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ABSTRACT

Capital account liberalization and exchange rate regime choice, what scope for flexibility in Tunisia?

This study evaluates within a game-theoretic framework the exchange rate regime from a welfare perspective. In a tradable-nontradable goods model framework, Tunisia's exchange rate regime choice is cast in terms of strategic interactions between the monetary authority and domestic enterprises. The monetary authority is assumed to choose an optimal exchange rate regime according to a welfare-related criterion by minimising a loss function defined in terms of external competitiveness and domestic inflation. Simulations outcomes reveal that capital account liberalization in the Tunisian economic context is compatible with a flexible exchange rate regime.

Key Words: *Exchange rate regime, Liberalization, Convertibility, Capital Account, Welfare, Tunisia.*

JEL Classification: *F31, F32, F37, F47.*

1. Introduction

The problematic of the choice of an optimal exchange rate regime was the subject of an old debate in international economics since the precursory and seminal papers of Mundell (1961), McKinnon (1963) and Kenen (1969), and the contributions of Crockett and Nsouli (1977), Dreyer (1978), Heller (1977, 1978), Holden and alii. (1979), Melvin (1985), Wickham (1985), and Honkapohja and Pikkarainen (1994) among others.

As Schor (1997) shows, this debate has never been closed.[1] In the last few years, the question attended a renewed interest for the emergent market economies particularly with Bailliu and Murray (2003), Chang and Velasco (2000), Edwards (1993, 1996, 2001), Edwards and Savastano (1999), and Williamson (2000), etc.…

Although this question arises for all the economies, it's of particular relevance for the emergent economies. These economies face a very unstable monetary and financial international environment characterized by a strong integration of the financial markets and a high volatility of capital flows. Which choice as for the exchange rate regime that these economies in search of a certain economic stability will make?

This question is of a particular importance as it conditions the whole economic policy of these countries; safeguard their competitiveness, their stability and consequently their economic growth.

Reflecting the differences in the levels of economic and financial development, no exchange rate regime can be prescribed in a uniform way for all these countries (Frankel, 1999).[2] Consequently, remain to choose the optimal degree of flexibility compatible with the economic conditions and orientations of the country.

[1] Schor (1997)," *Changes fixes ou changes flottants : un débat jamais clos* ".
[2] Frankel(1999), "*no single currency regime is right for all countries or at all times*".

Our objective within this paper is to study the choice of an optimal exchange rate regime for Tunisia. Our purpose consists in evaluating the impact of this choice on the welfare of the monetary authorities in particular the external competitiveness and inflation. Three sections are envisaged: we begin by presenting the various variants of exchange rate regimes as well as their respective characteristics (the Second section). In the third section, we examine a model for the Tunisian economy from which the simulation will allow us to shed critical lights on Tunisia's optimal exchange rate regime. The last section concludes the paper.

2. Exchange rate regime choice, a brief survey of the literature

Traditionally, we distinguish two types of exchange rate regimes: the fixed and the floating exchange rate regimes.

We mean by the fixed or pegged exchange rate system any regime in which the monetary authority, in this case the central bank intervenes without limit to buy and sell its currency against other currencies to a predefined rate.[3]

Drawing a clear demarcation line between fixed and flexible exchange rate regimes is not an easy task. In fact, as the official rates of intervention of the Central Bank on the exchange rate market, by the purchase and sale of the national currency against other currencies widen, the regime approaches a free float. In a floating regime, the nominal and real exchange rates are endogenous variables determined by the market forces according to the demand and supply. In the framework of this regime, the monetary authorities have no commitment to a desired trajectory of the exchange rate and consequently do not practice any intervention to guide this trajectory hence the autonomy of the monetary policy. Thus it's interesting to know the property and the comparative merits of every exchange rate system.

[3] In the Bretton Woods system, the exchange rate of the Dollar had a margin of fluctuation of + /- 1% around a central parity. In the case of the European monetary system of before August 1993, the fixed bilateral rates had a margin of fluctuation of + /- 2.25%.

One attributes to the fixed exchange rate regimes two principal virtues: the monetary discipline and the capacity for promoting international trade and investment. Two principal virtues are also attributable to the flexible exchange rate regimes which are: The autonomy of the monetary policy and the automatic adjustment to shocks.

Beyond the traditional fixed-flexible dichotomy, the recent literature distinguishes a variety of exchange rate regimes between these two polar cases of pure float and absolute fixity, classified by a decreasing flexibility order: the independent float, the lightly managed float[4], the managed float, the crawling broad band regimes, the crawling narrow band regimes, the crawling pegs, the pegged within bands regimes, the conventional systems of fixed parities[5], currency boards and currency union/dollarization, and the regimes of countries that have no distinct official legal tender[6].

