European Journal of Government and Economics 6(2), December 2017, 126-145

European Journal of Government and Economics

journal homepage: www.ejge.org

ISSN: 2254-7088

Sustainability of Italian Budgetary Policies: A Time Series Analysis (1862-2013)

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Article history. Received 11 June 2017; first revision required 3 August 2017; accepted 5 September 2017.

Abstract. The aim of this paper is to empirically investigate the sustainability of Italian national accounts in the years 1862-2013. The focus of the paper concerns applied tests related to the solvency and sustainability of fiscal policies. In fact, the growth rate of public debt should in the limit be smaller than the asymptotic rate of interest. Moreover, the debt-to-GDP ratio must eventually stabilize at a steady-state level. Unit root and stationarity tests show that the variables are first-difference stationary. The results of structural breaks tests evidence the presence of some breaks, due to internal and external crises. Thus, the applied analysis covers the entire period, but it also considers two different sub-periods (1862-1913 and 1947-2013). Furthermore, several cointegration tests highlight the evidence of a long-run relationship between public revenue and expenditure only for the first sub-period (1862-1913). Our econometric insight reveals that Italy faced sustainability problems in the Republican age.

Keywords. Fiscal policy; Sustainability; time series; cointegration; Italy

JEL classification. C22; H11; H60; O52

1. Introduction

The sustainability of fiscal policies is a central topic with regard to both economics and public policy. The rise of public indebtedness of many industrial countries during the last decades of the Twentieth century has caused increasing concern about its potentially unfavourable effects. Theoretically, equilibrium growth paths ought to be supported by adequate fiscal policy. Moreover, the European Union's treaties impose the practical necessity of sustainable public accounts, keeping the public debt/GDP ratio below 60%, and the public deficit/GDP below 3%.

A major question emerging from the global economic and financial crisis of 2008 is how to restore a country's economic growth while restoring fiscal health. This is relevant to the Euro area due to its dismal economic growth prospects coupled with high levels of public debt. Government debt and slow growth underscore the importance of understanding the potential effects for fiscal sustainability and economic growth and the trade-offs these often conflicting goals entail.

Fiscal consolidation programs involve actions on public sector spending and tax rates to accomplish the goal of stimulating the economy (OECD, 2011). When longer-term structural changes are required to increase aggregate supply, governments must address:

- Impediments such as market structure;
- How prices are set;
- How public sector finance is conducted;
- The borrowing and growth of government-owned enterprises;
- Financial sector regulation both domestically and from international agreements, and the functioning of labour markets and the rules and regulations that govern them.

In addition, governments must be cognizant of the effects on the social safety net and institutions that affect social capital. Fiscal structural reforms hold the potential to enhance the prospects for growth and debt reduction through use of automatic stabilizers, labour market reforms, which reduce labour taxes and social security contributions, and the effects on specific groups such as the elderly and youth, which might be adversely affected by policies.

Traditionally, the Italian economy, the third largest economy in the Eurozone, has had a high debt-to-GDP ratio. Italy has been hampered by weak productivity growth and low economic growth. The Italian budget has expanded continually since 1947, which we define as the republican period due to increasing economic activity and the pressures of inflation. Currently at 135%, Italy has the second largest debt to GDP ratio in the currency union after Greece. The size of the Italian economy remains smaller than in 2008, and approximately unchanged from the early years of the 21st century.

The Maastricht Treaty (1992) required Italy and other EU nations to undertake a well-focused fiscal consolidation in order to meet the Maastricht reference values. At that time, Italy's debt level exceeded its GDP and the fiscal deficit was 10% of GDP. From 1986, Italy had pursued fiscal consolidation policies with relatively moderate success although small setbacks had occurred periodically. During the period 1985-1990, the primary structural deficit was reduced by 1.7% of GDP. The fiscal consolidation process gained force after 1990 when external conditions were not conducive for initiating fiscal consolidations and the predicted survival rate was low (von Hagen et al., 2001).

The usual way pursued in literature to analyze the sustainability of fiscal policies implies stationarity and unit root tests for public debt and deficit, as well as cointegration tests between public expenditures and revenues. However, a common criticism to most of the available literature is that the econometric procedures used require a large number of observations, which is not usually the case in most tests of the intertemporal budget constraint. We try to overcome this problem by using an extended dataset covering 152 years, for the case of Italy. The Italian case is of interest because of the difficulties in reordering the public accounts to meet fiscal consolidation goals. This paper examines the sustainability of Italian public finance policies by applying unit root and cointegration tests to the data over the period 1862-2013. Moreover, we also test for the existence of structural breaks in the sample time period. Our study addresses a gap in the literature by applying Autoregressive Distributive Lag (ARDL) technique to examine this relevant issue for Italy. The ARDL approach is an important tool in modelling non-stationary time series data and the effect of structural breaks. Our main contribution to the debate is that we work on deep time series for a single country rather than rely on panel analysis over a shorter time-span.

Besides the Introduction, the outline of this paper proceeds as follows. Section 2 provides a survey of the literature. Section 3 contains an overview of the applied empirical methodology and a brief discussion of the data used. Section 4 discusses our empirical results. Finally, Section 5 presents some concluding remarks and policy implications.

2. Theoretical Framework and Empirical Literature Review

The sustainability of the fiscal policies of Europe and the United States is in the headlines from the early 1990s. A number of empirical studies have found that successful fiscal consolidation programs focus on cutting government spending as a percentage of GDP. Many successful fiscal consolidations also reformed tax systems to lower marginal income tax rates and reduce the after-tax cost for business investment in productive assets while eliminating "special interest" tax preferences for specific firms, industries, and locations. Lilico *et al.* (2009) found that successful fiscal consolidation programs were comprised of at least 80% government spending reductions and no more than 20% tax increases.

The basic framework of the theoretical analysis on fiscal sustainability draws on recent contributions, such as Hamilton and Flavin (1986), MacDonald and Speight (1986), Spaventa (1987), Trehan and Walsh (1988), Bohn (1991a, 1991b, 1995, 1998), Hakkio and Rush (1991), Corsetti (1991), Kremers (1988, 1989), MacDonald (1992), De Haan and Siermann (1993), Vanhorebeek and Van Rompuy (1995), Payne (1997), Bravo and Silvestre (2002), Afonso (2005), and Mendoza and Ostry (2008), to name a few.

Recalling the Intertemporal Budget Constraint (IBC), it is possible to present analytically two definitions of sustainability suitable for empirical testing (Hamilton and Flavin, 1986):

(i) The value of current public debt equals the sum of future primary surpluses.

(ii) The present value of public debt approaches zero in infinity.

To test the absence of Ponzi games, we inspect the stationarity of the first difference of the stock of public debt $\Delta GGCGD_t$, and cointegration between primary balance, *GGNPL*, and the (lagged) stock of the public debt, $GGCGD_{t-1}$ (Bohn, 2007; Afonso and Jalles, 2015):

$$GGNPL_t = \alpha + \beta GGCGD_{t-1} + u_t \qquad [1]$$

This 'backward-looking' approach implies that past increases in the level of public debt would imply larger primary balances today. According to the transversality condition, the IBC implies that the current value of the outstanding public debt is equal to the present value of the expected future (primary) surpluses. Thus, this condition constrains the public debt to growth no faster than the real interest rate.

