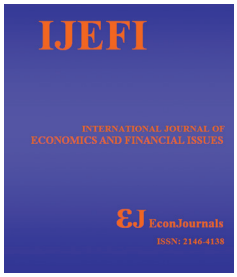

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Delayed Fiscal Adjustment and Economic Growth: Empirical Evidence using Autoregressive Distributed Lag Bound Testing Model

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ABSTRACT

This study is an attempt to quantify the delayed fiscal adjustment using an accounting framework and to test its short and long run effects on growth in Tunisia by using autoregressive distributed lag model over the period 1975-2015. We find that delayed fiscal adjustment hurts per capita gross domestic product (GDP) growth not only in the short run but also in the long run, which raises arguable evidence that the implementation of IMF supported programs is truly necessary in Tunisia in time of crisis particularly when public finance regulatory forces and the ability to adjust fail and become non-functional. This implies that any delay in bringing forward fiscal reforms is counterproductive in the short run and will result in net losses in per capita GDP growth in the long run.

Keywords: Fiscal Sustainability, Delayed Fiscal Adjustment, Economic Growth, Autoregressive Distributed Lag
JEL Classifications: E61, E62

1. INTRODUCTION

The effect of fiscal policy on economic growth is a controversial and long-standing topic in economic theory, empirical research, and economic policymaking (Buscemi and Yallwe, 2012). The harmful effects of fiscal deficits on economic growth has been empirically documented in several studies, such as Fischer (1993), Easterly and Rebelo (1993), Easterly et al., (1994), Bleaney et al., (2001). However, the empirical ambiguous results and the related threshold effects and the non-linearity in this relationship have grown sharply in the past few years (Adam and Bevan, (2005) and Roy and Van den Berg (2009). In line with this debate emerged broad consensus on the need to fiscal adjustment measures to put the nation's fiscal house in order, particularly when fiscal deficit ratios exceed a certain threshold.

However, the related theoretical and empirical economic literature provides an inconclusive debate on the effect of fiscal adjustment on economic growth. The ongoing academic debate, generated by those who support fiscal adjustment and those who promote fiscal expansionary policies, has revealed both benefits and drawbacks for economic growth (Alesina and Perotti (1995); McDermott and Wescott (1996); Alesina et al. (1998); Zaghini (2001); Krugman (2010); Baldacci et al. (2013); Alesina et al. (2015); Mastromatteo and Rossi (2015); Attanasia and Metelli, (2017)).

It should be noted that little has been said about the effects of delayed fiscal adjustment (DFA hereafter) or required fiscal adjustment on economic growth. According to the best of my knowledge, there has been very little empirical research (Wijnbergen and Anand, 1988; Wijnbergen and Budina, 2001; Fletcher and Sandri, 2015) dealing with links between these considered economic fundamentals. Motivated by this problem and the gap in the literature, the innovative contribution in this paper is to examine the quantitative temporal effect of delayed fiscal

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adjustment on economic growth in Tunisia using an autoregressive distributed lag (ARDL) approach.

There are several reasons for choosing Tunisia as a case study to check the relationship between DFA and per capita gross domestic product (GDP) growth. Over the considered period 1975-2015, Tunisia had experienced two socio-economic-political crises (1986, 2011) which have already resulted in implementing two supported-IMF programs: Structural adjustment program (SAP, August 1986) and extended fund facility (EFF, June 2013). Two opposing views emerged particularly on the related fiscal austerity measures underlining the advantages and drawbacks that may occur in connection with these programs. With these conflicting currents in mind, this paper seeks to provide a relevant scientific response to the debate.

