# A Time Series Approach for the Evaluation of the Tunisian Adjustment Program 1986 - 1991

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## Abstract

يرمى هذا البحث إلى تقييم برنامج الإصلاح الذى قامت به الحكومة التونسية تحت إشراف صندوق النقد الدولى فى الفترة من ١٩٨٦ – ١٩٩١.

يعتمد التقييم فى هذا البحث على طريقة " الحقائق المقابلة " حيث تقارن المسارات الزمنية الفعلية لبعض المتغيرات الهدفية بالمسارات التى كان بالإمكان الحصول عليها لو لم يكن هناك برنامج، حيث تتفادى هذه الطريقة عديداً من نقائص طريقة قبل وبعد المستعملة فى كثير من الدراسات حول تقييم برامج الإصلاح الإقتصادى.

من ناحية أخرى، وعلى خلاف بقية الطرق المستعملة فى تقييم هذه البرامج، تقوم الطريقة المتبعة فى هذه الورقة على نماذج السلاسل الزمنية التى لا تخضع للعيوب المرتبطة باستعمال النماذج الهيكلية.

بعد تطبيق هذه الطريقة لتقييم تأثير البرنامج على متغيرين هامين، التضخم والاحتياطيات، اتضح أن هذا البرنامج لم يكن له أى تأثير يذكر على التضخم فى حين كان له أثر إيجابى على مستوى الاحتياطيات.

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# Of The Tunisian Adjustment Program

# 1986-91

## 1. Introduction

After a period of sustained economic growth and relatively strong external balances during the 1970's, Tunisia's financial situation witnessed dramatic changes toward the mid 1980's. This was mainly due to the overturn in the export prices of oil, the slackening tourist activity, the decline in worker's remittances, and the drought that hit agricultural production very badly on several occasions.

Following these developments, in August 1986 Tunisia embarked on an economic adjustment program. To support this program, Tunisian authorities sought the help of the IMF for financial assistance. On the 4th of November, the Fund approved a stand-by arrangement (SBA) and compensatory financing (CFF) that entailed putting at the disposal of the Tunisian authorities, resources totaling the equivalent of SDR 218.36 million. Of the total, SDR 114.71 million was immediately available under the CFF. The CFF was activated due to a 13% shortfall in estimated earnings for 1986 from merchandise exports, travel, and workers' remittances. [1] The remainder was allowed to be drawn over a period of 18 months, in direct support of the adjustment program.

The Tunisian adjustment program rested on policies designed to contain overall demand, improve the competitiveness of the export sector and liberalize the economy. More specifically, these policies consisted primarily of the following : liberalizing prices, investment, and imports; lowering the profile of state eneterprises in production; adopting a more flexible exchange rate; and liberalizing the financial sector.

The aims of the stabilization programs were determined in the context of the objectives of the VII development plan 1987-91, with its emphasis on raising the growth rate of real output, stabilizing inflation, reducing external imbalances, and avoiding an excessive indebtedness of the economy. The program also aimed at reorienting the economy toward an outward and market-oriented outlook.

To sustain and strengthen the structural components that started during the 1986-88 stabilization program, Tunisian authorities embarked, in 1988, on a follow-up program that was prepared in close collaboration with IMF and World Bank staff. To back up the program. the IMF reserved SDR 207.3 million to be drawn in the context of a three-year extended facility. The program aimed at proceeding with the deregulation of prices and

foreign trade, the reform of the financial sector, restucturing public enterprises, and at introducung a comprehensive tax reform.

After five consecutive years of experience with adjustment programs backed up by the IMF, Tunisia, which combined macroeconomic stabilization and comprehensive structural reforms, offers a very important case to assess the performance of these programs.

Assessment is based on the counterfactual approach where the actual time paths of the most important variables in the program namely, inflation and balance of payments, are compared to the paths that would have been observed without the program. In drawing on the case of Tunisia, this paper seeks to shed some light on the usefulness of time-series analysis in assessing the effects of IMF-supported programs.

The rest of the paper is organized as follows : Section II presents a brief background and the circumstances surrounding the crisis years of the Tunisian economy. Section III presents the method used in assessing the effects of the program. Section IV reports the estimation results and evaluates the impact of the latter program. Section V concludes.

