



THE EFFECTIVENESS OF MONETARY POLICY IN THE CONTEXT OF CENTRAL BANK INDEPENDENCE IN DEVELOPING COUNTRIES CASE OF MOROCCO

SAIKAK Moulay-driss: PhD in economics.

RAOUF Radouane: Research Professor at the Mohammed V University in Rabat

Abstract: *The objective of independent central banks is to ensure price stability to achieve macroeconomic stability, because controlling inflation depends on the effect of monetary policy on activity. So central banks have two mandates. They act on the interest rate based on the economic situation. To ensure price stability, most developed and developing countries have made their central banks independent and transparent. Independence strengthens the credibility of monetary authorities and makes monetary policy in this context more effective. To verify the effectiveness of monetary policy within the framework of the independence of the central bank, we mobilized a SVAR model for the Moroccan case. The study covers two separate periods on a quarterly basis (1994 to 2005 and 2006 to 2020) to take account of the effective implementation of independence. The results imply an efficient transmission of monetary policy, and we conclude that the framework of independence is a good solution to conduct monetary policy for BAM.*

Key words: *Monetary policy efficiency, central bank independence, central bank transparency, SVAR*



Introduction

The Moroccan central bank is already more than a century old, but it was declared independent only fifteen years ago, in 2006. This independence was achieved with the advent of the new statutes of Bank Al-Maghrib (BAM) under Law No. 76-03, which defines the fundamental tasks and prerogatives of its governance bodies. Indeed, this reform has just affirmed Morocco's commitments undertaken since the 1990s, in political and economic matters under the aegis of the International Financial Institutions.

From the end of the 1990s, the institutional framework of economic policy sought to establish clear objectives that could be interpreted by public actors. The Moroccan Central Bank "Bank Al-Maghrib" joined this movement and stated an absolute objective which is price stability and thus the fight against inflation. Indeed, the reference framework of the monetary authority is the conclusions of Friedman (1968), who advocates anti-inflationary policies by controlling the money supply under the quantitative theory of money.

The institutionalization of the independence of the monetary authority from the government strengthens both the fight against inflation and its credibility. A guarantee of credibility, independence has as its corollary transparency and accountability, the requirement of communication, transparency of decisions and results. It should be noted that the statutes do not exclude consultation with the political decision-maker to avoid any differences between the two political instruments, monetary policy and fiscal policy.

The action taken by the issuing institution highlights the existence of an inflationary bias. Kydland and Prescott (1977) show that a discretionary policy leads to the problem of temporal inconsistency. Barro and Gordon (1983) applied the conclusions of the two economists on monetary policy by considering it as a repetitive game between the government (Principal) and the economic agents (Agent), and thus the rule against discretion. Discretionary policies that try to surprise economic agents give way to rules policies because of the problem of temporal inconsistency, that is, policies that will not be consistent over time, and therefore the credibility of the monetary authority is called into question. The asset of a central bank is the establishment and maintenance of its credibility.

To overcome the problem of temporal inconsistency, the literature proposes, at least, three solutions. The first was announced by Kydland and Prescott (1977) who favored rule policy over discretionary policy in so far as the central bank cannot deviate from the stated objective. Then, and to establish his reputation, Barro and Gordon (1983) advocated entrusting monetary policy to a conservative banker. Indeed, if economic agents know with certainty the intentions of the monetary authority and the economic model, they will be able to anticipate the future variables, and will not be surprised and will have the time to properly adjust their price. Kydland and Prescott (1977) argued that once expectations are formed based on zero inflation, the government tries to surprise agents by increasing inflation to reduce unemployment. When public decision-makers announce monetary rules, there is a temptation to "cheat" each period



to take advantage of inflation shocks. However, this situation threatens the viability of the balance of rules and tends to shift the economy to a lower balance under discretionary power (Barro & Gordon, 1983). Due to repeated interactions between the decision-maker and private agents, it is possible that reputational forces may support the rule. In other words, the potential loss of reputation - or credibility - motivates the political decision-maker to abide by the rule.

The third solution is to delegate monetary policy to a conservative banker, who is more prone to inflation than the government. The aim is to achieve a balance of non-cooperative play between monetary authority and private agents. In other words, this game is about solving the problem of the central bank's credibility. Consequently, Rogoff (1985) proposed appointing a head of the monetary institution who would be more prone to rising prices than his fellow citizens. The latter's appointment will be preferable to the adoption of a rigid rule policy. While this reduces inflationary bias, it does not minimize social loss because the models incorporate a compromise between inflation prevention and stabilization policy. Walsh (1995a) considers the delegation of monetary policy as a principal agent problem and proposes a central banker's contract to eliminate inflationary bias. Having a contract that imposes a penalty for higher inflation forces the central banker to voluntarily choose shares that eliminate inflationary bias, while preserving discretion.

According to the new statutes of BAM, the ultimate objective of the Moroccan monetary authority is price stability, while the government seeks to achieve other objectives such as full employment and economic growth. The focus is on assessing the effectiveness of the monetary policy implemented by Bank Al-Maghrib in the context of its independence. In other words, within the framework of the monetary policy conducted from 2006 to 2020, the effectiveness of the transmission of monetary policy in terms of price stability and output is examined.

This problematic leads to the following questions:

- o Is BAM an independent central bank?
- o Is an independent monetary policy more effective?

To assess the effectiveness of monetary policy in Morocco, we will evaluate the transmission channels of monetary policy. The literature proposes a variety of econometric methods. SVAR models and DSGE models are the most used.

In our work, we choose a structural modelling and use a structural VAR approach with six endogenous variables, the industrial production index, the consumer price index, the money supply, the credits to the economy, the real effective exchange rate and the short rate, to analyse the monetary policy. The modelling is done in two periods to capture the effective establishment of BAM's independence. These periods, which are spread out between 1994 and 2005 and from 2006 to 2020, are at quarterly intervals.

The choice of structural VAR modelling has several advantages. Firstly, it is recognized by its simplicity compared to other macro econometric models. Indeed, it involves estimating a low-dimensional system. Moreover, it requires few constraints. Indeed, the resulting simulations are



based on a limited number of economic assumptions. Finally, it allows the simulation of structural shocks.

This article is organized in two parts. The first part is devoted to the evaluation of the degree of independence of BAM and the second is an attempt to model the effectiveness of monetary policy in Morocco.

