

**For Submittal to the Program Committee of the
Scottish Economic Society for the
April 2017 Meetings in Perth**

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

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Abstract: In this paper, we analyse the sustainability of Italian public finances using a unique database covering the period 1862-2013. This paper focuses on empirical tests for the sustainability and solvency of fiscal policies. A necessary but not sufficient condition implies that the growth rate of public debt should in the limit be smaller than the asymptotic rate of interest. In addition, the debt-to-GDP ratio must eventually stabilise at a steady-state level. The results of unit root and stationarity tests show that the variables are non-stationary at levels, but stationary in first-differences form, or $I(1)$. However, some breaks in the series emerge, given internal and external crises (wars, oil shocks, regime changes, institutional reforms). Therefore, the empirical analysis is conducted for the entire period, as well as two sub-periods (1862-1913 and 1947-2013). Moreover, anecdotal evidence and visual inspection of the series confirm our results. Furthermore, we conduct tests on cointegration, which evidence that a long-run relationship between public expenditure and revenues is found only for the first sub-period (1862-1913). In essence, the paper's results reveal that Italy have sustainability problems in the Republican age.

Keywords: Public finance; sustainability; ARDL; Italy.

JEL classification: C22; H11; H60; O52.

¹ *Acknowledgements:* Comments from the participants at the 81st International Atlantic Economic Conference (Lisbon, March 2016) are gratefully acknowledged. However, the usual disclaimer applies.

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 Nineteenth 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. 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 labor 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 initiat-

ing 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. Our 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 Distributed 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.

Besides the Introduction, the outline of this paper proceeds as follows. Section 2 provides a survey of the literature and briefly reviews the sustainability and solvency conditions. Section 3 contains an overview of the applied empirical methodology and a brief discussion of the data used. Section 4 discusses our empirical results. Section 5 presents some concluding remarks and, finally, Section 6 gives suggestions for future researches.

2. Theoretical Framework and Empirical Literature Review

2.1 Studies on fiscal consolidation

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.

Alesina and Ardagna (2009) examined 107 large fiscal adjustments in 21 OECD member-countries from 1970 to 2007. They identified 21 successful large fiscal adjustments in 10 OECD member countries. After examining these episodes, they concluded that successful fiscal consolidations were based predominately or entirely on government spending reductions.

Biggs *et al.* (2010) found strong evidence that government spending reductions outweigh revenue increases in successful consolidations regardless of the methodology used to identify consolidations. They found that across two methods for identifying consolidations, successful fiscal consolidations averaged 85% spending cuts and 15% reve-

nue increases, while unsuccessful fiscal consolidations averaged 47% spending cuts and 53% revenue increases. Further the authors show that the degree of success correlates to a larger share of spending cuts.

Examining Denmark and Ireland in the 1980s, Giavazzi and Pagano (1990) found that large fiscal consolidation programs based predominantly or entirely on government spending reductions were expansionary. Alesina and Ardagna (1998) examined fiscal adjustments in 15 advanced countries during the 1980s. Five fiscal adjustments involved both government spending reductions and tax increases. Fiscal adjustments in Ireland (1987-89), Australia (1987), Belgium (1984-85), and Italy (1993, 1994-95) were based on government spending reductions. They concluded that “regardless of the initial level of debt, a large fiscal adjustment that is expenditure-based and is accompanied by wage moderation and devaluation is expansionary. However, they found that no large tax-based fiscal adjustment can be expansionary even if accompanied by devaluation”.

There is a large literature on the intertemporal budget constraint. The general conclusion to emerge from this is that fiscal policy is sustainable if the government budget constraint holds in present value terms. More precisely, the current debt should be offset by the sum of expected future discounted primary budget surpluses (Uctum and Wickens, 2000).

Giudice *et al.* (2003) studied the fiscal policy conducted by 14 EU member states over a period of 33 years. There have been 49 (based on size) and 74 (based on duration) episodes of fiscal consolidation. About half of them (24 and 43, respectively) have been connected with higher economic growth. Of that half, 11 and 19, respectively, are considered to be “pure” growth episodes in which growth cannot be attributed to a concomitant monetary policy or devaluation of the exchange rate. The authors found that the size of the adjustment and the size of the initial debt (in percent of GDP) do not seem to play a significant role. By contrast, they found the composition of fiscal adjustment is of high importance. Fiscal consolidation programs based predominately or exclusively on government spending reductions are more likely to enhance growth than programs that involve significant tax increases.

