SURVEY MEASURES OF INFLATION EXPECTATION

Endy Dwi Tjahjono
Harmanta
Nur M. Adhi Purwato [1]

Abstract

The research objective was to analyze various survey measures of inflation expectation in Indonesia. We found that the heterogeneity of inflation expectationamong economic agents and professional forecastersfor short forecast horizon is very low. Survey measures of inflation expectation appear to be forward looking, but only for relatively short horizon. Although the magnitude and length vary across measures of inflation expectation, we find that shock to inflation expectation significantly affect the dynamics of the actual inflation rate. Based on the accuracy, the effect on actual inflation and directional information that they have in predicting current and future inflation, inflation expectation from Consensus Forecast outperformed the others.

Keywords: Inflation expectation, Vector Auto Regression, balanced score.
JEL Classification: C42, E31.

1 Endy Dwi Tjahjono (endydt@bi.go.id), Harmanta (harmanta@bi.go.id), and Nur M. Adhi Purwato (adhipd@bi.go.id) are researchers in BRE-DKM Bank Indonesia and are responsible for the results and opinions presented in this paper. We would like to express our gratitude to Mr. Perry Warjiyo, Mr. Iskandar Simorangkir, and other researchers in BRE-DKM that have made contributions in this research.

I. INTRODUCTION

The important role of inflation expectation in determining the level of inflation has been accepted as an important premise in inflation targeting countries. Recent research in Indonesia, done by Alamsyah (2008), showed that after the crisis (2000-2007) Indonesia's inflation have shifted from a more backward looking behavior (1985-1997) to a more forward looking one. This finding is also confirmed by Harmanta (2009) that conclude that there is an increase in central bank's credibility after the implementation of full fledges Inflation Targeting Framework (third quarter of 2005) that make inflation formation to be more forward looking. In addition, according to Gnan et al. (2009), well-anchored low inflation expectations are widely regarded as an important indicator of a central bank's credibility regarding its price stability commitment. These arguments emphasized the importance of inflation expectation measures as one of critical information needed by Bank Indonesia as a monetary authority.

In general, there are three ways from which we can get measures of inflation expectation, first, survey among economic agents, second, survey among professional forecasters, and third, information from financial market.Deriving inflation expectation from financial market information has been extensively explored by researchers in Bank Indonesia. Laksmono et al. (2000) tried to derive inflation expectation from nominal deposit rate. Unfortunately, the researchers believe that the model is not robust and cannot be used to measure inflation expectation. According to the researchers, this may be caused by the insignificant influence of inflation in determining the deposit rate. Wuryandani (2001) used SVAR method that is based on Fisher equation to extract inflation expectation from nominal deposit rate. Based on research, done by Wuryandani et al. (2003), this measure was outperformed by SKDU measure of inflation expectation with regard to its ability to estimate future inflation. The most recent research that attempted to derive inflation expectation from financial market information was done by Kurniati and Sahminan (2008). In this research, inflation expectation was extracted from *Surat Utang Negara* (SUN) yields. Anwar and Chawwa (2008) found that this method also produce unsatisfactory measures of inflation expectation since SUN yields are mostly influenced by the movement in policy rate and market perception regarding fiscal condition.

In this research we will focus our attention to the first two methods of measuring inflation expectation which are survey among economic agents and professional forecasters. A number of empirical studies in developed countries found that economic agents' inflation expectations are heterogeneous. In addition, Gnan et al (2009) argue that Inflation expectation across various sectors or agents may influence each other. Analyzing survey measures of inflation expectation enable us to test two previous hypotheses that have been proven empirically in the developed countries.

To be precise, there are 4 empirical research questions that we try to answer, (i) are there any variations among inflation expectations of different economic agents and are there any inflation expectation spillovers among different economic agents?, (ii) are survey measures of

inflation expectation related to past, present or future inflation?, (iii) do survey measures of inflation expectation affect actual Inflation and how important are shocks to inflation expectations for actual inflation dynamics? And (iv) do survey data provide useful directional information regarding current and future level of inflation?In addition, we will also examine whether the available survey measures of inflation expectation are sufficient for monetary policy purposes, in terms of variety of agents and term structure of inflation expectation availability.

Second part of this paper analyzes the theoretical and empirical literatures, and part three explain the methodology. Result and analysis will be presented on chapter four, while conclusion will close the presentation.

II. THEORY

2.1 New Keynesian Phillips Curve

In the late 1950s, A.W. Phillips documented a statistical relationship between wage inflation and unemployment in the UK. This relationship was then also found to work well for price inflation and for other economies (Whelan, 2005). This statistical relationship is widely known as Phillips Curve which basically said that there is an inverse relationship between inflation and unemployment. In 1968, Milton Friedman criticizes the Phillips Curve in relation to its treatment of expectation. In addition to that, the stagflation which is a combination of high inflation and high unemployment in the 1970s seems to support Friedman critique toward Phillips Curve.

Keynesian economists responded to this critique and attempt to build models that incorporate rational expectations and that provide a microeconomic justification for monetary policy having at least a short run effect. They come up with sticky prices assumption in which made possible the condition of not all markets are clearing at once, and aggregate output may sometimes be below what would be obtained when all prices move flexibly. One of the widely known versions of sticky prices formulation is *Calvo Pricing*. Whelan (2005) argue that although this formulation is not the most realistic one, it turns out to provide analytically convenient expressions, and has implications that are very similar to those of more realistic but more complicated formulations. Calvo assumed that in each period, only a random fraction of firms (1- θ) are able to reset their price while all other firms keep their prices unchanged. If firms do get to reset their price, they must take into account that the price may be fixed for many periods. A firm chooses their price (z_t) that minimizes the following loss function:

$$L(z_t) = \sum_{k=0}^{\infty} (\theta\beta)^k E_t (z_t - p^*_{t+k})^2 \qquad (1)$$

Where $\beta < 1$ is the discount factor, and p^*_{t+k} is the optimal price that the firm would set in period $t+k$ in the absence of price rigidity

Differentiating this loss function with respect to z_t will result in the optimal reset price equation as follows:

$$z_t = (1 - \theta\beta) \sum_{k=0}^{\infty} (\theta\beta)^k E_t(\mu + mc_{t+k}) \tag{2}$$

This expression is achieved by assuming that the optimal price is set as a fixed markup over marginal cost:

$$p_t^* = \mu + mc_t \tag{3}$$

The aggregate price level is:

$$p_t = \theta p_{t-1} + (1 - \theta) z_t \tag{4}$$

By defining inflation rate as: $\pi_t = p_t - p_{t-1}$, we will get the following expression:

$$\pi_t = \beta E\pi_{t+1} + \frac{(1-\theta)(1-\theta\beta)}{\theta}(\mu + mc_t - p_t) \tag{5}$$

This expression is the New Keynesian Phillips Curve (NKPC) in which inflation is a function of next period inflation expectation and real marginal cost $(mc_t - p_t)$.

In reality, we cannot observe real marginal cost. Since marginal cost is pro-cyclical, many researchers use output gap (y_t) in the NKPC equation, so that the equation becomes:

$$\pi_t = \beta E\pi_{t+1} + \frac{(1-\theta)(1-\theta\beta)}{\theta} y_t \tag{6}$$

Gali and Gertler suggest a "hybrid" version of New Keynesian Phillips Curve which, in addition to the same assumptions we mentioned before, includes also a fraction of firms that set prices according to rule of thumb that depends on lagged inflation (Whelan, 2005). This suggestion is based on the poor empirical performance of NKPC, and an effort to incorporate the belief of many economists that current level of inflation is a function of its own lagged values. The expression for the "hybrid" NKPC is:

$$\pi_t = \lambda_b \pi_{t-1} + \lambda_f E\pi_{t+1} + \frac{(1-\theta)(1-\theta\beta)}{\theta} y_t \tag{7}$$

2.2 Criteria of Inflation Expectation Information needed by Monetary Authorities

A number of empirical studies find that economic agent inflation expectations are heterogeneous. Economic agents or sectors may differ in the way they form inflation expectations, which may result in persistent differences in inflation expectations. Mankiw et al. (2003) stated that Inflation expectation heterogeneity varies over time, moving with inflation, the variability of inflation and the variability of relative prices.

From the central bank point of view, the aims of monitoring inflation expectation are to obtain indications about the credibility of the central bank commitment to safeguarding price stability, and to collect information about future price dynamics overtime. Depending on the purpose, the type of agents whose expectations are monitored may differ (Gnan et al, 2009). Gnan also stated that monetary authority should simultaneously monitor inflation expectation of various sectors and agents (households, wage setters, price setters, financial markets and professional forecaster) because:

1. The appropriate monetary policy response may differ depending on the sector from which an expectation shocks originate
2. The central bank should monitor its credibility across a broad range of economic agents or sectors
3. Inflation expectation across various sectorsor agents may influence each other

In many economic models, monetary policy shows it most powerful effects on inflation over time horizon of two to three years (UK and US data). According to Gnan et al (2009), inflation expectation up to 12 months likely say more about price level effects than about monetary policy credibility. In contrast,Landau (2009) argue that monetary policy and the related communication should simultaneously consider inflation expectations over various time horizons and not be content with anchoring very long-term inflation expectation alone. Research done by Dewati, Suryaningsih and Chawwa (2009) conclude that a shock in the form of an increase in real SBI rate will be responded by a decrease in inflation in the next quarter up until next 4 quarters, with most effect is in the next 2 quarters. From this we can conclude that, for the case of Indonesia, it is desirable for Bank Indonesia to have term structure information on the dynamic development of inflation expectation for the next 1 to 4 quarters horizons.

III. METHODOLOGY

For the purpose of analyzing the behavior of the survey data (heterogeneity and spillovers among different indicators) and its correlation to the actual inflation, we use graphical analysis, correlation analysis and granger causality test. To examine whether survey measures of inflation expectation have an effect on the dynamic of the actual inflation, we use VAR (Vector Auto

Regression) analysis. And to analyze the potential directional information of survey measures of inflation expectation in predicting current and future level of inflation, we compare the additional predictive power of a simple inflation model if we add each inflation expectation measure as one of the independent variables in the model.

We use survey data that are published by *Direktorat Statistik Ekonomi dan Moneter* - Bank Indonesia for *Survei Konsumen* (SK), *Survei Penjualan Eceran* (SPE) and *Survei Kegiatan Dunia Usaha* (SKDU). For analysis in this paper, we use only quarterly inflation expectations from Consensus Forecast that are published by Consensus Economics. In addition to quarterly inflation expectations, Consensus Forecast also published current and next year inflation expectations every month. But this data have very limited usefulness since they do not have a fixed forecast horizon, and in order to correctly analyze the behavior of this data with regards to the relationship with other survey data and actual inflation, we need to treat the data separately according to the month they were published. This will result in a very short data point's availability. Summary of information regarding all the surveys that we use in this research are presented in Table 1.

For actual inflation data (*qtq* and *yoy*), we use inflation rate that are published by Statistic Indonesia (BadanPusatStatistik, BPS). We calculate the 6 month inflation rate based on Consumer Price Index published by BPS. We acquired quarterly Terms of Trade data from SOFIE (Short Term Forecast for Indonesian Economy) Model. Output Gaps (quarterly) are calculated using multivariate process based on unemployment and capacity utilization approach. Detailed explanation of this approach is available in Tjahjono et al. (2009).

The availability of the survey data are based on the availability of the data as published by DSM (for SK, SPE, SKDU and SPP). For Consensus Forecast, the availability of the data are based on the availability of the data in Bank Indonesia's Research Library (for hardcopy) and Bank Indonesia Library's website (for softcopy)

As summarized on Table 1, in Indonesia, there are various measures of inflation expectations from various economic agents. For each agent, usually there are various time horizons reported:

- SK and SPE have information about price level for the next 3 and 6 months (next 1 and 2 quarter).
- SKDU have information about price level for the next quarter (all publications), next 2 quarter inflation expectation (in second quarter publications), next 3 quarter inflation expectation(in first quarter publications), and next 4 quarter inflation expectation (in fourth quarter publications).
- SPP have information regarding next quarter inflation expectation (all publications), next 2 quarter inflation expectation (in second quarter publications), next 3 quarter inflation expectation (in first quarter publications), and next 4 quarter inflation expectation (in fourth quarter publications).

