An Empyrical Analysis of Price Stickiness in Five Latin American Inflation Targeters:2000-2016

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The main objective of this study is to examine empirically the assumption of price stickiness in five Latin American countries that have implemented inflation targeting schemes during the period under study 2000-2016. These countries are Brazil, Chile, Colombia, Mexico, and Peru. The study adopts a macroeconomic approach suggested by McCallum (1989, 1996) that in turn follows a methodology proposed by Barro (1977, 1978, 1981), and Barro and Rush (1980). An important contribution of this paper is that it separates monetary shocks in two categories: M1 shocks and policy rate shocks. Both types of shocks exhibit durable effects on real output, though in general, M1 surprises tend to be more persistent than policy rate surprises.
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1.- Introduction

The main objective of this study is to examine empirically the assumption of price stickiness in five Latin American countries that have implemented inflation targeting schemes during the period under study 2000-2016. These countries are Brazil (BR), Chile (CH), Colombia (COL), Mexico (MX), and Peru (PER). In general, these countries have been relatively successful in controlling inflation, producing one digit low inflation rates above but close to the two percent commonly interpreted by many central banks as the benchmark of price stability (Olivo 2016). The exception is Brazil, which have struggled to maintain inflation rates in the range between 5 and 10 percent.

Price stickiness is a fundamental assumption in the first generation and second generation (DSGE) New Keynesian models that are very influential in macro theory and monetary policy formulation in central banks around the world.

As pointed by (Morandé and Tejada, 2008), most studies of the subject of price stickiness have been conducted for developed countries or countries outside the Latin American region. A survey article by Levy (2007) reviews 14 studies: eight of them use data from the US economy, three studies use data from Germany, one from the Netherlands, one from Hungary, and one from Israel. Additionally, the majority of the studies employ micro-level data. Morandé and Tejada (2008) study price stickiness in Brazil, Chile, Colombia and Mexico using a microeconomic approach. All the papers reported in Levy (2007) also use micro-level data.

This study adopts a macroeconomic approach suggested by McCallum (1989, 1996) that in turn follows a methodology proposed by Barro (1977, 1978, 1981), and Barro and Rush (1980). This empirical approach is supported theoretically by a macro-model developed by McCallum (1989). McCallum's (1989) is a Keynesian first generation macro-model with rational expectations and price stickiness, in which monetary policy is modeled around a monetary aggregate. I extend McCallum's (1989) model to consider the most common case in which monetary policy is conducted using a short-term interest rate as an instrument. The two versions of the McCallum's (1989) macro-model allow the consideration of two types of monetary shocks or surprises: monetary aggregate surprises and policy rate surprises, and their impact on the temporal adjustment of prices.

For the empirical analysis, I use quarterly data of the five Latin American countries previously mentioned for the period 2000-2016. All data was obtained from the data base of the Economic Commission for Latin America and the Caribbean (ECLAC).

The paper is organized as follows. After this introduction, section 2 introduces the basic macro-model developed by McCallum (1989). Section 3 describes a modified version of McCallum's (1989) model that considers the case in which monetary policy uses a short-term interest rate as an instrument instead of a monetary aggregate. In section 4, I explain the methodological approach suggested by McCallum (1989, 1996), and present the main results obtained for each of the five countries under study. Section 5 discusses the main conclusions of the study.

2.-McCallum's basic model

McCallum's (1989) basic model starts with the derivation of an aggregate demand function from an IS-LM framework. The IS relation is specified as follows:

$$R_t = b_0 + b_1 y_t + E_{t-1}(p_{t+1} - p_t) + \eta_t \quad (1)$$

Where

$R_t =$ nominal interest rate

$p_t / p_{t+1} =$ log of the price level in periods t/t+1

$y_t =$ log of real output

$\eta_t =$ stochastic shock to saving or investment

The parameter signs are b_0>0 and b_1<0. In equation (1) the term $E_{t-1}(p_{t+1} - p_t)$ reflects the expected inflation rate between periods t and t+1 base on information in period t-1 and before.

The LM relation is specified as:

$$m_t - p_t = c_0 + c_1 y_t + c_2 R_t + \varepsilon_t \quad (2)$$

In (2) the parameter signs are c_0>0, c_1>0 and c_2<0. This LM function summarizes behavior pertaining the money demand and supply. For simplicity the money stock m_t is assumed to be under the control of the government's monetary authority.

Substituting (1) in (2) yields the following expression:

$$m_t - p_t = c_0 + c_1 y_t + c_2[b_0 + b_1 y_t + E_{t-1}(p_{t+1} - p_t) + \eta_t] + \varepsilon_t \quad (3)$$

Solving (3) for y_t produces the aggregate demand function:

$$y_t = \beta_0 + \beta_1(m_t - p_t) + \beta_2 E_{t-1}(p_{t+1} - p_t) + \nu_t \quad (4)$$

Where

$$\beta_0 = -\frac{c_0 + c_2 b_0}{c_1 + c_2 b_1}$$

$$\beta_1 = \frac{1}{c_1 + c_2 b_1}$$

$$\beta_2 = \frac{-c_2}{c_1 + c_2 b_1}$$

$$\nu_t = -\frac{\varepsilon_t + c_2 \eta_t}{c_1 + c_2 b_1}$$

Since c_2 and b_1 are negative, $\beta_1 > 0$ and $\beta_2 < 0$.

The next step is the derivation of an aggregate supply model. The general approach followed by McCallum (1989) presumes that product prices are set at the start of each period at expected market-clearing levels. These prices do not change within the period, thus unexpected shocks to demand or supply conditions will usually make the actual market-clearing values turn out to be different that had been expected. In such instances the quantity produced and sold will be that specified at the prevailing price by the demand function.

The assumption that p_t is preset at the expected value of the market-clearing price, which is denoted by $\overline{p}_t$, is expressed as:

$$p_t = E_{t-1}\overline{p}_t \quad (5)$$

Now $\overline{y}_t$ is defined as the value of y_t that corresponds to a situation of market- clearing (demand equals supply) in the labor market. $\overline{y}_t$ is assumed to grow smoothly as time passes:

$$\overline{y}_t = \delta_0 + \delta_1 t \quad (6)$$

Where δ_1 measures the rate of growth of market-clearing output.

In this framework, the market-clearing price $\overline{p}_t$ is the value of p_t that satisfies the following equality:

$$\beta_0 + \beta_1(m_t - p_t) + \beta_2 E_{t-1}(p_{t+1} - p_t) + \nu_t = \overline{y}_t$$

By rearranging the previous expression the value of $\overline{p}_t$ is:

$$\overline{p}_t = \frac{\beta_0 - \overline{y}_t + \beta_1 m_t + \beta_2 p_{t+1} + \nu_t}{\beta_1 + \beta_2} \quad (7)$$

At this point we have a system consisting of the equations (4), (5), (6) and (7). Aggregate demand is given y (4), so equations (5)-(7) together might be thought as something akin to aggregate supply.

To complete the model a relation that describes monetary policy behavior should be added. Let us assume that m_t is generated according to:

$$m_t = \mu_0 + \mu_1 m_{t-1} + e_t \quad (8)$$

Where e_t is a white noise disturbance representing nonsystematic or purely random policy behavior.

The system can be solved in terms of y_t and p_t. For our purposes, however, the solution for y_t is the relevant one. To obtain this solution, we start with the fact that the definition of $\overline{p}_t$ implies that:

$$\overline{y}_t = \beta_0 + \beta_1(m_t - \overline{p}_t) + \beta_2 E_{t-1}(p_{t+1} - \overline{p}_t) + \nu_t \quad (9)$$

The conditional expectation (given the information set Ω_{t-1}) of each side of (9) is:

$$E_{t-1}\overline{y}_t = \beta_0 + \beta_1 E_{t-1}(m_t - \overline{p}_t) + \beta_2 E_{t-1}(p_{t+1} - \overline{p}_t) \quad (10)$$

But with equation (6) generating $\overline{y}_t$, $E_{t-1}\overline{y}_t = \overline{y}_t$. Also from (5) $p_t = E_{t-1}\overline{p}_t$. Then (10) can be written as:

$$\overline{y}_t = \beta_0 + \beta_1(E_{t-1}m_t - p_t) + \beta_2 E_{t-1}(p_{t+1} - p_t) \quad (11)$$

Now we calculate $y_t - E_{t-1}\overline{y}_t = y_t - \overline{y}_t$. Subtracting (11) from (4), yields:

$$y_t - \overline{y}_t = \beta_1(m_t - E_{t-1}m_t) + \nu_t \quad (12)$$

Since $m_t - E_{t-1}m_t = e_t$, equation (12) can also be expressed as:

$$y_t = \overline{y}_t + \beta_1 e_t + \nu_t \quad (13)$$

In (13), y_t is expressed in terms of shocks all of which are exogenous. In this equation output deviates from its market-clearing value $\overline{y}_t$ whenever a nonzero shock affects aggregate demand $(\nu_t \neq 0)$ or a monetary policy shock occurs $(m_t \neq E_{t-1}m_t)$.Since the parameter β_1 is positive, a positive monetary surprise $(m_t > E_{t-1}m_t)$ will give rise to an output level greater than $\overline{y}_t$. This happens because, with p_t temporarily fixed, an unexpectedly large money stock makes the demand for output unexpectedly high, and suppliers meet the demand by producing more than they would normally choose to produce.

However, because $E(\nu_t) = 0$ and $E(e_t) = 0$, then $E(y_t - \overline{y}_t) = 0$. Thus, this model satisfies the natural-rate hypothesis. There is no monetary policy that will keep y_t permanently high or low in relation to $\overline{y}_t$.

2.1.- Multiperiod pricing

McCallum (1989) introduces an important modification of his basic model by considering the idea that prices may be preset not for one period, but as in the models of Taylor (1979, 1980) and Fischer (1977), for two or more periods.

Let us consider the case of two periods. At the start of t, half of the sellers set prices for t at the level $E_{t-1}\overline{p}_t$ and for t+1 at the level $E_{t-1}\overline{p}_{t+1}$. In this economy, half of the prices prevailing in period t will be equal to $E_{t-1}\overline{p}_t$ while the other half will have been set one period earlier at the level $E_{t-2}\overline{p}_t$. In place of equation (5), the modified model specifies that the average price level in period t is:

$$p_t = 0.5(E_{t-1}\overline{p}_t + E_{t-2}\overline{p}_t) \quad (14)$$

We have now a system compose of (4), (6), (7), (8), and (14). However, with this modification the special features of the basic model that permit a simple derivation of a solution for y_t are lost. To illustrate some of the features of this model without excessive complication, McCallum (1989) takes a special case of the aggregate demand function in which $\beta_2 = 0$. In this case:

$$y_t = \beta_0 + 0.5\beta_1(m_t - E_{t-1}\overline{p}_t) + 0.5\beta_1(m_t - E_{t-2}\overline{p}_t) + v_t$$

$$0.5(E_{t-1}\overline{y}_t + E_{t-2}\overline{y}_t) = \overline{y}_t = 0.5\beta_1(E_{t-1}m_t - E_{t-1}\overline{p}_t) + 0.5\beta_1(E_{t-2}m_t - E_{t-2}\overline{p}_t)$$

$$y_t - 0.5(E_{t-1}\overline{y}_t + E_{t-2}\overline{y}_t) = 0.5\beta_1(m_t - E_{t-1}m_t) + 0.5\beta_1(m_t - E_{t-2}m_t) + v_t \quad (15)$$

Where $m_t - E_{t-1}m_t = e_t$ and:

$$E_{t-2}m_t = E_{t-2}(\mu_0 + \mu_1 m_{t-1} + e_t) = \mu_0 + \mu_1 E_{t-2}m_{t-1} \quad (16)$$

$$m_{t-1} - E_{t-2}m_{t-1} = e_{t-1} \rightarrow E_{t-2}m_{t-1} = m_{t-1} - e_{t-1}$$

$$\rightarrow E_{t-2}m_t = \mu_0 + \mu_1(m_{t-1} - e_{t-1})$$

$$\rightarrow m_t - E_{t-2}m_t = \mu_0 + \mu_1 m_{t-1} + e_t - (\mu_0 + \mu_1 m_{t-1} - \mu_1 e_{t-1})$$

$$m_t - E_{t-2}m_t = e_t + \mu_1 e_{t-1} \quad (17)$$

Replacing (17) in (15), yields:

$$y_t = \overline{y}_t + 0.5\beta_1 e_t + 0.5\beta_1(e_t + \mu_1 e_{t-1}) + v_t$$

$$y_t = \overline{y}_t + 0.5\beta_1 e_t + 0.5\beta_1\mu_1 e_{t-1} + v_t \quad (18)$$

Thus in this case where prices are set for two periods, the current policy shock (e_t) as well as the previous period policy shock (e_{t-1}), affect current output. From the previous discussion it is clear that more lagged values of e would affect y_t if prices were preset for more than two periods of time.

3.- McCallum's model with the interest rate as the policy instrument

McCallum's (1989) basic model can be modified to consider the case of a monetary policy that uses a short-term interest rate as the policy instrument instead of a monetary aggregate.

