

Monetary policy and economic growth: A global and sector perspective in Tunisia

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Abstract

In this paper, we empirically examine the impact of key interest rate on national and sector economic growth. Using Tunisian quarterly data in the period 2000-2018, we estimate, in the first step, the long term relationships through VECM analysis and, in the second we enrich our study by introducing variables of interaction. We find that key interest rate significantly and positively influences national and sector economic growth and negatively affects the inflation. In specific, our results show that the economic crisis and the approved credits respectively influence negatively and positively the link between key interest rate and Tunisian economic growth. Finally, we show that the impact of changes in monetary policy is weaker in crisis period and improved by the bank credit rises.

Keywords: Key interest rate, economic growth, inflation, long-term relationship.

JEL classification: E31, E52, E58, O47

Politique monétaire et croissance économique : Une perspective globale et sectorielle de la Tunisie

Résumé

Dans cet article, nous examinons de manière empirique l'impact des taux d'intérêt directeur sur la croissance économique nationale et sectorielle. En utilisant les données trimestrielles tunisiennes pour la période 2000-2018, nous estimons, dans un premier temps, les relations à long terme à travers l'analyse VECM et, dans un second temps, nous enrichissons notre étude en introduisant des variables d'interaction. Nous constatons que le taux d'intérêt directeur influe de manière significative et positive sur la croissance économique nationale et sectorielle et sur l'inflation. En particulier, nos résultats montrent que la crise économique et les crédits approuvés influencent respectivement négativement et positivement le lien entre le taux directeurs et la croissance économique tunisienne. Enfin, nous montrons que l'impact des changements de politique monétaire est plus faible en période de crise et amélioré par la hausse du crédit bancaire.

Mots-clés: Taux d'intérêt directeur ; croissance économique ; inflation ; relations de long terme

1. Introduction

Economic growth is the ultimate goal of every country in the world. It requires a showy and strategic economic policy that anticipates the future economic conditions that must present, an increase in income, low unemployment, low inflation, balanced public and external balance. This economic policy requires instruments, including an effective and courageous monetary policy that seeks to achieve its objectives.

Today, monetary policy has become an essential component of the contemporary economy, allowing monetary authorities (central bank governors) to impact certain economic variables. The level of growth in developed economies and that in developing economies is the result of monetary and financial policy interventions across the transmission channels of the growth objective.

Yet, many developing countries find themselves in a paradox of the monetary policy relationship and economic growth. Indeed, central banks' accommodative monetary policies appear to have hurt productivity growth by creating an abundance of low-cost capital, which has eliminated the incentive for scarcity for productivity. Unfortunately, these policies, aiming at stimulating economic activity, seem to have dampened private investment. Private investment plays an important role in total productivity, but the current economic climate and monetary policy have changed the behaviour of the private sector. Another factor that allows developing countries to adopt a monetary policy that hinders growth is the use of loans from the International Monetary Fund (IMF). These countries are in a situation to follow monetary and economic policies which are not in phase with the current economic situation.

The monetary policy and economic growth relationship is a subject studied by all currents of economic thought. The quantitative theory of money suggests the neutrality of monetary action on economic activity, but it only leads to inflation. This theory is criticized by the Keynesian theory which shows that the currency is active and each monetary action must respond to the needs of the economy. Thus, Friedman (1968) continued the latter theory and shows that the effect of economic policy is neutral in the long run. The new classical school with Lucas (1972) and Sargent (1972) argues that not only in the long term but also the effect of monetary policy is neutral in the short term on economic activity. It is also the results of the work of Gali, (2000) and Mankiw and Taylor (2007) who have shown that economic growth is only influenced by real factors.

Carlson (1978), using the ST.Louis model applied to US data, shows that the supply of money has a positive and significant effect on productivity. For example, Barnanke and Mihov (1998) found using a VAR model that monetary policy shocks in the interbank market interest rate stimulate production. Recently, the work of King (2000) and Ondo Ossa (2005), using panel data from the CEMAC zone, has concluded that monetary reforms lead to high inflation and not an increase in GDP.

