# The sustainability of fiscal policy in Italy: a long term perspective.

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**Abstract**

The recent fears of a sovereign debt crisis have spurred interest in the sustainability of public debt. There are two different approaches to the assessment of sustainability: the use of sustainability gap indicators (Blanchard et al., 1990); the time series approach (Trehan and Walsh, 1988). In this paper we analyze the sustainability of public debt in Italy by using the tools of the econometrics of time series.

We examine the entire life of the Italian State, i.e. 1861-2009, by employing a database containing several statistical novelties: new time series estimates of public debt and GDP (respectively Banca d'Italia, 2008 and Vecchi, 2011) and an original reconstruction of the revenues of the State.

The long-term analysis of new homogeneous statistical series has led to a different perspective, in particular when compared with the existing Italian literature about the debt to GDP ratio.

Two hitherto unexplored issues are addressed. First, we examine the size and dynamics of the public finance's aggregates. In particular, we carry out a detailed historical analysis, aiming to identify, in a narrative approach, the determinants of public debt and its ratio to GDP. Second, exploiting unit root analysis and cointegration, we test for the sustainability of the public debt in Italy following the approach proposed by Trehan and Walsh (1988).

**JEL: C22, E62, H60, N4, N13, N14**

**Keywords:** Intertemporal Budget Constraint, Unit Roots, Cointegration, Fiscal Sustainability, Economic History.

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## 1. Introduction

One of the biggest issue in the Italian macroeconomic performance since the birth of the Italian State, is the extraordinary fluctuation in the public debt ratio. This statement sounds a bit unusual if we consider the last decades, but long-term analysis of the Italian finances shows that the various phases of imbalance and rebalancing of accounts have followed.

The fiscal unbalances have shown tremendous changes in recent years. Large budget deficits in the 1970s and 1980s trigged substantial economic concern in the Italian and European Institutions, generating a considerable literature to examine the sustainability of Italian fiscal deficits (see amongst others, Spaventa, 1988; Galli and Giavazzi, 1992; Musu, 1998; Graziani 1988; Dornbusch and Draghi 1989; Bagella and Paganetto 2002; Ente Einaudi 1992 )

The empirical literature focuses on the test of sustainability of the intertemporal budget constraint through the use of univariate and multivariate techniques, with particular attention to issues relating to presence of unit roots. In this context, the articles by Trehan and Walsh (1988), Bohn (1998) can be considered among the most influential in the analysis of sustainability.[1]

In this work, using this time-series approach, we intend to assess the sustainability of the fiscal policy in Italy using a sample much larger than those examined so far, covering the period 1861-2009. To do this, we refer to different data sources, and in particular to two major reconstructions of public finance aggregates recently made available. The first source is the Bank of Italy (Francese and Pace, 2008) which has reconstructed the evolution of public debt, since the unification of Italy, distinguishing between its various components, for the government sector (and not consolidated). The second data source is the General Accounting Office (RGS 2011), which has provided a reconstruction of the historical series of public expenditure of the state budget, and the different aggregates that comprise it, including interest payments. With regard to State revenues, we were able to reconstruct in this case the entire time series for the period of interest, primarily using the GAO data.

Finally, a careful work of reconstruction has focused on the time series of GDP. The time series of national accounts published by ISTAT in 1957, relating to the period from the unification of Italy to 1956, were, for many years, the base of studies and debate on the Italian economy. This reconstruction has been the subject of various criticisms and subsequent revisions.[2]

[1] As regards Italy, the so-called time series approach was used by Galli and Padovano (2005) to investigate the sustainability of public debt within the time span ranging from 1950 to 2002, and to evaluate the effect of the change regime associated with the accession of Italy to the Maastricht Treaty on the various determinants of public deficit.

[2] See Fuà (1969, 1974) and the Bank of Italy new reconstruction whose results were published in four volumes edited by Guido Rey (1992, 2000). These series were then subject to further revisions (Fenoaltea, 2006, 2005; Malanima, 2006, 2007). Since the series of GDP produced by Istat have several limitations, especially for the years 1861-1913, in

The use of a long sample, covering widely divergent historical periods, necessarily requires a preliminary and thorough analysis of the events that have characterized different historical moments.

This paper describes several dramatic historical experiences that, we believe, are important to examine the measures that successfully brought drastic financial imbalances under control in our economy in the period examined. The goal of the present paper is to investigate the political and economic shocks which have determinate the phases of the public debt, in a narrative approach since the 1861. We shall describe and interpret events which have led to dramatic swings in public debt. Studying these episodes may be useful to set out a laboratory for the analysis of the changes in the fiscal policy regime. This analysis must necessarily precede the analysis of the univariate and multivariate time series and provides the necessary information (political and economic shocks, breaks, outliers) to build and identify the model. Moreover, these episodes, namely the events surrounding the rise and the end of fiscal imbalance, may shed light on the causality problem between public expenditure and taxation and disclose the nature of the fiscal policy regime in effect during the phases.