In the literature, advocates of the on-demand approach and the promoters of expansionary fiscal policies support the view that budget deficits (or delayed fiscal adjustment) contribute to stimulating effective demand, creating added value and reducing unemployment. As a consequence, the created government' deficit tends to be self-financed by the presumed growth which may lead to more income tax revenues in the upcoming years. Contrariwise, a fiscal adjustment will have negative effects on growth since it causes a decline in consumption and investments which in turn worsens the unemployment problem. Mastromatteo and Rossi (2015) concluded that the deflationary effects of fiscal consolidation in European Union will aggravate recession over the medium-to-long run. Ideologically driven and based on economic management freighted with politics, austerity is considered by Blyth (2013) as a "*dangerous idea.*"

However, within neoclassical perspective, there exists a general consensus that fiscal adjustment using reduction in unproductive government expenditures as preferred tool, would mobilize more available saving resources, provide a lower interest rate and contribute to price stability, which in turn may increase productivity, investment and foster economic growth (productivity channel). As a consequence, lowering debt-to-GDP ratio reduces risk premiums, helps to anchor expectations and restore investor's confidence. This highlights the wealth effect channel and the investment channel as documented by McDermott and Westcott (1996) and Zaghini (2001).

The findings of recent empirical research carried out at the IMF (2015) show that fiscal adjustment causes output reduction and a rise in unemployment in the short run, while interest rate cuts and gains in price competitiveness boost net exports, which naturally soften the negative impact of austerity. According to IMF staff projections, fiscal consolidation equal to 1% of GDP causes a 0.5% reduction in output and 0.3% increase of unemployment over two years following the initial implementation. At the same time, this consolidation induces the real interest rate to fall by 20 basis points, and depreciates the real exchange rate by about 1.1 %. In turn, the resulting increase in net exports comes from more real exports responding to real exchange depreciation and less real imports as a consequence of the slowdown in economic activity. However, despite the widespread recognition that it is difficult to disentangle the fiscal reforms from other factors, IMF papers simulations show that fiscal adjustment can lift medium-to-long term per capita growth by 0.75 % in advanced economies and even more in developing countries.

Using simulation analysis and projections of the aggregate of G7 economies, the innovative contribution to the empirical research carried out by Fletcher and Sandri (2015) found that delaying fiscal consolidation leads to meaningful growth gains if the fiscal multipliers are higher during the stimulus phases than during the subsequent consolidation phase. This approach dealing with delayed fiscal adjustment had its roots in studies conducted by Wijnbergen et al. (1988). On the basis of simulation analysis for Poland in the 1990s conducted by Wijnbergen and Budina (2001), whenever the real interest exceeds the growth rate, delaying fiscal adjustment creates a greater adjustment problem later. However, none of the empirical literature dealing with this question used the causal and temporal analysis for testing the delayed fiscal adjustment-growth nexus. The present article offers a contribution to literature by introducing time series analysis to test (i) the effect of delayed fiscal adjustment on per capita GDP and (ii) the related causal connections.

To that end, section II of this paper outlines the methodology including an accounting model used to assess the delayed fiscal adjustment at the end of each period. Section III is a case study of Tunisia, in order to look at the short run and long run effect of DFA on per capita GDP growth.

2. METHODOLOGY

2.1. Framework for Quantifying Delayed Fiscal Adjustment

In line with the consistency (accounting) approach for fiscal deficits developed by Van Wijnbergen and Anand (1988), Van Wijnbergen (1989), and Van Wijnbergen and Budina (2001), this section provides a specific accounting model to assess the DFA defined as the difference between the primary fiscal deficit and the sustainable one. In accordance with this approach, sustainability is considered here as a level of primary deficit consistent with others macroeconomic fundamentals given the debt management constraint summarized by the constant debt to GDP ratio for both domestic and external debt. Therefore, fiscal inconsistency measured by the required (delayed) fiscal adjustment is quantified as the difference between the observed primary fiscal deficit and the related sustainable threshold, given the debt management target summarized by the constant debt to GDP ratio.

There are several reasons for choosing a consistency approach rather than a solvency one which is based on Present-Value Borrowing Constraint (Hamilton and Flavin, 1986; Wilcox, 1989; Bohn, 1995; 1998). Indeed, Cuddington (1997) assumes that besides the disadvantage of demanding time-series data requirements, fiscal sustainability tests related to the solvency approach make several assumptions that make it less than ideal for application in developing countries. In addition, fiscal gap analysis based on the stability of debt-to-GDP ratios as a benchmark to gauge sustainability of the current fiscal policy has been used in the empirical literature by Buiter (1985; 1997) and Blanchard (1993).

