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Capital Flows, Real Exchange Rates, and Capital Controls: What Is the Scope of Liberalization for Tunisia?

Summary: This paper deals with an important aspect of Tunisian economic and political decisions related to the opportunity for currency convertibility. Tunisia has established its current currency convertibility and has taken steps to achieve full convertibility of the dinar by gradually removing capital flow obstacles. Theoretical and empirical literature suggests that capital account liberalization generally leads to capital inflow in developing countries, generating an appreciation in the real exchange rate (RER) and thus a loss in competitiveness. However, preserving competitiveness is a key challenge for monetary authorities, who have to conciliate these two apparently conflicting purposes. To guide their decisions with respect to the prescribed procedure for capital liberalization, we need to evaluate the impact of each capital component flow on the RER. The question is addressed by analysing impulse response functions (IRF) resulting from a VAR model, covering 1970 to 2010 and gathering the RER, its fundamental determinants, monetary variables and an estimated capital control (CC) variable. Results show that a relaxation of CC overappreciates the RER to its long-term level, and liberalizing portfolio investment is the most compromising for competitiveness.

Key words: Competitiveness, Capital flow liberalization, Full convertibility, VAR model, Tunisian dinar.

JEL: F31, F37.

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Foreign resources, coveted by some developing countries enjoying high economic growth rates and low inflation rates, can offset the lack of internal financial resources of these countries, but previous experience has shown that developing countries cannot easily cope with full convertibility because they have to reconcile between two conflicting objectives. Indeed, some developing countries which earlier opened their capital account in the liberalization process, suffered from a loss of competitiveness resulting from the increase in aggregate expenditure which generates pressure on domestic prices and then an appreciation in the RER. Indeed, the increase in capital inflow allows developing countries to increase their expenditures and puts pressure on the non-tradable sector increasing non-tradable prices. So tradable prices (P_T) to non-tradable prices (P_N) decreases ($P_T / P_N = RER$) generating an appreciation in the real exchange rate. This phenomenon observed in Latin America (see for example

Guillermo A. Calvo, Leonard Leiderman, and Carmen M. Reinhart 1993; Donald J. Mathieson and Liliane Rojas-Suarez 1993; Guillermo Le Fort 2005) and in southern Asian countries (see for example Amadou N. R. Sy 2007) raises the debate on the appropriate sequencing of capital liberalization. Therefore, the experience of some emerging countries facing external crises after a surge of capital inflows, calls for caution in the sequencing and speed of capital liberalization (see for example Jonathan D. Ostry et al. 2010).

Openness to the outside world is the cornerstone of the Tunisian development strategy, which requires targeting a competitive RER so as to preserve its market shares and thus employment. At the same time, monetary authorities seek to be more integrated in the world economy by attracting foreign capital because capital inflow can contribute to raise investment, accelerate economic growth and improve the standard of living of the population. So concretely, policy makers are interested in preserving a competitive RER and are also concerned with the consequences of the capital flow liberalization on RER's instability and possible losses of competitiveness resulting from RER's appreciation. Indeed, premature opening of the capital account can lead to a massive capital flight from the country as described by Sebastian Edwards and Roberto Rigobon (2005). In order to avoid this phenomenon, and to face capital volatility, especially in a crisis period such as the recent financial crisis of (2007-2009), Tunisia has committed itself to gradually liberalizing its capital account after liberalizing its current account so that full convertibility can be gradually reached (Organization for Economic Co-operation and Development 2007). However, extensive literature about the effectiveness of capital control highlights the difference between actual and legal capital mobility. That is why we need to integrate an estimated variable to represent the degree of capital controls in the analysis.

The purpose of this paper is to assess the impact of capital inflow (by considering each of its components), on the RER and then on competitiveness and try to shed light on the sequencing and speed of capital liberalization in Tunisia to guide monetary authorities in the liberalization process.

This paper is organized as follows. The first section describes the Tunisian exchange rate policy pursued since 1970. The second section presents a dynamic measure of the degree of capital control in Tunisia, using the Kalman Filter Technique applied to Martin Feldestein and Charles Horioka's (F-H) approach (1980). The third section is devoted to constructing two VAR models as in Edwards (2000) in order to evaluate the dynamic interactions between capital flows, capital control and RER. Section four concludes and offers some policy recommendations.

1. A Cautious Exchange Rate Policy

According to the central bank of Tunisia "The announcement of the current convertibility in 1993 was coupled with the creation of an interbank market (March 1994) where the exchange rate is determined freely. Within this framework, local banks exchange currencies among themselves or with their customers at freely-negotiated rates. The role of the CBT consists of its intervention to fine-tune liquidity of the market in case of imbalances between supply and demand for currencies on this market and thereby can condition the value of the dinar. The purpose of this liberaliza-

tion is to confer more flexibility on the exchange rate determination" (Central Bank of Tunisia 2008).

According to IMF Exchange Rate Arrangements and Exchange Restrictions; Tunisia was classified as a country with a crawling pegged regime, until December 2004. From 2005 until 2007, the exchange rate regime applied in Tunisia according to the IMF was a managed float regime, with no predetermined trajectory for the exchange rate coupled with a monetary aggregate target. For 2008, the IMF reclassified Tunisia as a crawling peg country with a monetary aggregate target.

However, Reinhart and Kenneth S. Rogoff (2004) have shown that "*de facto* behavior" is often different from "*de jure* behavior" for a set of developed and developing countries. Calvo and Reinhart (2002) have analyzed the behavior of some developing countries and have shown that these countries continue to be pegged to other currencies despite their commitment to move to a floating regime. This is the "fear of floating".

Tunisia doesn't derogate from this rule. Officially, the IMF classifies the exchange rate regime in Tunisia as a "managed float", where the Central Bank of Tunisia (CBT) intervenes in a discretionary manner, when necessary. From this point of view, the managed float is not different from the anchor to a basket with a secret composition (see Eduardo Levy-Yeyati and Federico Sturzennegger 2005; Jeffrey Frankel and Shang-Jin Wei 2008). Indeed, Fatma M. Charfi (2009) has shown that, since 1978 the Tunisian dinar has been pegged to a currency basket made up of a settlement of foreign transactions (mainly European currencies and the American dollar with different weights over time). By August 1986, the Tunisian dinar was devalued, within the framework of a market-oriented reform process, and then during the 1990s, Tunisia adopted a real effective exchange rate (REER) targeting policy that aimed at preserving the competitiveness of the country. Authorities periodically adjust the nominal exchange rate to compensate for the differential of inflation relative to the trade partners, so as to maintain the REER constant (Figure 1).

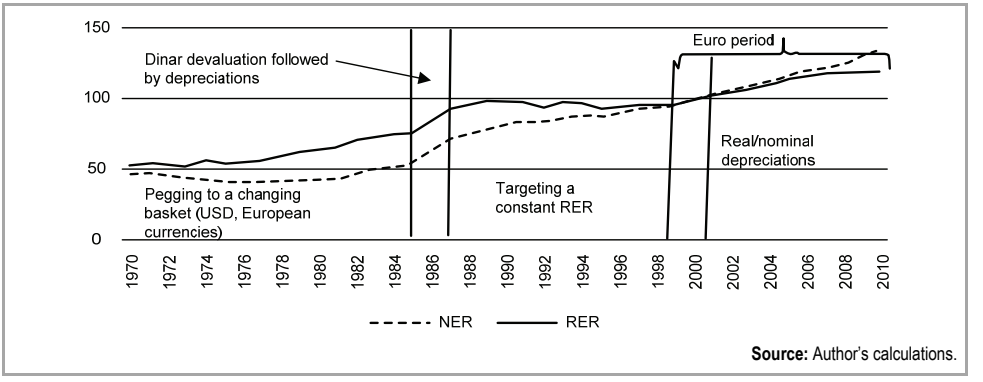


Figure 1 Real and Nominal Exchange Rate Indices 1970-2010

Since 2000, the central bank has implemented a more flexible exchange rate policy where the dinar is softly pegged to a currency basket composed of euros (65%) and dollars (35%) (Charfi 2009). Indeed, the nominal effective exchange rate (NER) depreciated by about 20 percent from 2000 to 2006 and about 35 percent from 2000 to 2010. The comparison between the nominal and real exchange rate (RER) indices highlights the management of the exchange rate in Tunisia.

