such cuts in controlled prices will stimulate aggregate demand, raising price pressures. This explains why many countries exclude administered prices from the price definition used in the inflation target.

The last category includes items directly related to interest rates: interest charges, mortgage payments and housing capital costs. When monetary policy is tightened and interest rates increased to curb inflationary pressure, the price of these items will rise, pushing up the overall price level in the short run, even though the ultimate effect of monetary policy will be deflationary. Such perverse response to monetary policy can be misleading. The effectiveness of monetary policy in the eyes of the public can be undermined if such items are included in the inflation target.

The method by which the above items are excluded varies: some have their prices totally excluded while the others are only partially excluded (e.g. in the case of changes to indirect taxes, only the effect of the tax change is excluded, not movements in the pre-tax goods price). This can be seen from the following derivation of the formula for calculating core inflation, taking into consideration the various types of price exclusions.

We start with the well-known definition of CPI:

[5] The precise effect on prices in the long run will depend on the extent to which monetary policy accommodates the price increase resulting from higher indirect taxes; this will typically depend on the extent of price rigidity in the economy.

$$(1) \qquad CPI_{it} \equiv \frac{\sum_{i=1}^{n} Q_{i0} P_{it}}{\sum_{i=1}^{n} Q_{i0} P_{i0}} \times 100$$

$$(2) \qquad CPI_{it} = \sum_{i=1}^{n} w_{i0} \frac{P_{it}}{P_{i0}} \times 100 \qquad \textit{where} \qquad w_{i0} \equiv \frac{Q_{i0} P_{i0}}{\sum_{i=1}^{n} Q_{i0} P_{i0}}$$

Note however that the price of good *i* at time *t* is a product of its original or pre-tax price and the taxes.

$$(3) \qquad P_{it} \equiv p_{it} \times (1 + VAT_{it}) \times (1 + \tau_{it})$$

where p_{it} is the pre-tax price of good *i* at time *t*
VAT_{it} is the VAT rate on good *i* at time *t*
τ_{it} is other indirect tax rate on good *i* at time *t*

Core is then defined as a subset of the CPI basket. First, we can order goods within the CPI basket in such a way that the core price level includes goods 1 to *m*, and fully excludes goods *m*+1 to *n*.

$$(4a) \qquad CORE_{it} = \frac{\sum_{i=1}^{m} w_{i0} \frac{P_{it}}{P_{i0}} \times 100}{\sum_{i=1}^{m} w_{i0}} \qquad \textit{where} \quad m \leq n$$

The denominator rescales the weights so that they still sum to 1. However, the core measure may also need to exclude any indirect taxes levied on items 1 to *m*, so that the remaining subset of prices reflect the fundamental (pre-tax) price changes. In that case, (4*a*) can be modified to (4*b*).

$$(4b) \qquad CORE_{it} = \frac{\sum_{i=1}^{m} w_{i0} \frac{p_{it}}{p_{i0}} \times 100}{\sum_{i=1}^{m} w_{i0}} \qquad where \quad m \le n$$

Given the definitions of CPI, core, and prices, we can write CPI in terms of the core price level, and excluded items:

$$(5) \qquad CPI_{it} = CORE_{it} \times \sum_{i=1}^{m} w_{i0} + \sum_{i=1}^{m} w_{i0} \frac{P_{it}}{P_{i0}} \left(1 - \frac{1+VAT_{i0}}{1+VAT_{it}} \times \frac{1+\tau_{i0}}{1+\tau_{it}} \right) \times 100 + \sum_{i=m+1}^{n} w_{i0} \frac{P_{it}}{P_{i0}} \times 100$$

Rearranging the terms yields the following definition for core inflation:

$$(6) \qquad CORE_{it} = \frac{\Omega}{\sum_{i=1}^{m} w_{i0}}$$

$$where \qquad \Omega \equiv CPI_{it} - \sum_{i=m+1}^{n} w_{i0} \frac{P_{it}}{P_{i0}} \times 100 - \sum_{i=1}^{m} w_{i0} \frac{P_{it}}{P_{i0}} \left(1 - \frac{1+VAT_{i0}}{1+VAT_{it}} \times \frac{1+\tau_{i0}}{1+\tau_{it}} \right) \times 100$$

To clarify all of the above, we can think of grouping the components of the CPI into four main categories:

1 — *h*, *h*+1 — *k*, *k*+1 — *m*, *m*+1 — *n*			
Fully included	Excl. VAT	Excl. VAT & other indirect taxes	Fully excluded

Goods *m*+1 to *n* are fully excluded from the calculation of core, for example, because they exhibit volatile movements due to supply factors. Such goods could be vegetables, fruits, and gasoline. Goods *h*+1 to *m* are excluded only to the extent that their prices are affected by indirect taxes. Cigarettes, beer, and vehicles are subject to both excise tax and VAT; clothes, personal services, and telephone services are subject only to VAT. The final category (goods *1* through *h*) are goods which are included fully in the core measure. These are goods whose prices are typically less volatile, and which are not taxed, e.g., newspapers and magazines and housing rents.

$$(7) \qquad \Omega = CPI_{it} - \sum_{i=m+1}^{n} w_{i0} \frac{P_{it}}{P_{i0}} \times 100 - \sum_{i=k+1}^{m} w_{i0} \frac{P_{it}}{P_{i0}} \left(1 - \frac{1+VAT_{i0}}{1+VAT_{it}} \times \frac{1+\tau_{i0}}{1+\tau_{it}} \right) \times 100$$

$$- \frac{VAT_{it} - VAT_{i0}}{1+VAT_{it}} \sum_{i=h+1}^{k} w_{i0} \frac{P_{it}}{P_{i0}} \times 100$$

A number of important assumptions are made in the derivation of core measure above, especially in defining core in (4*b*).

First, the derivation assumes that the tax incidence is fully borne by consumers. This allows us to exclude the full amount of the indirect tax. But if the burden of the tax is in part borne by producers (for example, if the industry is not perfectly competitive), then subtracting the full amount of the tax would underestimate (overestimate) the true core inflation when there is a tax increase (decrease). However, the practical effect of this assumption will be rather small: in Thailand, tax changes have been infrequent and of relatively small magnitude, and only around 10 percent of the original CPI basket is subject to indirect tax. Clearly, it might be preferable to have elasticities of prices with respect to changes in indirect taxes—but without this, the full pass through assumption seems a reasonable approximation, and one that is made in almost all other countries when calculating core inflation.

Second, the derivation is based on a unit price elasticity for all goods which are taxed. This allows us to maintain the original CPI weights, w_{i0}, for goods that are taxed in the calculation of core in (4*b*).[6] Because the weights are the same, this means the inflation rate excluding indirect taxes will only differ from the overall inflation rate when there is a change in taxes (i.e., in the case where $m = n$, and thus no item is fully excluded).[7]

[6] An alternative approach is to assume zero price elasticity for all goods taxed. This is essentially assuming that the representative consumer would purchase the same quantity of good *i*, Q_{i0}, regardless of the tax rate. However, this means that the weight w_{i0} must be recalculated, because the expenditure share of a good increases if its indirect tax rate is increased. The Bank of England adopts this assumption when calculating its RPIY measure of the core price level.

[7] Were the weights to be different, the monthly change of core prices would differ from the monthly change of CPI even when there is no change in taxes—somewhat counterintuitive.

Using the above derivations, we construct eight alternative measures of core inflation for Thailand:[8]

- CPI excluding all food items
- CPI excluding raw food items[9]
- CPI excluding energy items[10]
- CPI excluding raw food and energy items
- CPI excluding controlled items[11]
- CPI excluding VAT
- CPI excluding VAT and other indirect taxes
- CPI excluding raw food, energy, and indirect taxes

Figure 3.1 plots these series, their properties are discussed more fully in Section 5.

[8] The first five core series are calculated from January 1987 onwards. Since the VAT was only adopted in 1992, when it replaced the multiple-rate business tax, we only calculate the last two core series from 1992 onwards.