Let us write the IS relation with y_t in the left hand side:

$$y_t = d_0 - d_1[R_t - E_{t-1}(p_{t+1} - p_t)] + \chi_t \quad (19)$$

Now we assume that the policy rate is generated according to:

$$R_t = \gamma_0 + \gamma_1 R_{t-1} + \omega_t, |\gamma_1| < 1 \quad (20)$$

We maintain from the basic model the following relations:

$$p_t = E_{t-1}\overline{p}_t \quad (5)$$

$$\overline{y}_t = \delta_0 + \delta_1 t \quad (6)$$

Now $\overline{p}_t$ is derived as:

$$d_0 - d_1[R_t - E_{t-1}(p_{t+1} - p_t)] + \chi_t = \overline{y}_t$$

$$\overline{p}_t = \frac{d_0 - \overline{y}_t}{d_1} - R_t + E_{t-1}p_{t+1} + \frac{1}{d_1}\chi_t \quad (21)$$

At this point we have a system specified by equations (19), (20), (5), (6) and (21). To derive a solution for y_t, we note that the definition of $\overline{p}_t$ implies that:

$$\overline{y}_t = d_0 - d_1 R_t + d_1 E_{t-1}(p_{t+1} - \overline{p}_t) + \chi_t \quad (22)$$

Then we calculate the conditional expectation (given the information set Ω_{t-1}) of (22):

$$E_{t-1}\overline{y}_t = d_0 - d_1 E_{t-1} R_t + d_1 E_{t-1}(p_{t+1} - \overline{p}_t) \quad (23)$$

Given (6), $E_{t-1}\overline{y}_t = \overline{y}_t$. Also from (5), $p_t = E_{t-1}\overline{p}_t$. This implies that (23) can be written as:

$$\overline{y}_t = d_0 - d_1 E_{t-1} R_t + d_1 (E_{t-1} p_{t+1} - p_t) \quad (24)$$

Now (24) can be subtracted from (19) to obtain:

$$y_t - \overline{y}_t = -d_1 (R_t - E_{t-1} R_t) + \chi_t \quad (25)$$

Since (20) implies that $R_t - E_{t-1} R_t = \omega_t$, equation (25) can be equivalently written as:

$$y_t = \overline{y}_t - d_1 \omega_t + \chi_t \quad (26)$$

This equation expresses y_t in terms of shocks, all of which are exogenous.

As in the case of the basic model, the introduction of multiperiod pricing would modify (26) in a way that lagged values of the policy rate shock (ω) would appear in the output equation.

4.- Price stickiness, empirical results.

McCallum (1996) reviews two approaches to test empirically the hypothesis of price stickiness from a macroeconomic standpoint. The first approach is based on the estimation of a Vector Autoregression Model (VAR) and the analysis of the impact of the monetary shocks on output and prices using the innovation accounting tools produced by these models. I present some results from applying this approach in Appendix A. In general, this methodology indicates that monetary shocks do not have a statistical significant influence on output and thus, provides a very limited support of the price stickiness assumption. In the case of Brazil, policy rate shocks have a statistically significant impact on real output three quarters ahead. In Peru, M1 shocks have a statistically significant effect on real output three and four quarters ahead. For the rest of the countries under study, the impulse response functions that capture the effects on output of the policy rate and M1 shocks are not statistically significant.

The second method is proposed by McCallum (1989, 1996) and based on an idea developed originally by Barro (1977, 1978, 1980, 1981). This is the approach that I explore in detail in this section. In a first stage, I estimate equations for the rate of growth of M1 and the policy rate. These equations are estimated initially as simple autoregressions using OLS. If the residuals from these equations still exhibit autocorrelation according to the Q statistics of the correlogram, a Cochrane-Orcutt type of procedure and/or MA terms are introduced in the specification until obtaining white noise residuals. The non-autocorrelated residuals from these equations are interpreted as the monetary shocks or surprises: M1 shocks and policy rate shocks. Next, I move to a second stage in which current and lagged values of these shocks are introduced in an autoregressive specification for the log of output. If these monetary surprises have the expected signs (positive for the M1 surprises and negative for the policy rate surprises) and are statistically significant in the output equation, there is evidence of price stickiness as these shocks tend to generate persistent real effects. The output equations should also yield white noise residuals. If the basic specifications produce autocorrelated residuals, a Cochrane-Orcutt type of procedure and/or MA terms are introduced in the specification until obtaining white noise residuals. Though the cross correlation between the M1 surprises and the policy rate surprises show in general relatively low values (see Appendix B), I estimate separate equations for the log of output in terms of its own lags and each type of monetary shocks.

Appendix B contains the equations estimated for M1 growth (DM1) and the policy rate (I) for each country under study, and an analysis of the residuals derived from these equations. Here in the main text, I present the results of the equations of the log of output (LY) for each country and each kind of monetary shocks: M1 shocks (EM1) and policy rate shocks (EI).

i) Brazil

Table 1 presents the results of the log of output for Brazil (LYBR) using M1 surprises (EM1BR). The current M1 shock and M1 shocks lagged one, three and eight quarters have a statistical significant impact on current output and exhibit the positive sign expected.

Table 1

Dependent Variable: LYBR
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 07/12/18 Time: 19:28
Sample: 2004Q2 2016Q4
Included observations: 51
Convergence achieved after 32 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.599679	0.384473	1.559744	0.1265
LYBR(-1)	0.731196	0.139944	5.224928	0.0000
LYBR(-4)	0.794674	0.069135	11.49454	0.0000
LYBR(-5)	-0.573327	0.111495	-5.142195	0.0000
EM1BR	0.151613	0.085735	1.768384	0.0844
EM1BR(-1)	0.095476	0.051543	1.852338	0.0712
EM1BR(-3)	0.093279	0.047946	1.945522	0.0586
EM1BR(-8)	0.096604	0.057213	1.688504	0.0989
MA(1)	0.485760	0.165431	2.936332	0.0054
SIGMASQ	0.000173	4.70E-05	3.683871	0.0007

R-squared	0.986223	Mean dependent var	12.51059
Adjusted R-squared	0.983199	S.D. dependent var	0.113230
S.E. of regression	0.014677	Akaike info criterion	-5.425952
Sum squared resid	0.008831	Schwarz criterion	-5.047163
Log likelihood	148.3618	Hannan-Quinn criter.	-5.281205
F-statistic	326.1190	Durbin-Watson stat	2.109206
Prob(F-statistic)	0.000000		

Inverted MA Roots	-.49

Table 2 shows the results of the log of output for Brazil (LYBR) using the policy rate surprises (EIBR). Policy rate shocks lagged two and four quarters have a statistical significant impact on current output and exhibit the negative sign expected. The policy rate shock lagged five quarters is statistically significant, but presents a theoretically inconsistent positive sign.

Table 2

Dependent Variable: LYBR
Method: Least Squares
Date: 07/16/18 Time: 19:21
Sample (adjusted): 2003Q1 2016Q4
Included observations: 56 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.416876	0.212477	1.961980	0.0557
LYBR(-1)	1.033207	0.115784	8.923550	0.0000
LYBR(-2)	-0.392970	0.142310	-2.761360	0.0082
LYBR(-3)	0.328683	0.143897	2.284162	0.0269
LYBR(-4)	0.541606	0.139158	3.892025	0.0003
LYBR(-5)	-0.543639	0.105437	-5.156052	0.0000
EIBR(-2)	-0.008140	0.002549	-3.193100	0.0025
EIBR(-4)	-0.006613	0.002794	-2.366855	0.0221
EIBR(-5)	0.006400	0.002744	2.332272	0.0240

R-squared	0.990050	Mean dependent var	12.48671
Adjusted R-squared	0.988357	S.D. dependent var	0.132745
S.E. of regression	0.014324	Akaike info criterion	-5.507572
Sum squared resid	0.009643	Schwarz criterion	-5.182069
Log likelihood	163.2120	Hannan-Quinn criter.	-5.381375
F-statistic	584.5921	Durbin-Watson stat	2.011290
Prob(F-statistic)	0.000000		

The results contained in tables 1 and 2 indicate that monetary surprises generate persistent effects on output as the theory suggests in the case of price stickiness. M1 shocks exhibit a more durable effect on output than policy rate surprises.

ii) Chile

Table 3 displays the results of the log of output for Chile (LYCH) using M1 surprises (EM1CH). The current M1 shocks and M1 shocks lagged one quarter have a statistical significant impact on current output and exhibit the positive sign expected.

Table 3

Dependent Variable: LYCH
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 07/16/18 Time: 18:59
Sample: 2001Q3 2016Q4
Included observations: 62
Convergence achieved after 12 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.081347	0.132166	0.615495	0.5408
LYCH(-1)	0.826890	0.086084	9.605616	0.0000
LYCH(-4)	0.981838	0.029057	33.78952	0.0000
LYCH(-5)	-0.816080	0.089792	-9.088518	0.0000
EM1CH	0.098496	0.054159	1.818629	0.0745
EM1CH(-1)	0.111318	0.060158	1.850406	0.0697
MA(1)	0.252546	0.161500	1.563751	0.1237
SIGMASQ	0.000121	2.35E-05	5.159758	0.0000

R-squared	0.996563	Mean dependent var	10.25238
Adjusted R-squared	0.996117	S.D. dependent var	0.189203
S.E. of regression	0.011789	Akaike info criterion	-5.922244
Sum squared resid	0.007506	Schwarz criterion	-5.647775
Log likelihood	191.5896	Hannan-Quinn criter.	-5.814480
F-statistic	2236.687	Durbin-Watson stat	1.974585
Prob(F-statistic)	0.000000		

Table 4 shows the results of the log of output for Chile (LYCH) using the policy rate surprises (EICH). The policy rate shocks lagged two, three, and five quarters have a statistical significant impact on current output and exhibit the negative sign expected. The current policy rate surprises are statistically significant, but have a positive sign contrary to what is theoretically anticipated.

Table 4

Dependent Variable: LYCH
Method: Least Squares
Date: 06/22/18 Time: 22:40
Sample (adjusted): 2002Q2 2016Q4
Included observations: 59 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.211717	0.084556	2.503873	0.0155
LYCH(-1)	0.741866	0.068051	10.90168	0.0000
LYCH(-4)	0.963527	0.028041	34.36108	0.0000
LYCH(-5)	-0.725067	0.069710	-10.40122	0.0000
EICH	0.008506	0.002734	3.110889	0.0031
EICH(-2)	-0.007097	0.002734	-2.595699	0.0123
EICH(-3)	-0.005905	0.002251	-2.623984	0.0114
EICH(-5)	-0.006810	0.002303	-2.956234	0.0047

R-squared	0.997030	Mean dependent var	10.26930
Adjusted R-squared	0.996622	S.D. dependent var	0.177706
S.E. of regression	0.010329	Akaike info criterion	-6.182314
Sum squared resid	0.005441	Schwarz criterion	-5.900614
Log likelihood	190.3783	Hannan-Quinn criter.	-6.072350
F-statistic	2445.436	Durbin-Watson stat	1.677548
Prob(F-statistic)	0.000000		

The results shown in tables 3 and 4 suggest that monetary surprises generate durable effects on output as the theory holds in the case of price stickiness. However, the persistent is much less marked in the case of M1 surprises compared to policy rate surprises.

iii) Colombia

Table 5 presents the results of the log of output for Colombia (LYCOL) using M1 surprises (EM1COL). The current M1 shock, and M1 shocks lagged three and six quarters have a statistically significant impact on current output and exhibit the positive sign expected.

Table 5

Dependent Variable: LYCOL
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 07/16/18 Time: 18:57
Sample: 2003Q4 2016Q4
Included observations: 53
Convergence achieved after 9 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.122969	0.035273	3.486160	0.0011
LYCOL(-1)	0.990275	0.003047	324.9570	0.0000
EM1COL	0.145225	0.036942	3.931153	0.0003
EM1COL(-3)	0.120008	0.039120	3.067695	0.0036
EM1COL(-6)	0.055046	0.032866	1.674857	0.1007
MA(4)	-0.588815	0.171773	-3.427877	0.0013
SIGMASQ	3.31E-05	6.81E-06	4.865283	0.0000

R-squared	0.998806	Mean dependent var	11.57810
Adjusted R-squared	0.998650	S.D. dependent var	0.168195
S.E. of regression	0.006179	Akaike info criterion	-7.180754
Sum squared resid	0.001756	Schwarz criterion	-6.920527
Log likelihood	197.2900	Hannan-Quinn criter.	-7.080684
F-statistic	6414.352	Durbin-Watson stat	2.281809
Prob(F-statistic)	0.000000		

Inverted MA Roots	.88	-.00+.88i	-.00-.88i	-.88

Table 6 shows the results of the log of output for Colombia (LYCOL) using the policy rate shocks (EICOL). In the case of Colombia, only the current policy rate shocks have a statistical significant impact on current output and exhibit the negative sign expected.