In a study with a descriptive nature, Balassone *et al.* (2002) concluded that the consolidation of Italian public finances in the 1990s has been highly successful in putting an end to endemic high deficits and preventing the country from sliding into debt default. However, while fiscal consolidation has avoided major economic and social shocks, it has not been a panacea for Italian fiscal problems. In some areas of public spending it has reduced waste, but it has also induced governments to neglect allocative, distributive and stabilization issues.

One of the first applied study to the solvency of Italy's public finance is Baglioni and Cherubini (1993), where has been analyzed the sustainability of the Italian fiscal policy in the 1979-1991 period, using monthly data. The principal findings show that primary surplus is stationary, while public debt is not; permanent shocks explain about 90% of forecast error variance of public debt; debt is not sustainable even if the discount rates are considered. The paper applies some stationarity tests, but does not account for cointegration.

Paesani *et al.* (2006), focusing on the USA, Germany and Italy over the 1983-2003 period, studied how the accumulation of government debt affects long-term interest rates, both nationally and across borders. Empirical evidence shows that in all cases a more sustained debt accumulation leads at least temporarily to higher long-term interest rates. This transitory impact also spills-over into other countries, mainly from the US to the two European countries. This paper uses a multivariate econometric model.

A different empirical approach, semi-parametric estimations using penalized spline smoothing, is in Greiner and Kauermann (2008) tested how the primary surplus in two countries of the euro area, Germany and Italy, reacts to changes of public debt. Italian public debt does not seem to be sustainable although consolidation efforts in the Nineties have stabilized Italian debt.

In a similar empirical context, Piergallini and Postigliola (2013) investigated the sustainability of Italy's public finances from 1862 to 2012 adopting a non-linear perspective. They used a smooth transition regression approach to explore the scope for nonlinear fiscal adjustments of primary surpluses in response to the accumulation of debt. The empirical results show the occurrence of a significantly positive reaction of primary surpluses to debt when the debt/GDP ratio exceeded the trigger value of 110 percent.

Piergallini and Postigliola (2012) examined the historical dynamics of government debt in post-unification Italy (1861-2009). They found that, controlling for fiscal feedback policies, the debt-GDP ratio is mean-reverting. Moreover, policymakers reacted to the debt accumulation taking corrective measures to avoid potential long-run sustainability problems.

Balassone *et al.* (2011) investigated the link between government debt-to-GDP ratio and real per capita income growth in Italy over 1861-2009. The empirical findings support the hypotheses of a negative relation between public debt and growth, and of a stronger effect of foreign debt compared to domestic debt before World War I. The effect of public debt on growth appears to work mainly through reduced investment. They model the test on a standard production function, using a Two Stages Least Squares Estimator (2SLS) to take account for endogeneity, and performed the Johansen and Juselius cointegration test.

Magazzino and Intraligi (2015) studied the relationships between government debt/GDP and its macroeconomic determinants (such as primary balance/GDP, real GDP, the inflation rate and the average interest rate on Treasury bills) in the period 1958-2013 in Italy. Consistent with the theory, the results reveal a significant causal relationship moving from the primary balance to the real growth rate, as well as a clear influence of the inflation on the interest rate. In contrast, the influence of public debt on growth rate emerges only marginally. The empirical strategy applies some causality tests (Granger, Toda and Yamamoto), several structural breaks tests, and a Vector AutoRegressive (VAR) model.

Alternative studies present a prospective nature. Marattin and Marzo (2009) investigated the consequences of the adoption of a fiscal policy rule responding to past real debt/GDP ratio on the main public finance aggregates. According their estimates, a significant and sustainable reduction of debt/GDP ratio can be achieved over the next years if policymakers raise (up to 0.30) fiscal pressure's elasticity to public debt evolution, and/or reduce primary government expenditure by four percentage points over the next 4 years. Based on the simple arithmetic of public finance, they performed a number of simulation regarding the evolution of public finance aggregates. Casadio *et al.* (2012) analyzed possible targets for the Italian debt-to-GDP ratio with a small macroeconomic model. They found that external conditions play a fundamental role for the Italian fiscal consolidation. To reach a target of 100% of debt-to-GDP ratio by 2020, a further growth-sustaining policy has to be implemented. Spaventa (2013) underlined how, with a large stock of outstanding debt, a precondition to avoid unstable and potentially explosive outcomes is that fiscal policy aims at a reasonably low. A desirable fiscal policy program may however prove socially and politically unfeasible unless monetary policy lends some help.

The sustainability of Italian public accounts has been also investigated through the analysis of the relationship between government expenditure and revenues. Dalena and Magazzino (2012) examined the long-run equilibrium relationship between government expenditure and revenues in Italy from 1862 to 1993, using cointegration and causality techniques in the long as well as in the short-run. Empirical findings show that, for each sub-period, the policy adopted reflects the prevailing paradigm of public finance. In fact, the 'Tax-and-Spend' argument received empirical support from the liberal period data. In contrast, the interwar years are in line with the 'Spend-and-Tax' hypothesis. Finally, the 'Fiscal Synchronization' hypothesis emerges in the republican ages (Magazzino, 2012a). This paper uses an Error Correction Model (ECM), performing both the standard Granger causality test and a Granger non-causality test (due to Toda and Yamamoto). Trachanas and Katrakilidis (2013) evaluated the sustainability of the fiscal deficit as well as the long-run macroeconomic relationship between government spending and revenues for Italy, Greece and Spain in the years 1970-2010. The evidence for all three countries suggests that, allowing for structural break, the fiscal deficits are weakly sustainable in the long-run, the 'spend-and-tax' hypothesis is supported, and the budgetary adjustment process is asymmetric in Italy and Spain. This paper focuses on cointegration between government spending and revenues, applying several tests: Engle-Granger, Johansen trace, AutoRegressive Distributed

Lags (ARDL) bounds, and Gregory and Hansen tests. Buiatti *et al.* (2014) reconstructed the macro regional government deficits of Italy. They found that the incredibly large and persistent fiscal imbalances of poorer Southern regions are the ultimate cause of the National Public debt of Italy. They suggest the introduction of a tight set of hard budget rules and fiscal responsibility that must substitute the current set of norms and discretionary budget procedures. The empirical strategy uses a Generalized Method of Moments (GMM) estimator, some structural breaks test, and the *J*-test approach.

The effects of the recent economic-financial crisis are inspected in Di Mascio and Natalini (2014), where has been analyzed the Italian government's response to the sovereign debt crisis. The findings reveal that the current crisis has been managed with straight cutback management, as public administration has been considered by policy makers just as a source of public expenditure to be squeezed rather than as a provider of public services in need of modernization so as to sustain economic growth.

Some related issues are discussed in Magazzino (2012b), who assessed the empirical evidence of Wagner's Law in Italy for the period 1960-2008 at a disaggregated level, using a time series approach. The causality results show evidence in favour of Wagner's Law only for passive interests spending in the long-run, and for dependent labor income spending in the short-run. While Forte and Magazzino (2016) empirically assessed the relationship between government size and economic growth in Italy (1861-2008). The results show the presence of a non-linear relationship between the size of public sector (measured by the share of government expenditure over GDP) and the economic growth rate. In general, the presence of an inverted "U-shape" curve, which emerges for the last two decades, suggests that expenditure cuts might foster the GDP dynamic (Magazzino, 2013; 2014).

