Impact of the Central Bank Independence and the Free Lunch Hypothesis: A Case Study of the Bank of Algeria

Nadine SALAH[1,*]

[1] University of Algiers 3(Algeria), (Salah.nadine@univ-alger3.dz)

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Summary: This study has two main objectives. First, investigating the relationship between the Bank of Algeria's real independence, as measured by the TOR indicator, and the general price index as a representative of the main objective of the Bank of Algeria, price stability. Secondly, testing the free lunch hypothesis in the Algerian case. The results showed on one hand that the Bank of Algeria's real independence has a significant impact on the general price index, on the other hand we also prove that an improvement in the Bank of Algeria's independence impacts the general price index without causing a decline in growth, which aligns with the free lunch hypothesis.

Keywords: Inflation, Central Bank Independence, Index of the Central Bank independence, Bank of Algeria.

Jel Classification Codes : E31, E58, C43.

* Corresponding author.

I-Introduction:

There was a shift in how the role of central bank independence was perceived starting from the seventies, where very high levels of inflation were observed. Many countries began to give more independence to their central banks, adopting the idea that more independence would free the central banks from political pressure and solves the problem of time inconsistency (Boumol & Blinder, 2009, p. 264) leading it to be more effective in achieving its objectives in general and lowering inflation in particular.

The Bank of Algeria, like many others, gained independence in recent decades, beginning in the 1990s, when the 90-10 Law on Money and Credit was passed. Indeed, this law freed the Bank of Algeria from its role as a mediator to generate the necessary financing for huge public investments in the era of centralized planning. The years that followed these changes were marked by a significant drop in inflation, from a two-digit number at the beginning of this period to a single-digit number in 1997. This led us to the following questions: What is the degree of autonomy of the Bank of Algeria? How to measure this independence? And does this affect the anti-inflation policy?

I.1. The relation Between the central bank independence, the transparency and credibility of monetary policy:

With the expansion of the independence of central banks there is more focus on the transparency of the latter to enhance both its responsibility and credibility on one hand, and to guide the expectations in the financial market on the other. There is no consensus about the transparency of the central bank definition, but it can be divided into five points as follow **(Crow & Meade, 2008, p. 9)**: political transparency which relates the relationship between the executive and the central bank, economic transparency which has to do with releasing economic information that allows the evaluation of its decisions by the private sector, transparency about its decisions making, known as procedural transparency, policy transparency which refers to the release of information about the monetary policy and if this information released immediately and finally, operational transparency that covers the issue of the transmission of policy decision in practice.

The credibility of the central bank allows solving the problem of inflation bias, and its independence is simply a tool to achieve this credibility. Indeed, the central bank builds its credibility by enhancing its reputation, through strengthening its independence, responsibility and transparency.

The credibility of the central bank is defined as the possibility to affect people's expectations when they are confident in its ability to achieve its goals **(Boulenouar & Fekir, 2012, pp. 7-12)**. The most important conditions to achieve this credibility are **(Gourdon, 2006, p. 346)**:

- Consistency of monetary policy objectives;
- Necessary objectives with significant costs if not achieved;
- Transparency that allows to guide the expectations of economic agents;
- Favor a monetary rule rather than a discretionary policy;
- Put at the head of the central bank someone who has an aversion to inflation;
- Using punishment in order to oblige the governor to respect the promises of the monetary policy, as applied in New Zealand.

In this respect we have to point out the so called paradox of credibility. In this case a low rate of inflation for a long period pushes the economic agents to have too much confidence in the capacity of central bank in achieving its objectives. This behavior can, in the term, cause bank crises, speculation in the financial and real estate markets, which will eventually cause a change in asset prices and lower the general price level.