The choice criteria of an exchange rate regime traditionally suggested in the literature, which are usually related to the economic characteristics of a given country, are originating in most of the theory of the optimum currency area. The majority of the empirical studies attach themselves to verify the validity of these criteria in the exchange regime choice. Other factors, rarely tested in literature can also interfere in the decision process of the choice of an exchange rate regime. Thus the choice of an optimal exchange rate regime will depend on: the size of the country, its level of economic and financial development, its degree of openness to trade and to financial flows, the structure of its production and exportations, its inflation history, the inflationary temptations of the government, the nature and the source of the shocks, the position of its terms of trade and current account balance, the level of its exchange reserves and the mobility of the capital account, the

[4] Contrary to an independent float regime, within the framework of a managed float, the authorities can intervene on the exchange market in the only objective to lessen the excessive fluctuations of the exchange rate and not to defend a zone or a given level of the exchange rate.

[5] The country pegs (officially or de facto) its exchange rate, at a fixed rate, to a stable currency or to a basket of currencies.

[6] In this case, another monetary unit is the legal tender in the country, or the country is a member of a monetary union or of a cooperation monetary mechanism having adopted a common currency that has legal course in each of the member nations.

flexibility of its fiscal policy, as well as the preferences of the political decision-makers in the arbitrage between different economic policy objectives.

As Frankel (1999) asserts, "*no single currency regime is right for all countries and at all times*". The choice will depend rather on the relative weight granted to each of these factors.

The theoretical literature concerning the exchange rate regime choice is abundant. This literature distinguishes globally three principal approaches to explain the why and the how of the choice between fixed and flexible exchange rate regimes.

A first approach, which is of the theory of the optimum currency areas, developed during the 60's following the original works of Mundell, McKinnon and Kenen devotes the superiority of fixed exchange rate regimes within the framework of a monetary integration. The principal choice criteria of this regime are: the degree of mobility of the production factors, the degree of economic openness and the degree of production diversification. Other choice criteria have emerged ever since, in particular: the degree of financial integration, the similarity of the rate of inflation and the homogeneity of the preferences. An extension of the original approach devotes also superiority of fixed exchange rate regimes but adopts a different logic. It privileges an arbitrage between the benefits and the costs of the integration of a currency area.

A second approach that is in line with the works of Fisher (1977), Turnovsky (1977), Flood (1979), Aizenman and Frenkel (1982, 1985), considers the optimality of the choice between fixity and flexibility of the exchange rate regimes with reference to the stabilization capacities of different regimes in an environment exposed to different types of shocks. The conclusions of this literature seem to line up: if the economy is affected by monetary shocks, the fixed exchange rate regimes would be preferable. However, if these shocks are of real nature, flexibility would be more attractive.

A third approach, considers the role of the credibility in the choice process of an exchange rate system. The credibility of the monetary policy and the rationality of the economic agents were

explicitly advanced after the seminal works of Kydland and Prescott (1977), Calvo (1978) and those of Barro and Gordon (1983b). This approach was revived towards the end of the 80's and adapted by Horn and Persson (1988) in the exchange rate regime choice decisions. This approach has been also enriched thanks to the contributions of Aghevli, Mohsin and Montiel (1991), Collins (1996), Edwards (1996), and Persson and Tabellini (2000). According to this approach, adopting pegged exchange rate regime to a stable currency can generate gains in terms of a less inflation and therefore of a higher credibility of the monetary authorities. This credibility gain is generally arbitrated against the flexibility loss that causes the renunciation to the shocks adjustment mechanism.

If these different approaches can provide important knowledge to determine the choice of a particular exchange rate regime, the characteristics of an economy are also crucial for this choice. It is interesting at this stage to consider the choice of the exchange rate regime within the framework of the Tunisian economy.

3. Which exchange rate regime for Tunisia?

Since its independence, Tunisia has embarked through several economic development plans in a strategy for the instauration of a production structure and of a sector of public enterprises. During the 80's, Tunisia has undertaken a vast program of economic reforms that aimed at a decrease in public interventionism in the economic activity, a greater liberalization in the economy and the instauration of the market rules in an economy that was heavily controlled.[7]

The adoption by Tunisia of these structural economic reforms in a context of gradual opening since 1986, has assured a greater integration into the global economy, remarkable economic performances, and the instauration of the convertibility of its current account in January 1993.[8]

[7] These reforms had been undertaking in 1986, in the framework of the Structural Adjustment Program (SAP).

[8] The current account convertibility of the Tunisian Dinar was announced by the President of the Republic in December 27, 1992. It enters into effect with the law N° 93-48 of May 3, 1993. From 1993, exchange control has been lifted on the current operations, the resident's current accounts, the Tunisians investments abroad as well as some external loans.

The exchange rate policy in Tunisia has passed from a fixed exchange rate regime to a crawling parities regime defined to a composite basket of currencies. The composition as well as the weights of the currencies of the basket underwent some modifications by widening them to introduce the commercial partner's countries and the weak European currencies since the objective of the Tunisian authorities was to maintain the external competitiveness.