Table 6

Dependent Variable: LYCOL
Method: Least Squares
Date: 06/22/18 Time: 22:43
Sample (adjusted): 2001Q1 2016Q4
Included observations: 64 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.069181	0.058708	1.178383	0.2434
LYCOL(-1)	0.947690	0.122492	7.736728	0.0000
LYCOL(-2)	0.296725	0.153078	1.938399	0.0574
LYCOL(-4)	-0.249947	0.091003	-2.746576	0.0080
EICOL	-0.004474	0.002538	-1.762787	0.0831

R-squared	0.998479	Mean dependent var	11.51554
Adjusted R-squared	0.998376	S.D. dependent var	0.206435
S.E. of regression	0.008319	Akaike info criterion	-6.665631
Sum squared resid	0.004083	Schwarz criterion	-6.496968
Log likelihood	218.3002	Hannan-Quinn criter.	-6.599186
F-statistic	9683.610	Durbin-Watson stat	2.007731
Prob(F-statistic)	0.000000		

The results shown in tables 5 and 6 indicate that monetary surprises produce durable effects on output as the theory holds in the case of price stickiness. However, the persistent is much less marked in the case of the policy rate surprises compared to M1 surprises.

iv) Mexico

Table 7 contains the results of the log of output for Mexico (LYMX) using M1 surprises (EM1MX). The M1 shocks lagged two, four, and eight quarters have a statistical significant impact on current output and exhibit the positive sign expected.

Table 7

Dependent Variable: LYMX
Method: Least Squares
Date: 06/22/18 Time: 22:35
Sample (adjusted): 2003Q2 2016Q4
Included observations: 55 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.703472	1.869777	2.515526	0.0156
LYMX(-1)	0.899566	0.096746	9.298213	0.0000
LYMX(-3)	-0.526126	0.108823	-4.834685	0.0000
LYMX(-4)	0.827208	0.074373	11.12242	0.0000
LYMX(-5)	-0.628390	0.107446	-5.848446	0.0000
LYMX(-7)	0.356065	0.110587	3.219761	0.0024
LYMX(-9)	-0.216447	0.091130	-2.375155	0.0220
@TREND	0.001571	0.000599	2.624436	0.0119
EM1MX(-2)	0.157334	0.082701	1.902454	0.0637
EM1MX(-4)	0.177705	0.086900	2.044943	0.0469
EM1MX(-8)	0.232361	0.074618	3.114030	0.0032

R-squared	0.983033	Mean dependent var	16.53997
Adjusted R-squared	0.979177	S.D. dependent var	0.090494
S.E. of regression	0.013058	Akaike info criterion	-5.661906
Sum squared resid	0.007503	Schwarz criterion	-5.260439
Log likelihood	166.7024	Hannan-Quinn criter.	-5.506656
F-statistic	254.9257	Durbin-Watson stat	2.148544
Prob(F-statistic)	0.000000		

Table 8 displays the results of the log of output for Mexico (LYMX) using the policy rate surprises (EIMX). The policy rate shocks lagged one, three, and eight quarters have a statistical significant impact on current output and exhibit the negative sign expected. The current policy rate shock is statistically significant but with the opposite sign to what is anticipated.

Table 8
Dependent Variable: LYMX
Method: Least Squares
Date: 06/22/18 Time: 22:45
Sample (adjusted): 2003Q4 2016Q4
Included observations: 53 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.395722	0.457801	0.864398	0.3922
LYMX(-1)	0.953468	0.097623	9.766791	0.0000
LYMX(-3)	-0.378014	0.114836	-3.291763	0.0020
LYMX(-4)	0.973245	0.062666	15.53056	0.0000
LYMX(-5)	-0.798501	0.109905	-7.265343	0.0000
LYMX(-7)	0.226334	0.095629	2.366806	0.0225
EIMX	0.013526	0.005565	2.430754	0.0193
EIMX(-1)	-0.013086	0.005618	-2.329325	0.0246
EIMX(-3)	-0.008218	0.003621	-2.269336	0.0283
EIMX(-8)	-0.005651	0.003227	-1.751174	0.0870

R-squared	0.978352	Mean dependent var	16.54579
Adjusted R-squared	0.973821	S.D. dependent var	0.086899
S.E. of regression	0.014060	Akaike info criterion	-5.522692
Sum squared resid	0.008500	Schwarz criterion	-5.150939
Log likelihood	156.3513	Hannan-Quinn criter.	-5.379734
F-statistic	215.9282	Durbin-Watson stat	2.080608
Prob(F-statistic)	0.000000		

The results contained in tables 7 and 8 indicate that monetary surprises produce durable effects on output as the theory holds in the case of price stickiness. In the case of Mexico, the persistence of the impact of both kinds of monetary shocks on output is fairly similar.

v) Peru

Table 9 presents the results of the log of output for Peru (LYPER) using M1 surprises (EM1PER). The current M1 shocks, and the M1 shocks lagged two and seven quarters have a statistical significant impact on current output and exhibit the positive sign expected. The M1 shock lagged five quarters is statistically significant, but with a negative sign.

Table 9

Dependent Variable: LYPER
Method: Least Squares
Date: 06/22/18 Time: 22:39
Sample (adjusted): 2004Q1 2016Q4
Included observations: 52 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.011789	0.097137	0.121361	0.9040
LYPER(-1)	0.949254	0.074280	12.77942	0.0000
LYPER(-4)	0.552967	0.115874	4.772135	0.0000
LYPER(-5)	-0.610277	0.110354	-5.530159	0.0000
LYPER(-8)	0.354919	0.119699	2.965094	0.0050
LYPER(-9)	-0.246982	0.103083	-2.395946	0.0211
EM1PER	0.197649	0.046296	4.269269	0.0001
EM1PER(-2)	0.108926	0.048567	2.242823	0.0302
EM1PER(-5)	-0.095901	0.047160	-2.033514	0.0484
EM1PER(-7)	0.124238	0.051990	2.389626	0.0214

R-squared	0.998166	Mean dependent var	11.44002
Adjusted R-squared	0.997773	S.D. dependent var	0.226598
S.E. of regression	0.010694	Akaike info criterion	-6.067267
Sum squared resid	0.004803	Schwarz criterion	-5.692028
Log likelihood	167.7489	Hannan-Quinn criter.	-5.923409
F-statistic	2539.682	Durbin-Watson stat	2.367880
Prob(F-statistic)	0.000000		

Table10 contains the results of the log of output for Peru (LYPER) using the policy rate surprises (EIPER). The policy rate surprises lagged three and four quarters have a statistical significant impact on current output and exhibit the negative sign expected.

Table 10

Dependent Variable: LYPER
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 07/16/18 Time: 19:17
Sample: 2002Q3 2016Q4
Included observations: 58
Convergence achieved after 11 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.049006	0.069486	0.705261	0.4839
LYPER(-1)	0.906456	0.065621	13.81353	0.0000
LYPER(-4)	0.966558	0.036096	26.77765	0.0000
LYPER(-5)	-0.876867	0.068844	-12.73703	0.0000
EIPER(-3)	-0.010984	0.004357	-2.520851	0.0149
EIPER(-4)	-0.005260	0.004221	-1.246210	0.2185
MA(4)	-0.341914	0.150493	-2.271960	0.0274
SIGMASQ	0.000157	3.55E-05	4.419962	0.0001

R-squared	0.997573	Mean dependent var	11.39271
Adjusted R-squared	0.997233	S.D. dependent var	0.256413
S.E. of regression	0.013488	Akaike info criterion	-5.637982
Sum squared resid	0.009097	Schwarz criterion	-5.353783
Log likelihood	171.5015	Hannan-Quinn criter.	-5.527281
F-statistic	2935.556	Durbin-Watson stat	1.939375
Prob(F-statistic)	0.000000		

Inverted MA Roots	.76	-.00+.76i	-.00-.76i	-.76

The results contained in tables 9 and 10 indicate that monetary surprises produce durable effects on output as the theory holds in the case of price stickiness. However, the persistent is somewhat less marked in the case of the policy rate surprises compared to M1 surprises.

5.-Conclusions

A simple VAR model with four variables (log of real output, log of the price level, a policy interest rate, and the rate of growth of M1), offers little support of the price stickiness assumption in the five Latin American countries examined in this study. Based on an alternative empirical strategy suggested by McCallum (1989, 1996), I find ample evidence that suggest that monetary shocks have a persistent influence on real output in the five Latin American countries included in the investigation. This persistent impact of monetary shocks on real output is according to the theoretical framework developed by McCallum (1989), consistent with the assumption of no instantaneous adjustment of the price level (price stickiness).

An important contribution of this paper is that it separates monetary shocks in two categories: M1 shocks and policy rate shocks. In most instances, the impact of these shocks on real output has the sign suggested by the theory: positive for M1 surprises and negative for policy rate surprises. I find that these two kinds of shocks display a relatively low dynamic correlation between them and have, in most of the cases examined, a different time impact on real output. This, in turn, implies a different temporal adjustment process of prices. In the case of Brazil, prices adjust slower to M1 surprises than to policy rate surprises. In the case of Chile the opposite is observed. Prices adjust more slowly to policy rate shocks than to M1 shocks. Colombia is perhaps the case in which the impact of the two types of shocks is more different. The price adjustment process occurs in one quarter with a policy rate shock, while it takes up to six quarters with a M1 surprise. In Peru, the price adjustment mechanism is also slower with a M1 shock than with a policy rate shock. Only in the case of Mexico, the pattern of the temporal price adjustment process looks quite similar under both types of shocks. In general, the price adjustment mechanism tends to be slower with M1 surprises than with policy rate shocks. Many of the results, especially with M1 shocks, suggest a period of adjustment longer than four quarters.

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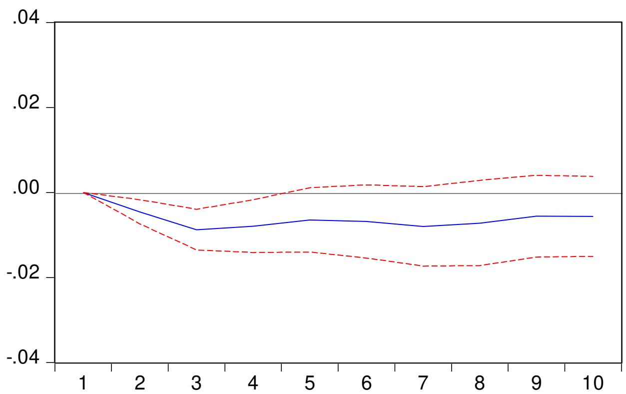
Appendix A

This appendix contains the impulse response functions of the log of output (LY) to the policy rate shocks (I) and the M1 shocks (DM1). To obtain these impulse response functions, I estimated VAR models for each country under analysis with four variables ordered as follow: log of output (LY), log of the price level (LP), policy rate (I), rate of growth of M1 (DM1).