I. 2. Central bank independence and inflation targeting:

Many studies have examined the relationship between central bank independence and the effectiveness of the inflation targeting policy. The conclusions do not always go in the same direction. There is no consensus on the existence of a relationship between central bank independence and more effective inflation targeting policy. Some economists argue that the independence of the central bank is essential to the success of the inflation targeting policy, as it frees the central bank from political pressure. Obtaining this independence would help create important conditions for this policy. Those conditions are: making price stability the main objective of monetary policy and strengthening the credibility and accountability of the central bank. other economists do not agree with this point of view. They believe that it is possible to improve the targeting of inflation in countries where the central bank's independence is weak. In the case of strong central bank independence, the credibility associated with adopting inflation targeting would no longer be necessary. On the other hand, the weak independence of the central bank means that the condition of a successful monetary policy is not fulfilled. Therefore, inflation targeting would help to meet these conditions and strengthen the independence of the central bank.

The adoption of inflation targeting would help to improve the independence of the central bank as long as price stability remains the main objective of monetary policy, thus reducing the pressure exerted by the authorities in favor of an expansionist policy. In general, legislative changes to the process of adopting inflation targeting reinforce the central bank's legal independence. (Alpanda & Honing, 2014) examined the relationship between the effectiveness of inflation targeting policy and the independence of the central bank in developed and developing countries. The results showed that the positive effect of the inflation targeting policy was stronger in countries with less independent central banks. Indeed, monetary policy can be improved further by improving independence. These results also showed that countries with less independent central banks should not wait for greater independence before adopting inflation targeting. In this context, some explain the growing independence of central banks in African countries by the pressure exerted by international investors to ensure that these countries adopt a policy of targeting the correct inflation (Ben Ltaif, 2016, p. 180).

I. 3. Literature Review:

There are suggestions to avoid the time-inconsistency problem put forward by (Kydland & Prescott, 1977), It consists of the non-respect of the promises made by the monetary authorities which could be tempted to surprise economic agents to improve the growth rate. One of the suggestions made to avoid the time-inconsistency problem is to adopt a monetary rule to improve the credibility of the central bank. But the model based on monetary rules can’t deal with unpredictable economic crises. Another alternative consists of improving the central bank’s independence. Theoretically, lowering political pressure would reduce the inflation rate without a decline in growth which is known as the free lunch hypothesis (Mourougane, 1997, p. 27).

One of the studies that investigated the relationship between the central bank’s independence and the level of inflation concerning the potential effect on growth is the one made by (Sylvester, Schaling, & Hoeberichts, 1988). It included twenty industrialized countries and showed that the independence of the central bank lowers the medium and the volatility of the inflation rate but doesn’t affect the medium and the volatility of the real growth rate in the short and the long run. (Brumm, 2011) had the same results after studying the case of forty-two countries. He concluded that there was bilateral and negative causation between inflation and the central bank’s independence. On the other hand, (Agoba, Abor, Osei, & Jarjisu, 2017)concluded that the independence of the central bank is a necessary condition but not a sufficient one for an effective monetary policy. According to the authors, the necessary conditions for an effective monetary policy are a developed financial market that allows the transfer of the impact of the interest rate changes to the economy, efficient institutions that enhance political authorities, and political stability that enhances the credibility of the monetary authorities. The study covers forty-eight African countries, including Algeria, which were compared to forty-eight developed countries and one hundred and seventy-seven developing countries. The results showed that the central bank independence wasn’t a sufficient condition to lower inflation in the African countries and the developing countries, in contrast with the developed countries where there are efficient financial markets and strong institutions.

According to (Eggertsson & Le Borgne, 2004) giving more independence to the central bank and giving a long-term tenure to governors make the latter exert more effort to implement a more effective monetary policy, and it reflects improved forecasts and reduced errors. The authors insist on the difference between the independence with regard to the choice of the instruments and the independence that concerns the choice of the objectives. The first improves the well-being of society while the second focuses on the majority of the current generation at the expense of the majority of the future generation and enhances the positions of politicians. The model of this study also showed that implicit incentives (attention to career prospects) are more effective than explicit incentives that may be in the form of a financial reward, for example.

