

Fiscal credibility as nominal anchor: the Brazilian experience

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Abstract

This study investigates how the fiscal credibility affects the inflation rate in an emerging economy under inflation target. Based on the Brazilian experience, a fiscal credibility index is built taking into account how the market expectations are anchored to the primary surplus target. The main idea is that a government that is able to anchor expectations around the target (case of high credibility) may reduce inflation. The findings provide empirical evidence that the success of government in achieving the fiscal primary surplus target (gain of credibility) is an important ally to reduce inflation rate and its expectations.

Key words: fiscal credibility, inflation, primary surplus, inflation targeting.

Resumo

Este estudo investiga como a credibilidade fiscal afeta a taxa de inflação em uma economia emergente sob o regime de metas de inflação. Com base na experiência brasileira, um índice de credibilidade fiscal é construído levando-se em conta como as expectativas de mercado são ancoradas à meta de superávit primário. A ideia principal é a de que um governo capaz de ancorar as expectativas em torno da meta (caso de alta credibilidade) pode reduzir a inflação. Os resultados evidenciam que o sucesso do governo em produzir a meta de superávit primário (ganho de credibilidade) é um importante aliado para reduzir tanto a taxa quanto as expectativas de inflação.

Palavras-chave: credibilidade fiscal, inflação, superávit primário, meta de inflação.

JEL classification: E31, E62, E63.

ANPEC: Área 5 – Economia do Setor Público

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1. Introduction

A sound fiscal position is essential to any economy. Since the 1990s the growing concern with inflation has brought several countries to adopt inflation targeting. There exist several studies which indicate that the use of this monetary framework represents a success in the control of inflation (e.g. Lin and Ye, 2009; and de Mendonça and de Guimarães e Souza, 2012). However, one of the preconditions to the success of inflation targeting is the fiscal balance. It is well-known that in the case where the government is not committed to fiscal balance, the result is a pressure on inflation due to the risk of expansionary monetary policy and to finance public debts. In brief, there exists a relationship between government fiscal commitment and inflation.

An important issue in the analysis regarding inflation targeting is credibility because it plays an essential role in the commitment of reaching low and stable inflation. Although a great part of the literature pays attention only to the credibility of the monetary authority, this is only one side of the coin. Following the literature that builds on Sargent e Wallace (1981), unsustainable fiscal policy may lead the monetary authority to monetize fiscal deficits and thus wreck credibility. Based on a different view, scholars from fiscal theory of price level (e.g. Woodford, 2001; and Sims, 1994) argue that the control of money supply is not a sufficient condition to stabilize inflation. In brief, the government solvency is essential to monetary policy being able to control inflation.

This study investigates how the fiscal credibility affects the inflation rate in an emerging economy under inflation target. The analysis on the Brazilian case after adoption of inflation targeting is useful, as with Chile and Poland, this country announces the inflation target jointly by the government and central bank in order to make the government commit to the fiscal discipline needed to achieve the target. Moreover, Brazil has had explicit fiscal primary surplus targets since 2000, and expectations of variables (e.g. inflation rate and primary surplus) are available from the Time Series Management System - Central Bank of Brazil (TSMS/CBB). The main idea is that a government that is able to anchor expectations around the target (case of high credibility) may reduce inflation. The results in this study provide empirical evidence that the success of government in achieving the fiscal primary surplus target (gain of credibility) contributes to the reduction of inflation.

Few studies analyze the impact of fiscal credibility on inflation rate in emerging economies. For an analysis of the pass-through on inflation for the Brazilian economy, de Mendonça and Tostes (2015), taking into account the fiscal credibility index built by de

Mendonça and Machado (2013), found that fiscal credibility is an important tool for reducing inflation. Kuncoro (2015) in an analysis regarding Indonesia concluded that fiscal credibility is important for price stabilization in the inflation targeting framework.

This study differs from these above-mentioned in several dimensions. It is important to highlight that the indicator of fiscal credibility in de Mendonça and Machado (2013) is based on the deviations of the market expectations on public debt-to-GDP in relation to the prudential benchmark suggested by International Monetary Fund. Moreover, the index used by Kuncoro (2015) quantifies the fiscal rules credibility measure using the deviation of actual budget from the projected one. In a different manner, the fiscal credibility index in this study takes into account how the market expectations are anchored to the primary surplus target. Therefore, we consider a true fiscal commitment announced previously by the government. This procedure is in agreement with the well-known definition of credibility made by Cukierman and Meltzer (1986), which can be understood as the difference between the policymaker's plans and the public's beliefs about those plans. Furthermore, we provide empirical evidence regarding the effect of fiscal credibility on inflation rate, inflation of market prices, inflation of administered prices, and inflation expectations, based on the structural model adopted by Central Bank of Brazil (CBB) through Ordinary Least Squares (OLS) and Generalized Method of Moments (GMM) regressions. Furthermore, a vector autoregression model (VAR) is also performed for the period January 2003 to December 2015.

The remainder of this study is organized as follows: Section 2 makes a presentation of the measurement of the fiscal credibility in Brazil for the period from 2003 to 2015. Section 3 presents the data and methodology used in this study. Section 4 provides empirical evidence, through an econometric analysis, of the effect of the fiscal credibility on inflation. Section 5 concludes the paper.

2. Measuring fiscal credibility in Brazil

It is a challenge to summarize the government's ability in guiding the expectation process of the economic agents through only one measurement (fiscal credibility index). It involves multiple dimensions such as: the intertemporal nature of fiscal sustainability; the empirical limits for the public debt-to-GDP growth ratio; the risk perception about possible fiscal dominance scenarios; the institutional setting and accountability of fiscal policy; and the effects of political and electoral cycles on fiscal authorities. In this context, we build an index

which starts from two criteria: (i) because the index under construction is a limited variable, instead of using variables like debt-to-GDP ratio (see, de Mendonça and Machado, 2013), which usually follow a non-stationary stochastic process, stationary fiscal flow measurement is used; and (ii) the use of a reference for exogenous expectation guidance based on a very well defined lower bound for the fiscal flow variable which is publicly preannounced for the next year.