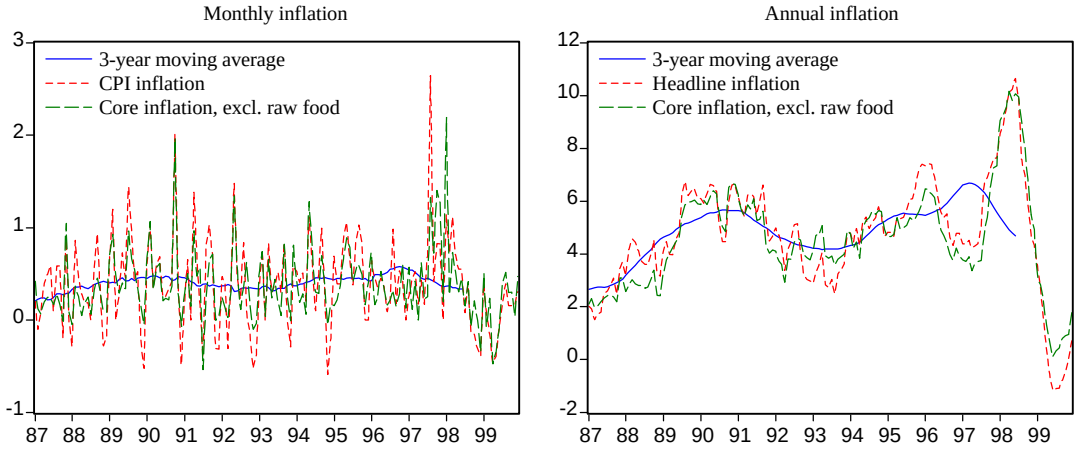
[9] Raw food includes rice, meats, vegetables, fruits, and dairy products.

[10] Energy includes gasoline (benzene and diesel), lubricant, cooking gas, and electricity.

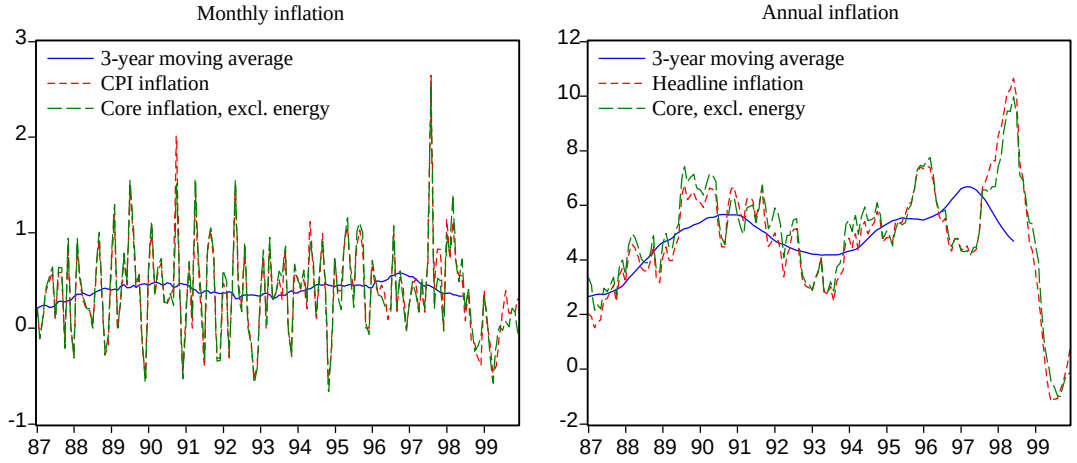
[11] Controlled items are public utilities (electricity, public water, and telephone), public transportation, and other public services.

Figures 3.1 (a)-(e) :- Monthly and Annual Rates of Core Inflation

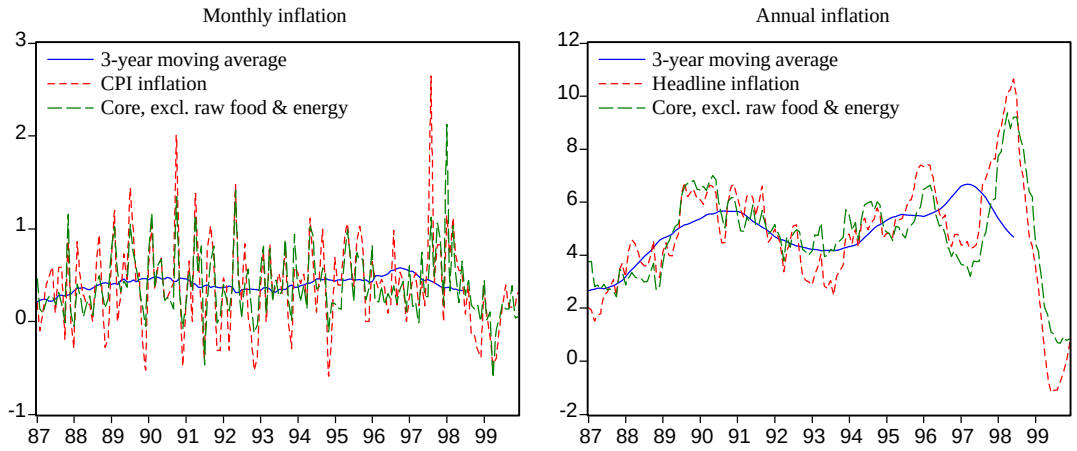
(a) Core excluding raw food



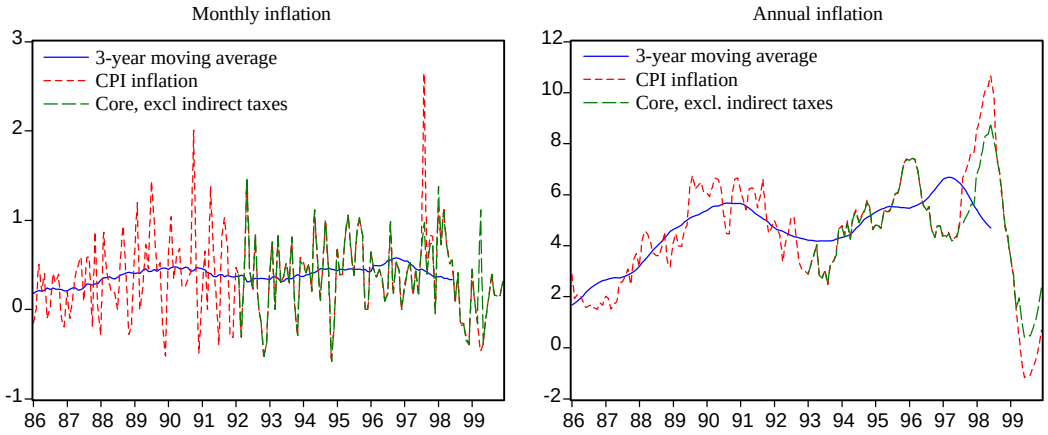
(b) Core excluding energy



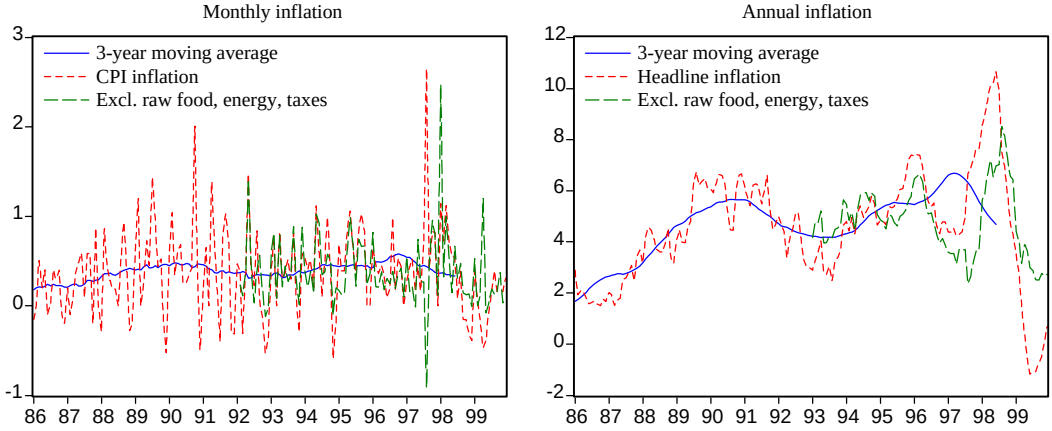
(c) Core excluding raw food and energy



(d) Core excluding indirect taxes



(e) Core excluding raw food, energy, and indirect taxes



One important issue in constructing core measures is to check that (except for controlled prices, or items excluded because of perverse interest rate effects) the excluded items do indeed have transitory movements. First, we can use Augmented Dickey-Fuller (ADF) tests to test for the stationarity of the price changes of each of the excluded components. Finding stationarity would suggest that shocks to the inflation rate of the excluded item are temporary and likely to be reversed, thus the item can be excluded without affecting the inflation trend. Second, we can test whether the current gap between headline and core inflation is likely to be reversed in the future by running the following regression:

$$(8) \qquad \pi_{cpi,t+h} - \pi_{cpi,t} = \alpha + \beta(\pi_{cpi,t} - \pi_{core,t}) + u_t$$

$\Pi_{cpi,t}$ is CPI or headline inflation at time t, and $\Pi_{core,t}$ is core inflation also at time t. Suppose that the current gap between headline and core inflation represents a temporary upward

(downward) deviation of headline inflation from trend (this being better captured by core inflation). Then, headline inflation in the future ($\Pi_{cpi,t+h}$), will be lower (higher) than today's headline inflation by the size of the current gap between headline and core inflation. Therefore, a core measure which excludes only transitory price movements should give estimated regression coefficients of 0 and -1 for α and β, respectively.

Most of the component inflation series turn out to be stationary. Table 3.3 shows the results of applying ADF tests to the main CPI components (sample periods, which vary depending on data availability, are given in Table 3.2). Based on year-on-year changes, all raw food items, all energy items except electricity, and some controlled prices seem to be stationary. Stationarity of processed food items and electricity is less evident, while bus fares seem to be non-stationary (less surprising, since these are controlled). Thus the test results suggest that movements in (raw) food price inflation are transitory, consistent with the appropriateness of their being excluded from core inflation.[12]

Prices of processed food are much less volatile than raw food prices (Figure 3.1). Really it is the exclusion of raw food items, and *not* all food items, that yields the greatest marginal benefit in lowering the volatility of the inflation. In addition, excluding all food items would mean omitting almost 40 percent of the CPI basket. Clearly, excluding so large a proportion of the CPI basket would invite criticism that the remaining core index—even if in some sense more relevant for monetary policy—would be completely unrepresentative of the prices facing consumers. However, excluding raw food items alone and retaining prepared food in our measure of core inflation would entail the omission of less than half this amount. This is our preferred approach.

Finally, to test for predictive ability of the core inflation measure, we run regression (8) for the core measure excluding raw food and energy, and test the joint restriction that $\alpha = 0$ and $\beta = -1$ to confirm the transitory nature of raw food and energy price movements. Results in Table 3.4 show that this joint restriction can be rejected when $h = 6$ (a short time horizon where it would be unreasonable to expect that inflation would revert back towards its underlying trend), but cannot be rejected when $h = 12$, 18 and 24 (longer run horizons where reversion to trend is more plausible).

[12] The exclusion of energy items is also largely acceptable.

Table 3.2:- Longest Time Series for CPI Subcomponents

Series	Time period
Rice, flour & flour products	1976:01 - 1999:12
Meat, poultry & fish	1976:01 - 1999:12
Vegetables & fruits	1976:01 - 1999:12
Eggs & dairy products	1976:01 - 1999:12
Other food from market	1976:01 - 1999:12
Non-alcoholic beverages	1976:01 - 1999:12
Prepared food	1976:01 - 1999:12
Apparel	1976:01 - 1999:12
Men and boys' apparel	1976:01 - 1999:12
Women and girls' apparel	1976:01 - 1999:12
Cloth	1976:01 - 1999:12
Housing	1976:01 - 1999:12
Shelter	1976:01 - 1999:12
Rents	1979:01 - 1999:12
Furniture	1976:01 - 1999:12
Housekeeping	1976:01 - 1999:12
Household textiles	1976:01 - 1999:12
Utilities	1976:01 - 1999:12
Cooking gas	1979:01 - 1999:12
Electricity	1979:01 - 1999:12
Public water	1979:01 - 1999:12
Personal and medical services	1976:01 - 1999:12
Personal services	1976:01 - 1999:12
Medical services	1976:01 - 1999:12
Public hospital	1979:01 - 1999:12
Transportation	1976:01 - 1999:12
Vehicles	1976:01 - 1999:12
Cars	1979:01 - 1999:12
Motorbike	1979:01 - 1999:12
Benzene	1979:01 - 1999:12
Diesel	1985:01 - 1999:12
Lubricant	1979:01 - 1999:12
Car gas	1987:01 - 1999:12
Public transportation	1985:01 - 1999:12
Bus fare	1979:01 - 1999:12
Communications	1986:01 - 1999:12
Telephone	1979:01 - 1999:12
Stamp	1986:01 - 1999:12
Reading, education & recreation	1976:01 - 1999:12
Reading and education	1985:01 - 1999:12
Recreation	1976:01 - 1999:12
Alcoholic beverages & cigarettes	1976:01 - 1999:12
Whisky	1983:01 - 1999:12
Beer	1979:01 - 1999:12
Cigarettes	1979:01 - 1999:12

Table 3.3 – ADF Tests on the Year-on-Year Changes in the Prices of CPI Components

ADF test with a constant term and no trend, 4 lags

Sample period: longest period available

Null hypothesis of unit root			
Rejected at 1%	Rejected at 5%	Rejected at 10%	Cannot reject
Rice, flour & flour products	**Other food**		
Meat, poultry & fish	**Non-alcoholic beverages**		
Vegetables & fruits	**Prepared food**		
Eggs & dairy products			
Benzene			Bus fare
Diesel			
Lubricant			
Cooking gas	Electricity		
Public water			
Telephone			
Public hospital			

NB: Stationary series suggest that the price changes are temporary.

Figure 3.1 :- Changes in the Prices of Raw and Processed Food

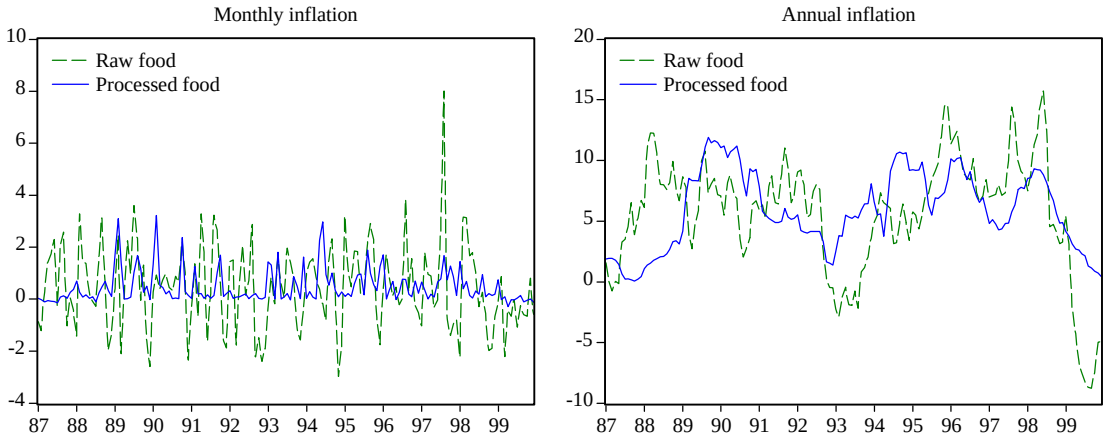


Table 3.4 :- Estimated Results of Regression

$$\pi^{yoy}_{cpi,t+h} - \pi^{yoy}_{cpi,t} = \alpha + \beta(\pi^{yoy}_{cpi,t} - \pi^{yoy}_{core,t}) + u_t$$