(Ben Ltaif, 2016)was interested in studying the relationship between the independence of the central bank and the use of non-conventional monetary policy in a period of crisis. The study concerned three groups: developed countries, developing countries, and the G5 group. The results showed that the level of independence of the central bank is not linked to the use of the non-conventional monetary policy.

The measure of the central bank independence is based on a range of criteria, which can be divided into two main parts known as organic independence and functional independence (Petit, 1992, pp. 22-23). The conditions included in the organic independence concern appointment of decision-makers and their mandates like: how the governor is appointed, the length of his mandate, and the extent of intervention by political authorities in the decisions of monetary authorities. On the other hand, functional independence has conditions that had to do with the objectives of the central bank, its ability to conduct the monetary policy, and its financial independence. Quantifying the level of independence of a central bank is not an easy task, because even if the legislation gives an idea about this independence it is not sufficient since other factors can interfere. Those factors can include the personality and the experience of the decision-makers, along with the possibility of the implication of the central bank in the government decision making, because of the valuable information that the central bank, can have, and in which case will improve its independence and make achieving its goals easier. Indeed, when we compare the different indicators of the central bank's independence and all the factors that could have an impact on the said independence we realize that those indicators don't take into account all the factors.

There are other difficulties besides quantifying the independence of the central bank. The studies that investigate the impact of the central bank's independence need to take into account a sufficiently long period. This will give a better understanding of the relationship between the variables and will allow more clarity of the effect of some changes in legislation that take a long delay (Santiago, 1996, p. 25). Another problem that could be faced is that the indicators used in the case of developed countries are not appropriate for developing countries. The simplest definition of central bank independence is legal independence, and it is the one that is used the most. But in the case of developing countries, legal independence doesn't always correspond to real independence. The most used indicator, in this case, is the turnover Rate TOR, which shows the changes in the governorship of the central bank, and it takes the value of "0" in the absence of change and the value of "1" when there is a change. Unlike legal indicators, this indicator has a positive relation with the inflation rate. Attention should also be paid to the interpretation of this indicator because the rise in the inflation rate could be due, either to political factors leading to an increase in the frequency of governor changes or following a sanction when the objective is not achieved.

(Aguir, 2013) studied the relationship between the central bank independence and the level of inflation using the TOR indicator for both developed and developing countries including Algeria. The author concluded that the central bank's independence is a necessary but non-sufficient condition to lower the inflation bias, i.e when individuals expect that the central bank will not respect its engagement. The results showed, also, that there is a negative but insignificant relationship between the independence of the central bank and the growth rate, which confirms the free lunch hypothesis. (Chigui, Boujelbene, &Mhamdi, 2011) also studied the relationship between inflation and the central bank's real independence using the indicator TOR. The results concerned forty developing countries, including Algeria, showed that there is a positive but non-significant relation between the two variables, which led the author to conclude that there are other economic variables that have more impact on inflation than that of the central bank independence.

(Crow & Meade, 2008)emphasize the importance of using the TOR indicator as well, to take into account, the difference between the developed and the developing countries. Besides, the problem of omitted variables, which can cause a bias towards the hypothesis that states that there is no relation between the rate of inflation and the independence of the central bank. The conclusions of the study were that: there is an improvement of the central bank independence from the eighties when the indicators of this independence were first used, there is a negative relation between the rate of inflation and the independence of the central bank. The improvement in transparency isn't great except for the developed countries. This improvement has a positive relationship with both central bank independence and the elasticity of the exchange rate.

The studies about the relationship between inflation and the independence of the central bank are often criticized; because a correlation doesn't mean that there is necessarily a relation of causation. The relation between the central bank and the government is a complex one. Different aspects need to be taken into account, like the role of the government in the nomination of the central bank's decision-makers, how much does the government interfere in the decision making process, the independence of the central bank's budget, the condition of the government borrowing from the central bank and how the objectives of the monetary policy are set. The central bank's independence is not only affected by political factors, it can also be affected by the economic environment since the changes in the internal and external markets can exert pressure on the monetary authorities.