1. Evaluating the degree of independence of BAM

Like all other countries, Morocco has been endowed with an organization whose mission is to conduct monetary policy. It was in 1906, and exactly on 7 April of the same year, that the monetary institution came into being under the name of "the State Bank of Morocco". This international bank of issue was created by the Algeciras Act of 1906 in the context of the imperialist rivalries of our first globalization. The speech made by King Mohammed V on 2 July 1959 marks the creation of a monetary authority: "The sovereignty of any nation is manifested by attributes, notably freedom of action in the conduct of financial and monetary policy and the orientation of its economy in accordance with its interests, and by the possession of a national currency issued by a national bank and not a satellite currency issued by a foreign institute. [...] Our country is thus endowed with a national institution run by nationals". On 30 June 1959, Morocco set up its own central bank called the Bank of Morocco to replace the State Bank of Morocco, and it was not until 1987, 3 March, that Morocco adopted the name "Bank Al-Maghrib". On 17 October 1959, the dirham was instituted as the new monetary unit of Morocco, replacing the Moroccan franc introduced in 1921.

Following the collapse of the international economic system in the 1970s, structural adjustment programs were imposed during the 1980s, forcing all national economies to transform themselves to adjust to the new state of the world economy.

To strengthen financial stability and modernize the banking system to accompany the integration of the Moroccan economy in the international environment, BAM was given a new status which was the subject of law n° 76-03 which came into force on 20 February 2006. Through this new statute, the fundamental missions of BAM have been redefined and expanded.

After giving a brief overview of the creation of BAM, we will assess its degree of independence by referring to the Cukierman, Webb and Neyapti index.

1.1. Legal measure of BAM's independence

The 2006 reform of BAM's statutes gives it more independence in the conduct of monetary policy from a legal perspective. Indeed, referring to BAM's 1993 statutes, CWN constructed their index and found a legal index score of 0.14, while following the 2006 statutes, an index of 0.757 was found, moving away from 0 and towards 1.

There are two problems with indicators based solely on the law. First, the statutes are incomplete in that they cannot explicitly specify the limits of authority between the central bank and the political authorities under all contingencies. These gaps are filled by tradition at best and by power politics at worst. Second, even when the law is very explicit, actual practice may



deviate from it. These findings lead us to assess the degree of independence of BAM by reference to the actual conduct of monetary policy.

The assessment of the actual conduct of monetary policy is made using the turnover rate of the central bank governor and the governor's policy vulnerability index.

1.1. Real measure of BAM's independence

1.1.1. Governor's turnover rate

The two measures of the true conduct of the central bank used by Cukierman (1992) are the turnover rate of the governor and his political vulnerability.

For the case of Morocco, BAM's statutes stipulate that the governor of the central bank is appointed for 6 years, so the average turnover rate of the governor is 0.16 (one change per 6 years).

The turnover rate of the Governor of the Central Bank of Morocco is 0.13, i.e., one change every seven and a half years. This suggests that the tenure of the governor of the central bank in his position presents a clear volatility. Indeed, Driss SLAOUI and M'Hamed Zghari did not finish their mandates (they remained in their posts for 4 years and 3 years respectively).

It should be noted that the turnover rate for the last Governor Mr Abdellatif JOUAHRI is not included in the calculations as he is still in his post.

Table 1: Turnover rate of the BAM Governor

Governor	Turnover rate of the BAM Governor	
M.M'hamed Zghari 1959-1964	0,16	
M. Driss SLAOUI 1964-1967	0,25	
M.M'hamed Zghari 1967-1969	0,33	
Son Altesse le prince Moulay Hassan BEN EL MEHDI 1969-1974	0,16	
Son Altesse le prince Moulay Hassan BEN EL MEHDI 1975-1981	0,16	number of changes / length of period :
Son Altesse le prince Moulay Hassan BEN EL MEHDI 1982-1984	0,33	6/45= 0,13
M. Ahmed BENANI 1985-1989	0,2	
M. Mohamed SEQAT 1989-1994	0,16	
M. Mohamed SEQAT 1995-2000	0,16	
M. Mohamed SEQAT 2001-2003	0,33	
M. Abdellatif JOUAHRI 2003 à nos jours	Is still a governor	

Source: Prepared by the author based on data from BAM (2019)

1.1.2. The Governor's political vulnerability

Three cases of political vulnerability of the governor of the central bank of Morocco can be distinguished (Table 8). Indeed, the appointment of Abdellah IBRAHIM on 24 December 1958 was followed by the arrival of M'Hamed Zghari on 1 July 1959 in the post of governor of the central bank. The second case concerns the Prime Minister El Hadj Ahmed BAHNINI who took office on 3 November 1963. A change of governor was made by the appointment of Driss SLAOUI in 1964. The third case was the appointment of M'Hamed Zghari in 1967 following the arrival of Mohamed BENHIMA's government on 6 July 1967. Thus, the political vulnerability ratio takes the value $(3/15) = 0.2$ since there were 15 changes of prime ministers and only 3 changes of central bank governors within a period not exceeding 6 months. Thus, the political vulnerability ratio of the central bank governor does not indicate a persistent sensitivity of the central bank governor to the executive authorities.

The degree of independence of BAM was assessed using three indices proposed by Cukierman, Webb and Neyapti (1992). It was found that, although BAM has recently made price stability its main objective, it is beginning to be more transparent. Indeed, using three indices measuring the degree of independence of the central bank namely, the legal index, the governor's rotation index and the governor's political vulnerability index, it seems that the central bank of Morocco has experienced an improvement in its degree of independence.

2. Application of SVAR modelling on Moroccan monetary policy

2.1. Description of variables and data

This study considers only national factors in the channels of transmission of monetary policy. These factors include the industrial production index (IPI) as a proxy for economic growth, the consumer price index (IPC) as a proxy for inflation, the real exchange rate index (TCR), money supply (MM), credits to the economy (CE) and a monetary policy indicator (the day-to-day weighted average rate). M3 is an intermediate instrument of the central bank, which measures the money supply of the economy. An increase in the M3 reflects a relaxation in monetary policy, which affects the IPC and economic growth, and is chosen instead of the M2.