Table 1 Average, Standard Deviation and Variation Coefficient of the NER and RER Indices (1970-2010)

Period	NER index			RER index		
	Average	σ^a	ε^b(%)	Average	σ	ε(%)
1970-2010	**88.86**	**34.51**	**38.84**	**92.97**	**24.25**	**26.08**
1970-1985	52	4.62	8.88	65.8	9.25	14.05
1986-2010	112.43	22.08	19.6	110.36	10.9	9.88
2007-2010[c]	146.93	6.357	4.325	128.27	0.97	0.76

Note: a) σ^a represents standard deviation; b) ε is the variation coefficient = the standard deviation reported to the average; c) Period corresponding to the recent financial crisis.

Source: Author's calculations.

Over the whole period, nominal variability is higher than real variability. However, when we consider two sub-periods: pre and post 1986 devaluation, we notice that prior to 1986, the variability of the RER is twice as important as the NER variation, while nominal variability is twice as important as the real variability after the devaluation. Thus, the second period is characterized by a great variability of the NER and a stability of the RER (as shown by Figure 1). This reflects the effort made by the monetary authorities to stabilize the RER index through adjustments of the NER index. The variability of the NER index was almost twice as important, if we compare it over the 1970-1985 period and 1986-2010, whereas that of the RER index has decreased by a third. It is also important to highlight that the exchange rate policy in the last financial crisis period (2007-2009) is characterized by a constant real exchange rate ($\varepsilon = 0.76$). Indeed, Tunisia represents a small economy, very dependent on abroad, and concerned with preserving its competitiveness. So, monetary authorities adjust the nominal exchange rate in order to maintain constant RER.

In the context of gradual capital account liberalization coupled with an independent monetary policy, a more flexible exchange rate is needed (Reinhart and Rogoff 2004). Indeed, the relationship between fixed exchange rates, perfect capital mobility and monetary policy independence is referred to as "the impossible trinity" as the three components cannot prevail at the same time. It seems obvious that the monetary authorities have allowed for a more flexible NER (Table 1, Figure 1).

2. How Effective Is the Capital Account Openness in Tunisia?

According to Peter J. Montiel (1994), "*an economy is financially open, when its residents are able to trade financial assets with residents of another country. The degree of financial openness however is a somewhat amorphous concept, not clearly defined in many applications and difficult to measure.*" However, the commitment to the liberalization of capital flow is not always translated into the removal of actual capital restrictions.

The distinction between actual and legal mobility raises the question of the effectiveness of capital control in developing countries. Measuring the degree of capital mobility from an economic point of view, and the extent to which developing countries integrate into the global capital market continues to be a debatable subject. Indeed, vast literature (both empirical and theoretical) concerning the evaluation of international financial integration has been developed over the last two decades.

Generally two types of capital mobility indicators are identified: qualitative and quantitative indicators. The first category is valid in the case of cross-sectional comparative studies using panel data. The main deficiency that makes such indicators unsuitable for an individual economy and thus for time series studies, is their inability to highlight the intensity of the phenomenon. This deficiency was corrected through the establishment of quantitative indicators. Geert Bekaert and Campell R. Harvey (1995) and Bekaert and Harvey (1997) determined dates when equity markets in emerging economies are open to foreign investors, based on various indicators, including the date of the introduction of foreign American Depositary Action (ADR), and official liberalization dates. In another study, Bekaert, Harvey, and Robin L. Lumsdaine (2002) extended their sample for 95 countries, where 16 had a free stock market during the period between 1980 and 1997, and 27 had an experience of market liberalization during the same period. The comparison of these different dates indicates that the capital account openness (based on AREAER IMF) shows that only Indonesia and Malaysia have both a complete stock market and an open capital account, and in both cases the capital account openness preceded the opening of the stock market. Peter B. Henry (2000) also based his study on stock market liberalization. Hence, the ratio of market capitalization indicates the degree of accessibility to investor country securities that may therefore reflect changes in the degree of capital control.

Given the narrowness of the Stock Exchange in Tunisia and the low level of its capitalization comparatively to similar countries such as Morocco and Jordan (see Table 2), the F-H approach seems to be more appropriate for measuring the degree of capital account openness. Indeed, from 2000 to 2009, the Tunisian stock exchange capitalization remained almost constant. In Morocco, it more than doubled and in Jordan, more than tripled. Stock exchange capitalization in Tunisia represents 15% of that of Morocco and 6% of that of Jordan. However, the Tunis Stock Exchange market remains less important than the others, because privatization efforts remain modest. Even though the privatization program goes back to 1987, privatizations have only accelerated since 1995. Indeed, over the period of 1987-1994, 48 companies were privatized for a total of $ 134 million. In comparison, during the period 1995-2005, 194 companies were sold to the private sector for $1.8 billion.

Table 2 Stock Exchange Capitalization in Some MENA Countries

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tunisia	0.14	0.13	0.10	0.09	0.09	0.09	0.12	0.14	0.17	0.20
Morocco	0.33	0.27	0.22	0.22	0.34	0.44	0.60	0.85	1.23	1.84
Jordan	0.64	0.63	0.70	0.89	1.29	2.2	2.4	2.25	2.08	1.92

Source: The World Bank, financial structure dataset.

Remember that the most famous indicator was originally developed by F-H in 1980 to analyse the behaviour of savings and investments in a number of countries to measure the effectiveness of international capital mobility. They argue that the degree of non-correlation between the two series is a good indicator of perfect capital mobility. Savings are highly linked to investment in countries with severe capital account restrictions, where these variables become independent in countries with

high capital mobility. Indeed, under this hypothesis, a country can borrow or lend at the world interest rate. Domestic investment is no longer constrained by available internal resources since global savings are affected according to opportunities in yield differentials. F-H finds that over the period of 1960-1974, the investment rate and average savings are strongly and positively correlated for OECD countries. These results lead them to conclude the existence of restrictions on capital movements in an environment of high capital mobility. This phenomenon, known as the F-H puzzle, raised questions about the relevance of the F-H relationship as an indicator of capital mobility.

New literature has emerged to deal with this paradox and to check whether the F-H specification can actually measure the degree of mobility (see Yan Bai and Jing Zang 2010). To solve the F-H puzzle, endogeneity and simultaneity are the most listed arguments in empirical and theoretical literature. The studies of Lawrence H. Summers (1988) and Jerry Coakley, Farida Kulasi, and Ron Smith (1999) presented the argument of "policy response" to explain the paradox of F-H. They indicate that the channel generates a strong correlation between investment and domestic savings. Maurice Obsfeld (1986) in his search highlights the fact that savings and investment react in the same manner to shocks. However, F-H contribution remains the main reference for explaining the savings investment correlations in empirical works (see for example, Frankel 1992; Alan M. Taylor 1996).

2.1 Savings and Investment Relationship: Issues and Measurements

F-H (1980) and Feldestein (1983) proposed to measure financial integration in the world economy by measuring the correlation between national investment and national savings, using the following equation:

$$\left(\frac{I}{Y}\right) = \alpha + \beta\left(\frac{S}{Y}\right) + \varepsilon \quad (1)$$

where (I/Y) represents the ratio of domestic investment to gross national product (GNP) and (S/Y) the ratio of domestic saving to GNP.

In this equation, β reflects the financial level of integration. Indeed, if the international markets are fully integrated, an increase in domestic investment will be broadly financed by foreign capital and not necessarily by domestic savings. To know whether or not a country is perfectly integrated with the outside world, economists tested the hypothesis H_0: $\beta = 1$ reflecting capital immobility against the alternative hypothesis H_1: $\beta = 0$ where the economy is open and there is perfect capital mobility.

Jeffrey D. Sachs (1981) proposed a modification of the F-H model by introducing foreign savings (current account deficit) instead of domestic savings. Indeed, a current account deficit means that the country borrows from abroad to cover the deficit, which leads to capital inflow.

$$\left(\frac{CC}{Y}\right) = \alpha + \gamma\left(\frac{S}{Y}\right) \quad (2)$$

with, $\gamma = \beta - 1$. If domestic and foreign savings are not correlated $\gamma = 0$ and $\beta = 1$. Consequently, the absence of capital mobility is equivalent to a null correlation between the two types of savings. See Sophie Béreau (2007).

The model developed by Montiel (1994) integrated some developing countries' specificities to the F-H approach by adding aid inflows to savings, as a financing source of domestic investment and estimated this model for 62 developing countries over the period of 1970-1990. He then compared its results to a benchmark established by the study of Robert G. Murphy (1984) for industrialized countries which considered that a country is strongly integrated financially into the world market if the value of $\beta < 0.6$, and concluded that a great number of developing countries (especially Latin American countries) can be considered financially integrated into the world market.