(Temple, 1998) emphasizes, for his part the problems that the unusual values could cause in the big samples including the studies on the developing countries, and that measuring the effect of the independence of the central bank on inflation can be very sensitive in countries with high inflation. In his view, considering the independence of the central bank as an exogenous variable can be problematic, because there could be a third variable that can cause both the inflation rate and the independence of the central bank like the power of voters opposed to inflation (Walsh, 2005, p. 7).

(Posso & Tawadors, 2013) used a different econometric approach known as latent variable or covariance structure analysis which takes the existence of measurement errors directly into account, and which doesn't rely on the indicators of the independence of the central bank as a perfect measurement of the latter. The results confirmed a negative relationship between the central bank's independence and the inflation rate.

(Arnone & Romelli, 2013) also used a different approach by relying on a dynamic indicator of the independence of the central bank. They studied a group of ten developed countries and concluded that the changes in the central bank independence influence the inflation dynamic by influencing the expected inflation, plus the confirmation of a negative relationship between the inflation rate and the central bank independence.

More recently (Elgin, Yalaman, Yasar, & Basbug, 2021, p. 6) investigated whether the central bank independence is associated with economic policy responses to mitigate the adverse economic effects of the COVID 19 current pandemic. Their results showed that the cuts in policy rates and reserve requirement ratios were more limited in countries with higher central bank independence. And that counties with more independent central banks adopted larger fiscal and macro-financial packages. In a cross-country analysis that included Algeria.

Other authors indicate that the absolute independence of the central bank could have a bad impact on its accountability. On the other hand, inflation stability isn't the only objective of the monetary policy. This is why they call for the determination of the objectives by the government. According to (Capoen, 1994), there are some risks associated with the central bank's independence. In a model of a closed economy, the joint efforts of both the governments and the monetary authorities could result in a non-optimal equilibrium, with a high increase in the interest rate and the budget deficit, because the two policies do not go in the same direction. Giving all the power to the central bank contains a risk of this later being biased against inflation. On the other hand, the rising interest rate could lead to unwanted results by increasing the cost of financing firms, lower their revenue and ability to invest and produce, which in term could lead to a rise in inflation. In an open economy, on the other hand, giving the financial policy the objective of the stimulation of the economy and the monetary policy the objective of price stability could lead to a rise in the exchange rate and budget deficit. Finally, the monetary policy is considered as a source of conflict between countries. Close coordination is needed and the independence of the central bank makes this coordination harder. This makes the monetary policy less effective in the context of international crises.

A couple of studies took interest in the specific case of the Bank of Algeria. (Ould Hennia, 2016/2017, p. 137) for example, calculated an indicator of the transparency of monetary policy in Algeria and examined its relationship with the inflation rate. The following aspects were taken into account when calculating this indicator: political aspect, economic aspect, procedural aspect, monetary policy, and the practical aspect. The results showed that there is an improvement in the Bank of Algeria's transparency, which went from 3 points in 1990 to 9 points in 2014 after the reforms in the cash and bank field. (Azzouz, 2008) also investigated the legal independence oh the Bank of Algeria, and this as stipulated in the Money and Credit Law on one hand, and under the amendments of the Presidential Order 03-11on the other. The criteria taken into account consisted of the nomination of the decision-makers, monetary policy formulation, monetary policy objectives, and the government lending limits. The results led to the conclusion that the independence of the Bank of Algeria is about 0.49 according to the money and credit law, and about 0.46 according to the amendments of the Presidential Order 03-11. This means that there is a small decline due mainly to the change in the term of office of the governor that wasn't stipulated in the Presidential Order 03-11 while it was set as 6 years according to Article 22 of the money and credit law. At last (Boulenouar & Fekir, 2012) investigated whether there was an improvement in the credibility when there is an improvement in the independence in the case of the central banks of Tunisia, Morocco, and Algeria. The result showed that the Bank of Algeria was the least independent, with a legal independence indicator that was about 1/8. On the other hand, the negative correlation between the independence of the Bank of Algeria and the rate of inflation was not observed. However, the results concerning real independence were different indicating the difference between real and legal independence, and the free lunch hypothesis wasn't confirmed in the case of Algeria.