The following accounting framework for Tunisia starts from a specific government budget constraint which can be written in nominal terms as:

$$PD_t + i_t B_{t-1}^{int} + i_t^* E_t B_{t-1}^* = \Delta B_t^{int} + E_t \Delta B_t^* \quad (1)$$

Where: PD_t is the primary fiscal deficit; B_{t-1}^{int} is domestic public debt; i_t is the nominal interest rate on domestic public debt; B_{t-1}^* is the foreign currency debt at (t–1); i_t^* is nominal interest rate on the external public debt; E_t is the nominal exchange rate; and Δ lag operator.

$$PD_t + (1+i_t)B_{t-1}^{int} + (1+i_t^*)E_t B_{t-1}^* = B_t^{int} + E_t B_t^* \quad (2)$$

Expressing all stocks and flows as shares of GDP and in real terms (Appendix A.1):

$$pd_t + \frac{1+i_t}{(1+\pi_t)(1+g_{rt})} b_{t-1}^{int} + \frac{(1+i_t^*)(1+\hat{e}_t)}{(1+\pi_t^*)(1+g_{rt})} b_{t-1}^{ext} = b_t^{int} + b_t^{ext} \quad (3\text{-}1)$$

$$pd_t + \frac{1+r_t}{(1+g_{rt})} b_{t-1}^{int} + \frac{(1+r_t^*)(1+\hat{e}_t)}{(1+g_{rt})} b_{t-1}^{ext} = b_t^{int} + b_t^{ext} \quad (3\text{-}2)$$

Where lowercase letters denote the ratio of the corresponding uppercase variables to nominal GDP, π_t is the inflation rate at t, g_{rt} is the real growth rate, $\hat{e}_t$ is the percentage depreciation of the real effective exchange rate, b_t^{ext} (b_t^{int}) public external (domestic) debt as share of GDP, π_t^* is the foreign inflation rate, r_t is the domestic real interest rate, r_t^* is the foreign real interest rate.

Moreover, in terms of public debt flows, equation (3-2) can be rewritten as:

$$pd_t + \frac{r_t - g_{rt}}{(1+g_{rt})} b_{t-1}^{int} + \frac{(1+r_t^*)(1+\hat{e}_t) - (1+g_{rt})}{(1+g_{rt})} b_{t-1}^{ext} = \Delta b_t^{int} + \Delta b_t^{ext} \quad (4)$$

By considering the IMF and international rating agencies benchmarks which are reflected in the stability of debt-to-GDP around prudential limits ($\bar{b}$) particularly for the developing countries, we assume the stability of this indicator as follow:

$$\Delta b_t^{int} + \Delta b_t^{ext} = \Delta b_t = 0 \text{ and } \bar{b} = b_{t-1} = b_{t-2} = \ldots\ldots = b_{t-n} \quad (4')$$

Using Eq. (4'), Eq. (4) leads to:

$$Spd_t = \frac{g_{rt} - r_t}{(1+g_{rt})} b_{t-1}^{int} + \frac{(1+g_{rt}) - (1+r_t^*)(1+\hat{e}_t)}{(1+g_{rt})} b_{t-1}^{ext} \quad (5)$$

$$Spd_t = \left[\frac{g_{rt} - r_t}{(1+g_{rt})} \alpha_{t-1} + \frac{(1+g_{rt}) - (1+r_t^*)(1+\hat{e}_t)}{(1+g_{rt})} \gamma_{t-1} \right] \times b_{t-1}$$

$$\text{Where } \alpha_{t-1} = \frac{b_{t-1}^{int}}{b_{t-1}} \times 100; \gamma_{t-1} = \frac{b_{t-1}^{ext}}{b_{t-1}} \times 100 \quad (6)$$

Spd_t denotes the sustainable primary fiscal deficit as % GDP, a_{t-1} (γ_{t-1}) denotes the share of dsomestic debt (external debt) in total public debt. Spd_t is a sustainable level because it is constrained by the stability of debt-to-GDP ratio around $\bar{b}$ and consistent with the excess of real GDP growth over the relevant real interest rate of domestic and foreign public debt.

