

Quantifying qualitative data from expectation surveys: how well do expectation surveys forecast inflation?

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As early as 2001, the Bangko Sentral ng Pilipinas adopted new measures of collecting information that could assess the direction and general state of business and the economy especially during times of economic uncertainties. These new measures consist of two quarterly opinion surveys – the Business Expectations Survey of top corporations in the Philippines and the Consumer Expectations Survey of households in the country. Both surveys provide a quarterly outlook on the economy by corporates and consumers all over the country. This paper examines the ability of confidence indicators from the Business Expectations Survey to provide advance warning on the peaks and troughs of the Philippine business cycle measured through the real gross domestic product growth rate. This is the first comprehensive analysis of survey data fitting both in-sample and out-of-sample real time data to track the peaks and troughs of the Philippine business cycle. It was found that the resulting turning points at downturns coincide with actual critical conditions and events in the Philippine economy which triggered a real contraction or slowdown during those periods. The paper further examines the ability of confidence indicators to predict future movements of inflation and exchange rates applying a modified “KLR signals approach” of setting thresholds and estimating conditional probabilities empirically from the survey data. Results show that confidence indicators from the Business Expectations Survey are useful tools for an advanced assessment of macroeconomic and financial risks.

I. The Rationale for Conducting Business and Consumer Surveys

The conduct of surveys is almost as old as recorded history. During the early times, censuses were conducted to enumerate citizens for taxation and military purposes. Two thousand years later, technology and communications development modernized the world as well as the tools for the conduct of surveys – creating a huge demand for information and making data collection and processing swift and efficient. As a result, surveys are being conducted to fill in the data gaps in all aspects of economic and social life – industry, trade, finance, government, health, education, and other economic and social activities worldwide.

At present, many central banks are conducting business and consumer expectation surveys with corporates and households as survey respondents, respectively. These two sectors were identified under the System of National Income and Product Accounts as the major producers of goods and services for the whole economy as well as for the rest of the world. Hence, decisions made on future economic activities based on the expectations of businesses and consumers would largely determine the future course of business and the economy. Through the conduct of these two surveys, expectations of businesses and consumers are recorded and transformed into advance information on business and the economy including the likely paths of inflation, interest rates, and exchange rates in the near future.

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Two questions on the analysis of survey results are: 1. Do the indicators derived from the surveys provide correct or reliable advance information on the whole economy and on key economic indicators like inflation and the exchange rate? And 2. Aside from the direction of change, which is computed through the difference or changes in values of the indicators from the survey, how would one interpret the actual numerical values of the said indicators?

The first question is answered in Section III, which shows the tracking ability of the indicators derived from the surveys with respect to the movements of gross domestic product (GDP) growth rates, inflation rates, interest rates, employment, and exchange rates.

The second question is also addressed in the succeeding sections, which demonstrate the application of the Kaminsky, Lizondo, and Reinhart (KLR) signals approach to calculate empirical probabilities (based on the numerical values of the survey indicators from the survey data) to predict the future movements of inflation and exchange rates.

II. Business and Consumer Expectations Surveys in the Philippines

The Business Expectations Survey (BES) and the Consumer Expectations Survey (CES) are currently being conducted quarterly by the Bangko Sentral ng Pilipinas (BSP). These two quarterly surveys are intended to provide advance indicators on the overall direction of business and economic activities during the current and next quarters from the viewpoint of a representative sample of the top 7000 corporations in the Philippines covered by the BES, and a random nationwide sample of 5000 households for the CES.

The Questionnaires

Both the BES and CES ask mostly qualitative questions usually answerable with three possible choices as shown below:

Business Expectations Survey Sample Questions

	Current Quarter (Jul-Sep 2010)			Next Quarter (Oct-Dec 2010)		
	Improving	No Change	Deteriorating	Improving	No Change	Deteriorating
Business Outlook						

What are your company's expectations with respect to the following?

