Technical Report

Output Gap Estimation for Inflation Forecasting: The Case of the Philippines

by Paul D. McNelis and Cristeta B. Bagsic

and "Inception Report: Visit to Central Bank of the Philippines"
by Paul D. McNelis (July 29, 2005)

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Preface

This report is the result of technical assistance provided by the Economic Modernization through Efficient Reforms and Governance Enhancement (EMERGE) Activity, under contract with the CARANA Corporation, Nathan Associates Inc. and The Peoples Group (TRG) to the United States Agency for International Development, Manila, Philippines (USAID/Philippines) (Contract No. AFP-I-00-00-03-00020 Delivery Order 800). The EMERGE Activity is intended to contribute towards the Government of the Republic of the Philippines (GRP) Medium Term Philippine Development Plan (MTPDP) and USAID/Philippines' Strategic Objective 2, "Investment Climate Less Constrained by Corruption and Poor Governance." The purpose of the activity is to provide technical assistance to support economic policy reforms that will cause sustainable economic growth and enhance the competitiveness of the Philippine economy by augmenting the efforts of Philippine pro-reform partners and stakeholders.

This technical report was written by Paul D. McNelis, Ph.D., Department of Finance, Fordham University, New York, and Cristeta B. Bagsic, Center for Monetary and Financial Policy, Bangko Sentral ng Pilipinas (BSP), following technical assistance requested by Diwa C. Guinigundo, Assistant Governor for Monetary Policy of the Bangko Sentral ng Pilipinas (BSP), on May 6, 2005. Dr. McNelis wrote his "Inception Report: Visit to Central Bank of the Philippines" in July 2005, following a short visit to Manila, and worked with BSP staff on several subsequent trips to develop the output gap models discussed in this report.

The views expressed and opinions contained in this publication are those of the authors and are not necessarily those of USAID, BSP, the GRP, EMERGE or its head offices.

Output Gap Estimation for Inflation Forecasting: The Case of the Philippines

Paul D. McNelis*and Cristeta B. Bagsic †

December 2006

Abstract

This paper examines alternative estimation models for obtaining output gap measures for the Philippines. These measures are combined with the rates of growth of broad money, nominal wages and oil prices for forecasting inflation. We find that models which combine these leading indicators in a nonlinear way outperform other linear combinations of these variables for out-of-sample forecasting performance.

Key words: forecasting, output gaps, principal components
JEL Classification: E5, F4

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1 Introduction

Output gap is a an argument for the interest rate, along with current inflation and lagged interest rates,in most discussions of Taylor rules for central banks. The rationale is that a positive output gap is an indicator of inflationary pressure not seen in actual inflation. Yet there is considerable uncertainty over output gap and its key component, potential output. Does a rise or fall in current GDP mean a change in potential output or just a cyclical change in demand? These alternatives have different policy implications. Central bank can raise interest rates to curb a rise in demand but cannot affect potential output.

We examine three measures for obtaining potential output, and thus the output gap. These measures are the Hodrick-Prescott (HP) Filter, the Constant Elasticity of Substitution (CES) Production Function and the Structural Vector Autoregressive (SVAR) approaches for obtaining measures of the output gap in the Philippines. We find that all three measures help forecast inflation. We argue that the BSP should adopt a "thick model" approach to output gap estimation for inflation forecasting, making use of all of these measures as well as information from the rates of growth of broad money, nominal wages, and the price of oil

In the next section we discuss our alternative measures of the output gap. These we turn to models of inflation, both for in-sample understanding and for out-of-sample forecasating.

2 Output Gap Measures

We discuss our three alternative measures and show quantitative estimates for this variable.