Combining Ed. (4') and (6), the expression for the sustainable primary fiscal deficit is:

$$Spd_t = \left[\frac{g_{rt} - r_t}{(1+g_{rt})} \alpha_{t-1} + \frac{(1+g_{rt}) - (1+r_t^*)(1+\hat{e}_t)}{(1+g_{rt})} \gamma_{t-1} \right] \times \bar{b} \quad (7)$$

This accounting framework based on a predetermined non-increasing public debt for defining the sustainability of fiscal deficit is in line with empirical studies conducted by Van Wijnbergen and Anand (1988; 1989) for Turkey, Marshall and Schmid-Hebbel (1994) for Chile, and Faini (1994) for Morocco. Then, it would be possible to quantify the delayed fiscal adjustment (DFA_t) as the difference between observed primary fiscal deficit as a % GDP, d_t, and the corresponding sustainable level.

$$DFA_t = d_t - Spd_t \quad (8)$$

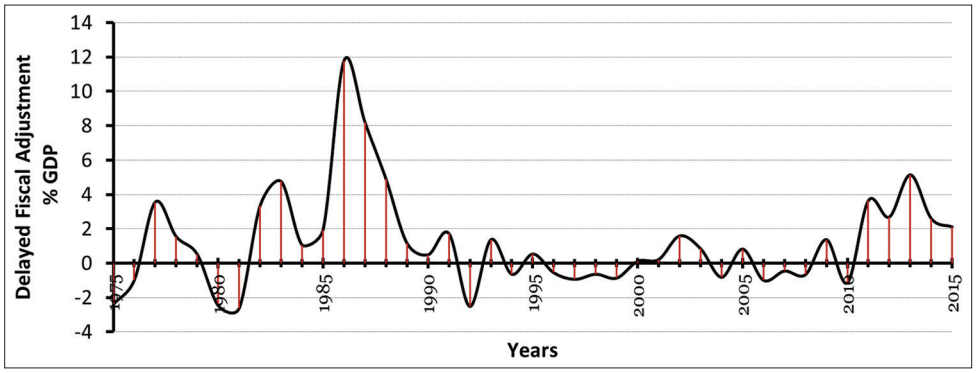
Eq. (7) and (8) show that fiscal adjustment is likely to stem from two sets of measures: explicit measures (fiscal consolidation) to reduce the primary fiscal deficit ($d_t \downarrow$) and/or increase implicitly the sustainable level ($Spd_t \uparrow$). Fiscal adjustment could bring into play very significant opposite strengths which incur and complement each other. (i) Comprehensive public spending and fiscal reforms reduce the DFA significantly and translate the policy-makers' willingness and ability to adjust; at the same time, (ii) supporting policies and/or complementary actions aimed at enhancing economic growth and maintaining price stability, would increase the level of the authorized (Spd) fiscal deficit and lessen the DFA. Whether it comes from deliberate changes in fiscal policy and/or from the automatic effect of business cycle fluctuations, DFA is considered as an indicator of the required fiscal adjustment for ensuring debt-to-GDP stability goal around a prudential limit $\bar{b}$.

In the following quantifications of sustainable threshold of primary fiscal deficits in Tunisia, we assume that the non-increasing public debt condition should be established around an optimal level of public debt as share of GDP. In this country study case, this optimal level is estimated to be equal to 48.5% by the Tunisian government Institute of Competitiveness and Quantitative Studies (ITCEQ, 2017). Using Eqs. (7) and (8) and data from the World Bank Development Indicators, the Tunisian Central Bank Reports, the Ministry of Finance, The National Statistics Institute, and Tunisian institute of Competitiveness and Quantitative Studies (ITCEQ), the assessment of the Delayed fiscal adjustment over the period 1975-2015 for Tunisia leads to the following evolution represented in Figure 1.

This assessment, covering 40 years of Tunisian public finance history, involves three quite separate phases that correspond to the main shifts in the fiscal policy; the phases are interrelated by the emergence of two politico-economic crises (Figure 1).