Economic Indicators	Current Quarter (Jul-Sep 2010)			Next Quarter (Oct-Dec 2010)		
	Up	No Change	Down	Up	No Change	Down
Average Peso Borrowing Rate						
Average Inflation Rate						
Average (P/\$) Exchange Rate (up – appreciation; down – depreciation)						

Consumer Expectations Survey Sample Questions

What do you think of the country's present economic condition compared to that of 12 months ago (*cite reference period*)?

1 – Better 2 – Same 3 – Worse

What is the present financial situation of your family compared to that of 12 months ago (*cite reference period*)?

1 – Better 2 – Same 3 – Worse

The Indicators

Qualitative data derived from the two surveys are quantified into indicators using diffusion indices or balance statistics. The diffusion index (D) is a measure of the difference between the percentage of corporates/consumers with an “improving or positive outlook” and those with a “deteriorating or negative outlook”. The diffusion index in the BES is measured by:

$$D = (100 * \sum \sum w_j Y_{ij}) / n \quad -100 \leq D \leq 100$$

Where:

$W_j = N_j / N$ is the weight of the response of the respondent firms in the j^{th} sector

N_j = number of firms in the top 7000 corporations belonging to the j^{th} sector

$N = 7000$

$i = 1$ to n_j ; n_j = number of sample firms in the j^{th} sector

$j = 1$ to k ; k = the number of sectors

n = total number of sample firms = $n_1 + n_2 + \dots + n_k$

$Y_i = 1$ if respondent's outlook is improving

0 if no change, and

-1 if deteriorating

$D > 0$ means that optimistic respondents outnumber the pessimists;

$D = 0$ optimistic respondents equal the pessimists;

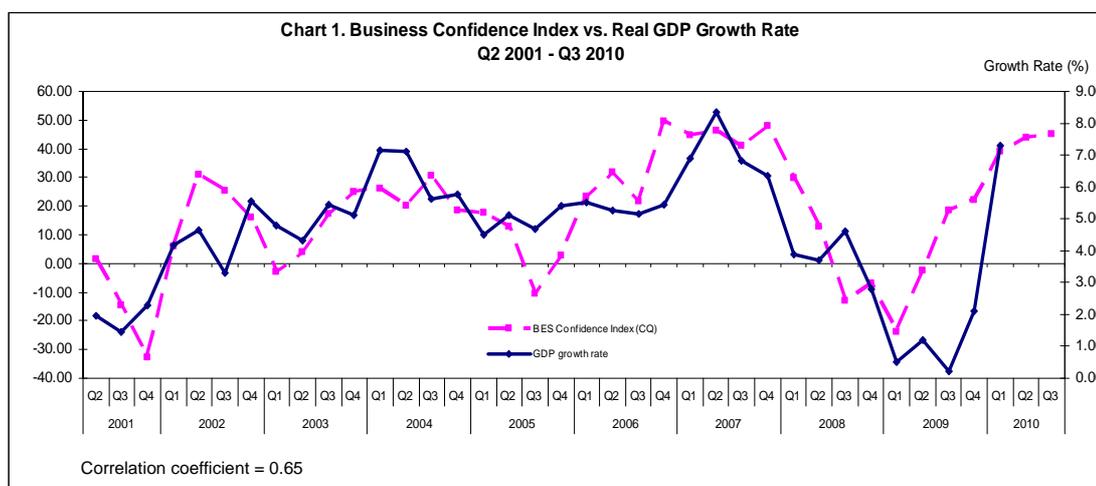
$D < 0$ pessimistic respondents outnumber the optimists.

Except for average capacity utilization, expansion plans and business constraints, which are computed in actual percentages, all of the other indicators are diffusion indices which are estimated using the above formula. The same computing methodology is also applied in the computation of the consumer outlook indices, but the weights are based on population size in the sampling areas. Time series data are available from these two surveys. Quarterly indices from the BES are available as from 2001, while those for the CES started in 2007. Listed below are the indicators derived from the two surveys:

BES INDICATORS	CES INDICATORS
Business confidence index on the macroeconomy (current and next quarters) – overall, for industry, construction, services, and trade, and by region	Consumer outlook index – average of 3 indicators – family financial situation, family income, and economic condition of the country (current quarter, next quarter, and in the next 12 months)
Business confidence index on own operations (current and next quarters) – overall, for industry, construction, services, and trade, and by region	Buying conditions index for consumer durables
Volume of business activity index	Buying intentions index for consumer durables
Volume of total order book index	Buying intentions index for house and lot
Credit access index	Buying conditions index for house and lot
Financial conditions index	Financial situation index
Average capacity utilization	Buying conditions index for motor vehicles
Employment outlook index	Unemployment expectation index
Expansion plans - manufacturing	Buying intentions index for motor vehicles
Inflation expectation index	Inflation expectation index
Exchange rate expectation index	Exchange rate expectation index
Interest rate expectation index	Interest rate expectation index

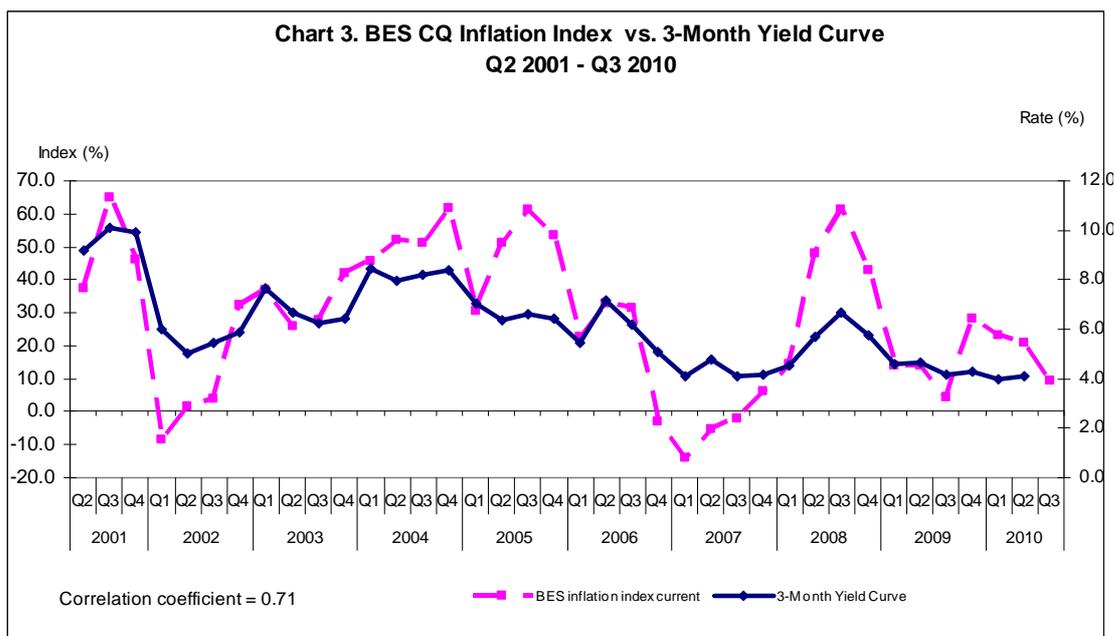
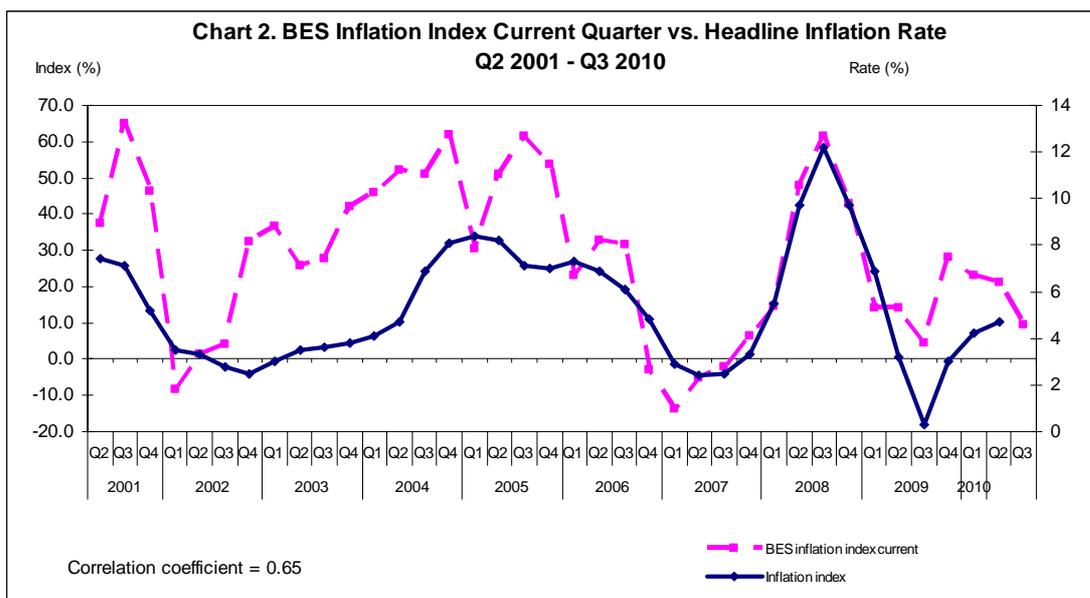
III. Tracking Ability of BES Indices