2.1 HP Filter

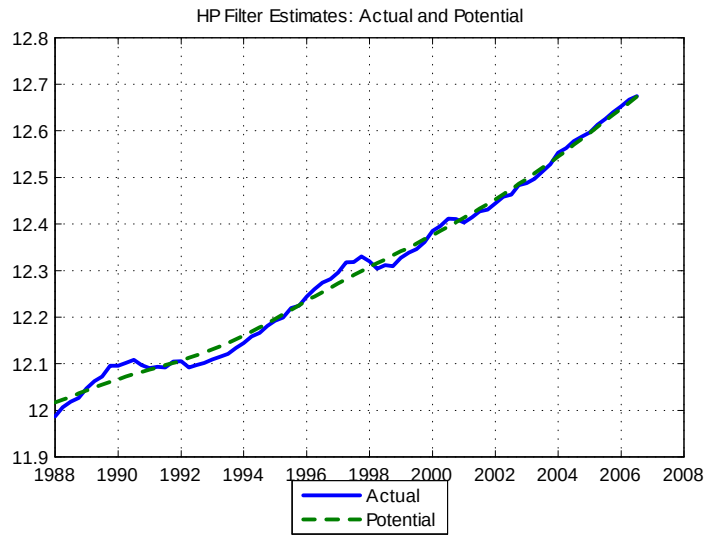
This method is between and betwixt detrending and first differencing of data. The advantage is that it is easy and quick to use. The following equation describes the filter:

$$\underset{y_t^x}{Min}\left\{\sum_{t=0}^{x}(y_t-y_t^x)^2+\lambda\sum_{t=0}^{T}\left[\left(y_{t+1}^x-y_t^x\right)-\left(y_t^x-y_{t-1}^x\right)\right]^2\right\} \tag{1}$$

The parameter λ is the controlling parameter for the smoothness of the trend. It is usually set at 1600. The output gap is defined simply as $y_t - y_t^x$, the difference between actual log output less the smoothed trend output. This is clearly a mechanical device which defines cycles it extracts by the choice of the smoothing parameter λ.

Actual and potential output appear in Figure 1.

Figure 1



2.2 CES Production Function

The Constant Elasticity of Substitution approach was originally developed by Arrow, Chenery, Minhas and Solow (1961) as an alternative to the more familiar Cobb-Douglas production function. It has the following functional form:

$$Y_t = A \cdot Z_t \left[(1-\alpha)L_t^{-\kappa} + \alpha K_t^{-\kappa}\right]^{-\frac{1}{\kappa}} \tag{2}$$

The variable Z_t is the aggregate total factor productivity shock, A is a constant term, while α, $(1-\alpha)$ represent the coefficients for capital K and labor L, known as distribution parameters which explain the relative factor shares in total output. The parameter κ is the substitution parameter.

The CES production yields the following equations for the marginal products of labor and capital:

$$\frac{\partial Y_t}{\partial L_t} = A^{\kappa-1} Z_t^{\kappa-1}(1-\alpha)\left(\frac{Y_t}{L_t}\right)^{\kappa+1} \tag{3}$$

$$\frac{\partial Y_t}{\partial K_t} = A^{\kappa-1} Z_t^{\kappa-1}\alpha\left(\frac{Y_t}{L_t}\right)^{\kappa+1} \tag{4}$$

The elasticity of substitution of capital and labor, symbolized by $\eta_{K,L}$:

$$\eta_{K,L} = \frac{1}{1+\kappa} \tag{5}$$

A necessary condition for multiple steady-states is that $\kappa > 0$. This CES function reduces to the Cobb-Douglas log-linear function under the assumption of $\kappa = 0$.

Using a second-order Taylor expansion of equation (2) with the dependent variable re-defined as $y_t = Y_t/L_t$, with $k_t = K_t/L_t$, and assuming Constant Returns to Scale, the CES function takes the following form::

$$\log(y_t) = \log(A) + \lambda \cdot tr + \alpha \log(k_t) - .5\kappa\alpha(1-\alpha)\left[\log(k_t)\right]^2 + \epsilon_t \qquad (6)$$

The parameter λ picks up a trend term.

The main advantage is that CES used production theory, based on capital, labor, trend terms, not an ad-hoc mechanical application to one data series.

We define the output gap as the residual between $\log(y_t)$ and $\widehat{\log(y_t)}$, or simply $\widehat{\epsilon}_t$. This is not the normal practice. If measures of capacity utilization and full-employment were available, we could use the estimated production function to generate potential output under assumptions of full capacity utilitzation and full emplyment. .