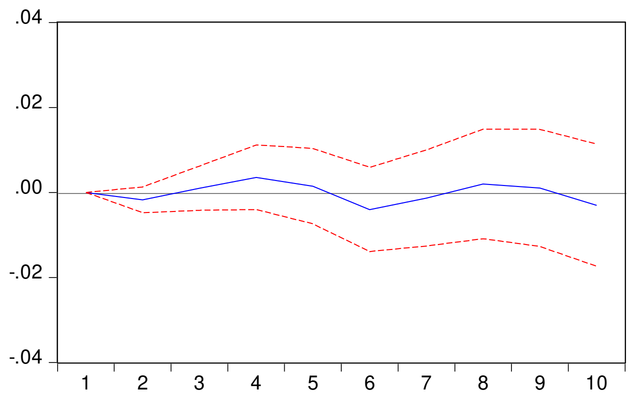
i) Brazil

VAR model with four lags

Response of LYBR to IBR



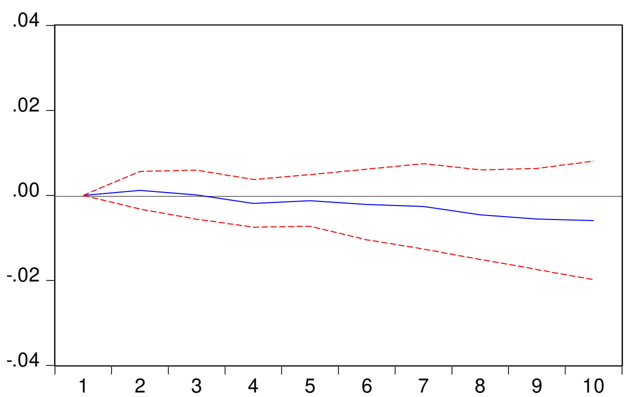
Response of LYBR to DM1BR



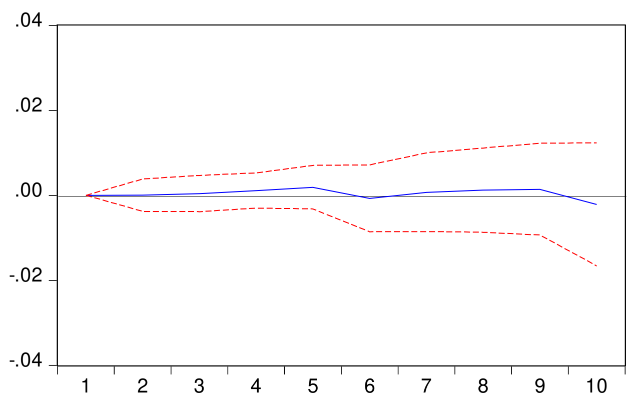
ii) Chile

VAR model with eight lags

Response of LYCH to ICH

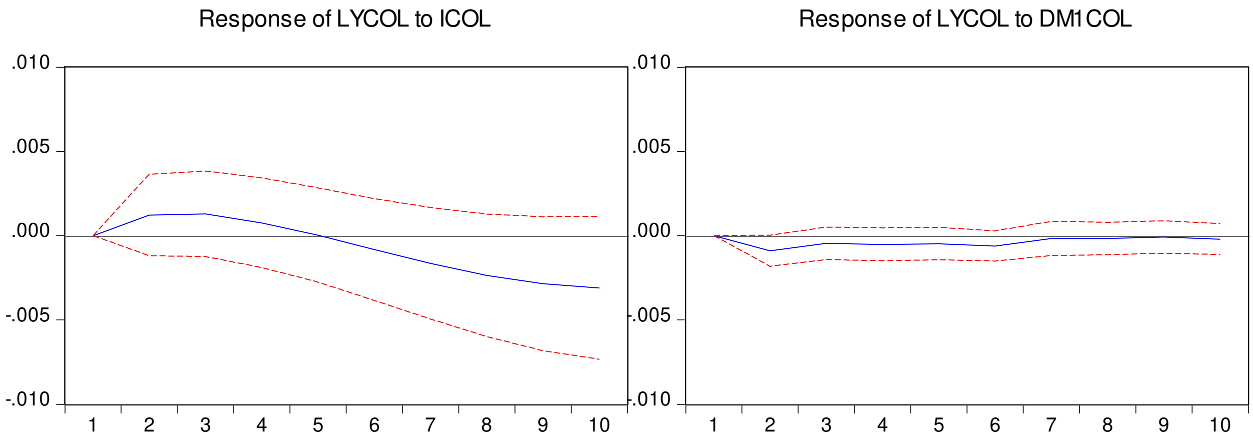


Response of LYCH to DM1CH



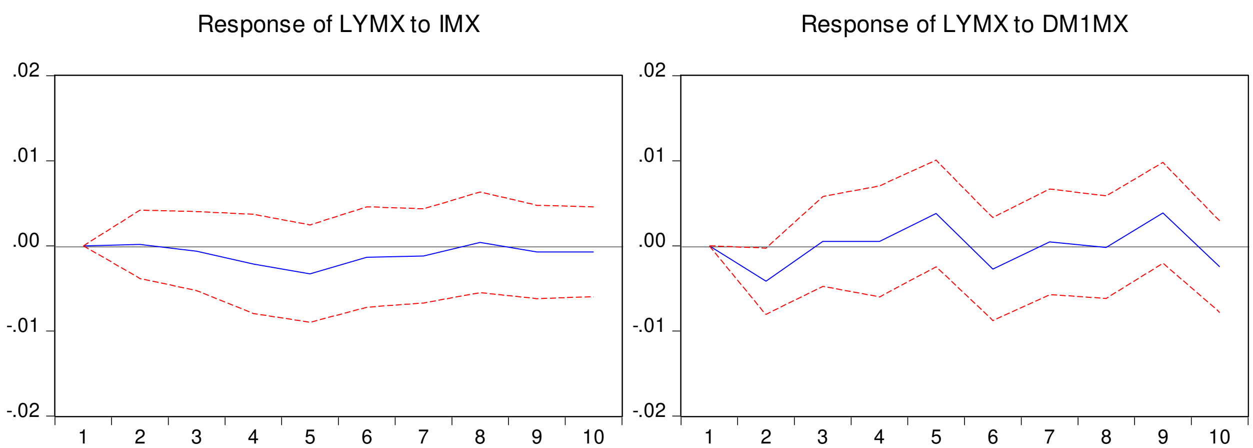
iii) Colombia

VAR model with three lags



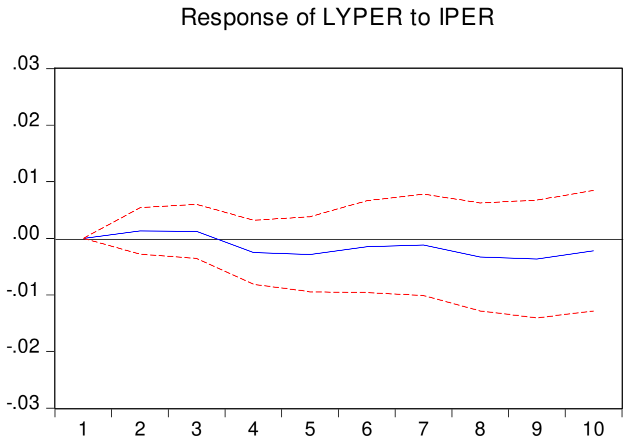
iv) Mexico

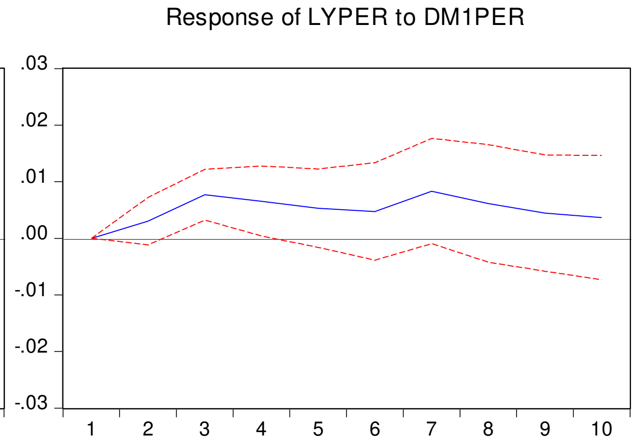
VAR model with four lags



v) Peru

VAR model with four lags





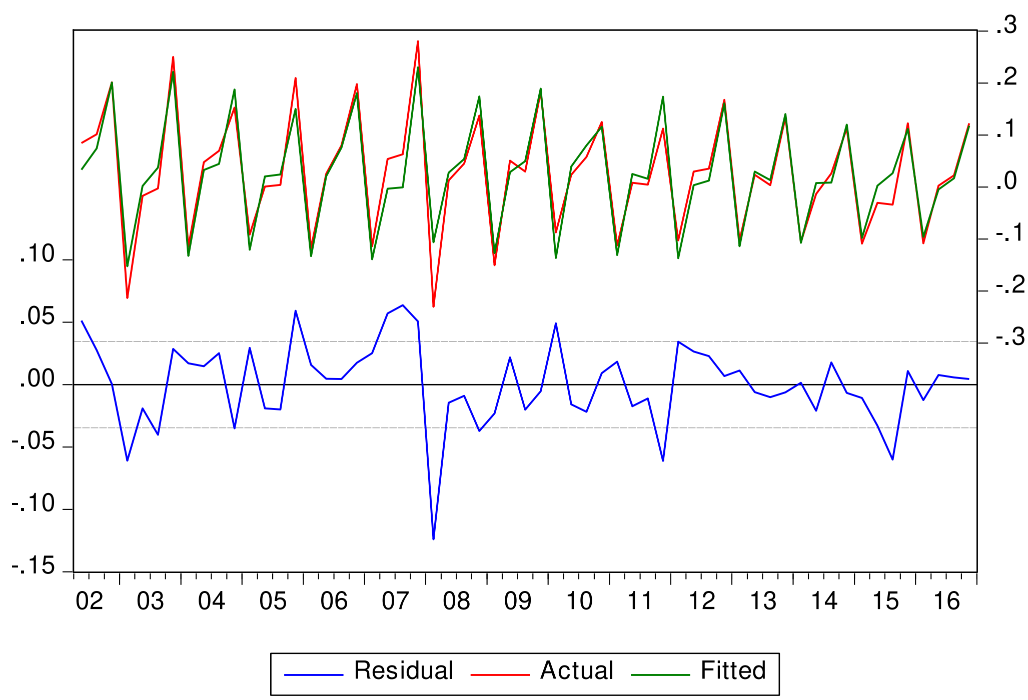
Appendix B

i) Brasil

Dependent Variable: DM1BR
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 07/15/18 Time: 22:02
Sample: 2002Q2 2016Q4
Included observations: 59
Convergence achieved after 20 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.003684	0.004666	-0.789403	0.4334
DM1BR(-4)	0.185750	0.094554	1.964476	0.0547
DM1BR(-8)	0.757265	0.080665	9.387756	0.0000
AR(8)	-0.426736	0.111396	-3.830794	0.0003
AR(11)	0.381107	0.111876	3.406512	0.0013
SIGMASQ	0.001075	0.000182	5.903283	0.0000

R-squared	0.911521	Mean dependent var	0.026411
Adjusted R-squared	0.903174	S.D. dependent var	0.111166
S.E. of regression	0.034591	Akaike info criterion	-3.721246
Sum squared resid	0.063418	Schwarz criterion	-3.509971
Log likelihood	115.7767	Hannan-Quinn criter.	-3.638772
F-statistic	109.2025	Durbin-Watson stat	1.755289
Prob(F-statistic)	0.000000		



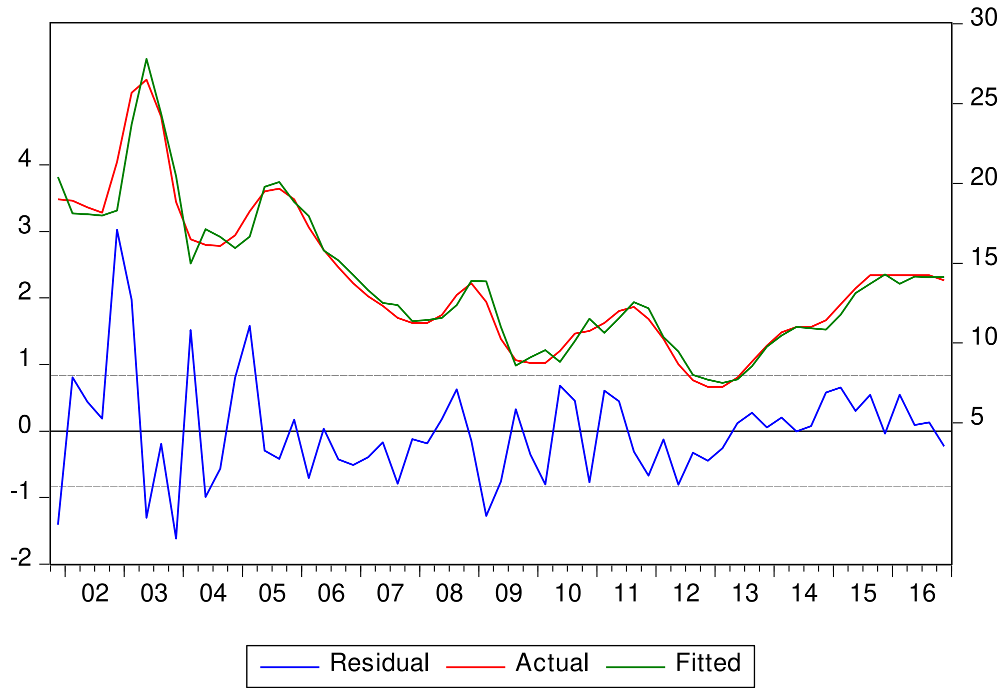
Sample: 2000Q1 2016Q4
Included observations: 59
Q-statistic probabilities adjusted for 2 ARMA terms and 2 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. |*. |	. |*. |	1	0.102	0.102	0.6409	
. | . |	. | . |	2	-0.051	-0.062	0.8049	
.*| . |	.*| . |	3	-0.078	-0.067	1.1990	0.274
.*| . |	.*| . |	4	-0.153	-0.144	2.7318	0.255
.*| . |	.*| . |	5	-0.129	-0.112	3.8383	0.279
. | . |	. | . |	6	0.050	0.053	4.0104	0.405
. | . |	. | . |	7	0.058	0.017	4.2471	0.514
.*| . |	.*| . |	8	-0.066	-0.108	4.5539	0.602
.*| . |	.*| . |	9	-0.070	-0.085	4.9093	0.671
. | . |	. | . |	10	0.060	0.072	5.1728	0.739
. | . |	. | . |	11	-0.026	-0.034	5.2219	0.815
.*| . |	.*| . |	12	-0.148	-0.180	6.9039	0.734
. |*. |	. |*. |	13	0.104	0.097	7.7503	0.735
. |*. |	. | . |	14	0.081	0.062	8.2694	0.764
. |*. |	. |*. |	15	0.092	0.095	8.9622	0.776
**| . |	**| . |	16	-0.224	-0.328	13.164	0.514
.*| . |	**| . |	17	-0.205	-0.207	16.749	0.334
.*| . |	. | . |	18	-0.109	-0.000	17.791	0.336
. | . |	. |*. |	19	0.063	0.131	18.149	0.380
. |** |	. |*. |	20	0.258	0.138	24.283	0.146
. |*. |	.*| . |	21	0.150	-0.071	26.411	0.119
. | . |	. | . |	22	0.030	0.034	26.500	0.150
. | . |	. | . |	23	-0.053	0.039	26.778	0.178
. | . |	. | . |	24	-0.034	0.015	26.898	0.215