The BSP regularly monitors the ability of the BES and CES diffusion indices to track the quarterly movements of economic indicators. Empirical data from the survey results show that the business confidence index of the BES is positively correlated with the real gross domestic product growth rate of the Philippines with a correlation coefficient of 0.65.



It can also be seen from the chart that the BES business confidence index generally tracks the movement of the GDP growth rate starting from Q1 2001. Moreover, during the 2007 financial crisis the index registered a downturn and succeeding upturn ahead of the GDP growth rates in Q1 2007 and in Q2 2009, respectively.

Likewise, the BES inflation index and headline inflation rate are also positively correlated, with a correlation coefficient of 0.65. The inflation index rises ahead of headline inflation in Q1 2002 and Q1 2007 where inflation registered a turning point from a downturn to an upturn phase. The BES inflation index also correlates significantly with the three-month yield curve for government securities, with a correlation coefficient of 0.71. The BES inflation index also leads the three-month yield curve during periods of turning points from a downturn to an upturn phase.



Significant but lower correlations were also observed for the peso borrowing rate, exchange rate, and employment indices.

BES INDICES AND ECONOMIC INDICATORS	CORRELATION COEFFICIENT
BES peso borrowing rate and the three-month yield curve	0.60
BES exchange rate index and the average exchange rate	0.52
BES employment outlook index and the employment rate	0.56

Although the correlations are not remarkably high (ranging from 0.52 to 0.71) all of the correlation coefficients are statistically significant at the 1% level. These results indicate that the indices derived from the BES track the movement of its counterpart indicators and even lead these indicators at some turning points. This validates the economic framework that business expectations of corporates determine the near future course of business and the economy.

In the case of the CES indices, the analysis of the tracking ability will not be presented due to the lack of sufficient data points necessary for a robust analysis.

IV. Predictive Ability of BES Indices

The Modified Signals Approach

Following the Kaminsky-Reinhart signals approach, which was used to test leading indicators of currency crisis, a modified signals approach probability table was used to evaluate the ability of the BES inflation index to provide an advance warning signal on an impending increase in the inflation rate. The succeeding discussion describes the application of the modified signals approach.

When an indicator deviates from its “normal value” and assumes an “extreme value” beyond a certain threshold, this is taken as a warning signal of an impending increase in inflation. The possible thresholds of an indicator were the values corresponding to some predetermined value of the index (BES inflation index) such as 10%, 20%, 30%, and so on. For each threshold value, the quarterly values of an indicator² were transformed into a binary variable defined as:

Let Y_t be the inflation index

Let I_t be a binary variable such as

$$I_t = 1 \text{ if } Y_t > T$$

0 if $Y_t \leq T$, for $T = 10\%, 20\%, 30\%$ and/or any predetermined threshold level for the inflation index value.