3. Data and methodology

The first step of our empirical strategy concerns stationarity and unit root tests. According to Engle and Granger (1987), a linear combination of two non-stationary series can be stationary, and if such a stationarity exists, the series are considered to be cointegrated. This requires, however, that the series have the same order of integration. In order to examine the stationarity properties of the time series, we apply different unit root tests: the Augmented Dickey and Fuller (ADF, 1979) test, determining the number of lags using the Hannan-Quinn criterion; the Elliott, Rothenberg, and Stock (ERS, 1996) test, setting the maximum lag according to the method proposed by Schwert (1989); the Phillips and Perron (PP, 1988) test, selecting the bandwidth automatically in accordance to the Newey-West procedure using Bartlett kernel; and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS, 1992) test, with equivalent band-width selection procedures. The tests differ with respect to their null hypotheses: The null hypothesis of the ADF, ERS and the PP tests is the existence of a unit root in the time series, whereas the null hypothesis of the KPSS test is trend stationarity of the time series. Moreover, we also checked if any of the variables have structural breaks. To this extent, the Zivot and Andrews (ZA, 1992) and the Clemente, Montañés, and Reyes (CMR, 1998) tests were performed (see the Appendix for details).

Once we found that the variables are non-stationary at their levels and are in the same order of the integration, we can apply the cointegration test. As in Trachanas and Katrakilidis (2013), we performed several cointegration tests, to check the robustness of the results.The ARDL bounds testing approach of cointegration is developed by Pesaran and Shin (1999) and Pesaran *et al.* (2001). This approach has several advantages over the traditional cointegration approaches of Engle and Granger (1987), and Johansen and Juselius (1992). This takes care of small sample properties and simultaneity biasness in relationship among variables. The main constraint in the application of the conventional cointegration techniques is that they require all the variables included in the model to be non-stationary at levels but should be integrated of the same order. The present ARDL approach to cointegration method surmounts this problem as it is applicable irrespective of order of integration of regressors whether *I(0)* or *I(1)* or mixture of both. Apart from that, the ARDL model also has advantages in selecting sufficient numbers of lags to capture the data generating process in a general-to-specific modeling framework. These meritorious features justify the use of ARDL model to obtain robust estimates.The bounds testing procedure is based on the joint *F*-statistics or Wald statistics that is tested the null of no cointegration, $H_0: \delta_r=0$, against the alternative of $H_1: \delta_r \neq 0$, $r=1, 2, \ldots, 4$. If the calculated *F*-statistics lies above the upper level of the band, the null is rejected, indicating cointegration. If the calculated *F*-statistics is below the upper critical value, we cannot reject the null hypothesis of no cointegration. Finally, if it lies between the bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressors. The next step is to test for stability of the long-run coefficients as well as the dynamics of the short-run ones following Pesaran (1997).

Cointegration analysis considered also the Gregory and Hansen (1996) test for cointegration with regime shifts. The null hypothesis (H_0) is no cointegration, against the alternative (H_1) of cointegration with a single shift at an unknown point in time. The Gregory and Hansen approach is an extension of similar tests for unit root tests with structural breaks, for example, by Zivot and Andrews (1992). Gregory and Hansen propose the cointegration tests, which accommodates a single endogenous break in an underlying cointegrating relationship. The null hypothesis of no cointegration with structural breaks is tested against the alternative of cointegration. The single break date in these models is endogenously determined.

In our analysis, the log transformations of the variables have been derived. The empirical analysis uses the time series data of public expenditure (% of GDP, *G*) and revenue (% of GDP, *R*) for Italy in the 1862-2013 years. We used the data recently reconstructed by Forte (2011) for Italy. The choice of the sub-periods is in line with studies that cover a similar time span (Balassone *et al.*, 2011; Burret *et al.*, 2013; Brady and Magazzino, 2017). Moreover, the sample used in the regression analysis excludes the years 1915-1946 to prevent distortions from the extreme values recorded for most variables over that period because of the two world wars. The partition of the sample is also driven by major facts in Italian history (early unification; world wars and Fascism; Republican period). Moreover, structural break analysis confirm this choice.

Figure 1 shows the dynamic of our series. In the right-side panel, the first-differences series are graphed. A visual inspection of the series in logarithmic form shows that there was a clear upward trend for both series after the WWII. Some descriptive statistics are summarized in Table 1 as a preliminary analysis. Both variables have negative value of skewness in the sub-period 1947-2013, indicating that the distributions are skewed to the left. Correlation analysis show that public expenditure and revenue are highly correlated in each period.

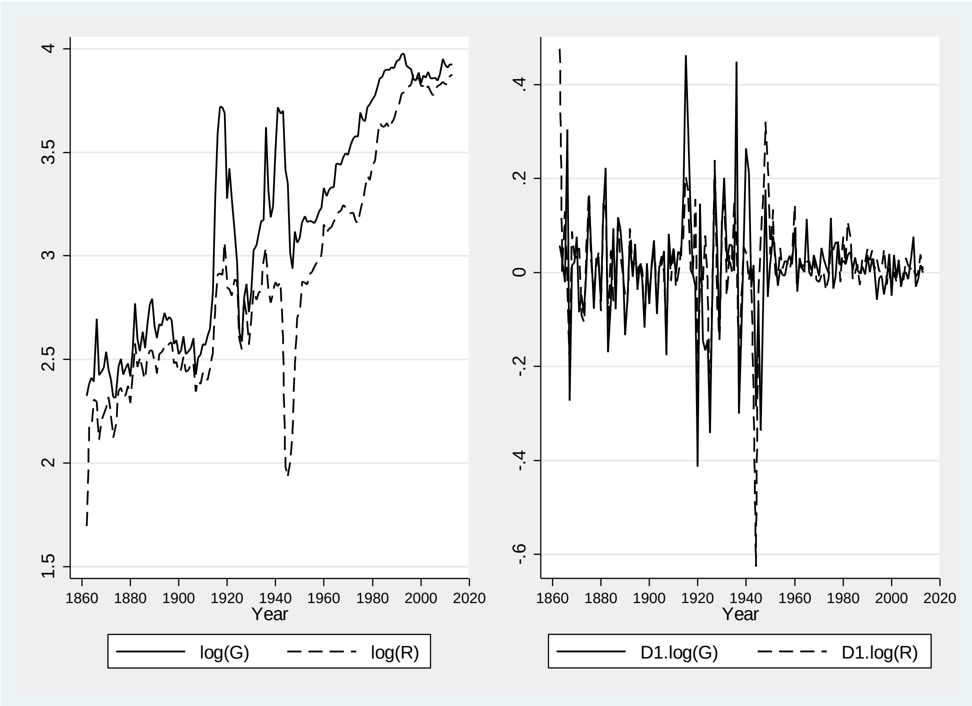

Figure 1. Public expenditure and revenue in Italy (1862-2013, (% of GDP, log-scal). Source: Forte (2011) and own elaboration.