To measure the degree of capital mobility for Mexico, the Philippines and South Korea, Michael P. Dooley, Donald J. Mathieson, and Rojas-Suarez (1997) developed a model that took into account disguised capital flows and used a Kalman filter technique. This method allows the authors to assess a temporally variable capital control. They concluded that the studied countries experienced an important increase in the degree of capital mobility between 1977 and 1989.

Similarly, in order to highlight the dynamic evolution of capital account liberalization in our study, we need to estimate a temporally variable coefficient correlation between saving and investment which requires the use of the Kalman filter technique.

2.2 Evidence from the Financial Opening of the Tunisian Economy

Tunisian monetary authorities established currency convertibility in 1993, and has made commitments to ease payments' restrictions regarding capital transactions for residents in order to reach the full convertibility of the dinar.

To check the effectiveness of the gradual liberalization of the capital account, it would seem necessary to estimate a dynamic indicator of the degree of capital account openness. That is why we choose a specification with a temporally variable coefficient associated with savings (β_t). However, the instability of the coefficient is checked empirically by verifying the instability of the model over the period studied. For this purpose, we apply the squared Cusum test to the recursive residuals. Empirical results, reported in Appendix 2, have shown that the statistic *s* (Cusum squared statistic) moves outside the critical lines which points to the instability of β (which represents the degree of capital account control or opening over time).

The constructed model is a dynamic linear composed of two equations called state space model. The first (Equation 3) is the signal equation, characterizing domestic investment which depends on an initial wealth factor α and on a temporally variable openness factor β_t. The second (Equation 4) is referred to as the transition or state equation where the vector β_t is the state. This equation shows the temporally openness degree variable (β) which is explained by its own past values, the current account which reflects foreign savings, and the foreign exchange reserves' movements.

The equation system to be estimated on a set of annual Tunisian data over the period of 1970-2010, consists of the following two equations:

$$\left(\frac{I}{Y}\right)_t = \alpha + \beta_t \left(\frac{S}{Y}\right)_t + \varepsilon_t \quad (3)$$

$$\beta_t = \beta_0 + \eta\beta_{t-1} + \sum_{i=0}^{n} \lambda_i \left(\frac{CC}{Y}\right)_{t-i} + \sum_{j=0}^{n} \sigma_j \left(\frac{res}{Y}\right)_{t-j} + \upsilon_t \quad (4)$$

Before estimating the above equation system, we evaluated the statistical properties of the used variables. The results of unit root tests based on a unit root null versus a trend-stationary alternative are reported in Table 4 (Appendix 4, Table 4) and show that the series are integrated in order I(1) and are stationary in the first difference.

The results of the estimated equation system are as follows:

Table 3 Estimate of the Modified Model over the 1970-2010 Period

Coefficient	α	λ	η	β_0	σ
Estimated value	6.20 (1.87)***	- 0.75 (-6.13)*	0.82 (10.52)*	0.10 (1.93)***	- 0.25 (-2.0)*
			β_t= 0.69 (16.21)*		

Note: * 1% significance level; and *** 10% significance level.

Source: Author's estimations.

The current account and foreign exchange reserves coefficients are negative and statistically significant. In other words, this means that the capital inflows (corresponding to a current account deficit) as well as the depletion of foreign exchange reserves reduce the sensitivity of investment to savings. This result vindicates the assumption of internal and external financing substitutability. In addition, the coefficient relative to the past values of the openness coefficient (η) is positive and statistically significant which supports the gradual openness of the capital account. The estimated values of the capital control variable (β) over the 1970-2010 period are represented in Figure 2, as follows:

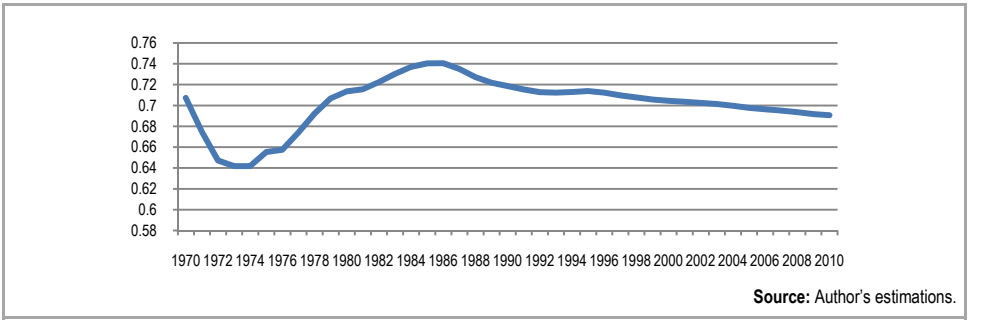


Figure 2 Evolution of Capital Control in Tunisia 1970-2010

The general shape of the chart highlights three periods: the first runs from 1970 to 1975, the second covers the period of 1976-1986 and the third spans from 1987 until now. What emerges from this graph is that since the implementation of the structural reform program, the severity of capital controls has declined. However, it should be noted that this trend is consistent with the changing external financial rules.

Historically, after the painful experience of 60 years of farmland collectivization, the Tunisian authorities have undertaken an openness policy since the early 70's, initiating a process of industrialization and promoting the export sector. For this purpose, there was a progressive withdrawal of the state in favor of the private sector. During this same period and being a net exporter of oil and phosphates, Tunisia has taken advantages from oil revenues earned after the first oil crisis and the soaring of phosphate prices. However, being engaged in a process of industrialization, the Tunisian economy required the use of foreign capital. Thus, it was normal to have less control over the movements of foreign capital over this period.

Over 1976-1986, the figure shows an increase in the capital control which is consistent with the law in effect then. Indeed, the law 1976-18, reinforces the prohibition on transfers to abroad (whether current or capital transactions). Also this period is characterized by an economic crisis with very low economic growth rates (even negative in 1986: -1.4%), an excessive external debt accumulated since the early 70's and a foreign exchange reserves reduction, reaching their lowest level in 1986 (the equivalent of 25 days of imports). For these reasons, there has been a tightening of the foreign exchange constraint and Figure 2 highlights the increase in capital controls with a peak in 1986.

Since 1987, in the context of a structural reform program supported by the IMF and the World Bank, funds flowed to the country, and contributed to decreasing the share of investment funded by the national savings, which partly explains the decrease in control over capital movements. In addition, the current convertibility, which is the crowning of the liberalization process initiated since 1986, and the creation of an interbank foreign exchange market in 1994, has strengthened the downward trend. The examination of the exchange regulation of capital transactions shows that the authorities have encouraged capital inflows rather than outflows, in particular FDIs which remain the most coveted inflows. On the other hand portfolio investments have remained subject to regulations, as has been the case with private loans (Appendix 3). Concretely, FDIs represent the most affected component by liberalization (among all capital flow components), and the weakness of the FDI inflows is due, to a great extent to the lack of development of the local stock market (Table 2). The Figure 3 highlights that over 1970-2005, FDIs rarely exceed the level of 4%, but increase in 2006 to represent more than 10% of the GDP at the detriment of LTK (long and medium run capital) and PFI (portfolio investment). Indeed, this increase is due to some Arab investors who are beginning to take an interest in some privatizations in Tunisia. We note that the sharp increase may be accounted for by the sale of 35% of "Tunisie Telecom's" capital to the group of Dubai Tecom-Dig. This transaction amounted to the sum of $2.25 billion, ($1.5 billion of the receipts from this company's privatization were used for the paying back of the external national debt),

OECD (2007). In contrast, portfolio investments do not exceed 1% of the GDP over the period of 1970-2010; since they are controlled by the government. As FDIs are technology transfer generators and are less sensitive to the sudden reversals of capital flows in the event of financial panic than STK (short-term capital) or PFI, they enjoy governmental support and have a greater degree of freedom compared to the other kinds of flows. Indeed, the PFI and the STK remain very much under the control of the authorities and do not constitute a great source of financing for the economy. The medium and long term capital remains dominated by administration flows. The gradual relaxation of the constraint on capital movements has also been strengthened by the accession of Tunisia to the WTO in 1995 and by the free trade agreement with the European Union, since 1994. Besides, Tunisia has made several bond issues on the international market, owing to its good reputation. Indeed, Tunisia has subscribed to a loan in Japanese yen (Samurai credit), dollars in the domestic U.S. and Eurodollar on the European market.