I. 4. The independence of the Bank of Algeria:

The central bank's independence (at least the legal one) changes when there is a change in the legislation, and the Bank of Algeria has known several legal amendments. In this part, we will go through each of them and discuss their effect on the independence of the Bank of Algeria.

The day after the independence, Law No. 144-62 of 13/12/1962 provided the Algerian Central Bank considerable independence during the period following its emergence. However, and following the Finance Act of 1965, it was obliged to grant advances and loans without conditions or restrictions to the treasury. Changes in its independence began in the eighties with the adoption of the Bank and Credit Act 86-12. This law has restored its traditional functions, including that of the Bank of banks. However, these legal gains have often been limited. The constraints led to the emergence of the Bank Independence Act 88-06 which strengthened the role of the Central Bank in the conduct of monetary policy, in addition to being considered a commercial entity subject to the principles of independence and balance of accounts.

The adoption of the money and credit law 90-10 allowed a significant positive change concerning the independence of the Bank of Algeria. This law, which derived the most important principles from the ideas of the 1986 and 1988 laws, defines the Bank of Algeria as "a national institution with moral personality and financial independence" (Azzouz, 2008, p. 11), and the main points of this law about the independence of the Bank of Algeria can be summarized in the following points: (Maamri & Yahyaoui, 2017, pp. 65-66))Law No. 90-10 related to money and credit 19 ،Ramadan of 1410 corresponding to 14 April of 1990(

- The Bank of Algeria and the financing of the budget deficit: There is always a risk of financing the budget deficit by the central bank in the absence of the necessary laws to limit it. The government can finance its deficit automatically in the case of Algeria, and loans granted to the government are not at market rate but at a lower rate. All this does not serve the independence of the Central Bank except for the requirement of the amount and the deadline. According to article 46 of this law, this amount should not exceed 10% of the gross domestic product, and for a period that does not exceed 240 consecutive or non-consecutive days during the same year. The Bank of Algeria can also intervene in the money market to buy and sell public bonds maturing in less than six months, but in no way can these transactions be carried out for the treasury or for the groups that issue these bonds.
- The nomination of central bank's decision-makers: The Governor of the Bank of Algeria and his deputies are appointed by decree of the President of the Republic under Articles 20 and 22 of the above-mentioned Law. Their terms of office have been set at 6 years for the governor and 5 years for the vice governors, with the possibility of re-renewal once. The Governor and his deputies are removed by a decree issued by the President of the Republic in cases of legally proven health problems or gross error.
- The powers of the Bank of Algeria: The government consults the Governor on the issues relating to cash or credit. The Bank of Algeria also represents the government and participates in negotiations. The project of regulations prepared for release is reported to the minister of finance within two days of the approval of the council of the Bank of Algeria. The Minister is entitled to request its amendment and shall inform the Governor within three days.

- Government authority on the Bank of Algeria budget: The initial capital of the Bank of Algeria consists of an allocation that the State fully byes, and which is determined by law.
- Setting and implementing the monetary policy: The government makes monetary policy decisions but advises the Bank of Algeria, which has the last word on the issues outlined in the law as the central bank's objectives.
- The objectives of the monetary policy: There were multiple objectives for the monetary policy, according to this law, even if the Bank of Algeria emphasized practically the goal of price stability. Those objectives, according to article 55 of the above law were: the regular growth of the national economy, the development of all national productive capacities, and internal and external stability of the currency.
- The fact that the Banking supervision is one of the tasks of the Bank of Algeria under Article 62 of the Money and Credit Law, and that it is the Bank of Algeria that determines the rate of re-discount, is a good index for its independence.