Using Core Measure Excluding Raw Food and Energy Prices

sample period	1987:01-1999:12	1990:01-1999:12	1987:01-1997:06
h = 6			
α	-0.091 (0.328)	-0.350 (0.405)	0.087 (0.195)
β	0.139 (0.394)	0.266 (0.458)	-0.535 (0.205)
Adjusted R^2	0.00	0.01	0.11
p-value for $\alpha = 0, \beta = -1$	0.01	0.01	0.07
h = 12			
α	-0.146 (0.527)	-0.575 (0.663)	0.119 (0.290)
β	-0.682 (0.586)	-0.698 (0.698)	-1.114 (0.275)
Adjusted R^2	0.03	0.03	0.25
p-value for $\alpha = 0, \beta = -1$	0.76	0.51	0.62
h = 18			
α	0.080 (0.465)	-0.348 (0.552)	0.256 (0.355)
β	-1.656 (0.587)	-2.093 (0.614)	-0.980 (0.393)
Adjusted R^2	0.19	0.26	0.18
p-value for $\alpha = 0, \beta = -1$	0.08	0.08	0.57
h = 24			
α	0.270 (0.418)	-0.250 (0.418)	0.344 (0.485)
β	-1.531 (0.557)	-1.943 (0.543)	-1.068 (0.538)
Adjusted R^2	0.22	0.34	0.13
p-value for $\alpha = 0, \beta = -1$	0.18	0.19	0.48

NB: Standard errors calculated using Newey-West method.
P-values are for Chi-squared tests on the joint coefficient restriction.

4. Core Measures Using Cross-Sectional Distribution of the Data

The approach to measuring core inflation described in Section 3 excludes the prices of certain goods (usually food and energy), which are judged *a priori* to be unusually volatile and subject to temporary shocks. However, excluding only food and energy may not be sufficient to generate an accurate measure of core inflation. There may be other CPI components which are also subject to temporary shocks, and which should also be excluded. Conversely, in some months food and energy price movements *may* contain information about future inflation, either because in normal months their movement does reflect the general trend in inflation, or because some components within food and energy may be not that volatile after all. Either too much or too little may be excluded.

This section develops an alternative approach to measuring core inflation which uses simple statistical methods to allow the excluded goods to vary depending on the *actual* distribution of monthly price changes for individual goods.[13] In particular, this approach uses measures such as the trimmed mean and the median inflation rate, which can be seen as more robust measures of the underlying movement in consumer price inflation.

Why should we use the median or trimmed mean instead of the simple mean inflation rate? When the underlying distribution of price changes for individual goods is normal, use of the simple mean is appropriate. But when the distribution is non-normal, the trimmed mean can be a much more efficient estimator of the population mean. One way to see this is to recognise that the inflation rates of the individual goods that make up the CPI basket are really a sample from the (true and unobserved) population distribution of price changes. When constructing an inflation measure, we are really trying to estimate the central tendency of the underlying population distribution. When the distribution of price changes in the underlying population is normal, then the sample mean is the most efficient estimator of the mean of the underlying population. But when the underlying population is non-normal, for example when it has fat tails, the sample mean becomes an inefficient estimator of the population mean. For when there are fat tails, there is a greater likelihood that the sample of price changes is accidentally skewed, and thus that the sample may be dominated by outliers on one side of the distribution. In this case the trimmed mean—which discards a proportion of the two tails of the sample—turns out to be a more efficient estimator of the population mean.

But there are other reasons why we might wish to look at the trimmed mean when trying to measure the underlying inflation rate. When we observe skewness in the distribution of monthly price changes, this could be due to underlying price behaviour which we would wish to exclude from core inflation. First, as discussed above, many prices are subject to sharp changes which often prove transitory. This could be due to seasonal price variations (the price of food varying with the harvest); changes in controlled prices; changes in oil prices; or simple measurement error. This suggests using a statistical approach as a means of

[13] This has been advanced by Bryan and Cecchetti (1996), and is developed further in Bryan, Cecchetti and Wiggins (1999)

excluding these outliers (such as using the trimmed mean or, in the limit, the median), rather than simply excluding certain goods, such as food and energy, *a priori*. Of course, to the extent that food and energy tend to produce outlying price changes, the two approaches would—reassuringly—give similar core measures.

To assess the relevance of these theoretical arguments for using the median or trimmed mean to estimate inflation, we need to examine the distribution of monthly price changes of individual goods and services in Thailand. We do this by calculating statistics that summarize the distribution of monthly seasonally adjusted price changes of individual goods.[14]

First, let us define inflation in individual good i over time period k as:

$$(1) \qquad \pi_{it}^{k} = \frac{1}{k}\ln(p_{it} / p_{it-k})$$

where p_{it} is the price level for good i at time t.

We can then define mean overall inflation at time t over the preceding period k as:

$$(2) \qquad \Pi_{it}^{k} = \sum_{i} r_{it}\pi_{it}^{k}$$

where r_{it} are the "relative importances", which – unlike the simple weights – are allowed to change each period.[15] We can then calculate higher order central moments as:

$$(3) \qquad m_{rt}^{k} = \sum_{i} r_{it}(\pi_{it}^{k} - \Pi_{t}^{k})^{r}$$

and use these to define the skewness and kurtosis accordingly:

$$(4) \qquad S_{t}^{k} = \frac{m_{3t}^{k}}{(m_{2t}^{k})^{3/2}} \text{ and } K_{t}^{k} = \frac{m_{4t}^{k}}{(m_{2t}^{k})^{2}}$$

---

[14] The definitions and approach are standard and follow Bryan, Cecchetti and Wiggins (1999).

[15] Since the consumer price index in Thailand is the arithmetic average (and not a geometric average) of the price levels of individual goods, the aggregate inflation rate can be approximated by the averaging the individual inflation rates, where the weights are replaced by "relative importances", r_{it}, which very over time. For example, if the aggregate price level $P_t = \sum w_{it} p_{it}$, then $r_{it} = w_i(p_{it} / p_{t-k})$. However, in the current version of this paper fixed weights rather than relative importances are used throughout: for small monthly changes, the difference between the two methods is not that great.

Table 4.1 :- Consumer Price Inflation, 1990:01 to 1999:08
31 Components

Time Horizon	1 month	3 months	1 year	2 years	3 years
Standard Deviation					
Average	15.40	10.11	5.48	3.85	3.24
Std. Dev.	9.77	4.34	1.58	0.76	0.54
Skewness					
Average	0.47	0.40	0.32	0.48	0.20
Std. Dev.	2.23	1.82	1.17	0.52	0.54
Kurtosis					
Average	11.96	9.83	5.90	4.13	3.96
Std. Dev.	8.02	7.27	3.55	1.99	1.97

Following Bryan, Cecchetti and Wiggins, Table 4.1 calculates basic statistics summarizing the distribution of monthly price changes in Thailand.[16] The table shows that the distribution of individual price changes is non-normal, particularly at higher frequencies, where the distribution in any given month is often skewed (albeit with possible reversal in subsequent months) and has fat tails. As the inflation horizon increases from 1 month to 3 years:

- the standard deviation of individual price changes declines, implying that inflation rates for longer periods are less volatile, and that transitory changes have time to reverse themselves;
- the average skewness of the distribution of individual price changes remains positive but shows no clear pattern; however, the volatility of the skewness declines (as measured by the standard deviation of the skewness), suggesting that at higher frequencies skewness may reverse sign in subsequent periods;
- the average kurtosis declines: the tails of the distribution shrink, perhaps as the frequency of observed outliers dies down.