## II. Background andThe Emergency of Difficulties

After its independence in 1956 and throughout the 1960's, Tunisia had followed an inward-looking development strategy based on two aspects : first, to build a strong industrial base through stepped-up capital formation and import substitution in the industrial sector, and second, to adopt a system of collective organization of agriculture.

This strategy was rapidly confronted with its own limitations causing a crisis situation that reached its peak in the years 1969-70. Over-accumulation of capital resulted in a bias against wage-incomes and reduction in demand. As a consequence of the limitation of the domestic market, capacities were left idle. Between 1962-72 consumption per capita decreased by 0.1 percent and the rate of utilization of capacities was, at best, around 60 percent. [2]

In the early 1970\s the Tunisian government decided to withdraw from the previous collectivistic-state oriented model of development. The new economic policy sought to get the private sector more involved in the production process, to open up the economy to foreign investors and capital and to encourage export industries. In this regard, many laws were promulgated to encourage new domestic and foreign investment in manufacturing.

During 1971-80 the investment ratio to the GNP hovered around the average rate of 27 percent. Growth rates of exports on the other hand were spectacular, especially in the first half of the decade, due notably to the increase in oil prices. During the same period, the real GDP growth rate averaged 7.5 percent and real absorption 7.8 percent, which explains the relative stability of the savings ratio during that period. Overall, the performance of the Tunisian economy during the 1970's was relatively satisfactory, even

if it was beset, every now and then, by unfavorable weather and world markets conditions.

Continuing with the same liberal orientation engaged in during the 70's, the Tunisian economy entered the 1980's with a very unfavorable situation. Tables 1 and 2, persent some domestic and external economic indicators in the first half of the decade before the outbreak of the crisis in 1986.

The beginning of the 1980's was a very difficult period for the Tunisian economy. Inflation was running at two-digit levels, output was sluggish, and foreign exchange earnings declining due notably, to the reduction of oil prices.

In 1986, many factors were combined to expose the Tunisian economy's vulnerability to many domestic and international shocks. Domestically, drought had a damaging effect on cereals crops. Production dropped from 20.7 millions of quintals in 1985, to 6.1 in 1986. Output n industry was sluggish. Overall, the real GDP decreased by 1.6 percent. On the international level, oil and phosphate prices continued to drop, tourist income fell from 416 millions of dinars (MD) in 1985 to 386 MD in 1986, and the balance of payments deficit reached 153 MD against 94 MD one year before. On top of all these adverse developments, came the decision of neighboring Libya to force the return of 40.000 Tunisian workers. This incident meant for the Tunisian economy a loss of workers remittances, a closed market for exprots, and an increasing rate of unemployment which was already a subject of concern. Earlier in the same year, the credit-worthiness of the country was shaken by a demand for credit from the Eurocredit market that did not find full support.

The country was facing a very uncertain future. Domestic, political and social unrest were not showing any signs of abating. On the other hand, there was some concern about the loss of European markets for agricultural products, especially, with Spain and Portugal being in the process of joining the European Economic Community (EEC), and about lower oil revenues.

Faced with this bleak picture, the Tunisian authorities decided to approach the IMF for financial assistance. The Fund agreed to an SBA starting from Novermber 4th 1986. In August 1988, the Fund agreed to an Extended Fund Facility (EFF) over three years.

## Table 1

### Tunisia : Selected Domestic Economic Indicators, 1980 - 85

(Annual percentage change, unless otherwise noted)

|  | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|
| Real GDP | 7.4 | 5.5 | - 0.5 | 4.7 | 5.7 | 5.6 |
| Real Agriculture Value Added | 9.9 | 6.5 | - 10.3 | 2.5 | 12.9 | 17.4 |
| Real Absorption | 9.2 | 9.5 | 2.5 | 2.9 | 6.7 | - 1.4 |
| Consumer Price Index | 10.1 | 8.8 | 13.8 | 8.9 | 8.4 | 8.0 |
| Broad Money : M2 | 17.3 | 22.9 | 20.2 | 17.1 | 12.0 | 13.5 |
| Domestic Credit | 19.1 | 29.7 | 25.5 | 21.0 | 15.8 | 16.2 |
| Fiscal Deficit % of GDP | - 2.8 | - 2.5 | - 5.8 | - 8.3 | - 4.9 | - 5.1 |
| Investment % of GDP | 30.3 | 33.5 | 32.9 | 30.6 | 33.0 | 27.8 |
| Savings % of GDP | 25.2 | 25.2 | 22.8 | 22.7 | 21.6 | 20.1 |