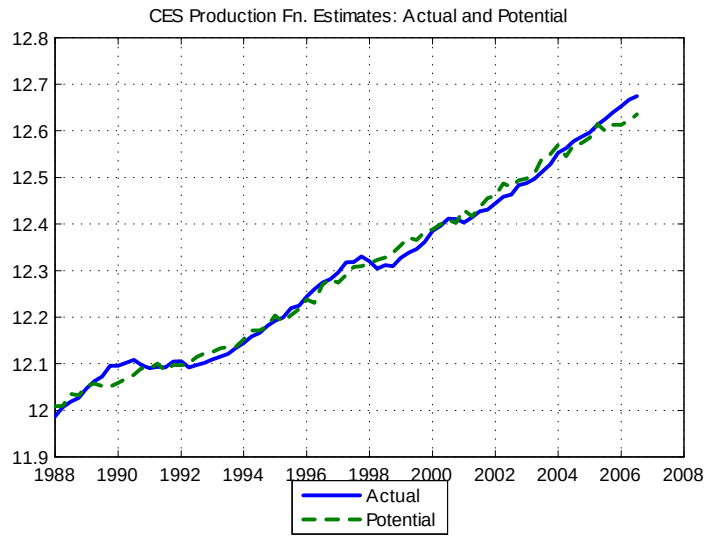
Table 1 gives the estimates for the CES Production function coefficients for equation (6):

Table 1

Nonlinear Estimates		
Parameter	Pt. Estimate	Robust St. Dev.
A	1.76	290.53
λ	0.0045	0.0018
α	0.387	124.82
κ	-0.0001	147.96

Actual and potential output appear in Figure 2.

Figure 2



2.3 SVAR Approach

This method usses a wider set of variables, not just output, capital, labor trend terms. It is based on a vector autoregressive model of the from:

$$[I - A(L)]Y_t = u_t \tag{7}$$

where $A(L)$ is a lag operator, Y a matrix of endogenous variables, and u a matrix of residuals. Equation (7) is known as the Reduced Form (RF) Model. The idea behind this this approach is to convert the multivariate AR given by equation (7) into a restricted Wold moving average (MA) process:

$$\begin{aligned} Y_t &= [I - A(L)]^{-1} u_t \\ &= S(L)\varepsilon_t \end{aligned}$$

We impose linear restrictions relating the innovations of the MA process ε_t to the residuals of the Reduced Form estimated VAR model at time t, u_t,for a $k-$variable model:

$$\begin{aligned} \varepsilon_t &= S(0)u_t \\ E(\varepsilon_t, \varepsilon_t^{'}) &= S(0)E(u_t u_t')S'(0) = \Sigma. \end{aligned}$$

The basic point of SVAR estimation is simple and straightforward. Knowledge of $S(0)$, the matrix of contemporaneous effects of the structural disturbances ε_t on Y_t allows us to recover the structural shocks from the reduced-form

residuals u_t.In estimating the SVAR, we first estimate a VAR model. The logarithm of output enters in first-differences and must be the first variable in the model.

Changes in permanent component of output can be written as:

The model tells us that the permanent component of changes is GDP is simply its own current and lagged innovations or shocks. There represent the non-cyclical innovations to real GDP coming from purely exogenous techological change or other sources beyond the control of policy. The other cyclical components of the change in GDP are explained by the lagged (not current) values of other variables in the model.

It is important to note that potential gdp and gdp gap are presented as first differences, not in terms of levels. We can convert these into levels by starting from an initial estimate of $log(gdp)$.The calculation of the output gap is within the structure of the VAR/SVAR model. We do not compare actual output with a trend level or level of output from a production function. We simply compare the output generated by permanent shocks to GDP with the level of output generated by cyclical or demand-side variables within the VAR framework. It is conceptually different from the HP and CES measures.

In the SVAR estimation, we use the following variables: the logarithmic change in real GDP, Δy, the logarithms of the real exchange rate and employmetn, given by RER,and $EMPLOY$, the rate of interest, $WAIR$,and the deficit/GDP ratio, given by DEF/GDP.

Table 2-A gives the point estimates for the SVAR estimation.