During the period 1976-1986, the sustainable levels of fiscal deficits were positive and relatively high, at the same time, fiscal

Figure 1: Delayed fiscal adjustment Tunusia (1975-2015)



policy had taken an expansionary turn financed by external borrowing. However, the related upward trend in primary fiscal deficits and the downward trend in the corresponding sustainable thresholds, over this period, have severely raised the problem of delayed fiscal adjustment. This DFA reached its highest level in 1986. These fiscal imbalances, along with the deterioration of overall growth, were major factors that triggered the first crisis (1986). This crisis was initially economic, and then became political and economic after the government overthrow in 1987. During the second period (1986-2010), the government authorities were obliged to implement a structural adjustment program (SAP) prepared by IMF Staff based on a neo-liberal agenda. Consequently, a fiscal consolidation plan was implemented and economic accompanying measures, such as market liberalization, privatization, local currency devaluation, were introduced. As a result, a significant downward trend in the DFA was recorded over this period.

The third period (2011-2015) highlights shortcomings of the on-going political crisis in the aftermath of the Revolution (14 January 2011). There has been a reversal in the declining trend of fiscal adjustment that started in 2011. This shift over the third period (2011-2015) is mainly explained by three interrelated factors: (i) A deterioration in public finances resulting particularly from large public sector wage increases and social transfers aimed at combating the marginalization and social exclusion of both individuals and rural areas, (ii) political instability (six governments during 5 years), (iii) and a pronounced slowdown in economic activity which has led to low cyclical tax revenues and a significant increase in fiscal deficits.

2.2. Model Identification and Econometric Methodology

Drawing from the theoretical and empirical channels linking fiscal adjustment measures to growth, this research will focus on new issues involving the effect of the DFA on growth using an ARDL specification.

Il should be noted that an ARDL model, being part of the family of dynamic models, allows to estimate short-term dynamics and long-term effects for series cointegrated or even integrated into different orders I(0) or I(1) (Pesaran and Shin (1999), and Pesaran et al. (2001)). In addition, according to these authors, coefficients from ARDL estimators are super consistent in small sample sizes and the endogeneity is less a problem in the ARDL framework because it is free of residual correlation. Therefore, these are important issues in the DFA-growth nexus because of the related mixed channels and the time series availability for the case study of Tunisia (1987-2015).

In order to analyze the effects of DFA on the growth, we used the empirics of economic growth developed by Mankiw et al. (1992), Edwards (1993), Harrison (1996), Barro (1996), and Arawatari et al. (2018). The regression model described below is consistent with the specification of Kneller et al. (1999) and Buscemi and Yallwe (2012):

$$y_t = \alpha + \sum_{i=1}^{m} \beta_i Z_{it} + \sum_{j=1}^{k} \gamma_i X_{it} + \varepsilon_t \quad (9)$$

When y_t, the per capita growth rate, is a function of fiscal variables, X_t, and Z_t is a vector of conditioning non-fiscal variables. As a result the regression equation is specified as follow:

$$Y_t = \alpha + \beta\, DFA_t + \gamma_1\, INV_t + \gamma_2\, INF_t + \gamma_3\, TOP_t + \varepsilon_t \quad (10)$$

The dependent variable Y_t is the natural log of per capita real GDP. The delayed fiscal adjustment (DFA), the main explanatory variable in the present study, can be considered as an indicator of fiscal disequilibrium which synthesise the most fiscal variables. Control variables are considered to provide additional explanatory power and robustness to the related regression model. Investment, INV, is the natural log of real physical capital formation; TOP is trade openness; INF inflation are considered as additional explanatory variables; α is the intercept, β, γ_1, γ_2, and γ_3 are the coefficients associated with the related set of variables and ε_t denotes the white noise.

3. RESULTS AND DISCUSSIONS

3.1. Unit Root Tests and ARDL Lag Order Selection

As long as ARDL bounds tests are subject to the assumption that the variables are I(0) or I(1) or a mixture of both (Pesaran et al., 2001) and according to that ARDL estimators are not valid for I(2) process data, it's useful to check the stationary process of the data series using Augmented Dickey Fuller (ADF) test.