The one-step-ahead expectations of fiscal primary surplus are the natural candidate for being the main information for a fiscal credibility index because the fiscal primary surplus is the adjustment component in the nominal deficit that could ensure the fulfillment of the intertemporal budget restriction. In addition, the expectations of fiscal primary surplus are measured as a ratio-to-GDP (usually a stationary process) and represent the median of financial market institutions expectations for the next year for the fiscal primary surplus. This information is extracted from a daily survey of market expectations conducted by Central Bank of Brazil (CBB) for the evolution of the main Brazilian macroeconomic variables (Focus Market Readout).

It is important to highlight that since the promulgation of the Fiscal Responsibility Law in 2000 the government has to define annual goals for fiscal variables for execution in current year and the next two years, publicly announced as an Annex of Budget Guidelines Law (Lei de Diretrizes Orçamentárias – LDO) by September of the previous year. In other words, this information represents a benchmark for macroeconomic forecasts, and thus, the goals for fiscal primary surplus (FPS^*) are the essence of the fiscal credibility index in order to evaluate the performance and ability of the government to anchor expectations. Table 1 shows these goals and their respective laws.²

It is a fact that expectations deteriorate faster as the fiscal primary surplus is lower than the target. Hence, the use of different intervals creates an asymmetrical framework which is useful in the measurement of credibility. In this context, two intervals are considered in the index: (i) an ideal interval which corresponds to a very good performance of the government regarding the primary surplus in reaching the target, that is, $[FPS_{min}^{ideal}, FPS_{max}^{ideal}] = [FPS^* - 0.05, FPS^* + 0.1]$; and (ii) a tolerance interval which represents an acceptable performance given by $[FPS_{min}^{tolerance}, FPS_{max}^{tolerance}] = [FPS^* - 0.15, FPS^* + 0.3]$. Taking into consideration the idea above, a fiscal credibility index is elaborated ($FCRED$), which assumes

² Some fiscal surplus goals were revised within the current year. Those revisions were not considered because they do not affect the expectations formed during the previous year.

a loss in credibility when the average of the market expectations on fiscal primary surplus ($E(FPS)$), indicates the expectation that the government is not capable of bringing the fiscal primary surplus to the ideal interval or to the tolerance interval around the target.

Table 1
Legal framework for fiscal primary surplus (2000-2015)

Year	Legal framework	Goal
2000	LDO 2000 – Law N. 9,811	3.40
2001	LDO 2001 – Law N. 9,995	3.35
2002	LDO 2002 – Law N. 10,226	3.88
2003	LDO 2003 – Law N. 10,524	3.75
2004	LDO 2004 – Law N. 10,707	4.50
2005	LDO 2005 – Law N. 10,934	4.25
2006	LDO 2006 – Law N. 11,178	4.25
2007	LDO 2007 – Law N. 11,439	4.25
2008	LDO 2008 – Law N. 11,514	3.80
2009	LDO 2009 – Law N. 11,768	3.80
2010	LDO 2010 – Law N. 12,017	3.30
2011	LDO 2011 – Law N. 12,309	3.10
2012	LDO 2012 – Law N. 12,465	3.10
2013	LDO 2013 – Law N. 12,708	3.10
2014	LDO 2014 – Law N. 12,919	3.10
2015	LDO 2015 – Law N. 13,080	1.20

Source: Brazilian Parliament
(<http://www2.camara.leg.br/atividade-legislativa/orcamentobrasil>)

Therefore, when the expectation on fiscal primary surplus is found between the lower bound (FPS_{min}^{ideal}) and the upper bound (FPS_{max}^{ideal}) of the ideal interval, the credibility is full (assumes value 1). In contrast, fiscal credibility is null (assumes value 0) when expectation on fiscal primary surplus is out of the tolerance interval $[FPS_{min}^{tolerance}, FPS_{max}^{tolerance}]$. Furthermore, the index assumes a value between 0 and 1 when market expectations are inside the intervals $[FPS_{max}^{ideal}, FPS_{max}^{tolerance}]$ and $[FPS_{min}^{ideal}, FPS_{min}^{tolerance}]$, and decreases as expectations deviate from the ideal interval. Hence,

$$FCRED = \left(\begin{array}{ll} 1 & \text{if } FPS_{min}^{ideal} \leq E_t(FPS_{t+12}) \leq FPS_{max}^{ideal} \\ 1 - \frac{1}{FPS_{max}^{tolerance} - FPS_{max}^{ideal}} [E_t(FPS_{t+12}) - FPS_{max}^{ideal}] & \text{if } FPS_{max}^{ideal} < E_t(FPS_{t+12}) \leq FPS_{max}^{tolerance} \\ 1 - \frac{1}{FPS_{min}^{tolerance} - FPS_{min}^{ideal}} [E_t(FPS_{t+12}) - FPS_{min}^{ideal}] & \text{if } FPS_{min}^{ideal} > E_t(FPS_{t+12}) \geq FPS_{min}^{tolerance} \\ 0 & \text{if } E_t(FPS_{t+12}) < FPS_{min}^{tolerance} \text{ or } E_t(FPS_{t+12}) > FPS_{max}^{tolerance} \end{array} \right).$$

Taking into account monthly data, the behavior over time regarding goals for fiscal

primary surplus and expectations for the next year for the fiscal primary surplus which are essential for building the credibility index, is presented in figure 1.³ In general, it is possible to identify two phases. The first, before the subprime crisis (2007), inflation expectations are inside the tolerance interval and near the primary surplus target practically all the time. The second represents a deterioration of the expectations and they exceed the lower bound of the tolerance interval most of the time.