The monetary policy adopted by central banks is that of lowering the policy rate in case of economic recession and increasing the policy rate in case of improvement of the economic situation. Recently in Tunisia, the objective of the central bank is mainly to ensure price stability, increasing the key interest rate which reached 7.5% in 2019. This is strongly opposed by politicians, civil communities and especially by the unions (UGTT). So we can understand the moves against the last decision of the central bank. But, what is certain is that Tunisia faces various economic difficulties and we can no longer understand the decision of the central bank to raise the key rate in an economy with a trade deficit of 17.33 billion dinars a rate EUR / Dinars exchange rate of 3.47 and 3.025 Dollars / Dinars and public debt reached 70% of GDP. On the other hand, from a pragmatic point of view, all independent central banks consider that monetary policy has real short-term effects on price stability, economic growth and the stability of financial systems. Among monetary policy interventions is the increase or decrease in the key interest rate which has an effect on investment credits and especially on economic growth.

The purpose of this paper is to examine the monetary policy and economic growth relationship through a national and sectoral study examining the effect of changes in the key interest rate on inflation and on the global and sectors economic growth. First, we will study the long-term relationship between the key interest rate, output and inflation in national and sectors perspective. Thus, we will analyse the responses of the variables (inflation, growth) following the fluctuation of the key rate.

Several empirical studies have studied this important topic. Gerlach and Smets (1995), Nubukpo (2002) and Cortet (1998) with a study of the G8 countries have shown that the effect of monetary policy on economic growth is short-term. They explained that changes in key interest rates only affect agents' income through asset renewal and therefore have only a limited impact in the short term. According to Nubukpo (2002) a monetary policy in developing countries decreasing (respectively increasing) the policy rate results in an increase (respectively decrease) in inflation.

In the case of developing countries, we cite the work of Kamgna and Ndambendia (2008), Montiel et al (2012) and Bikai and al (2015) who showed that changes in the key rate of the central banks have no or very little effect on economic activity and prices. In other words, in

the developing countries, there is a weakness of the transmission channels. These results have recently been shown by Bernanke et al. (2005), Rabanal (2007), Davoodi et al. (2013), Binning (2013), Mutuku and Koech (2014).

Empirically, most of the cited studies use classical estimation approaches, descriptive statistics, and time series to analyze the relationship between monetary policy and economic growth (Davoodi et al (2013), Binning (2013), Mutuku and Koech (2014). Other studies have used VAR modeling to measure the effect of monetary policies on economic activity (Montiel et al (2012), Kamaan (2014), Kareem et al (2013), Onyeiwu (2012) used the MCO method and the correlation matrix.

However, to examine the relations of monetary policy and economic growth, other studies have used the Error Correction Modelling (ECM) which reveals the existence of long-term relationships between inflation and other variables.

Thus, all studies focused on macroeconomic variables and examined the relationship between countries' economic growth and monetary policy. But in this paper we will use another empirical approach based on VECM modelling in the first step. In the second step, we introduce a news variables interaction to see its effects on the relationship between global and sectors economic growth which allow us to explain and evaluate the last monetary policy decision in Tunisia.

With this introduction, the remainder of this paper is structured as follows: In section 2, we describe data and methodology. The main findings and analysis are given in section 3 followed by concluding remarks in section 4

2. Methodology and data

2.1 Methodology

In this paper, we aim to check linear and asymmetric long-term relationships between Key interest rate and growth of Tunisian sector (industrial sector, agricultural sector, manufacturing sector, and sector of services. Our methodology begins by testing traditional linear cointegration using VECM model based on Johansen's procedure which apply the likelihood maximum (LM) on VAR model assuming that errors are independently identically and distributed.

The reduced form of the VAR model is the following

$$y_t = A_0 + A_1 y_{t-1} + \dots + A_k y_{t-k} + \varepsilon_t, \quad t = 1, \dots, T \quad (1)$$

Where A_0 is the vector of constants, A_1 to A_k are matrices of coefficients

and ε_t is the vector of disturbances which have serially uncorrelated disturbances, zero means and homoscedastic variances.

y_t is the vector of endogenous variables.