Unit root tests revealed in Table 1 confirm that none of the variables is integrated of order 2 or above. Hence, variables under

consideration are stationary at most in their first differences (Y, INV, INF and TOP) but one time series is stationary in its level (DFA), therefore a mixture of I(1) and I(0) data shows that ARDL bounds testing procedures are the best econometric methodology for establishing the long run relationship between delayed fiscal adjustment and growth. Moreover, small properties of the ARDL approach are far superior to that of the Johansen and Juselius (1991) cointegration technique (Pesaran and Shin, 1999).

The selection of order of ARDL model is based on Akaike Information Criteria (AIC). After evaluating 256 models, the selected top 20 ones by AIC criterion illustrated (Figure 2. Appendix A.2) show the ARDL model's optimal lags associated with all regressors' variables in a way (1, 2, 3, 0, 0). Afterwards, we conduct the ARDL bounds testing approach of cointegration according to Pesaran et al. (2001). This ARDL test presupposes the estimation of the following conditional error correction model:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta Y_{t-i} + \sum_{i=0}^{q} \beta_i \Delta DFA_{t-i} + \sum_{i=0}^{q_1} \gamma_{1i} \Delta INV_{t-i} + \sum_{i=0}^{q_2} \gamma_{2i} \Delta INF_{t-i} + \sum_{i=0}^{q_3} \gamma_{3i} \Delta TOP_{t-i} + \lambda_1 Y_{t-1} + \lambda_2 DFA_{t-1} + \lambda_3 INV_{t-1} + \lambda_4 INF_{t-1} + \lambda_5 TOP_{t-1} + \varepsilon_t \quad (11)$$

The bounds test on Eq. (10) uses the F distribution and the null hypothesis of no cointegration which means H_0: $\lambda_1=\lambda_2=\lambda_3=\lambda_4=\lambda_5=0$ against H_1: $\lambda_1\neq\lambda_2\neq\lambda_3\neq\lambda_4\neq\lambda_5\neq0$.

3.2. Long Run Estimates

Empirical results using bounds tests in Table 2 show a significant long run relationship between real per capita GDP and DFA. As a result, there is evidence of a stable long run relationship between the considered variables.

Despite this conclusion, control variables [Table 3] require further attention like investment, inflation and trade openness particularly in growth regressions. In line with the neoclassical growth model (Barro, 1991) and (Levine and Renelt, 1992), the significant result at 1% level raises that 1% increase in private investment boosts GDP per capita by 0.5%.

The empirical findings provide mixture results concerning the long run relationship of GDP and inflation. Earlier empirical findings (Fischer (1993), Barro (1996) and Bruno and Easterly (1998)) have shown a significant negative relation between inflation and growth if the rate of inflation exceeds a threshold level, which raises the issue of nonlinear relationship between inflation and growth (Arawatari et al., 2018). Specifically for Tunisia, this study shows that inflation harms significantly economic growth in the long run: a 1% increase in inflation rate reduces real GDP per capita by 0.034%.

The relationship between trade openness and economic growth has been theoretically and empirically controversial. Specifically for developing countries, while conventional wisdom predicts a growth-enhancing effect of trade (Barro and Sala-i-Martin, 1997; Almeida and Fernandes, 2008; Edwards, 1993), recent developments suggest that trade openness is not always beneficial to economic growth (Herzer, 2013; Zahonogo, 2016). In this study case, trade openness has a significant adverse effect on real GDP per capita growth which is consistent with Kim and Lin (2009) results for some developing countries. This finding could be attributed to technological, financial constraints and/or to the country's ability to determine knowledge accumulation and technology implementation.

Table 1: ADF unit root tests

Variables	ADF	k	P-values		ADF	k	P-values
Y	−0.27	0	0.920	ΔY	−6.30***	0	0.000
DFA	−3.65***	0	0.008	-	-	-	-
INV	−1.19	1	0.667	ΔINV	−4.41***	0	0.001
INF	−3.4**	0	0.016	ΔINF	−9.30***	0	0.000
TOP	−2.33	0	0.167	ΔTOP	−6.18***	0	0.000

Author's formulation where Y=natural log of GDP per capita (Constant 2010 LCU), DFA=delayed Fiscal Adjustment as % GDP, INV=natural log of real gross fixed capital formation, INF=inflation rate (CPI), TOP=trade openness ratio as total value of exports and imports as % GDP, ADF Augmented Dickey Fuller. k lag length that is automatically selected by Akaike's Information Criteria. ** and ***represent 5% and 1% level of significance respectively