So far, and within the framework of this exchange rate policy, the Tunisian authorities have privileged a strategy of an effective real exchange rate targeting. This strategy objective was to maintain the real exchange rate in a constant level to a composite basket of currencies of its main trading partners. Within the framework of this exchange rate policy, and through regular adjustments in the value of the nominal exchange rate, it was to guarantee the consistency of the effective real exchange rate.[9]

If such an exchange rate strategy has allowed Tunisia to record remarkable economic performances, the sustained effort of the authorities for the elimination of the rules that bridle the functioning of the market at the internal as well as the external levels, the increasing economic openness, the regional integration with the north and south Mediterranean countries as well as the imminent capital account liberalization, are as much factors that risk compromising the conduct of such a policy in the future.[10] Actually, these evolutions have important impacts on the choice of the exchange rate regime and most of them risk making difficult the defence of any form of fixed parity. For a number of reasons, these elements leave to privilege a transition to a flexible exchange rate regime (Fanizza and alii, 2002; Fanizza and alii, 2004). In the absence of an exchange rate flexibility, Tunisia would be confronted with the negative effects of the financial liberalization. As for the

[9] Concretely, the equilibrium real exchange rate is estimated on the Basis of the economic fundamentals, the monetary authorities intervene consequently through various policies to guarantee a trajectory of the exchange rate closet of this equilibrium level. For a more detailed analysis of this topic, one can refer to the works of Montiel and Ostry (1991) and Calvo and alii. (1995).

[10] As Calvo and alii. (1995) show, the monetary authorities can follow a constant real exchange rate targeting policy only for a limited period.

optimum degree of flexibility, it can go from a managed float to a lightly managed float according to the steps of the reforms brought to the economy and primarily to the financial system and to the fiscal and monetary policies.

We will examine within the framework of this study this hypothesis empirically. We will especially try to answer the following question: would the choice of the flexibility option be an optimal choice in the case of the Tunisian economy?

3.1. The model

This study follows the recent literature relating to the evaluation of the different exchange rate regimes with reference to the welfare criteria. The welfare approach defined in terms of costs/profits in the decision of the exchange rate system choice, was notably adopted by Aizenman (1994), Chin and Miller (1998), Devereux and Engel (1999), Eaton (1985), Helpman and Razin (1982), Lapan and Enders (1980) and Neumeyer (1988). These authors consider an objective function defined with respect to real and nominal variables, that the maximisation determines the different costs and advantages of the adoption of a particular exchange rate system. The current accounts, the production, the growth rate, are usually the most important real variables considered in the framework of these studies. The nominal variables are primarily the general price level or the rate of inflation. These models are usually defined, within the framework of a Nash non cooperative game between the government and the representative agents of the private sector.

Based on Agénor (1994), Asikoglu and Uctum (1990), Devarajan and Rodrik (1992), and Zhang (2001), we propose a model that applies this approach of the choice of an exchange rate regime to the case of the Tunisian economy with reference to the welfare criteria. The choice of an exchange rate system within the framework of this model is defined in terms of strategic interaction between the economic agents represented by the domestic firms and the monetary authorities. The basic

hypothesis of the approach is that the choice of an exchange rate system by the monetary authorities results from a welfare comparison that can achieve the different exchange rate regimes. In a tradable/non tradable goods model framework, the authorities are supposed to choose an optimal exchange rate regime that maximizes their welfare. The latter is obtained by the minimisation of a loss function defined in terms of external competitiveness and domestic inflation.[11]

The approach of the choice of an exchange regime with respect to the welfare criteria considers the model of a small open economy producing tradable and non tradable goods. The economic agents are on the one hand represented by the monetary authorities, and by the agents of the private sector on the other. These agents interact within the framework of an optimisation game where each tries to maximize his welfare. The welfare of the monetary authorities is defined with respect to real and/or nominal targets objectives while those of the enterprises are defined with respect to the relative prices. To attain this objective, the monetary authorities have access to the exchange rate as instrument of the economic policy, while the enterprises act on the non tradable goods prices. This optimisation game allows each of the agents to determine his objective function while minimizing a loss function.

The monetary authorities loss-function such as defined in the literature is determined by the deviation of the real exchange rate and the inflation rates of their respective targets. Analytically this function is defined by the following equation:

$$Z^g = -\alpha\left[\left(\ln E + \ln P_E - \ln P_N\right) - \ln\Omega\right] + \frac{1}{2}\lambda\left(\ln P - \ln\Theta\right)^2 \qquad \alpha, \lambda \succ 0 \qquad (1)$$

Z^g **:** The monetary authorities loss-function expressed in logarithm.

[11] Within the framework of the Tunisian growing economic openness, the Tunisian authorities have privileged an exportation promotion strategy attended by a real constant exchange rate strategy. According to this policy, the Tunisian authorities are very concerned with the preservation of the external competitiveness as well as the price stability. Their policies are consequently defined in terms of competitiveness and inflation. The choice of this modelling in the Tunisian case is therefore particularly suitable. Within the framework of this model, the authorities' welfare is measured by the external competitiveness. That does not exclude the economic growth objective that is captured through the competitiveness effect.

E: the nominal exchange rate.

α, λ : Are two coefficients that represent the weights granted by the monetary authorities respectively to the external competitiveness and the domestic inflation.

P, P_E and P_N represent respectively the general price level, the tradable goods prices and the non-tradable goods prices.