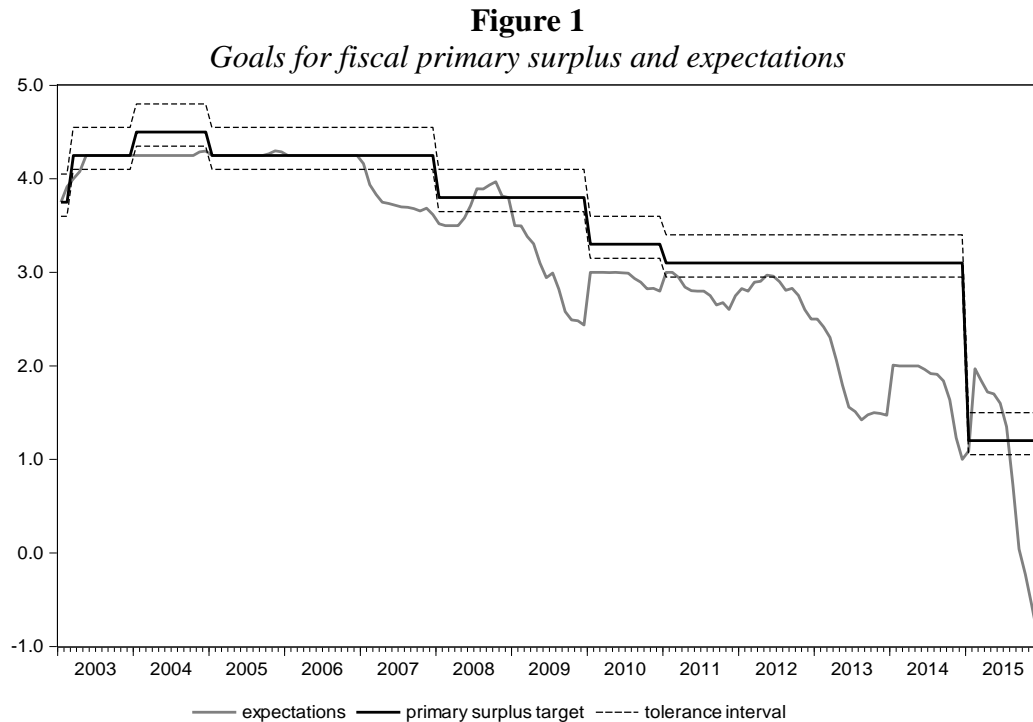
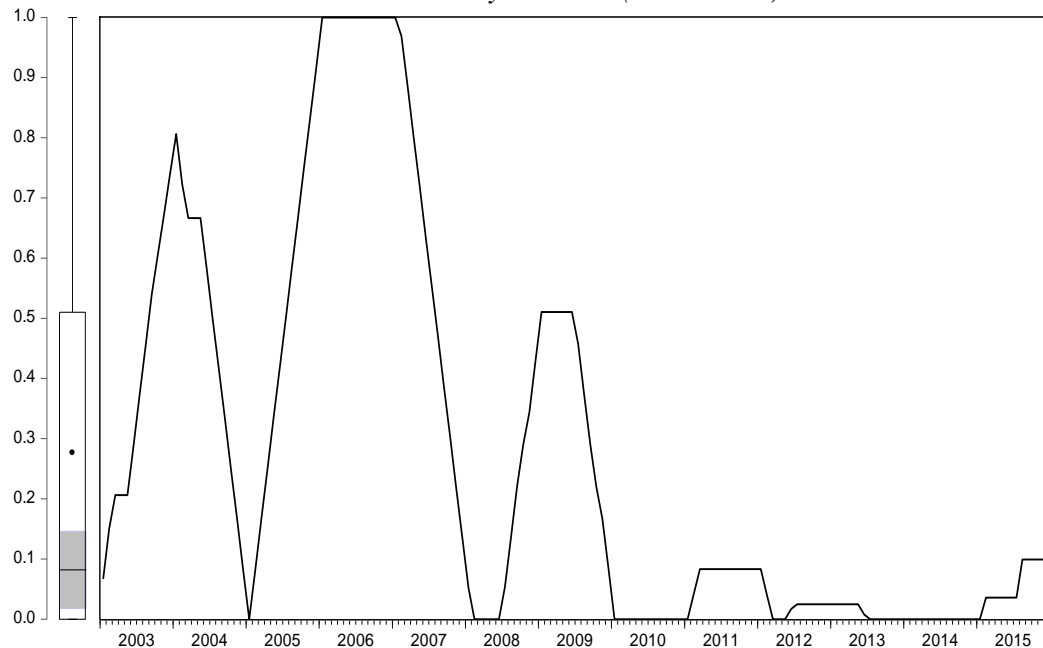


Figure 2 shows the performance of fiscal credibility from 2003 to 2015 in Brazil. A clear trend of worsening over time is observed. In large measure, the subprime crisis implied a change of the fiscal stance in the Brazilian economy. As pointed out by CBB, the intensification of the effects of the international financial crisis on the internal expectations prompted the government to adopt expansionist fiscal measures. As a consequence, “in December 2008 tax cuts were introduced which favored the credit market conditions and propitiated expansion of consumers’ available income. In this sense, noteworthy is the adjustment of the progressive income tax table to the growth of nominal wages of the economy; the reductions of IPI rates levied on the purchase of new vehicles and trucks, and of the Financial Operations Tax (IOF) levied on loans granted to individuals; the creation of two intermediate rates, of 7.5% and 22.5%, of the table of the Individual Income Tax (IRPF),

³ The start date corresponds to when all series used in this study are available from CBB.

reducing in up to 50% the tax levied on lower income bracket” (CBB, Inflation Report, March 2009, p. 51). After this period, because of the bad management of the Brazilian fiscal policy, there is a clear downturn in fiscal credibility.