Ahrend *et al.* (2006) found that both policy interest rates (e.g., the target federal funds rate in the United States) and long-term interest rates are more likely to decline when fiscal consolidations rely on government spending reductions rather than tax increases. Using a dynamic general equilibrium model, Cournède and Gonand (2006) found that tax increases are a much more costly way, in terms of real GDP growth, to achieve fiscal sustainability than government spending reductions.

The IMF (2010), however, argued that Alesina and Ardagna (2009) suffered from methodological issues that caused them to overstate the expansionary effects of fiscal consolidations in the short-term. Instead, the IMF used an “action-based” method to identify fiscal consolidations that relies on an examination of ex-ante official plans with the goals of government budget deficit reduction and/or government debt stabilization. The IMF found that fiscal consolidations were contractionary overall, but that government spending reductions have much smaller contractionary effects. According to the IMF, a fiscal consolidation equal to 1% of GDP based on tax increases caused a 1.3% decrease in GDP and a 0.6 percentage point increase in the unemployment rate after two years, while a fiscal consolidation equal to 1% of GDP based on government spending

reductions caused a 0.3% decrease in GDP and 0.2 percentage point increase in the unemployment rate after two years.

Among different types of government spending reductions, the IMF found that a reliance on reductions in transfer payments caused GDP to increase by 0.2% after two years, while reductions in government consumption and investment caused GDP to decline by 0.4% and 0.6%, respectively, after two years. However, these results were within the margin of error.

While IMF studies strike a more cautionary note than Alesina and Ardagna (2009) or Giudice *et al.* (2003) regarding the ability of expansionary “non-Keynesian” factors to overwhelm contractionary Keynesian reductions in aggregate demand in the short-term, the IMF and these other studies agree that fiscal consolidation programs based predominately or entirely on government spending reductions – especially in transfer payments to households and firms – produce stronger GDP growth in the short-term than fiscal consolidation programs in which tax increases play a significant role.

Molnár (2012) showed that the presence of fiscal rules – expenditure or budget balance rules – is associated with a greater probability of stabilising debt. Moreover, the analysis confirmed that spending-driven adjustments vis-à-vis revenue-driven ones are more likely to stabilise debt, and it also revealed that large consolidations need multiple instruments for consolidation to succeed. Sub-national governments, in particular state-level governments can contribute to the success of central government consolidation, if they co-operate.

Forte and Magazzino (2013) analyzed the relationship between trade deficit and budget deficit. Using yearly data for the period between 1970 and 2010 in 33 European countries. They found evidence supporting the hypothesis that a chronic and robust budget deficit generates a trade deficit. In fact, the dynamic estimates show that a 1% decrease in the government budget surplus/GDP ratio tends to deteriorate the current account/GDP ratio of 0.37%, confirming previous studies with a different empirical basis.

Mencinger *et al.* (2014) explored the transmission mechanism regarding the short-term impact of public debt and growth. The results across all models indicate a statistically significant non-linear impact of public debt ratios on annual GDP per capita growth rates. Further, the calculated debt-to-GDP turning point, where the positive effect of accumulated public debt inverts into a negative effect, is roughly between 80% and 94% for the ‘old’ member states. Yet for the ‘new’ member states the debt-to-GDP turning point is lower, namely between 53% and 54%.

Forte and Magazzino (2015), using yearly data, studied the Ricardian equivalence and twin deficits hypotheses for the Euro Area countries in the 1970-2010 period. The estimates of two subgroups constructed with the Index of Globalization confirm the Ricardian hypothesis. In regard to the dynamic panel data, the Anderson-Hsiao IV estimators indicate that only the first lag of government budget has a positive and significant effect on trade deficit, while the more reliable GMM methods seem to be consistent with the Ricardian view. The Common Correlated Effects Mean Group estimates show that RE holds for 1970-1991 years, while in the second sub-period results are in line with the Keynesian view.

Ferreira (2016) investigated the causality relationships between real gross domestic product growth and the growth of three debt categories, namely public, foreign and pri-

vate debt, in the 28 European Union (EU) countries during 2001-2012 years. Using panel Granger causality estimations, statistically relevant bidirectional causality relationships between public debt and economic growth emerge for the periods both before and after the outbreak of the recent financial crisis. Moreover, there is clear evidence of economic growth's contribution to decreasing public debt.