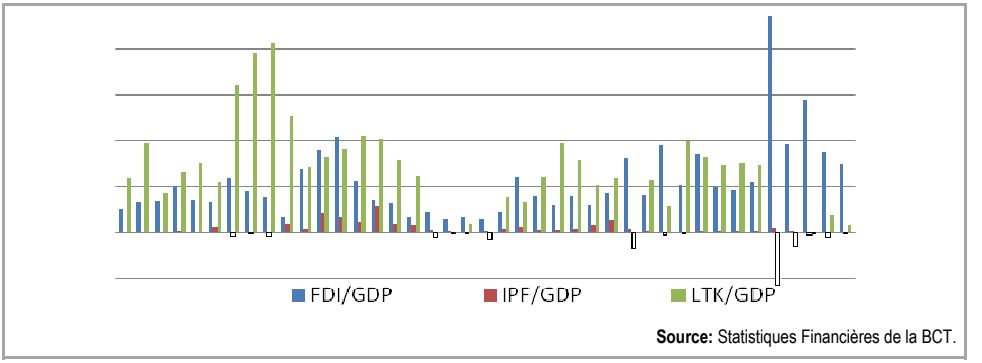


Figure 3 Composition of Capital Flows in Tunisia (1970-2010)

Encouraging capital inflows seems to be obvious on legal grounds, but the assessment of capital opening reveals timid financial integration, even if the β coefficient diminishes in the mid-1980s, by reaching a level of 0.69 in 2010 (Figure 2). Considering the β value as an indicator of financial integration level with the rest of the world, Murphy (1984) ranks countries whose coefficient is higher than 0.6 as countries with a small degree of financial openness. Tunisia is therefore, considered as a country having a small degree of financial opening despite its commitment and determination to reach full convertibility of the dinar.

3. Capital Restrictions and Real Exchange Rate

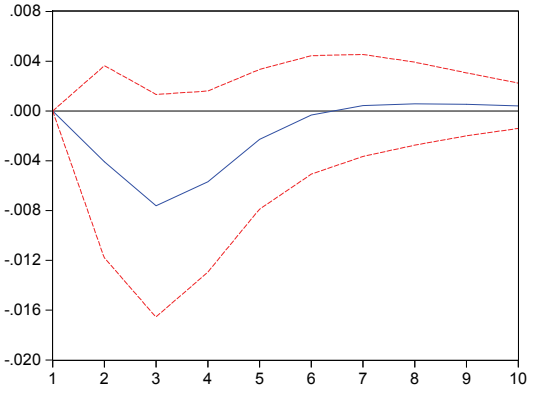
Several analysts consider capital inflow as being part of the fundamentals and if such an inflow generates an appreciation of the RER, this appreciation will be an equilibrium phenomenon (see Edwards 1989; Ibrahim A. Elbadawi and Raimundo Soto 1994; John Williamson 1994). In this case, the government needn't counterbalance the real appreciation by a macroeconomic or an exchange rate policy (see Dooley, Frankel, and Mathieson 1987). As capital flows in, there will be an increase in ex-

penditure and an appreciation in the RER. Once capital stops flowing in or even slows down to adjust to its new long-run equilibrium level, the RER will be overly appreciated, and in order to reach the new equilibrium, massive adjustments may be required. Adjustments are not instantaneous and will take a more or less longer time to occur, depending on the RER's response to each component of capital inflows (see Bernard Laurens and Jamie Cardoso 1998; Edwards 2000).

Empirically, the analysis of the equilibrium RER determinants in Tunisia according to Charfi (2008) shows that not only an inflow of capital but also a term of trade deterioration, and productivity gain (Balassa effect) lead to ERER's appreciation. Domenico Fanizza et al. (2002) applying Philippe R. Lane and Gian M. Milesi-Ferretti's (2001) methodology to Tunisian data over 1970 and 2000 confirms that capital inflow leads to ERER's appreciation by using the same fundamentals.

In order to study the adjustment process, we have analyzed the dynamic interactions between capital flows and RER. Two unrestricted VARs were constructed. The first includes RER, a measure of capital flows, terms of trade, productivity differential as fundamentals influencing RER and its equilibrium value, a measure of the capital control severity (β estimated in Section 1, Figure 2) and monetary policy variables which are the interest rate differential adjusted by a proxy for expected depreciation (called spread), the inflation rate and the excess of the domestic credit supply. The second VAR dissociates the aggregate capital inflows into foreign direct investment (FDI), portfolio investment (PFI), long and medium run capital (LTK) and short run capitals (STK).

For both VAR models, the analysis was undertaken using the cyclical component of the series which in turn was obtained by filtering the series using the Hodrick-Prescott procedure. For all the series, the cyclical component is stationary (Appendix 4, Table 5). As usual, in estimating these VARs the different series were ordered in a way that takes into account their degree of exogeneity. We note that, even when alternative ordering was tried, most results were not altered.



Source: Author's estimations.

Figure 4 Response of RER to One S. D. Total Capital Flows Innovation

Figure 4 evaluates the RER impulse response to the net capital inflows' innovations (NKF). As predicted by standard economic theory, a capital inflow leads to an appreciation of the RER, but the effect is not marked in magnitude since the RER appreciation, resulting from a 1% increase in aggregate capital inflows, is only about 0.7% (although the coefficient has a low significance) and RER returns to equilibrium within 6 years. By comparison with Latin American countries, Edwards (2000) found a value of 4% for Argentina, 2% for Mexico, 0.8% for Brazil and 0.6% for Chile. Similarly to the Tunisian case, Argentina adjusted itself completely after 6 years, but the other countries adjusted themselves later (Chile adjusted itself after 10 years).

The IRFs ensuing from the second VAR are presented in Figure 5 and show that, unlike short run capital flows; FDI, PFI and LTK inflows generate a slight RER appreciation. The appreciation reaches a maximum (about 0.3%) when the shock results from FDI and (about 0.5%) when it results from LTK. Innovations to IPF results in a more pronounced appreciation (about 0.7%), as may be seen in Figure 5. However, the adjustment process begins only in the third period for FDI and IPF and in the second period for LTK.

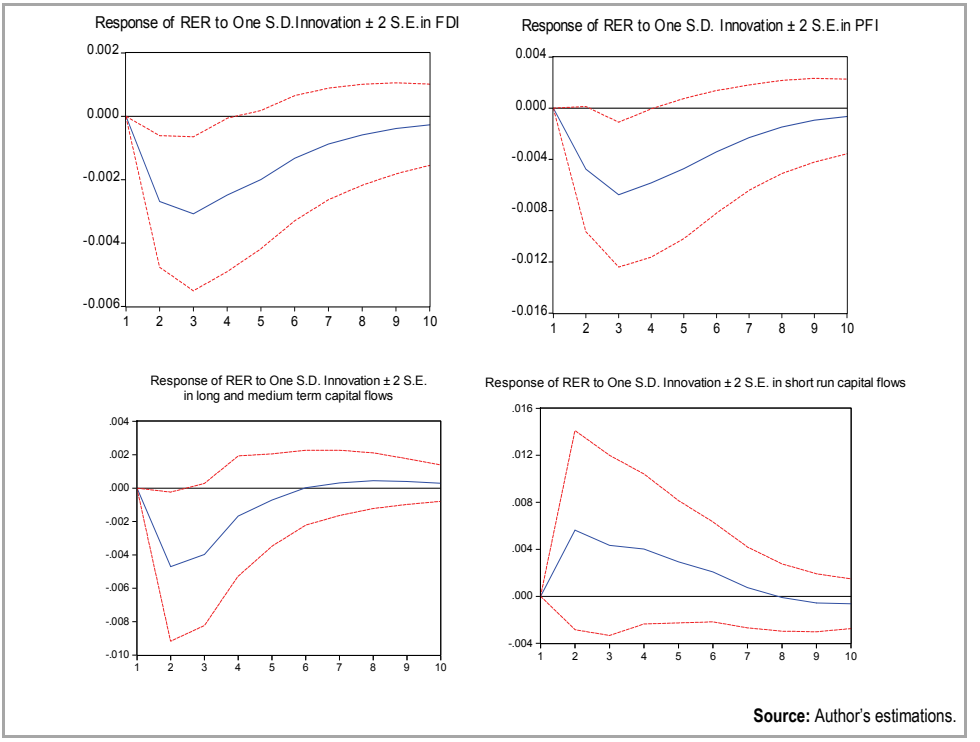
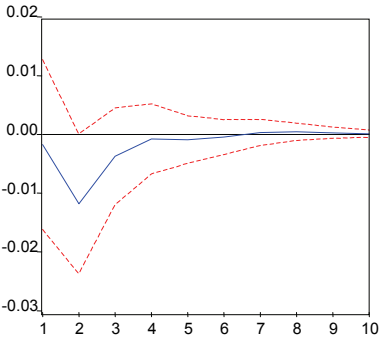


Figure 5 Response of RER to One S. D. ± 2 S. E. Innovation in Various Components of Capital Flows

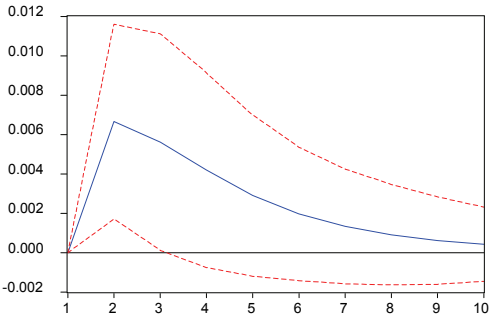
Notice for the particular case of short run capital, innovation to this capital category results in a RER depreciation which is not statistically significant.