4. Empirical analysis

The focus of the present section is the analysis of the fiscal policy sustainability for each time period in Italy. In order to test for fiscal sustainability, we test whether the transversality condition is met (Burret et al., 2013) by conducting various stationarity tests on public expenditure and revenues. First, the solvency of the fiscal policies pursued by Italy will be tested according to the Trehan-Walsh procedure, i.e. by analysing the statistical properties of the deficit inclusive of interest payments (Trehan and Walsh, 1988). More specifically, the stationarity of the deficit-to-GDP time series will be the maintained hypothesis.

Table 1. Exploratory data analysis.

Variable	Mean	Median	s.d.	Skewness	Kurtosis	Range	IQR	10-Trim
1862-2013								
G	3.1726	3.1760	0.5446	0.0066	1.5150	1.6608	1.1027	3.174
R	2.9109	2.8380	0.5533	0.3431	2.0341	2.1788	0.7949	2.892
1862-1914								
G	2.5494	2.5461	0.1197	0.0080	2.3130	0.4784	0.1856	2.549
R	2.3870	2.4352	0.1586	-1.7616	8.0278	0.8862	0.1800	2.407
1947-2013								
G	3.6275	3.7578	0.3055	-0.6052	1.8945	1.0379	0.5642	3.655
R	3.4065	3.4400	0.4033	-0.6542	2.8381	1.7175	0.6542	3.444

Sources: our calculations on Forte (2011) data.

The presence of a unit root in these time series clearly reflects fiscal insolvency, implying that the solvency condition is violated (Vanhorebeek and Van Rompuy, 1995). We have also split our time span into two periods: 1862-1913 and 1947-2013. An additional reason to conduct such an analysis rests on the fact that longer sample periods may actually “hide” unsustainability periods in the series.

Several unit root and stationarity tests are used in an attempt to verify the stability conditions. Since unit roots in fiscal data imply that economic shocks have a sustaining effect on the data over time, the identification of a unit root denotes a non-stationary (unsustainable) time series. In order to take a possible distortion of structural breaks into account, we follow a twofold approach. First, we conduct the unit root and stationarity tests on the entire sample (1862-2013) and on the two sub-samples (1862-1913 and 1947-2013). Second, we additionally apply two tests on unit root and structural break.

The stationarity tests on the 1862-2013 years are only indicative, since the whole period is characterized by large-scale events and structural breaks. If we allow for a constant, the tests indicate that both variables are non-stationary in the levels, but stationary in first-differences (integrated of order 1). If we also include a trend in the estimation, the results for their levels are ambiguous; in fact, expenditures tend to be stationary in levels with trend, as the ERS and PP test statistics allow for rejecting the hypothesis of a unit root on the five percent significance level. In contrast, all proposed tests do not reject the hypothesis of stationarity for the differenced series. Given these mixed results, we conclude that the analysis of the whole time series could not be meaningful. Moreover, the power of standard unit root tests decreases substantially if there are significant structural breaks in the time series. Therefore, we divide the sample into two sub-periods as discussed above.

With regard to the first sub-period (1862-1913), expenditures and revenues tend to be first-differences stationary, in both specifications. Thus, in this respect, evidence in favour of solvency is found.

Finally, in the last period (1947-2013), as for expenditures, if we allow for a constant, the tests indicate that they are non-stationary in the levels, while the differenced series is stationary. If we also include a trend, expenditures continue to be I(1). On the other hand, the results for revenues are ambiguous, since, allowing for a constant, the ADF (at 10 percent) and PP tests (1 percent) reject the unit root hypothesis; while including a trend in the deterministic component, the ERS and PP test statistics allow for rejecting the non-stationary hypothesis. Nevertheless, all proposed tests clearly indicate the absence of a unit root when the differenced series of revenues is analyzed. These findings clearly indicate that Italian fiscal policies have undoubtedly been insolvent in the last sub-period.

In summary, the results allow the rejection of the non-stationarity hypothesis for the entire period as well as for the two selected sub-periods.

To further explore unit root properties of the variables, we supplement a ZA unit root test that is sensitive to structural breaks a) in the intercept, b) in the intercept and trend (Table 2).

Table 2. Results for unit roots and stationarity tests.

		1862-2013			
Variable	***Unit root and stationarity tests***				
	Deterministic component	**ADF**	**ERS**	**PP**	**KPSS**
G	constant	-1.4290	-0.1598	-1.4290	1.3706***
R	constant	-1.0549	0.3597	-1.5968	1.3243***
G	constant, trend	-3.4063*	-3.4309**	-3.8367***	0.0368
R	constant, trend	-3.0884	-2.4993	-3.4300*	0.2219***
ΔG	constant	-6.6434***	-2.6640***	-11.2386***	0.0217
ΔR	constant	-10.8174***	-0.9545	-11.0261***	0.0563
ΔG	constant, trend	-6.6207***	-6.4510***	-11.2009***	0.0211
ΔR	constant, trend	-10.7720***	-1.5720	-10.9828***	0.0562
1862-1913					
Variable	***Unit root and stationarity tests***				
	Deterministic component	**ADF**	**ERS**	**PP**	**KPSS**
G	constant	-2.2051	-1.1322	-3.3304**	0.4682**
R	constant	-2.4543	-1.0413	-5.2232***	0.6861**
G	constant, trend	-1.2706	-1.1772	-3.6332**	0.1683**
R	constant, trend	-0.6916	-1.1933	-5.4742***	0.2742***
ΔG	constant	-9.3828***	-1.6348**	-14.3553***	0.1988
ΔR	constant	-10.1177***	-1.6606*	-18.7841***	0.3286
ΔG	constant, trend	-9.2972***	-9.3446***	-17.4027***	0.1901**
ΔR	constant, trend	-9.9661***	-2.9705*	-35.8019***	0.0948
1947-2013					
Variable	***Unit root and stationarity tests***				
	Deterministic component	**ADF**	**ERS**	**PP**	**KPSS**
G	constant	-1.8269	0.3349	-2.1533	0.9158***
R	constant	-2.8422*	-0.1615	-4.2098***	0.9768***
G	constant, trend	-0.3792	-1.0534	-0.4320	0.2219***
R	constant, trend	-1.7730	-3.1633**	-5.2981***	0.1320*
ΔG	constant	-9.1832***	-9.3629***	-12.8693***	0.4858**
ΔR	constant	-4.6307***	-1.7669*	-4.5872***	0.4596*
ΔG	constant, trend	-9.2348***	-8.6189***	-14.6196***	0.1107
ΔR	constant, trend	-5.1860***	-4.3358***	-5.2588***	0.1243*

Notes. Tests are performed on the log-levels of the variables. ADF, ERS, PP, and KPSS refers respectively to the Augmented Dickey-Fuller test, the Elliot, Rothenberg, and Stock point optimal test, the Phillips-Perron test, and the Kwiatkowski, Phillips, Schmidt, and Shin test. When it is required, the lag length is chosen according to the HQIC. ***p<0.01, **p<0.05, *p<0.10. Lag length based on Modified SBIC for ADF and ERS, Bartlett kernel for PP and KPSS.

