A monetary policy rule: The augmented Monetary Conditions Index for Philippines using UECM and bounds tests

Wai-Ching Poon

Abstract:
This paper constructs the augmented monetary conditions index (AMCI) over 1982:1-2004:4 using UECM and bounds test approach for the Philippines data. Results reveal evidence of cointegration between the real GDP and its determinants, namely short-term interest rate, exchange rate and claims on private sectors that take into account three key transmission mechanisms channels in the conduct of monetary policy, namely the interest rate, exchange rate and credit channels. While asset price channel is found to be insignificant. The monetary conditions during the study periods is reflected in the Bangko Sentral ng Pilipinas’s reaction to the prevailing economic situation, imply that the AMCI tracks the inverse movements of the real GDP growth reasonably well after 1990s. Possible light of policy implications have put forward.

Keywords: AMCI, monetary policy, cointegration, bounds test, UECM, transmission mechanisms

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1. Introduction and motivation

In the open economies, the inclusion of both interest rate and exchange rate transmission mechanism channels in the conduct of monetary policy are common. Short-term interest rates have been the primary instrument of domestic and foreign monetary conditions for many countries, where changes in the monetary policy stance affect the interest rate and vary saving-investment decisions. Monetary Conditions Index (hereafter MCI) is defined as the weighted sum of the percentage points change in the short-term real interest rate relative to their values in a base period and the percent change in the exchange rate relative to the base period (See Freedman, 1995, p.75). The idea of using MCI as approximate measure of the state of the overall monetary conditions was pioneered by the Bank of Canada in the late 1980s, followed by New Zealand in December 1996. Empirically speaking, a MCI can be constructed using either nominal or real variables².

In the process of formulating monetary policy, series of variables could be ranged from the ultimate policy target at one end to the policy instrument at the other end, with operational target, intermediate targets and indicators or information variables in the middle (See Freedman, 1995). When MCI is featured eminently as an operational target, it shows the degree of easing or tightening of the monetary policy stance relative to a benchmark period. When MCI is used as a policy indicator, it keeps track on both interest rate and exchange rate movements and their effects on aggregate demand (AD). Interest rate affects AD through their impact on the intertemporal consumption and saving decisions of households, as well as the intertemporal investment decisions of firms. Meanwhile, the exchange rate influences AD through its impact on the relative price of domestic-versus foreign-produced goods. When MCI is served as an informative indicator for liquidity conditions in the financial system, it also provides information on monetary policy stance by comparing the effects of interest rate and exchange rate on the inflation rate (Hansson and Lindberg, 1994). Since exchange rate can be influenced by factors other than monetary policy actions, and it is difficult to assess the source of shocks to the exchange rate and appropriate policy responses, hence emphasis is now placed on using an MCI as an indicator of monetary and financial conditions, rather than a policy target (Peng and Leung, 2005).

Intuitively, an increase in MCI reflects tightening, while a decrease in MCI signifies easing of monetary conditions. Monetary conditions can be tightened by an increase

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² Freedman (1995), Peeters (1999) and Gottschalk (2001) have used nominal term of the variables for Canada, EMU, and Euro area respectively. Kennedy and Riet (1995) estimated MCIs for the period 1987-1995 for Germany, the United Kingdom, Italy, Spain and France, on the basis of nominal weightings from the NIGEM model [NIGEM model took the weight from the multinational model of the London-based National Institute for Economic and Social Research (NIESR)]. Meanwhile, Hansson and Lindberg (1994), Gerlach and Smets (2000), Bofinger and Wollmershauser (2001) and de Wet (2002) typically based the MCIs on real terms of the variables. Whilst, Duguay (1994) has estimated both nominal and real MCI, with more emphasis on the former for short-term period due to the problems of data availability of Canada’s main trading partners that were used in the calculation of the real effective exchange rate.
in the domestic short-term interest rate and would induce capital inflows, and consequently lead to an appreciation of the exchange rate. Exchange rate appreciation brings contradiction effect to the economy. Hence, tighten monetary conditions serves to dampen AD, and *vice versa*. If a lessening of inflationary pressure relative to what had been expected, the desired path for monetary conditions is revised downwards. However, if inflation pressures have increased relative to earlier expectations, the desired monetary conditions should be adjusted upwards (Bank of Canada, 1995). However, previous studies have questioned the weight of MCI. The MCI weight represents the output elasticity with respect to the real interest rate and the real exchange rate on AD. The question now is whether MCI could be a useful indicator of the domestic monetary conditions for the Philippines in facing a more liberalizes economy.