Figure 2
Fiscal credibility – Brazil (2003-2015)



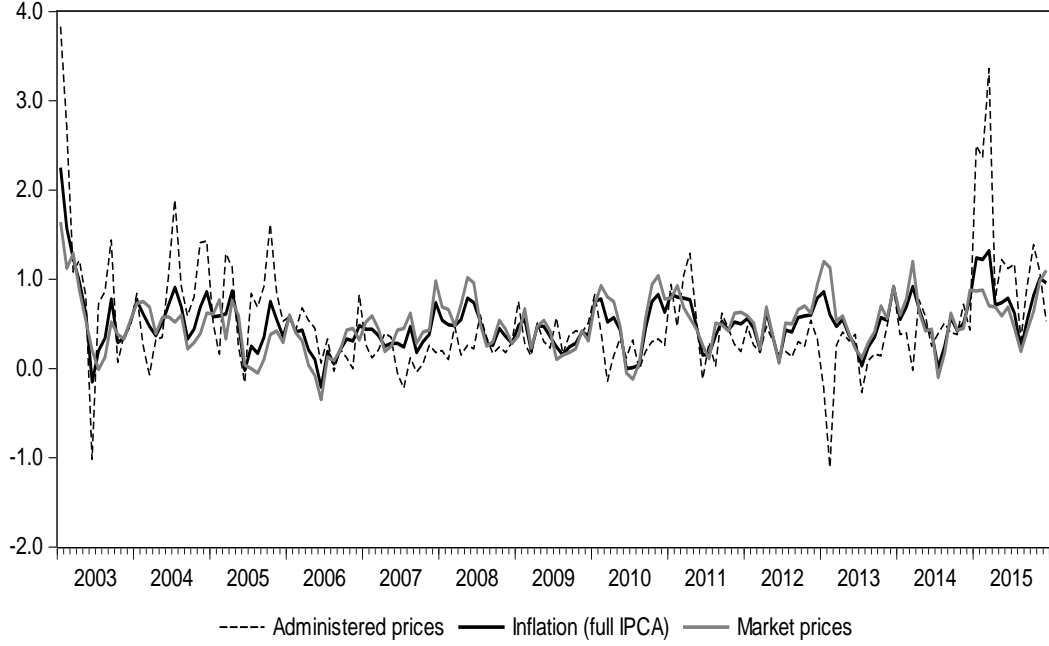
3. Data and methodology

In order to observe the possible impact of the fiscal credibility on inflation rate, the period under analysis is from January 2003 to December 2015 (156 observations – monthly frequency). This analysis starts in January 2003 because this is when the Brazilian economy eliminated the negative effects caused by the confidence crises due to the election of President Luiz Inácio Lula da Silva and when, for example, new information started being released by CBB such as Brazilian Economic Activity Index (IBC-Br).

The official price index that is used to measure inflation rate in Brazil is the National Consumer Price Index (extended) – IPCA. In general, prices are a result of market prices (prices resultant of market force) and administered prices (prices defined by contracts and prices that are monitored, depending on government authorization).⁴ Administered prices are divided into tax, public utility services, and petroleum derivatives, which in turn, are slightly sensitive to the market forces. Moreover, inflation expectations are an essential component to be analyzed under inflation targeting system.

⁴ Figure 3 presents the performance of these variables for the period 2003 to 2015.

Figure 3
Inflation (full IPCA), Market Prices, and Administered Prices (%)



With the intention of observing the relation between the fiscal credibility and inflation rate in the Brazilian economy, the first empirical procedure is straightforward. We present four scatterplots and correlations for fiscal credibility (*FCRED*) and its relation with: full inflation rate (*INF*), inflation of market prices (*INF_M*), inflation of administered prices (*INF_A*), and inflation expectations (*E(INF)*) respectively (see figure 4). With exception for the case of administered prices, there exists a negative correlation (around -0.3) to other cases, which in turn, suggests that fiscal credibility may reduce inflation rate and reinforces the causal hypothesis to be tested econometrically.

A simple manner of observing how fiscal credibility can affect inflation under inflation targeting is through a Phillips curve. Because credibility is a forward-looking concept (see de Mendonça and de Guimarães e Souza, 2009) and taking as reference the version of the Phillips curve used in the structural model adopted by CBB when inflation targeting was adopted in June of 1999 (see Bogdanski, Tombini, and Werlang, 2000), the following equation is considered:⁵

$$(2) \quad INF_t = \alpha_0 + \alpha_1 INF_{t-1} + \alpha_2 E_t(INF_{t+12}) + \alpha_3 GAP_t + \alpha_4 \Delta(WPI + EX)_t + \alpha_5 FCRED_t + \varepsilon_t,$$

where: $\varepsilon_t \sim N(0, \sigma^2)$;

INF_t - is the inflation measured by National consumer price index – extended (IPCA);

⁵ See table A.1 (appendix) for sources of data and description of the variables. Descriptive statistics are presented in table A.2 (appendix).