Source: Author's estimations.

Figure 6 Response of Domestic Credit Growth to One S. D. Innovation ± 2 S. E. in Capital Flows

To deal with consequences of capital inflows on the RER, two approaches have been used: sterilized interventions aiming at reducing the inflationary consequences of capital inflows and the imposition of some form of capital control. To test if policymakers practice an active sterilized intervention, we analyzed the IRF of excess domestic credit to a one standard deviation (SD) innovation in capital inflows. Figure 6, shows that a unitary shock on capital inflows leads to the restriction of the excess domestic credit in the first year by 0.2% (even though the coefficient is not statistically significant in the first period but becomes statistically significant in the second period) and by 1.2% for the following period and also shows that equilibrium is then reached in the fourth year. So, it seems obvious, that sterilization policy is undertaken by the authorities to counterbalance the inflationary effect of capital inflows. Another means of avoiding the negative consequences of capital liberalization on the RER is to maintain a certain degree of control on capital (see Jonathan D. Ostry et al. 2010). Figure 7 shows that a unitary shock on capital control (CC) generates a RER depreciation of about 0.6% at the end of the first year and equilibrium is established at the end of 10 years.

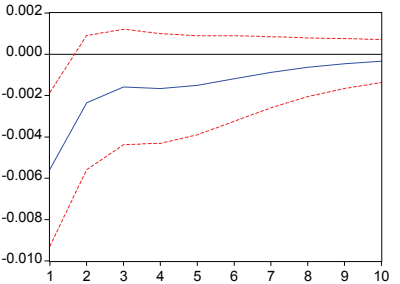


Source: Author's estimations.

Figure 7 Response of RER to One S. D. Innovation ± 2 S. E. in Capital Control Relaxation

Thus a larger opening of the capital account will generate RER appreciation. To face the financial crisis that occurred in 2007-2009, Tunisian monetary authorities, in addition to sterilized intervention, maintained control on capital account as shown by Figure 2. Here, we refer to that the imposition of some form of capital controls aimed at slowing the rate at which capital flows come into and out of the country. Indeed, the estimation of the capital control variable for the last financial crisis shows that there is not any further capital relaxation despite the monetary authorities' commitment to gradually relax capital flow constraints.

It is important to recall that capital control allows policy makers to rely on the domestic interest rate to be an instrument of monetary policy to control inflation. With capital flows' liberalization, the interest rate will stop being a monetary policy instrument (Pelin Berkmen and Nikolay Gueorguiev 2004). That is why, it is important to know the RER's response to a one SD innovation in the spread (Figure 8).



Source: Author's estimations.

Figure 8 Response of RER to One S. D. Innovation ± 2 S. E. in Spread

Indeed, if the domestic asset's yields exceed foreign asset yields by 1%, then the RER will be appreciated by about 0.55% during the first period, then a depreciation trend will be triggered and equilibrium is reached 10 years later.

The comparison of the RER's responses to a one SD innovation in net capital flows (NKF) found in this study to those found by Edwards (2000) for some Latin American countries shows that the impact is lower in Tunisia, because the financial integration achieved by Latin American countries is deeper than the one realized in Tunisia. However, when we consider the capital flow components separately, the IRFs show that the impact of portfolio investment on the RER's appreciation is the most important in magnitude and the system takes 10 years to come back to its long-term level. The impact of the FDI on the RER is less important in magnitude but also requires 10 years to return to equilibrium. Concerning long term capital components, which are mainly made up of government loans, equilibrium takes place after only 6 years. Thus we can conclude that the most harmful liberalization component for competitiveness consists in the PFI, which is still controlled by the authorities. These results justify the time-scale gradual reforms undertaken by the Tunisian authorities, which are characterized by the liberalization of the safest capital category such as FDIs which generate a technology transfer and which cannot leave as easily as PFI,

Ayhan M. Kose et al. (2009). The least controllable categories, such as PFI, should be liberalized at the end of the process.

This study is based on the impulse response function and can be completed by an analysis of the forecast error variance decomposition. The objective is to calculate the contribution of each of the innovations to the variance of the error in percentage. When an innovation explains a large part of the variance of the forecast error; we conclude that the economy is considered highly sensitive to shocks affecting the series. The results of the variance decomposition are shown in Table 6 (Appendix 5). The variance of the forecast error of RER was due 78.6% to its own innovation, 6% to the domestic credit excess supply (Excd), 4% to FDI, 3% to TOT, 3% to long term capital (LTK), PROD and inflation. The short run analysis highlighted the exogenous character of RER. However, in the medium and long run (5-10 years), the forecast error variance of RER due to its own innovations decreased and reached 60%. In contrary, the contribution of TOT increased to 12%, those of FDI and LTK, increased to 6.5%. The contribution of the domestic credit excess supply and PROD innovations amounted to 5% and that of inflation to 3.5%. However, it should be noted that the contribution of PFI and CC, in explaining the error forecast variance of the RER, remained modest (1%) in the short, medium and long run. So, when an innovation explains a small part of the forecast error variance, we conclude that the RER is not sensitive to shocks affecting these series (IPF, CC). However, the marginal role played by these two variables may be due to a cautious degree of capital openness.

4. Conclusions

The RER has been at the core of open economies' economic policies. It is also an indicator of competitiveness. When appreciated, it triggers the emerging countries' fear. However, historically, foreign capital account liberalization has been instrumental in stimulating capital inflows for emerging countries. So, reconciling the objective of preserving competitiveness with capital flow liberalization proves to be a hard task. As far as Tunisia is a small open country pursuing an export-promoting policy, it would have to face a loss of its competitiveness if a real appreciation, induced by a probable capital inflow, took place. Analyzing the authorities' commitment to capital flow liberalization shows that the Tunisian authorities encourage capital inflows, particularly, FDIs. However, legal commitment cannot provide an effective measurement of the capital control severity.

In this article, we have evaluated a dynamic measurement of capital control which should reflect the effective capital account openness in Tunisia. Results highlight the persistence of severity controls on capital flows over the whole period, despite the relaxation of regulation in capital inflows, especially in FDI inflows. Several reasons hinder the surge of FDIs. Among them is the narrowness of the Tunis Stock Exchange market, as well as the fact that the privatization efforts remain modest. The efforts of openness which have been undertaken by the authorities (especially for attracting FDI) are important as far as the legislative aspect is concerned but the implementation of the corresponding measures has been slow. Other components are still controlled by monetary authorities (PFI, STK and LTK), that is why the Tu-

nisian economy was preserved from the recent financial crisis. The integration of the capital control relaxation index in two VAR models gathering the economic fundamentals and monetary policy variables show that capital control relaxations and capital inflows' innovations generate a RER appreciation, as predicted by the standard RER models. The IRFs allow us to evaluate the persistence and the importance of these effects according to the capital flow category. Results have shown that the most persistent effects are those relative to FDI and PFI, whereas the most important and sharpest ones are those relative to PFI. Although a shock to the PFI explains only a marginal variation of the RER, it remains the most harmful component. Oppositely, FDI explains a larger part of RER variation, but the economy can benefit from the positive externalities that it can generate. Indeed, the slow pace of the total liberalization phase of PFI finds a perfect explanation in the obtained IRF that also shows that capital control depreciates the RER and preserves competitiveness. Thus, the level of capital account openness set by the authorities is substantiated by the conducted analysis.