Ω, Θ Represent respectively the targeted levels of the real exchange rate (equilibrium exchange rate) and the general price level.

The authorities' loss-function as defined in the equation is captured through the sum of two factors:

- The deviation of the real exchange rate from its equilibrium level, or its misalignment (first term). The negative sign of this term indicates that the appreciation of the real effective exchange rate affects negatively the authorities' welfare. In fact, the deviation of the real exchange rate of its equilibrium trajectory (appreciation) causes the monetary authorities a loss in terms of external competitiveness.

- The deviation of the general price level of its targeted level (second term of the equation) causes a loss to the monetary authorities in terms of a higher inflation.

Following the literature, the general price level can be expressed by the following equation:

$$\ln P = \delta \ln P_N + (1-\delta)(\ln E + \ln P_E) \qquad 0 \prec \delta \prec 1 \qquad (2)$$

$(1-\delta)$: is a measure of the degree of the economic openness.

A small economy is usually a "price taker", the tradable goods prices are consequently determined on the international markets. According to Adams and Gro (1986), the prices of the non-tradable goods are determined by:

$$\ln P_N = \varepsilon\left[(\ln E + \ln P_E - \ln P_N) - \ln \Omega\right] + \phi \ln \psi \qquad \varepsilon, \phi \succ 0 \qquad (3)$$

ε: is the non-tradable goods prices elasticity with respect to real exchange rate disequilibrium (overvaluation or undervaluation).

ϕ : is the non-tradable goods prices elasticity with respect to the domestic monetary growth.[12]

ψ : is a measure of the domestic monetary growth.

The non-tradable goods prices such as defined in this equation, are determined by two terms: the domestic monetary growth and the deviation of the real exchange rate of its equilibrium level (misalignment).

The first term indicates that an undervaluation of the real exchange rate implies an increase (proportionally to elasticity ε) in the non-tradable goods prices. In fact, an undervaluation induces an increase in exportation and a consequent transfer of the resources from the non-tradable goods sector to the tradable goods one. The consequent decrease of the production and supply of the non-tradable goods induces an increase of their prices. Conversely, an overvaluation of the real exchange rate has downwards effects on the non tradable goods prices.

The second term represents the effect of an increase or a decrease of the domestic monetary growth on the non-tradable goods prices (proportionally to elasticity ϕ).

Within the framework of this model, the choice of the exchange rate system is determined by a game between the monetary authorities and the private sector economic agents represented by the enterprises. While setting up their prices, theses enterprises try within the framework of this game to minimize their losses and to protect their positions. Literature defines their behaviour by a loss-function of the following form:

$$Z^e = \tfrac{1}{2}\left\{\ln P_N - \varepsilon\left[\left(\ln E + \ln P_E - \ln P_N\right) - \ln \Omega\right] - \phi \ln \Psi\right\}^2 \qquad (4)$$

[12] The non tradable goods are goods that are not traded because of material impossibility (infrastructures, transportations.) or because of the domestic (protection measures) or world-wide regulations (embargo), or for reasons of transportation costs. Non-tradable goods can become tradable when the regulations impeding their free circulation are eliminated or when the transportation costs lower or disappear. The tradable goods are often assimilated to the manufactured products while the non tradable goods are assimilated to the services (electricity, water, transportation, constructions, telecommunications…).

The equations (1) and (4) define respectively the behaviour of the monetary authorities and the enterprises. Both behaviours define a Nash non cooperative game in which each agent tries to minimize his loss function. The monetary authorities' instrument is the nominal exchange rate while that of the enterprises is represented by the non-tradable goods prices.

In order to derive the choice of the exchange regime, we consider the model defined in the previous section:

$$Z^{g} = -\alpha\left[\left(\ln E + \ln P_E - \ln P_N\right) - \ln\Omega\right] + \frac{1}{2}\lambda\left(\ln P - \ln\Theta\right)^2$$

We proceed by a variables change and express them in proportional rates of change rather than in level:

$$e = \ln E,\ \varphi = \ln\psi,\ \omega = \ln\Omega,\ p_N = \ln P_N,\ p_E = \ln P_E,\ \theta = \ln\Theta$$

With the thus defined variables, the general price level will be determined by:

$$\ln P = \delta p_N + (1-\delta)e \qquad (5)$$

To simplify, we suppose that the international prices remain unchanged (p_E =0) and we derive the monetary authorities' loss function within the framework of a flexible exchange rate regime:

$$Z_f{}^{g} = -\alpha(e - p_N - \omega) + \tfrac{1}{2}\lambda\left[\delta p_N + (1-\delta)e - \theta\right]^2 \qquad (6)$$

The enterprises loss-function in the framework of a flexible exchange rate system becomes:

$$Z_f{}^{e} = \tfrac{1}{2}\left[p_N - \varepsilon(e - p_N - \omega) - \phi\varphi\right]^2 \qquad (7)$$