There are many potential sources to this non-normality in the distribution of individual price changes. One economic interpretation is that in the presence of costs to changing prices ("menu costs"), firms may change prices infrequently, but by large amounts when they do so. So in any individual month, observed price changes may be non-normal, and subject to lots of noise, even though the underlying distribution would be normal if prices could be changed

[16] Calculations use 31 components of the consumer price index, seasonally adjusted using X-11. The first observation is available in January 1987; since the distribution of three-yearly price changes is calculated, the common sample period for calculations is January 1990 through August 1999 (the last available observation). Figures are expressed at an annualized rate.

costlessly.[17] It is only over long horizons, when the cost of changing prices can be disregarded, that this noise will abate. An alternative explanation is that the underlying distribution of price changes is itself non-normal. For example, if price changes are drawn from a combination of normal distributions but with differing variances, then the resulting distribution will tend to have fat tails. Either way, since the distribution is non-normal, the sample mean—especially at high frequencies—becomes a less efficient estimator of the mean price change in the underlying population.

One way to remove these outliers is to use the trimmed mean or weighted median of individual price changes. To calculate x_α, the (weighted) α-percent trimmed mean, we arrange the sample of monthly (seasonally adjusted) inflation rates for individual components of the CPI in order, calculate the corresponding cumulative weights, and then calculate the mean after excluding the bottom and top α-percent of the distribution of price changes. Thus:

$$(5) \qquad \bar{x}_\alpha = \frac{1}{1-2\frac{\alpha}{100}} \sum_{i}^{\alpha,100-\alpha} w_i x_i$$

In this paper we set α=10 and calculate the 10-percent trimmed mean for Thailand, concentrating on the middle 80 percent of the distribution of monthly inflation rates. In general, the optimal trim will depend on the underlying process generating the monthly inflation data. But the 10 percent value corresponds closely to that used in the literature applied to other countries.[18] In addition, we calculate the (weighted) median (which corresponds to the 50 percent trimmed mean), as an additional robust estimator of underlying inflation. Both measures are presented in Figure 4.1:

[17] Note that on this argument, if firms choose to change their prices more often in some months than others, the distribution of actual price changes in the population may be a misleading indicator of the underlying distribution of price changes.

[18] Bryan, Cecchetti and Wiggins (1999) use a Monte Carlo experiment, drawing from a mixed normal distribution, to show the greater efficiency of the trimmed mean as an estimator, and show that the optimal trim increases with the degree of kurtosis in the distribution of the underlying population. They also assess the efficiency of trimmed mean estimators on actual data, comparing the trimmed mean with the centered 36-month moving average inflation rate, and find that, using U.S. data, trimming at the 7 percent level turns out to be optimal.

Figure 4.1 :- Monthly and Annual Rates of Trimmed Mean Core Inflation

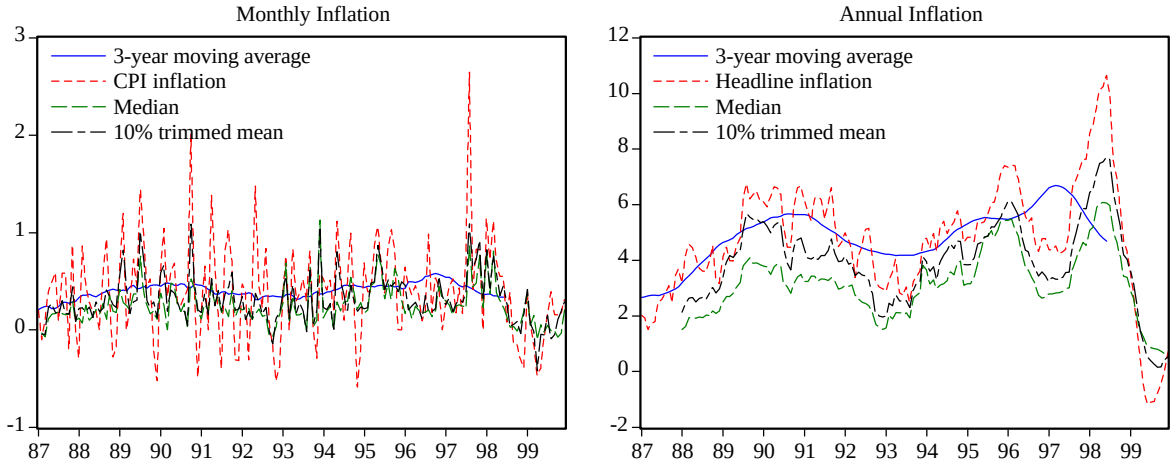


Table 4.2 reports the frequency with which each CPI subcomponent is trimmed for the sample period February 1987-December 1999. Out of the 155 months, the price of fruits and vegetables is trimmed as many as 129 times. Note that 3 out of the top 5 most frequently trimmed items fall in the category of raw food or energy, and all raw food items rank within the top 10 most frequently trimmed items, while energy items also rank very high on the list. Thus, there is a tendency for the trimmed mean approach to select the same items as those determined *a priori* for exclusion based on historical behavior. This is encouraging because it suggests that the historical properties of price movements are likely to hold over time and that the two approaches to measuring core inflation are consistent.

Table 4.2 :- Number of Times Subindices Are Trimmed
1987:02-1999:12

Series Name	Number of times trimmed
Vegetables & fruits	129
Vehicle_x*	109
Benzene	103
Diesel	98
Car	87
Rice, flour & flour products	86
Motorcycle	66
Eggs & dairy products	63
Meats, poultry & fish	61
Utilities	61
Lubricant	54
Beer	51
Cigarettes	50
Whiskey	49
Car gas	45
Reading	44
Public transportation	35
Housekeeping	32
Other food from market	31
Prepared food	29
Beverages	25
Medical services	22
Communications	22
Apparel, cloth	21
Recreation	19
Apparel, women's	13
Personal services	13
Apparel, men's	12
Household textiles	10
Furniture	9
Shelter	8

* Vehicle_x = vehicle other than gasoline, car, motorcycle

5. An Evaluation of Core Measures

Section 1 motivated the use of concept of core inflation as a guide to monetary policy for an inflation targeting central bank, based on three key advantages over headline inflation:

- *core inflation provides a clearer indication of inflation trend;*

- *core inflation is more controllable through monetary policy instruments; and*
- *core inflation can be used to improve accountability for meeting the inflation target, which can strengthen the credibility of the monetary authority.*

This section evaluates alternative measures of core inflation against the above criteria.

Does the core measure provide a clearer indication of inflation trend?

To provide a more accurate measure of underlying inflation, measures of core inflation need to be less volatile than headline inflation rates, but should also capture the trend in underlying inflation better. One way to measure this is to use the centered three-year moving average of headline inflation as a benchmark measure of the current inflation trend. Then we calculate the root mean squared error (RMSE) and the mean absolute deviation (MAD) of the different core inflation series from this benchmark measure.

Tables 5.1 and 5.2 presents summary statistics for various core measures for two sample periods: January 1987-December 1999, and January 1987-June 1997. The latter sample is chosen to exclude the financial crisis period, during which there is exceptional volatility in inflation due to exchange rate fluctuations. Each table reports the statistics in two main parts: (a) monthly changes, and (b) annual changes. Variability is defined as the standard deviation divided by the mean.