Table 2: Variables included in the SVAR models

Variables	Code	Period 1	Period 2	Source
Interbank market rate in %	TMP	1994Q1-2005Q4	2006Q1-2020Q1	IFS
Money supply in logarithm	MM	1994Q1-2005Q4	2006Q1-2020Q1	BAM
Industrial production index in logarithm	IPI	1994Q1-2005Q4	2006Q1-2020Q1	IFS+HCP
consumer price index in logarithm	IPC	1994Q1-2005Q4	2006Q1-2020Q1	IFS+HCP
real effective exchange rate in logarithm	TCR	1994Q1-2005Q4	2006Q1-2020Q1	IFS
credits to the economy in logarithm	CE	1994Q1-2005Q4	2006Q1-2020Q1	BAM

2.2. Structure of the SVAR model

To empirically test the effectiveness of the mechanisms of transmission of monetary policy in the Moroccan framework, we use a SVAR model with six endogenous ones such as:

$$A_0 Y_t = \alpha + \sum_{i=1}^p A_i Y_{t-i} + \varepsilon_t$$

With $Y_t = (IPI, IPC, MM, CE, TCR, TMP)'$ the dimension 6 vector of endogenous variables. $\varepsilon_t = (\varepsilon^{AS}, \varepsilon^{AD}, \varepsilon^{DM}, \varepsilon^{CE}, \varepsilon^{BP}, \varepsilon^{PM})'$ Represents the vector of uncorrelated innovations and refers to the structural shocks of the model. Canonical innovations refer to shocks or impulses whose propagation results in fluctuations of the studied system.

2.3. Identification of shocks

To identify the different shocks, the methodology of Camarero et al (2002) is followed:

The behavior of the endogenous variables is explained by six structural shocks: the aggregate supply shock (ε^{AS}), the aggregate demand shock (ε^{AD}), The money demand shock (ε^{DM}), the credit shock (ε^{CS}), the balance of payments shock (ε^{BP}) and the monetary policy shock (ε^{PM}).

Global supply shock: ε^{AS}

Based on De Arcangelis (1997), if full employment output is equal to current output expectations formed in $t - 1$, i.e., $IPI = E[IPI_t^s / I_{t-1}]$, then the output gap can be interpreted as the output innovation e_{IPI} and the following relationship holds:

$$e_{IPI} = \varepsilon_t^{AS}$$

This implies that aggregate supply shocks equal real output innovations and, therefore, are treated as technology shocks.

IS shocks: ε^{AD}

A short-term block recursive structure is assumed in which the non-policy variables (IPI, IPC) do not respond simultaneously to innovations in the policy variables (MM, TCR). This assumption, common in the literature (see Gordon and Leeper, 1994; Shioji, 1997), reflects the fact that non-policy variables respond slowly to changes in policy variables due to the existence of decision lags. Thus, the above relationship for the aggregate demand shock can be rewritten as follows:

$$e_{IPC} + \beta_{21} e_{IPI} = \varepsilon_t^{AD}$$

The money demand shock: ε^{DM}

The reaction function of the central bank where BAM reacts concomitantly to the monetary aggregate and the exchange rate is represented by:

$$\beta_{31} e_{IPI} + \beta_{32} e_{IPC} + \beta_{36} e_{TMP} + e_{MM} = \varepsilon^{DM}$$



The shock of credit to the economy: ε^{CSP}

According to Ehrmann et al (2003), the demand for loans that a bank face is assumed to depend on output, the price level, and the interest rate on loans. The reaction rule for the period from 2006 to the present can be expressed in terms of innovations as follows:

$$\beta_{41}e_{IPI} + \beta_{42}e_{IPC} + \beta_{46}e_{TMP} + e_{CE} = \varepsilon^{CE}$$

The balance of payments shock: ε^{BP}

Since ε^{BP} has been normalized to the exchange rate, it is considered that this shock represents the market's adjustment expectations. It can be concluded that:

$$\beta_{51}e_{IPI} + \beta_{52}e_{IPC} + e_{TCR} + \beta_{56}e_{TMP} = \varepsilon^{BP}$$

The monetary policy shock: ε^{PM}

In Morocco, BAM has designated M3 as the intermediate target, while the short-term interest rate has become the monetary policy instrument. The reaction rule for the period from 2006 to the present can be expressed in terms of innovations to financial variables as follows:

$$\beta_{63}e_{MM} + \beta_{65}e_{TCR} + e_{TMP} = \varepsilon^{PM}$$

Where the structural shock ε^{PM} has been normalized to short-term interest rates, so that this type of shock is assumed to be captured by innovations in this variable.

The empirical analysis presented in this paper is based on the so-called 'successive relationship'. This involves determining the relationship between variables recursively in blocks (Raghavan and Silvapulle, 2006). Over-identified restrictions are used, which is a common practice.

The residues of the reduced form of equation (1) can be related to the structural residues by the following structure: $Ae_t = B\varepsilon_t$

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & a_{36} \\ a_{41} & a_{42} & 0 & 1 & 0 & a_{46} \\ a_{51} & a_{52} & 0 & 0 & 1 & a_{56} \\ 0 & 0 & a_{63} & 0 & a_{65} & 1 \end{bmatrix} \begin{bmatrix} e_{IPI} \\ e_{IPC} \\ e_{MM} \\ e_{CE} \\ e_{TCR} \\ e_{TMP} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} \end{bmatrix} \begin{bmatrix} \varepsilon^{AS} \\ \varepsilon^{AD} \\ \varepsilon^{DM} \\ \varepsilon^{CE} \\ \varepsilon^{BP} \\ \varepsilon^{PM} \end{bmatrix}$$

2.4. Seasonal adjustment of data

The IPI, IPC, MM, CE and TCR series are seasonally adjusted using the TRAMO/SEATS program.

2.5. Unit root testing

After performing the usual unit root tests (Dickey-Fuller), some variables are stationary in level and others in difference (Table 3). As a result, we opt for the estimation of a SVAR on the variables in level. This approach is widely applied in the literature of SVAR models (Sims, et al., 1990; Cushman and Zha, 1997; Amisano et al., 1997; Ramaswamy and Sloek, 1998; Bernanke and Mihov, 1998; Kim and Roubini, 2000; Elbourne, 2008, Ouchchikh, 2014 for the Moroccan case).

Table 3: Stationarity test of the series

	Series	ADF	PP	Conclusion
Model 1	IPI_1	S (Cte et T)	S (Cte et T)	S (Cte et T)
	IPC_1	S (Cte et T)	S (Cte et T)	S (Cte et T)
	MM_1	NS (Cte et T)	NS (Cte et T)	NS (Cte et T)
	CE_1	NS (Cte et T)	NS (Cte et T)	NS (Cte et T)
	TCR_1	NS (Cte et T)	NS (Cte et T)	NS (Cte et T)
	TMP_1	S	S (Cte)	S
Model 2	IPI_2	NS (Cte et T)	NS (Cte et T)	NS (Cte et T)
	IPC_2	S (Cte et T)	S (Cte et T)	S (Cte et T)
	MM_2	S (Cte et T)	S (Cte et T)	S (Cte et T)
	CE_2	S (Cte et T)	S (Cte et T)	S (Cte et T)
	TCR_2	NS (Cte et T)	NS (Cte et T)	NS (Cte et T)
	TMP_2	S (Cte et T)	S (Cte et T)	S (Cte et T)

2.6. the optimal number of delays

As for the selection of the number of delays, the information criteria (LR, AIC, FPE, SC and HQ) opt for a single delay for both models.