3.3. Short Run Estimates

The empirical findings of the error correction form of the specified ARDL are presented in Table 4. In line with the expectations, delayed fiscal adjustment in Tunisia hurts real GDP per capita growth in the short as well as in the long term. Although the effects were ambiguous in the short run (−0.65 in *t* and +0.29 in *t*−1), the negative effects outweigh the positive effects. All other things being equal, a permanent 1% variation of DFA as % of GDP over two consecutive years could reduce per capita GDP growth by 0.34%. However the magnitudes of the short run coefficients are smaller as compared to the long run ones. As a global result, lack of public finance austerity measures causes not only negative effect on growth in the short term, but also it will have higher potential losses in the longer term (−7%). This result allows to validate the Barro (1996) idea according to which "*big government is bad for growth*" (p.19) and it is in line with IMF simulation for the effects of fiscal consolidation on growth (IMF, 2015). It provides strong objective evidence in supporting the adoption of structural adjustment program (SAP, August 1986) and extended fund facility (EFF, June 2013) Arrangement by Tunisian authorities in close contact with the IMF, particularly,

Table 2: Bounds tests for the existence of a long run relationship

Bounds test result	F-statistics	1% Critical bounds		5% Critical bounds		10% Critical bounds	
		I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
DFA explain per capita GDP (Y_t)	18.742	2.43	3.39	2.89	4	3.98	5.46

Author's formulation where Y=natural log of GDP per capita (Constant 2010 LCU), DFA=Delayed fiscal adjustment as % GDP. Sample: 1975-2015, Included observations=40. The selected model and the related F-statistics for Y_t as a dependent variable is an ARDL (1, 2, 3, 0, 0) which passes the diagnostic tests (serial correlation, normality, functional form specification, heteroscedasticity and stability). According to Pesaran et al. (2001, the specification of the deterministic component is case 2: Restricted constant and no trend

Table 3: Long run estimates

Dependent variable is the natural log of per capita GDP		
Regressor	**Coefficient**	**T-statistic**
DFA	−7.002*	−1.83
INV	0.533***	3.28
INF	−3.355**	−2.43
TOP	−1.764**	−2.45
Intercept	5.790***	2.92
Diagnostic test statistics (P-value)		
Serial correlation	Breusch–Godfrey serial correlation LM test	0.60
Functional form	Ramsey's RESET test	0.89
Residual normality	Jarque-Bera test	0.33
Heteroscedasticity	Breusch-Pagan-Godfrey test	0.81

Author's formulation where Y=natural log of GDP per capita (Constant 2010 LCU), DFA=delayed fiscal adjustment as % GDP, INV=natural log of real physical capital formation, INF=inflation rate (CPI), TOP=trade openness ratio as total value of exports and imports as % GDP. *, **and ***represent, 1%, 2% and 10% level of significance respectively

Table 4: Short run ARDL estimates

Dependent variable: ΔY_t		
Regressor	**Coefficient**	**T-statistic**
ΔDFA_t	−0.65***	−7.56
ΔDFA_{t-1}	0.29***	3.58
ΔINV_t	0.10***	3.28
ΔINV_{t-1}	0.03	1.16
ΔINV_{t-2}	−0.1***	−3.30
ECM_{t-1}	−0.08***	−5.92
Diagnostic test statistics		
R-squared		0.76
F-Statistic		17.04
DW		2.12
CUSUM		Stable
CUSUMSQ		Stable

ECM=Y− (−7.0028*DFA+0.5332*INV−3.3555*INF−1.7640*TOP+5.79). Author's formulation where Y=natural log of GDP per capita (Constant 2010 LCU), DFA=delayed fiscal adjustment as % GDP, INV=natural log of real physical capital formation, INF=inflation rate (CPI), TOP=Trade openness ratio (total value of exports and imports as % GDP). ***Represents 1% level of significance

when public finance regulatory mechanisms and the ability to adjust have failed in times of crisis.