To avoid the inflationary consequences of the capital inflows, monetary authorities seem to be resorting to sterilized interventions, but these interventions can increase the domestic interest rate which can be harmful for investment and growth. Another manner to avoid the negative consequences of capital liberalization is to maintain a degree of control on capital despite the strong desire to attract foreign capital and specially FDIs. To avoid negative effects of the capital flows volatility, especially in a crisis period, Tunisia tried to maintain the same capital control level between 2007 and 2010 and to preserve competitiveness by targeting a constant real exchange rate for the same period. Thereby, the capital account should be open only when the reform process has reached a certain degree of maturity to avoid returning to restrictions on capital flows when a crisis may occur. The solution lies in opting for an adequate sequencing and pace of liberalization and stabilization reforms.

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Appendix 1
Data Sources and Definitions

The real effective exchange rate index (RER), is computed as in Charfi (2008).

$$\text{RER}_{t/0} = \prod_{i=1}^{5} (S_{it} / S_{i0}) * (P_{it} / P_{i0}) / (P_t / P_0)]^{\alpha i} \quad \text{(A1)}$$

S_{it} = the number of dinars per unit of foreign currency *i* at time *t*
S_{i0} = the number of dinars per unit of foreign currency *i* at time *0*
P_{it} = the consumer price index of country *i* at time *t*
P_{i0} = the consumer price index of country *i* at time *0*
P_t = Tunisian consumer price index at time *t*
P_0 = Tunisian consumer price index at time *0*.

Data related to the nominal exchange rate come from the various issues of Tunisian Central Bank financial statistics.

P_i is the consumer price index of country *i*, based on 1995. The data are extracted from the IMF international financial statistics CD-ROM (2009).

P is the consumer Tunisian price, based on 1995. The data are extracted from various issues of Tunisian Central Bank financial statistics.

I/Y represents the Investment to GNP. S/Y represents domestic savings to GNP. The data related to these two variables are extracted from the data base of the World Bank: World Development Indicators 2007.

CC/Y: the current account to GNP. Res: International foreign reserves variation.

NKF: Net capital flows = $\sum FDI + PFI + LTK + STK$. These data come from Tunisian Central Bank financial statistics. Inflation is represented by relative variation of the consumer price index.

Spread represents the interest rate differential adjusted by the relative variation of the nominal exchange rate. Spread reflects the difference between domestic asset yields and foreign asset yields. Data concerning interest rates are extracted from IMF international financial statistics CD-ROM (2009).

Excd = [d log (domestic credit)$_t$ - d log (real GDP)$_{t-1}$]. Excess supply of domestic credit is measured as the rate of growth of domestic credit minus the lagged rate of growth of the real GDP. The domestic credit and real GDP result from various issues of Tunisian Central Bank financial statistics.

Appendix 2
Cusum of Squares Test

To test the stability of β, we first proceeded to estimate the relationship between investment and savings (FH equation) over the period of 1970-2010, using the ordinary least squares (OLS) method.

The estimated equation is the following:

$$I_t = 1{,}57 + 0{,}53\ S_t$$
$$(2{,}22)\quad (2{,}40)$$

$$R^2 = 0{,}12;\ \text{F-statistic} = 5{,}74;\ \text{DW} = 0{,}54.$$

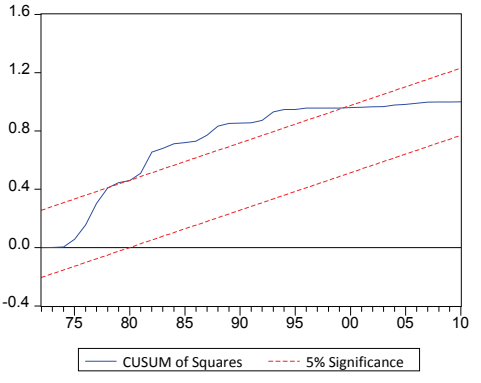
Then, to test the stability of β, we applied Cusum of squares tests on this coefficient. The Cusum of squares tests, developed by Robert L. Brown, James Durbin, and James M. Evans (1975) serves to test the coefficients' temporal stability in a linear regression. It is based on the cumulative sum of squares of the residues, given by:

$$s_t = \left(\sum_{i=k+1}^{t} u_i^2\right) \Big/ \left(\sum_{i=k+1}^{T} u_i^2\right) \quad \text{for t =1,.....T}$$

where u is the recursive residual, resulting from the recursive estimate of the linear regression which link up the investment to savings.

Under the null hypothesis, the statistic s converges towards an average $E(s_t)= \frac{t-k}{T-k}$, which is equivalent to showing the stability of the model.

The Cusum of squares test provides a plot of s_t against t and the pair of 5% critical lines. Movement outside the critical lines, as shown by Figure 9, is suggestive of parameter or variance instability and indicates the rejection of the null hypothesis (rejection of stability).



Source: Author's estimation.

Figure 9 Cusum of Squares Applied to Test the Stability of the Relationship between Investment and Saving 1970-2010

Appendix 3
Capital Exchange Regulation Transactions in Tunisia

Foreign direct investments in Tunisia: Foreign investment in projects in Tunisia is free at the creation and expansion phases. It is subject to prior authorization for certain projects carried out in some economic activity sectors.

Portfolio foreign investments: Foreign investment in portfolio in Tunisia is subjected to regulations. Non-residents having made investments, pursuant to the regulation, are free to transfer net real proceeds and gains on transfer or liquidation of their invested assets through foreign currency import.

Tunisian investments abroad: In order to finance their foreign investment: (i) resident companies can transfer, in line with their foreign currency turnover for the previous financial year, which must not be less than 50 thousand dinars. From 50,000 dinars to 500,000 dinars, they may finance liaison or representation agencies. From 100,000 dinars to 1,000,000 dinars, they may finance subsidiaries, affiliates or capital acquisition in companies set up abroad. The mentioned companies financing the above-stated investment through the debit of their professional accounts in foreign currency may carry out transfers in this respect within the limit of 3,000,000 dinars per year, regardless of the type of investment and of the foreign currency turnover of the considered company. Funds available in professional accounts in foreign currency used in this respect must be derived from the company's exports of goods and services. Funds needed for financing investment must be fully available in the account when the transfer is carried out; (ii) non-exporting resident companies or those having recorded foreign currency turnover of less than 50,000 dinars can transfer from 50,000 dinars to 250,000 dinars for liaison or representation agencies, and from 100,000 dinars to 500,000 dinars for branches, subsidiaries and capital acquisition in companies set up abroad.

Shareholding of residents in the capital of nonresident companies set up in Tunisia: Resident private individuals and Tunisian legal entities or foreign legal entities established in Tunisia are authorized to hold shares in the capital of nonresident companies set up in Tunisia and carry out related transfers. Terms for carrying out these transfers by the authorized intermediaries are fixed in the circular of the BCT.

External borrowings: (a) resident companies may, for their activities' needs, borrow freely, from nonresidents in foreign currency up to 10 million dinars per calendar year for lending institutions and 3 million dinars for the other companies. When granted for a period of more than 12 months, these loans are borrowed freely and without limit for lending institutions and within a limit of 10 million dinars per year for other companies. However, the lending institutions must be subdued to a prior voluntary assessment of a rating agency, or listed on the stock exchange market; (b) transfers related to reimbursement in principal and interest payment of these borrowing are free.

Opening accounts abroad: Resident companies having incurred contracts to provide services or to accomplish works on behalf of non-residents abroad, are authorized to freely open at banks of countries where these contracts are carried out,

accounts in currencies of these countries to save part of the income collected in this respect and meant to cover local expenditure.

This procedure exclusively concerns contracts incurred in foreign countries where the law into effect calls for the use of part of the income to cover local expenditure in national currency.

At the end of the contract, the resident company must settle any account that was opened abroad in the local currency and remit the credit amount of this account as per the law into effect.

Source: Central Bank of Tunisia 2008.

Appendix 4
Stationary Tests of the Variables

We test the unit root hypothesis against the alternative stationary assumption. Investment to GNP and savings to GNP stationary tests are given in Table 4.

Table 4 Unit Root Tests over the Period (1970-2010)[1]

Variable	(ADF)	PP	Variable	(ADF)	PP
I/Y	- 1.99 (k=0)	-2.22	Δ (I/Y)	- 4.02 (k=0)	-3.97
S/Y	- 2.76 (k=0)	-2.33	Δ (S/Y)	- 5.89 (k=0)	-10.74

Note: MacKinnon critical values are of: - 3.65; - 2.95 and - 2.61 for respective confidence of 1%, 5% and 10%.