2.2 Data

In order to study the relationships between key interest rate and economic growth of Tunisian sectors, we consider macroeconomic and sectoral variables: production (Y), key interest rate (KIR), consumer price index (CPI), capital (K) measured as the fixed gross capital formation, labour (L). We use these variables for global Tunisian economy and for four Tunisian economic sectors namely: agriculture, Industrial, manufacture and services. We collect our data from World Bank database series, and the Tunisian central bank database. Our time series are quarterly spanning from 2000 to 2018.

2.3 Main findings

In order to study the long-term relationships between the variables under investigation, it is necessary to see the order of integration of the variables. For this reason, we start our analysis by testing on the presence of unit root for all variables and determine the order of integration

In table 1, we show the results of the unit root tests. ADF tests show the same conclusion that the series are integrated of order one (1). In other words, our series are non-stationary and there are some possibilities to find cointegration relationships between variables.

Table1: unit root test results

Variables	Y		K		L		KIR		CPI	
	Level	1 st difference	Level	1 st difference	Level	1 st difference	Level	1 st difference	Level	1 st difference
Global economy	-1.947	-2.928**	-1.897	-3.545***	-1,675	-3,615***	-1.290	-3.874***	-1.2980	-4.445***
agriculture	-1.421	-4.456***	-1.7720	-3.716***	-1,466	-3.1720**	-----	-----	-----	-----
industry	-1.865	-4.088***	-1.804	-4.017***	-1,324	-3.645***	-----	-----	-----	-----
manufacturing	-1.412	-4.172***	-1,675	-3,987***	-1,453	3.225**	-----	-----	-----	-----
Services	-1.456	-3.083**	-2.008	-4.238***	-1.879	-4,238***	-----	-----	-----	-----

*, **, and *** denote significance respectively at 10%, 5% and 1%, with critical values respectively -2.588587, -2.901779 and -3.522887

3. Estimation results

In the second step of this empirical part, we test cointegration between variables. We use the Johansen trace test and max-eigen value test applied on global Tunisian economy and sectoral VAR model. The results shown on table2 indicate that at 5% level the two Johansen cointegration tests give one cointegrating equation for national economy and sectoral VAR. model.

Table2: Johansen cointegration test at 5% level

Sector model	Trace test	Max-eigenvalue test
Global panel	One (2) cointegrating equation	One (1) cointegrating equation
Agriculture	One (1) cointegrating equation	One (1) cointegrating equation
Industry	One (1) cointegrating equation	One (1) cointegrating equation
Manufacturing	One (1) cointegrating equation	One (1) cointegrating equation
services	Two (2) cointegrating equations	One (1) cointegrating equations

In the above results, we find that some long term relationships occur between variables in Tunisian economy and in each sector. In the following work, we estimate our VEC model in different cases. We try also to present the residual covariance matrix to show the sign of link between variables.

Moreover, we determine how each endogenous variable responds over time to a shock in other variables.

$$Y_t = \alpha + \beta_1 K_{t-1} + \beta_2 L_{t-1} + \beta_3 CPI_{t-1} + \beta_4 KIR_{t-1} + \text{short term relationships} \quad (2)$$

Table 3 : long-term relationships estimation

Variables	K		L		KIR		CPI		constant
	β_1	t-stat	β_2	t-stat	β_3	t-stat	β_4	t-stat	α
Global economy	0.364	15.989***	1.8226	30.37***	0.0985	4.322***	-0.055***	-4.709	11.865
agriculture	0.117	9.913***	4.0547	23.651***	0.1143	3.477***	-0.635***	-9.448	34.670
industry	0.139	6.056***	1.2488	13.518***	0.1935	8.846***	-0.0459	-0.857	12.890
manufacturing	0.2018	7.069***	2.8557	10.049***	0.2778	11.569***	-0.352***	-7.417	9.069
Services	0.4069	6.089***	2.924	43.410***	0.4911	32.297***	-0.114***	-13.015	18.218

*, **, and *** denote significance respectively at 10%, 5% and 1%,

The estimation results are reported in table 3. The Tunisian economic growth presents a long run relationship with inflation, key interest rate and other control variables. In this equation, the Tunisian output is significantly and negatively related to the inflation, and significantly and positively related to other variables. So, an increase in the key interest rate leads to a level prices stability that is brake on inflation which gives an increase or stability of Tunisian GDP.