The second order resolution of these equations yields respectively the monetary authorities' reaction function (8) and the domestic enterprises one (9):

$$Rg : \bar{e} = \frac{\left(\alpha - \lambda\delta p_N + \lambda\delta^2 p_N + \lambda\theta - \lambda\theta\delta\right)}{\left(\lambda - 2\lambda\delta + \lambda\delta^2\right)} \qquad (8)$$

$$R_e : \bar{p}_N = \frac{(\varepsilon e - \varepsilon\omega + \phi\varphi)}{(1+\varepsilon)} \qquad (9)$$

The simultaneous resolution of the equations (8) and (9) yields the Nash equilibrium values of the devaluation rate and of the inflation rate:

$$\tilde{e} = \frac{\alpha + \alpha\varepsilon + \lambda\varepsilon - \lambda\omega\delta^2 - \lambda\varphi + \lambda\delta^2 + \lambda\theta + \lambda\theta\varepsilon - \lambda\delta - \lambda\delta\varepsilon}{\lambda\left(\delta\varepsilon + 1 + \varepsilon - 2\delta + \delta^2\right)} \tag{10}$$

$$\tilde{p}_N = \frac{\alpha\varepsilon + \lambda\theta\varepsilon - \lambda\theta\delta\varepsilon - \lambda\varepsilon\omega + 2\lambda\delta\varepsilon\omega - \lambda\delta^2\varepsilon\omega + \lambda\phi\varphi - 2\lambda\delta\phi\varphi + \lambda\delta^2\phi\varphi}{\lambda\left(1 - 2\delta + \delta^2 - \delta\varepsilon + \varepsilon\right)} \tag{11}$$

By substituting these values in equation (6), we determine the authorities' loss-function under a flexible exchange rate system:

$$\tilde{Z}_f{}^g = -\alpha\left[\frac{\alpha + \lambda\delta\phi\varphi + \lambda\theta - \lambda\theta\delta - \lambda\phi\varphi - \omega\lambda + 2\omega\lambda\delta - \omega\lambda\delta^2}{\lambda\left(1 - 2\delta + \delta^2 - \delta\varepsilon + \varepsilon\right)}\right] + \frac{1}{2}\lambda\left[\frac{\alpha}{\lambda(1-\delta)}\right]^2 \tag{12}$$

In order to determine the monetary authorities' welfare function in the framework of a fixed exchange rate system we proceed by a comparative methodology. In fact, under a fixed exchange rate regime, the authorities announce and maintain a fixed exchange rate (therefore e=0, no adjustment in the exchange rate). In this case, and according to the equation (9), the behaviour of the enterprises within the framework of a fixed exchange rate system will thus be defined as:

$$\hat{p}_N = \frac{\left(-\varepsilon\omega + \phi\varphi\right)}{\left(1 + \varepsilon\right)} \tag{13}$$

Accordingly, the monetary authorities' loss function within the framework of a fixed exchange rate system will be defined as:

$$\tilde{Z}_x{}^g = -\alpha\left[\frac{\left(\varepsilon\omega - \phi\varphi\right)}{\left(1 + \varepsilon\right)} - \omega\right] + \frac{1}{2}\lambda\left[\delta\frac{\left(-\varepsilon\omega + \phi\varphi\right)}{\left(1 + \varepsilon\right)} - \theta\right]^2 \tag{14}$$

3.2. Simulations outcomes

To simulate the model, it's necessary to determine the relative weight granted by the Tunisian monetary authorities to the competitiveness objective within the framework of their arbitrages between competitiveness and inflation.

The exportation promotion policy in Tunisia sustained by a real exchange rate targeting strategy lets us suppose that the authorities grant a weight rather important to the competitiveness objective. The weak rates of inflation recorded during the last three decades let us also anticipate that the authorities are highly concerned with the inflation objective and grant it therefore a rather important weight. Hence, we will suppose that the authorities grant the same importance to the competitiveness and to the inflation objectives (α =0.5).

It is worth mentioning that the simulation parameters are difficult to estimate with precision. Approximations will be set primarily on the basis of the available statistics as well as on the basis of our assessment of the reform of the Tunisian economy. These estimations, though approximative, do not impair our conclusions and give rather satisfactory results.

We also consider in our simulation basis an economic openness rate of the Tunisian economy $(1-\delta)$ of 30%, consequently the coefficient (δ) is estimated at 70%. [13]

Since about ten years, the inflation annual rate (measured by the consumer price index) has fluctuated around 3% in Tunisia thanks to a broad money growth rate targeting between 8 and 10%. The Tunisian Central Bank domestic broad money growth rate projection for the year 2005 is

[13] According to our preliminary simulations this economic openness rate is satisfactory. The openness rate generally used in the literature (X+M/PIB) accounts only for the degree of the current account openness and can not consequently be a reliable measure of the degree of effective economic openness of a country. We approximate here an openness rate that accounts for the current account liberalization degree as well as the capital account. Note that Tunisia's trade openness rate remains rather low. Indeed, with the different tariffs and non tariffs barriers, Tunisia holds the index of 8 out of 10 of the "*Trade restrictiveness index*" of the International Monetary Fund (IMF, 2005). At the capital account level, the degree of openness is much weaker.

estimated to be about 8%.[14] Therefore, we consider a growth rate (φ) of 9.5% for the domestic monetary growth in our simulation basis and an inflation target (θ) of 3%. [15]

The non-tradable goods prices reveal certain rigidity to the increase in Tunisia given that they are in most of the cases state managed. We suppose that the non-tradable goods inflation elasticity with respect to the monetary growth (ϕ) is of 0.7. In this case, an increase of 10% in the monetary supply will induce an increase of 7% in the prices of the non-tradable goods. The elasticity of the prices of non-tradable goods with respect to the real exchange rate disequilibrium (ε) is estimated at 0.2.