Forte and Magazzino (2016a), studying the effects of large changes in fiscal policy, both in case of a fiscal consolidation and of fiscal stimulus in 18 EMU countries from 1980 to 2015, showed that adjustments by cutting current expenditures, rather than by tax increases, are more likely to boost economic growth. They also showed that cuts of investment expenditures may reduce GDP growth. During fiscal stimulus episodes, tax cuts and public investments are more likely to increase growth than current public expenditure increases.

2.2 Studies on fiscal sustainability

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.

Caporale (1995) tested fiscal solvency in ten EU countries, using a test for speculative bubbles. It is found that the hypothesis of no bubble can be rejected for Denmark, Germany, Greece, and Italy, implying that the government is not intertemporally solvent.

Vanhorebeek and Van Rompuy (1995) tested solvency and sustainability for eight ERM countries during the period 1970-1994, and for the Belgian central government from 1870 onwards. In the short-term comparison of the ERM countries, no support was found for the sustainability presumption, suggesting the need for a structural change of fiscal policies in order to achieve sustainability. Only France and Germany, and perhaps Denmark, seem to obey the solvency criterion (i.e., the stationarity of the budget deficit), whereas Italy's fiscal policy undoubtedly leads to insolvency. For other countries mixed results were obtained.

Payne (1997) examined the sustainability of budget deficits of the G-7 countries in the 1949-1994 period. Following the approach by Hakkio and Rush (1991) it is found that in the case of Germany it appears for each dollar increase in expenditures, revenues increase by an equal amount. For France, Japan, and Italy the budget deficits of these countries may not be sustainable due to the lack of cointegration.

Papadopoulos and Sidiropoulos (1999) examined the stationarity of the inclusive-of-interest public deficit for five EU economies. The results support the occurrence of sustainable deficits for the Greek, Spanish, and Portuguese economies. On the contrary, Italy and Belgium may incur unsustainable deficits, implying that their selection in Phase 2 of the EMU is questionable.

Uctum and Wickens (2000) derived conditions suitable for determining fiscal policies sustainability in the presence of debt and deficit ceilings. On the basis of infinite horizon-tests, they found that many countries do not have a sustainable policy. Howev-

er, there is some evidence that the government discounted net debt is mean-reverting for a few countries, implying that their fiscal policies are sustainable. The evidence in favour of sustainability is strengthened for most countries when data are extended to incorporate future fiscal consolidation plans. This reflects the general shift towards fiscal austerity in recent years. In addition, the results suggest that satisfying the intertemporal budget constraint provides a sufficient fiscal discipline for governments.

The results by Artis and Marcellino (2000) are consistent with a realization of stable debt/GDP ratios in line with the Maastricht criteria. Moreover, the ambitious aims of the Stability and Growth Pact may drive debt ratios down towards zero.

Bravo and Silvestre (2002) tested for sustainability by performing an empirical analysis of cointegration between public expenditures and revenues as ratios of GDP in 11 member states of the EU during the period 1960-2000. Assuming cointegration between expenditures and revenues as sufficient condition for sustainability, the results point to the possibility of sustainable budgetary paths in Austria, France, Germany, Netherlands and the UK, but not in Belgian, Denmark, Ireland, Portugal, Italy and Finland.

Greiner *et al.* (2007) studied the sustainability of fiscal policy for five Eurozone countries, using an approach developed by Bohn (1991a, 1991b, 1995, 1998). In contrast to the majority of literature, they found that fiscal policy shows evidence for sustainability, although the Maastricht treaty's rules may be temporarily violated.

Mendoza and Ostry (2007) examined fiscal solvency and public debt sustainability in both emerging market and advanced countries. They recommended that countries should be wary of allowing public debt ratios to rise above the 50-60 percent range.

Baum *et al.* (2013) investigated the relationship between public debt and economic growth focusing on 12 Eurozone countries for the period 1990-2010. The empirical results suggest that the short-run impact of debt on GDP growth is positive and highly statistically significant, but decreases to around zero and loses significance beyond public debt-to-GDP ratios of around 67%. In addition, the long-term interest rate is subject to increased pressure when the public debt-to-GDP ratio is above 70%.