Table 1.
Summary of the Surveys that Contain Inflation Expectation Data

Survey among Economic Agents

Indicator	Agents	Frequency	Data	Time Horizon (in quarter)	Availability
Survei Konsumen (SK)	Consumers	Monthly	1. Next Quarter Price Change (Index)	*t+1*	Every Month since January 2006
			2. Next two Quarter Price Change (Index)	*t+2*	Every Month since March 2003
Survei penjualan eceren (SPE)	Retailers	Monthly	1. Next Quarter Price Change (Index)	*t+1*	Every Month since January 2002
			2. Next two Quarter Price Change (Index)	*t+2*	Every Month since January 2002
Survei Kegiatan Dunia Usaha (SKDU)	Firms	Quarterly	1. Next Quarter Price Change (Index)	*t+1*	Every Quarter since 1999-Q1
			2. End of year Inflation Expectation (% yoy)	*t+1, t+2,t+3*	for each t+k horizon, every Q(4-k), since 2003 Q1
			3. Next of year Inflation Expectation (% yoy)	*t+4*	Every Q4, since 2003 Q4

Survey among Professional Forcasters/Economists

Indicator	Agents	Frequency	Data	Time Horizon (in quarter)	Availability
Survei Persepsi Pasar (SPP)	Professional Forcasters/ Economists	Quarterly	1. Next Quarter Inflation (% yoy, range)	*t+1*	Every Quarter, since 2004Q2
			2. End of year Inflation Expectation (% yoy, range)	*t+1, t+2, t+3*	for each t+k horizon, every Q(4-k), since 2004Q2
			3. Next year Inflation Expectation (% yoy,yoy)	*t+4*	Every Q4, since 2004Q2
Consensus Forecsat (CF)	Professional Forcasters	Monthly	1. End of year Inflation Expectation (% yoy)	Various	Since Dec-2000
			2. Next year Inflation Expectation (% yoy)	Various	Since Dec-2000
			Next 1 to 6 quarter inflation Expectation (% yoy)	*t+1, t+2, t+3, t+4, t+5, t+6*	Every Quarter since 2000-Q4

Notes:
The availability of the survey data are based on the availability of the data as published by DSM (for SK, SPE, SKDU and SPP). For Consensus Forecast, the availability of the data are based on the availability of the data in Bank Indonesia's Research Library (for hardcopy) and Bank Indonesia Library's website (for softcopy)

- CF has information regarding inflation expectation for 1 to 6 quarter a head horizons. Other than that, it also has monthly data on current year inflation expectation and next-year inflation expectation (average of *yoy* monthly inflations).
- From all the surveys, CF is the only one which gives us a complete term structures of inflation expectation dynamics for the next 1 to 4 quarter horizons. It would be ideal if Bank Indonesia have the same kind of information from the other surveys. As will be apparent in the next chapters, analyzing the relationship among various survey measures of inflation expectation would require that those surveys have compatible measurements and forecast horizons.

Worth to note on CF measures of inflation expectation, the quarterly *yoy* inflation expectations published by CF are actually the average of monthly *yoy* inflation forecast of a particular quarter, not the *yoy* inflation forecast of the last month of the quarter. This will complicate analysis in a way that these measures are not compatible with any other measurement from the other surveys. But considering that the level of fluctuation or variance among monthly *yoy* inflation in each quarter are relatively low, in this paper, we will examine also the accuracy, correlation and additional predictive power of CF measures by assuming that these measures are compatible with end of quarter *yoy* inflation expectation (in addition to assuming them as compatible with the average monthly *yoy* inflation expectation of each quarter).

As shown in Table 1, there are two types of inflation expectation data that we get from the surveys, balance scores (SK,SPE,SKDU) and Inflation rates(Consensus Forecast, SPP, SKDU_end of year inflation). The survey that uses balance scores are measuring price movement of the next 3 or 6 months period, while survey that uses inflation rate are measuring *yoy* inflation for

Table 2.
Modified Balance Score

				For SK6m and SPE6m				For SKDU			
T_Survey	T_forecast	SBT	SBT_yoy	T_Survey	T_forecast	SBT	SBT_yoy	T_Survey	T_forecast	SBT	SBT_yoy
Oct-06	Jan-07	168.02	652.01	Mar-07	Sep-07	174.10	332.54	2000-1	2000-2	17.24	60.21
Nov-06	Feb-07	154.17	643.70	Apr-07	Oct-07	174.03	339.08	2000-2	2000-3	15.80	61.26
Dec-06	Mar-07	163.97	648.73	May-07	Nov-07	174.08	332.60	2000-3	2000-4	19.45	61.01
Jan-07	Apr-07	163.33	640.71	Jun-07	Dec-07	175.41	338.64	2000-4	2001-1	12.88	65.38
Feb-07	May-07	173.58	644.05	Jul-07	Jan-08	177.06	342.79				
Mar-07	Jun-07	165.53	650.63	Augst-07	Feb-08	175.51	349.20				
Apr-07	Jul-07	164.62	652.56	Sep-07	Mar-08	174.23	348.33				
May-07	Augst-07	164.08	654.38								
Jun-07	Sep-07	167.96	661.99								
Jul-07	Oct-07	174.38	670.35								

If we assume that the index (SBT) is a measure of price movement expectation of agent from the time of the survey until the next three month, then we can get a measure of next 3 month yoy inflation expectation of agent by adding 3 previous index (with 3 month lag each) with the current index.

If we assume that the index (SBT) is a measure of price movement expectation of agent from the time of the survey until the next 6 month, then we can get a measure of next 6 month yoy inflation expectation of agent by adding 1 previous index (with 6 month lag) with the current index.

If we assume that the index (SBT) is a measure of next quarter inflation expectation (qtq), then we can get a measure of next quarter yoy inflation expectation of agent by adding 3 previous index with the current index.

a particular horizon. The two measurements are not compatible one another. For comparison purposes, we modified the balance scores so that they are compatible to *yoy* inflation expectation measures. This is done by adding the previous balance scores to the current balance score. A detailed modification method is explained in below. As we will see in the next chapters, this modification can reasonably mimic the movement of the actual *yoy* inflation.

IV. RESULT AND ANALYSIS

4.1 Correlation, Heterogeneity and Spillovers of Inflation Expectation among Survey Data

As shown in Table 3, all surveys that use either balance scores or inflation rates measurement have significant correlation with actual inflation at the intended forecast horizon. The correlation with actual inflation decreases as the forecast horizon increases.

Table 3.
Correlation of Survey Measures of Infllation Expectation with Actual Inflation

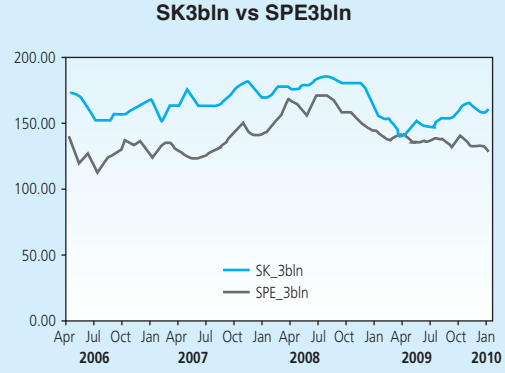
Correlation between balance score and actual price movement				Cerrelation between inflation forecast/ expectation and actual inflation	
	Inflation_qtq	Inflation_6m			Inflation_yoy
				CF_1Q	0.7658
SK3bln	0.53	-		CF_2Q	0.5247
SK6bln	-	0.29		CF_3Q	0.2025
SPE3bln	0.43	-		CF_4Q	-0.2003
SPE6bln	-	0.25		CF_5Q	-0.3097
SKDU	0.49	-		CF_6Q	-0.4344

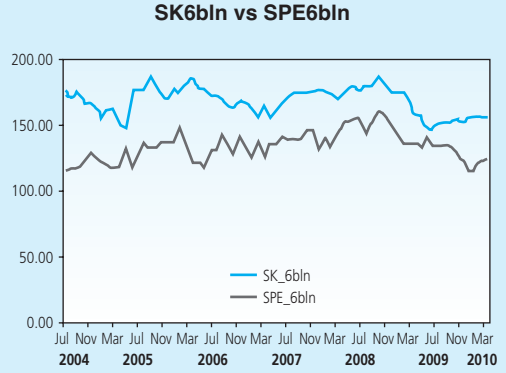
Many empirical studies in developed countries have found that inflation expectations of different economic agents are heterogeneous, and this heterogeneity varies over time, moving with inflation, the variability of inflation and the variability of relative prices. In this section, we will examine the heterogeneity of inflation expectation measures from various economic agents. In addition, we will also try to capture any indications of spillover between a certain agent inflation expectations to the others.

Based on the assumed availability of information regarding price movement that economic agents have, we expect that firms' inflation expectation influence retailers' inflation expectation. As producers of goods and services, firms should have firsthand information regarding their future pricing plan. The next group of agents that received this information should be the retailers and then the consumers. Based on the same argument, we also expect retailers' inflation expectation influence consumers' inflation expectation. Granger causality test and lead/lag correlation are the methods of choice to test these hypotheses. For this purpose, we will group Inflation expectation data with compatible measurements and time horizons:

- SK 3 month and SPE 3 month - Monthly Data
- SK 6 month and SPE 6 month - Monthly Data
- SK 3 month, SPE 3 month and SKDU - Quarterly Data
- SKDU (*yoy* modified), Consensus Forecast 1 Quarter – Quarterly Data
- Consensus Forecast 1 Quarter and SPP 1 Quarter- Quarterly Data
- SKDU's end of year inflation expectation and SPP's endof year inflation expectation -Quarterly Data

For next 3 and 6 month price movement expectation (monthly data), we have 2 indicators, based on consumers (SK) and retailers (SPE) surveys. As we can see from Figure 1, for 3 month price movement, both indicators shows significantly high correlation, with the highest correlation is between price movement expectation of consumer at time t and price movement expectation of retailers at time *t-1*. From this we can conclude that retailers price movement expectation lead consumer price movement expectation by 1 month. For 6 month price movement expectation, the same thing happens in which retailers' expectation lead consumers' expectation





Correlation	SK_3bln
SPE_3bln-2	0.5592
SPE_3bln-1	**0.6562**
SPE_3bln	0.6554
SPE_3bln+1	0.6353
SPE_3bln+2	0.6137

Correlation	SK_3bln
SK_3bln-2	0.5281
SK_3bln-1	0.6082
SK_3bln	0.6554
SK_3bln+1	**0.6687**
SK_3bln+2	0.5453

The Result of Granger Causality Test

SK3bln	granger cause	SPE3bln	X
SP3bln	granger cause	SK3bln	✓
SK6m	granger cause	SPE6m	X
SPE6m	granger cause	SK6m	✓

Correlation	SK_6bln
SPE_6bln-6	0.0163
SPE_6bln-5	0.1326
SPE_6bln-4	0.2574
SPE_6bln-3	0.312
SPE_6bln-2	0.3817
SPE_6bln-1	**0.4386**
SPE_6bln	0.3509
SPE_6bln+1	0.3825
SPE_6bln+2	0.3558
SPE_6bln+3	0.3661
SPE_6bln+4	0.3997
SPE_6bln+5	0.4356
SPE_6bln+6	0.3712

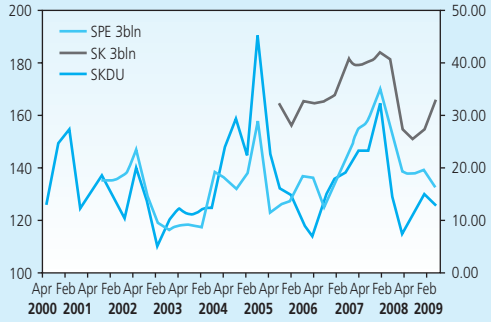
Correlation	SK_6bln
SPE_6bln-6	0.0939
SPE_6bln-5	0.2332
SPE_6bln-4	0.251
SPE_6bln-3	0.2826
SPE_6bln-2	0.3155
SPE_6bln-1	0.3735
SPE_6bln	0.3509
SPE_6bln+1	**0.4219**
SPE_6bln+2	0.3577
SPE_6bln+3	0.2762
SPE_6bln+4	0.1881
SPE_6bln+5	0.0119
SPE_6bln+6	-0.1039

Figure 1. Correlation of Inflation Expectation from Consumer Survey and Retailer Survey (Original balance scores)

by 1 month. From correlation analysis and granger causality test, we can see that there is a possibility of inflation expectation's spillover from retailers to consumers.