Table 4: Selection of the optimal number of delays

	Delays	LR	FPE	AKAIKE	Schwarz	Hannan-Quinn
Model 1	0	-----	3.08×10^{-19}	-25.59636	-25.11932	-25.41766
	1	274.0938*	1.11×10^{-21} *	-31.24413*	-29.33599*	-30.52933*
	2	44.31115	1.47×10^{-21}	-31.06364	-27.72438	-29.81273
	0	-----	1.97×10^{-19}	-26.04544	-25.60748	-25.87608

	1	516.0081*	1.26×10^{-23} *	-35.71524*	-33.96339*	-35.03779*
Model 2	2	38.59059	1.92×10^{-23}	-35.34739	-32.28164	-34.16184

2.7. The normality test

By conducting the Jarque-Bera normality test, the null hypothesis of normality is not accepted for residual e_4 for model 1 and residuals e_1 and e_4 . Nevertheless, despite the departure from the normality assumption, the VAR model continues to provide consistent and unbiased estimators (Gonzalo, 1994; Brooks, 2008).

Table 5: Jarque-Bera normality test

	Residues	e_1	e_2	e_3	e_4	e_5	e_6
Model 1	JB	2.823424	0.256857	0.354815	10.22214	1.688460	3.305876
	Prob	0.2437	0.8795	0.8374	0.0060	0.4299	0.1915
Model 2	JB	40.54923	3.321669	3.684958	19.73819	1.248538	3.884203
	Prob	0.0000	0.1900	0.1584	0.0001	0.5357	0.1434

2.8. Error autocorrelation

the statistical test $LM > 5\%$, so we reject the hypothesis of autocorrelation of errors for both models.

Table 6: LM test for autocorrelation

	Khi-deux	Dof	P-value
Model 1	695.3781	651	0.1110
Model 2	823.9562	735	0.0122

2.9. The SVAR stability test

To test the stability of the model, the inverse of the roots of the characteristic polynomial is used. It is shown that the models are stable (stationary) because all inverses of the roots of the autoregressive characteristic polynomial exhibit moduli less than one. Consequently, the estimated SVAR (1) models are satisfactory representations of the data used.

Table 7: Inverse of the roots of the characteristic polynomial

	Root	Modulus
Model 1	0.938912	0.938912
	0.913158	0.913158
	0.781065	0.781065
	0.565231	0.565231
	0.422592	0.422592
	0.112378	0.112378
Model 2	0.880830	0.886133
	0.096797	0.886133
	0.760170	0.760170
	0.609849	0.609849
	0.495157	0.499021
	0.061976	0.499021

3. Result and discussion

3.1. Impulse response functions

3.1.1. Interest rate shocks

We begin by analyzing the responses of the main macroeconomic aggregates to an interest rate shock.

The simulations carried out using the SVAR model (Figures 1 and 2) show that monetary policy shocks influence the evolution of the main macroeconomic aggregates.

During the first period, the growth rate registers a decrease following the increase in the interest rate in the medium term (six quarters) and an increase in the long term, which confirms the result found by Boughrara (2009) which stipulates that Morocco's GDP progresses despite the monetary tightening. The analysis conducted during the second period, when BAM becomes independent, shows that the GDP growth rate decreases following an increase in the interest rate in the medium term, to return to equilibrium in the long term, which suggests that a high cost of money negatively impacts the consumption and investment decisions of economic agents and is considered a brake on production. This result is in line with those of Ortiz and Barcelo (2010) and Neamie (2008). Our results confirm the theoretical corpus according to

which economic activity contracts following a restrictive monetary policy shock and therefore the interest rate channel under BAM independence is more effective.

At the same time, the monetary shock generates a fall in the price level in the medium term before stabilizing in the first period. From 2006 onwards, prices depreciate with a significant drop before stabilizing, after three and a half years, at the level reached at the beginning of the reaction. This result is in line with the one found by Neamie (2008) who observed that there is a deceleration of prices following a restrictive monetary policy shock, but contradicts the results found by Ortiz and Barcelo (2010). This finding suggests that BAM controls prices through the interest rate as part of its independence.

In terms of credits to the economy, the restrictive monetary policy shock results in a significant increase from the beginning of the response in the first period. This behavior of credits to the economy is contrary to theoretical expectations, since we expected a contraction in the volume of credit distributed following the rise in interest rates. It should be noted that this result is different from those of Ortiz and Barcelo (2010) who found a contraction of bank credit following the rise in interest rates. In the second period, the shock to credit following a rise in the interest rate results in an increase and then a decrease from the third year, which is stipulated by the theory.

A monetary policy shock through an increase in the interbank market interest rate reduces the volume of the M3 money supply, but over a short period (two quarters), which is different from the result obtained in the BAM independence framework.

Figure 1: Impulse response functions following an interest rate shock (model 1)