Dependent Variable: IBR
Method: Least Squares
Date: 07/12/18   Time: 19:06
Sample (adjusted): 2001Q4 2016Q4
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.453324	0.391305	1.158493	0.2518
IBR(-1)	1.917543	0.122835	15.61075	0.0000
IBR(-2)	-1.426883	0.239986	-5.945697	0.0000
IBR(-3)	0.383314	0.189982	2.017637	0.0486
IBR(-5)	0.338822	0.184915	1.832312	0.0724
IBR(-6)	-0.476203	0.230451	-2.066397	0.0436
IBR(-7)	0.225786	0.118081	1.912127	0.0612

R-squared	0.968208	Mean dependent var	13.80574
Adjusted R-squared	0.964675	S.D. dependent var	4.446703
S.E. of regression	0.835751	Akaike info criterion	2.586647
Sum squared resid	37.71793	Schwarz criterion	2.828878
Log likelihood	-71.89274	Hannan-Quinn criter.	2.681580
F-statistic	274.0884	Durbin-Watson stat	1.772478
Prob(F-statistic)	0.000000		



Sample: 2000Q1 2016Q4
Included observations: 61
Q-statistic probabilities adjusted for 6 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*. |	. |*. |	1	0.087	0.087	0.4818	0.488
.*| . |	.*| . |	2	-0.077	-0.085	0.8666	0.648
. | . |	. | . |	3	0.032	0.048	0.9355	0.817
. | . |	. | . |	4	-0.025	-0.039	0.9765	0.913
.*| . |	.*| . |	5	-0.161	-0.151	2.7547	0.738
.*| . |	.*| . |	6	-0.092	-0.072	3.3518	0.764
. | . |	. | . |	7	-0.029	-0.040	3.4112	0.845
. |*. |	. |*. |	8	0.171	0.181	5.5221	0.701
. |*. |	. | . |	9	0.087	0.054	6.0818	0.732
. | . |	. | . |	10	-0.003	-0.013	6.0824	0.808
. | . |	. | . |	11	0.059	0.031	6.3490	0.849
. | . |	. | . |	12	0.006	-0.022	6.3522	0.897
. | . |	. | . |	13	-0.065	-0.006	6.6870	0.918
. | . |	. | . |	14	0.005	0.055	6.6887	0.946
. | . |	. | . |	15	0.015	0.030	6.7073	0.965
.*| . |	.*| . |	16	-0.132	-0.151	8.1924	0.943
.*| . |	.*| . |	17	-0.073	-0.083	8.6576	0.950
. | . |	. | . |	18	-0.022	-0.047	8.7012	0.966
. | . |	. | . |	19	-0.029	-0.032	8.7794	0.977
.*| . |	.*| . |	20	-0.088	-0.087	9.5069	0.976
. | . |	. | . |	21	0.031	0.020	9.5975	0.984
. |*. |	. |*. |	22	0.159	0.112	12.079	0.956
. | . |	. | . |	23	0.064	0.016	12.492	0.962
.*| . |	.*| . |	24	-0.106	-0.080	13.652	0.954
. | . |	. | . |	25	-0.034	-0.019	13.775	0.966
. | . |	. | . |	26	-0.038	-0.040	13.934	0.974
.*| . |	. | . |	27	-0.113	-0.045	15.380	0.964
.*| . |	. | . |	28	-0.101	-0.027	16.559	0.957

Sample: 2000Q1 2016Q4
Included observations: 59
Correlations are asymptotically consistent approximations

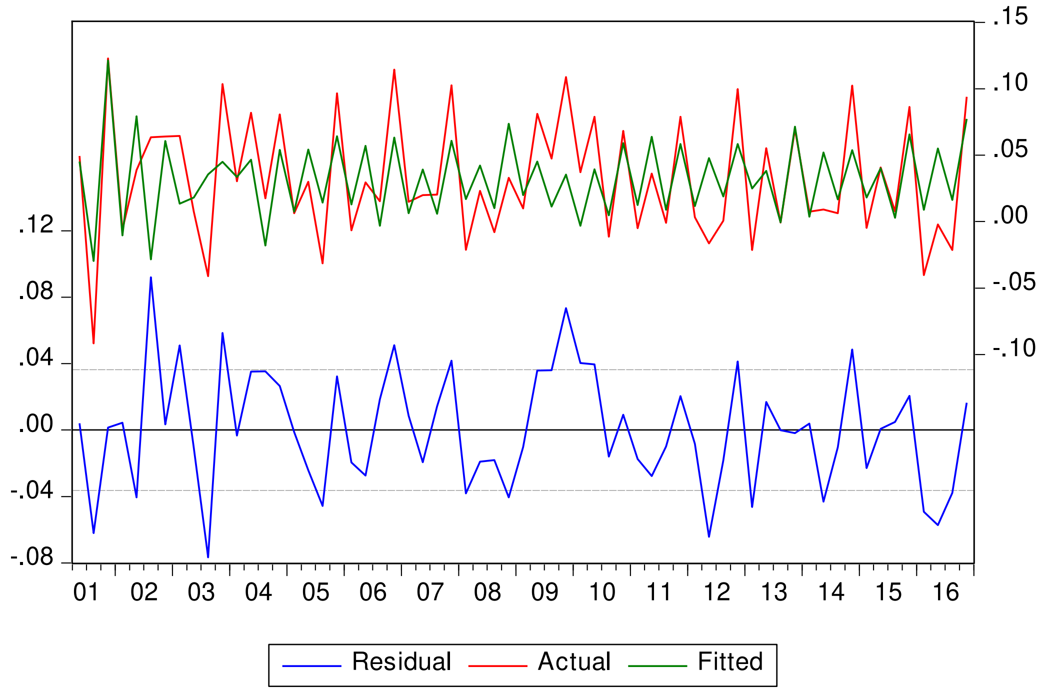
EM1BR,EIBR(-i)	EM1BR,EIBR(+i)	i	lag	lead
.**| . |	.**| . |	0	-0.1713	-0.1713
***| . |	. |* . |	1	-0.2876	0.1151
.**| . |	. |* . |	2	-0.1705	0.0972
.**| . |	. |* . |	3	-0.2001	0.0793
. |**. |	. |* . |	4	0.1736	0.0987
. | . |	. |* . |	5	0.0042	0.1199
. |* . |	.**| . |	6	0.1206	-0.2221
. |* . |	. *| . |	7	0.0861	-0.1053
. | . |	. *| . |	8	0.0331	-0.0548
. |* . |	.**| . |	9	0.0683	-0.1577
. | . |	. | . |	10	0.0385	0.0300
. |**. |	. |**. |	11	0.2039	0.1698
. | . |	. *| . |	12	-0.0360	-0.0802
. *| . |	. *| . |	13	-0.1231	-0.0853
. |* . |	. |* . |	14	0.0509	0.0946
. |* . |	. |* . |	15	0.0811	0.0876
.**| . |	. | . |	16	-0.2237	0.0468

ii) Chile

Dependent Variable: DM1CH
Method: Least Squares
Date: 06/22/18 Time: 17:47
Sample (adjusted): 2001Q2 2016Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.038702	0.008817	4.389439	0.0000
DM1CH(-1)	-0.193952	0.114488	-1.694075	0.0955
DM1CH(-3)	-0.287938	0.105813	-2.721197	0.0085
DM1CH(-4)	0.265537	0.114075	2.327743	0.0234

R-squared	0.403722	Mean dependent var	0.032239
Adjusted R-squared	0.373403	S.D. dependent var	0.045891
S.E. of regression	0.036326	Akaike info criterion	-3.731156
Sum squared resid	0.077857	Schwarz criterion	-3.595084
Log likelihood	121.5314	Hannan-Quinn criter.	-3.677638
F-statistic	13.31572	Durbin-Watson stat	1.919074
Prob(F-statistic)	0.000001		



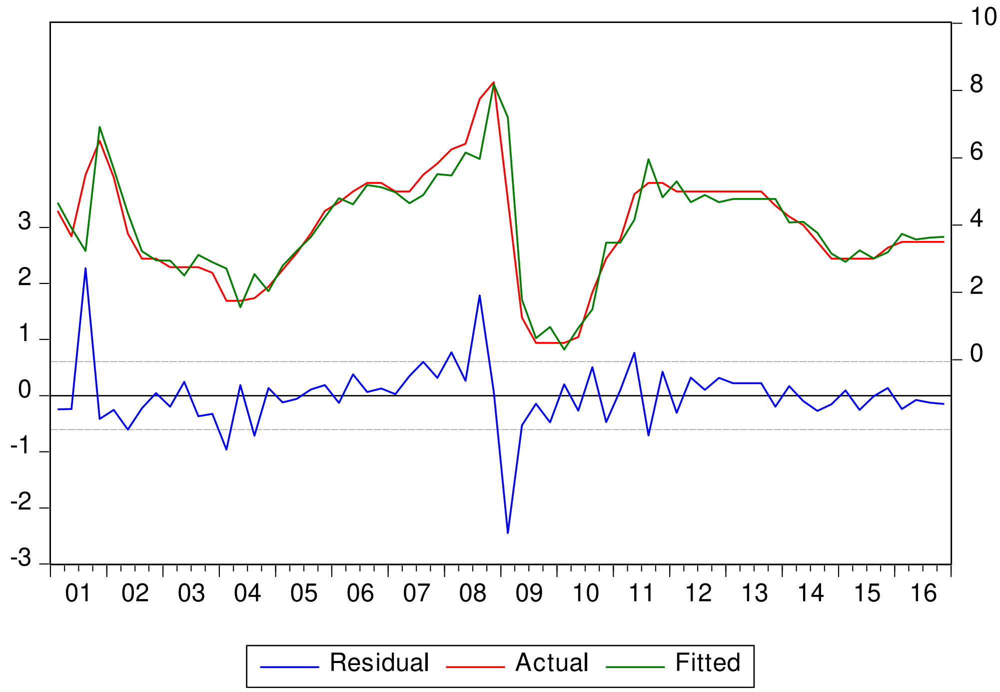
Sample: 2000Q1 2016Q4
Included observations: 63
Q-statistic probabilities adjusted for 3 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	0.039	0.039	0.0985	0.754
. | . |	. | . |	2	-0.016	-0.018	0.1163	0.943
. | . |	. | . |	3	0.043	0.044	0.2429	0.970
.*| . |	.*| . |	4	-0.180	-0.185	2.5024	0.644
.*| . |	. | . |	5	-0.071	-0.055	2.8580	0.722
**| . |	**| . |	6	-0.250	-0.264	7.3330	0.291
. | . |	. | . |	7	-0.007	0.025	7.3371	0.395
. |** |	. |** |	8	0.279	0.257	13.126	0.108
.*| . |	.*| . |	9	-0.135	-0.170	14.510	0.105
. | . |	.*| . |	10	-0.027	-0.117	14.567	0.149
. | . |	. | . |	11	0.013	-0.050	14.581	0.203
. | . |	. |*. |	12	0.051	0.123	14.786	0.253
. | . |	. | . |	13	0.030	0.033	14.862	0.316
. | . |	. | . |	14	-0.031	0.062	14.941	0.382
. | . |	.*| . |	15	0.012	-0.123	14.954	0.455
. |*. |	. |*. |	16	0.143	0.077	16.726	0.404
.*| . |	. | . |	17	-0.119	-0.037	17.980	0.390
.*| . |	. | . |	18	-0.119	-0.054	19.260	0.376
. | . |	. | . |	19	-0.027	-0.050	19.328	0.436
. |*. |	. |** |	20	0.167	0.221	21.989	0.341
. |*. |	. | . |	21	0.074	0.067	22.529	0.370
. | . |	. | . |	22	0.013	0.016	22.546	0.428
. | . |	.*| . |	23	0.009	-0.099	22.554	0.487
. | . |	. | . |	24	0.019	-0.058	22.594	0.544
.*| . |	.*| . |	25	-0.176	-0.074	25.951	0.410
.*| . |	. |*. |	26	-0.108	0.087	27.237	0.397
. | . |	. | . |	27	-0.045	-0.039	27.469	0.439
. |*. |	. | . |	28	0.138	0.033	29.708	0.377

Dependent Variable: ICH
Method: Least Squares
Date: 06/22/18 Time: 18:25
Sample (adjusted): 2001Q1 2016Q4
Included observations: 64 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.816198	0.235681	3.463145	0.0010
ICH(-1)	1.660906	0.121075	13.71795	0.0000
ICH(-2)	-1.353328	0.221689	-6.104623	0.0000
ICH(-3)	0.849539	0.221405	3.837042	0.0003
ICH(-4)	-0.365272	0.120389	-3.034102	0.0036

R-squared	0.875048	Mean dependent var	3.915625
Adjusted R-squared	0.866577	S.D. dependent var	1.659117
S.E. of regression	0.606027	Akaike info criterion	1.911121
Sum squared resid	21.66888	Schwarz criterion	2.079784
Log likelihood	-56.15587	Hannan-Quinn criter.	1.977566
F-statistic	103.2957	Durbin-Watson stat	1.983054
Prob(F-statistic)	0.000000		