$E_t(INF_{t+12})$ – is the market expectations (average) on inflation accumulated over the next 12 months (measured by IPCA);

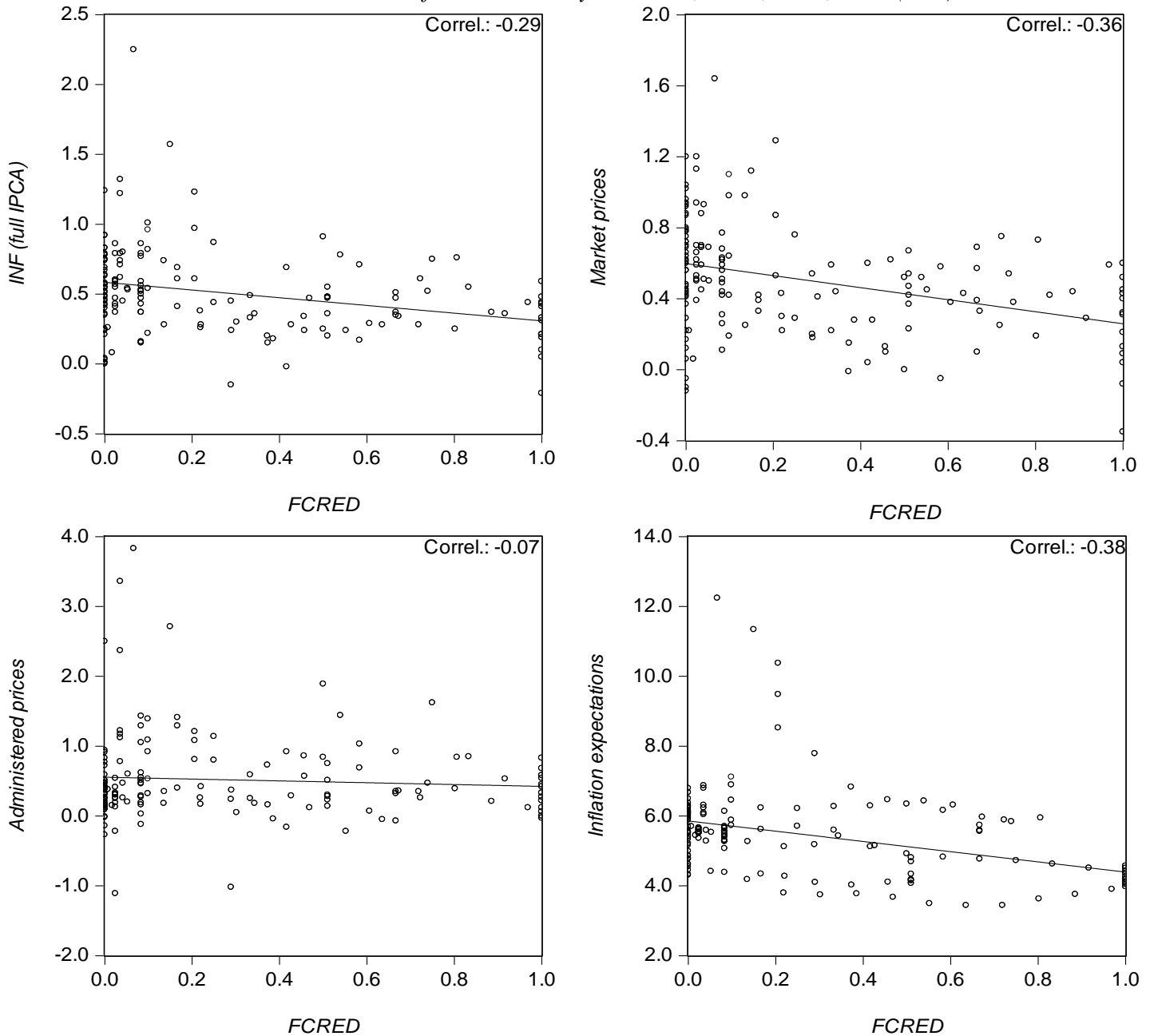
GAP – is the output gap and corresponds to the difference between Brazilian Economic Activity Index (IBC-Br) and the potential output (Hodrick-Prescott filter);

WPI – is the log of wholesale price index (USA);

EX – is the log of exchange rate - US dollar/Brazil nominal exchange rate; and

$FCRED$ – is the fiscal credibility – it is computed following the procedure presented in the previous section (see equation 1).

Figure 4
Correlations between fiscal credibility and: INF , INF_M , INF_A , and $E(INF)$



In order to see the effect of fiscal credibility on inflation of market prices, inflation of administered prices, and inflation expectations, equation (2) is rewritten in the following way:

$$(3) \quad INF_{M_t} = \alpha_6 + \alpha_7 INF_{M_{t-1}} + \alpha_8 E_t(INF_{t+12}) + \alpha_9 GAP_t + \alpha_{10} \Delta(WPI + EX)_t + \alpha_{11} FCRED_t + \varepsilon_t^0,$$

$$(4) \quad INF_{A_t} = \alpha_{12} + \alpha_{13} INF_{A_{t-1}} + \alpha_{14} E_t(INF_{t+12}) + \alpha_{15} GAP_t + \alpha_{16} \Delta(WPI + EX)_t + \alpha_{17} FCRED_t + \varepsilon_t^1,$$

$$(5) \quad E_t(INF_{t+12}) = \alpha_{18} + \alpha_{19} INF_{t-1} + \alpha_{20} GAP_t + \alpha_{21} \Delta(WPI + EX)_t + \alpha_{22} FCRED_t + \varepsilon_t^2,$$

where:

INF_{M_t} - is the inflation measured by IPCA - non monitored prices; and INF_{A_t} - is the inflation measured by IPCA - supervised prices – total.

In this framework, the impact of the variable $FCRED$ on inflation rate is straightforward. From the theoretical view it is expected that the results indicate a negative and significant coefficient on $FCRED$ ($\alpha_5, \alpha_{11}, \alpha_{17}, \alpha_{22} < 0$). The negative impact of the credibility on inflation is in consonance with the view that a greater commitment with the fiscal goals increases the power of the central bank to achieve the target and thus to anchor inflation expectations.

In general, the use of time series data in estimations needs to analyze whether the series in the model have a unit root (non-stationary data series) to avoid the possibility of spurious regression. Hence, the Augmented Dickey–Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests are performed. The results indicate that all series are $I(0)$ (see table A.3 – appendix).⁶

In order to estimate the equations (2), (3), (4), and (5), this study uses two methods: Ordinary Least Squares (OLS) and Generalized Method of Moments (GMM). These methods are useful to observe the impact caused by the fiscal credibility on inflation rate (and its variations) through a direct observation of the estimated parameters.