Table 2-A

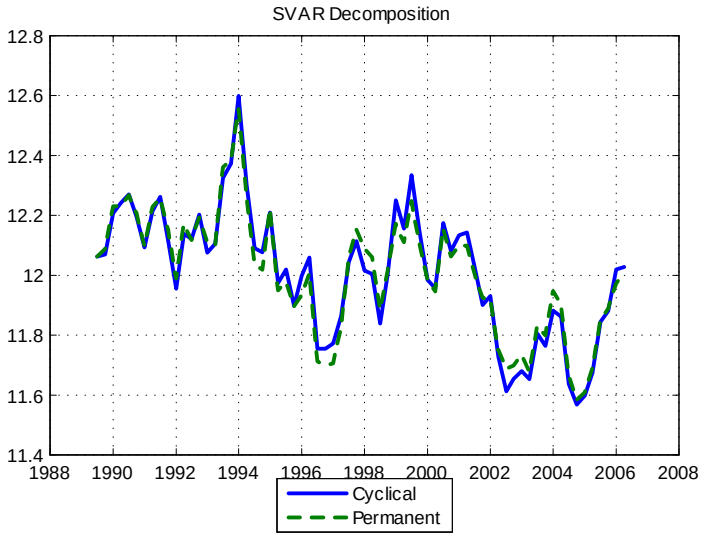
Contemporaneous Arguments: Point Estimates:					
Dependent Variable	Δy	DEF/GDP	WAIR	RER	Employ
Δy	1.000				
DEF/GDP	0.153	1.000			
WAIR	-0.003	0.114	1.000		
RER	-1.146	1.042	0.009	1.000	
Employ	-0.640	-0.176	0.003	0.100	1.000

Table 2-B

Unrestricted Contemporaneous Arguments: Std Errors					
Dependent Variable	Δy	DEF/GDP	WAIR	RER	Employ
Δy					
DEF/GDP	0.023				
WAIR	3.239	0.021			
RER	0.084	0.054	0.0004		
Employ	0.044	0.028	0.0002	0.008	

Actual and potential output from the SVAR estimation appear in Figure 3.

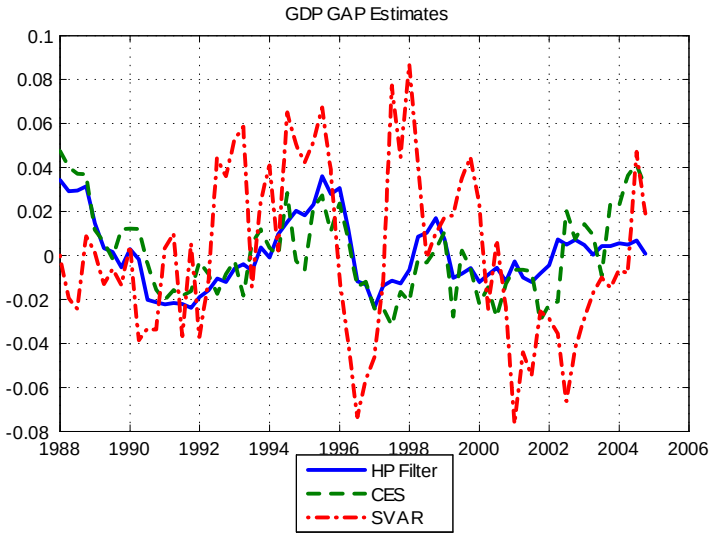
Figure 3



2.4 Comparing Gap Estimates

Figure 4 presents all three gap measures. These are the gap measures for the full sample. We see that the SVAR measures is considerably more volatile than the HP and CES measures.

Figure 4



3 Inflation Forecasts

The proof of the pudding in the eating: how well do these alternative measures help forecast inflationary developments? We find that all three are helpful for recursive out of sample forecasts. For in-sample, the HP and CES are significant but the SVAR measure is not. But the best overall model for forecasting is one which uses all three measures as explanatory variables.

We do not know what exactly the "output gap" is, so why not use all three? We also used linear and non-linear principal components to "distill" one measure from all three, and use these alternatives but they did not do better. In all of our model, we define inflation as as $p_t - p_{t-4}$.

The benchmark model againt which we compare the explanatory power of models with various output gap measures and other leading indicators, is a model with only the ow lags of inflation. We then explore alternative models: (1) lags of inflation and HP gap; (2) lags of inflation and CES gap; (3) lags of inflation and SVAR gap.

We also make use of additional leading indictors: the annualized rates of growth of broad money $\Delta_4 m3_t = (m3_t - m3_{t-4})$, nominal wages $\Delta_4 w_t = (w_t - w_{t-4})$, and the price of oil $\Delta_4 po_t = (po_t - po_{t-4})$.