Fedeli *et al.* (2014) tested relationship between the non-accelerating inflation rate of unemployment (NAIRU) and fiscal policy indicators, with a panel of 22 OECD countries (1980-2009). They found that the increase in fiscal burden may be relevant in increasing the NAIRU in the long-run. High budget deficits not only do not reduce unemployment, but also aggravate it in the long-run. These results suggest that deficits in excess of that allowed by the cyclical budget balance increase structural unemployment.

Investigating the sustainability of fiscal policy in a set of 19 countries by taking a longer-run secular perspective over the period 1880-2009, Afonso and Jalles (2014) concluded that since in most cases non-stationarity can be rejected, longer-run fiscal sustainability is not rejected (Japan and Spain can be exceptions).

2.3 Studies on Italian public finance

Baglioni and Cherubini (1993) 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.

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.

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.

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.

Ballassone *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.

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 stabilisation issues.

Dalena and Magazzino (2012) examined the long-run equilibrium relationship between government expenditure and revenue 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).

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.

Magazzino (2012b) 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 favor of Wagner's Law only for passive interests spending in the long-run, and for dependent labor income spending in the short-run.

Pierrigallini 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.

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.

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.

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.

Di Mascio and Natalini (2014) 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.

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.

Forte and Magazzino (2016b) 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. Therefore, the Augmented Dickey and Fuller (ADF, 1979), the Elliott, Rothenberg, and Stock (ERS, 1996), the Phillips and Perron (PP, 1988), and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS, 1992) tests were performed to test whether the data are dif-

ference stationary or trend stationary, as well as to determine the number of unit roots at their levels. 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.

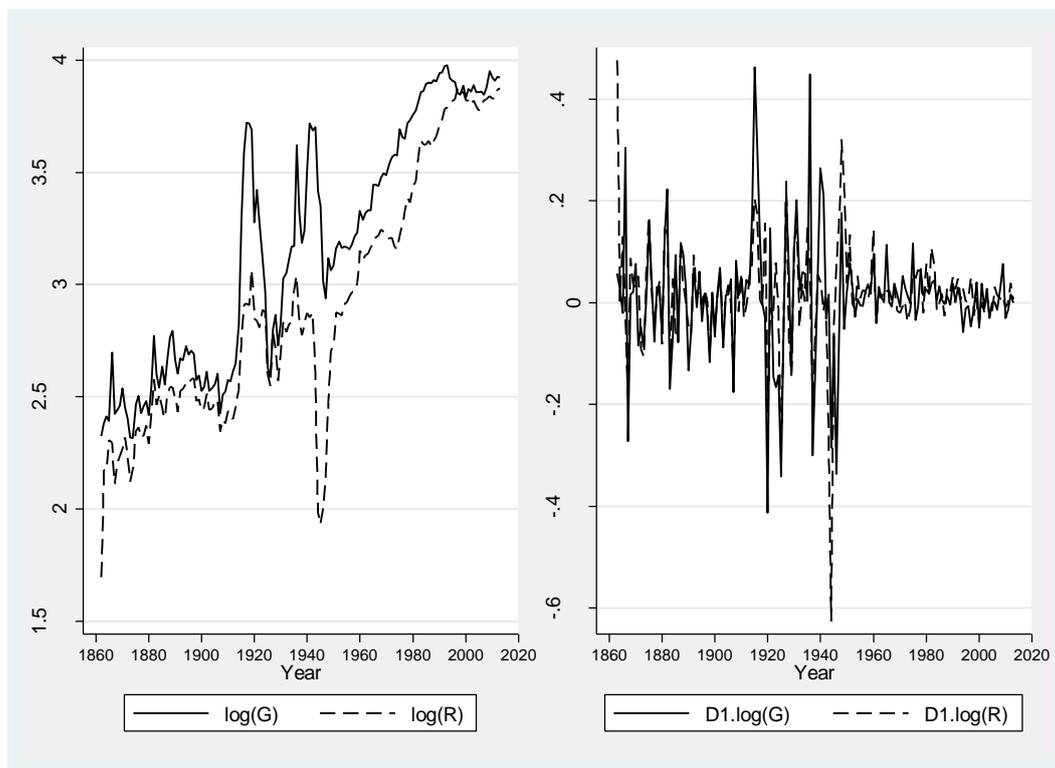
Once we found that the variables are non-stationary at their levels and are in the same order of the integration, we can apply the cointegration test.