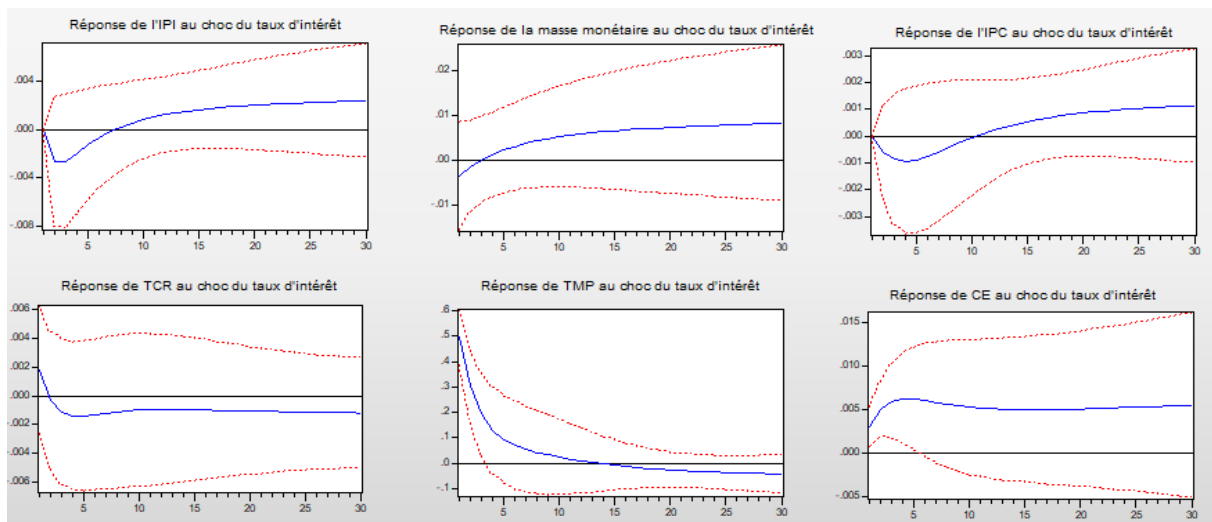
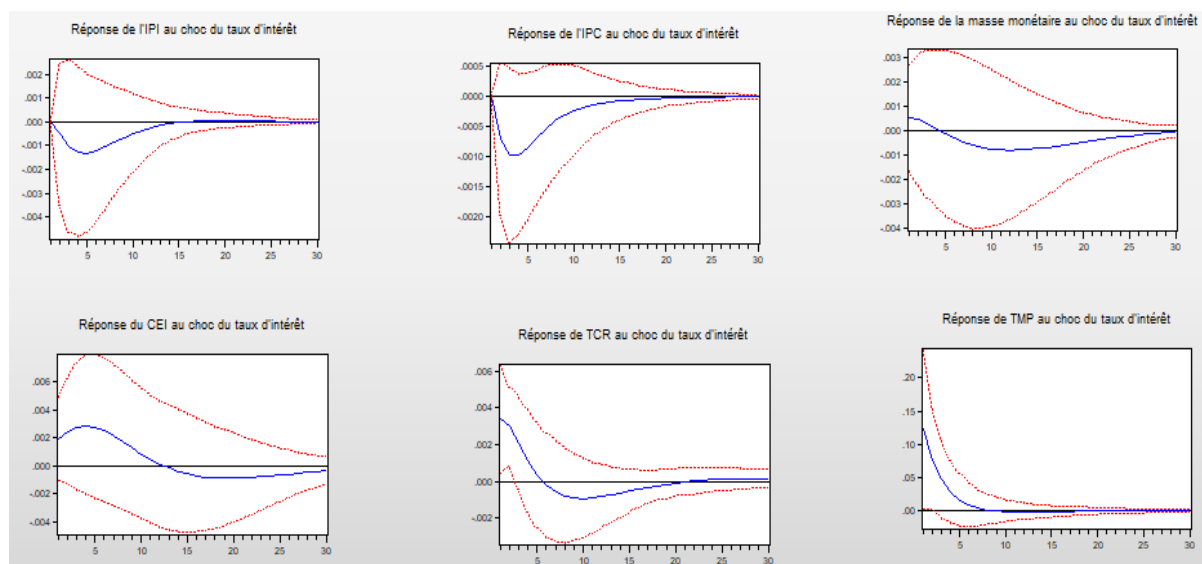


Figure 2: Impulse response functions following an interest rate shock (model 2)



After analyzing the effects of a shock to the interest rate, we focus on analyzing the effects of shocks to other variables in the system on output and prices.

3.1.2. Shock on the demand for money

During the first period, the money supply shock generates a sustained rise in prices (graph). The same is true for the second period. Indeed, the money supply shock gradually fuels the rise in prices until the third quarter and then fades to its equilibrium level. This is fully in line with expectations, especially from the quantitative theory of money which establishes a positive correlation between the money supply and the price level. According to the analysis, BAM controls inflation through the growth of the money supply within its independence.

The analysis of GDP shows that, in the first period, the expansion of M3 supports economic activity (Figure 3). For the second period, a shock to the money supply increases economic activity with a peak in the fourth quarter and then a return to equilibrium is recorded in the twelfth quarter (Figure 4). This result is logical, as the monetary expansion allows for an easing of the financing conditions of the economy.

Figure 3: Impulse response functions following a shock to the MM (Model 1)

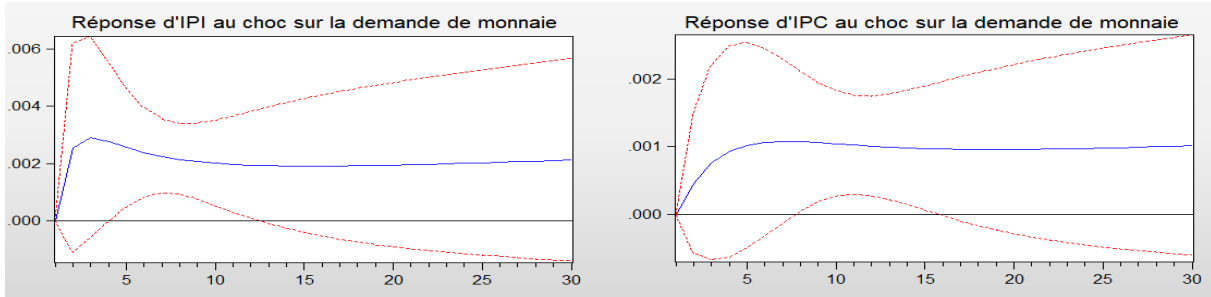
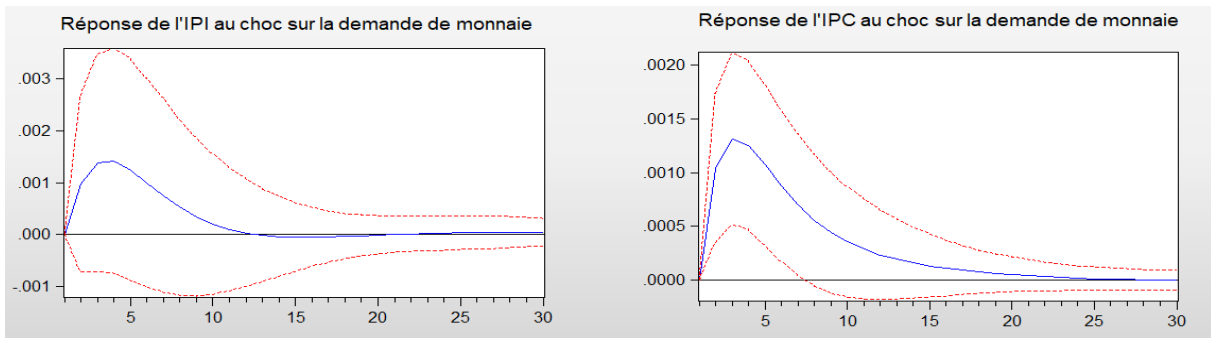


Figure 4: Impulse response functions following a shock to the MM (Model 2)



3.1.3. Credit shock

An increase in credit has a positive impact on output and a negative impact on prices during the first period (Figure 5). In contrast, during the second period, the growth of the industrial production index declines for ten quarters and after an insignificant increase following a shock to bank credit. As for the impact of the credit shock on prices, the reaction of the latter is bearish (Figure 6).