In general, macroeconomic time series models are subject to the problem of endogeneity. Moreover, the fact that the series have monthly frequency may still have issues of heteroscedasticity in the regressions. Hence, OLS method cannot performs well under these issues. Therefore, in order to deal with these problems the GMM is used. A condition for efficient estimation based on GMM is that overriding restrictions need to be respected (Woodridge, 2001). In this context, all regressions present the J-statistic as a test for over-

⁶ The main criticisms of those tests are their lack of power (low probability of rejection when the null is false), as our general results were rejection over non-stationarity we considered unnecessary to perform other tests. Moreover, our fiscal credibility index is not tested for nonstationarity because it is a limited variable by construction.

identifying restrictions in the models. Furthermore, as usual, the instrument variables in the GMM regressions are the lagged regressors.⁷

In order to observe the relevance of the credibility effect on inflation (full IPCA), inflation of market prices, inflation of administered prices, and inflation expectations over time, this study besides the OLS and GMM models provides empirical evidence through Vector Autoregressive (VAR) models.⁸ In general, the analysis of VAR is made through impulse response functions because it allows one to see the impulse of fiscal credibility on inflation rate and inflation expectations caused by shocks (or innovations) provoked by residual variables over time. As suggested by Koop, Pesaran, and Potter (1996) and Pesaran and Shin (1998), this study makes use of the generalized impulse response function (impulse responses are invariant to any re-ordering of the variables in the VAR) because it provides more robust results than the orthogonalized method.

4. Empirical evidence

This section presents some empirical evidence on the impact of the fiscal credibility on inflation (full IPCA), inflation of market prices, inflation of administered prices, and inflation expectations in the Brazilian economy. The analysis is divided into three steps. In the first step we present OLS estimations. The second step presents GMM estimations. Finally, in the third step, we observe the response of the inflation rate and its variations to a shock transmitted by the fiscal credibility through impulse-response analysis.

The coefficients for the OLS estimations are in consonance with the theoretical perspective (see table 2). The negative and significant coefficients on fiscal credibility observed for the regressions on inflation (full IPCA), inflation of market prices, and inflation expectations are in line with the first impression from the correlation observed in figure 5. This observation is a clear indication that the government commitment with the fiscal primary surplus target (high credibility) is an important mechanism to reduce inflation rate. This result comes as no surprise because one of the main pillars for the success of inflation targeting is the sustained fiscal balance. In this context, a breach of the Brazilian government with the fiscal surplus (low credibility) target denotes a lack of the commitment to ensure an

⁷ In order to eliminate skewing the results, the maximum of lags applied for each instrument was 9. In addition, the number of instruments in all models is less than 14% in relation to the total of observations) – the instruments are listed in the appendix (see table A.4).

⁸ Based on Schwarz (SIC), Akaike (AIC), and Hannan-Quinn (HQ) criteria, the VAR order is 2 (see table A.5). Furthermore, VARs satisfy the stability condition (see figure A.1 – appendix).

environment that supports the reaching of the inflation target. The non-significance for fiscal credibility in the explanation of inflation of administered prices can be a consequence that prices are defined by contracts and thus are less subject to the success of the government in the achievement of the targets.

Besides the coefficients on fiscal credibility, the coefficients on the other variables for the explanation of the dependent variables shown in table 2 are in line with the theoretical view. The positive and significant coefficient on inflation expectations in most models is coherent with the argument that the forward-looking behavior of economic agents is crucial for the success of inflation targeting. The negative and significant coefficient on the output gap in most models regarding inflation (INF , INF_M , and INF_A) reflects the fact that Brazil has experienced a low and negative growth rate in a large part of the period under analysis. Although the coefficient on the variable that captures the effect on the external shocks transmitted to inflation is positive in most of models, the non-significance is a result that the exchange rate was overvalued most of the time.

Table 2				
<i>OLS estimates of the effect of fiscal credibility on INF, INF_M, INF_A, and $E(INF)$</i>				
Regressors	OLS (HAC)			
	Equation (2)	Equation (3)	Equation (4)	Equation (5)
Const.	0.051 (0.108)	0.166* (0.100)	-0.397** (0.202)	4.563*** (0.353)
INF_{t-1}	0.496*** (0.053)			2.096*** (0.632)
INF_{Mt-1}		0.531*** (0.049)		
INF_{At-1}			0.387*** (0.066)	
$E_t(INF_{t+12})$	0.040* (0.022)	0.020 (0.019)	0.120*** (0.039)	
GAP_t	-0.009*** (0.003)	-0.012*** (0.003)	-0.001 (0.010)	0.020 (0.020)
$\Delta(WPI+EX)_t$	0.337 (0.476)	-0.233 (0.492)	2.159 (1.481)	0.950 (2.774)
$FCRED_t$	-0.084* (0.049)	-0.150** (0.060)	0.142 (0.099)	-0.780** (0.331)
Adj. R ²	0.509	0.470	0.344	0.430
F-statistic	32.896	28.348	17.185	29.998
Prob(F-statistic)	0.000	0.000	0.000	0.000

Note: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denotes 0.10. Robust standard errors (Newey-West) are in parentheses.

The coefficients for the GMM estimations (see table 3) do not present significant changes in terms of sign and statistical significance when they are compared with those in the OLS estimations (see table 1). Therefore, the results are in line with the assumption that the fiscal credibility is an important element to decrease inflation rate and its expectations.