Sample: 2000Q1 2016Q4
Included observations: 64
Q-statistic probabilities adjusted for 4 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	0.007	0.007	0.0029	0.957
. | . |	. | . |	2	-0.019	-0.019	0.0266	0.987
. | . |	. | . |	3	-0.014	-0.014	0.0405	0.998
.*| . |	.*| . |	4	-0.067	-0.067	0.3533	0.986
. | . |	. | . |	5	0.007	0.007	0.3563	0.996
.*| . |	.*| . |	6	-0.129	-0.132	1.5642	0.955
. | . |	. | . |	7	0.057	0.058	1.8040	0.970
. | . |	. | . |	8	-0.041	-0.054	1.9326	0.983
.*| . |	.*| . |	9	-0.095	-0.095	2.6198	0.977
. | . |	.*| . |	10	-0.048	-0.067	2.8030	0.986
. | . |	. | . |	11	-0.000	0.003	2.8030	0.993
.*| . |	.*| . |	12	-0.089	-0.126	3.4529	0.991
. | . |	. | . |	13	-0.042	-0.044	3.6019	0.995
.*| . |	**| . |	14	-0.167	-0.211	5.9678	0.967
. | . |	. | . |	15	-0.016	-0.052	5.9912	0.980
.*| . |	.*| . |	16	-0.131	-0.202	7.4945	0.963
. | . |	. | . |	17	-0.013	-0.056	7.5097	0.976
. | . |	.*| . |	18	-0.027	-0.169	7.5763	0.984
. | . |	. | . |	19	0.058	0.004	7.8968	0.988
. |*. |	. | . |	20	0.095	-0.052	8.7644	0.985
. |*. |	. | . |	21	0.091	0.065	9.5855	0.984
. |*. |	. | . |	22	0.079	-0.047	10.215	0.984
. | . |	. | . |	23	0.032	0.018	10.318	0.989
. | . |	.*| . |	24	0.001	-0.102	10.318	0.993
. | . |	. | . |	25	0.001	-0.004	10.318	0.996
. | . |	. | . |	26	0.047	-0.059	10.559	0.997
. | . |	. | . |	27	0.018	0.010	10.597	0.998
. |** |	. |*. |	28	0.268	0.211	18.996	0.898

Sample: 2000Q1 2016Q4
Included observations: 63
Correlations are asymptotically consistent approximations

EM1CH,EICH(-i)	EM1CH,EICH(+i)	i	lag	lead
.**| . |	.**| . |	0	-0.1979	-0.1979
.**| . |	. |*. |	1	-0.2385	0.0781
.**| . |	. |*. |	2	-0.1564	0.0562
***| . |	. |*. |	3	-0.3110	0.1167
. |*. |	. |*. |	4	0.1196	0.1190
. | . |	. *| . |	5	-0.0011	-0.1013
. |*** |	. *| . |	6	0.3310	-0.0433
. |*. |	. |*. |	7	0.0635	0.1105
. *| . |	. *| . |	8	-0.0793	-0.0507
. |** |	. *| . |	9	0.2523	-0.0974
. *| . |	. | . |	10	-0.0433	-0.0326
. | . |	. |*. |	11	0.0099	0.0928
. | . |	. |*. |	12	0.0289	0.0739
. |*. |	. | . |	13	0.1344	-0.0136
. |*. |	. |** |	14	0.0804	0.1851
.**| . |	. |** |	15	-0.2440	0.1908
. | . |	. | . |	16	-0.0161	0.0167

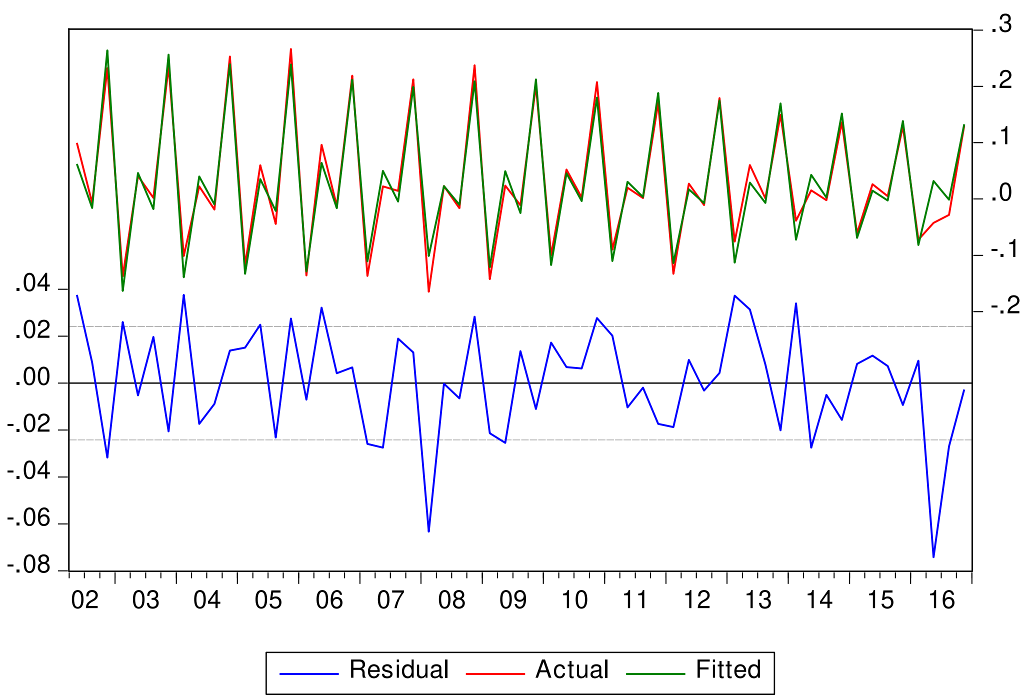
iii) Colombia

Dependent Variable: DM1COL
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 07/15/18 Time: 21:54
Sample: 2002Q2 2016Q4
Included observations: 59
Convergence achieved after 6 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000217	0.002394	0.090445	0.9283
DM1COL(-4)	0.362569	0.105066	3.450870	0.0011
DM1COL(-8)	0.552618	0.103462	5.341242	0.0000
AR(8)	-0.624123	0.124160	-5.026768	0.0000
SIGMASQ	0.000536	9.70E-05	5.527851	0.0000

R-squared	0.959046	Mean dependent var	0.031788
Adjusted R-squared	0.956013	S.D. dependent var	0.115399
S.E. of regression	0.024203	Akaike info criterion	-4.456851
Sum squared resid	0.031632	Schwarz criterion	-4.280789
Log likelihood	136.4771	Hannan-Quinn criter.	-4.388124
F-statistic	316.1419	Durbin-Watson stat	2.148738
Prob(F-statistic)	0.000000		

Inverted AR Roots	.87+.36i	.87-.36i	.36-.87i	.36+.87i
	-.36-.87i	-.36+.87i	-.87-.36i	-.87+.36i



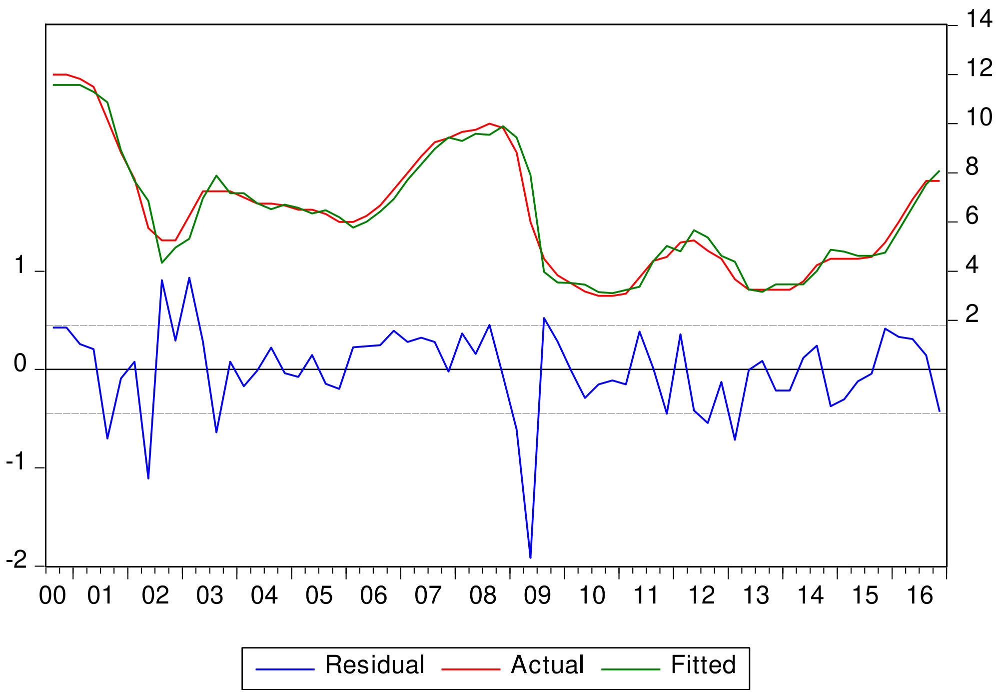
Sample: 2000Q1 2016Q4
Included observations: 59
Q-statistic probabilities adjusted for 1 ARMA term and 2 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.*| . |	.*| . |	1	-0.097	-0.097	0.5834	
. | . |	. | . |	2	0.037	0.028	0.6696	0.413
.*| . |	.*| . |	3	-0.086	-0.080	1.1425	0.565
. |*. |	. | . |	4	0.087	0.071	1.6346	0.652
. | . |	. | . |	5	-0.044	-0.026	1.7662	0.779
.*| . |	.*| . |	6	-0.144	-0.165	3.1799	0.672
. | . |	. | . |	7	0.028	0.017	3.2352	0.779
. | . |	. | . |	8	0.027	0.028	3.2849	0.857
. | . |	. | . |	9	0.003	-0.015	3.2854	0.915
. |*. |	. |*. |	10	0.098	0.129	3.9950	0.912
. | . |	. | . |	11	0.035	0.045	4.0856	0.943
.*| . |	.*| . |	12	-0.135	-0.175	5.4835	0.906
.*| . |	.*| . |	13	-0.150	-0.163	7.2534	0.840
. | . |	.*| . |	14	-0.040	-0.069	7.3815	0.881
. | . |	. | . |	15	0.012	-0.013	7.3938	0.918
.*| . |	.*| . |	16	-0.118	-0.079	8.5539	0.900
. | . |	. | . |	17	0.058	0.064	8.8454	0.920
. |*. |	. |*. |	18	0.134	0.112	10.421	0.885
. | . |	. | . |	19	0.066	0.022	10.809	0.902
.*| . |	.*| . |	20	-0.172	-0.191	13.536	0.810
. | . |	. | . |	21	0.067	0.031	13.963	0.832
.*| . |	.*| . |	22	-0.080	-0.076	14.589	0.843
.*| . |	.*| . |	23	-0.077	-0.081	15.186	0.854
.*| . |	.*| . |	24	-0.169	-0.109	18.109	0.752

Dependent Variable: ICOL
Method: Least Squares
Date: 06/22/18 Time: 18:34
Sample (adjusted): 2000Q3 2016Q4
Included observations: 66 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.451621	0.150701	2.996798	0.0039
ICOL(-1)	1.646026	0.083591	19.69145	0.0000
ICOL(-2)	-0.719292	0.080818	-8.900163	0.0000

R-squared	0.967641	Mean dependent var	6.349848
Adjusted R-squared	0.966614	S.D. dependent var	2.450387
S.E. of regression	0.447731	Akaike info criterion	1.275139
Sum squared resid	12.62915	Schwarz criterion	1.374669
Log likelihood	-39.07958	Hannan-Quinn criter.	1.314468
F-statistic	941.9629	Durbin-Watson stat	1.811431
Prob(F-statistic)	0.000000		



Sample: 2000Q1 2016Q4
Included observations: 66
Q-statistic probabilities adjusted for 2 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*. |	. |*. |	1	0.080	0.080	0.4392	0.508
. | . |	. | . |	2	-0.023	-0.030	0.4767	0.788
. | . |	. | . |	3	-0.056	-0.052	0.7018	0.873
.*| . |	.*| . |	4	-0.197	-0.190	3.5031	0.477
. | . |	. |*. |	5	0.060	0.091	3.7664	0.584
. | . |	. | . |	6	0.011	-0.014	3.7752	0.707
. | . |	. | . |	7	0.017	0.003	3.7965	0.803
. | . |	. | . |	8	0.051	0.018	3.9949	0.858
. | . |	. | . |	9	-0.011	0.013	4.0053	0.911
. | . |	. | . |	10	0.049	0.048	4.1972	0.938
.*| . |	.*| . |	11	-0.122	-0.131	5.4033	0.910
. | . |	. | . |	12	-0.065	-0.031	5.7593	0.928
. | . |	. | . |	13	0.039	0.043	5.8872	0.950
. | . |	. | . |	14	0.066	0.072	6.2601	0.960
. |*. |	. | . |	15	0.131	0.066	7.7588	0.933
. | . |	. | . |	16	0.008	-0.006	7.7643	0.956
. | . |	. | . |	17	0.017	0.055	7.7901	0.971
. | . |	. | . |	18	-0.013	0.006	7.8054	0.981
. | . |	. | . |	19	-0.005	0.033	7.8078	0.989
. | . |	. | . |	20	-0.026	-0.048	7.8737	0.993
.*| . |	. | . |	21	-0.066	-0.041	8.3094	0.994
. | . |	. | . |	22	0.027	0.022	8.3830	0.996
. | . |	. | . |	23	0.062	0.042	8.7824	0.997
. | . |	.*| . |	24	-0.054	-0.088	9.0995	0.997
.*| . |	.*| . |	25	-0.181	-0.199	12.698	0.980
.*| . |	. | . |	26	-0.108	-0.038	14.016	0.973
.*| . |	.*| . |	27	-0.089	-0.082	14.932	0.970
. |*. |	. |*. |	28	0.111	0.083	16.398	0.960