Another required variable for our simulation is the equilibrium real exchange rate growth rate. According to Fanizza and alii. (2002), between 1990 and 2001, the real effective exchange rate based on GDP deflator in Tunisia is appreciated by about 7%. In average, the exchange rate is appreciated therefore of about 0.7% per year on this period. Furthermore, according to the estimations of equilibrium real exchange rate on the basis of the Tunisian economic fundamentals, these authors indicate that Tunisia's effective real exchange rate was near its equilibrium trajectory. We therefore consider in our simulation basis a similar trend of the equilibrium exchange rate. The annual equilibrium real exchange growth rate is then set to 1%. In order to resolve the indeterminacy problem related to the estimation of the value of λ, we assume that monetary authorities' preferences follow a Cobb-Douglas function. This allows us to write $\lambda = 2(1-\alpha)$.

On the basis of the above specified parameters, the simulations outcomes reported in table 1, let us deduce that a flexible exchange rate regime causes to the monetary authorities an inferior loss compared to the fixed exchange rate regime and it would consequently be more favourable.

[14] Annual report of the Central Bank of Tunisia.

[15] Despite the liberalization process of the Tunisian economy, many prices remain regulated. Indeed, the oil, water, basic products, electricity, telephone and public transportations' prices still remain state regulated. At the same time, the salaries remain comparatively rigid since the wage negotiations in Tunisia generally intervene every three years.

Table 1

Simulation Base : α = 0.5, ϕ =0.7, ε = 0.2, ω =0.01, $\lambda = 2(1-\alpha)$, φ =0.1, δ =0.7, θ = 0.03	
$Z^g{}_x$	0.0334
$Z^g{}_f$	-0.2348

According to the evolution of the economic conditions, the authorities can change their preferences of competitiveness by increasing the weight granted to this variable. Which exchange rate regime would be optimum in this case from the authorities' standpoint? To investigate this issue, we vary the value of (α) in the loss function on the basis of the same simulation parameters values. The results are reported in the following table.

Table 2

Simulation Base : α = 0.5, ϕ =0.7, ε = 0.2, ω =0.01, $\lambda = 2(1-\alpha)$, φ =0.1, δ =0.7, θ = 0.03										
	α =0.02	α =**0.03**	α =0.04	α =0.05	α = 0.1	α = 0.15	α =0.50	α =0.80	α =0.90	α =0.99
$Z^g{}_x$	0.0014	**0.0021**	0.0028	0.0034	0.0068	0.0101	0.0334	0.0534	0.0600	0.0660
$Z^g{}_f$	0.0015	**0.0021**	0.0025	0.0028	0.0024	-0.0018	-0.2348	-1.7090	-4.4226	-54.3649

From this table, we can remark that when we change the value of α, a flexible exchange system causes, from a certain threshold, a less heavy loss than a fixed exchange rate regime and would be consequently more optimal. Indeed, if authorities grant a weight superior to 3 % to the competitiveness objective, a flexible system would be more favourable for the authorities since it causes a lower loss than a fixed exchange rate regime ($0.0025 \prec 0.0028$). For a preference weight inferior to this threshold, a fixed exchange rate would be more optimal for the monetary authorities. As far as Tunisia is concerned, the sustained effort of the Tunisian authorities to promote the exportations and the competitiveness of the domestic products on the foreign markets, lets us suppose that the preferences of Tunisian monetary authorities are superior to this threshold and that it can even surpass the chosen coefficient in our simulation basis (the value of α =0.5). From this perspective, and considering the Tunisian economy data, we can assert that a flexible exchange rate regime would be more optimal in the Tunisian context. The exchange rate flexibility in the

perspective of the economic openness and the capital account liberalization would allow the Tunisian monetary authorities to draw benefits from this choice. The principal conclusion that emerges from these results is that an eventual change in the preferences of the monetary authorities regarding the arbitrages between competitiveness and inflation to promote the growth by the exportations or for the balance of the payments adjustments purposes will be compatible with a flexible exchange rate regime. Based on table 3, an increase of the value of α, causes the authorities a lower loss in the presence of a flexible exchange rate regime.