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 Engel 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 $H_1: \delta_r \neq 0$, $r=1, 2, \dots, 4$. 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.

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. Figure 1 shows the dynamic of our series. In the right-side panel, the first-differences series are graphed.

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



Source: Forte (2011).

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.

Table 1: Exploratory data analysis.

1862-2013								
Variable	Mean	Median	Standard Deviation	Skewness	Kurtosis	Range	IQR	10-Trim
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								
Variable	Mean	Median	Standard Deviation	Skewness	Kurtosis	Range	IQR	10-Trim
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								
Variable	Mean	Median	Standard Deviation	Skewness	Kurtosis	Range	IQR	10-Trim
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.

Correlation analysis show that public expenditure and revenue are highly correlated in each period (Table A in Appendix). Moreover, these results are broadly confirmed by cross correlations analysis.

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. 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 long-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 in-

cluding 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: the 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.

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 also 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).

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. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

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 suspect 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.

Table 4: ARDL bounds test estimation results.

1862-2013					
Model for estimation	Lag length	F-statistics	Significance level	Critical bound	
				F-statistics	
				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					
Model for estimation	Lag length	F-statistics	Significance level	Critical bound	
				F-statistics	
				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					
Model for estimation	Lag length	F-statistics	Significance level	Critical bound	
				F-statistics	
				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). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

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 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 9, 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 may 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 hold. 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.

5. 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 be 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.

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.

6. Appendix

Table A: Correlation matrix.

1862-2013		
	G	R
G	1.0000	
R	0.9031***	1.0000
1862-1913		
	G	R
G	1.0000	
R	0.8105***	1.0000
1947-2013		
	G	R
G	1.0000	
R	0.9526***	1.0000

Notes: Sidak's correction applied, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Figure A: Plot of cumulative sum (CUSUM) of recursive residuals, 1862-2013.

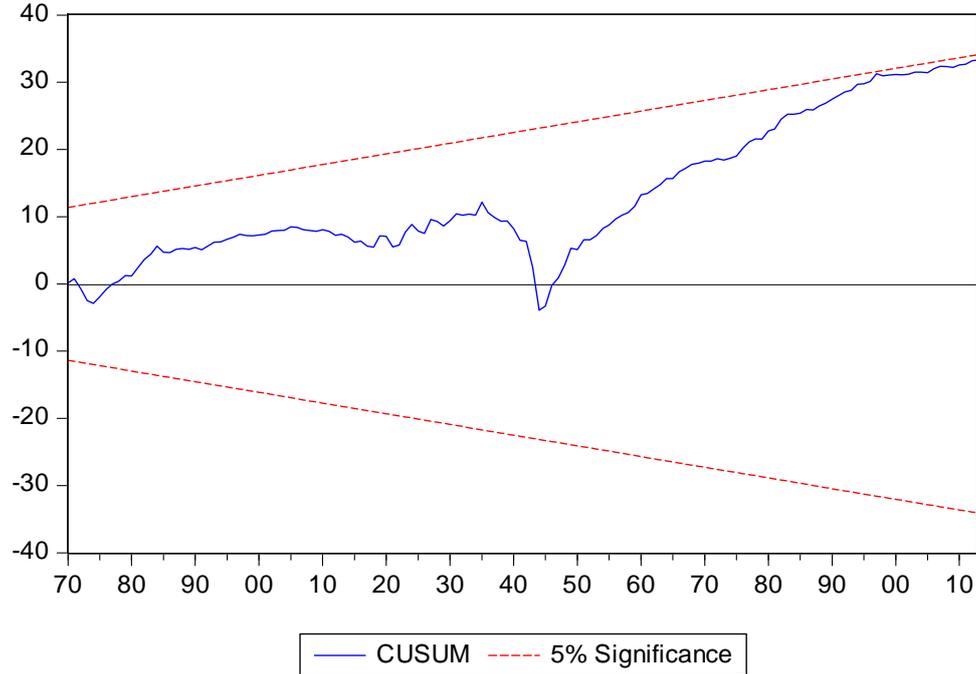


Figure B: Plot of cumulative sum (CUSUM) of recursive residuals, 1862-1913.