Sample: 2000Q1 2016Q4
Included observations: 59
Correlations are asymptotically consistent approximations

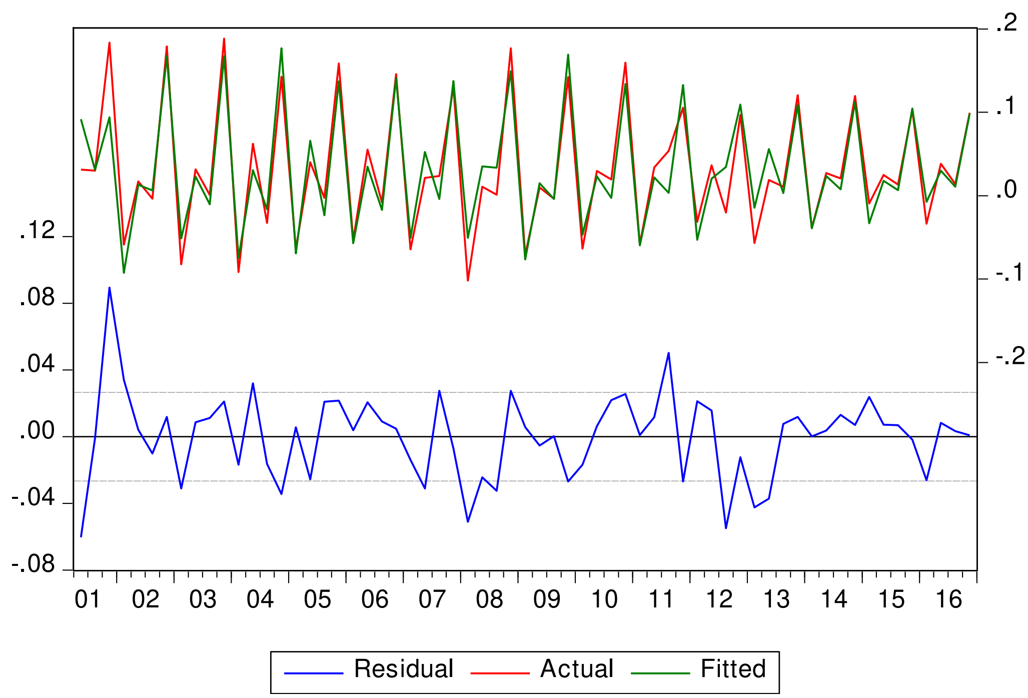
EM1COL,EICOL(-i)	EM1COL,EICOL(+i)	i	lag	lead
. *| . |	. *| . |	0	-0.1311	-0.1311
. *| . |	. |* . |	1	-0.1312	0.0537
. *| . |	. | . |	2	-0.0775	-0.0009
.**| . |	. |* . |	3	-0.1765	0.1093
. | . |	. |* . |	4	0.0111	0.1401
. *| . |	. |**. |	5	-0.0683	0.2435
. |* . |	.**| . |	6	0.0574	-0.1921
.**| . |	. *| . |	7	-0.2097	-0.0836
. |* . |	. |* . |	8	0.1065	0.1200
. | . |	. |* . |	9	0.0289	0.0866
. |* . |	. | . |	10	0.0851	-0.0064
. |* . |	. | . |	11	0.0688	-0.0017
. *| . |	. | . |	12	-0.1115	-0.0353
. |**. |	. |* . |	13	0.2468	0.1254
. |* . |	. | . |	14	0.0728	-0.0288
. |* . |	. |* . |	15	0.0714	0.1271
. *| . |	.**| . |	16	-0.1188	-0.1635

iv) Mexico

Dependent Variable: DM1MX
Method: Least Squares
Date: 06/22/18 Time: 18:09
Sample (adjusted): 2001Q2 2016Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.037836	0.010285	3.678863	0.0005
DM1MX(-1)	-0.269069	0.093477	-2.878440	0.0056
DM1MX(-2)	-0.272010	0.090512	-3.005231	0.0039
DM1MX(-3)	-0.333801	0.090818	-3.675512	0.0005
DM1MX(-4)	0.619209	0.093878	6.595897	0.0000

R-squared	0.884188	Mean dependent var	0.031414
Adjusted R-squared	0.876201	S.D. dependent var	0.075617
S.E. of regression	0.026606	Akaike info criterion	-4.339324
Sum squared resid	0.041057	Schwarz criterion	-4.169234
Log likelihood	141.6887	Hannan-Quinn criter.	-4.272427
F-statistic	110.7027	Durbin-Watson stat	1.671398
Prob(F-statistic)	0.000000		



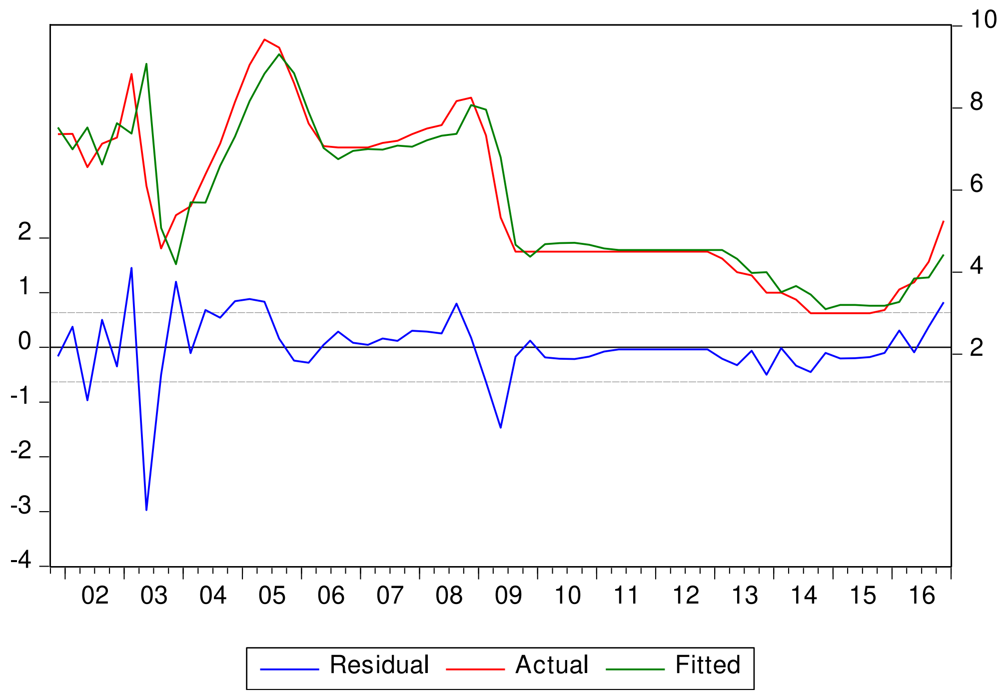
Sample: 2000Q1 2016Q4
Included observations: 63
Q-statistic probabilities adjusted for 4 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*. |	. |*. |	1	0.120	0.120	0.9499	0.330
.*| . |	.*| . |	2	-0.098	-0.114	1.5913	0.451
. | . |	. | . |	3	0.020	0.048	1.6186	0.655
.*| . |	**| . |	4	-0.204	-0.232	4.5209	0.340
. | . |	. | . |	5	-0.054	0.017	4.7230	0.451
. | . |	.*| . |	6	-0.058	-0.116	4.9608	0.549
. | . |	. | . |	7	-0.040	0.001	5.0756	0.651
. | . |	.*| . |	8	-0.022	-0.093	5.1110	0.746
.*| . |	.*| . |	9	-0.178	-0.185	7.5005	0.585
. | . |	.*| . |	10	-0.058	-0.066	7.7562	0.653
. | . |	. | . |	11	0.003	-0.059	7.7568	0.735
.*| . |	.*| . |	12	-0.118	-0.167	8.8760	0.713
. |*. |	. |*. |	13	0.150	0.099	10.726	0.634
. | . |	.*| . |	14	-0.025	-0.184	10.777	0.703
. | . |	. | . |	15	-0.004	0.028	10.778	0.768
. |*. |	. | . |	16	0.117	-0.035	11.963	0.747
.*| . |	.*| . |	17	-0.081	-0.085	12.542	0.766
. |*. |	. | . |	18	0.105	0.058	13.550	0.758
. |*. |	. | . |	19	0.121	0.050	14.923	0.727
. | . |	. |*. |	20	0.061	0.081	15.277	0.760
. | . |	. | . |	21	0.027	-0.042	15.347	0.805
.*| . |	. | . |	22	-0.069	0.015	15.827	0.824
. | . |	. |*. |	23	0.062	0.124	16.216	0.846
. | . |	. | . |	24	0.019	0.022	16.255	0.879
**| . |	.*| . |	25	-0.227	-0.139	21.811	0.647
.*| . |	.*| . |	26	-0.110	-0.117	23.149	0.624
.*| . |	. | . |	27	-0.092	-0.048	24.107	0.624
. | . |	. |*. |	28	0.035	0.136	24.253	0.668

Dependent Variable: IMX
Method: Least Squares
Date: 06/22/18   Time: 18:57
Sample (adjusted): 2001Q4 2016Q4
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.395944	0.259409	1.526334	0.1325
IMX(-1)	1.234563	0.110314	11.19132	0.0000
IMX(-2)	-0.362258	0.108203	-3.347952	0.0014
IMX(-7)	0.047501	0.031299	1.517662	0.1346

R-squared	0.895140	Mean dependent var	5.685738
Adjusted R-squared	0.889621	S.D. dependent var	1.905443
S.E. of regression	0.633052	Akaike info criterion	1.986797
Sum squared resid	22.84304	Schwarz criterion	2.125215
Log likelihood	-56.59732	Hannan-Quinn criter.	2.041045
F-statistic	162.1937	Durbin-Watson stat	1.998871
Prob(F-statistic)	0.000000		



Sample: 2000Q1 2016Q4
Included observations: 61
Q-statistic probabilities adjusted for 3 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	-0.015	-0.015	0.0141	0.905
. | . |	. | . |	2	0.037	0.037	0.1055	0.949
. | . |	. | . |	3	0.003	0.004	0.1061	0.991
. |*. |	. |*. |	4	0.079	0.078	0.5239	0.971
. | . |	. | . |	5	0.005	0.007	0.5255	0.991
.*| . |	.*| . |	6	-0.110	-0.116	1.3692	0.968
. | . |	. | . |	7	-0.038	-0.043	1.4708	0.983
.*| . |	.*| . |	8	-0.101	-0.102	2.2107	0.974
. | . |	. | . |	9	0.006	0.005	2.2131	0.988
. | . |	. | . |	10	0.018	0.046	2.2382	0.994
. | . |	. | . |	11	0.017	0.029	2.2616	0.997
. | . |	. | . |	12	-0.013	-0.009	2.2752	0.999
. | . |	. | . |	13	0.052	0.041	2.4891	0.999
. |*. |	. | . |	14	0.081	0.055	3.0230	0.999
. | . |	. | . |	15	0.035	0.024	3.1233	0.999
. | . |	. | . |	16	-0.027	-0.034	3.1854	1.000
. | . |	. | . |	17	-0.042	-0.049	3.3374	1.000
.*| . |	.*| . |	18	-0.066	-0.078	3.7249	1.000
. | . |	. | . |	19	-0.040	-0.036	3.8739	1.000
.*| . |	. | . |	20	-0.072	-0.050	4.3610	1.000
.*| . |	.*| . |	21	-0.131	-0.107	6.0148	0.999
.*| . |	. | . |	22	-0.066	-0.049	6.4430	0.999
. | . |	. | . |	23	0.058	0.067	6.7802	1.000
. |*. |	. |*. |	24	0.125	0.128	8.3974	0.999
.*| . |	.*| . |	25	-0.126	-0.128	10.096	0.996
. | . |	.*| . |	26	-0.060	-0.106	10.497	0.997
. | . |	.*| . |	27	-0.033	-0.090	10.622	0.998
. | . |	. | . |	28	0.031	-0.024	10.735	0.999

Sample: 2000Q1 2016Q4
Included observations: 61
Correlations are asymptotically consistent approximations