## Table 2

### Selected External Economic Indicators : 1980 - 85

(Annual percentage change, unless otherwise noted)

|  | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|
| Merchandise Exports (f.o.b.) | 40.1 | 13.7 | - 19.4 | - 6.9 | - 3.5 | - 4.3 |
| Merchandise Imports (f.o.b.) | 27.1 | 9.1 | - 8.4 | - 7.2 | 0.6 | - 12.3 |
| Terms of Trade | 14.8 | 2.0 | - 7.5 | - 6.5 | - 3.5 | - 2.2 |
| Workers' Remittances | 12.6 | 12.1 | 4.3 | - 3.4 | - 11.9 | - 14.5 |
| Debt Service Ratio % of Foregin Exchange Receipts | - | - | 14.2 | 16.1 | 19.4 | 21.6 |
| Current Account Balance (% oF GDP) | - 4.3 | - 4.8 | - 8.5 | - 7.6 | - 10.7 | - 6.4 |
| Balance of Payments (in Millions of Dinars) | 29.0 | 46.0 | 16.0 | - 10.0 | - 116.0 | - 94.0 |

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Table 3 given below, summarizes the evolution of the main domestic and external indicators during program years.

It should be pointed out that on August 18, 1986, well before the program had officially started, the Tunisian authorities announced a 10 percent devaluation of the Dinar along with cuts in public spending and a reduction in import tariffs. Other measures included decisions to lower subsidies on a number of staple foods and to increase the basic industrial wage by 10 percent. Of course, it would be naive to think that all these measures did not involve the IMF.

### Table 3
### Tunisia : Selected Economic Indicators During the Program Year 1980 - 85
(Annual percentage change, unless otherwise noted)

|  | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|
| Real GDP | - 1.4 | 6.6 | 0.2 | 3.7 | 7.5 | 3.7 |
| Real Absorption | - 4.0 | 0.8 | - 1.4 | 9.0 | 9.4 | 1.2 |
| Consumer | 6.2 | 8.2 | 9.6 | 7.7 | 6.5 | 8.2 |
| Broad Money : M2 | 6.8 | 14.9 | 17.5 | 15.5 | 7.7 | 5.8 |
| Domestic Credit | 8.3 | 8.8 | 4.4 | 24.1 | 6.3 | 8.2 |
| Fiscal Deficit % of GDP | - 7.3 | - 4.7 | - 3.8 | - 4.3 | - 5.3 | - 4.1 |
| Workers' Remittances | 28.9 | 42.2 | 16.3 | - 0.8 | 13.2 | - |
| Current Account Balance Ratio % of GDP | - 7.5 | - 1.1 | + 1.1 | - 3.6 | - 5.6 | - 4.6 |
| Debt Service Ratio % of Foreign Exchange Receipts | 26.9 | 26.8 | 22.1 | 22.0 | 24.2 | 22.8 |
| Balance of Payments in Millions of Dinars | 153.0 | 97.0 | 325.0 | 92.3 | - 61.6 | - 95.0 |

Sources :

International Financial Statistics (IMF), World Tables (the World Bank), Statistiques Financières and Rapport Annuel (Central Bank of Tunisia).

Many of the Fund policy recommendations are part of " prior actions " that the IMF requires a country to take even before a program is agreed upon. Measures to devalue the local currency, reduce subsidies and cut tariffs are very typical IMF recommendations.

## III. ARMA Models For Reserves and Inflation

This paper focuses on the effects of the five-year adjustment program of the evolution of international reserves and the inflation rate. This is done for two reasons. Firstly, because the latter variables are the most important targets of IMF-supported programs, and secondly, because quarterly data on other variables, notably on output, are not available.

The behavior of international reserves and inflation variables before and after the start of the program, as represented by the rate of change of international reserves and the consumer price index (CPI) respectively, is summarized in table 4. The before-after comparison reveals that the average rate of change in the CPI over program years is lower than that of the pre-program period, and the average loss in internationl reserves was less pronounced during the program. Although these findings are positive in their own right, one has to avoid making the hasty conclusion that the impact of the program on both variables was positive. This is due to the fact that the before-after comparisons suffer from many flaws.