The money and credit law has known several changes, the first being the decree No. 01-01 of 2001. The Money and Credit Commission was divided under this amendment allowing for the emergence of two independent structures: The money and credit Council, which represents the monetary authorities, and the administrative board that manages the Bank of Algeria. These changes have reduced the independence of the Bank of Algeria by allowing the government to manage the monetary policy since its officials have the majority in the council. In addition, this amendment did not specify the term of office of the governor and the reasons for his dismissal and the dismissal of his deputies, which reduces the independence of the Bank of Algeria.

The same is true for Presidential Order No. 03-11 of 26 August 2003, which did not refer to the term of office of the Governor and his deputies in Article 13. Among the other amendments issued in this matter are those about the formulation, supervision, follow-up, and evaluation of the monetary policy, which became part of the powers of the Money and Credit Council through Article No. 62. These changes improve the independence of the Bank of Algeria compared to what was indicated in the Money and Credit Law, which did not give sufficient powers to the Bank of Algeria in the formulation of monetary policy. Concerning the objectives of monetary policy, it was emphasized in Article 35 to achieve rapid growth of the economy while ensuring internal and external stability of the currency)Ordinance No. 11-03 relating to cash and credit 27 ،Jumada al-Thani of 1424, corresponding 26 of 2003(. We note here that the operational objective that appeared in the Money and Credit Law, and which is inconsistent with the price stability objective, has been removed, thus improving the independence of the Bank of Algeria. The same conditions were maintained for loans granted to the Government in March 2003, plus exceptional advances for the management of the external debt, which force the Bank of Algeria to manage the public debt and has a negative impact on its independence.

The order 10-04 of 26 August 2010 amended and supplemented the Order 03-11 and changed the objectives of the monetary policy. It states that: “The mission of the Bank of Algeria is to ensure price stability as one of the objectives of monetary policy and ... for the rapid growth of the economy while ensuring monetary and financial stability”)Ordinance No. 04-10 relating to cash and credit 16 ،of Ramadan 1431 corresponding to August 26 of 2010(. This shows the emphasis on the goal of price stability, which is seen as positive for the independence of the Bank of Algeria.

The economic conditions and the crisis experienced by the Algerian economy following the drop in oil prices at the beginning of 2014, led the public authorities to take a series of measures that increased the dependency of the Bank of Algeria on the treasury and negatively affected its independence. Indeed, article 45 of the amendments made by Law 17-10 of October 2017, which came to supplement Decree No. 03-11 corresponding to the 2003 Law on Money and Credit states that the bonds issued by the Treasury can be directly bought by the Bank of Algeria (www.Bank-of-algeria.dz), which is part of the policy adopted by the later in order to face the crisis after the failure of internal borrowing.

II– Methods and Materials:

As mentioned earlier the legal independence gives us a good idea about a central bank’s independence even if doesn’t necessarily represent its real independence, especially in developing economies like Algeria. Many studies try to quantify the legal independence of the Bank of Algeria via several indicators, and then investigate the relationship between this independence and the inflation rate. The general conclusion from these studies is that there is a decline in the independence of the Bank of Algeria, even if there is an improvement in its transparency. Like most of the developing countries, this does not necessarily reflect real independence because the independence given by the legal texts is not always translated into reality. So, most of the indicators based on the legal texts are ineffective in expressing the Bank of Algeria's independence.

In order to study the relationship between the general price stability as the Bank of Algeria's main objective and the real independence of the Bank of Algeria, we construct a dummy variable (TOR) that represents the changes in the governor of The Bank of Algeria. This variable is a proxy for the real independence of the Bank of Algeria. Note here that it is different from the turnover rate that is represented usually by an average of the changes in a given time period, which can't be used in our case because our time series aren't long enough. Our variable takes a value of one (1) when the Governor is changed and zero (0) when there is no change. The Governor of the Algerian central bank has changed eleven times since 1962, and seven times during the study period 1990 Q2-2022 Q3. We also gathered quarterly data from ONS (l'officenationale des statistiques) and the Bank of Algeria's dataset, covering the period 1990 Q1 - 2022 Q3 for our dependent variable the general price index (IPC).