3.1 Alternative Models: Distilling Information from Indicators

Stock and Watson (2000) have shown that the best way to forecast inflation is to combine information from a wide class of potential leading indicators or explanatory variables. We have six possible indicators: the three output gap measures, as well as the rates of growth of broad money, wages and the price of oil.

One way to combine the information from these variables is to make use of principal component methods.

Linear principal components for a set of variables is equivalent to a series of orthogonal regressions. Given a data set X consisting of T observations for H variables, we find the first principal component by computing the eigenvalues and eigenvectors of from the following equation:

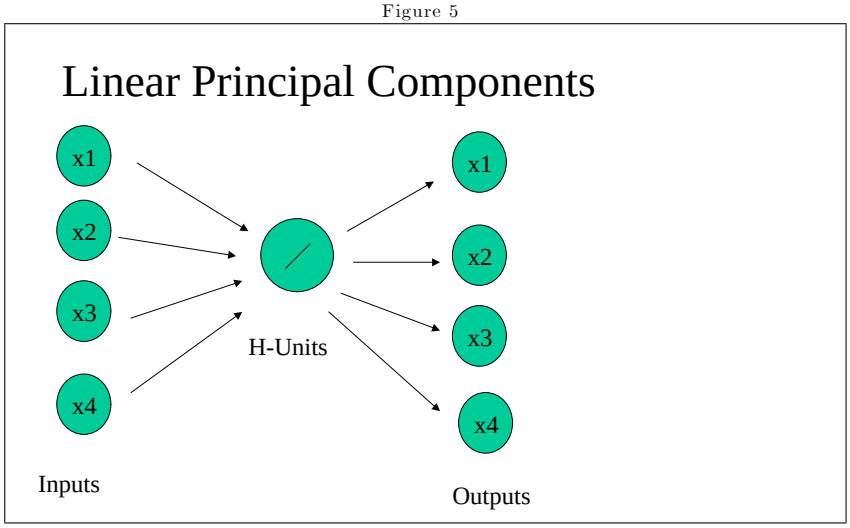
$$[X'X - \boldsymbol{\nu}_i I]\mathbf{V}_i = 0$$

where $\boldsymbol{\nu}_i$ is the i-th eigenvalue and $\mathbf{V}_i$ is the associated eigenvector of dimension (H by 1) for eigenvalue $\boldsymbol{\nu}_i$. For linear principal components, the first linear principal compent is simply the matrix X multiplied by the eigenvector associated with the first or largent eigenvalue, $\mathbf{V}_1$:

$$PC_1 = X \cdot \mathbf{V}_1$$

For a matrix of rank H, there can be at most H eigenvalues. Figure 5 pictures the setup of a linear principal compoents. The variables x1 through x4 map into each other through the H-unit set of principal componets.

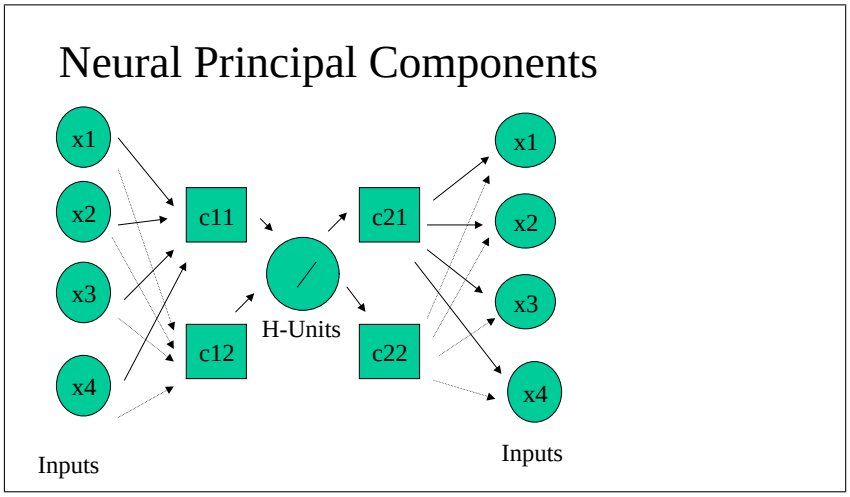
Figure 5



An alternative to the linear principal components is the use of nonlinear auto-associative maps. Just as in the linear principal components, the variables x1

through x4 map into each other. Figure 6 pictures one example of a nonlinear principal component. The variables x1,...x4 map into each other, as before, but they do so thorugh a set of encoding receptors, usually logistic functions. represented by the boxes c11 and c12, onto at most H-units, where H=4. The H units are then decoded by the logistic functions in boxes c21 and c22.