The main flaw of this approach resides in the fact that it cannot measure the independent effects of the program since it attributes all the changes in the relevant variables to the program itself and ignores the effects of nonprogram factors and shocks that are also affecting these variables. [3]

In order to evaluate the impact of the adjustment program, we adopt the counterfactual approach. Unlike the before-after approach, the counterfactual approach can measure the independent effects of the program without being blurred by nonprogram factors. Moreover, it recognizes the fact that the program can yield unfavorable results and still be considered successful if the alternative is not any better. Accordingly, counterfactuals for what would have happened to the balance of payments and inflation without the program, are required as a basis for evaluation.

### Table 4

**Comparison of Before and After Control Percentage Rates of change in CPI and international Reserves.**

(Annual percentage change, unless otherwise noted)

| Period | CPI | Reserves |
|---|---|---|
| Before Control | | |
| 5 - Year (1981.3-1982.2) | 10.8 | - 14.2 |
| 4 - Year (1982.3-1983.2) | 5.7 | - 31.5 |
| 3 - Year (1983.3-1984.2) | 6.4 | - 53.1 |
| 2 - Year (1984.3-1985.2) | 5.0 | - 63.7 |
| 1 - Year (1985.3-1986.2) | 3.1 | - 81.7 |
| Five Year average of pre-control rates of change | 6.2 | - 48.8 |
| After Control | | |
| 1 - Year (1986.3-1987.2) | 5.8 | + 3.9 |
| 2 - Year (1987.3-1988.2) | 4.1 | + 15.8 |
| 3 - Year (1988.3-1989.2) | 4.9 | - 8.3 |
| 4 - Year (1989.3-1990.2) | 4.2 | - 26.0 |
| 5 - Year (1990.3-1991.2) | 6.0 | - 40.0 |
| Five Year average of pre-control rates of change | 5.0 | - 10.9 |

In other works structural equations systems or reduced-form models were relied upon to generate counterfactuals based on the behavior of a control-group of non-program countries. [4] However, the use of structural models is almost invariably associated with problems relative to, among other things, the arbitrariness in the choice of the endogenous and exogenous variables to be included and normalization of each equation, the choice of lag lengths, the problems of aggregation and the modelling of expectations. In contrast, projections of the relevant variable time paths, using a time-series appoach, certainly offer an inexpensive way to generate counterfactuals.

In what follows, I use the model building strategy suggested by Box and Jenkins (1970) for identification, and diagnostic checking, so as to represent each series as an ARMA process. In the first stage, identification involves the determination of the orders of the autoregressive and moving average components of the processes as well as the number of times each series has to be differenced to make it stationary. When more than one model seem to adequately represent the data, Akaike Information Criterion (AIC) will be used as a basis for choice. Once the model is chosen, estimation is performed. Finally, diagnostic checks involve testing the whiteness of the estimated residuals of the chosen model.

## IV. Estimation Results and Evaluation of The Program

The Foregoing procedure was applied to seasonally-unadjusted quarterly data on infation rates (INFL), and rates of change in international reserves (CRES). Since, as mentioned previously, the Tunisian authorities are believed to have started applying IMF measures well before the official start of the program, namely, quarterly data spanning the period 1965. 1-1986.2.

It should be mentioned that both series, INFL and CRES, exhibited a pattern of peaks and valleys spaced at more or less regular intervals. This kind of pattern is indicative of the presence of deterministic seasonal fluctuations.

To take into account this pattern of seasonality, each variable was regressed on seasonal dummies that take on the value of unity in the appropriate season and zero otherwise. [5] Then the residuals, or the non-seasonal components, of each regression was modeled as an ARMA process. Once these models were identified, each equation was reestimated by including the seasonal dummies. The final estimation results for INFL and CRES are :

$$(1 + 0.344L^2 - 0.414L^3 - 0.327L^4 - 0.447L^5)\, CRES_t$$

$$\quad (2.953) \quad (-3.599) \quad (-2.862) \quad (-3.534)$$

$$= -0.315 + 0.102D2 + 0.520D3 + 0.263D_4 + E_{1t}$$

$$\quad (-1.148) \quad (0.670) \quad (2.574) \quad (1.816)$$

$$\hat{\sigma}_{E_1} = 0.197, \qquad X^2(12) = 20.33$$

$$INFL_t = 1.762 - 1.591D_2 - 0.123D_3 + 0.273D_4$$

$$(5.901) \ (-3.813) \ (-0.290) \ (2.156) \ + \ (1 - 0.340L^4 \ 0.248L^5 + 0.402L^6$$

$$(-4.740) \ (-3.318) \ (6.009) \ + \ 0.406L^7 + 0.273L^8) \ _{E_{2t}} \quad (7.137) \ (3.311)$$