Table (1): Governors of the Bank of Algeria and their term of office.

The Governor	Term of office
MrSeghir MOSTAPHAI	**28/12/1962-30/06/1981**
MrMahfoud AOUFI	**01/07/1981-31/10/1982**
MrRachid BOURAOUI	**01/11/1982-30/11/1989**
Mr Bader-Eddine NOUIOUA	**01/12/1985-16/10/1989**
MrAbderrahmaneRoustoumi HADJ NACER	**17/10/1989-21/06/1992**
MrAbdelouahab KERAMANE	**22/06/1992-05/31/2001**
Mr Mohamed LEKSACI	**02/06/2001-31/05/2016**
Mr Mohamed LOUKAL	**31/12/2016-20/04/2019**
Mr Ammar HIOUANI	**20/04/2019-14/11/2019**
MrAymane BENADBERRAHMANE	**14/11/2019 -09/2020**
MrRosthom FADLI	**09/2020 - 05/2022**
Mr Salah-Eddine TALEB	**05/2022 – until this day.**

The source :Bank of Algeria, https://portail-banques-dz.com, the official journal.

III- Results and discussion:

To test our hypothesis, which is whether changes in the Bank of Algeria's Governor have an impact on the general price index (IPC), We use the one factor analysis of variance. Which is a special case of analysis of variance (ANOVA), for one factor of interest, the change of the Governor versus no change in our case. To do so we first need to make sure that the necessary conditions are met: (1) that the dependent variable (IPC) is normally distributed which is tested by running the **Jarque-Bera** test, and (2) that the variances are homogeneous which is tested by the **Bartlett test**. The **Jarque-Bera** test shows that IPC is normally distributed, the null hypothesis that states that the series is normally distributed is accepted since the p-value obtained 0.2 is much greater than 0.05. And the p-value obtained by running the **Bartlett test** 0.6 also pushes us to accept the null hypothesis which in this case states that the variances are homogeneous.

After we made sure that all the conditions are met we proceed with the estimation of our model. The are analysis of the model as it is represented below does not interest us, since we not looking for the analysis of the change in IPC in the case of a change in the Governor versus the case of no change. We are rather trying to know if changes of the Governor have an impact on IPC, and we answer this question by testing the following null hypothesis: the means are the same in the two cases (change and no change), and we do so by analyzing the Fisher statistic.

IPC = 48.44*TOR + 121.80
F statistic 4.876804
Prob (F-statistic) 0.028986

The P-value of the F statistic 0.03 is inferior to 0.05 which leads us to decline the null hypothesis. This means that the means are significantly different in the two groups (change in the governor, and no change in the governor), which translates to the conclusion that the changes in the Governor does in fact have an impact on the General price index according to the ANOVA test.
Not all economics agree with the hypothesis that are at the bases of the central bank independence economic model. (Steiner, 2003, p. 106) for example states that if you want to regulate the inflationary pressures you shouldn't pay attention only to the Central Bank and the financial system, but pay more attention to the importance of the level of collective bargaining. they emphasized specially on the Bundesbank case which is widely cited in the traditional central bank independence economic model. In their opinion the effectiveness of the Bundesbank's policy if effectiveness there is, is not due to the increase in its independence or its reputation, but rather to the implementation of instruments of political control of collective bargaining in Germany from 1974. However the idea that the central bank independence is only one of the several institutional devices for ensuring price stability is clearly discussed in the economic literature, as denoted in (Alex Cukierman, 1992, pp. 372-383) who developed the turnover rate of the central bank governor as an indicator of actual central bank independence, and whose work is the bases of most studies regarding the subject of real central bank independence . They studied the importance of the said indicator in explaining variations of inflation in both developing and industrial countries, and concluded that it is highly significant in developing counties .Our results concerning the Algerian case align with the findings of the vast majority of literature regarding central bank independence in developing countries, and with those of (Alex Cukierman, 1992).