Fornext quarter price movement expectation, we have 3 indicators, based on consumers, retailers and firms surveys. As we can see in Figure 2, all indicators show significantly high correlation at time t. Since we use quarterly data, we do not see the same phenomenon as in the monthly data in which retailers' expectation lead consumers' expectation. But, the result of granger causality test among all indicators seems to suggest that consumers' expectation is "influenced" by retailers' expectation. If we use quarterly data, consumers, retailers and firms price movement expectations seems to move together with a very high correlation among them. This may suggest that the heterogeneity of inflation expectationamong these agents is very low.

SK3bln vs SPE3bln vs SKDU
(Quarterly Data)



The Result of Granger Causality Test

SK3bln	Granger cause	SKDU	X
SKDU	Granger cause	SK3bln	X

SK3bln	Granger cause	SKDU	X
SKDU	Granger cause	SK3bln	X

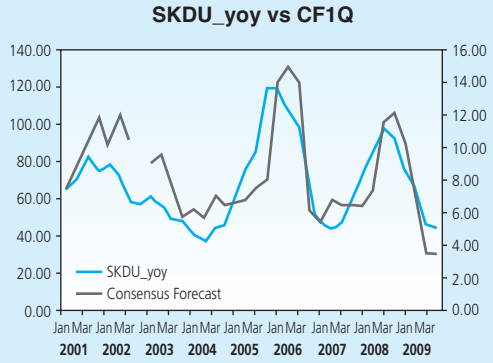
SK3bln	Granger cause	SPE3bln	X
SPE3bln	Granger cause	SK3bln	✓

Correlation	SKDU	Correlation	SKDU	Correlation	SPE	Correlation	SPE	Correlation	SK3bln	Correlation	SK3bln
SK3bln-3	0.2055	SPE3bln-3	-0.1139	SK3bln-3	0.6165	SKDU-3	0.0969	SPE3bln-3	-0.1802	SKDU-3	-0.5014
SK3bln-2	0.2613	SPE3bln-2	-0.0167	SK3bln-2	0.5569	SKDU-2	0.2684	SPE3bln-2	0.0431	SKDU-2	-0.2432
SK3bln-1	0.3378	SPE3bln-1	0.2336	SK3bln-1	0.7313	SKDU-1	0.3157	SPE3bln-1	0.5556	SKDU-1	0.5797
SK3bln-0	0.8197	SPE3bln-0	0.7926	SK3bln-0	0.7722	SKDU-0	0.604	SPE3bln-0	0.8217	SKDU-0	0.7699
SK3bln+1	0.7556	SPE3bln+1	0.7713	SK3bln+1	0.3765	SKDU+1	0.3375	SPE3bln+1	0.7077	SKDU+1	0.5000
SK3bln+2	0.1407	SPE3bln+2	0.3927	SK3bln+2	0.283	SKDU+2	0.0337	SPE3bln+2	0.482	SKDU+2	0.2149
SK3bln+3	-0.3922	SPE3bln+3	0.0555	SK3bln+3	-0.6805	SKDU+3	-0.1231	SPE3bln+3	0.4149	SKDU+3	0.0728

Figure 2.
Correlation of Inflation Expectation from Consumer Survey, Retailer Survey and Business Survey

As previously mentioned, Consensus Forecast (CF) data are actually measures the average monthly *yoy* inflation forecast of each quarter, but for the analysis in this section we will use CF Indicators as if they measure quarterly *yoy* inflation expectation (the *yoy* inflation expectation of the last month in each quarter). The compatible indicator for 1 quarter a head Consensus

Forecast is the modified SKDU balance scores. This balance scores have been modified to be compatible with the measurement of *yoy* inflation (detailed explanation of the modification are in the Appendix). Figure 3 shows that both indicators (CF and SKDU) have significantly high correlation, with the highest correlation is between inflation expectation of firms at time t and inflation expectation of professional forecasters at time *t+1*. Firms' inflation expectation seems to lead CF's inflation expectation by 1 quarter. Based on this and the result of granger causality test, we may conclude that there seems to be an indication that inflation expectation of professional forecasters is "influenced" by inflation expectation of firms.



Correlation	SKDU
CF-3	-0.3142
CF-2	0.0709
CF-1	0.4781
CF	0.771
CF+1	**0.8148**
CF+2	0.5544
CF+3	0.1702

Correlation	CF
SKDU-3	0.3786
SKDU-2	0.6532
SKDU-1	**0.8092**
SKDU	0.7179
SKDU+1	0.3866
SKDU+2	-0.0157
SKDU+3	-0.385

The Result of Granger Causality Test

SKDU_yoy	granger cause	CF1Q	✓
CF1Q	granger cause	SKDU_yoy	X

Figure 3.
Correlation of Inflation Expectation from Business Survey ('Modified' SKDU) and Professional Forecasters Survey (CF)

Survei Persepsi Pasar (SPP) reports the modus of the next quarter and end of year inflation expectation range. Correlation analysis as previously done to the other indicators cannot be used in analyzing SPP data, so instead we will use graphical analysis. The compatible indicator for next quarter inflation expectation is Consensus Forecast 1 Quarter, and for end of year inflation expectation is SKDU-end of year. As we can see from Figure 4, for next quarter inflation expectation, forecast from CF are always inside the modus range of SPP. For short horizon, as shown by the other surveys, the heterogeneity of inflation expectation between CF and SPP is very low. For end of year inflation expectation, both SPP and SKDU collect the same data. For every first, second and third quarters, each survey asks the respondent their inflation expectation of the fourth quarter of the same year. While at fourth quarter of every year, they ask the respondents' inflation expectation of the fourth quarter of next year. As we can see from Figure 4, most of the time, SKDU respondents have higher inflation expectation than SPP respondents. The horizons for these data are mostly longer than 1 quarter. For these longer horizons, we observed that the heterogeneity of inflation expectation between SPP and SKDU are higher than what we found among other surveys for 1 quarter a head horizon.

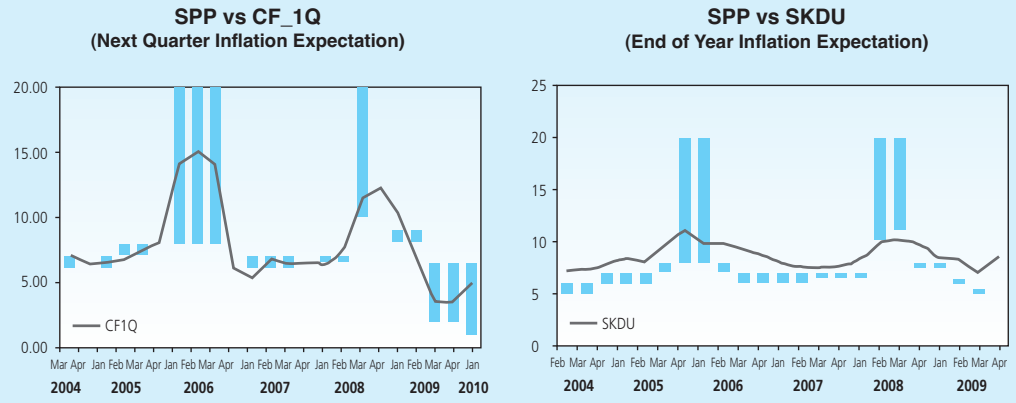


Figure 4.
Correlation of Inflation Expectation from Business Survey (SKDU) and Professional Forecasters Survey (SPP and CF)

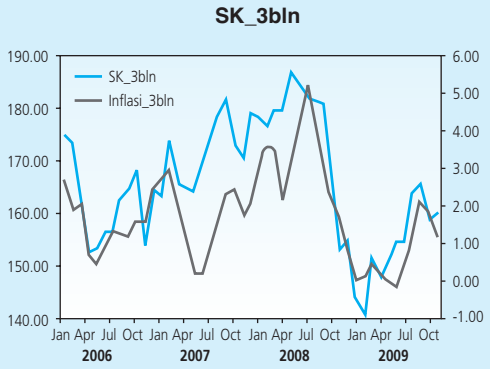
Among the compatible surveys that use balance scores method, we find that they have significantly high correlation. The longer the forecast horizon, the level of correlation among different surveys decreases. We find the same behavior from all the surveys that ask the respondent the future expected inflation rate. The correlation among surveys with 1 quarter a head forecast horizon is very high. On the other hand, we find that inflation expectation from SKDU respondent (the Mean) is persistently higher than the expectation of SPP respondent (the Modus) for forecast horizon longer than 1 quarter.

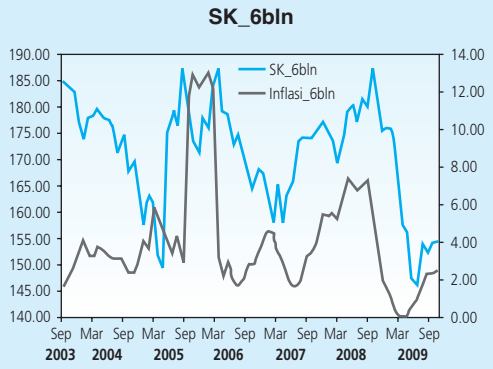
From the analysis in this section we can conclude that for 1 quarter a head forecast horizon, the level of heterogeneity of inflation expectation of firms (SKDU), consumers (SK), retailers (SPE) and professional forecaster (SPP and CF) are very low. The evidence from correlation analysis and granger causality test suggest that the consumer inflation expectation might be "influenced" by retailers' inflation expectation, and inflation expectation of professional forecaster might be "influenced" by inflation expectation of firms.

4.2 Relationship with Past, Current and Future Inflation

This sectionexamine the correlation between survey measures of inflation expectation with actual inflation. Similar to the previous section, we are not only interested on the correlation of inflation expectation and actual inflation at the intended forecast horizon, but also to the past and current inflation (measured at the time of the survey).Correlation analysis can be done using both balance scores data and inflation rates data. For surveys that report inflation expectation rates we will also try to assess their accuracy with regards to their ability to forecast inflation rate at the intended forecast horizon.

From Figure 5, we can see that SK 3 monthbalance scores are highly correlated to the next 3 month inflation, but the highest correlation is with the present level of *qtq* inflation.The same thing happen with SK 6 monthbalance score, in which they are highly correlated to the next 6 months inflation, but the highest correlations are with the first 3 months inflations. Higher correlation to future inflation compared to past inflation might reflect the forward looking behavior of consumers in forming inflation expectation. Although it need to be noted that consumers still put relatively high consideration to current level of inflation in forming inflation expectation.