For the whole period, we find ambiguous results: in the first case, we cannot reject the hypothesis that revenues have a unit root. Yet, if we also allow for a structural break in the trend, the hypothesis is rejected. The first specification test indicates a break point in 1975, the first year in which there were the effects of the Italian tax reform; while the second specification isolates a break at the end of the WWII, with the need to finance the reconstruction. While for the expenditures, both tests reject the null hypothesis of unit root only at 10 percent significance level, with a break at the outbreak of the First World War (1914). For this reason, previous ambiguous results are confirmed. Comparing expenditure and revenue break points, the ZA results suggest that fiscal policy of the 19th century is significantly different from that of the 20th century. The significant breakpoint in 1914 is due to the sharp increase of expenditure growth to finance WWI. The CMR test shows that both for revenues and expenditures, despite the structural breaks, we are unable to reject the null hypothesis of a unit root in these series. Notwithstanding, the rejection of the stationarity hypothesis does not mean that public accounts are not sustainable, as observed by Trehan and Walsh (1991): stationarity rejection does not necessarily imply the absence of sustainability of the government accounts.

For the pre-WWI years, if we allow for a structural break in the intercept, we can reject the null hypothesis for both expenditures and revenues; and we obtain similar results when we include also the trend in the model. Curiously, all tests indicate as a break point the year 1881, when the III Cairoli's Government (Historical Left) abolished the fiat of the lira (Forte and Magazzino, 2016).

As regards the republican age, for expenditures and revenues we retain the null hypothesis both allowing for a structural break in the intercept and for a break in the trend. Both tests indicate for revenues a break point located in the first Eighties, related with the effects of the so-called "divorce" between the Bank of Italy and the Italian Ministry of Treasury as well as the effects of the second oil shock. If we allow for a break only in the intercept, the break corresponds to the initial phase of the Second Republic. While, including a break also in the trend, the date coincides with those found for revenues (1982).

We therefore can conclude that both our series are integrated of order one, or *I(1)* only in the second sub-period, while inconclusive results are reached for the whole sample period. The lag-order selection has been chosen according to the Akaike's information criterion (AIC), the Schwarz's Bayesian information criterion (SBIC), and the Hannan-Quinn information criterion (HQIC).

Now we can proceed to investigate fiscal sustainability in Italy by testing for the existence of cointegration between public expenditure and revenues. Figure 1 can supply a visual inspection of the time series and a preliminary idea. One can suspects that Italy in the more recent years might not pass the sustainability tests. In Table 4, we show the results of the ARDL bounds cointegration tests.

The empirical findings allow the rejection of the cointegration hypothesis for both equations of the whole period, and only for the equation with public expenditure as a dependent variable in the second sub-period. On the other hand, for the years 1862-1913 a cointegration relation is found for both equations. Therefore, considering the results of the entire sample time period (1862-2013), one can conclude that fiscal policy may not been sustainable for Italy since Unification.

Table 3: Results for unit root tests with structural breaks and for additive outlier unit root tests (single structural break).

1862-2013						
ZA tests						
Variable	**(a)**			**(b)**		
	T_b	k	t_{min}	T_b	k	t_{min}
G	1914	3	-4.777* (-4.80)	1914	3	-4.984* (-5.08)
R	1975	3	-4.266 (-4.80)	1943	3	-5.539** (-5.08)
CMR tests						
Variable	**Optimal break point**	**k**	**t-stat**	**5% Critical Value**		
G	1917	6	-1.791	-3.560		
R	1974	1	-3.403*	-3.560		
1862-1913						
ZA tests						
Variable	**(a)**			**(b)**		
	T_b	k	t_{min}	T_b	k	t_{min}
G	1881	1	-5.706*** (-4.80)	1881	1	-5.647*** (-5.08)
R	1881	1	-8.548*** (-4.80)	1881	1	-8.762*** (-5.08)
CMR tests						
Variable	**Optimal break point**	**k**	**t-stat**	**5% Critical Value**		
G	1878	6	-4.416***	-3.560		
R	1878	6	-1.869	-3.560		
1947-2013						
ZA tests						
Variable	**(a)**			**(b)**		
	T_b	k	t_{min}	T_b	k	t_{min}
G	1994	2	-3.561 (-4.80)	1982	2	-3.605 (-5.08)
R	1981	2	-4.311 (-4.80)	1982	2	-5.058* (-5.08)
CMR tests						
Variable	**Optimal break point**	**k**	**t-stat**	**5% Critical Value**		
G	1982	2	-3.505*	-3.560		
R	1982	0	-5.335***	-3.560		

Notes. (a) refers to the model allowing for break in intercept and (b) the model allowing for break in intercept and trend. T_b is the break date endogenously selected. t_{min} is the minimum *t*-statistic. *k* denotes the lag length. 5% Critical Values are given in parentheses. ****p*<0.01, ***p*<0.05, **p*<0.10.

Table 4. ARDL bounds test estimation results.

Model for estimation	**Lag length**	***F*-statistics**	**Significance level**	**Critical bound *F*-statistics**	
1862-2013					
				I(0)	***I(1)***
F_R^G	1	4.355	1	6.84	7.84
			2.5	5.77	6.68
F_G^R	1	1.432	5	4.94	5.73
			10	4.04	4.78
1862-1913					
				I(0)	***I(1)***
F_R^G	1	7.306**	1	6.84	7.84
			2.5	5.77	6.68
F_G^R	1	6.456**	5	4.94	5.73
			10	4.04	4.78
1947-2013					
				I(0)	***I(1)***
F_R^G	1	2.715	1	6.84	7.84
			2.5	5.77	6.68
F_G^R	1	10.467***	5	4.94	5.73
			10	4.04	4.78

Notes. Asymptotic critical value bounds are obtained from table *F*- statistic in Pesaran *et al.* (2001). ****p*<0.01, ***p*<0.05, **p*<0.10.

Table 5. Gregory and Hansen cointegration tests.

Country	Constant	Constant and trend	Constant and slope	Constant, slope and trend
		Dependent Variable: G		
1862-2013	-4.24 (1920)	-4.29 (1908)	-5.15** (1937)	-5.66** (1937)
1862-1913	-6.85*** (1869)	-6.82*** (1869)	-6.28*** (1872)	-6.37*** (1869)
1947-2013	-4.12 (1908)	-4.01 (1884)	-4.14 (1908)	-6.25*** (1909)
		Dependent Variable: R		
1862-2013	-3.56 (1979)	-4.01 (1979)	-4.36 (1943)	-4.84 (1938)
1862-1913	-10.47*** (1874)	-10.39*** (1874)	-10.36*** (1874)	-10.57*** (1898)
1947-2013	-5.58*** (1992)	-5.86*** (1992)	-5.74*** (1990)	-5.58** (1973)

Notes. ADF statistics are reported. 5% Critical Values: -4.61, -4.99, -4.95, -5.50 respectively.

However, to allow for the possibility of structural breaks in the long-run cointegrating relationship, we applied the Gregory and Hansen (1996) cointegration test with breaks. Briefly, under this procedure, a dummy variable is included to account for a shift in the cointegrating regression. The minimum ADF statistic endogenously determines the breakpoint and is compared to critical values supplied by Gregory and Hansen (1996). The procedure offers four different models corresponding to the four different assumptions concerning the nature of the shift in the cointegrating vector. Table 5 clearly confirms previous ARDL bounds tests results, showing the existence of cointegration with a break for the first sub-period.

Table 6. Cointegration of government revenues and expenditures.