Apart from the interest rate and exchange rate channels, other transmission mechanism channels are influencing the conduct of monetary policy stance. On the supply side of the credit market, tight monetary policy reduces banks' lending ability as tightening of monetary policy reduces bank reserves and ultimately the quantity of customer deposits (Bernanke and Gertler, 1995; Bank of International Settlements, 1997). On the demand side of the credit market, tight monetary policy makes borrowers less creditworthy or less eligible for loans (Abel and Bernanke, 2005).

The present study is different from the conventional construction of MCI. Here, the augmented MCI (hereafter AMCI) is constructed by incorporating the claims on private sectors and share price to capture for the credit and the asset price channels respectively in addition to the interest rate and exchange rate channels. This study employs the Autoregressive Distributed Lag (ARDL) bounds test approach to examine cointegration between the real GDP and its determinants. The weights of the AMCI are derived from the AD equation. Long run elasticities will be calculated, and it will then be used to construct the AMCI index.

1.1 The Philippines in brief
Apart from Marcos bailouts and cronies, the heavy dependence of the banking system on funds from the Bangko Sentral ng Pilipinas (BSP, the Central Bank of the Philippines) at low interest rates has contributed to financial chaos during the 1980s. BSP set interest rates on both bank deposits and loans to adjust for inflation. During the early 1980s, the Philippines embarked on comprehensive financial sector reforms and BSP has liberalized foreign exchange regulations, which included: 1) investors were allowed to purchase foreign exchange up to $1 million annually from the banking system for investment abroad, without prior approval from BSP; 2) all limits on repatriation of capital or remittances of dividends from foreign direct investment were removed; 3) foreign banks were permitted to grant short-term foreign currency loans to eligible borrowers without prior approval from BSP, and commercial banks were allowed to extend both short- and long-term foreign currency loans without prior approval from BSP; 4) interest rate liberalization and deregulation in 1981-1983 (see Circular No.1353 that was issued on August 24, 1992). However, due to
economic and political crises, reforms were not taking-off smoothly until the latter half of the 1980s.

Since the early 1980s, there were large intermediation margins between lending and borrowing rates. Philippine banks offered different rates for deposits on different amounts. For instance, rates offered on six-month and twelve-month time deposits differed by 1 percentage point, and the rate differential for foreign currency deposits for all available maturities were within a single percentage point range. Interest rates of time deposits were bid up to reduce capital flight. The World Bank even claimed that the Philippine commercial banking industry was highly oligopolistic. The Philippines relies heavily on government securities in its monetary operations to freeze the central bank debt issue and to finance budget deficit. The central bank bills became the main instrument of monetary policy until 1986.

Following debt crisis in 1983 and the subsequent moved to floating exchange rate regime in October 1984, monetary aggregates (M3) was the indicator of domestic monetary policy stance to achieve price stability. However, a rise in M3 in 1993-1995 has not led to higher inflation (Bayangos, 2000). It was funded mainly by significant pick up in credit extended by the monetary system. Similarly, the relatively high year-on-year growth in M3 of more than 40 percent during the early part of the 1995 also failed to ignite price surge even after 8–12 months. In addition, money supply growth has been expanded during economic and political turmoil and then contracted when the Philippines tried to meet IMF requirements. The flooding of money prior to the 1986 elections was one reason why the newly installed Aquino administration chose to scrap the arrangement with the IMF in the early 1986. The BSP released funds to stabilize the financial situation for three times: i) following a financial scandal in early 1981; ii) after the onset of an economic crisis in late 1983; and iii) after a coup attempt in 1989. The money, the so-called Jobo bills, was then repurchased by the Treasury and the Central Bank at high interest rates in which the interest paid was greater than borrowing rate.