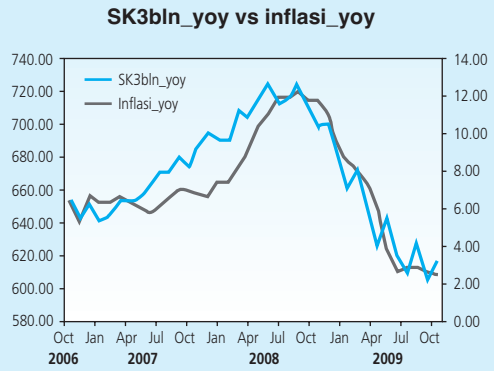
Korelasi	SK_3bln
inflasi3m-3	0.2376
inflasi3m-2	0.4121
inflasi3m-1	0.5610
inflasi3m	0.7994
inflasi3m+1	0.7902
inflasi3m+2	0.6909
inflasi3m+3	0.5330

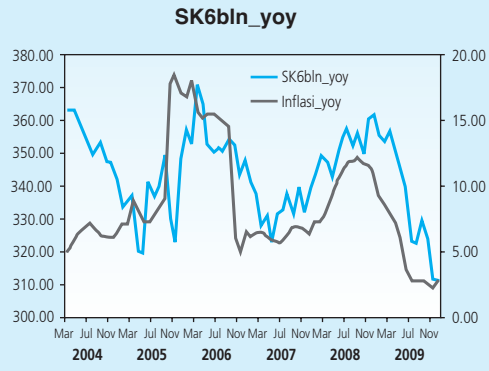
Korelasi	SK_6bln
inflasi6m-6	-0.3447
inflasi6m-5	-0.2328
inflasi6m-4	-0.1038
inflasi6m-3	-0.0184
inflasi6m-2	0.1092
inflasi6m-1	0.2466
inflasi6m	0.4014

Korelasi	SK_6bln
inflasi6m	0.4014
inflasi6m+1	0.4878
inflasi6m+2	0.4848
inflasi6m+3	0.4875
inflasi6m+4	0.4266
inflasi6m+5	0.3700
inflasi6m+6	0.2940

Figure 5.
Correlation of Inflation Expectation from Consumer Survey (SK) and Actual inflation

SK balance scores are expected to give indication of price movement expectation for the next three or six months, so it will be compatible with the measurement of *qtq* or 6 month inflation. To get a compatible measure of next 3 or 6 month *yoy* inflation, we add previous balance scores to the current balance scores (3 previous balance scores with 3 month interval each for next 3 month balance score; and 1 previous balance score with 6 month interval for 6 month balance score). One caveat of this approach is that the modified balance scores are not based only on the available information to the respondents at the time of the survey, but also based on the "incomplete" information available at the time before the survey.





Correlation	SK_3bln_yoy
inflasi_yoy-3	0.1566
inflasi_yoy-2	0.4046
inflasi_yoy-1	0.6571
inflasi_yoy	0.8738
inflasi_yoy+1	0.9251
inflasi_yoy+2	**0.9418**
inflasi_yoy+3	0.9136

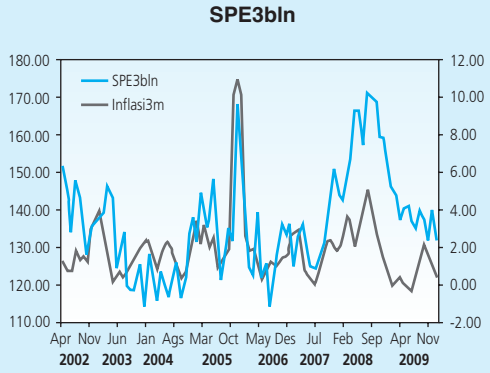
Correlation	SK_6bln_yoy
inflasiyoy-6	-0.3176
inflasiyoy-5	-0.2356
inflasiyoy-4	-0.1708
inflasiyoy-3	-0.0952
inflasiyoy-2	-0.0017
inflasiyoy-1	0.132
inflasiyoy	0.304

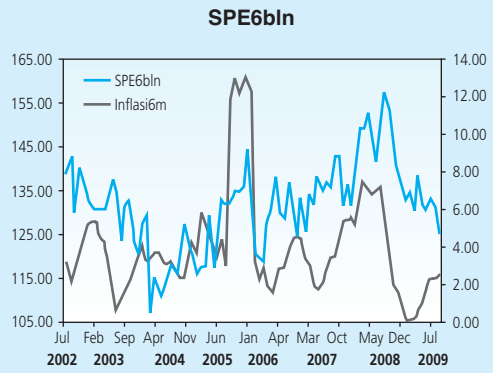
Correlation	SK_6bln_yoy
inflasiyoy+1	**0.4616**
inflasiyoy+2	**0.5174**
inflasiyoy+3	**0.5568**
inflasiyoy+4	**0.5643**
inflasiyoy+5	**0.5129**
inflasiyoy+6	0.451

Figure 6. Correlation of Inflation Expectation from Consumer Survey ('Modified' SK Index) and Actual inflation

From Figure 6 we see that there is high correlation between the modified 3 month balance scores with the next 3 month *yoy* inflations, but the highest correlation is with the next 2 months *yoy* inflation. We also see that there is high correlation between the modified balance scores with the next 6 months *yoy* inflations, but the highest correlation is with the next 3 and 4 months *yoy* inflations.These results are in accordance to the result of the original balance scores. The only difference is that the levels of correlation to future inflations are more pronounced.

Figure 7 shows the correlation of retailers' inflation expectation with actual inflation.As we can see,both 3 month and 6 month balance scores show higher correlation to future level of inflation than current and past level of inflation. Compared to consumers, retailers show a more forward looking behavior and put less weight to the current level of inflation in forming inflation expectation.





Korelasi	SPE_3bln
inflasi3m-3	-0.0189
inflasi3m-2	-0.0195
inflasi3m-1	0.0446
inflasi3m	0.0950
inflasi3m+1	**0.2950**
inflasi3m+2	**0.4789**
inflasi3m+3	**0.4288**

Korelasi	SPE_6bln
inflasi6m-6	-0.0525
inflasi6m-5	0.0270
inflasi6m-4	0.0951
inflasi6m-3	0.1310
inflasi6m-2	0.0791
inflasi6m-1	0.0698
inflasi6m	0.0552

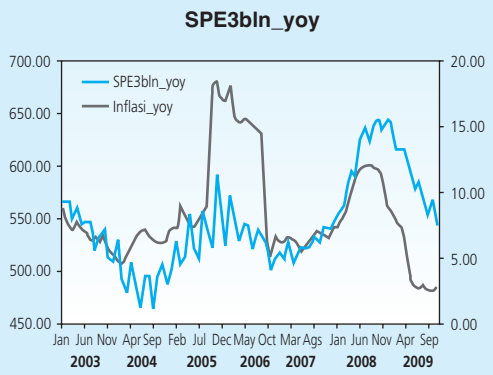
Korelasi	SPE_6bln
inflasi6m+1	0.0403
inflasi6m+2	0.0905
inflasi6m+3	0.1084
inflasi6m+4	0.1764
inflasi6m+5	0.2260
inflasi6m+6	**0.2455**

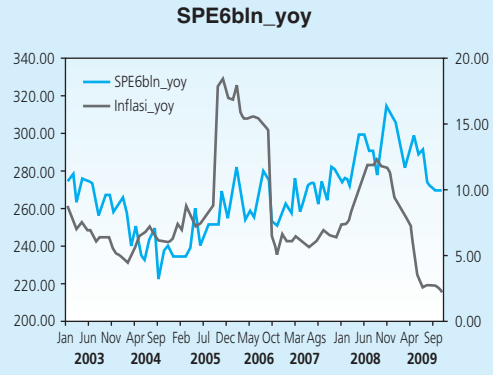
Figure 7.
Correlation of Inflation Expectation from Retailer Survey (SPE) and Actual inflation

We modified the SPE balance scores, using the same method used on SK balance scores. The correlation result can be seen in Figure 8.As in SK data, for modified 3 month balance scores, the correlation with *yoy* inflation is highest at time *t+2*. Compare to the original balance scores, the modified 6 month balance scores shows higher correlation to the next 3 month level of inflations than to the next 6 month level of inflation.

If we use full sample of both SK and SPE, overall correlation levels of retailers' inflation expectation to actual inflation are lower than what we found in consumers. This is mostly caused by the longer availability of retailers' inflation expectation data compared to consumers'. For apple to apple comparison between the two surveys, we will shows correlation analysis that encompasses the same period for both surveys in Table 4. It is very fortunate that the period in which consumer and retailers survey are available are in accordance with the period after the implementation of Inflation Targeting Framework by Bank Indonesia.

As we can see in Table 4, three month SPE balance scores show higher correlation to future level of inflation than current and past level of inflation. Similar to what we find if we use full sample period of both surveys, compared to consumers, retailers show a more forward looking behavior and put less weight to the current level of inflation in forming the next 3 month inflation expectation. A different result is shown for 6 month balance scores in which





Correlation	SPE_3bln_yoy
inflasi_yoy-3	0.1840
inflasi_yoy-2	0.2159
inflasi_yoy-1	0.2604
inflasi_yoy	0.2628
inflasi_yoy+1	**0.2727**
inflasi_yoy+2	**0.2957**
inflasi_yoy+3	0.2493

Correlation	SPE_6bln_yoy
inflasiyoy-6	0.0924
inflasiyoy-5	0.1375
inflasiyoy-4	0.1969
inflasiyoy-3	0.2120
inflasiyoy-2	0.2110
inflasiyoy-1	0.2213
inflasiyoy	0.2279

Correlation	SPE_6bln_yoy
inflasiyoy+1	0.2203
inflasiyoy+2	**0.2470**
inflasiyoy+3	**0.2431**
inflasiyoy+4	0.2154
inflasiyoy+5	0.2047
inflasiyoy+6	0.1549

Figure 8. Correlation of Inflation Expectation from Consumer Survey ('Modified' SPE Index) and Actual inflation

we found that both SK and SPE balance scores shows a very similar pattern of correlation with current and future level of inflation.In forming the next 6 month inflation expectation, both consumers and retailers, after the implementation of ITF, show a forward looking behavior with less influenced from current level of inflation.

Table 4. Correlation of Consumers and Retailers" Inflation Expectation with Actual Inflation (Period: January 2006-November 2009)

Jan 06 - Nov 09		
Correlation	SK3m	SPE3m
inflasi3m-3	0.308321	0.329546
inflasi3m-2	0.533157	0.409331
inflasi3m-1	0.685564	0.51451
inflasi3m	0.800137	0.632471
inflasi3m+1	0.795977	0.712527
inflasi3m+2	0.715949	0.66845
inflasi3m+3	0.576258	0.556668

Jan 06 - Nov 09		
Correlation	SK6m	SPE6m
inflasi6m-6	-0.46292	-0.47199
inflasi6m-5	-0.28871	-0.34051
inflasi6m-4	-0.0963	-0.07841
inflasi6m-3	0.10965	0.23695
inflasi6m-2	0.324169	0.370252
inflasi6m-1	0.505773	0.504591
inflasi6m-0	0.655621	0.610855
inflasi6m+1	0.741244	0.675028
inflasi6m+2	0.773329	0.681516
inflasi6m+3	0.757868	0.666486
inflasi6m+4	0.72652	0.666332
inflasi6m+5	0.690567	0.614218
inflasi6m+6	0.604644	0.522138

The correlations of firms' inflation expectation to actual inflation are shown in Figure 9. The highest correlation is found between firms' inflation expectation and the next quarter inflation, which is the intended forecast horizon. From this we can conclude that compared to consumers and retailers, firms show a more "rational" inflation expectation. This is a preliminary finding that needs to be explored more since it is only based on correlation analysis and using a "qualitative" measure of inflation expectation. The analysis in the next 2 sections hopefully can add more arguments to this finding.

Correlation	SKDU
Inflasi_qtq-4	-0.0925
Inflasi_qtq-3	-0.2044
Inflasi_qtq-2	-0.0636
Inflasi_qtq-1	-0.0985
Inflasi_qtq	0.2717
Inflasi_qtq-1	**0.4886**
Inflasi_qtq-2	0.1555
Inflasi_qtq-3	0.2859
Inflasi_qtq-4	-0.0822

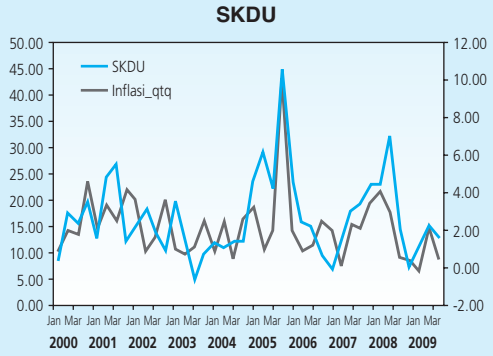


Figure 9.
Correlation of Inflation Expectation from Business Survey (SKDU) and Actual inflation

Since SKDU balance scores are supposed to be compatible with the next quarter price movements, we add 3 previous quarter balance score to the current balance score to get a measure of *yoy* inflation expectation. A different result is found, in which the highest correlation is now with the current level of *yoy* inflation. But correlation to the next quarter inflation remains quite high. This might due to the higher correlation between current and previous quarter level of *yoy* inflation compared to the current and previous quarter level of *qtq* inflation. Form Figure 10, we can see that the movement of firms' next quarter inflation expectation can imitate the movement of actual inflation relatively well.