Time period	Dependent variable	Engle-Granger test		ARDL bound tests	
		Vector	P-Value	Vector	P-Value
1862-1913	R	[1-0.9740]***	0.000	[1-0.9343]***	0.001
	G	[1-1.2117]***	0.000	[1-1.3639]***	0.000
1947-2013	R	[1-0.6276]***	0.000	[1-0.8818]***	0.000

Notes. Asymptotic critical value bounds are obtained from table *F*- statistic in Pesaran *et al.* (2001). ****p*<0.01, ***p*<0.05, **p*<0.10. Only cointegrating vectors with at least a 10% significance level are reported.

For the first sub-period, in the revenues equation, the estimated coefficient for public expenditure is less than one. For each percentage point of GDP increase in public expenditure, in Italy during the years 1862-1913 public revenues only increase by 0.93-0.97. However, this estimated coefficient is very close to one, suggesting that in the above mentioned period of time public expenditure exhibited a slightly higher growth rate than public revenues, do not thus challenging the hypothesis of fiscal sustainability.

On the other side, for the more recent period (1947-2013), the public expenditure's coefficient in the equation where revenues are the dependent variable is less than one. Here, we can state that for each percentage point of GDP increase in public expenditure, in Italy in the 1947-2013 period public revenues only increase by 0.6276. In this case, public expenditure exhibited a clearly higher growth rate than public revenues, suggesting that fiscal sustainability problems emerge.

As can be seen from Table 7, the null hypothesis of no cointegrating relationship against alternative of at most one cointegrating relationship cannot be rejected in any of the models at a 5% level of significance, suggesting that there is no cointegrating relationship among variables. Although the 5% critical values were adjusted (lifted up) in order to account for a small sample bias, the null hypothesis of no cointegration could not have been rejected even using none adjusted 5% critical values.

Table 7. Results for Johansen and Juselius cointegration tests.

				1862-2013			
H_0	H_1			Model[a]			
		Trace	Eig. Stat.	LL	SBIC	HQIC	AIC
None	At most 1	24.5119*	16.1212*	284.9919	-3.5995*	-3.6710*	-3.7199
		(25.32)	(18.96)				
At most 1	At most 2	8.3907	8.3907	293.0525*	-3.5733	-3.6625	-3.7740*
		(12.25)	(12.52)				
				1862-1913			
H_0	H_1			Model[b]			
		Trace	Eig. Stat.	LL	SBIC	HQIC	AIC
None	At most 1	64.6594	49.1299	103.3854	-3.9001	-3.9469	-3.9759
		(25.32)	(18.96)				
At most 1	At most 2	11.5296*	11.5296*	127.9504*	-4.5551*	-4.6955*	-4.7824*
		(12.25)	(12.52)				
				1947-2013			
H_0	H_1			Model[b]			
		Trace	Eig. Stat.	LL	SBIC	HQIC	AIC
None	At most 1	25.4214	23.3952	259.4186	-6.8652	-7.1436	-7.3259
		(25.32)	(18.96)				
At most 1	At most 2	2.0262*	2.0262*	271.1162*	-6.9634*	-7.3213*	-7.5557*
		(12.25)	(12.52)				

Notes. 5% Critical Values in parentheses. a: include a linear trend in the cointegrating equations and a quadratic trend in the undifferenced data; b: include a restricted trend in the model.

Furthermore, our empirical findings are in line with previous results by Vanhorebeek and Van Rompuy (1995), who found that Italian fiscal policies have undoubtedly been insolvent in the period 1970-1994. Corsetti and Roubini (1991) found, amongst other things, the government finances of Italy to be unsustainable. Caporale (1995) found that the government of Italy is intertemporally insolvent. Payne (1997) showed that in the case of Italy the budget deficits might not be sustainable due to the lack of cointegration. Moreover, cointegration is present between revenues and expenditures, although the estimated coefficient (0.63-0.88) is significantly less than one, which suggests that public expenditure was growing faster than public revenues. Such a relationship between public revenues and expenditure questions the issue of sustainability. Papadopoulos and Sidiropoulos (1999) derived that Italy may incur unsustainable deficits, so that its selection in Phase 2 of the EMU is questionable. Uctum and Wickens (2000) found that the market value of the debt-GDP for Italy was not mean-reverting (1994-2000), though a general improvement in fiscal stances toward the end of the century could be noted. Moreover, they concluded that fiscal policy in Italy was not sustainable. Bravo and Silvestre (2002) found that cointegration between expenditures and revenues does not emerge in the Italian case, implying that condition for sustainability does not held. In addition, Afonso (2005) found that Italy was one of the majority EU-15 member countries with sustainability problems. On the contrary, Afonso and Jalles (2014) concluded that the solvency condition would be satisfied for Italy, since non-stationarity can be rejected, and, therefore, longer-run fiscal sustainability cannot.

4. Concluding remarks

This study has extended the research on the fiscal sustainability of the Italian budgetary policies in the 1862-2013 years. Unit root and stationarity tests have been conducted on the entire sample (1862-2013), and on two sub- samples (1862 -1913 and 1947-2013). The results of unit root tests allow the rejection of the non-stationarity hypothesis for the entire period as well as for the two selected sub-periods. Unit root tests with structural breaks confirm previous findings. Cointegration analyses reveal that for the whole period a long-run relationship does not emerge. Therefore, considering the results of the entire sample time period (1862-2013), one can conclude that fiscal policy may not been sustainable for Italy since Unification. Moreover, cointegration is present between public expenditure and revenues for the first sub-period (1862-1913), with an estimated coefficient very close to one (0.93-0.97), do not thus implying problems for fiscal sustainability. On the other hand, for the Republican age (1947-2013), a long-run relationship is discovered, although the estimated coefficient (0.63-0.88) is significantly less than one, which suggests that public expenditure was growing faster than government revenues, raising some concerns about the issue of sustainability. Therefore, we support a fiscal consolidation strategy and refute the perception that Italian fiscal policy is on a sustainable path.

The concept of practical sustainability is most relevant in the framework of the budgetary preconditions of Maastricht. In other words, if Italian fiscal policies were to be conducted in the future as it was in the Republican age (1947-2013), there could be emerge some problems. In addition, our results are in line with empirical findings in Brady and Magazzino (2017).

Acknowledgements

Comments from the participants at the Scottish Economic Society 2017 Conference (Perth, Scotland, 24-26 April 2017) are gratefully acknowledged. We would like also to thank the anonymous referees and the Editor for useful comments. All remaining errors are our own.

References

Afonso, A. (2005). Fiscal Sustainability: The Unpleasant European Case. FinanzArchiv, 61 (1), 19-44. doi: 10.1628/0015221053722532

Afonso A., & Jalles, J.T. (2014). A longer-run perspective on fiscal sustainability. Empirica, 41(4), 821-847. doi: 10.1007/s10663-013-9240-0

Afonso A., & Jalles, J.T. (2015). How Does Fiscal Policy Affect Investment? Evidence from a Large Panel. International Journal of Finance & Economics, 20 (4), 310-327. doi: 10.1002/ijfe.1518

Baglioni, A., & Cherubini, U. (1993). Intertemporal budget constraint and public debt sustainability:

the case of Italy. Applied Economics, 25(2), 275-283. 10.1080/00036849300000033

Balassone, F., Francese, M., & Pace, A. (2011). Public Debt and Economic Growth in Italy. Quaderni di Storia Economica – Bank of Italy.