It appears that the credit channel is effective when the central bank is independent. This result may be due firstly to the predominance of indirect intermediation in the Moroccan economy, to the degree of competition.

Figure 5: Impulse response functions following an impact on the CE (model 1)

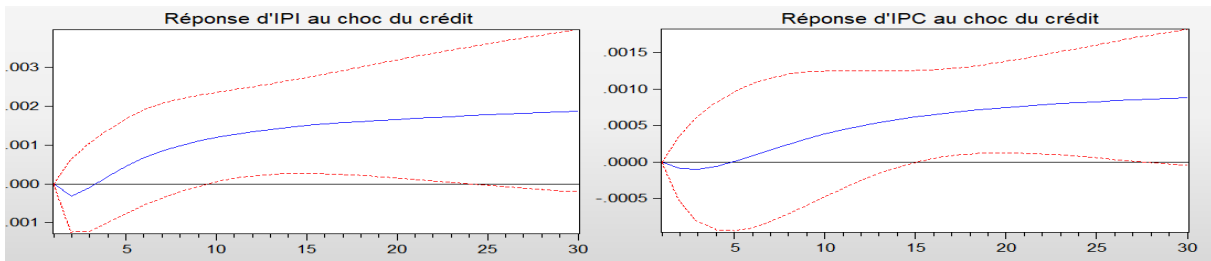
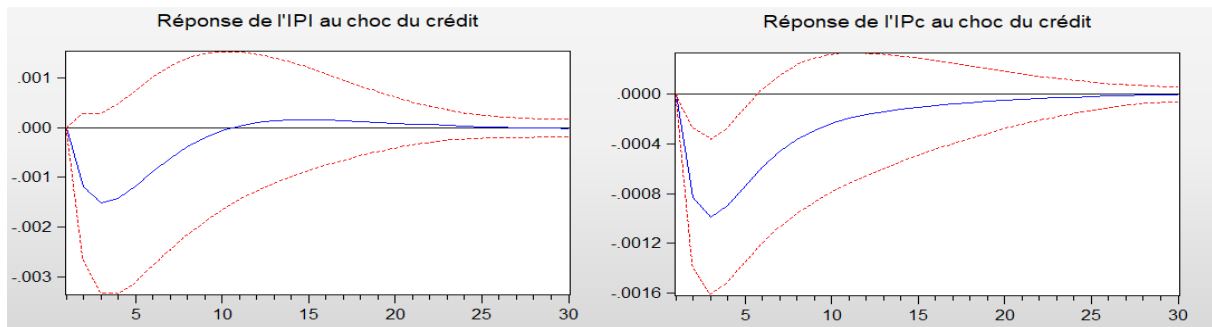


Figure 6: Impulse response functions following an impact on the CE (model 2)



3.1.4. Exchange rate shock

In the first period, the effect of the exchange rate shock on industrial production is positive in the first eight quarters, in contrast to its effect which is negative in the second period, which suggests the inefficiency of the exchange rate channel in the framework of central bank independence. Moreover, the behavior of prices shows a similar response to shocks to industrial production in the first period. In contrast, during the period of BAM independence, prices appear to be under control and thus the effectiveness of the exchange rate channel in achieving price stability (Figures 7 and 8).

This analysis shows that the exchange rate channel is effective in terms of price control and, conversely, ineffective in terms of stimulating industrial production.

Figure 7: Impulse response functions following a shock to the TCR (model 1)

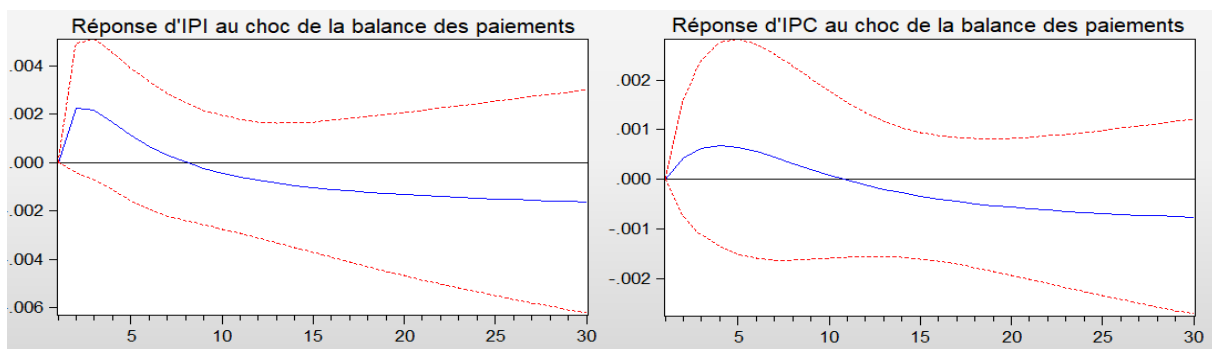
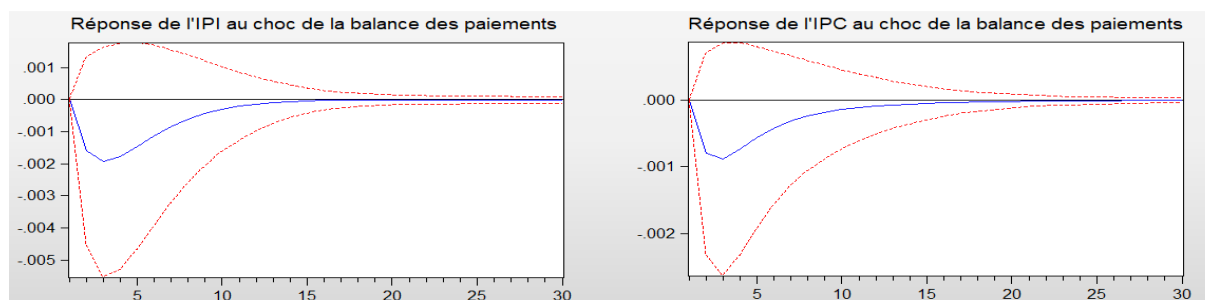


Figure 8: Impulse response functions following a shock to the TCR (model 2)



3.2. Variance decomposition

When the response functions reflect the impact of a shock to one variable on all the variables in the model, the variance decomposition indicates the relative importance of each shock affecting the VAR model in explaining the variance of each variable over a given time horizon. Tables 8 and 9 summaries the results of the variance decomposition of output and prices over a ten-year horizon.