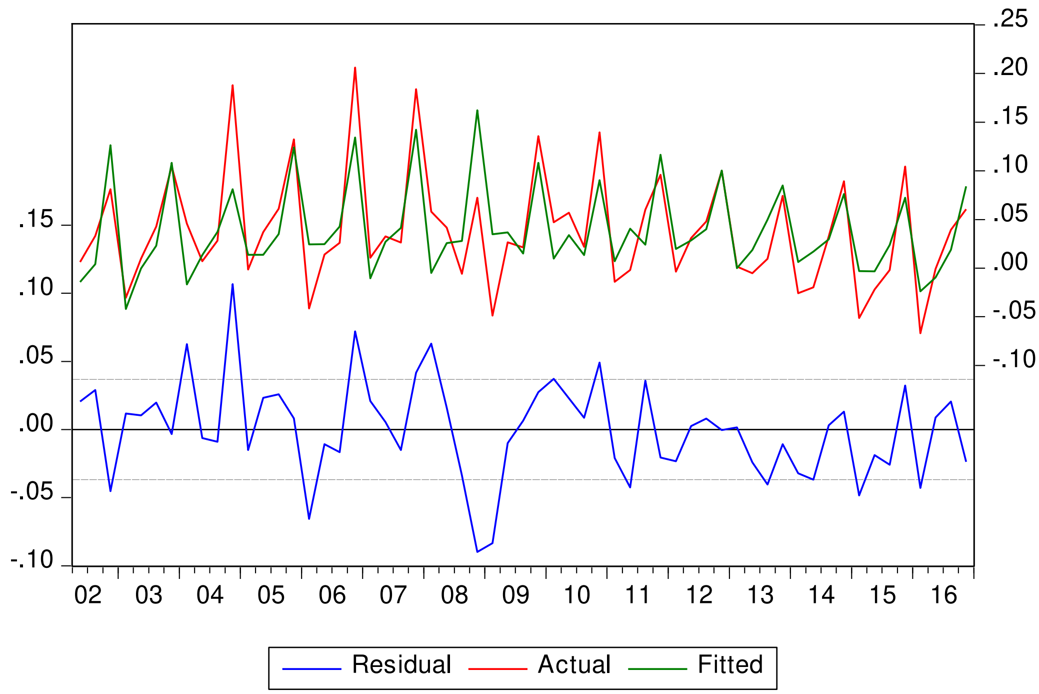
<table>
<tr><th>EM1MX,EIMX(-i)</th><th>EM1MX,EIMX(+i)</th><th>i</th><th>lag</th><th>lead</th></tr>
<tr><td>.**| . |</td><td>.**| . |</td><td>0</td><td>-0.1693</td><td>-0.1693</td></tr>
<tr><td>. *| . |</td><td>. | . |</td><td>1</td><td>-0.0843</td><td>0.0329</td></tr>
<tr><td>. *| . |</td><td>.**| . |</td><td>2</td><td>-0.0514</td><td>-0.1581</td></tr>
<tr><td>. |* . |</td><td>. |* . |</td><td>3</td><td>0.1177</td><td>0.1082</td></tr>
<tr><td>.**| . |</td><td>. |**. |</td><td>4</td><td>-0.1652</td><td>0.2022</td></tr>
<tr><td>. |* . |</td><td>. |* . |</td><td>5</td><td>0.1146</td><td>0.1522</td></tr>
<tr><td>. | . |</td><td>***| . |</td><td>6</td><td>-0.0401</td><td>-0.2505</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>7</td><td>-0.0087</td><td>-0.0080</td></tr>
<tr><td>. | . |</td><td>. |**. |</td><td>8</td><td>0.0424</td><td>0.2372</td></tr>
<tr><td>. *| . |</td><td>. |* . |</td><td>9</td><td>-0.1149</td><td>0.0638</td></tr>
<tr><td>. |* . |</td><td>. |* . |</td><td>10</td><td>0.0627</td><td>0.0909</td></tr>
<tr><td>. *| . |</td><td>. |* . |</td><td>11</td><td>-0.0495</td><td>0.0757</td></tr>
<tr><td>. *| . |</td><td>. |* . |</td><td>12</td><td>-0.0855</td><td>0.0786</td></tr>
<tr><td>. *| . |</td><td>. |* . |</td><td>13</td><td>-0.0483</td><td>0.0567</td></tr>
<tr><td>. | . |</td><td>. *| . |</td><td>14</td><td>-0.0291</td><td>-0.0424</td></tr>
<tr><td>. |**. |</td><td>. *| . |</td><td>15</td><td>0.1697</td><td>-0.0860</td></tr>
<tr><td>. |* . |</td><td>. *| . |</td><td>16</td><td>0.0904</td><td>-0.0471</td></tr>
</table>

v) Peru

Dependent Variable: DM1PER
Method: Least Squares
Date: 06/22/18 Time: 18:18
Sample (adjusted): 2002Q2 2016Q4
Included observations: 59 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006945	0.005870	1.183106	0.2418
DM1PER(-4)	0.405357	0.119562	3.390344	0.0013
DM1PER(-8)	0.391434	0.115579	3.386713	0.0013

R-squared	0.615431	Mean dependent var	0.039073
Adjusted R-squared	0.601696	S.D. dependent var	0.058225
S.E. of regression	0.036747	Akaike info criterion	-3.720035
Sum squared resid	0.075617	Schwarz criterion	-3.614398
Log likelihood	112.7410	Hannan-Quinn criter.	-3.678799
F-statistic	44.80879	Durbin-Watson stat	1.665601
Prob(F-statistic)	0.000000		



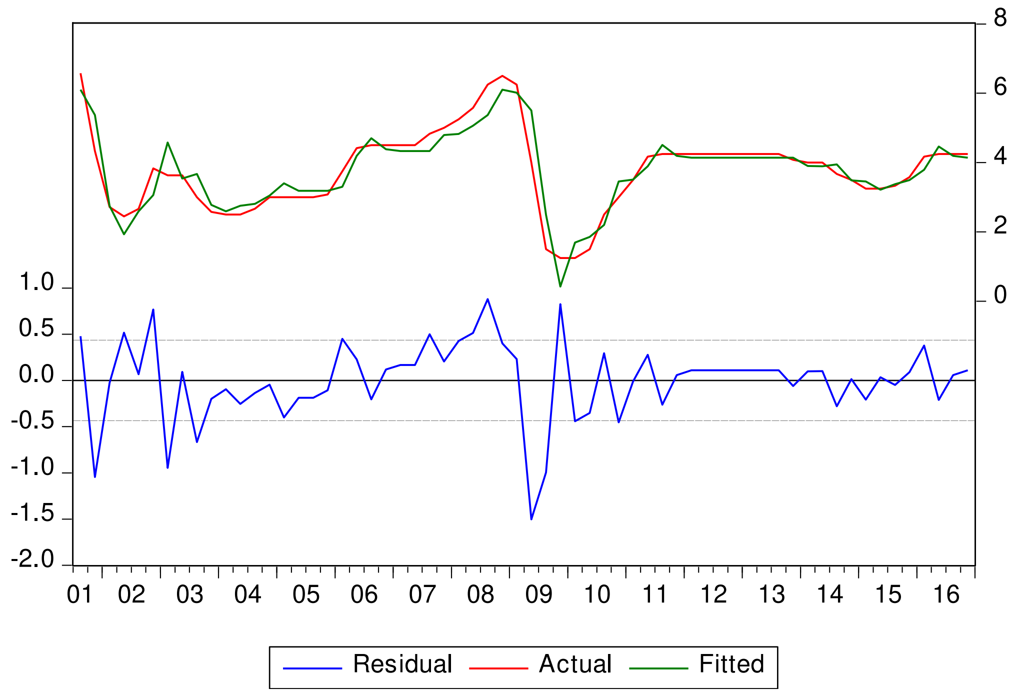
Sample: 2000Q1 2016Q4
Included observations: 59
Q-statistic probabilities adjusted for 2 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*. |	. |*. |	1	0.161	0.161	1.6018	0.206
. | . |	. | . |	2	0.001	-0.025	1.6019	0.449
. | . |	. | . |	3	-0.011	-0.007	1.6097	0.657
.*| . |	.*| . |	4	-0.092	-0.091	2.1619	0.706
.*| . |	.*| . |	5	-0.149	-0.123	3.6343	0.603
. | . |	. |*. |	6	0.056	0.102	3.8508	0.697
.*| . |	.*| . |	7	-0.075	-0.110	4.2388	0.752
.*| . |	.*| . |	8	-0.141	-0.126	5.6428	0.687
. |*. |	. |*. |	9	0.122	0.155	6.7084	0.667
. |*. |	. |*. |	10	0.130	0.082	7.9522	0.634
. |*. |	. |*. |	11	0.162	0.149	9.9191	0.538
. |*. |	. |*. |	12	0.194	0.114	12.787	0.385
. |*. |	. |*. |	13	0.125	0.090	14.006	0.373
.*| . |	.*| . |	14	-0.113	-0.075	15.029	0.376
.*| . |	. | . |	15	-0.068	-0.038	15.405	0.423
.*| . |	.*| . |	16	-0.153	-0.119	17.356	0.363
.*| . |	. | . |	17	-0.109	-0.012	18.373	0.366
. | . |	. | . |	18	0.017	0.051	18.399	0.430
. | . |	. | . |	19	0.062	0.042	18.745	0.473
. | . |	. | . |	20	0.028	0.025	18.818	0.534
. | . |	.*| . |	21	-0.007	-0.096	18.823	0.596
. | . |	.*| . |	22	-0.001	-0.091	18.823	0.656
. | . |	. | . |	23	0.030	-0.005	18.913	0.706
. |*. |	. |*. |	24	0.131	0.083	20.665	0.658

Dependent Variable: IPER
Method: Least Squares
Date: 06/22/18 Time: 19:39
Sample (adjusted): 2001Q3 2016Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.898200	0.181266	4.955161	0.0000
IPER(-1)	1.409577	0.092114	15.30261	0.0000
IPER(-2)	-0.646678	0.084396	-7.662430	0.0000

R-squared	0.863303	Mean dependent var	3.782097
Adjusted R-squared	0.858669	S.D. dependent var	1.155900
S.E. of regression	0.434549	Akaike info criterion	1.218159
Sum squared resid	11.14111	Schwarz criterion	1.321085
Log likelihood	-34.76293	Hannan-Quinn criter.	1.258570
F-statistic	186.3062	Durbin-Watson stat	1.927026
Prob(F-statistic)	0.000000		



Sample: 2000Q1 2016Q4
Included observations: 62
Q-statistic probabilities adjusted for 2 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	0.026	0.026	0.0426	0.836
. | . |	. | . |	2	-0.015	-0.016	0.0581	0.971
. | . |	. | . |	3	0.072	0.073	0.4037	0.939
.*| . |	.*| . |	4	-0.162	-0.167	2.2036	0.698
. |*. |	. |*. |	5	0.108	0.126	3.0179	0.697
. | . |	. | . |	6	0.022	-0.001	3.0532	0.802
.*| . |	. | . |	7	-0.078	-0.052	3.4944	0.836
.*| . |	.*| . |	8	-0.088	-0.132	4.0614	0.852
. | . |	. | . |	9	-0.023	0.025	4.0994	0.905
.*| . |	.*| . |	10	-0.081	-0.092	4.5999	0.916
. | . |	.*| . |	11	-0.065	-0.068	4.9285	0.935
.*| . |	.*| . |	12	-0.114	-0.146	5.9580	0.918
.*| . |	.*| . |	13	-0.180	-0.146	8.5737	0.804
. | . |	.*| . |	14	-0.045	-0.074	8.7410	0.847
. | . |	. | . |	15	0.037	0.028	8.8571	0.885
.*| . |	.*| . |	16	-0.086	-0.131	9.4968	0.892
. | . |	. | . |	17	-0.005	-0.041	9.4990	0.923
. | . |	. | . |	18	-0.001	-0.033	9.4992	0.947
. | . |	. | . |	19	-0.009	-0.007	9.5067	0.964
. | . |	.*| . |	20	0.022	-0.098	9.5513	0.976
. | . |	. | . |	21	0.054	0.012	9.8352	0.981
. | . |	. | . |	22	0.017	-0.039	9.8625	0.988
. |*. |	. |*. |	23	0.152	0.126	12.226	0.967
. | . |	. | . |	24	0.071	-0.031	12.754	0.970
. |*. |	. |*. |	25	0.129	0.136	14.529	0.952
. | . |	.*| . |	26	-0.060	-0.182	14.924	0.959
**| . |	**| . |	27	-0.224	-0.206	20.606	0.804
. | . |	.*| . |	28	0.021	-0.070	20.656	0.839

Sample: 2000Q1 2016Q4
Included observations: 59
Correlations are asymptotically consistent approximations

EM1PER,EIPER(-i)	EM1PER,EIPER(+i)	i	lag	lead
.**| . |	.**| . |	0	-0.2057	-0.2057
.**| . |	. |**. |	1	-0.1500	0.2038
***| . |	. |*** |	2	-0.2655	0.3100
.**| . |	. |**. |	3	-0.1630	0.1557
. *| . |	. *| . |	4	-0.0495	-0.0736
.**| . |	. | . |	5	-0.1563	-0.0082
. *| . |	. *| . |	6	-0.1286	-0.0704
. |* . |	. |* . |	7	0.0676	0.0542
. |**. |	. |* . |	8	0.1668	0.0749
. *| . |	. *| . |	9	-0.0414	-0.0771
. |* . |	.**| . |	10	0.1490	-0.2007
. *| . |	. |* . |	11	-0.0466	0.0494
. | . |	. |* . |	12	0.0114	0.1085
. *| . |	. |* . |	13	-0.0552	0.1487
. | . |	. |* . |	14	0.0365	0.1119
. *| . |	. | . |	15	-0.1227	0.0150
. |**. |	. | . |	16	0.2081	-0.0154