$$\hat{\sigma}_{E_1} = 1.361, \quad X^2(11) = 16.59$$

The estimated models are used to predict what would have happened in the absence of the adjustment program. I first consider deterministic forecasts made at a unique time origin namely, the second quarter of 1986, and 20 quarters into the future. These forecasts are deterministic in the sense that all future random shocks take their expected values of zero and hence, are not contaminated by events in the post-sample period. Deterministic forecasts for CRES and INFL are given in figures 1 and 2.

If we assume that the predicted series reflect reasonably well what would have happened in the absence of control, then the Tunisian adjustment program had virtually no effect on inflation and a noticeably positive effect on international reserves. These findings come as no surprise since they are consistent with previous findings on the effects of IMF programs. [6]

The latter results show that Fund-program effects are usually stronger in correcting external imbalances than in dampening the pace of inflation. These remarks notwithstanding, it bears mentioning that the weak effect on inflation, in the case of Tunisia, can also be explained by the several price increases enacted during program years. For many years, most prices were institutionally determined and fixed below market levels due to the presence of consumer subsidies. Therefore, inflation was repressed and the recorded actual rates could be thought of, at least partly, as the reflection of previous repression. On the other hand, the comparisons between actual and deterministic paths of CRES bear witness to the improvement in the external position of Tunisia, especially, in the period 1987-89, during which reserves were replenished. The crossing of the two curves around the year 1990, is also consistent with the deterioration of the balance of payments situation in that year.

The deterministic forecasts presented below would be very reliable if, in the post-sample period, the program has caused a structural change in the system. Put in other terms, one needs to see if the program has altered the paths of the variables of interest. If there is no structural change in the system, the actual values of the relevant variables can be interpreted as realizations of random shocks that would have hit the economy in the absence of the program. In this case, deterministic forecasts that do not use this valuable information would tend to produce less reliable forecasts. On the other hand, adaptive forecasts using information on forecast errors in prior periods would be more appropriate.

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To test whether there was a change in the paths of CRES and INFL in the post-sample period, I use a prediction test for structural stability proposed by Box and Tiao (1976). The basic idea of this test is to compare deterministic forecasts with actual values in the post-sample period. A large discrepancy between the two would be indicative of structural change. As pointed out by Lütkepohl (1988), who presented the small-sample behavior of the test, among the advantages of the latter test, is that the form of the structural change does not have to be known and that it represents a natural choice if forecasting is the ultimate objective. Box-Tiao's test revealed that the structural change hypothesis could not be accepted in the case of inflation but could not be rejected in the case of international reserves. The $x^2$ Q-statistics for CRES and INFL were 150.2 and 4.2, respectively. The 5 percent values of $x^2$ corresponding to the estimation equations of the above variables were 28.9 and 31.4, respectively. In practice, since tests are based on estimated values, a closer approximation based on F distribution can be used. This test was also performed. The ensuing results led to the same conclusions as the $x^2$ test. The results of these tests point to the fact that the effect of the program was much stronger on international reserves than on inflation.

Although deterministic forecasts show that the Tunisian adjustment program did not have any effect on inflation and had a positive effect on international reserves, one has to bear in mind that forecasts are made with error. The first source of error resides in the fact that innovations in the forecast period are unknown and are assumed, under the deterministic forecasting scheme, to take on the value of zero. The second source of error is related to the fact that true parameter values are not known and are estimated with less than perfect precision. This lack of precision is also transmitted through the forecasting equation since parameters are usually multiplied by exogenous variables that can deviate drastically from their mean values and exacerbate forecast uncertainty.

The 95 percent prediction confidence intervals for CRES and INFL were found to cover all the actually observed values for the latter variables. This finding points to the fact that the results might have been affected by forecast uncertainty. In such a case the observed values of the above variables could possibly just be realizations of random shocks, there being no change in the paths of the latter variables. Therefore, as mentioned earlier, adaptive forecasts that make use of post-sample information could reveal more accurate than deterministic forecasts that do not use such an information. Adaptive foreecasts tor CRESS and INFL are given in figures 3 and 4.