Balassone, F., Franco, D., Momigliano S., & Monacelli D. (2002). Italy: Fiscal Consolidation and Its Legacy. SSRN Paper.

Baum, C. (2001). Stata: The language of choice for time series analysis?. The Stata Journal, 1(1), 1-16.

Becketti, S. (2013). Introduction to Time Series Using Stata. Texas: Stata Press.

Bohn, H. (2007). Are stationarity and cointegration restrictions really necessary for the intertemporal budget constraint?. Journal of Monetary Economics, 54, 1837-1847. doi: 10.1016/j.jmoneco.2006.12.012

Bohn, H. (1991a). Budget balance through revenue or spending adjustments?. Journal of Monetary Economics, 27(3), 333-359. doi: 10.1016/0304-3932(91)90013-E

Bohn, H. (1991b). The sustainability of budget deficits with lump-sum and with income-based taxation. Journal of Money, Credit and Banking, 23(3), 581-612. 10.2307/1992692

Bohn, H. (1995). The sustainability of budget deficits in a stochastic economy. Journal of Money, Credit and Banking, 27(1), 257-271. doi: 10.2307/2077862

Bohn, H. (1998). The behaviour of US public debt and deficits. Quarterly Journal of Economics, 113(3) 949-963. doi: 10.1162/003355398555793

Brady, G.L., & Magazzino, C. (2017). The Sustainability of Italian Public Debt and Deficit. International Advances in Economic Research, 23(1), 9-20. doi: 10.1007/s11294-016-9623-7

Bravo, A.B.S., & Silvestre, A.L., (2002). Intertemporal sustainability of fiscal policies: some tests for European countries. European Journal of Political Economy, 18(3), 517-528.

Buiatti, C., Carmeci, G., & Mauro, L. (2014). The origins of the public debt of Italy: Geographically dispersed interests?. Journal of Policy Modeling, 36(1) 43-62. doi: 10.1016/j.jpolmod.2013.10.016

Burret, H.T., Feld, L.P., & Köhler, E.A. (2013). Sustainability of German Fiscal Policy and Public Debt: Historical and Time Series Evidence for the Period 1850-2010. CESifo Working Paper, 4135.

Caporale, G.M. (1995). Bubble finance and debt sustainability: a test of the government's intertemporal budget constraint. Applied Economics, 27(12), 1135-1143. doi: 10.1080/00036849500000096

Casadio, P., Paradiso, A., & Rao, B.B. (2012). The dynamics of Italian public debt: alternative paths for fiscal consolidation. Applied Economics Letters, 19(7), 635-639. doi: 10.1080/13504851.2011.591726

Clemente, J., Montañés, A., & Reyes, M. (1998). Testing for a unit root in variables with a double change in the mean. Economics Letters, 59(2), 175-182. doi: 10.1016/S0165-1765(98)00052-4

Corsetti, G. (1991). Testing for Solvency of the Public Sector: An Application to Italy. Economic Notes, 20(3), 581-599.

Corsetti, G., & Roubini, N. (1991). Deficits, public debt and government solvency: Evidence from OECD countries. Journal of Japanese and International Economies, 5(4), 354-380. doi: 10.1016/0889-1583(91)90004-A

Dalena, M., & Magazzino, C. (2012). Public Expenditure and Revenue in Italy, 1862-1993. Economic Notes, 41(3), 145-172. doi: 10.1111/j.1468-0300.2012.00243.x

de Haan, J., & Siermann, C.L.J. (1993). The Intertemporal Government Budget Constraint: A Review and Application for The Netherlands. University of Groningen, Research Memorandum, 556.

Dickey, D.A., & Fuller, W.A. (1979). Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association, 74, 427-431. doi: 10.2307/2286348

Di Mascio, F., & Natalini, A. (2014). Austerity and Public Administration: Italy Between Modernization and Spending Cuts. American Behavioral Scientist, 58(12), 1634-1656. doi: 10.1177/0002764214534667

Elliott, G., Rothenberg, T.J., & Stock, J.H. (1996). Efficient tests for an autoregressive unit root. Econometrica, 64(4), 813-836. doi: 10.2307/2171846

Enders, W. (2014). Applied Econometric Time Series. Chichester: Wiley.

Engle, R.F., & Granger, C.W.J. (1987). Co-integration and error correction: representation, estimation, and testing. Econometrica, 55(2), 251-276.

Franses, P.H., van Dijk, D., & Opschoor, A. (2014). Time Series Models for Business and Economic Forecasting. Cambridge: Cambridge University Press.

Forte, F. (2011). L'economia italiana dal Risorgimento ad oggi, 1861-2011, Siena: Cantagalli.

Forte, F. & Magazzino, C. (2014). Economic growth and fiscal consolidation: the optimal mix between current and investment public expenditure. The case of Europe. In Forte, F., Mudambi, R., & Navarra, P. (eds.). Handbook of Alternative Theories of Public Economics. Cheltenham: Edward Elgar.

Forte, F., & Magazzino, C. (2016). Government size and economic growth in Italy: a time-series analysis. European Scientific Journal, 12(7), 149-169. doi: 10.19044/esj.2016.v12n7p149

Forte, F., & Magazzino, C. (2011). Optimal Size Government and Economic Growth in EU Countries. Economia Politica-Journal of Analytical and Institutional Economics, 28(3), 295-321.

Gregory, A.W., & Hansen, B.E. (1996). Residual-Based Tests for Cointegration in Models with Regime Shifts. Journal of Econometrics, 70(1), 99-126. doi: 10.1016/0304-4076(69)41685-7

Greiner, A., & Kauermann, G. (2008). Debt policy in euro area countries: Evidence for Germany and Italy using penalized spline smoothing. Economic Modelling, 25(6), 1144-1154. doi: 10.1016/j.econmod.2008.02.006

Köller, U., & Semmler, W. (2007). Debt sustainability in the European Monetary Union: Theory and empirical evidence for selected countries. Oxford Economic Papers, 59(2), 194-218. doi: 10.1093/oep/gpl035

Hakkio, C.S., & Rush, M. (1991). Is the Budget Deficit "Too Large?". Economic Inquiry, 29(3), 429-445. doi: 10.1111/j.1465-7295.1991.tb00837.x

Hamilton, J.D., & Flavin, M.A. (1986). On the Limitations of Government Borrowing: A Framework for Empirical Testing. American Economic Review, 76(4), 808-819.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with applications to the demand for money. Oxford Bulletin of Economics and Statistics, 52(2), 169-210. doi: 10.1111/j.1468-0084.1990.mp52002003.x

Kremers, J.J.M. (1988). Limits on the US Federal Debt. Economics Letters, 28(3) 259-262. doi: 10.1016/0165-1765(88)90127-9

Kremers, J.J.M. (1989). U.S. Federal Indebtedness and the Conduct of Fiscal Policy. Journal of Monetary Economics, 23(2), 219-238. doi: 10.1016/0304-3932(89)90049-4

Kwiatkowski, D., Phillips, P.C.B., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root?. Journal of Econometrics, 54(1-3), 159-178. doi: 10.1016/0304-4076(92)90104-Y

Lilico, A., Holmes, E., & Sameen, H. (2009). Controlling Spending and Government Deficits: Lessons from History and International Experience. London: Policy Exchange.