We analyzed the correlation of consensus forecast data with two measurements of inflation, the average *yoy* quarterly inflation and the end of period *yoy* quarterly inflation. Due to the small variances among monthly *yoy* inflation in a quarter (shown in Appendix), the correlation results show similar outcomes (Figure 11). This confirms the fact that we can use CF data as a very good proxy of end of period quarterly *yoy* inflation expectation. From Figure 11, we can see that, as the forecast horizon increase, the correlations of the forecasts with actual inflations decrease. All forecasts (regardless of forecast horizons) show significant correlation to the current and next quarter level of inflations.

Correlation	SKDU_yoy
Inflasi-3	0.0122
Inflasi-2	0.3476
Inflasi-1	0.7021
Inflasi	**0.884**
Inflasi+1	0.7124
Inflasi+2	0.4297
Inflasi+3	0.0217

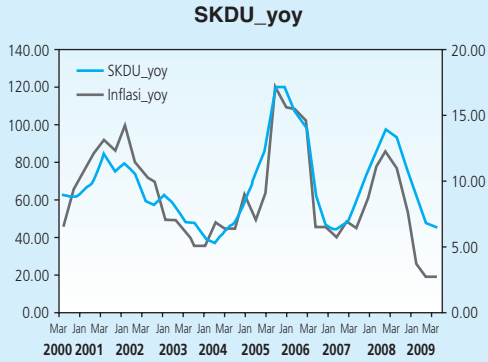


Figure 10.
Correlation of Inflation Expectation
from Busines Survey ('Modified' SKDU Index) and Actual inflation

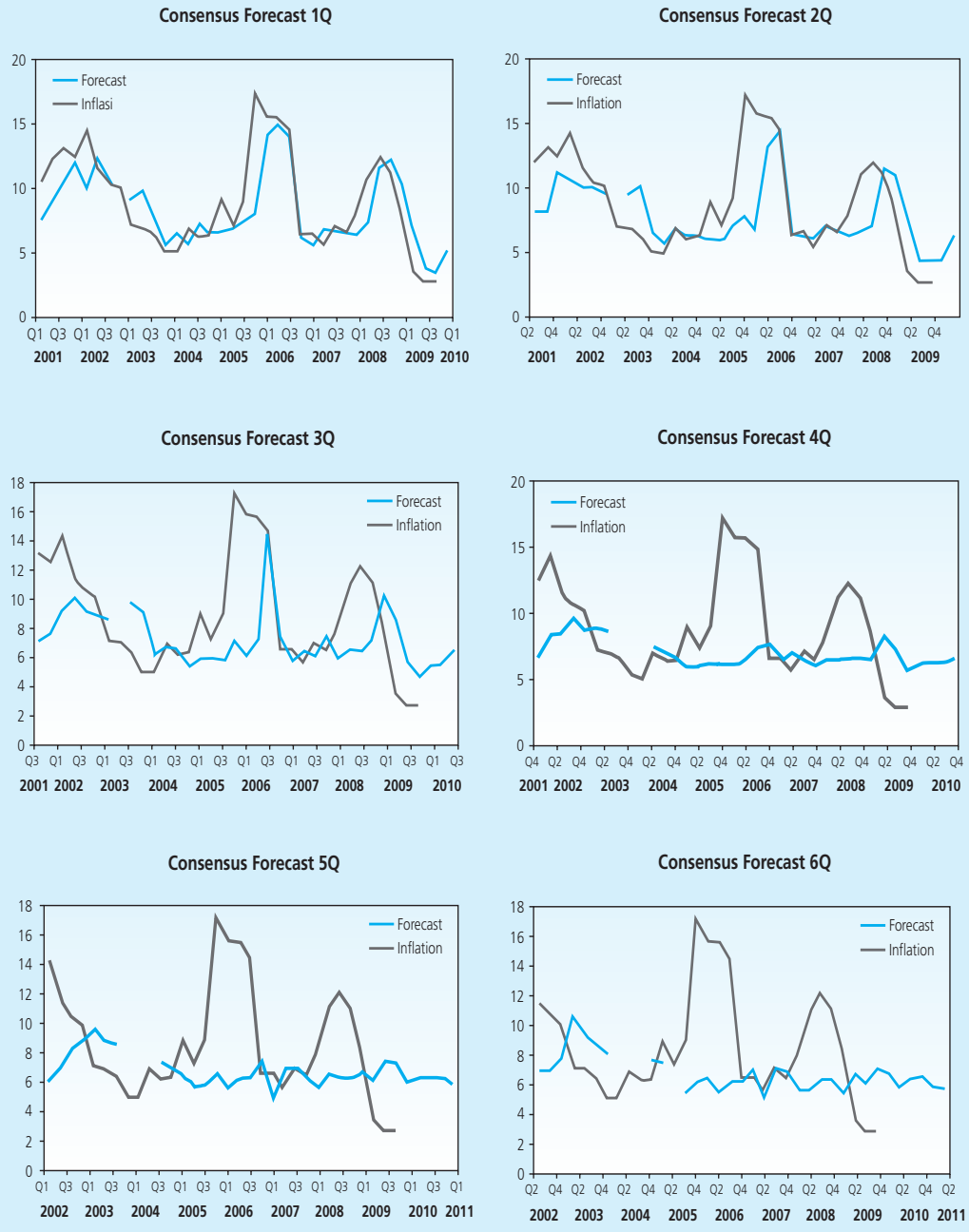


Figure 11.
Inflation Expectation from Consensus Forecast and Actual inflation

Correlation of CF Measures of Infllation Expectation with Actual Inflation (end of quarter yoy inflation)

Horizon	CF_1Q	CF_2Q	CF_3Q	CF_4Q	CF_5Q	CF_6Q
-4	-0.2061	-0.1735	-0.1048	-0.1226	0.0676	-0.1212
-3	-0.0326	-0.0375	0.0982	0.1424	0.2500	0.1455
-2	0.2812	0.0521	0.0986	0.2812	0.3714	0.2834
-1	0.6178	0.4620	0.2438	0.3999	0.4142	0.3993
0	0.8567	0.7031	0.6153	0.5445	0.3386	0.5462
1	**0.7658**	0.6477	0.5166	0.4732	0.2754	0.4727
2	0.4032	**0.5247**	0.4407	0.3370	0.1300	0.3413
3	-0.0260	0.0823	**0.2025**	0.0846	-0.0775	0.0974
4	-0.3659	-0.2925	-0.2932	**-0.2003**	-0.1949	-0.2024
5			-0.3624	-0.3529	**-0.3097**	-0.3617
6					-0.3466	**-0.4334**

Correlation of CF Measures of Infllation Expectation with Actual Inflation (average monthly yoy inflation in a quarter)

Horizon	CF_1Q	CF_2Q	CF_3Q	CF_4Q	CF_5Q	CF_6Q
-4	-0.3000	-0.2506	-0.1646	-0.2041	-0.0359	-0.0458
-3	-0.1525	-0.0949	0.0129	0.0357	0.1481	0.1387
-2	0.2118	0.0006	0.0628	0.2213	0.2999	0.2484
-1	0.5822	0.4019	0.1649	0.3321	0.3650	0.3317
0	0.8626	0.7105	0.6092	0.5231	0.3376	0.3241
1	**0.8076**	0.6722	0.5732	0.5080	0.3157	0.2994
2	0.4521	**0.5628**	0.4606	0.3806	0.1884	0.1917
3	0.0417	0.1446	**0.2769**	0.1543	-0.0113	-0.0257
4	-0.3185	-0.2556	-0.2488	**-0.1309**	-0.1149	-0.1445
5			-0.3679	-0.3323	**-0.2793**	-0.2669
6					-0.3158	**-0.2887**

Table 5 reports various accuracy measures of different agents' inflation expectations. In this table the accuracy of CF data is based on the comparison with the end of period'*yoy* quarterly inflation. Inflation expectation from Consensus Forecast shows a comparable performance with inflation expectation series produced by SSMX model. CF and SKDU measures of inflation expectation also show relatively similar performance, but the SKDU measures only available in the third quarter's publications. From the table, we can conclude that among all survey that reports the inflation expectation rates (not balance scores), Consensus Forecast has the best performance in terms of accuracy in predicting the level of inflation at the intended forecast horizons. Comparison of various accuracy performance of CF in Table 5 and 6, once again confirms the fact that we can use CF data as a very good proxy of end of period *yoy* quarterly inflation expectation.

Table 5.
Accuracy of Survey Measures of Inflation Expectation

Accuracy Table	ME	MAE	RMSE	TIC	U-Theil
CF_1Q(yoy)	0.62	1.59	2.29	0.94	0.12
CF_2Q(yoy)	1.08	2.21	3.20	0.85	0.18
CF_3Q(yoy)	1.49	2.98	3.97	0.83	0.23
CF_4Q(yoy)	1.86	3.34	4.44	0.78	0.26
CF_5Q(yoy)	1.88	3.58	4.65	0.78	0.28
CF_6Q(yoy)	1.76	3.63	4.64	0.79	0.28
SSMX(yoy)	-0.62	4.84	7.24	0.87	0.16
SSMX(qtq)	-0.07	2.59	4.03	1.01	0.37
SKDU_4QYOY(Q4)	0.32	4.52	5.28	0.73	0.29
SKDU_3QYOY(Q1)	0.56	3.87	4.40	0.45	0.24
SKDU_2QYOY(Q2)	0.63	3.50	4.29	0.44	0.23
SKDU_1Q(Q3)	0.49	2.85	3.46	0.35	0.19

Note:
TIC (Theil Inequality Coefficient) allows for the performance of the inflation expectations survey data to be compared to naïve (or random walk) predictions of inflation. A TIC of less than 1 is said to out-perform a naïve forecast; ME = Mean Error; MAE = Mean absolute error. RMSE = Root Mean Square Error. U-Theilmeasure of the degree to which inflation expectation differs from actual inflation. Values closer to 0 indicating greater forecasting accuracy

Table 6. Accuracy of CF Measures of Inflation Expectation
(Compared to average yoy inflation of each quarter)

Accuracy Table	ME	MAE	RMSE	TIC	U-Theil
CF_1Q(yoy)	0.65	1.34	2.17	0.84	0.12
CF_2Q(yoy)	1.14	2.12	3.19	0.81	0.18
CF_3Q(yoy)	1.59	2.89	3.99	0.79	0.23
CF_4Q(yoy)	1.99	3.30	4.53	0.76	0.27
CF_5Q(yoy)	2.00	3.57	4.80	0.78	0.29
CF_6Q(yoy)	1.87	3.58	4.77	0.78	0.29

For the same reasons we mentioned in the previous chapter, we cannot use correlation and error analysis with SPP measures of inflation expectation, so instead we use graphical analysis. From Figure 12, we can see that the accuracy of next quarter inflation expectation from SPP is relatively good, since all inflation data points are inside the modus range. On the other hand, the accuracy of end of year inflation from SPP and SKDU are not good since most of inflation data points are not inside the modus range (for SPP) or near the inflation expectation data points (for SKDU).