Table 3
GMM estimates of the effect of fiscal credibility on INF , INF_M , INF_A , and $E(INF)$

Regressors	GMM (HAC)			
	Equation (2)	Equation (3)	Equation (4)	Equation (5)
Const.	0.022 (0.100)	0.092 (0.132)	-0.482** (0.219)	5.283*** (0.228)
INF_{t-1}	0.520*** (0.069)			0.746** (0.333)
INF_{Mt-1}		0.515*** (0.064)		
INF_{At-1}			0.461*** (0.092)	
$E_t(INF_{t+12})$	0.045** (0.018)	0.038* (0.020)	0.132*** (0.044)	
GAP_t	-0.014** (0.006)	-0.015** (0.006)	-0.012 (0.013)	0.002 (0.035)
$\Delta(WPI+EX)_t$	0.213 (1.004)	-1.839 (0.974)	2.015 (2.458)	7.784** (3.144)
$FCRED_t$	-0.088* (0.049)	-0.131** (0.066)	0.138 (0.090)	-1.074*** (0.322)
Adj. R ²	0.464	0.424	0.349	0.281
J-statistic	17.607	19.348	9.406	11.779
Prob(J-statistic)	0.284	0.251	0.896	0.380
Instrum. rank	21	22	22	16

Note: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denotes 0.10.
Robust standard errors (Newey-West) are in parentheses.

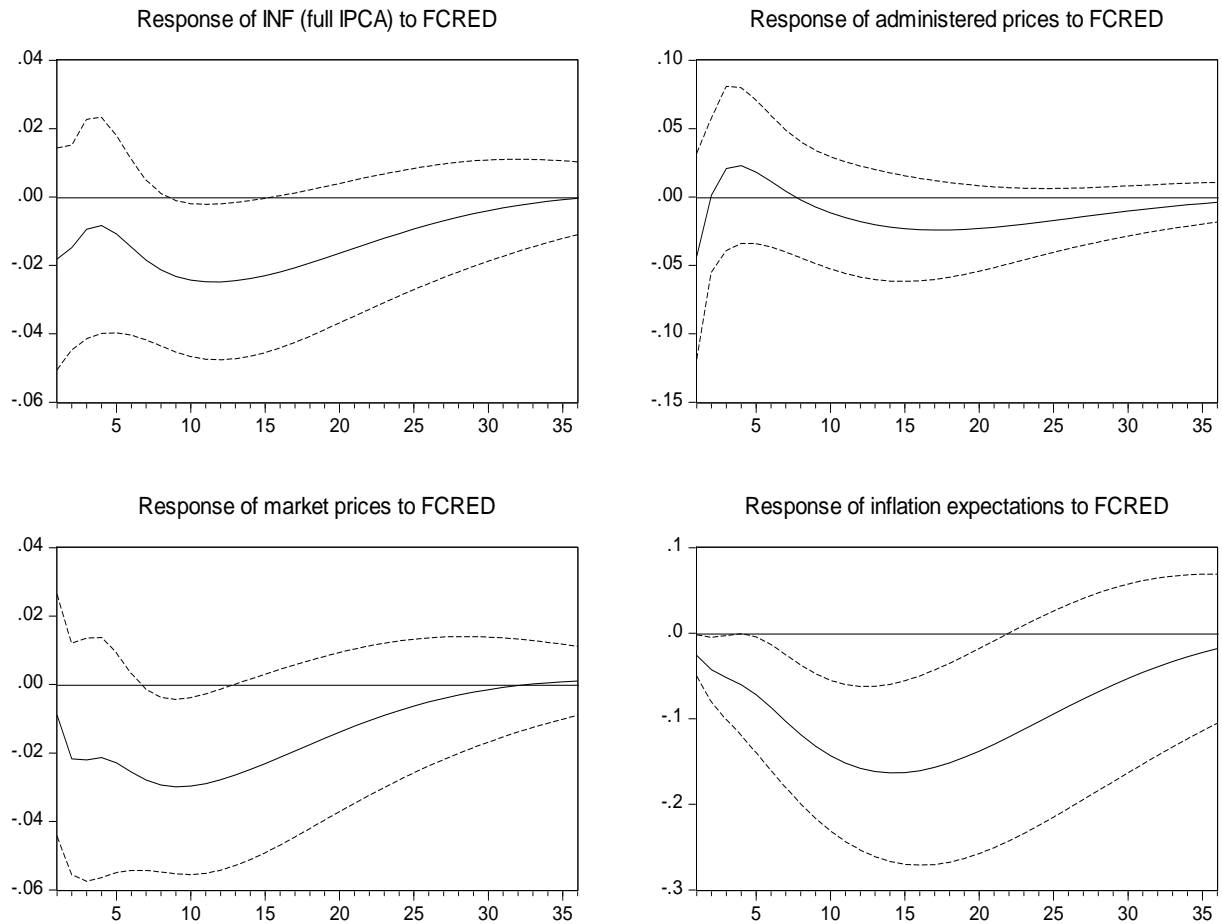
Extending the analysis regarding the impact of the fiscal credibility on inflation rate, inflation of market prices, inflation of administered prices, and inflation expectations, the previous results from OLS and GMM models are confirmed through the generalized impulse-response functions plotted out to the 36th month. Figure 5 suggests that an unexpected positive shock on fiscal credibility provokes a significant decrease in inflation rate, inflation of market prices, and inflation expectations. We can see that the negative effect on inflation due to a shock transmitted through fiscal credibility takes around 9 months to become significant and remains significant for about 6 months. A similar effect is valid for the case of

inflation of market prices. An unexpected positive shock on fiscal credibility provokes a significant decrease in inflation of market prices after 6 months and abides significant for 6 more months. In the same vein, a shock transmitted by fiscal credibility also provokes a negative impact on inflation expectations. However, the statistical significance of this effect is considerably greater than that observed for the previous cases. Finally, such as presented in the OLS and GMM estimations, the effect of fiscal credibility on inflation of administered prices is not observed.