With the adoption of IMF loan program, BSP has conducted monetary policy by targeting monetary aggregates to control inflation. Following crisis in 1997, the peso depreciated by more than 50 percent at the end of the year. The rise in interest rates did not help the peso that eventually made monetary targeting a less reliable indicator for monetary policy. In January 2000, the BSP's policy-makers have shifted to an inflation-targeting framework to attaining low and stable inflation. Therefore, the monetary authorities have to broaden measure of domestic monetary conditions that has virtually altered the landscape of monetary stance formulation.

The remaining of the paper is organized as follows. Section 2 outlines the empirical model framework, variables selection and data sources for the investigation. Section 3 analyzes the empirical results. Section 4 depicts the estimated AMCl's under consideration. Finally, Section 5 offers conclusions and policy implications.
2. Methodology
2.1 Model specification and data
The weights of AMCIs are estimated in a single equation based econometric approach using Autoregressive Distributed Lag (ARDL) bounds test approach as proposed by Pesaran et al. (2001) to test for the cointegration between real GDP, long- and short-term interest rate, exchange rate, and claims on private sector over the quarterly period 1982:1-2004:4.

Following Stevens (1998), the conventional benchmark formulation of the AMCI was computed based on equation as shown in equation (1).

\[ y = \gamma r + \delta e + \text{“other variables”} \quad (1) \]

where \( y \) is the real Gross Domestic Product (GDP) [calculated by the ratio of nominal GDP on percent of CPI (2000=100)]; \( r \) denotes real interest rates [following Batini and Turnbull (2002) and OECD (1996), the ex ante short-term real interest rate is measured by the difference between 3-month Treasury bill rate and the actual inflation rate; \( e \) denotes natural logarithm of the real exchange rate [as units of Pilipino currency per unit of US dollar] (where a rise in \( e_t \) represents depreciation). The parameters \( \gamma \) and \( \delta \) are the coefficients terms on interest rate and exchange rate in equation (1). “Other variables” include: 1) Time deposits rate as proxy for long-term real interest rate (BOND) [following Peng and Leung (2005), calculated by time deposit rate (>2 Years) minus CPI]; and 2) Real claim on private sectors (COPS) to account for credit channel [calculated as the COPS/CPI%].

According to Steven (1998), Ericsson et al. (1998), and Batini and Turnbull (2002), the simple transmission process of monetary policy can be depicted in the AMCI at time \( t \) as:

\[ \text{AMCI}_t \equiv \alpha (r_t - r_b) + \beta (e_t - e_b), \quad \alpha + \beta = 1 \quad (2) \]

Subscript \( t \) is a time index, the subscript \( b \) is the base period, \( r_t \) and \( e_t \) are the real interest rate and the exchange rate at current period respectively. \( r_b \) and \( e_b \) are the real interest rate and the natural logarithm of the real exchange rate at base period (2000=100) respectively. Meanwhile, \( \alpha \) and \( \beta \) denote respective weights, where \( \alpha = \gamma/(\gamma + \delta) \), \( \beta = \delta/(\gamma + \delta) \). The weight of the AMCI is estimated using two variables, i.e., \( r \) and \( e \) that affect AD function using the single equation based MCIs. All variables with the exception of the interest rate are expressed in logarithms (Guender, 2001; Burger and Knedlik, 2003) and all series are expressed in real terms. Time deposit is collected from SEACEN Financial Statistics, while other data are obtained from the International Financial Statistics.

2.2 Autoregressive Distributed Lag (ARDL) Bounds Test
The bounds test as proposed by Pesaran et al. (2001) is applied to examine cointegration between output and the determinant variables. This approach is based on the estimation of an unrestricted error-correction model (UECM). The estimation
strategy of Autoregressive Distributed Lag (ARDL) is a valid asymptotic inference. This technique has the advantage of not acquiring a precise identification of the order of the underlying data. The values of the optimum lag lengths are appropriately chosen to mitigate any residual serial correlation and the problems of endogenous regressors, irrespective of whether the variables are I(0) or I(1) (Hsiao, 1997; Pesaran et al., 2001) and the ordinary least square (OLS) estimates is used. Bounds test involves two asymptotic critical value bounds, depending on whether the variables are I(0) or I(1) or a mixture of both. If the test statistic exceeds the respective upper critical values, there is evidence of a long-run relationship, and the null hypothesis of no cointegration is rejected. If it falls below the lower bounds, the null hypothesis of no cointegration cannot be rejected, and if it lies between the bounds, inference is inconclusive.