In addition, we see the same coefficients sign in the Tunisian growth sector. In the agricultural sector a 1% rises in key interest rate increase respectively the production of agriculture, industry, manufacture and services by 0,1143%, 0.1935%, 0.2778% and 0,4911%. So, the sector if services is most influenced by the key interest rate changes than other sectors. If we see the coefficients of consumer price index (CPI), we can conclude that the agricultural sector is lot impacted by rises of inflation. The industrial sector is not or weakly influenced by inflation increases compared to other sectors.

3.1 Key interest rate choc analysis

Even with these results we cannot conclude on the long-term relationships between variables of global economy or sectors in cases of key interest rate fluctuations. The residual covariance matrix which show the sign of the link between variables and the variance decomposition can help us to understand the behaviour of production in case of increases and decreases of the key interest rate.

Table 4 in the appendix, reports the covariance matrix. In general, and for the global Tunisian economy, the correlations among the residuals are low. The residual in the key interest rate equation is most correlated with that of the consumer price index equation. Thus, a shock to key interest rate will have a more common component with inflation. Moreover, in most cases, the residual of inflation is negatively correlated with those of all other variables, which implies that in period of rising inflation all production inputs are negatively influenced.

In sectoral cases, we see that results of covariance matrix confirm the above conclusion of the estimation outputs. So, CPI is most negatively correlated with production in agricultural case and the lowest in industrial one. Besides, the key interest rate has always the most significant and negative covariance value with the inflation variables in all cases of Tunisian economic sectors.

Table 5 reports the results of the variance decomposition of the key interest rate within a twenty period horizon. These results indicate that for the global Tunisian economy, inflation, GDP, capital and labor explain together about 57% of the key interest rate changes. The remaining 43% are explained by the key interest rate itself. Looking at the separate effects of variables, the capital (k) suffers the greatest effect of future key interest rate changes followed by GDP (Y), inflation and finally labor.

As it can be seen in the same table 5, inflation and agricultural production together explains 29% of the future changes in key interest rate in Tunisia, and the major part (43%) due to changes in key interest rate itself. The greatest effects of future key interest rate changes are explained by agricultural capital followed by production and consumer price index (Inflation).

The different analysis is found in agricultural sector. So, the separate effects of key interstate changes indicate that the lowest one is explained by the consumer index price and the highest is explained by capital.

Table5: Variance Decomposition of KIR

	Periods	Y	CPI	KIR	K	L
Global Economy	20	15.17620	13.890716	43.47102	23.68194	3.780124
Agriculture	20	17.863324	11.17208	48.14877	19.053272	3.762553
Industry	20	24.142353	6.619845	45.90374	18.023842	10.31022
Manufacturing	20	25.82478	12.022760	31.88125	27.13092	3.140283
Services	20	13.90324	13.453329	26.183963	26.28003	10.17943

These results give us an explanation of the long-term relationship between the key interest rate, economic growth and its inputs. But it does not give us an idea of the timing of monetary policy aimed to change the key interest rate to decide on future inflation and future economic growth. Thus, this analysis does not give us an explanation of the Tunisian central bank decision which said that the aim of increasing the key interest rate is for reducing consumer credit in the first step and maintain or reduce the inflation in the second step. To do this, we try to extend our analysis into interaction variables that enrich our present study and give us new results that help us to evaluate monetary policy in Tunisia.