In addition to the advantage of including both long-run and short-run information, ECM allows estimating the speed of adjustment towards long-run equilibrium. The significant coefficient related toECM_{t-1} is only 0.08 illustrating that nearly only 8% of disequilibria is being corrected in each year after a shock previous year, and reflecting rigidities and time requirement in implementing fiscal reforms. Furthermore, the low speed of adjustment is consistent with ECM outcome featuring significant differences between short-run and long-run coefficients.

The diagnostic tests check represented in the lower panel of Table 4 state no evidence of serial correlation and heteroscedasticity with 0.61 and 0.81 as respective P-values. In addition, Ramsey's RESET test point out a well functional form of this model and Jarque-Bera's test cannot reject the null hypothesis of normality for residuals. The stability of estimated coefficients in the ECM is confirmed using the plots of CUSUM and COSUMSQ statistics which are well within the critical bounds as shown in the Appendix A.3 Figure 3. As a result, the empirical findings can be considered for fiscal policy decision-making without distortion in the level of per capita GDP and the estimated coefficients could be used to predict the future.

4. CONCLUSION AND POLICY IMPLICATIONS

This paper is an attempt to investigate the effects of delayed fiscal adjustment on per capita GDP growth for Tunisia using the ARDL testing model. Indeed, Tunisia had experienced two socio-economic-political crises (1986, 2011) which have already resulted in implementing two supported-IMF programs: Structural adjustment program (SAP, August 1986) and extended fund facility (EFF, June 2013). Two opposing views therefore emerged particularly on the related fiscal austerity measures underlining the advantages and drawbacks that may occur in connection with these programs.

Including control variables, the empirical results from ARDL bound testing showed a negative cointegrated relationship between delayed fiscal adjustment and per capita GDP which confirm that for a rise of delayed fiscal adjustment as share of GDP by 1%, there will be net losses in per capita GDP by 7% in the long run. Afterwards, the ECM dynamic regressions showed that the effects of delayed fiscal adjustment on per capita GDP were ambiguous in the short run (−0.65 in t and +0.29 in (t−1)), but the negative effects outweigh the positive effects. As a result for policy makers, there are urgent needs for implementing growth-oriented fiscal reforms particularly in times of crisis when public finance regulatory forces and the ability to adjust fail and become non-functional.

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APPENDIX

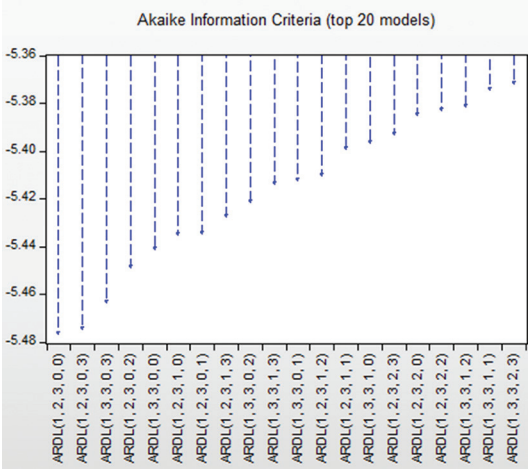
A. 1. Accounting framework

$$\frac{E_t}{E_{t-1}} = \frac{E_t \dfrac{P_t^*}{P_t}}{E_{t-1}\dfrac{P_t^*}{P_t}} = \frac{e_t}{e_{t-1}\dfrac{1+\pi_t^*}{1+\pi_t}} = \frac{(1+\hat{e}_t)(1+\pi_t)}{(1+\pi_t^*)}$$

$$1+r_t \approx \frac{1+i_t}{(1+\pi_t)}; 1+r_t^* \approx \frac{1+i_t^*}{(1+\pi_t^*)}$$

Where E_t = nominal exchange rate at t, e_t real exchange rate, P_t^* (P_t) = external (domestic) price level at period t, π_t^* (π_t) = external (domestic) rate of inflation, $\hat{e}_t$ = the depreciation rate of the real exchange rate, r_t^* (r_t) real interest rate on external (domestic) public debt.

A. 2. Figure 2: Autoregressive distributed lag model's optimal lags



A. 3. Figure 3: Plots of cumulative sum and sum of squares of recursive residuals for delayed fiscal adjustment