2.3 Log-linear model
Based on the outlined theoretical arguments above, a general function of the real GDP in the equation (1) can be written as: \( y_t = f(r, e, BOND, COPS) \), where \( r \) accounts for short- and \( BOND \) for long-term interest rate channels, \( e \) for exchange rate channel, and \( COPS \) for credit channel. Hence, the log-linear model is specified as in equation (3).

\[
Ly_t = \beta_0 + \beta_1 r_t + \beta_2 Le_t + \beta_3 BOND_t + \beta_4 LCOPS_t + \epsilon_t \tag{3}
\]

An increase in interest rate decreases the output growth. A negative weight is expected in the government bond risk rate since the higher the corporate bond risk premium, the higher the cost of external risk. On the other hand, higher exchange rate decreases the potential output via higher cost of imported goods. However, the negative sign of estimated coefficient of the real exchange rate indicates that appreciation leads to expansionary effect on the output. As a consequence, exchange rate appreciation does impose cost on risk adverse market contributors, and responds in favor of trade and induces exports at the margin. This impact is particularly true when the income effect exceeds substitution effect. Meanwhile, an increase in asset prices stimulates the credit channel and increases the borrowing capacity and boosts up consumption. Hence, a higher level is an indicative of a looser stance that signals a higher output growth. Meanwhile, a higher risk spread reflects tighter credit condition and thus lowers the output growth. Hence, positive values are expected for \( \beta_4 \), negative values for \( \beta_1 \) and \( \beta_3 \), and \( \beta_2 \) is ambiguous.

2.4 Unrestricted Error Correction Model (UECM)
To test for the cointegration among output and the key selected determinants, equation (3) is converted into UECM form. A set of UECMs (represented by equation (4)) has been estimated with four lags \((p=4)\) imposed on each first differenced term.

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3 Peng (2000) used this method to calculate the MCI for Hong Kong with 4 lags included for each explanatory variable. This strategy has also been employed by Gerlach and Smets (2000) to estimate
in the ARDL model by considering the common practice of using quarterly data for the optimum order of lags in the ARDL model (Pesaran and Pesaran, 1997, p.304).

\[
\Delta L_y_t = \beta_0 + \beta_1 L_{y_{t-1}} + \beta_2 L_{r_{t-1}} + \beta_3 L_{e_{t-1}} + \beta_4 L_{BOND_{t-1}} + \beta_5 L_{COPS_{t-1}} + \sum_{i=1}^{p} \beta_{6i} \Delta L_{y_{i-1}} + \\
\sum_{i=0}^{p} \beta_{7i} \Delta r_{i-1} + \sum_{i=0}^{p} \beta_{8i} \Delta L_{e_{i-1}} + \sum_{i=0}^{p} \beta_{9i} \Delta L_{BOND_{i-1}} + \sum_{i=0}^{p} \beta_{10i} \Delta L_{COPS_{i-1}} + \varepsilon_u \tag{4}
\]

where \( \beta_0 \) is an intercept term, \( \Delta \) is difference operator, \( \varepsilon_i \) is the random error terms, and \( p \) is the lag length. The cointegration between the real GDP and its determinants is tested by imposing restriction on the jointly significant of the estimated parameters, with \( H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0 \) (no cointegration) versus \( H_1 : \) at least one \( \beta_i \neq 0 \), where \( i = 1, 2, 3, \ldots, 5 \) (cointegration).