Before BAM's independence, between the first quarter and the fifth year, the supply shock explains a share of the variance of output ranging from 100% to 51.77%. In the second period, the supply shock explains a share of the variance in industrial output ranging from 100% to 85% (Tables 8 and 9).

The analysis of the variance decomposition of the forecast error of industrial production has shown that variations in production are caused by the interest rate and the money supply rather than by credit and the exchange rate.

According to the result of the table, one cannot put forward the superiority of one channel over the other in the transmission of monetary policy in Morocco.

Table 8: Variance decomposition of output (model 1)

		Décomposition de la variance de l'IPI					
	Horizon	IPI	IPC	MM	CE	TCR	TMP
Model 1	1	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
	4	79.38671	0.765459	8.469279	0.053149	4.708019	6.617384
	8	71.89893	0.779202	14.98156	0.834933	4.855826	6.649545
	12	65.86033	1.175224	18.45721	2.611742	4.736902	7.158595
	16	58.75005	2.241035	20.18546	4.622545	5.199309	9.001599
	20	51.77518	3.633162	20.95217	6.427663	5.944048	11.26777
	24	45.61384	5.052254	21.24855	7.917319	6.737629	13.43041
	28	40.39939	6.358271	21.33138	9.116877	7.477664	15.31642

32	36.04286	7.509537	21.32264	10.08292	8.132764	16.90928
36	32.40170	8.507385	21.27771	10.86838	8.701147	18.24369
40	29.34065	9.368032	21.22111	11.51502	9.191280	19.36392

Table 9: Variance decomposition of output (model 2)

		Décomposition de la variance de l'IPI					
	Horizon	IPI	IPC	MM	CE	TCR	TMP
Modèle 2	1	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
	4	91.35663	0.789555	1.659391	1.970757	3.222680	1.000990
	8	86.05331	2.095325	2.529126	2.595875	4.265550	2.460817
	12	85.52335	2.344582	2.548260	2.579595	4.318433	2.685779
	16	85.47426	2.364923	2.547519	2.604373	4.318021	2.690900
	20	85.45601	2.365670	2.548155	2.621060	4.317171	2.691938
	24	85.45095	2.365767	2.548376	2.624325	4.317098	2.693481
	28	85.44851	2.365942	2.550145	2.624365	4.317239	2.693798
	32	85.44591	2.366109	2.552195	2.624722	4.317336	2.693730
	36	85.44391	2.366214	2.553493	2.625301	4.317367	2.693712
	40	85.44287	2.366262	2.554046	2.625704	4.317367	2.693752

As for the variance decomposition of the price forecast error, it could be argued that price changes are rather caused by the money supply and secondarily by the interest rate and bank credits (Table 10).

Table 10: Variance decomposition of the IPC (model 2)

		Décomposition de la variance du IPC					
	Horizon	IPI	IPC	MM	CE	TCR	TMP
Model 2	1	6.291146	93.70885	0.000000	0.000000	0.000000	0.000000
	4	6.194381	65.32707	11.08228	6.257307	4.934641	6.204325
	8	6.141284	56.82723	15.00635	7.827605	5.483103	8.714426
	12	6.306435	55.73126	15.54250	8.039187	5.476534	8.904083
	16	6.325374	55.51482	15.65404	8.110485	5.473702	8.921575

20	6.326313	55.46064	15.67790	8.136438	5.472282	8.926429
24	6.326166	55.44772	15.68147	8.144254	5.471668	8.928722
28	6.326131	55.44536	15.68151	8.145902	5.471489	8.929617
32	6.326126	55.44507	15.68144	8.146059	5.471462	8.929844
36	6.326115	55.44497	15.68154	8.146053	5.471463	8.929857
40	6.326104	55.44487	15.68164	8.146081	5.471465	8.929840

Conclusion

From 2006 onwards, the government introduced important reforms to the legal and institutional framework for monetary policy. These reforms have contributed to the modernization of the economy. To confirm or deny the effectiveness of monetary policy under the independence of the Moroccan monetary authority, we opted for a SVAR modelling on two periods, before and after the independence of BAM, on quarterly data. The first period runs from 1994 to 2005 and the second from 2006 to 2020.

The empirical analysis focuses on the transmission channels of monetary policy. The domestic channels examined in this chapter include Morocco's industrial production index (IPI), the consumer price index (IPC), the money supply measured by M3, the short-term interest rate (TMP), credits to the economy (CE) and the real effective exchange rate (TCR). Restrictions were imposed on the contemporaneous effects of endogenous variables.

The empirical analysis concluded that in the BAM independence framework:

- The interest rate channel is more effective, economic activity contracts following a restrictive monetary policy shock.
- BAM controls prices through the interest rate and money supply growth since an increase in the interest rate reduces the volume of money supply.
- The credit channel is effective. The credit channel is effective, as there has been an increase in industrial production and a downward reaction of prices following a shock to bank credits.
- The exchange rate channel is effective in controlling prices and ineffective in stimulating industrial production. This result is expected despite the flexibilization of the exchange rate in Morocco.