3.2 Results based on approved credit variable interaction

We expect that the overall impact of key interest rate on national or sectoral growth depends on approved credits granted by the banking system in Tunisia. The regression model is of the following form:

$$Y_t = \alpha + \beta_1 K_{t-1} + \beta_2 L_{t-1} + \beta_3 CPI_{t-1} + \beta_4 KIR_{t-1} + \beta_5 KIR_{t-1} * AC_{t-1} +$$

short term relationship

(3)

We get quarterly approved credits of Tunisian economy and sectoral approved credits from the annual reports of the Tunisian Central Bank.

Table 6: effect the approved credits on relationship between key interest rate and Tunisian economic growth

	KIR		KIR*AC	
	coef	t-stat	coef	t-stat
Global economy	0.0994***	11.6077	0.418904***	11.7630
agriculture	0.1405***	3.21270	0.155661***	3.14491
industry	0.1944***	3.25687	0.013313**	2.34798
manufacturing	0.2530***	5.66084	0.145713***	5.21143
services	0.4897***	10.9323	0.193729***	11.6294

*, **, and *** denote significance respectively at 10%, 5% and 1%

The results for estimating equation (3) are reported in Table 6. In this table, we report the coefficients of key interest rate and its interaction with national and sector approved credits variables. The results show that the coefficients of key interest rate have always the same positive sign and significant. The rises of approved credits influence on the relationship between key interest rate and the economic growth. The coefficients of the interaction between key interest rate variable and approved credits variables are positive and statistically significant, this implies that the positive impact of key interest rate increases on national or sector growth is higher in cases of approved credits rises.

So with these findings, we can conclude that the monetary policies designed to reduce inflation should encourage banks to provide more investment and consumption credit to improve the economic growth of a country that is not the case in Tunisia, because, investment and consumption lead together to arise the economic growth rate.

3.3 Results based on Tunisian economic crisis

We examine now the effect of the national economic crisis on the relationship between key interest rate and the Tunisian economic growth. In particular, we test whether key interest rate changes exert different effects on national or sectors growth during the crisis. The regression model is presented as follow:

$$\begin{aligned}
 Y_t &= \alpha + \beta_1 K_{t-1} + \beta_2 L_{t-1} + \beta_3 CPI_{t-1} + \beta_4 KIR_{t-1} + \beta_5 KIR_{t-1} * crisis_{t-1} \\
 &+ \text{short term relationship}
 \end{aligned}
 \quad (4)$$

Where crisis is a dummy variable which equals 1 if the year is in global economic crisis and zero otherwise. We calculate the Tunisian economic growth rate as:

$$\begin{aligned}
 GDP \text{ Growt hrate} &= \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} \\
 \text{And} \begin{cases} crisis = 1 & \text{if } GDP \text{ growth rate} < 0 \\ crisis = 0 & \text{otherwise} \end{cases}
 \end{aligned}$$

Table 7 : Effect of Tunisian economic crisis.

	KIR		KIR*crisis	
	coef	t-stat	coef	t-stat
Global economy	0.11054**	2.42925	-0.711729***	-7.39651
agriculture	0.22506**	2.63344	-0.129027***	-3.57693
industry	0.10695***	3.92493	-0.072498***	-7.30339
Manufacturing	0.23299***	3.15874	-0.137726***	-8.06903
Services	0.49523***	3.52098	-0.376951**	-2.3717

*, **, and *** denote significance respectively at 10%, 5% and 1%

The results for estimating equation (4) are reported in Table 7. In this table, we report the coefficients of key interest rate and its interaction with national economic crisis dummy variable. We find consistent results with earlier analysis. However, the Tunisian economic crisis significantly influence on the relationship between key interest rate and economic growth. The coefficients of the interaction between key interest rate variable and national economic crisis dummy are positive and statistically significant. This result implies that the positive impact of key interest rate increases on national or sector growth become less important in the economic crisis period.

To put an end to such exceptional economic situation, the Tunisian central bank should react in two ways:

- Choose the best timing to decide the change of the key interest rate. This timing must necessarily be away from political pressure, without orders from the International Financial Institutions (IMF) and especially in a period of high economic growth rate and not in a period of economic crisis.
- Use unconventional monetary policy measures such as "quantitative easing", in order to overcome the failure of conventional instruments in controlling inflation and quickly return to the path of growth.