The general UECM was tested downwards sequentially by dropping the insignificant first differenced variables to arrive at a parsimonious equation using general-to-specific strategy (Hendry and Ericsson, 1991). When these explanatory variables were used tested, Wald test results revealed that variable \( BOND \) was insignificant at 10 percent level. The output is not reported here but available from the author upon request. The model was re-tested by using \( r \), \( Le \), and \( LCOPS \). Therefore, the final UECM model for Philippines is shown in equation (5):

\[
\Delta L_y_t = \beta_0 + \beta_1 L_{y_{t-1}} + \beta_2 L_{r_{t-1}} + \beta_3 L_{e_{t-1}} + \beta_4 L_{COPS_{t-1}} + \sum_{i=1}^{p} \beta_{5i} \Delta L_{y_{i-1}} + \sum_{i=0}^{p} \beta_{6i} \Delta r_{i-1} + \\
\sum_{i=0}^{p} \beta_{7i} \Delta L_{e_{i-1}} + \sum_{i=0}^{p} \beta_{8i} \Delta L_{COPS_{i-1}} + \varepsilon_u \tag{5}
\]

The long-run elasticity can then be derived from UECM by using the estimated coefficient of the one-lagged explanatory variables, multiplied by a negative sign, and divided by the estimated coefficient of the one lagged dependent variable (Bardsen, 1989). Meanwhile, the short-run elasticity is derived from the estimated coefficient of the first differenced variable in UECM.

3. Empirical results

3.1 Time Series Properties of the Data

The Augmented Dickey Fuller (ADF) and Kwiatkowski, Phillips, Schmidt, and Shin (hereafter KPSS) tests for the presence of unit roots in the different series. Results (Table 1) yield sufficiently large statistics that reject the null hypothesis of a unit root and infer that all the series are \( I(1) \) variables.

the responses of the central banks to exchange rate changes using data for Australia, Canada and New Zealand from 1992:1 to 1997:2.
Results in Table 2 revealed that the estimated UECM model in equation (5) satisfies the assumption of the classical linear regression model. The estimated residuals show no significant evidence of serial correlation (LM test), Jarque-Bera test confirms residual normality ($H_0$: normally distributed), autoregressive conditional heteroscedasticity effect (ARCH test [1]) rejects the presence of heteroscedasticity in the disturbance term ($H_0$: no ARCH up to order $q$ in the residuals), and the presence of a general specification error is rejected based on the Ramsey RESET [1] test ($H_0$: no general specification error). In addition, the plots of CUSUM and recursive residuals plots as shown in Figure 1 appear inside 5 percent critical bands imply that the estimated parameters of UECM are stable over the sample period. From the estimated final UECM in Table 2, all the regressors are statistically significant at 10 percent level.

3.2 Cointegration Tests

The bounds test on the estimated UECM shows that the variables in Equation (3) are cointegrated among the real GDP and the determinant variables. The results of bounds test for cointegration analysis are reported in Table 3. The computed F-statistics, $F(Ly|r,Le,LCOPS) = 4.1073$ exceeds the upper critical value $I(1)$ band of 3.885 at 10 percent level, the result of the inference show that the null hypothesis of no cointegration can be rejected, indicating real GDP, real exchange rate, real interest rate, and claims on private sector are cointegrated.

To reaffirm the cointegration results, Banerjee et al. (1998) have developed the error-correction mechanism test based on the OLS coefficient of the lagged dependent variable in UECM level form. From Table 2, the computed $t$-statistic for the coefficient on $Ly_{t-1}$ exceeds the critical value at the 10% significance level. The significant and negative magnitude of the error correction term of 0.1 reflects the slow speed of adjustment from short-run disequilibrium towards the long-run equilibrium state, which implies evidence of weak cointegration between the examined variables.

Both the ECM cointegration technique and bounds test approach have empirically showed the presence of cointegration between $Ly$ and $Le$, $r$, and $LCOPS$ during the period under study. The finding of a cointegrating relation indicates that the real GDP equations in this study are specified correctly with their determinants. According to Perman (1991, p.20), if we fail to find a cointegrating vector for a given variables sets, a broader set of series is needed to see if they are cointegrated. Hence, cointegration analysis could serve as a misspecification test, and equivalently serve as a guide to variables selection. The results of the exclusion test in Table 4, again, conclude that all the series are statistically significant at least at 10 percent level. Therefore, all these variables should be retained in the model.