Annexes:

Construction of the CWN legal index

Caractéristiques	Poids	Score	Poids*score
1- Chief executive officer :	0,20		0,1625
a- Term of office :	0,05		

6 to 8 years		0,75	0,0375
b- Who appoints the CEO ?	0,05		
Legislature ;		0,50	0,025
c- Dismissal :	0,05		
No provision for dismissal ;		1,00	0,05
d- May the CEO hold other offices in the government ?	0,05		
No ;		1,00	0,05
<hr/>			
2- policy formulation :	0,15		0,1
<hr/>			
a- Who formulates monetary policy ?	0,05		
Bank alone ;		1,00	0,05
b- Who has final say in resolution of conflict	0,05		
The bank, on issues clearly defined in the law as its objectives ;		1,00	0,05
c- Role in the government's budgetary process :	0,05		
Central bank has no say.		0,00	0,00
<hr/>			
3- Objectives :	0,15		0,15
<hr/>			
- Price stability is the major or only objective in the charter, and the central bank has the final word in case of conflict with other government objectives.	0,15	1,00	0,15
<hr/>			
4- Limitations on nonsecuritized lending to the government :	0,50		0,3445
<hr/>			
a- Limitation on nonsecuritized lending :	0,15		
Advances permitted, but with strict limits		0,67	0,1005
b- Securitized lending :	0,10		
Not permitted		1,00	0,10
c- Terms of lending	0,10		
Specified by the bank charter		0,67	0,067
d- Potential borrowers from the bank	0,05		
Public and private sector		0,00	0,00
e- Limits on central bank lending	0,025		
Shares of government revenue		0,33	0,00825
f- Maturity of loans :	0,025		
Within 6 Months		1,00	0,025
g- Interest rates on loans	0,025		
At market rates		0,75	0,01875
h- Central bank prohibited from buying or selling government securities in the primary market ?	0,025		
Yes		1,00	0,025
<hr/>			
			0,757
<hr/>			

Political vulnerability of the Governor of BAM

Appointment of Central Bank Governors	Moroccan Prime Ministers
	10 octobre 2013 Abdelilah BENKIRANE
	9 novembre 2011 Abdelilah BENKIRANE
	19 Septembre 2007 Abbas EL FASSI
	7 Novembre 2002 Driss JETTOU
➤ M'Hamed Zghari (1er juillet 1959 au 20 août 1964)	8 juin 2004 Driss JETTOU
➤ M. Driss SLAOUI (1964-1967)	14 mars 1998 Abderrahmane YOUSOUFI
➤ M'Hamed Zghari (1967)	6 septembre 2000 Abderrahmane YOUSOUFI
➤ Le prince Moulay Hassan Ben El Mehdi (11 février 1969 au 1er novembre 1984)	27 février 1995 Abdellatif FILALI
➤ Ahmed Bennani (1er avril 1985, septembre 1989)	7 juin 1994 Abdellatif FILALI
➤ Mohammed Seqat (septembre 1989 à 2003).	30 septembre 1986 Azzedine LARAKI
➤ Abdellatif JOUAHRI (depuis mars 2003)	11 août 1992 Mohamed Karim LAMRANI
	19 novembre 1983 Mohamed Karim LAMRANI
	12 avril 1972 Mohamed Karim LAMRANI
	6 Aout 1971 Mohamed Karim LAMRANI
	5 novembre 1981 Maati BOUABID
	27 mars 1979 Maati BOUABID
	10 octobre 1977 Ahmed OSMAN
	20 November 1972 Ahmed OSMAN
	7 October 1969 Ahmed LARAKI
	6 Juillet 1967 Mohamed BENHIMA
	3 November 1963 El Hadj Ahmed BAHNINI
	24 décembre 1958 Abdallah IBRAHIM
	12 Mai 1958 El Hadj Ahmed BALAFREJ
	28 octobre 1956 M'barek Lahbil EL BEKKAI
	7 décembre 1955 M'barek Lahbil EL BEKKAI

Bibliography

- Adel, B. (2008). Monetary Transmission Mechanisms in Morocco and Tunisia. papier presented au Workshop sur: Monetary Policy and Inflation Targeting, Tunis.
- Aglietta, M. (1992). L'indépendance des banques centrales : Leçons pour la banque centrale européenne. *Revue d'économie financière*, 37-56.
- Aguir, A. (2013). L'indépendance réelle de la banque centrale et le biais inflationniste : une validation empirique. HAL Id: halshs-00800059.
- Alesina, A. (1988). Macroeconomics and Politics. *NBER Macroeconomics Annual 1988*, Volume 3, 13 - 62.
- Alex, C. (1992). *Central Bank Strategy, Credibility, and Independence: Theory and Evidence*. The MIT Press.
- Amisano, G. a. (1997). *Topics in Structural VAR Econometrics*, . 2nd edition, Springer
- António Afonso, L. G. (s.d.). The policy mix in the US and EMU: Evidence from a SVAR. *North American Journal of Economics and Finance*.
- Arcangelis, G. D. (1996). monetary policies under the EMS: An empirical VAR approach. research seminar in international economics. Michigan.
- BARR0, R. J. (1983a). Rules, discretion and reputation in a model of monetary policy. *Journal of Monetary Economics*, 101-121.
- Bennouna Hicham, L. K. (2016). Analyse des canaux de transmission de la politique monétaire au Maroc. document de travail de Bank Al-Maghrib.
- Bernanke, B. S., & Mihov, I. (Aug, 1998). Measuring Monetary Policy. *The Quarterly Journal of Economics*.
- Brooks, C. (2008). *Introductory econometrics for finance*. Cambridge University Press, UK.
- Cushman, D. O., & Zha, T. (1995). Identifying monetary policy in a small open economy under flexible exchange rates. Working Paper, No. 95-7, Federal Reserve Bank of Atlanta, Atlanta, GA.
- Elbourne, A. (2008). The UK housing market and the monetary policy transmission mechanism: An SVAR approach. *Journal of Housing Economics* 17.
- Friedman, M. (1968). The role of monetary policy. *The American Economic Review*, Volume LVIII-N°1.
- Garcia-Ortiz A., P.-Barcelo. R. (2010). Financial Innovations in Morocco: Efficiency of Monetary Policy. Internet site: <http://lead.univtl.fr/fichiers/Caire2010>
- Gonzalo, J. (1994). Five alternative methods of estimating long-run equilibrium relationships. *Journal of Econometrics*, Elsevier, vol. 60(1-2), 203-233
- Kim, S. (2003). Monetary Policy Rules and Business Cycles. *The Scandinavian Journal of Economics*, 221-245.



- Ouchchikh, R. (N°12 juillet 2018). La politique monétaire marocaine a-t-elle un effet symétrique ou asymétrique sur la production et les prix? *Finance & Finance Internationale*.
- Ouchchikh, R. (N°8 janvier 2017). Estimation des mécanismes de transmission de la politique monétaire au Maroc: une approche SVAR. *Finance & Finance Internationale*.
- Sløk, R. R. (1998). The Real Effects of Monetary Policy in the European Union: What Are the Differences? *IMF Econ Rev* 45, 374–396.
- Sims, C. A. (1980). Macroeconomics and Reality. *Econometrica* Vol. 48, No. 1 (Jan., 1980), 1-48.