Lütkepohl, H. (2005). New Introduction to Multiple Time Series Analysis. Berlin: Springer.

Lütkepohl, H., & Krätzig, M. (2004). Applied Time Series Econometrics. Cambridge: Cambridge University Press.

MacDonald, R., & Speight, A.E.H. (1986). The Intertemporal Government Budget Constraint in the UK, 1961-1986. The Manchester School, 58(4), 329-347. doi: 10.1111/j.1467-9957.1990.tb00426.x

MacDonald, R. (1992) Some Tests of the Government's lntertemporal Budget Constraint Using US Data. Applied Economics, 24(12), 1287-1292. doi: 10.1080/00036849200000087)

Magazzino, C. (2014). Government size and economic growth in Italy: an empirical analyses based on new data (1861-2008). International Journal of Empirical Finance, 3(2), 38-54.

Magazzino, C. (2012a). Politiche di bilancio e crescita economica. Torino: Giappichelli.

Magazzino, C. (2012b). Wagner versus Keynes: Public Spending and National Income in Italy at a Disaggregated Level. Journal of Policy Modeling, 34(6), November-December, 890-905. doi: 10.1016/j.jpolmod.2012.05.012

Magazzino, C., Intraligi V. (2015). La dinamica del debito pubblico in Italia: un’analisi empirica (1958-2013). Rivista italiana di economia demografia e statistica, 59(3), 167-178.

Marattin, L., & Marzo, M. (2009). A Note on the (Un)Pleasant Arithmetic of Fiscal Policy: The Case of Italian Public Debt. Economic Notes, 38(3), 169-183.

OECD. (2011). Fiscal consolidation: targets, plans and measures. OECD Journal on Budgeting, 11/2. doi: 10.1787/16812336

Paesani, P., Strauch, R., & Kremer, R. (2006). Public Debt and Long-Term Interest Rates: The Case of Germany, Italy and the USA. ECB Working Paper Series, 656, July.

Papadopoulos, A.P., & Sidiropoulos, G.P. (1999). The Sustainability of Fiscal Policies in the European Union. International Advances in Economic Research, 5(3), 289-307.

Perron, P., & Vogelsang, T. (1992). Nonstationarity and level shifts with an application to purchasing power parity. Journal of Business and Economic Statistics, 10(3), 301-320. doi: 10.1080/07350015.1992.10509907

Pesaran, H.M. (1997). The role of economic theory in modelling the long run. The Economic Journal, 107(440), 178-191. doi: 10.1111/1468-0297.00151

Pesaran, H.M., & Shin, Y. (1999). Autoregressive distributed lag modelling approach to cointegration analysis. In Storm S., (Ed.). Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium. Cambridge: Cambridge University Press.

Pesaran, H.M., & Shin, Y., Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16(3), 289-326. doi: 10.1002/jae.616

Piergallini, A., & Postigliola, M. (2012). Fiscal Policy and Public Debt Dynamics in Italy, 1861-2009. Rivista Italiana degli Economisti, 17(3), 417-440.

Piergallini, A., & Postigliola, M. (2013). Non-linear budgetary policies: Evidence from 150 years of Italian public finance. Economics Letters, 121(3), 495-498. doi: 10.1016/j.econlet.2013.09.030

Phillips, P.C.B., & Perron, P. (1988). Testing for a unit root in time series regression. Biometrika, 75(2), 335-346. doi: 10.2307/2336182

Schwert, G.W. (1989). Tests for unit roots: A Monte Carlo investigation. Journal of Business and Economic Statistics, 7(2), 147-159. doi: 10.2307/1391432

Spaventa, L. (2013). The growth of public debt in Italy: past experience, perspectives and policy problems. PSL Quarterly Review, 66(266), 291-324.

Spaventa, L. (1987). The Growth of Public Debt: Sustainability, Fiscal Rules, and Monetary Rules. IMF Staff Papers, 34(2), 374-399.

Trachanas, E., & Katrakilidis, C. (2013). Fiscal deficits under financial pressure and insolvency: Evidence for Italy, Greece and Spain. Journal of Policy Modeling, 35(5), 730-749. doi: 10.1016/j.jpolmod.2013.03.013

Trehan, B., & Walsh, C.E. (1988). Common trends, the government budget constraint, and revenue smoothing. Journal of Economic Dynamics and Control, 12(2), 425-444. doi: 10.1016/0165-1889(88)90048-6

Uctum, M., & Wickens, M. (2000). Debt and deficit ceilings, and sustainability of fiscal policies: an intertemporal analysis. Oxford Bulletin of Economics and Statistics, 62(2), 197-222. doi: 10.1111/1468-0084.00168

Vanhorebeek, F., & Van Rompuy, P. (1995). Solvency and Sustainability of Fiscal Policies in the EU. De Economist, 143(4), 457-473. doi: 10.1007/BF01384910

von Hagen, J., Hughes Hallett, A., Strauch ,R. (2001). Budgetary Consolidation in EMU, Centre for Economic Policy Research – Economic Papers. 148, March.

Zivot, E., & Andrews, D. (1992). Further evidence on the Great Crash, the oil price shock, and the unit-root hypothesis. Journal of Business and Economic Statistics, 10(3), 251-270. doi: 10.1198/073500102753410372

Appendix

Methodological details

The econometric literature has proposed several unit root tests with structural breaks. Yet, one obvious weakness of the Zivot and Andrews (1992) strategy, relating as well to similar tests proposed by Perron and Vogelsang (1992), is the inability to deal with more than one break in a time series. Addressing this problem, Clemente *et al.* (1998) proposed tests that would allow for two events within the observed history of a time series, either additive outliers (the AO model, which captures a sudden change in a series) or innovational outliers (the IO model, allowing for a gradual shift in the mean of the series). This taxonomy of structural breaks follows from Perron and Vogelsang's work (1992). However, in that paper the authors only dealt with series including a single AO or IO event (Enders, 2014; Franses, 2014; Becketti, 2013; Lütkepohl, 2005; Lütkepohl and Krätzig, 2004; Baum, 2001).

The AO is the type of outliers that affects a single observation. After this disturbance, the series returns to its normal path as if nothing has happened. The IO is the type of outliers that affects the subsequent observations starting from its position or an initial shock that propagates in the subsequent observations. An AO affects only the *t* observation, whereas an IO affects all observations beyond time *t* through the memory of the system.

The double-break additive outlier model involves the estimation of the equation

$$y_t = \mu + \delta_1 DU_{1t} + \delta_2 DU_{2t} + \ddot{y}_t \qquad \text{[A.1]}$$

where $DU_{mt} = 1$ for $t > TB_m$ and 0 otherwise, for $m = 1, 2$. TB_1 and TB_2 are the breakpoints, to be located by grid search. The residuals from this regression, $\ddot{y}_t$, are then the dependent variable in the equation to be estimated.

The equivalent model for the innovational outlier leads to the formulation

$$y_t = \mu + \delta_1 DU_{1t} + \delta_2 DU_{2t} + \phi_1 DT_{b1,t} + \phi_2 DT_{b2,t} + \alpha y_{t-1} + \sum_{i=1}^{k} \theta_i \Delta y_{t-i} + e_t \qquad \text{[A.2]}$$

where again an estimate of α significantly less than unity will provide evidence against the *I(1)* null hypothesis.