Table 1: Results of Augmented Dickey Fuller (ADF) and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) unit root tests

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF</th>
<th>KPSS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regressor</td>
<td>Coefficient</td>
<td>t-statistic</td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Constant</td>
<td>0.5440</td>
<td>1.3182</td>
</tr>
<tr>
<td>ΔLY_{t-1}</td>
<td>-0.5431</td>
<td>-5.4214***</td>
</tr>
<tr>
<td>ΔLY_{t-2}</td>
<td>-0.5597</td>
<td>-5.4145***</td>
</tr>
<tr>
<td>ΔLY_{t-3}</td>
<td>-0.5643</td>
<td>-5.5214***</td>
</tr>
<tr>
<td>ΔLY_{t-4}</td>
<td>0.3398</td>
<td>3.6645***</td>
</tr>
<tr>
<td>Δr</td>
<td>-0.0012</td>
<td>-1.2091</td>
</tr>
<tr>
<td>Δr_{t-1}</td>
<td>-0.0019</td>
<td>-2.0256**</td>
</tr>
<tr>
<td>Δr_{t-3}</td>
<td>-0.0013</td>
<td>-1.5058</td>
</tr>
<tr>
<td>Δr_{t-4}</td>
<td>-0.0012</td>
<td>-1.4265</td>
</tr>
<tr>
<td>ΔLe</td>
<td>0.1058</td>
<td>2.1187**</td>
</tr>
<tr>
<td>ΔLe_{t-2}</td>
<td>-0.0613</td>
<td>-0.9801</td>
</tr>
<tr>
<td>ΔLe_{t-3}</td>
<td>-0.0483</td>
<td>-0.7687</td>
</tr>
<tr>
<td>ΔLCOPS</td>
<td>0.2880</td>
<td>4.6188***</td>
</tr>
<tr>
<td>ΔLCOPS_{t-2}</td>
<td>0.1127</td>
<td>1.9212*</td>
</tr>
<tr>
<td>ΔLCOPS_{t-3}</td>
<td>0.0569</td>
<td>0.9031</td>
</tr>
<tr>
<td>ΔLCOPS_{t-4}</td>
<td>-0.1210</td>
<td>-2.1454**</td>
</tr>
<tr>
<td>Ly_{t-1}</td>
<td>-0.0989</td>
<td>-1.8149*</td>
</tr>
<tr>
<td>r_{t-1}</td>
<td>-0.0019</td>
<td>-1.8283*</td>
</tr>
<tr>
<td>Le_{t-1}</td>
<td>0.1124</td>
<td>2.4179**</td>
</tr>
<tr>
<td>LCOPS_{t-1}</td>
<td>0.0301</td>
<td>1.9110*</td>
</tr>
</tbody>
</table>

Notes: Sample (adjusted): 1982Q1 to 2004Q4 (92 observations). Adjusted R bar-squared: 0.94133; residual sum of squares: 0.044166; F-statistic (P-value): 77.8513 (0.000); Durbin-Watson statistic: 1.7412; Breusch-Godfrey lagrange multiplier test [4]: 8.9585 (0.062); LM[3]: 5.2148 (0.1567); LM[2]: 5.1111 (0.0776); LM[1]: 1.9257 (0.1652) and autoregressive conditional heteroskedasticity ARCH test[1]: 2.2739 (0.132); Ramsey RESET functional test: 1.6557 (0.198), Jarque-Bera normality test [2]: 3.2187 (0.200). Figure in brackets (.) is p-values. Asterisks (*, **, ***) denote statistically significant at 10%, 5%, and 1% level respectively.

Figure 1: Plots of CUSUM and recursive residuals
3.3 Long-run and short-run elasticities

The long-run coefficients are derived from the UECM in Table 2 based on Bardsen (1989) method. The estimated long-and short-run elasticities of the real GDP function are presented in Table 5. The estimated long-run coefficients of the real interest rates, real exchange rate, and claims on private sectors are correctly signs as expected. This implies that an increase in the exchange rate seemed to promote AD, or depreciation in Philippines leads to expansionary effect on the output.