Figure 6



We combine the three output gaps and the three growth rates for a nonlinear principal component to see if this provides additional information not gleaned by the linear principal componet.

Finally, using all the information, from the three output gaps, the three growth rates, the linear and nonlinear principal components, we construct a trimmed mean (the mean cutting out the highest and lowest 10% outliers), to form a single leading indicator.

We summarize the models we use in Table 3.

Table 3

Alternative Forecasting Models for Inflation

Model	Arguments	
Reference	$\Delta_4 p_{t-1} ... \Delta_4 p_{t-k}$	
1	$\Delta_4 p_{t-1} ... \Delta_4 p_{t-k}$	$ygap_{HP,t-1} ... ygap_{HP,t-k}$
2	$\Delta_4 p_{t-1} ... \Delta_4 p_{t-k}$	$ygap_{CES,t-1} ... ygap_{CES,t-k}$
3	$\Delta_4 p_{t-1} ... \Delta_4 p_{t-k}$	$ygap_{SVAR,t-1} ... ygap_{SVAR,t-k}$
4	$\Delta_4 p_{t-1} ... \Delta_4 p_{t-k}$	$\Delta_4 m3_{t-1} ... \Delta_4 m3_{t-k}$
5	$\Delta_4 p_{t-1} ... \Delta_4 p_{t-k}$	$\Delta_4 w_{t-1} ... \Delta_4 w_{t-k}$
6	$\Delta_4 p_{t-1} ... \Delta_4 p_{t-k}$	$\Delta_4 po_{t-1} ... \Delta_4 po_{t-k}$
7	$\Delta_4 p_{t-1} ... \Delta_4 p_{t-k}$	$LPC_{t-1} ... LPC_{t-k}$
8	$\Delta_4 p_{t-1} ... \Delta_4 p_{t-k}$	$NPC_{t-1} ... NPC_{t-k}$
9	$\Delta_4 p_{t-1} ... \Delta_4 p_{t-k}$	$TM_{t-1} ... TM_{t-k}$

Note: LPC: linear principal component of gap/growth variables
NLP: non-linear principal component of gap/growth variables
TM: trimmed mean of gap, growth, LPC, NPC variables

3.2 In-Sample Performance

Before evaluating the forecasting performance, we first examine the performance of the model on the full data set. The results appear in Table 4. We should note that the data we use in the in-sample estimation differ from the data used in the forecasting. The forecasting arguments for the output gaps are recursively updated. We do not use the full-sample output gaps as arguments for forecasting inflation in earlier periods of the model.

We see that model 5, with lagged wage growth arguments, is statistically significant at the ten percent level. We chose a lag length of six for inflation and wage growth to ensure that the residuals were free of autocorrelation.

Table 4

	Reference	1	2	3	4	5	6	7	8	9
RSQ	0.921	0.927	0.924	0.925	0.930	0.937	0.933	0.924	0.925	0.928
Granger Tests of Causality										
Model										
		1	2	3	4	5	6	7	8	9
p-values		0.593	0.898	0.806	0.386	0.070	0.190	0.882	0.836	0.512

3.3 Out-of-Sample Performance

Table 5 gives the out-of-sample forecasting performance of the models. We see that the best model, in terms of overall forecasting performance, is model 8, with the nonlinear principal component of the three output gap measures

as well as wage, broad money, and oil price growth rates. The forecasting improvement over the benchmark model is 8.2 percent. This performance is statistically significant, based on the Diebold-Mariano (DM) and Clark-West (clarkwstat) tests of comparative forecasting accuracy.Concluding Remarks

The uncertainties in output gap estimation arise from model selection, and data issues. Statistical and data revisions have been known to contradict prior appreciation of output gap estimates. It is in this context that the Philippine monetary authorities will find the use of a "‘thick model"’ attractive, if not a necessity during periods when indicators of inflation do not all point in one direction.

This study does not make any determination on how much weight the central bank should accord the output gap in setting policy. The determination of such weight should be the subject of future research, as exercises to improve estimates from current models by remedying data gaps. But having seen the significant relationship between Philippine inflation rate and the output gap, these efforts should serve the central bank well.