Table 3

Simulation Base : α = 0.5, ϕ =0.7, ε = 0.2, ω =0.01, $\lambda = 2(1-\alpha)$, φ =0.1, δ =0.7, θ = 0.03

	ω =-2.6	ω =0	ω = 0.01	ω = 0.04	ω =1.5	ω =5	ω =10	ω =50
$Z^g{}_x$	-1.0048	0.0292	0.0334	0.0459	0.6676	2.2764	4.8638	37.8133
$Z^g{}_f$	-1.0178	-0.2378	-0.2348	-0.2258	0.2122	1.2622	2.7622	14.7622

From table 3 and 4 we deduce that the equilibrium real exchange rate growth (ω) and the inflation target (θ) act in magnitude and not in the direction of the choice of a particular exchange rate regime. In fact, whatever the value taken by these parameters in our simulation basis, the choice of a flexible exchange system seems to be evident for the monetary authorities since it causes a lower loss than the fixed regime.

Table 4

Simulation Base : α = 0.5, ϕ =0.7, ε = 0.2, ω =0.01, $\lambda = 2(1-\alpha)$, φ =0.1, δ =0.7, θ = 0.03

	θ = 0	θ = 0.01	θ =0.02	θ = 0.03	θ = 0.1	θ = 0.3	θ =0.4	θ =0.5
$Z^g{}_x$	0.0341	0.0338	0.0335	0.0334	0.0352	0.0672	0.0983	0.1393
$Z^g{}_f$	-0.2048	-0.2148	-0.2248	-0.2348	-0.3048	-0.5048	-0.6048	-0.7048

In contrast to these two variables, the effect of the economic openness rate on the choice of the exchange rate regime is more pronounced. The simulation outcomes for different openness parameter values (1-δ), show that from an openness threshold of 25% (δ =0.75), a flexible

exchange system gives to the authorities a more important welfare than a fixed system, and is consequently more optimal. For a degree of economic openness inferior to this threshold (75%), a flexible system causes an important loss in terms of welfare to the authorities and a fixed regime will be preferred ($0.0525 \succ 0.0335$). In the case of an autarky economy ($\delta \geq 98$), a fixed exchange system represents the only practical choice. These results are in line with the conventional theory of the optimal exchange rate regime choice according to which the openness increases the need for flexibility. The principal knowledge that emerges for the Tunisian case is that the openness of the Tunisian economy and the capital account liberalization would be more compatible with a flexible exchange rate regime.

Table 5

Simulation Base : α = 0.5, ϕ =0.7, ε = 0.2, ω =0.01, $\lambda = 2(1-\alpha)$, φ =0.1, δ =0.7, θ = 0.03

	δ =0.5	δ =0.55	δ =0.6	δ =0.7	δ = **0.75**	δ = 0.8	δ =0.9	δ =0.98
$Z^g{}_x$	0.0333	0.0333	0.0333	0.0334	**0.0334**	0.0335	0.0336	0.0337
$Z^g{}_f$	-0.1821	-0.2032	-0.2237	-0.2348	**-0.1750**	0.0525	4.2350	255.7732

With regards to the domestic monetary growth variable, the results of simulation (Table 6) show that a flexible exchange system, even with a negative monetary supply (cases of disinflation), will be optimal for the case of the Tunisian economy. This result holds up to monetary growth level of about 80%. Beyond this threshold, the trend reverses and a fixed exchange system will be more optimal for the authorities ($0.3232 \prec 0.3252$). These results can be explained by reference to the credibility theory. The discretionary economic policies that generally accompany a flexible exchange rate system, and the lack of discipline that they generate by the excessive monetary supply, can induce an important inflationary bias that the authorities can only correct by resorting to the exchange rate fixity. The adoption of an exchange rate system as a rule of anchorage of the exchange rate to a stable currency, allows a higher credibility of the monetary authorities and gains in terms of a less inflation. The adoption of the rigid fixed exchange regimes, within the framework of a

Currency Board or Dollarization regimes, represent an extreme case of exchange rate fixity the finality of which is the quest for a higher credibility. When the domestic monetary supply becomes excessively high (superior to 350%), the tendency in favour of a flexible exchange system reverses again. In this case, and beyond a certain threshold of the monetary supply, even the adoption of a fixed exchange system cannot be a remedy to the credibility problems if it is not accompanied by anti-inflationary measures.

Table 6

Simulation Base : α = 0.5, ϕ =0.7, ε = 0.2, ω =0.01, $\lambda = 2(1-\alpha)$, φ =0.1, δ =0.7, θ = 0.03

	φ = -0.5	φ = -0.1	φ = 0	φ = 0.2	φ = 0.4	φ = **0.8**	φ = 0.9	φ = 3.5	φ = 6.5	φ = 9.5
$Z^g{}_x$	-0.1140	-0.0224	0.0047	0.0638	0.1296	**0.2812**	0.3232	2.0022	5.3401	10.1786
$Z^g{}_f$	-0.6548	-0.3748	-0.3048	-0.1648	-0.0248	**0.2552**	0.3252	2.1452	4.2452	6.3452

According to the results recorded in table 7, the effect of the non-tradable goods inflation elasticity with respect of the domestic monetary supply (ϕ) on the authorities welfare is very feeble, and plays rather in magnitude than on direction for the choice of the exchange rate regime. On the contrary, the effect of the domestic inflation elasticity with respect to the equilibrium real exchange rate (ε) on the performance of the different exchange rate systems is pronounced. As the results reported in Table 8 shows, from a 0.25 value threshold of this parameter, a fixed exchange rate system gives the authorities a higher welfare than a flexible system ($0.0308 \prec 0.0358$). Choosing the appropriate exchange rate regime depends therefore, and to a certain extent, on the sensitivity of the domestic inflation to the equilibrium exchange rate misalignment.