4. Conclusion

This paper is motivated by our lack of understanding of the monetary policies in developed and decisions taken by central bank in these countries. We analyze the effect of key interest rate on global and sector Tunisian economic growth by estimating the long term relationships given by VEC model.

Our results show that rises of key interest rate positively influence the Tunisian economic growth. Looking the separate effect on Tunisian sector, we find that the manufacturing and services sectors are the most influenced by changes in key interest rate and the agricultural sector is the most negatively influenced by inflation, direct consequence of increased key interest rate. These finding can be explained by the strong dependence of the first two sectors on banks and their granted credits, and all changes in monetary policy which necessarily influence their returns. The agricultural sector often remains the most fragile one in Tunisia which is much influenced by changes in its input prices.

Our key findings can be summarized as follow:

- The relationship between key interest rate and economic growth is negatively dependent on economic crisis. This timing of new monetary policy must necessarily without pressure of the International Financial Institutions (IMF) and without in economic periods crises.
- Encourage banks to grant the credits to take advantage in short and long term from changes in key interest rate.
- Use unconventional monetary policy measures in controlling inflation and support economic activity in the three sectors.

One direction for future research would be the empirical examination of the relationships between monetary policy uncertainty and economic growth in developing countries. We believe it would be of great interest for local and foreign investors and especially for the policy-makers to use the findings information.

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Appendix

Table 4: Residual covariance matrix

		Y	CPI	KIR	K	L
Global economy	Y	2.1251e-05	-4.272e-05	4.301e-05	2.6451e-06	5.6121e-07
	CPI	-4.272e-05	0.0037	-0.00049	-0.00014	-5.1413e-08
	KIR	4.3015e-05	-0.00049	0.0025	0.000012	2.5879e-05
	K	2.6451e-06	-0.00014	0.00012	0.000106	1.72341e-06
	L	5.6128e-07	-5.141e-08	2.587e-05	1.723e-06	1.3481e-06
Agriculture	Y	0.0005155	-8.9149e-06	5.8636e-05	0.000168	4.393e-09
	CPI	-0.0008914	0.00392	-0.00137	-2.7944e-05	1.49241e-05
	KIR	5.8636e-05	-0.001378	0.00274	0.00018	2.45994e-05
	K	0.000168	-2.7944e-05	0.00018	0.00060	8.8285e-06
	L	4.3939e-09	1.49241e-05	2.4599e-05	8.8285e-06	1.3672e-06
Industrial	Y	8.33e-07	-2.5375e-05	6.29e-05	6.640e-05	4.99e-06
	CPI	-2.537e-05	0.0041157	-0.0004	-0.000210	-1.011e-05
	KIR	6.2956e-05	-0.00040	0.00244	0.00011	1.221e-05
	K	6.640e-05	-0.000210	0.00011	0.00014	2.038e-06
	L	4.99e-06	-1.0131e-05	1.2211e-05	2.038e-06	1.176e-06

Manufacturing	Y	5.1594e-05	0.000145	3.7471e-05	5.656e-05	5.7258e-06
	CPI	-0.000145	0.00377	-0.000728	-0.00031	-2.2657e-05
	KIR	-3.7471e-05	-0.000728	0.00287	-8.73190e-06	2.8146e-05
	K	5.6562e-05	-0.00031	-8.7319e-06	0.00016	4.49942e-06
	L	5.7258e-06	-2.265e-05	2.8146e-05	4.4994e-06	1.474e-06
Services	Y	2.2621e-05	-3.3272e-05	5.5605e-05	0.000264	9.228e-07
	CPI	-3.3272e-05	0.0054	-0.00049	-1.93e-06	-2.316e-05
	KIR	5.560e-05	-0.00049	0.000235	2.936e-05	1.8742e-05
	K	0.000264	-1.93e-06	2.936e-05	1.571e-05	3.394 e-06
	L	9.228e-07	-2.316e-05	1.874e-05	3.394 e-06	1.286e-06