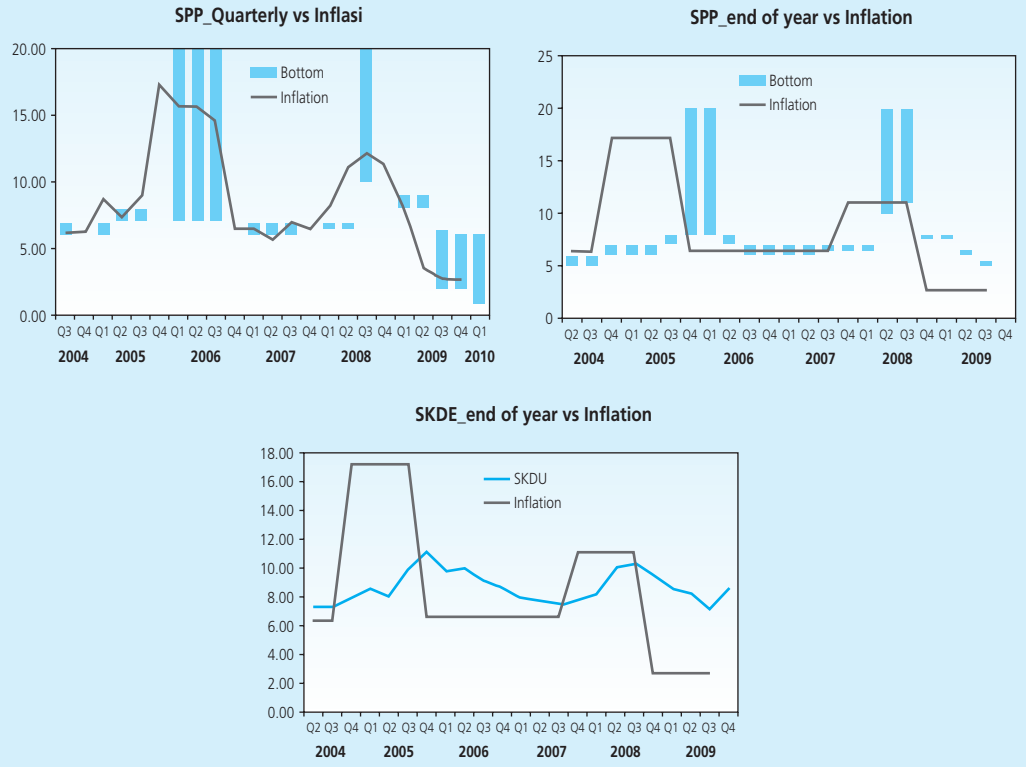


Figure 12. Inflation Expectation from Proffesional Forecaster (SPP), Busines Survey (SKDU) and Actual inflation

From the analysis in this section we can conclude that survey measures of inflation expectation seems to be forward looking, but only for quite short horizon (mostly less than the intended forecast horizon). The modified SKDU balance scores and 1 quarter consensus forecast show comparable correlation with next quarter *yoy* inflation. Both measures also show similar behavior with the current and *t-1 yoy* inflation.

For survey data that measures next two quarter inflation expectation, inflation expectation from Consensus Forecast shows higher correlation with actual inflation than the modified SK 6 month and SPE 6 month. Among all survey that report the inflation expectation rates (not balance scores), consensus forecast has the best performance in terms of accuracy in predicting the level of inflation at the intended forecast horizon. For comparison purposes, we plot the modified SKDU balance scores, SSMX inflation expectation, 1 quarter a head Consensus Forecast and inflation series in Figure 13. From the Graph we can see that the modified SKDU, consensus forecast and SSMX series can mimic the movement of actual inflation relatively well.

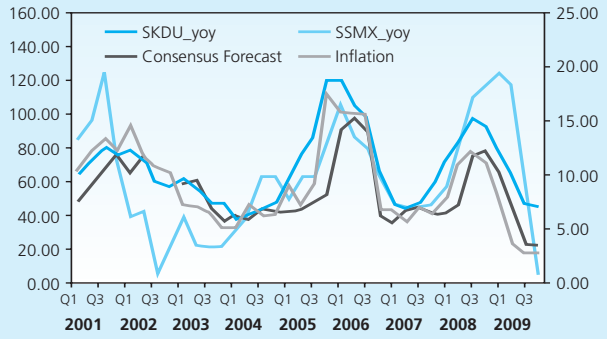


Figure 13. Comparison of Various Measures of Quarterly Inflation Expectation

Similarity of the movement between 1 quarter a head consensus forecast and the modified SKDU balance scores as evident in Figure 13, and also the similarity of correlation of both indicators with past, present and future inflation, motivate us to explore further the relationship between these measures.

As mentioned in Table 1, besides reporting price movement expectation in the form of balance scores, SKDU also reports end of year *yoy* inflation expectation rate in first, second and third quarter publications, and end of next year *yoy* inflation expectation rate for fourth quarter publications. The accuracy of these measures in forecasting actual inflation is reported in Table 5. Due to the limited data series available from SKDU, we cannot apply the same method we use in the previous section to analyze the relationship between SKDU inflation expectation and Consensus Forecast.

Table 7 reports the published inflation expectation rate from Consensus Forecast and SKDU. In contrast to what we found if we use the modified balance score from SKDU, the 1

Table 7.
Consensus forecast vs SKDU (inflation rate date)

Year	Actual Inflation	Consensus Forecast				SKDU			
		4Q	3Q	2Q	1Q	4Q	3Q	2Q	1Q
2001	12.55	6.80	7.70	11.10	11.80	-	-	-	-
2002	9.95	8.90	9.00	9.50	9.00	-	-	-	-
2003	5.16	9.30	9.10	6.50	5.80	7.56	9.5	9	8.02
2004	6.40	6.50	5.50	6.20	6.50	7.89	7.37	7.3	7.37
2005	17.11	6.00	7.00	7.50	8.10	11.08	8.37	8.06	9.75
2006	6.60	7.70	7.40	6.40	6.10	8.63	9.81	9.86	9.2
2007	6.59	6.10	7.40	6.60	6.50	7.75	7.89	7.6	7.47
2008	11.06	6.60	7.10	11.40	12.10	9.54	8.23	10.06	10.17
2009	2.78	5.80	4.90	4.30	3.50	8.48	8.48	8.23	7.17

quarter ahead inflation expectation rate between SKDU and Consensus Forecast are significantly differ. These differences are also appeared in the longer horizons. However, we still need to consider that data points in these comparisons are limited so that we may not observe the real relationship. Nevertheless, if we only focus in the data presented in Table 7, we can see that consensus forecast has higher accuracy in predicting actual inflation than SKDU.

We can also observe in Table 7 that for Consensus Forecast, there are significant corrections from the longer horizon's forecasts to the shorter ones. While for SKDU, we do not observe the same behavior. Table 8 may reveal the reason for these differences. We apply the method used by Harmanta (2009) to examine whether inflation expectations are anchored to the targets announced by the government. We use only 4 quarter a head inflation expectation from the two surveys, since unlike the shorter horizons,they are most likely influenced by the government targets.

Table 8.
Consensus Forecast, SKDU (inflation rate data) and BI's Inflation target

Year	Actual Inflation	Inflation Expectation		Target	Mistake	Surprise		Anchoring	
		CF_4Q	SKDU			CF_4Q	SKDU	CF_4Q	SKDU
1	2	3a	3b	4	5	6a	6b	7a	7b
2001	12.55	6.8	-	4-6	6.55	-5.75	-	0.8	-
2002	9.95	8.9	-	9-10	0	-1.05	-	-0.1	-
2003	5.16	9.3	7.56	8-10	-2.84	4.14	2.40	-2.84	-0.44
2004	6.40	6.5	7.89	4.5-6.5	0	0.10	1.49	0.00	1.39
2005	17.11	6	11.08	5-7	10.11	-11.11	-6.03	0.00	4.08
2006	6.60	7.7	8.63	7-9	-0.40	1.10	2.03	0.00	0.00
2007	6.59	6.1	7.75	5-7	0	-0.49	1.16	0.00	0.75
2008	11.06	6.6	9.54	4-6	5.06	-4.46	-1.52	0.60	3.54
2009	2.78	5.8	8.48	3.5-5.5	-0.72	3.02	5.70	0.30	2.98

Notes:
Column 7 is calculated by the difference between the upper bound or lower bound of the target (whichever is the closest to inflation expectation measures) and the measures of inflation expectation, Column 5 = 2 - 4, Column 6 = 3 - 2, Column 7 = 3 - 4

From column 7a and 7b, we can see that the 4 quarter a head Consensus Forecasts are mostly anchored to the government's inflation target. While SKDU inflation expectations only anchored in one year (2006). From this we can conclude that the credibility of the government's inflation target is higher in the eyes of Consensus Forecast respondents, compared to SKDU respondents. How much of this difference will affect the dynamic of actual inflation? The analysis in the next two sections will try to shed some lights to this question by comparing the effect of shocks of different inflation expectation measures to the dynamic of actual inflation, and examine their directional information in predicting current and future level of inflation.

4.3 The Effect on Actual Inflation

To analyze whether each survey measures of inflation expectation affect the dynamic of the actual inflation, we estimate bivariate VAR models with inflation and a measure of inflation expectation as endogenous variables. To identify shocks to expected inflation, we assume that the inflation rate react contemporaneously to inflation expectation shocks, whereas expected inflation reacts with a one period lag in the fluctuations of the actual inflation. This is based on Cholesky decomposition, where expected inflation is ordered before actual inflation. This ordering captures our identifying assumption that expected inflation is contemporaneously predetermined. To explore the dynamic interrelationship between expected and actual inflation, we use impulse response function and variance decomposition.

The method and assumptions used in this section is similar to the one used by Gnaan et al. (2009) and Leduc et al. (2007). Unfortunately, in our case, we find that one of the variables in each model have a unit root while the other is stationer (except for the SK6m and SPE6m_*yoy* models, where both endogenous variables are non-stationer). Because of limited data points, in some of the models, we cannot reject that inflation have a unit root (if we use more data points, we can reject that inflation have a unit root). To be cautious, we estimate all VAR models using the difference of the variables. In the case of SK6m and SPE6m_*yoy*, Johansen cointegration tests show that there is no cointegration among the endogenous variables used in those models. We estimate bi-variate VAR models containing two lags of the endogenous variables. The results are robust with respect to the inclusion of additional lags. However, due to the rather short time series (especially for the data with quarterly frequancy), we chose to include only two lags in our preferred specification.

For the analysis in this section we will group the impulse response function for the models that have the same frequency and compatibility with a certain measurement of inflation (*qtq*, 6 months or *yoy*). For the first group, we will examine SK and SPE measures of inflation expectation for 3 and 6 months forecast horizon (original balance scores). From previous section we found that these measures shows a very low heterogeneity, retailers inflation expectation lead consumers' inflation expectation by 1 month and consumers' inflation expectation might be influenced by retailers' inflation expectation. The results of impulse response function seem to agree with these findings. As we can see from Figure 14, shocks to changes in consumer expectation have a direct effect on the changes of inflation from horizon 1 until 2, while shocks to changes in retailers' expectation have an effect on the changes in inflation rate at horizon 3. Unfortunately for the 6 months measures we do not found the same phenomenon. Shocks to changes in consumers' next 6 month price movement have a very small effect on the changes on the level of inflation. While a shock to changes in retailers' expectation have no effect on inflation.