Confirming the significant impact of the bank of Algeria's real independence on the general price index arises another question regarding the free lunch hypothesis, which states that lowering political pressure and increasing a Central Bank's independence would reduce the inflation rate without causing a decline in growth. In order to test this hypothesis, we apply the same methodology as before. To do so we use data concerning the growth rate (GDPG) calculated from gathered quarterly data from the Bank of Algeria's dataset on the gross domestic product (GDP), covering the period 1990 Q1 - 2022 Q2.
To be able to proceed with the ANOVA model we must first test for the series normality using the **Jarque-Bera test**. Unfortunately, the results show that the GDPG series is not normally distributed. Indeed, the P-Value obtained 0.0 is way below the 0.05 mark, which pushes us to decline the null hypothesis. This means that the ANOVA model is invalid in this case.
To counter this problem, we use a non-parametric test, the **Kruskal-Wallis test** which relies on the rank-ordering of data rather than calculations involving means and variances. This test determines whether samples come from the same population or if at least one sample (in the case of more than two samples) comes from a population different from the others. The null hypothesis being that the samples, change in the Governor of the Bank of Algeria versus no change in our case, are the same. We obtain a P-value of 0.06 superior to 0.05, which drives us accept the null hypothesis and therefore conclude that the samples are the same. In our case this translate to the fact that the real independence of the Bank of Algeria, represented by the TOR index, has no significant impact on growth. This contrasts with the conclusions of (Boulenouar & Fekir, 2012) who compared the growth rate before and after the Bank of Algeria's independence and noticed a decline, but aligns with the free lunch hypothesis. In conclusion the real independence of the Bank of Algeria has a significant impact on the general price index, but does not have a negative impact on growth.

IV-Conclusion:

There is a growing interest in the subject of central bank independence, because of its impact on the performance of the monetary policy and its ability to meet its objectives in general, andthe price stability objective in particular. Studies concerning the Bank of Algeria have shown that there is a decline in its independence, even if there is an improvement in its transparency. Like in most developing countries, legal indicators do not necessarily reflect real independence, because the independence given by legal texts isn't always translated on the ground, making most indicators based on legal texts ineffective in expressing the independence of the Central Bank.

In order to investigate the effect of the independence of the bank of Algeria on inflation on one hand, we use the ANOVA test, and estimate a model with a dummy variable based on the TOR rate as an indicator of the real independence of the Bank of Algeria. Our estimation results showed that the changes in the Governor has a significant impact on the General price index according to the ANOVA test. This means that the real Bank of Algeria's independence has in fact an effect on the General price index, which aligns with the general findings of the economic literature and the findings of (Alex Cukierman, 1992). On another hand the use of the **Kruskal-Wallis test** showed that the free lunch.

- Appendices:

Estimation output for the ANOVA model:

Dependent Variable: IPC
Method: Least Squares
Date: 03/24/23 Time: 22:45
Sample (adjusted): 1990Q1 2022Q3
Included observations: 131 afteradjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TOR	48.44605	21.93768	2.208349	0.0290
C	121.8092	5.071122	24.02017	0.0000

R-squared	0.036428	Meandependent var	124.3979
Adjusted R-squared	0.028958	S.D. dependent var	57.30545
S.E. of regression	56.46963	Akaike info criterion	10.92043
Sumsquaredresid	411357.6	Schwarz criterion	10.96433
Log likelihood	-713.2883	Hannan-Quinn criter.	10.93827
F-statistic	4.876804	Durbin-Watson stat	0.080092
Prob(F-statistic)	0.028986		

Bartlett ,Jarque-Bera, and Kruskal-Wallis tests:

varible	test	Test-statistic	P-value
IPC	Jarque-Bera	3.56189	0.05912
	Bartelett	2.87681	0.23730
GDPG	Jarque-Bera	33.48094	0.00000
	Bartelett	0.34832	0.55506
	Kruskal-Wallis	3.4247	0.06423

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