Table 5.1 :- Summary Statistics of Various Core Series, 1987:01-1999:12

(a) Monthly Changes

Series	Mean	Median	SD	Variability	RMSE	MAD	Observations
3-year moving average	0.40	0.41	0.07	0.18			
Headline	0.44	0.43	0.48	1.11	0.48	0.36	137
Excl. raw food	0.41	0.30	0.38	0.94	0.39	0.28	137
Excl. energy	0.45	0.44	0.49	1.10	0.50	0.39	137
Excl. raw food & energy	0.42	0.33	0.37	0.87	0.37	0.28	137
Median	0.27	0.23	0.20	0.72	0.24	0.20	137
Trimmed mean, 10%	0.34	0.28	0.23	0.68	0.24	0.19	137

(b) Annual Changes

Series	Mean	Median	SD	Variability	RMSE	MAD	Observations
3-year moving average	5.1	5.2	0.76	0.15			
Headline	5.3	5.0	1.57	0.30	1.46	1.03	126
Excl. raw food	5.0	4.8	1.53	0.31	1.48	1.01	126
Excl. energy	5.4	5.4	1.40	0.26	1.39	1.04	126
Excl. raw food & energy	5.1	5.0	1.30	0.25	1.35	0.95	126
Median	3.3	3.2	1.07	0.32	2.01	1.83	126
Trimmed mean, 10%	4.2	4.1	1.23	0.30	1.45	1.18	126

Table 5.2 :- Summary Statistics of Various Core Series, 1987:01-1997:06

(a) Monthly Changes

Series	Mean	Median	SD	Variability	RMSE	MAD	Observations
3-year moving average	0.39	0.39	0.06	0.17			
Headline	0.40	0.40	0.48	1.19	0.47	0.37	107
Excl. raw food	0.38	0.30	0.35	0.93	0.34	0.26	107
Excl. energy	0.42	0.44	0.49	1.16	0.49	0.39	107
Excl. raw food & energy	0.40	0.33	0.34	0.85	0.34	0.26	107
Median	0.26	0.21	0.19	0.75	0.22	0.19	107
Trimmed mean, 10%	0.32	0.26	0.22	0.70	0.22	0.18	107

(b) Annual Changes

Series	Mean	Median	SD	Variability	RMSE	MAD	Observations
3-year moving average	4.8	4.9	0.62	0.13			
Headline	4.9	4.8	1.18	0.24	0.82	0.69	96
Excl. raw food	4.7	4.7	1.10	0.24	0.71	0.59	96
Excl. energy	5.2	5.3	1.17	0.23	0.95	0.79	96
Excl. raw food & energy	5.0	5.0	1.04	0.21	0.75	0.59	96
Median	3.1	3.2	0.90	0.29	1.84	1.75	96
Trimmed mean, 10%	3.9	4.0	1.02	0.26	1.11	0.96	96

Except for core measure excluding energy alone, other core series improve on the volatility of the CPI as indicated by the reduction in the standard deviation both at high (monthly) and low (annual) frequencies. The least volatile measure is the median, followed by the 10% trimmed mean and then the measure excluding both raw food and energy.

The reported RMSE and MAD statistics suggest that all core measures, except the series excluding energy, capture inflation trend better than the CPI when monthly changes are considered. As reported, the median and the 10% trimmed mean seem to underestimate the inflation trend, as indicated by their lower sample means. The discrepancy is particularly acute when using year on year changes. However, a large part of the underestimation—at least when using monthly inflation—is due to small discrepancies between the headline CPI and the CPI when calculated as a weighted average of the 31 components that we were able to identify. Much of this reported difference may disappear with data improvements. For the two core series excluding raw food and excluding both raw food and energy, the RMSE and MAD statistics for annual changes confirm that they capture inflation trend better than headline inflation for the period prior to the financial crisis. However, when the financial crisis is included in the sample period, the improvement in the ability to capture inflation trend becomes less obvious. This is likely to be a result of the unprecedented fluctuations in the exchange rate that causes in turn the usual fluctuations in inflation.

Treating the crisis as a nonrepresentative period, two core series—one excluding raw food and the other excluding raw food and energy—seem to outperform headline

inflation as an indicator of current underlying inflation. Similarly, also excluding indirect taxes, as suggested in Section 3, but only available over the shorter time period January 1992-June 1997, also seems to better measure underlying inflation (Table 5.3). Since indirect taxes make up only a small proportion relative to raw food and energy (roughly 1/3 to 1/2 of the combined weight of raw food and energy) and they are changed only infrequently, this core series behaves is similar to the inflation series excluding raw food and energy.

Table 5.3 :- Summary Statistics of Various Core Series, 1992:01-1997:06

(a) Monthly Changes

Series	Mean	Median	SD	Variability	RMSE	MAD	Observations
3-year moving average	0.39	0.39	0.05	0.13			
Headline	0.40	0.39	0.45	1.13	0.45	0.35	47
Excl. raw food	0.40	0.36	0.33	0.82	0.33	0.26	47
Excl. energy	0.42	0.44	0.48	1.15	0.48	0.38	47
Excl. raw food & energy	0.42	0.36	0.33	0.79	0.33	0.26	47
Excl. raw food, energy, taxes	0.42	0.36	0.33	0.79	0.33	0.26	47
Median	0.29	0.23	0.24	0.83	0.24	0.21	47
Trimmed mean, 10%	0.32	0.27	0.24	0.73	0.23	0.19	47

(b) Annual Changes

Series	Mean	Median	SD	Variability	RMSE	MAD	Observations
3-year moving average	4.8	4.7	0.56	0.12			
Headline	4.7	4.8	1.24	0.26	0.84	0.68	36
Excl. raw food	4.8	4.9	0.65	0.14	0.47	0.42	36
Excl. energy	4.9	5.2	1.22	0.25	0.91	0.77	36
Excl. raw food & energy	5.0	5.0	0.61	0.12	0.69	0.58	36
Excl. raw food, energy, taxes	5.0	5.0	0.58	0.12	0.66	0.55	36
Median	3.4	3.2	1.07	0.32	1.57	1.42	36
Trimmed mean, 10%	3.9	4.0	1.03	0.27	1.10	0.94	36

A good measure of core inflation should also be expected to serve as a good predictor of future inflation trends. To evaluate how well each core measure predicts the future inflation trend, we compare current core inflation with inflation 6, 12 and 18 months ahead (Table 5.4). Here again core measure excluding raw food and energy performs the best: it is the only core measure with RMSE and MAD statistics consistently lower than the corresponding values for headline inflation.

Table 5.4 :- Predictive Power of Core Measures, 1988:01-1997:06

(a) Monthly Changes

Deviation from future inflation trend	6 months ahead		12 months ahead		18 months ahead	
	RMSE	MAD	RMSE	MAD	RMSE	MAD
Headline	0.47	0.36	0.47	0.37	0.47	0.36
Excl. raw food	0.34	0.26	0.35	0.27	0.35	0.27
Excl. energy	0.48	0.39	0.49	0.39	0.48	0.38
Excl. raw food & energy	0.33	0.26	0.34	0.27	0.34	0.27
Median	0.23	0.20	0.24	0.21	0.25	0.22
Trimmed mean, 10%	0.23	0.18	0.23	0.19	0.24	0.20

(b) Annual Changes

Deviation from future inflation trend	6 months ahead		12 months ahead		18 months ahead	
	RMSE	MAD	RMSE	MAD	RMSE	MAD
Headline	0.89	0.75	1.08	0.91	1.34	1.16
Excl. raw food	0.88	0.69	1.13	0.90	1.39	1.15
Excl. energy	0.93	0.78	1.05	0.89	1.30	1.12
Excl. raw food & energy	0.81	0.66	1.01	0.85	1.27	1.09
Median	1.97	1.88	2.11	1.99	2.27	2.11
Trimmed mean, 10%	1.24	1.06	1.42	1.18	1.67	1.35

Another issue related to the predictive power of core measures is the fact that some prices in the CPI basket tend to lead other prices. This suggests that a larger proportion of lead items in the inflation measure will tend to improve its predictive power. We thus hope not to exclude lead items in the construction of core inflation. Unfortunately, lead prices tend to be those of raw materials and primary commodities such as raw food and fuel. We use Granger causality tests to determine whether or not a subcomponent of the CPI is likely to contain some leading information. If so, its monthly changes are then likely to Granger cause the monthly changes of the remaining CPI basket.