Source: Author's estimations.

Table 5 Unit Root Tests over the Period (1970-2010) for the Cyclical Components of the Variables Included in the VAR

Variable	(ADF)	PP
NKF	- 4.97 (k=0)	-4.88
FDI	- 6.69 (k=0)	-10.20
PFI	- 4.9 (k=0)	-4.87
LTK	- 4.35 (k=0)	-4.19
STK	- 7.50 (k=0)	-7.50
Spread	- 5.78 (k=0)	-5.78
Inflation	- 6.53 (k=0)	-6.95
Excd	- 6.15 (k=0)	-10.75
Beta β	- 4.45 (k=4)	-4.82
RER	- 3.15 (k=0)	-3.24
Dprod	-5.24 (k=0)	-5.22

Source: Author's estimations.

For all the variables, the unit root (which is the null hypothesis rejected to 1%). For the RER, the null hypothesis is rejected to 5%. Therefore, all the cyclical components of all the variables are stationary.

[1] The null hypothesis is a unit root versus a trend-stationary alternative. The augmented Dickey and Fuller test statistics (ADF) for a variable X_t is given by the t-statistic on the estimated coefficient π_2 in the following regression (including the constant): $\Delta X_t = \pi_1 + \pi_2 X_{t-1} + \Sigma \beta_i \Delta X_{t-i}$ where k is determined by the highest order lag for which the corresponding β_i is significant (David A. Dickey and Wayne A. Fuller 1981).

Appendix 5

Table 6 Variance Decomposition of the Prediction Error

Variance Decomposition of RER:

Period	S.E.	RER	TOT	STK	PFI	LTK	FDI	PROD	CC	spread	excd	INF
1	0.02	100.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.02	78.58	2.69	0.04	0.59	2.85	3.65	2.60	0.03	0.05	6.37	2.55
3	0.03	67.33	8.96	0.28	0.60	6.03	4.68	2.48	0.04	0.65	5.43	3.52
4	0.03	63.19	11.81	0.38	0.55	5.73	5.73	3.01	0.29	0.72	5.09	3.50
5	0.03	60.93	12.07	0.58	0.68	5.76	6.24	3.88	0.61	0.80	5.03	3.42
6	0.03	59.65	11.83	0.72	0.83	6.04	6.43	4.59	0.79	0.79	5.01	3.34
7	0.03	59.22	11.67	0.79	0.91	6.21	6.38	4.88	0.83	0.78	5.04	3.30
8	0.03	59.13	11.64	0.81	0.92	6.27	6.33	4.93	0.83	0.78	5.05	3.29
9	0.03	59.11	11.67	0.82	0.92	6.28	6.34	4.92	0.83	0.78	5.06	3.29
10	0.03	59.07	11.69	0.81	0.92	6.27	6.36	4.92	0.83	0.78	5.05	3.29

Variance Decomposition of TOT:

Period	S.E.	RER	TOT	STK	PFI	LTK	FDI	PROD	CC	spread	excd	INF
1	0.06	13.30	80.12	0.18	0.21	1.41	1.43	1.11	0.19	0.18	1.14	0.74
2	0.07	10.68	73.11	0.28	0.21	2.84	1.28	2.25	0.29	1.47	6.68	0.91
3	0.07	10.70	68.40	0.27	0.30	6.06	1.44	3.10	0.51	1.52	6.30	1.39
4	0.07	10.76	67.55	0.39	0.76	6.07	1.43	3.33	0.51	1.60	6.23	1.38
5	0.07	10.91	67.29	0.39	0.76	6.17	1.43	3.35	0.54	1.59	6.20	1.37
6	0.07	10.99	67.08	0.39	0.76	6.29	1.43	3.34	0.57	1.60	6.17	1.39
7	0.07	11.08	67.00	0.39	0.76	6.31	1.43	3.33	0.56	1.60	6.15	1.39
8	0.07	11.11	66.96	0.39	0.76	6.31	1.44	3.33	0.56	1.60	6.14	1.39
9	0.07	11.12	66.94	0.39	0.76	6.30	1.45	3.34	0.57	1.60	6.14	1.39
10	0.07	11.11	66.92	0.39	0.77	6.30	1.46	3.35	0.57	1.60	6.14	1.39

Variance Decomposition of STK:

Period	S.E.	RER	TOT	STK	PFI	LTK	FDI	PROD	CC	spread	excd	INF
1	1.23	1.53	2.08	96.32	0.00	0.02	0.01	0.01	0.00	0.01	0.02	0.00
2	1.32	1.33	2.87	86.21	4.96	0.57	1.92	0.58	0.03	0.24	1.23	0.04
3	5.73	1.40	3.21	85.18	4.99	0.60	2.13	0.66	0.23	0.33	1.22	0.05
4	4.03	43.26	1.85	48.60	2.85	0.39	1.45	0.46	0.15	0.21	0.75	0.03
5	3.25	27.84	36.70	31.29	1.87	0.26	0.94	0.34	0.10	0.14	0.49	0.03
6	3.03	24.32	32.06	39.96	1.63	0.22	0.83	0.30	0.09	0.12	0.43	0.03
7	5.24	17.24	22.72	28.31	30.29	0.16	0.59	0.22	0.06	0.09	0.31	0.02
8	4.51	12.70	16.72	20.84	22.30	26.49	0.43	0.16	0.05	0.06	0.23	0.01
9	8.94	9.73	12.82	15.98	17.09	20.31	23.67	0.12	0.04	0.05	0.17	0.01
10	4.71	7.67	10.10	12.59	13.47	16.00	18.65	21.30	0.03	0.04	0.14	0.01

Variance Decomposition of IPF:

Period	S.E.	RER	TOT	STK	PFI	LTK	FDI	PROD	CC	spread	excd	INF
1	7.10	6.18	8.17	10.14	10.95	12.89	15.02	17.16	19.33	0.03	0.11	0.01
2	5.81	5.09	6.73	8.35	9.01	10.61	12.36	14.12	15.91	17.72	0.09	0.01
3	6.51	4.26	5.64	6.99	7.54	8.88	10.35	11.82	13.32	14.84	16.35	0.01
4	6.07	3.62	4.79	5.93	6.40	7.54	8.78	10.03	11.30	12.59	13.87	15.16
5	6.07	3.62	4.79	5.93	6.40	7.54	8.78	10.03	11.30	12.59	13.87	15.16
6	6.07	3.62	4.79	5.93	6.40	7.54	8.78	10.03	11.30	12.59	13.87	15.16
7	6.07	3.62	4.79	5.93	6.40	7.54	8.78	10.03	11.30	12.59	13.87	15.16
8	6.07	3.62	4.79	5.93	6.40	7.54	8.78	10.03	11.30	12.59	13.87	15.16
9	6.07	3.62	4.79	5.93	6.40	7.54	8.78	10.03	11.30	12.59	13.87	15.16
10	6.07	3.62	4.79	5.93	6.40	7.54	8.78	10.03	11.30	12.59	13.87	15.16

Variance Decomposition of LTK:

Period	S.E.	RER	TOT	STK	PFI	LTK	FDI	PROD	CC	spread	excd	INF
1	6.21	3.47	4.96	6.60	6.27	9.99	8.41	9.61	10.82	12.06	13.29	14.53
2	6.25	3.85	4.98	6.54	6.48	10.22	8.30	9.47	10.68	11.90	13.14	14.44
3	6.26	3.89	5.00	6.53	6.46	10.25	8.29	9.45	10.66	11.87	13.16	14.45
4	6.27	3.88	5.03	6.51	6.44	10.23	8.39	9.45	10.67	11.85	13.13	14.43
5	6.27	3.91	5.01	6.51	6.44	10.25	8.39	9.48	10.67	11.82	13.11	14.40
6	6.28	3.96	5.01	6.50	6.44	10.27	8.39	9.51	10.66	11.80	13.09	14.37
7	6.28	4.02	5.02	6.49	6.44	10.28	8.38	9.51	10.65	11.79	13.08	14.36
8	6.29	4.04	5.03	6.49	6.43	10.28	8.38	9.50	10.64	11.78	13.07	14.35

9	6.29	4.05	5.03	6.49	6.43	10.27	8.38	9.50	10.64	11.78	13.07	14.35
10	6.29	4.05	5.04	6.49	6.43	10.27	8.38	9.50	10.64	11.78	13.07	14.34