Table 5

	Reference	1	2	3	4	5	6	7	8	9
RMSQ	0.022	0.021	0.023	0.023	0.023	0.023	0.025	0.021	0.02	0.0243
% GAIN		5.91	-3.64	-4.55	-4.55	-3.18	-14.09	3.18	8.18	-10.45
DM-Significance Test for Prediction Accuracy: Model 8 vs. Reference Lags for correction for autocorrelation										
	1	2	3	4	5	6	7	8		
dmstat	1.29	1.189	1.314	1.63	2.348	2.79	2.003	1.561		
p-value	0.099	0.117	0.095	0.052	0.009	0.003	0.023	0.059		
Clark and West Test for Predictive Accuracy with Nested Models Lags for correction of variance/covariance matrix										
	1	2	3	4	5	6	7	8		
clarkwstat	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016		
p-value	0	0	0	0	0	0	0	0		

4 Concluding Remarks

The uncertainties in output gap estimation arise from model selection and data issues. Statistical and data revisions have been known to contradict prior appreciation of output gap estimates. It is in this context that the Philippine monetary authorities will find the use of a "‘thick model"’ attractive, if not a necessity during periods when indicators of inflation do not all point in one direction.

This study does not make any determination on how much weight the central bank should accord the output gap in setting policy. The determination of such weight should be the subject of future research, as exercises to improve estimates from current models by remedying data gaps. But having seen the

significant relationship between Philippine inflation rate and the output gap, these efforts should serve the central bank well. We conclude, in the spirit of Sargent, Williams and Zha (2004) that it is important to acknowledge model uncertainty, about the formation of output gap measuers, in the formulation of monetary policy, and make use of thick models, or combinations of models.

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Inception Report
Visit to Central Bank of Philippines

by Paul McNelis

July 29, 2005

Background

During the week of July 25, Paul McNelis met with the research staff of the Central Bank to discuss further USAID/EMERGE collaboration with the Central Bank on two projects related to their commitment to inflation targeting as the objective of monetary policy. One project is the identification of potential output as the transmission channels of monetary policy. The other project is refining the use of a static general equilibrium model, to take up the resource effects of trade, with the use of the econometric models now in place. The research department has three models in current use: a single-equation core inflation forecasting model, a short term model for quarterly data, and a longer-term annual model for examining trends in the economy. We discussed the structure and use of these models for several days.

McNelis gave two presentations, one relating to the use of calibrated dynamic general equilibrium models for policy evaluation, and another on finding optimal monetary policy rules for given fiscal or tax regimes. Since the Philippines is now shifting to a consumption tax from other forms of taxation, understanding the short term inflationary and demand-depressing effects of a consumption tax is important for more precise inflation targeting.

McNelis had several meetings with Deputy Governor, Diwa Guingundo, and with Mrs. Editha Alido, Director of Department of Economic Research, as well as with Francisco Dakila, the officer in charge of the newly created Center for Monetary and Financial Policy, within the Department of Economic Research. He also met with Denis Bautista and Raquel Claveria from the same Department for several conversations.

Issues

1. Measure of output gap and inflationary trends

Briefly put, the task of the research department is to give the leaders of the central bank information about future inflation and the output gap (the difference between actual demand and potential output) for setting interest rates as a response to changes in these variables. The bank wants to improve its measurement of output gaps, obtain better forecasts of inflation and to understand better the transmission mechanism of monetary policy (how interest rate changes affect the real sector of the economy).

The identification of potential output for output gap targets of monetary policy requires the use of several models. There are many ways to measure potential output for an economy. One way is through the use of a production function, and another is through the identification of longer-

term trends (via filtering methods). All of these methods are subject to criticism. It would be risky for the Central Bank to rely too much on one or the other of the models. One of the best ways to avoid model-dependence is to use a hyper-model, to make use of several models to obtain measures of potential output and put varying, adaptive weights on the alternative models. We have to acknowledge misspecification in macroeconomic models, namely that all of our models are partial, and that the best strategy is to use Bayesian methods of updating weights on a series of models.