In the short-run, all determinants are correctly sign as expected. The foreign exchange earnings on devaluation follow J-curve pattern that first decline and then rising as the current account improve following the net exports expansion and/or import substitutes are found. As a consequent, exchange rate appreciation does impose cost on risk adverse market participants, and responds in favor to trade. This impact is particularly true when the income effect exceeds substitution effect (see de Grauwe, 1988). This relationship is consistent with Bayangos’s (2000) study where contractionary effect of peso depreciation happens in the short-run may be attributed to the period where trade flows adjust to relative price. Identifying the long-run component of the inflation path is important for economic policy-makers rather than focusing on short-term shocks. Therefore, this study focuses on the long-run relationship. The estimated cointegrating equation can be written as:

\[ L_y = -0.0190r + 1.1367Le + 0.3041LCOPS + 5.5012 \]  

### Table 3: Results of the bounds test for cointegration analysis

<table>
<thead>
<tr>
<th>Computed F-statistics (Wald test)</th>
<th>F(4, 78) = 4.1073***</th>
</tr>
</thead>
<tbody>
<tr>
<td>(H₀ : β₁ = β₂ = β₃ = β₄ = 0)</td>
<td></td>
</tr>
<tr>
<td>Asymptotic critical values bounds</td>
<td>Lower bound, l(0)</td>
</tr>
<tr>
<td>10% level</td>
<td>2.823</td>
</tr>
<tr>
<td></td>
<td>Upper bound, l(l)</td>
</tr>
<tr>
<td></td>
<td>3.885</td>
</tr>
</tbody>
</table>

Notes: The reported critical values are from Narayan (2005), Case III: Unrestricted intercept and no trend (page 1988) for F statistic (k=3).

### Table 4: Results of Likelihood Ratio Exclusion Test

<table>
<thead>
<tr>
<th>Variables</th>
<th>Ly</th>
<th>r</th>
<th>Le</th>
<th>LCOPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>X²-statistics</td>
<td>3.2937</td>
<td>3.3425</td>
<td>5.8462</td>
<td>3.6519</td>
</tr>
<tr>
<td></td>
<td>(0.0695)*</td>
<td>(0.0675)*</td>
<td>(0.0156)**</td>
<td>(0.0560)*</td>
</tr>
</tbody>
</table>
Notes: Asterisks (*) and (**) denote statistically significant at 10% and 5% level respectively. Figure in parentheses are the p-value.

Table 5: Estimated short-run and long-run elasticity of real GDP in Philippines using bounds test approach (Dependent variable is \( L_y \))

<table>
<thead>
<tr>
<th>Variables</th>
<th>Short-run</th>
<th>Long-run</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r )</td>
<td>-0.0056*</td>
<td>-0.0190*</td>
</tr>
<tr>
<td>( L_e )</td>
<td>-0.0038*</td>
<td>1.1367**</td>
</tr>
<tr>
<td>LCOPS</td>
<td>0.3365**</td>
<td>0.3041*</td>
</tr>
<tr>
<td>( C )</td>
<td>0.5441</td>
<td>5.5012</td>
</tr>
</tbody>
</table>

Note: Asterisks (*) and (**) denote statistically significant at 10% and 5% level respectively. The structural form long-run coefficient for \( r, L_e, \) and \( LCOPS \) are derived as \((\beta_2/\beta_1), (\beta_3/\beta_1)\) and \((\beta_4/\beta_1)\), respectively from the estimated equation UECM. The short-run elasticity is captured by the estimated coefficients of the first-difference variable in UECM. Sample adjusted: 92 observations used for estimation from 1982Q1 to 2004Q4.

4. Estimated AMCI

From equation (6), the coefficients relating to the real interest rate, real exchange rate, and claims on private sector are -0.019, 1.1367, and 0.3041 respectively. The associated weights of AMCI index, \( \alpha \) and \( \beta \), are -0.017 and 1.017 respectively. Therefore, the AMCI derived from the estimated AD function is shown in equation (7a). When the equation is scaled and \( L_e \) is transformed, the derived AMCI would be as shown in equation (7b).

\[
\text{AMCI}_t = -0.017 (\Delta r) + 1.017 (\Delta L_e) \quad (7a)
\]
\[
\text{AMCI}_t = \Delta r - 59.83 \Delta L_e - 16.005 \Delta LRCOPS \quad (7b)
\]

where \( \Delta \) denotes the difference operator. The weight \( L_e/r \) is termed the AMCI ratio. The relative estimated weight is -59.83 (or equivalently to the weight of the interest rate over the weight of the exchange rate is -0.0167). The results suggest that a one-percentage point rise in the real interest rate has about the same effect on GDP to a 0.0167-percentage drop in real exchange rate (appreciation). In other words, the results suggest that a one-percentage-appreciation has the same effect on AMCI as a 59.8 percent point increase in real interest rate, \textit{ceteris paribus}, or roughly equivalent to a 16-percentage rise in real claims on private sector.