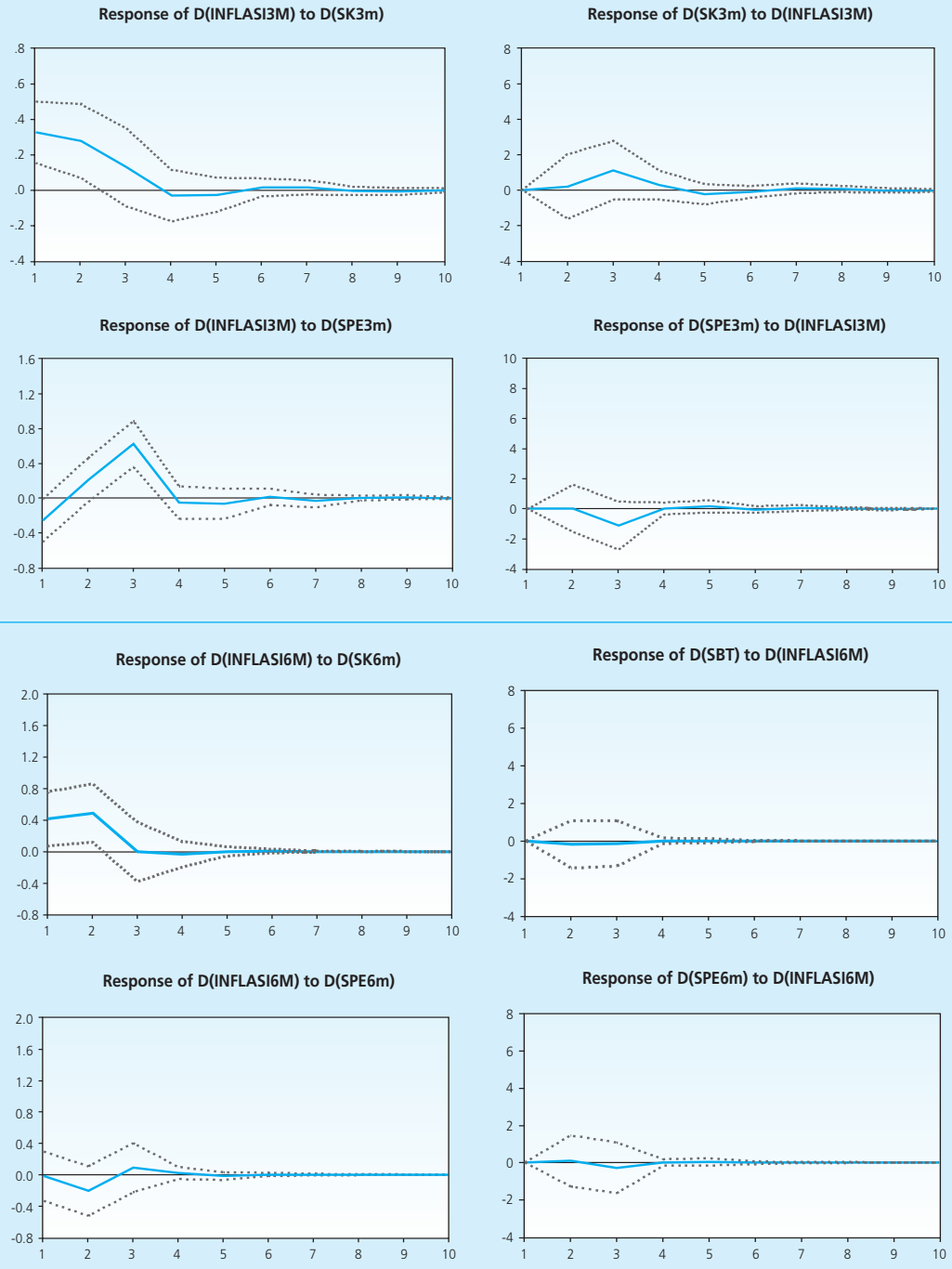


Figure 14. Impulse Response Function of Consumer Survey and Retailer Survey Measures of Inflation Expectation

Frequency: Quarterly

Figure 15. Impulse Response Function of Various Measures of Quarterly Inflation Expectation

Figure 15 shows impulse response function for various measures of inflation expectation with quarterly frequency. It is important to note that we found a different response of shocks from 1 quarter Consensus Forecast and modified SKDU balance scores to the dynamic of actual inflations. From previous sections, we found that both measures have a similar correlation with past, current and future level of inflations. From Figure 15, we can see that shocks to changes in Consensus Forecast's inflation expectation have an effect on the changes on the level of inflation at horizon 1 and 2. While shocks to changes in firms' expectation affect the changes of inflation only at horizon 2. The graph also shows that shocks to changes in Consensus Forecast's inflation expectation (of various forecast horizons) affect the changes on the level of inflation starting from horizon 1. The magnitude and the length of the effects are decreasing as the forecast horizon increases.

As evident in Figure 16, compared to the other survey measures of inflation expectation, shock to the modified SK and SPE inflation expectation have relatively smaller effect on the dynamic of actual inflation.

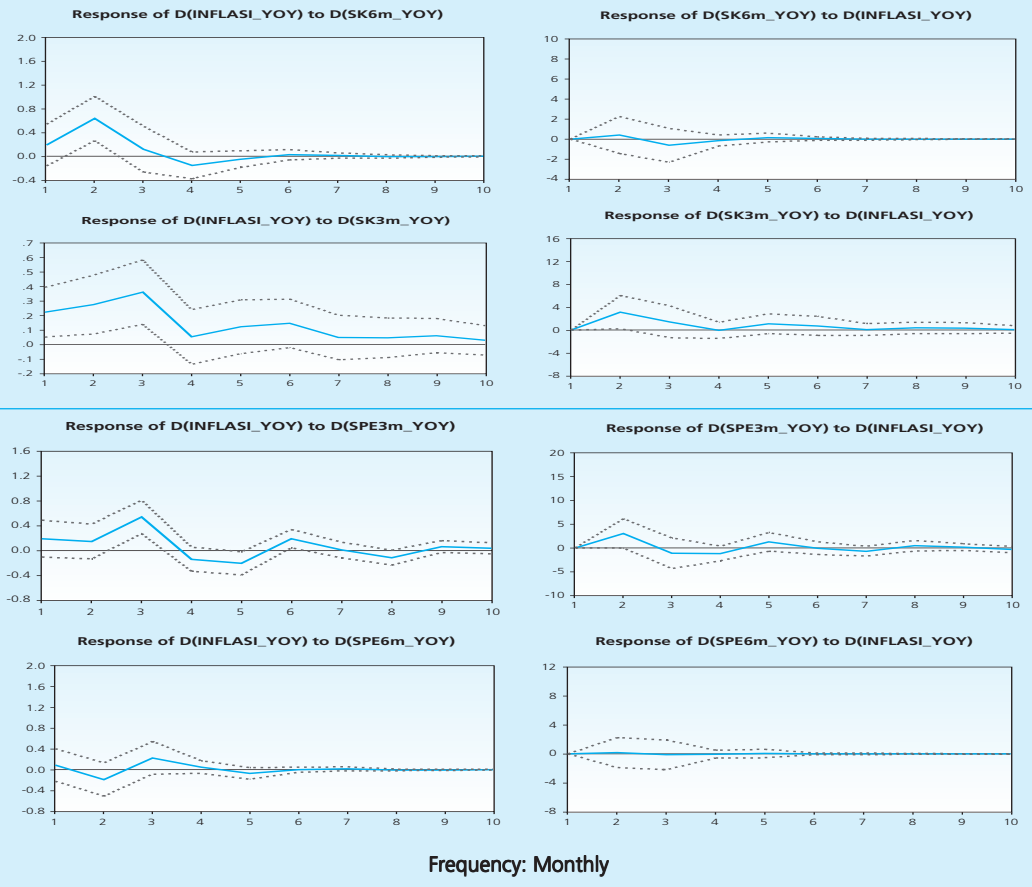


Figure 16. Impulse Response Function of 'Modified' Measures (SK and SPE) Inflation Expectation

Granger Causality test in Table 9 shows that almost all of the inflation expectation indicators granger causes inflation, except for SPE6m (*SurveiPenjualanEcerean* – 6 months). On the other hand, inflation doesn't granger cause all indicators, except for SPE3m (*SurveiPenjualanEceran*-3 months) and CF_2Q(Consensus Forecast – 2 Quarter).–Based on Impulse Response Function and granger causality test results, we can conclude that almost all of inflation expectation indicators have an effect on the dynamic of the actual inflation. The result of variance decomposition of inflation for each VAR model is shown in Table 10. From this table we can see that depending on the indicator used, shocks to inflation expectation account for up to 75.76% of the variability of the changes of inflation.

Table 9.
Granger Causality Test Result

D(SKDU)	granger cause	D(inflasi_qtq)	√	D(inflasi_qtq)	granger cause	D(SKDU)	–
D(SK3m)	granger cause	D(inflasi_qtq)	–	D(inflasi_qtq)	granger cause	D(SK3m)	–
D(SPE3m)	granger cause	D(inflasi_qtq)	√	D(inflasi_qtq)	granger cause	D(SPE3m)	√
D(SK6m)	granger cause	D(inflasi_6m)	√	D(inflasi_6m)	granger cause	D(SK6m)	–
D(SPE6m)	granger cause	D(inflasi_6m)	–	D(inflasi_6m)	granger cause	D(SPE6m)	–
D(CF_1Q)	granger cause	D(inflasi_yoy)	√	D(inflasi_yoy)	granger cause	D(CF_1Q)	–
D(CF_2Q)	granger cause	D(inflasi_yoy)	√	D(inflasi_yoy)	granger cause	D(CF_2Q)	√
D(CF_3Q)	granger cause	D(inflasi_yoy)	√	D(inflasi_yoy)	granger cause	D(CF_3Q)	–
D(CF_4Q)	granger cause	D(inflasi_yoy)	√	D(inflasi_yoy)	granger cause	D(CF_4Q)	–
D(SKDU_yoy)	granger cause	D(inflasi_yoy)	√	D(inflasi_yoy)	granger cause	D(SKDU_yoy)	–
D(SK3m_yoy)	granger cause	D(inflasi_yoy)	√	D(inflasi_yoy)	granger cause	D(SK3m_yoy)	–
D(SK6m_yoy)	granger cause	D(inflasi_yoy)	√	D(inflasi_yoy)	granger cause	D(SK6m_yoy)	–
D(SPE3m_yoy)	granger cause	D(inflasi_yoy)	√	D(inflasi_yoy)	granger cause	D(SPE3m_yoy)	–
D(SPE6m_yoy)	granger cause	D(inflasi_yoy)	√	D(inflasi_yoy)	granger cause	D(SPE6m_yoy)	–

Table 10.
Variance Decomposition of Inflation

(Monthly)
Variance Decomposition of Inflation

Horizon	SK_3m	SPE_3m	SK_6m	SPE_6m
1	27.86	4.71	7.16	0.02
2	36.97	7.22	15.46	1.88
3	38.43	25.96	15.44	2.20
4	38.24	25.06	15.49	2.22
5	38.22	25.06	15.49	2.23
6	38.18	26.13	15.49	2.23
7	38.21	26.13	15.49	2.24
8	38.19	26.18	15.49	2.24
9	38.20	26.18	15.49	2.24
10	38.20	26.18	15.49	2.24

SK_3m and SPE_3m vs Inflasi_qtq
SK_6m and SPE_6m vs Inflasi_6m

(Quarterly)
Variance Decomposition of Inflation

Horizon	SKDU	SKDU_yoy	CF_1Q	CF_2Q	CF_3Q	CF_4Q
1	1.17	2.61	45.08	69.10	58.27	24.55
2	20.83	56.14	55.73	70.27	57.88	33.39
3	31.57	56.95	57.22	72.43	58.12	35.06
4	30.85	58.39	58.33	72.36	58.16	36.36
5	32.78	58.70	58.13	75.74	58.64	36.52
6	33.22	58.74	58.25	75.76	58.63	36.57
7	33.24	58.77	58.19	75.24	58.64	36.59
8	33.36	58.77	58.19	75.24	58.64	36.59
9	33.37	58.77	58.19	75.44	58.64	36.59
10	33.38	58.77	58.19	75.46	58.64	36.59

SKDU vs Inflasi_qtq
SKDU_yoy, CF_1Q, CF_2Q, CF_3Q and CF_4Q vs inflasi_yoy

(Monthly)
Variance Decomposition of Inflation (in %)

Horizon	SK3m_yoy	SPE3m_yoy	SK6m_yoy	SPE6m_yoy
1	17.53	1.95	1.59	0.40
2	32.93	2.88	16.36	1.97
3	48.68	15.44	16.82	4.20
4	46.70	16.13	17.52	4.31
5	47.35	17.69	17.58	4.52
6	48.99	18.92	17.60	4.52
7	48.84	18.91	17.60	4.53
8	48.85	19.38	17.60	4.53
9	49.11	19.50	17.60	4.53
10	49.11	19.54	17.60	4.53

SK3m_yoy, SPE3m_yoy, SK6m_yoy, SPE6m_yoy vs Inflasi_yoy
All variables are in difference

4.4 Directional Information in Predicting Current and Future Inflation

In this section we will examine the directional information that each inflation expectation measure has in predicting current and future level of inflation. This is done based on the idea that although survey measures of inflation expectation are not accurate, they may still be useful to supplement other economic indicators in providing a more accurate forecast of inflation.