Further information on the output gap that can come from the use of a static computable general equilibrium model can also be used. Such a model can provide parameters and inputs for trends in capital stock and productivity, terms of trade for the ongoing updating of the econometric models, and the calibration of the dynamic model for policy evaluation

Proper measure of the output gap is of major importance. If the central bank over-reacts to changes in the output gap, by raising interest rates when potential output is growing rather than when there is excess demand, it will be killing off growth opportunities for the country. On the other hand, if it does not react to changes in output, when potential output is constant, it will be setting the stage for more inflation.

Proper measurement of output developments is a major issue in scholarly debates in the United States about the "great inflation" of the 1970's. While many academic economists have attacked the FED for formulating bad policy at that time, others have shown that the FED policy at the time, understood by the data available at that time, instead of the revised data we have know, was perfectly in accord with responsible monetary policy.

For forecasting inflationary developments for different time horizons, the bank uses three models, a monthly inflation model, a quarterly model and an annual model. To sharpen their forecasts, it would be helpful to compare their accuracy against each other and with a combined model.

2. Policy evaluation

Economic forecasting, of course, is not the same as policy evaluation.

Once the central bank identifies output gap and expected inflationary pressures, how should it combine these measures in a "rule" for changing the interest rate? The rule need not be a hard and fast, literally fixed rule, but rather a benchmark for discussing the setting of the interest rate. To do this, objective functions of the central bank need to be made more explicit, and the budget constraints, and welfare consequences compared, for different policy rules, under differing structural assumptions and scenarios. To accomplish this task, it is necessary to use a smaller, calibrated theoretical model, based on underlying theory, but specified to capture many of the features of the Philippines. The small dynamic model can be adjusted in incremental ways, to allow different features of the monetary transmission mechanism to come into play, so that the staff can assess the relative importance of the channels by which monetary policy affects the economy.

3. Banking sector fragility

The central bank is also the lender of last resort for an economy, so that it is naturally concerned with the fragility of the banking sector, as a consequence both of external developments and of

changes in its own policy framework for interest rates. For this reason it is necessary to draw upon early warning signals for banking sector fragility. Such empirical work has been done for crisis-prone countries, but a more extensive system can be developed for the Philippine economy.

Needs of the Bank Staff

The bank's staff members know their abilities and, more importantly, know what they do not know. They want to find and put in place better ways to measure the output gap, to generate more precise inflation forecasts, to understand better how their forecasts and measures should be combined for a benchmark rule for interest-rate setting that is best for the economy, and they want to develop a user-friendly early warning system for banking fragility.

The bank staff wants to improve their software capacity to implement more advance modeling methods beyond the standard econometric packages.

The staff wants to draw upon existing computable general equilibrium models for extracting information for trends in potential output.

The bank would like to improve the forecasting ability of existing models by understanding more recent Bayesian learning methods for combining forecasts of a family of models at their disposal.

The bank staff recognizes that dynamic general equilibrium models need to be used and they recognized their need to learn how to use these models. They also recognize that they lack the computational skills to implement these models.

For banking sector fragility and early warning signals, several programs making use of neural networks and signally methods are now available.

Agenda

The staff sees this as a project over the next year and year and a half to two years. McNelis can be available over the course of the next two years, for up to 60 days, for work at the Central Bank. McNelis has had extensive experience on a similar project at Bank Indonesia which ended in the year 2001. This project can proceed more rapidly now, since new software programs such as DYNARE, created by Michel Julliard in Paris, are now available on the web, which are used by research departments at many central banks. McNelis has also worked on neural network methods for classification in a recently published book from Elsevier Science publishers.

The staff would also like to make use of regular training from outside experts, on a range of topics related to the project, from filtering methods for output gap measurement, to Bayesian methods for forecasting with combined models, to the formulation of dynamic general equilibrium models for policy evaluation, to early warning signal assessment with new financial software for classification of risks.

Clearly, structured learning in a well-organized framework, and pre-set curriculum, would be desirable. However, this training is not academic, and policy makers need to learn quickly as needs arise. Furthermore, academic experts may not be available in a well-structured order of appearance. So outside workshops may have to proceed on several fronts.

My impression is that the priority right now is on the output-gap measurement and identification. This project involves data gathering, econometric updating, and use of a general equilibrium model.

In order to keep the staff moving forward on the project, regular use of tutorials by outside experts would be very effective. The European Central Bank, where McNelis spent the spring term in 2005, regularly has such tutorial workshops. McNelis is prepared to work with the staff in identifying such experts for training.