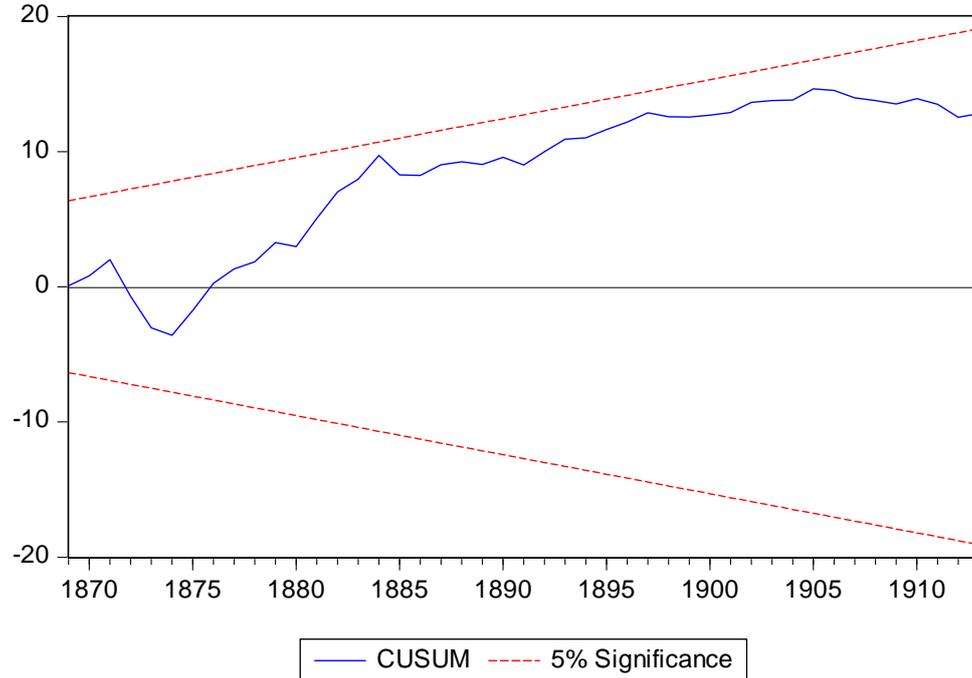
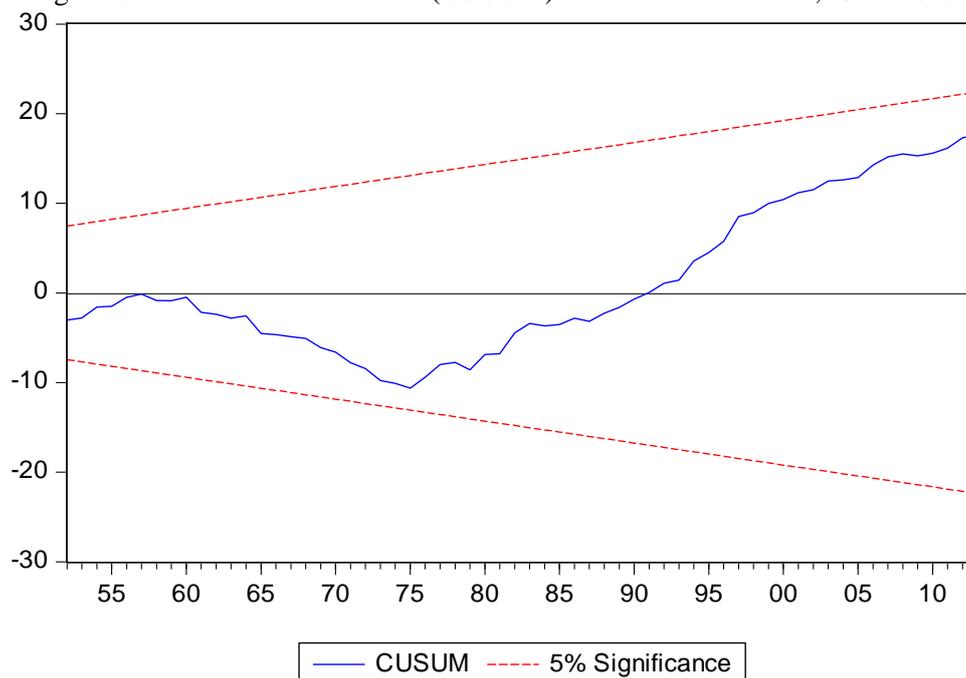


Figure C: Plot of cumulative sum (CUSUM) of recursive residuals, 1947-2013.



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