Causality test results in Table 5.5 suggest that raw food is likely to contain leading information, so the exclusion of raw food from core measure (whether or not energy is also excluded) is likely to result in some loss of timely price signals. This, however, is not necessarily in contradiction with the previous evidence that core measure excluding raw food and energy captures future inflation trend better than the CPI. In terms of forecasting power, there are both gain and loss from the exclusion of raw food prices. The gain comes from removing “noises”, and it can be substantial. The loss, on the other hand, comes from the fact that transitory movements in the price of raw food can effect subsequent permanent changes in the price of goods using raw food as input, especially when price adjustments

cannot be carried out costlessly for those goods (e.g., there are menu costs). Thus, ideally we would want to exclude just the part of raw food price changes that have *no* permanent effect on other prices to fully preserve the leading signals and maximize the forecasting power.

There is, however, no supportive evidence that energy prices by themselves lead other prices in the CPI basket. Indirect taxes, especially the VAT, are somewhat likely to effect subsequent changes in the general price level beyond the tax incidence, but controlled prices are likely to lag rather than lead other prices. The latter is expected since controlled prices are generally kept low to ameliorate the inflationary burden on consumers, and are adjusted upward when they have already lagged substantially behind the general price increase.

Table 5.5 :- P-values for Granger Causality Tests of Month-on-Month Changes
Seasonal adjustments for price series where applicable

Sample period	1987:02-1999:12		1992:02-1999:12	
Excluded items (lag periods)	Excluded items → Core	Core → Excluded items	Excluded items → Core	Core → Excluded items
Food				
(3)	0.44	0.15	0.06	0.02
(6)	0.11	0.56	0.01	0.09
(12)	0.47	0.76	0.09	0.12
(24)	0.60	0.53		
Raw food				
(3)	0.36	0.09	0.05	0.18
(6)	0.08	0.24	0.01	0.46
(12)	0.34	0.41	0.02	0.69
(24)	0.30	0.79		
Energy				
(3)	0.64	0.78	0.58	0.43
(6)	0.28	0.28	0.27	0.07
(12)	0.43	0.77	0.29	0.29
(24)	0.32	0.18		
Raw food & energy				
(3)	0.20	0.50	0.04	0.51
(6)	0.02	0.83	0.01	0.36
(12)	0.04	0.24	0.01	0.18
(24)	0.02	0.90		
Controlled prices				
(3)	0.92	0.13	0.89	0.09
(6)	0.72	0.14	0.39	0.09
(12)	0.66	0.07	0.63	0.05
(24)	0.63	0.08		
VAT				
(3)			0.33	0.63
(6)			0.04	0.69
(12)			0.15	0.82
Excise taxes				
(3)			0.30	0.10
(6)			0.43	0.00
(12)			0.44	0.00
Indirect taxes				
(3)			0.22	0.80
(6)			0.02	0.67
(12)			0.05	0.84

Is the core measure more controllable through monetary policy?

By removing the transitory movements which might obscure the fundamental link between monetary policy variables and inflation, a core measure should help us tighten the estimates of the relationship between policy and its target. In particular, a link between monetary policy instruments such as short-term interest rates and core measure should be clearer than the corresponding link between monetary policy instruments and the CPI. And such clearer link would imply that the core measure reflects more closely the part that is responsive to monetary policy.

We estimate the relationship between changes in short-term interest rates and various measures of inflation. Table 5.6 reports the regression results for the period February 1992-December 1999. All core measures consistently improve on the goodness of fit, as indicated by higher R^2 statistics. This implies that the variance in core inflation tends to be more closely associated with changes in policy variables, and thus core inflation is more controllable through policy instruments. Among the four core measures tested, the one which excludes raw food, energy and taxes seems to be the most controllable, followed closely by core measure excluding raw food and energy. The regression results (not shown) also suggest that the 1-month RP rate outperforms the 1-day and 1-week RP rates as policy instrument. This is expected since the shorter-run interest rates are more likely to be used for shorter-run policy purposes such as stabilizing the exchange rate. Therefore, they tend to be more volatile and less indicative of the long-term policy to control inflation.

Does the core measure improve the credibility of the monetary authority?

Finally we evaluate how likely each core measure will help improve the credibility of the monetary authority. To the extent that all core measures are more controllable by monetary policy than the CPI, adopting core inflation as a policy target will raise the chance of the monetary authority "hitting the target right". However, the issue of credibility extends beyond this technical consideration. A good core measure should also be easy to comprehend in the eyes of the public. More importantly, the public must also feel that they can relate to it, in particular that the core measure captures well their cost of living.

The exclusion of predetermined items is straightforward and is likely to be easily understood. In addition, many countries have long adopted this technique in the calculation of core inflation, so the public is like to be quite comfortable with this approach. The concept of trimmed mean is slightly more complicated, and at first the public may be suspicious of the fact that this approach trims different items at different points in time. However, if the sub-indices of the CPI become public information so that anyone can crosscheck the calculation of core inflation, the public should soon feel that this technique is also transparent and thus become less suspicious over time.

Table 5.6 :- Estimated Results of Regression

$$\Pi_{yoy,t} = \beta_0 + \Sigma_{k=24..36}\, \beta_k\, \Delta RP1month_{t-k} + u_t$$

Sample period	1990:01-1999:08				
Inflation measure	Headline	Excl. raw food & energy	Excl. raw food, energy & taxes	Median	Trimmed mean 10%
β_0	**4.702 (0.638)**	**4.997 (0.447)**	**4.770 (0.273)**	**3.205 (0.313)**	**3.858 (0.426)**
β_{24}	-0.249 (0.219)	-0.201 (0.141)	-0.055 (0.092)	-0.085 (0.098)	-0.133 (0.141)
β_{25}	-0.290 (0.258)	-0.193 (0.168)	-0.070 (0.101)	-0.094 (0.110)	-0.147 (0.168)
β_{26}	-0.435 (0.241)	**-0.345 (0.153)**	-0.122 (0.089)	-0.198 (0.099)	-0.275 (0.154)
β_{27}	-0.416 (0.231)	**-0.352 (0.154)**	-0.119 (0.082)	**-0.209 (0.103)**	-0.281 (0.151)
β_{28}	-0.450 (0.284)	**-0.392 (0.196)**	**-0.219 (0.101)**	-0.210 (0.132)	-0.291 (0.192)
β_{29}	-0.398 (0.251)	**-0.397 (0.183)**	**-0.225 (0.104)**	**-0.247 (0.113)**	-0.307 (0.171)
β_{30}	-0.304 (0.312)	-0.337 (0.227)	-0.227 (0.140)	-0.170 (0.149)	-0.228 (0.208)
β_{31}	-0.160 (0.234)	-0.239 (0.177)	-0.268 (0.143)	-0.109 (0.128)	-0.141 (0.166)
β_{32}	-0.316 (0.304)	-0.398 (0.210)	**-0.333 (0.131)**	-0.174 (0.152)	-0.238 (0.203)
β_{33}	-0.256 (0.273)	-0.314 (0.183)	**-0.363 (0.118)**	-0.178 (0.147)	-0.215 (0.188)
β_{34}	-0.309 (0.258)	**-0.410 (0.170)**	**-0.359 (0.097)**	-0.248 (0.138)	-0.311 (0.179)
β_{35}	-0.090 (0.281)	-0.117 (0.185)	-0.148 (0.103)	-0.016 (0.140)	-0.040 (0.181)
β_{36}	-0.216 (0.359)	-0.262 (0.246)	**-0.233 (0.106)**	-0.184 (0.179)	-0.225 (0.239)
R^2	0.25	0.40	0.41	0.29	0.28
Adjusted R^2	0.07	0.25	0.27	0.12	0.11
No. of observations	69	69	69	69	69

NB: Standard errors calculated using Newey-West method. **Bold font** denotes statistical significance at 5%