Variance Decomposition of FDI:

Period	S.E.	RER	TOT	STK	PFI	LTK	FDI	PROD	CC	spread	excd	INF
1	6.36	3.96	5.31	6.35	6.45	10.16	9.73	9.29	10.41	11.52	12.78	14.03
2	6.36	3.96	5.30	6.34	6.45	10.14	9.80	9.32	10.39	11.52	12.79	14.00
3	6.37	3.99	5.30	6.34	6.45	10.13	9.80	9.32	10.38	11.51	12.79	14.00
4	6.37	3.99	5.30	6.34	6.45	10.13	9.79	9.32	10.38	11.51	12.78	13.99
5	6.37	3.99	5.31	6.34	6.45	10.14	9.79	9.32	10.38	11.51	12.78	13.99
6	6.37	3.99	5.31	6.34	6.45	10.14	9.79	9.32	10.38	11.51	12.78	13.99
7	6.37	3.99	5.31	6.34	6.45	10.14	9.79	9.32	10.38	11.51	12.78	13.99
8	6.37	3.99	5.31	6.34	6.45	10.14	9.79	9.32	10.38	11.51	12.78	13.99
9	6.37	3.99	5.31	6.34	6.45	10.14	9.79	9.32	10.38	11.51	12.78	13.99
10	6.37	3.99	5.31	6.34	6.45	10.14	9.79	9.32	10.38	11.51	12.78	13.99

Variance Decomposition of PROD:

Period	S.E.	RER	TOT	STK	PFI	LTK	FDI	PROD	CC	spread	excd	INF
1	6.75	4.00	4.72	5.68	6.09	9.02	8.77	18.45	9.23	10.23	11.37	12.44
2	6.90	4.03	5.39	6.33	5.96	9.59	8.46	17.70	9.04	10.20	11.06	12.23
3	6.96	4.18	6.21	6.24	5.99	9.66	8.40	17.43	8.90	10.05	10.89	12.05
4	6.97	4.19	6.35	6.23	5.97	9.63	8.37	17.38	8.88	10.08	10.88	12.03
5	6.98	4.20	6.38	6.22	5.96	9.65	8.41	17.38	8.88	10.06	10.86	12.01
6	6.98	4.20	6.37	6.22	5.97	9.65	8.42	17.39	8.88	10.05	10.85	11.99
7	6.98	4.20	6.37	6.22	5.97	9.65	8.42	17.41	8.88	10.05	10.85	11.99
8	6.98	4.21	6.37	6.22	5.97	9.65	8.42	17.41	8.88	10.05	10.85	11.99
9	6.98	4.21	6.37	6.22	5.97	9.65	8.42	17.41	8.88	10.05	10.85	11.98
10	6.98	4.21	6.37	6.22	5.97	9.65	8.42	17.41	8.88	10.04	10.85	11.98

Variance Decomposition of CC:

Period	S.E.	RER	TOT	STK	PFI	LTK	FDI	PROD	CC	spread	excd	INF
1	6.99	4.20	6.35	6.20	5.95	9.64	8.44	17.46	8.97	10.02	10.82	11.95
2	7.01	4.21	6.34	6.19	5.95	9.68	8.48	17.50	8.98	9.98	10.78	11.91
3	7.02	4.30	6.33	6.18	5.95	9.70	8.47	17.53	8.97	9.95	10.75	11.87
4	7.03	4.40	6.34	6.18	5.95	9.70	8.46	17.51	8.95	9.93	10.74	11.85
5	7.03	4.45	6.35	6.17	5.94	9.70	8.45	17.50	8.94	9.92	10.73	11.84
6	7.03	4.47	6.36	6.17	5.94	9.70	8.45	17.49	8.94	9.92	10.73	11.83
7	7.03	4.48	6.37	6.17	5.94	9.69	8.46	17.49	8.94	9.92	10.73	11.83
8	7.03	4.47	6.37	6.17	5.94	9.69	8.46	17.49	8.94	9.92	10.73	11.83
9	7.03	4.47	6.37	6.17	5.94	9.69	8.46	17.49	8.94	9.92	10.73	11.83
10	7.03	4.48	6.37	6.17	5.94	9.69	8.46	17.49	8.94	9.91	10.73	11.83

Variance Decomposition of SPREAD:

Period	S.E.	RER	TOT	STK	PFI	LTK	FDI	PROD	CC	spread	excd	INF
1	7.34	8.51	5.96	5.73	5.51	8.97	7.77	16.34	8.22	12.27	9.85	10.87
2	7.41	8.59	5.86	5.62	5.45	8.88	8.02	16.05	8.06	12.07	10.31	11.09
3	7.45	9.25	5.83	5.57	5.40	8.80	8.00	15.89	8.08	11.96	10.26	10.98
4	7.49	9.58	5.89	5.51	5.34	9.01	7.91	15.76	8.04	11.83	10.25	10.89
5	7.52	9.82	6.04	5.47	5.32	9.12	7.85	15.67	7.98	11.74	10.18	10.82
6	7.53	9.94	6.14	5.45	5.30	9.12	7.84	15.61	7.95	11.70	10.15	10.80
7	7.54	9.97	6.19	5.44	5.29	9.10	7.87	15.60	7.95	11.68	10.13	10.79
8	7.54	9.97	6.20	5.44	5.29	9.09	7.88	15.61	7.95	11.67	10.12	10.78
9	7.54	9.96	6.20	5.44	5.29	9.09	7.89	15.62	7.95	11.67	10.12	10.77
10	7.54	9.97	6.20	5.44	5.29	9.10	7.89	15.62	7.95	11.66	10.12	10.77

Variance Decomposition of EXCD:

Period	S.E.	RER	TOT	STK	PFI	LTK	FDI	PROD	CC	spread	excd	INF
1	7.54	9.97	6.20	5.44	5.29	9.10	7.89	15.62	7.95	11.66	10.12	10.77
2	7.54	9.97	6.20	5.44	5.29	9.10	7.89	15.62	7.95	11.66	10.12	10.77
3	7.54	9.97	6.20	5.44	5.29	9.10	7.89	15.62	7.95	11.66	10.12	10.77
4	7.54	9.97	6.20	5.44	5.29	9.10	7.89	15.62	7.95	11.66	10.12	10.77
5	7.54	9.97	6.20	5.44	5.29	9.10	7.89	15.62	7.95	11.66	10.12	10.77
6	7.54	9.97	6.20	5.44	5.29	9.10	7.89	15.62	7.95	11.66	10.12	10.77
7	7.54	9.97	6.20	5.44	5.29	9.10	7.89	15.62	7.95	11.66	10.12	10.77
8	7.54	9.97	6.20	5.44	5.29	9.10	7.89	15.62	7.95	11.66	10.12	10.77
9	7.54	9.97	6.20	5.44	5.29	9.10	7.89	15.62	7.95	11.66	10.12	10.77
10	7.54	9.97	6.20	5.44	5.29	9.10	7.89	15.62	7.95	11.66	10.12	10.77

Variance Decomposition of INF:

Period	S.E.	RER	TOT	STK	PFI	LTK	FDI	PROD	CC	spread	excd	INF
1	7.63	9.83	6.22	5.57	5.19	8.94	7.75	15.32	8.08	12.05	9.91	11.15
2	7.66	9.76	6.85	5.53	5.15	8.87	7.68	15.19	8.02	12.05	9.82	11.08
3	7.67	9.75	6.85	5.52	5.15	8.87	7.66	15.19	8.00	12.06	9.88	11.06
4	7.67	9.74	6.85	5.52	5.15	8.91	7.66	15.19	8.00	12.06	9.87	11.06
5	7.67	9.74	6.85	5.51	5.15	8.91	7.66	15.18	8.00	12.06	9.87	11.06
6	7.67	9.74	6.85	5.51	5.15	8.91	7.66	15.18	8.00	12.06	9.87	11.06
7	7.67	9.74	6.85	5.51	5.15	8.91	7.66	15.18	8.00	12.06	9.87	11.06
8	7.67	9.74	6.85	5.51	5.15	8.91	7.66	15.18	8.00	12.06	9.87	11.06
9	7.67	9.74	6.85	5.51	5.15	8.91	7.66	15.18	8.00	12.06	9.87	11.06
10	7.67	9.74	6.85	5.51	5.15	8.91	7.66	15.18	8.00	12.06	9.87	11.06

Source: Author's estimations.