Setting the signalling horizon at the current quarter, the effectiveness of the index in signalling an impending increase in inflation for the current quarter is evaluated using the following matrix:

² Prior to the indicator's transformation into a binary variable, the BES inflation index has been transformed into a diffusion index as defined on page 3 of this paper.

Table 1. True and False Warning Signals		
	No Increase in Inflation	Increase in Inflation
No Signal	A	B
Signal	C	D

In this matrix:

- **A** is the number of quarters when the inflation index did not issue a signal ($I_t = 0$) and no increase in inflation occurred during the current quarter.
- **B** is the number of quarters in which the inflation index failed to issue a signal. This means that the indicator did not signal an increase in inflation ($I_t = 0$) and inflation actually increased during the current quarter.
- **C** is the number of quarters in which the inflation index issued a bad signal or noise. A bad signal is when the indicator signalled an increase in inflation ($I_t = 1$) and no increase occurred during the current quarter.
- **D** is the number of quarters in which the inflation index issued a good signal. A good signal is when the index signalled an increase in inflation ($I_t = 1$) and inflation actually increased during the current quarter.

From this matrix, the performance of the inflation index in predicting an increase in inflation was examined in the following way:

- Signal = $D/(B+D)$ measures the percentage of correct signals issued by the inflation index;
- Noise = $C/(A+C)$ measures the percentage of wrong signals issued by the inflation index;
- Noise to Signal = $\{C/(A+C)\}/\{D/(B+D)\}$ measures the ratio of the percentage of wrong signals (Noise) to the percentage of correct signals (Signal) issued by the index;
- Conditional Probability of Higher Inflation = $D/(C+D)$ measures the probability of an increase in inflation occurring during the current quarter given that the index emitted a signal;
- Unconditional Probability of Higher Inflation = $(B+D)/(A+B+C+D)$ measures the probability of higher inflation in the current quarter.

If, as the threshold increases, the conditional probability of higher inflation increases, then the predictive power of the BES inflation index in projecting a possible increase in inflation will be confirmed. Moreover, the significance of this approach lies in its capability of providing estimates of the probability of an increase in inflation given the value of the inflation index in any given quarter.

Modified Signals Approach on the BES Inflation Index

The unconditional probability of an increase in inflation during the current quarter, without considering the value of the BES inflation index, is 0.5 or 50-50. Given the value of the BES inflation index, the signals approach test confirmed that as the BES inflation index gets higher, the probability of an increase in inflation rate during the quarter increases as shown in the table below. Furthermore, the results could be used in evaluating the probability of an

increase in inflation rate during the quarter once the BES inflation index is known. For example if the BES inflation index at any given quarter is 45%, then the probability of higher inflation is 0.85 and it becomes a certainty if the BES inflation index exceeds 50%. Moreover, the “Noise” disappears as the BES inflation index increases. As more data comes in from the BES results, the empirical conditional probabilities could also be updated regularly.

SIGNALS APPROACH PROBABILITY TABLE ON HIGHER INFLATION BASED ON THE BUSINESS EXPECTATIONS SURVEY INFLATION INDEX Q2 2001-Q2 2009				
Threshold	Signal $D/(B+D)$	Probability of higher inflation during the current quarter given that the BES inflation index is above the threshold $D/(C+D)$	Noise $C/(A+C)$	Noise to signal ratio $(C/(A+C))/(dD/(B+D))$
5%	0.88	0.56	0.69	0.79
10%	0.88	0.58	0.69	0.79
20%	0.81	0.62	0.50	0.62
30%	0.75	0.67	0.38	0.50
40%	0.69	0.85	0.14	0.21
50%	0.50	1.00	0.00	0.00
60%	0.33	1.00	0.00	0.00
Unconditional probability of higher inflation			0.50	

Modified Signals Approach on the BES Exchange Rate Index

Similarly, the signals approach test confirmed that as the BES exchange rate index increases, the probability of an exchange rate appreciation also increases. The probability table below could be used to evaluate the probability of an exchange rate appreciation for a given value of the exchange rate index.