Figure 5

Response of INF , INF_M , INF_A , and $E(INF)$ to generalized one s.d. $FCRED$ innovation

Response to Generalized One S.D. Innovations ± 2 S.E.



5. Conclusion

This study presented empirical evidence regarding the effect of fiscal credibility on inflation rate, inflation of market prices, inflation of administered prices, and inflation

expectations, in the Brazilian economy after the adoption of inflation targeting. One important contribution in this study was the elaboration of a fiscal credibility index based on how the market expectations are anchored to the primary surplus target. The findings suggest that the success of government in achieving the fiscal primary surplus target (gain of credibility) is an important ally to reduce inflation rate and its expectations.

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Appendix

Table A.1
Sources of data and description of the variables

Variable name	Variable description	Data source
<i>FPS*</i>	Primary surplus target - annual goals for fiscal primary surplus	LDO
<i>E(FPS)</i>	Primary surplus expectations - Market expectations on fiscal primary surplus	CBB – MES
<i>FPS^{tolerance}</i>	Tolerance interval - acceptable range for fiscal primary surplus.	Devised by authors
<i>FPS^{ideal}</i>	Ideal interval - ideal range for fiscal primary surplus.	Devised by authors
<i>INF</i>	Inflation - National consumer price index (IPCA) - in 12 months	CBB – TSMS (code 13,522)
<i>E(INF)</i>	Inflation expectations - Market expectations inflation accumulated over the next 12 months (IPCA – official price index)	CBB – MES
<i>INF_M</i>	Broad national consumer price index (IPCA) - non monitored prices	CBB – TSMS (code 11,428)
<i>INF_A</i>	Broad national consumer price index (IPCA) - Supervised prices – Total	CBB – TSMS (code 4,449)
<i>GAP</i>	Output gap - difference between Economic Activity Index (IBC-Br) and the potential output (Hodrick-Prescott filter)	CBB – TSMS (code 17,439)
<i>WPI</i>	Wholesale price index (2005=100) - United States	CBB – TSMS (code 3808)
<i>EX</i>	Exchange rate - Free - United States dollar (purchase) - period average	CBB – TSMS (code 3697)
<i>FCRED</i>	Fiscal credibility index	Devised by authors, based on equation 1

Note: CBB - Central Bank of Brazil; TSMS - Time Series Management System; MES – Market Expectation System; and LDO - Budget Guidelines Law (Lei de Diretrizes Orçamentárias).

Table A.2
Descriptive statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.
<i>INF</i>	0.508	0.480	2.250	-0.210	0.315
<i>E(INF)</i>	5.452	5.508	12.237	3.437	1.282
<i>INF_M</i>	0.504	0.500	1.640	-0.350	0.310
<i>INF_A</i>	0.519	0.375	3.830	-1.110	0.624
<i>GAP</i>	-9.75E-13	0.418	10.024	-13.502	4.246
$\Delta(WPI+EX)$	0.003	0.000	0.134	0.035	0.584
<i>FCRED</i>	0.276	0.083	1.000	0.000	0.332

Table A.3
Unit root tests (ADF, PP, and KPSS)

Series	ADF				PP				KPSS			
	Lags	I/T	Test	C.V. (5%)	Band	I/T	Test	C.V. (5%)	Band	I/T	Test	C.V. (10%)
<i>INF</i>	0	I	-7.14	-2.88	2	I	-7.20	-2.88	6	I	0.25	0.35
<i>E(INF)</i>	2	I+T	-4.87	-3.44	6	I+T	-6.56	-3.43	9	I	0.32	0.35
<i>INF_M</i>	0	I	-6.18	-2.88	6	I	-6.08	-2.88	5	I	0.27	0.35
<i>INF_A</i>	0	I	-8.15	-2.88	5	I	-8.16	-2.88	7	I	0.28	0.35
<i>GAP</i>	13	I	-4.25	-1.94	2		-7.92	-1.94	5	I	0.03	0.35
$\Delta(WPI+EX)$	0		-9.69	-1.94	6		-9.65	-1.94	7	I+T	0.04	0.12

Note: C.V. = critical value. Trend (T) and intercept (I) are included based on Schwarz criterion. ADF – the final choice of lag was made based on Schwarz criterion. PP and KPSS – spectral estimation method is Bartlett kernel and the Newey West Bandwidth is used.

Table A.4
List of GMM instruments

Equation (2)	<i>INF</i> (-2 to -6) <i>E(INF)</i> (-1 to -6) <i>GAP</i> (-1 to -2) $\Delta(WPI+EX)$ (-1) <i>FCRED</i> (-1 to -6)
Equation (3)	<i>INF_M</i> (-2 to -6) <i>E(INF)</i> (-1 to -7) <i>GAP</i> (-1 to -2) $\Delta(WPI+EX)$ (-1) <i>FCRED</i> (-1 to -6)
Equation (4)	<i>INF_A</i> (-2 to -3) <i>E(INF)</i> (-1 to -9) <i>GAP</i> (-1 to -3) $\Delta(WPI+EX)$ (-1) <i>FCRED</i> (-1 to -6)
Equation (5)	<i>INF</i> (-2 to -3) <i>GAP</i> (-1) $\Delta(WPI+EX)$ (-1 to -6) <i>FCRED</i> (-1 to -6)

Table A.5
AIC, SIC, and HQ criteria for VAR

Order	AIC	SIC	HQ
0	0.696	0.838	0.754
1	-7.085	-5.951	-6.625
2	-8.147*	-6.020*	-7.283*
3	-7.922	-4.803	-6.655
4	-7.810	-3.699	-6.140
5	-7.670	-2.566	-5.596
6	-7.694	-1.598	-5.217
7	-7.650	-0.562	-4.770
8	-7.562	0.518	-4.279

Note: (*) denotes lag order selected by the criterion.