Table 5.7 :- Weights of Excluded Items

Core Measures	1994:01	1998:01	1999:08	1994:01-1999:12
CPI excluding				
Food	0.39	0.35	0.35	0.38
Raw food	0.18	0.15	0.15	0.17
Energy	0.06	0.06	0.06	0.06
Raw food & energy	0.24	0.21	0.21	0.23
Controlled prices*	0.06	0.06	0.06	0.06
Indirect taxes	0.08	0.11	0.09	0.09
Raw food, energy, taxes	0.30	0.30	0.29	0.31
Median	1.00	1.00	1.00	1.00
Trimmed mean 10%	0.20	0.20	0.20	0.20

* Controlled items include electricity, public water, telephone, public hospital

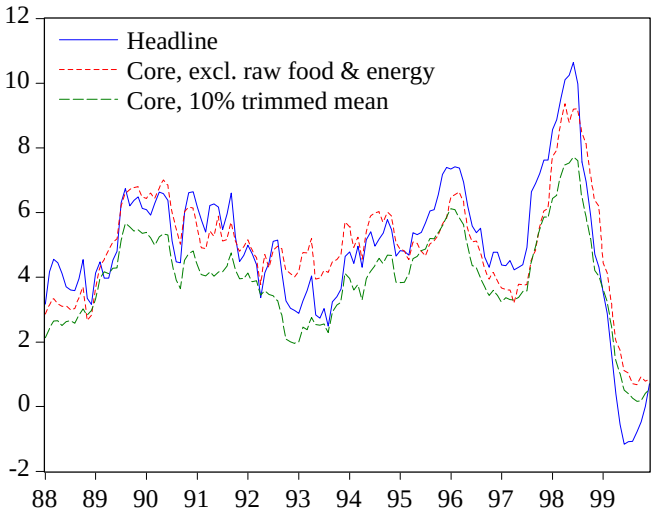
A good core measure should also be perceived by the public as a good capture of their basket of consumption. One consideration is that the core measure should not exclude too large a portion of the CPI basket, and Table 5.7 reports the total weight of excluded items for each core measure. Another consideration is that the core measure closely reflects the cost of living. Given that at present the most widely accepted cost of living index for Thailand is the CPI, a core measure which deviates significantly from the CPI is likely to be criticized as a poor index of welfare, and the public will be highly critical if it is adopted as a policy target. By comparing the long-term mean of each core measure with that of headline inflation (Tables 5.1-5.3), the trimmed mean and the median would be considered rather poor choices for policy target in this respect.

6. Conclusion

Table 6.1 :- Summary of Core Measure Performance

Criteria	Inflation measure	Excl. raw food	Excl. energy	Excl. raw food & energy	Excl. raw food, energy & taxes	Median	Trimmed mean 10%
Accuracy in capturing trends	Decline in volatility						
	- of monthly changes	Yes	Yes	Yes	Yes	Yes	Yes
	- of annual changes	Yes	No	Yes	Yes	Yes	Yes
	Good match of current inflation trend	Yes	No	Yes	Yes	No	No
	Good forecast of future trend	No	No	Yes		No	No
Controllability	Improved relationship with monetary policy variables			Yes	Yes	Yes	Yes
Public approval	Ease of understanding	Yes	Yes	Yes	Yes	Yes	Yes
	Transparency of methodology	Yes	Yes	Yes	Yes	Yes	Yes
	Proportion of excluded items	Fairly low	Very low	Fairly low	Low	High	Fairly low

Figure 6.1 :- Comparison of Various Annual Inflation Measures



References

Alvarez, Luis J., and M[a] de los Llanos Metea. 1999. "Underlying Inflation Measures in Spain." *Measures of Underlying Inflation and Their Role in the Conduct of Monetary Policy*. Bank of International Settlements, Basel, Switzerland.

Bryan, Michael F., and Stephen G. Cecchetti. 1993. "Measuring Core Inflation." NBER Working Paper No. 4303. National Bureau of Economic Research, Cambridge, Massachusetts, USA.

Bryan, Michael F., Stephen G. Cecchetti, and Rodney L. Wiggins, II. 1997. "Efficient Inflation Estimation." NBER Working Paper No. 6183. National Bureau of Economic Research, Cambridge, Massachusetts, USA.

Johnson, Marianne. 1999. "Core Inflation: A Measure of Inflation for Policy Purposes." *Measures of Underlying Inflation and Their Role in the Conduct of Monetary Policy*. Bank of International Settlements, Basel, Switzerland.

Quah, D., and S. Vahey. 1995. "Measuring Core Inflation." The Centre for Economic Performance, The London School of Economics, London, U.K.

บทสรุปผู้บริหาร

1. อัตราเงินเฟ้อพื้นฐาน (core inflation) ที่หักหมวดอาหารสดและหมวดพลังงานน่าจะเป็นเป้าหมายในการดำเนินนโยบายการเงินที่ดีกว่าอัตราเงินเฟ้อ (headline inflation) เนื่องจากอัตราเงินเฟ้อพื้นฐานดังกล่าวขจัดการเปลี่ยนแปลงของระดับราคาที่เกิดจากปัจจัยด้านอุปทานซึ่งโดยรวมมีความผันผวนมากและไม่สามารถควบคุมได้ด้วยนโยบายการเงิน ดังนั้นอัตราเงินเฟ้อพื้นฐานจึงสะท้อนแนวโน้มระยะยาวของเงินเฟ้อได้ชัดเจนกว่า และการเปลี่ยนแปลงอัตราดอกเบี้ยระยะสั้นของ ธปท. สามารถควบคุมอัตราเงินเฟ้อพื้นฐานได้ดีกว่าอัตราเงินเฟ้อ

2. การเปลี่ยนแปลงอัตราภาษีมูลค่าเพิ่มมีผลกระทบค่อนข้างสูงต่อระดับราคา แต่ไม่ได้สะท้อนแรงกดดันด้านอุปสงค์และไม่มีผลในระยะยาวต่ออัตราเงินเฟ้อ ดังนั้นจึงขอเสนอทางเลือกดังนี้

    2.1 ให้มี escape clause ในกรณีที่มีการเปลี่ยนแปลงอัตราภาษีมูลค่าเพิ่ม หรือ

    2.2 ประกาศเป้าหมายของนโยบายการเงินเป็นกรณี ขึ้นอยู่กับการเปลี่ยนแปลงอัตราภาษีมูลค่าเพิ่ม หรือ

    2.3 หักภาษีมูลค่าเพิ่ม (และภาษีทางอ้อมอื่นๆ เช่น ภาษีสรรพสามิต) ออกจากการคำนวณอัตราเงินเฟ้อพื้นฐาน อย่างไรก็ตาม แนวทางนี้ต้องพิจารณาถึงความเหมาะสมของข้อสมมุติเกี่ยวกับภาระภาษีที่ตกกับผู้บริโภคและระยะเวลาการส่งผ่านผลกระทบของการเปลี่ยนแปลงอัตราภาษีไปสู่ราคาผู้บริโภคด้วย

3. กระทรวงพาณิชย์ควรเป็นหน่วยงานที่จัดทำและประกาศอัตราเงินเฟ้อพื้นฐาน เพื่อความโปร่งใสของการดำเนินนโยบายการเงิน

4. ธปท. ควรเร่งผลักดันให้กระทรวงพาณิชย์จัดทำอัตราเงินเฟ้อพื้นฐานโดยเร็ว และควรร่วมทบทวนวิธีการจัดทำในรายละเอียดกับกระทรวงพาณิชย์ โดยเฉพาะการแก้ไขปัญหาที่เกิดจากการปรับน้ำหนักของตะกร้าสินค้าผู้บริโภค ซึ่งพบว่าหากเป็นการปรับมาก (เช่น การปรับน้ำหนักของหมวดข้าว แป้ง และผลิตภัณฑ์จากแป้งจากฐานปี 2533 เป็นฐานปี 2537) อาจส่งผลให้อัตราเงินเฟ้อพื้นฐานแสดงความผิดปกติได้

5. อย่างไรก็ตาม ในขณะที่กระทรวงพาณิชย์ยังอยู่ในระหว่างเตรียมการนั้น ...