SIGNALS APPROACH PROBABILITY TABLE ON PESO APPRECIATION ESTIMATED BASED ON THE BUSINESS EXPECTATIONS SURVEY EXCHANGE RATE INDEX Q2 2001-Q2 2009				
Threshold	Signal $D/(B+D)$	Probability of exchange rate appreciation during the current quarter given that the BES exchange rate index is above the threshold $D/(C+D)$	Noise $C/(A+C)$	Noise to signal ratio $(C/(A+C))/(D/(B+D))$
-15%	1.00	0.58	0.80	0.80
-10%	0.94	0.62	0.67	0.71
-5%	1.00	0.59	0.80	0.80
0%	0.82	0.67	0.47	0.57
5%	0.82	0.78	0.27	0.32
10%	0.69	0.75	0.20	0.28
15%	0.41	0.88	0.07	0.16
20%	0.41	0.88	0.07	0.16
25%	0.35	0.86	0.07	0.19
40%	0.06	1.00	0.00	0.00
Unconditional probability of peso appreciation			0.53	

V. Summary

Empirical results confirm that tracking the Philippine business cycle through the business confidence index shows significant and consistent results. The same encouraging results hold for the other BES diffusion indices on inflation, the exchange rate, the peso borrowing rate, and employment. The application of the turning point cyclical analysis as well as simple correlation techniques proved to be a simple but useful approach in monitoring the movements of key economic indicators.

The predictive ability of the BES diffusion indices for possible inflationary pressures and exchange rate appreciation using empirical conditional probabilities from the BES were also found to be significant.

The application of the modified signals approach to estimate the probability of higher inflation and exchange rate appreciation from the counterpart BES diffusion indices proved to be a useful tool for estimating conditional probabilities for higher inflation and exchange rate appreciation.

The conduct of the BES was demonstrated to be a very useful instrument for monitoring and predicting the movement of the economy, inflation, the exchange rate, and other economic indicators, which in turn underscore its importance in generating advance indicators for monetary policy.

The application of the simple statistical techniques on cyclical analysis and the use of the modified signals approach probability table have enhanced the analysis of the BES results.

In the future, the analysis of BES results could be further enhanced through the application of statistical techniques which could make use of the BES survey results not only for tracking and predicting the movements of key economic indicators but also for forecasting the growth rates of these indicators.

References

- Arnold, S. (2005), "Non-Parametric Statistics", Pennsylvania State University.
- Batchelor, R. (2006), "How Robust Are Quantified Survey Data? Evidence from the United States", Cass Business School, London.
- Cintura, Cruz, Deveza, and Guerrero (2005), "Early Warning System for Macroeconomic Vulnerability", *BS Review*, Bangko Sentral ng Pilipinas.
- Deveza, T. (2006), "Early Warning System on the Macroeconomy: Business Cycles and Leading Economic Indicators", *BS Review*, Bangko Sentral ng Pilipinas.
- Goldstein, Kaminsky, and Reinhart (2000), "Assessing Financial Vulnerability, an Early Warning System for Emerging Markets", Institute for International Economics.
- Henzel and Wollmershauser (2005), "An alternative to the Carlson-Parkin Method for the Quantification of Qualitative Inflation Expectations: Evidence from the Ifo World Economic Survey", *Ifo Working Paper No. 9*.
- Mevik, A.K. (2004), "Uncertainty in the Norwegian Business Tendency Survey", Statistics Norway, Statistical Methods and Standards.
- Muller, Wirz, and Sydow (2007), "A Note on the Carlson-Parkin Method of Quantifying Qualitative Data", KOF-Swiss Economic Institute.
- Shenker, R. (2008), "Methods of Quantifying Qualitative Data", ETH, Swiss Federal Institute of Technology Zurich.
- Sheufele, R. (2009), "Are Qualitative Inflation Expectations Useful to Predict Inflation?", *IFO-INSEE-ISAE Macroeconomic Forecasting Conference*, Halle Institute for Economic Research (IWH).

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Nonparametric Statistics

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