We follow the method of Ranchold (2003) that use a simple model of inflation with past inflation, the output gap and trade weighted index as the regressors. This model is the open economy version of the hybrid New Keynesian Phillips Curve. For our purpose, we will use the version of NKPC that was also used by Alamsyah (2008) with past inflation, the output gap and terms of trade as the regressors. We measure the contribution of the addition of inflation expectation data to the explanatory power of the model (i.e the increase in adjusted R^2 when survey data is included in the model). As in the correlation analysis, we are not only interested in the additional predictive power of the survey data to the model of inflation at the intended forecast horizon, but also at the time of the survey and at the time after the survey up until the forecast horizon.

First Regression : $\pi_t = \pi_{t-1} + Ogap_t + TOT_t$

First Regression : $\pi_t = \pi_{t-1} + Ogap_t + TOT_t + \pi^e$

Where π_t is inflation at period t; π_{t-1} is past inflation (time t-1); $Ogap$ is output gap at period t; TOT is the term of trade, and π^e is survey measures of inflation expectation. The additional predictive power is calculated as the difference between Adjusted R-square of the two regressions (second regression minus first regression).

Ideally we would do the regression using the level of each variables, but since according to unit root test, some of the variables are I(1), we have to do the regression in first difference. In every case, Johansen's cointegration test shows that all I(1) variables in each model are not cointegrated (unit root cointegration test results are in the Appendix). As in every regression, using the first difference of the variables makes the interpretation harder. But since we only interested in the increase (or decrease) in the adjusted R^2 of the model, the interpretation would not be a problem.

For the analysis in this section, we use only the survey data that are compatible with the measurement of *yoy* inflation. Because of this, we only use the modified version of SK, SPE and SKDU data, in addition to CF data. For comparison purposes, we also use inflation expectation series that we get from SSMX model. The available data for output gap and TOT are only in quarterly frequency, so we use only data for the month of March, June, September and December for SK and SPE. We cannot analyze the modified SK data that are based on the next 3 month price movement expectation because of the limited data points available for this series.

Table 11. Contribution to Adjusted R2
When Inflation Expectation Measures is added in the simple Model of Inflation

Horizon	CF_1Q	CF_2Q	CF_3Q	CF_4Q	CF_5Q	CF_6Q	SPE3bln_yoy	SK6bln_yoy	SPE6bln_yoy	SSMX_yoy	SKDU_yoy
0	15%	5%	28%	3%	3%	5%	-4%	-6%	-1%	26%	13%
1	21%	-4%	-1%	-2%	2%	8%	17%	44%	1%	5%	43%
2	-3%	24%	3%	-7%	-7%	-6%	-3%	-8%	-3%	0.2%	3%
3	-6%	-5%	23%	5%	-3%	-4%	-6%	-5%	-5%	5%	10%
4			28%	7%	-4%	-8%					
5			-7%	1%	-4%	-9%					
6					-5%	-13%					
7						-11%					

From Table 11, we can see that the addition of inflation expectation measures from CF, SKDU_*yoy* and SPE3bln_*yoy* add a substantial predictive power to the simple model of next quarter inflation. The highest extra predictive power is caused by the addition of SKDU_*yoy*. SK6bln_*yoy* produce similar additional predictive power as SKDU_*yoy*, but this series is actually intended to measures next 2 quarter inflation expectation. For the next 2 quarter model of inflation, the highest additional predictive power is given by the inclusion of CF_2Q series.

SSMX-generated inflation expectation series shows a significant additional predictive power if added to inflation model at time *t*. This shows that, unlike the surveys' measures, this series is actually design to predict inflation at time *t*, not time *t+1*. SSMX model is not considered to be a consistent and fully rational expectation model, since its forecast is different from the expectation. This is actually inlinewith empirical evidences in Indonesia, where although inflation formation tends to be forward looking, but the past inflation still have a significant influence.

For modeling purposes, CF_1Q series can be used as an alternative of inflation expectation series in macro-econometric model. This series provide directional information regarding current and next quarter inflation. Compared to the one used by SSMX, this series can be regarded as a more "rational" (since more accurate in predicting future level of inflation), but based on imperfect foresight process (contrary to SSMX that use actual inflation in estimating inflation expectation). Different outcomes that we observed between CF and SSMX series with regards to their predictive power in determining current and future level of inflation, arised from the different assumptions applied to their data generating process. Both series represent "non-fully rational" expectations but with different degree of forward looking behavior. The advantage of using CF series compared to SSMX is that the level of forward looking behavior in inflation formation is not fixed and can be changed overtime. But the choice of implementing this series in macro-econometric model should be based on"its accuracy on forecasting the inflation and other macroeconomic variables.

Because of the lag in the publication of survey data, for forecasting purposes, central bank will be interested in the performance of more than 2 quarter horizon. The only available

data with ample performance is from Consensus Forecast, but the performance of next 4-6 quarter inflation forecast is not good.

As noticeable from the analysis that we have done throughout Chapter 5, there are many limitations due to the incomplete information and incompatibility of different survey data. A few criteria of "ideal" inflation expectation information that are needed for policy analysis and modeling purposes, are :

1. Each survey should have term structure of inflation expectation dynamics of 1 to 4 quarter a head horizons.
2. Inflation expectations are measured in end of period quarterly *yoy* inflation expectation.
3. If it's not possible to have reliable information from the respondents regarding their end of period *yoy* quarterly inflation expectation rate,then the survey should have information regarding price movement expectation that encompasses next 1 to 4 quarters horizons (measured using balance scores method). These price movement expectation data should be supplemented by price movement perception of the last 1 to 4 quarters (also measured using balance scores method). By having both expectation and perception balance scores, we will have enough information to transform the balance scores data into inflation expectation rates using the Carlson-Parkin approach (as discussed in Millet, 2006).

V. CONCLUSION

This study has analyzed empirically the inflation surveys and found several importantfindings, *first*, among various measures of inflation expectations in Indonesia, consensus forecast (CF) is the only one that gives a complete term structures of inflation expectation from 1 to 4 quarters a head horizons. In addition, CF also has monthly data on current year inflation expectation and next-year inflation expectation (average of *yoy* monthly inflations).*Second*, the heterogeneity of inflation expectationamong economic agents and professional forecasterfor short forecast horizon (1 quarter a head) is very low. For modeling purposes, it may be acceptable to assume homogeneous inflation expectation among agents.*Third*, correlation analysis and granger causality test seems to suggest that consumer inflation expectation might be influenced by retailers' inflation expectation, and Inflation expectation of professional forecaster might be influenced by inflation expectation of the firms.

These three findings lead to the *first conclusion*;the inflation expectations of different economic agents varies one another and there are inflation expectation spillovers among different economic agents. The mechanism in which how these spillovers take place is an issue that warrants further research. Among these inflation expectation surveys, the consensus forecast (CF) can be used as the main source of information in determining the level of public's inflation expectation.'*Second* conclusion, all surveys of quarterly inflation expectation provide useful directional information regarding next quarter inflation. Among them, only CF measures provide useful directional information regarding next 2 quarter inflation, hence is the most sufficient

for monetary policy purposes. For predicting the movement of future inflation rate, these data can be supported by other survey measures of inflation expectation, especially from Survei Kegiatan Dunia Usaha. For modeling purposes, 1 quarter a head consensus forecast (CF) series can be used as an alternative of inflation expectation series in macro-econometric model since this series provide directional information regarding current and next quarter inflation.

This paper also finds that inflation expectation from observed surveys seems to be forward looking, but only for relatively short horizon (mostly less than the intended forecast horizon). Although the magnitude and length vary across measures of inflation expectation, the shock to inflation expectation significantly affects the dynamics of the actual inflation rate. Among all survey that report the inflation expectation rate (not balance score), Consensus Forecast has the best performance in terms of accuracy in predicting the level of inflation at the intended forecast horizon. This is the *third* conclusion of this paper.

The policy implication for the three conclusions above is straightforward. To increase their usefulness in supporting monetary policy analysis, inflation expectation information from various surveys that currently performed by Bank Indonesia need to be improved by increasing the compatibility of expectation measurement of different surveys and expanding the time horizons availability.

REFERENCES

Alamsyah, Halim, 2008, "*Persistensi Inflasi dan Dampaknya terhadap Pilihan dan Respons Kebijakan Moneter di Indonesia*", Universitas Indonesia, September 2008.

Anwar, Muslimin and TevyChawwa, 2009 , "*Analisis Ekspektasi Inflasi Indonesia Pasca ITF",* WP No.9, Bank Indonesia, May 2009.

Curtin, R., 2006 , "Inflation Expectations: Theoretical Models and Empirical Tests", Paper presented at the Narodowy Bank Polski's workshop on "The Role of Inflation Expectations in Modeling and Monetary Policy Making" on February 9 and 10, 2006.

Dewati, Wahyu, Ndari Suryaningsih danTevy Chawwa, 2009, "*Revisiting Transmisi Kebijakan Moneter: Pendekatan VAR dan Panel Data",* Bank Indonesia, LHP No.19, December 2009.

Forsells, M. danG. Kenny, 2004 , "Survey Expectations, Rationality and the Dynamics of Euro Area Inflation", Journal of Business Cycle Measurement and Analysis.

Gnan, Ernest, Johann ScharlerdanMaria Antoinette Silgoner, 2009, "Inflation Expectations-Role and Measurement for Monetary Policy," Monetary Policy & the Economy, Oesterreichische National bank (Austrian Central Bank), issue 2, pages 41-67, August 2009.

Harmanta, 2009, "*Kredibilitas Kebijakan Moneter dan Dampaknya terhadap Persistensi Inflasi dan Strategi Disinflasi di Indonesia: Dengan Model DSGE*", Universitas Indonesia, October 2009.

Kurniati, Yati dan Sahminan, 2008, "*Ekstraksi Ekspektasi Inflasi dari Yields Surat Utang Negara*", Research Note No. 23, Bank Indonesia, 2008.

Laksmono R, Didi et al., 2000, "*Suku Bunga sebagai salah satu indikator ekspektasi inflasi*", Buletin Ekonomi Moneter dan Perbankan, Bank Indonesia, Maret 2000.

Leduc, S., K. Sill danT. Stark, 2007, Self-Fulfilling Expectations and the Inflation of the 1970s: Evidence from the Livingston Survey, Journal of Monetary Economics 54(2), 433–459,– 2007.

Mankiw, N. G., R. Reis danJ. Wolfers, 2003, "Disagreement about Inflation Expectations", NBER Working Paper 9796, 2003.

Millet, F.C., 2006, "Finding the Optimal Method of Quantifying Inflation Expectations On The Basis of Qualitative Survey Data", manuscript, Balliol College, University of Oxford.

SatishRanchhod, 2003, "The Relationship between Inflation Expectations Survey Data and Inflation," Reserve Bank of New Zealand Bulletin, Reserve Bank of New Zealand, vol. 66, December 2003.

Tjahjono Endi, Haris Munandar danJati Waluyo, 2010, "*Revisiting Estimasi Potential Output dan Output Gap Indonesia: Pendekatan Fungsi Produksi berbasis Model*", WP No. 02, Bank Indonesia, April 2010.

Whelan, Karl, 2005, "The New-Keynesian Phillips Curve", Lecture Notes EC4010, Trinity College Dublin.

Wuryandani, Gantiah, 2001, "S*uku Bunga Riil Ex-Ante sebagai Indikator Arah Kebijakan Moneter*", Bank Indonesia, December 2001.

Wuryandani, GantiahdanAbdul M. Ikram and Diah E. Handayani, 2003, "Monetary Policy Transmission Through Inflation Expectation Channel", Transmission Mechanism of Monetary Policy in Indonesia, Bank Indonesia, 2003.