Figures 3 and 4 show that there are negligible differences between the actual and the adaptive forecasts for CRES and INFL, respectively.

CRES ..... CRESFCST



CRES ..... CRESFIT



INFL ..... INFLFIT



INFL ..... INFLFCST

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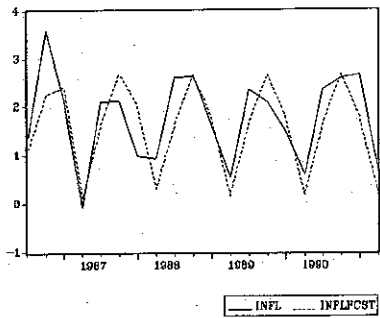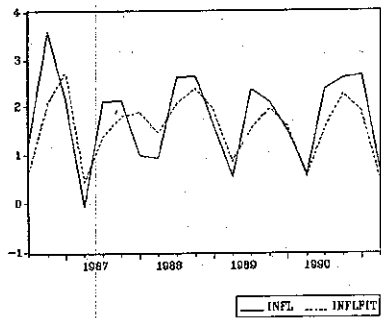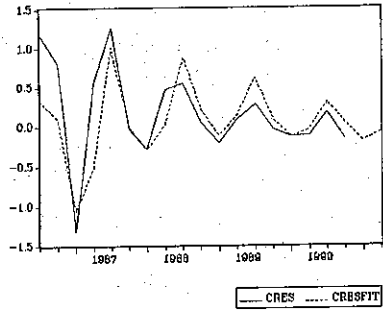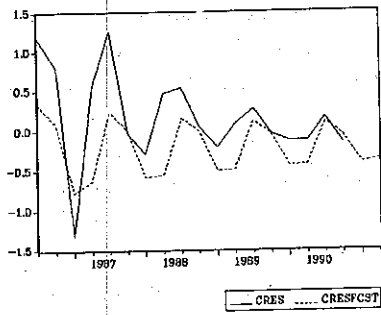
Based on the deterministic and adaptive forecasts for inflation, one can conclude that the Tunisian adjustment program did not have any effect on inflation. The counterfactual paths were not substantially different from the actual paths. This finding can be explained by the fact that deflationary effect of reduced fiscal deficit and disciplined monetary and financial policies, was offset by the inflationary pressure caused by the liberalization of many prices in the economy. Regarding international reserves, while deterministic forecasts showed that the program had a positive effect, adaptive forecasts, on the other hand, showed the absence of any substantial effect. This discrepancy notwithstanding, deterministic forecasts are believed to be a better representation of the counterfactual path for at least three reasons. First, as explained earlier, the deterministic projection seems to be more consistent with actual facts. Second, the test of structural stability shows that there is reason to believe that the program has indeed changed the time path of internatioal reserves. Third, as pointed out by Hsiao and Fakeyesi (1988), there is a tendency for adaptive forecasting to generate less divergent forecasts from the actual path than deterministic forecasting, because forecats are usually more influenced by the most observations.

Finally, it should be mentioned that different deterministic paths for inflation and international reserves could have been generated if different model specifications were adopted. However, caution was exercised in choosing the best model using optimality criteria. Since the procedure of identifying ARMA models is inexact, other candidate specifications were tried and generated conclusions similar to the ones reached through the specifications adopted in this paper.

## V. Conclusion

In this paper a time-series approach was used to assess the effect of the 1986-91 Tunisian adjustment program on inflation and international reserves. The method of evaluation adopted is the counterfactual method where the actual paths of the latter variables were compared to the paths that would have been generated without the program. This method is immune from many of the flaws characterizing the use of the Before-After method in so many other studies.

The counterfactual paths for inflation and international reserves were generated using time-series forecasts. This time-series approach offers an inexpensive way to generate counterfactuals and avoid many of the problems associated with the use of structural models.

The results indicate that the impact of the program on inflation is non-existent but is remarkable on international reserves. These findings corroborate previous results on the impact of IMF-supported programs, showing that the latter programs are more successful in correcting external imbalances than curbing inflation.

# Foot Notes
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(5) Since only three dummies can be included simultaneously, the first quarter dummy was used as the normalizing dummy and therefore was not included.

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