The results give a much lower weight to the real interest rate than to the real exchange rate, which means that a one-percent point change in the real interest rate has less effect on the output than a one-percentage change in the real exchange rate. This finding is consistent with Peng (2000)’s study that the estimates for small open economies indicate generally smaller ratios of the real interest rate against the real exchange rate.

Do the constructed AMCIs match with the monetary policies implemented by the BSP? From Figure 2, virtual inspection shows monetary conditions during the study periods is found to be reflected in the BSP’s reaction to the prevailing economic
situation, implying AMCI tracks the movements of real interest rate plausibly well after 1990s. Many events took place during the 1990s, among those related to debt issues were: i) the aftermath of the prescribed guidelines regarding the rescheduling of bank debts of the Philippines, and ii) revised guidelines relating to the Philippine Government’s program for the conversion of external debt into equity investment in Philippine enterprises.

Overall, the interest rates confine the AMCI extremely well. Despite floating exchange rate regime was implemented in October, 1984 and further liberalization of exchange rate system in August 1992, the volatility of exchange rates are quite stable. Prior to July 7 1997, AMCI showed a continuous tightening of monetary conditions. Peso-dollar rates sustained at real appreciation, while higher interest rates were jacked up to meet program targeted by the IMF. No skepticism as to why the AMCI ratio is approximately 1:60, with notwithstanding much smaller weight. It is obvious that BSP is able to stabilize peso exchange rate and control inflation by adjusting interest rate. Since July 2003, BSP has kept its two key policy interest rates unchanged at 6.75% for overnight borrowing and 9% for overnight lending. However, there has been an upward pressure on market rates, with the benchmark 91-day Treasury-bill rate increasing from an average of 5.4% in 2002 to 6% in 2003, and 7.8% in October 2004 (see Annual Report, various issues). BSP perceived an increase in interest rate will aggravate the growth prospects in this circumstance. Due to political uncertainties and the weak investment climate, the peso-US dollar rate continued to depreciate to facilitating Philippine exports.

Figure 2: Real AMCI and contribution from its components

5. Policy implications and conclusions
The present study empirically investigates the long-run relationship of components in the real GDP in order to estimate the AMCI's index using the bounds testing approach.
as proposed by Pesaran et al. (2001) for the quarterly period 1982:1-2004:4. Results revealed that the real GDP and the real short-term interest rate, real exchange rate and real claims on private sector are cointegrated. There is evidence that a stable relationship exist among the real GDP and its determinant that ultimately affect the inflation rate. This has verified the stability of the Philippines output demand function that is used to construct the AMCI. This study also reveals that the policy implemented by the authority is corresponding reasonably well to the AMCI. In particular, the real interest rate confines extremely well to the AMCI. This has indicated that stimulation of the monetary conditions in Philippines is linked to the real GDP.

Here are a few policy implications. First, credit transmission mechanism channel has provided a weak short-run measure of domestic monetary conditions in the Philippines. Credit channel per se is significant concern of the BSP on the whole relative to the near term outlook on output. Despite deregulation of the banking sector, bank lending of the commercial banks can be counteracted by selling large fixed-term debt obligation of the bank to maintain their lending ability. This strategy is out of the constraint with respect to reserve. Second, transmission of monetary policy to real sector via the short-run interest rate channel is competent and efficient. While, bond market is revealed as shallow and liquidity insufficiently, since the bond market could be probably dominated by the government securities, and yet not much variety on private bond issues. But, bond issues may become a cheaper alternative source of financing for corporations instead of bank loans due to the sluggish recovery in bank intermediation that disrupted the smooth transmission of monetary policy through the long-run interest rate channel. Hence, the crucial things now are to firmly establish transparency, promote its liquid secondary market, uphold prudent regulations by the BSP, as well as open up the market for private sector. For future research, one may compare the economics performance using inflation targeting framework and AMCI by considering the same key transmission mechanisms channels in the conduct of monetary policy stance in Philippines.

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