Table 7

Simulation Base : α = 0.5, ϕ =0.7, ε = 0.2, ω =0.01, $\lambda = 2(1-\alpha)$, φ =0.1, δ =0.7, θ = 0.03

	ϕ =0	ϕ = 0.1	ϕ =0.2	ϕ =0.5	ϕ =1.5	ϕ =2.5	ϕ =3.5	ϕ =4.5	ϕ =5.5
$Z^g{}_x$	0.0047	0.0087	0.0127	0.0250	0.0683	0.1149	0.1650	0.2184	0.2753
$Z^g{}_f$	-0.3048	-0.2948	-0.2848	-0.2548	-0.1548	-0.0548	0.0452	0.1452	0.2452

In Tunisia the price structure is relatively rigid and it's unlikely that this elasticity surpasses this threshold. The growing Tunisian economic openness and capital account liberalization could bring an additional flexibility to the domestic price structure but it remains improbable that such a threshold can be surpassed. Thus we conclude, and from an openness perspective, that a flexible exchange regime will be an optimal choice for the Tunisian economy.

Table 8

Simulation Base : α = 0.5, ϕ =0.7, ε = 0.2, ω =0.01, $\lambda = 2(1-\alpha)$, φ =0.1, δ =0.7, θ = 0.03

	ε = 0	ε =0.1	ε = 0.2	ε =**0.25**	ε =0.3	ε = 0.35	ε = 0.45	ε =0.65	ε =0.85
$Z^g{}_x$	0.0402	0.0365	0.0334	**0.0320**	0.0308	0.0296	0.0276	0.0242	0.0216
$Z^g{}_f$	-1.3172	-0.6407	-0.2348	**-0.0872**	0.0358	0.1399	0.3064	0.5343	0.6829

In order to derive the optimal exchange rate system choice in the context of the Tunisian economic openness, proceeding from the exchange liberalization measures and suppression of the tariffs and non-tariffs barriers, we further vary simultaneously all the parameters values in our simulation basis to see their effects on the monetary authorities' welfare performance. We, therefore, consider a weight of 50 % for the competitiveness, a 25% domestic monetary growth, an economic openness rate of 65%, an 8% inflation target, a 5% annual equilibrium real exchange growth rate, a unitary domestic inflation elasticity with respect to the monetary supply and of 0.5 with respect to real exchange rate misalignment. The simulations outcomes are reported in table 9. They indicate a lower loss within the framework of a flexible exchange rate regime.

Table 9

Simulation Base : α = 0.5, ϕ =1, ε = 0.5, ω =0.05, $\lambda = 2(1-\alpha)$, φ =0.25, δ =0.35, θ = 0.08

$Z^g{}_x$	0.1004
$Z^g{}_f$	0.0495

Let us now consider the monetary authorities' preferences changes effect on welfare performance.

These new parameters give positive results for a flexible system (Table 10).

Table 10

Simulation Base: α = 0.5, ϕ =1, ε = 0.5, ω =0.07, $\lambda = 2(1-\alpha)$, φ =0.25, δ =0. 35, θ = 0.08

	α = 0.5	α = 0.6	α = 0.7	α = 0.8	α = 0.9	α = 0.95
$Z^g{}_x$	0.1004	0.1203	0.1402	0.1602	0.1801	0.1900
$Z^g{}_f$	0.0495	0.0362	-0.0028	-0.1061	-0.4667	-1.2258

4. Conclusion

In this paper, and within a game-theoretic framework, we have considered a model that puts in interaction the monetary authorities on one hand and the private sector agents represented by the domestic enterprises on the other. The choice of an exchange regime by the monetary authorities results from the minimisation of a loss-function defined in the framework of a Nash non cooperative game with these enterprises. Based on the Tunisian economic parameters, the simulations outcomes reveal that the opening of the Tunisian economy and the liberalization of its capital account is compatible with a flexible exchange rate regime since it causes a less heavy loss than a fixed system. Such a system can assure the competitiveness objective and mitigate the inflationary bias generally associated with the capital account openness. It can therefore bring the required credibility for such a transition period. This is particularly important as long as this transition phase is accompanied by new risk elements that necessitate a high credibility of the policies and institutions.

In a capital account liberalization perspective, the simulations outcomes show that a change in the preferences of the monetary authorities in the framework of the arbitrage between competitiveness and inflation is compatible with a flexible exchange regime. Such a regime leaves the authorities a margin of manœuvre to eventually correct the balance of the payments disequilibrium or to promote a policy of economic growth by exportations.

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