The paper is organized as follows. Section 2 provides an historical analysis of the political events and economic shocks which have impinged on the dynamic of GDP and debt. Section 3 reports data reconstruction of the variables involved (public debt, GDP, public expenditure and revenues) and Section 4, displays the results obtained using the time series approach and the cointegration approach to test the sustainability of public debt. Section 5 shows some critical issues on the time series approach. The last section concludes the paper and an Appendix reports the univariate statistical analysis.

## 2 The Italian debt in a long term perspective

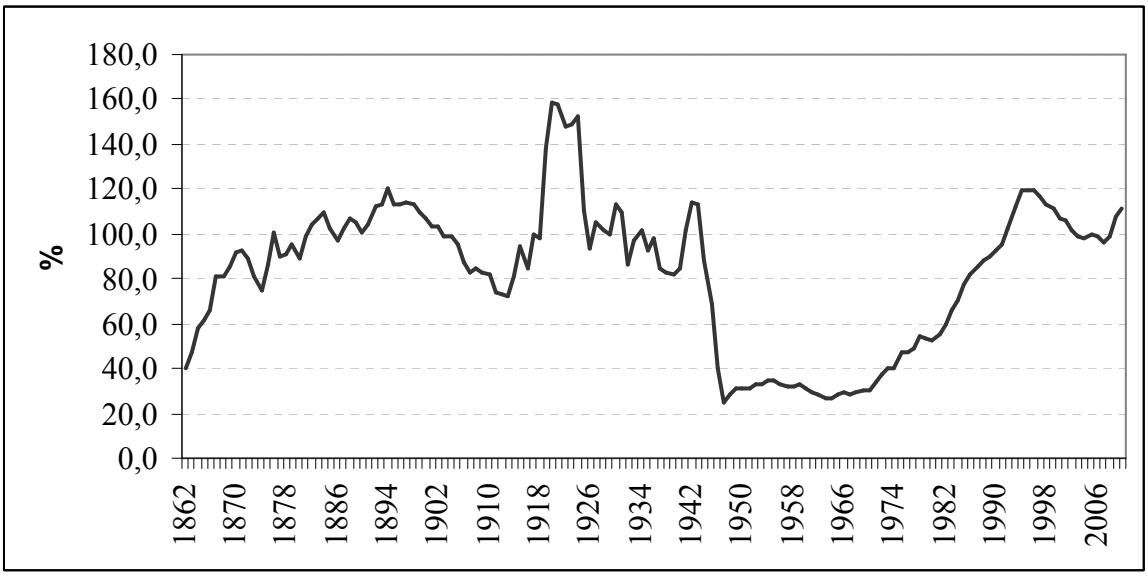
From the graphical inspection of Italian debt (displayed in Figure 1) during the last 150 years we can identify several important key issues. First, the high incidence of public debt to GDP which, over the full sample of the Italian history, was on average about 82 per cent. Second, the cyclical pattern of the debt/GDP ratio, with long waves of recovery and reduction. For instance, the burden of public debt in Italy observed in the 1990s is comparable in size to the levels achieved during the last two decades of the nineteenth century: from 1993 to 2010, the debt / GDP ratio was on average

our work we will analyze the evolution of the ratio of government debt to GDP using the new series of GDP at current and constant prices (2010) estimated by Vecchi (2011), for the years 1861-2007. The new GDP estimates are from a research group coordinated by Alberto Baffigi (see Vecchi, 2011, p. 211)

about 107 per cent, which is effectively the same level reached in the years 1876-1899. Finally, the historical analysis over the long-period mitigate the fiscal policy disequilibrium during the 1980s of the last century.

In the present paragraph, we shall distinguish different periods of time in the analysis of Italian national debt, to the aim of better understanding similarities and differences and focusing on the role of monetary and fiscal policies. Of course, since the historical period of time analysed is very long and rich of political and economic events, the following represents a reconstruction of some the main stylized effects.

**Figure 1: debt to GDP ratio, 1862-201**




Source: for public debt, our elaboration upon Francese, Pace (2008); for GDP, our elaboration upon Vecchi (2011).

*The economics of Right-wing (1861-1876)*

During the period (1861-1876), the dynamics of output remained well below the average recorded in the advanced European economies, with a per capita growth of 0.5 per cent a year (see Table 1). Slow economic growth, heavy fiscal pressure and high national debt were the main features of the new Kingdom of Italy (De Cecco, 1990, p. 263).

In just five years, from 1861 to 1866, the national debt had nearly doubled, from 1 to 3.3 millions of currents euros. The public debt on GDP was on average about 74 per cent during the entire period, with a maximum of 92.8 per cent reached in 1871 (Table 1).

Two were the main reasons which contribute to the growth of national debt from the high level debt (38% of the GDP) inherited from pre-unification States: persistent deficits, extraordinary military

expenses. The imbalance between revenues and expenditures was very high, in 1861 revenues covered only half of expenses (Toniolo 1992, Zamagni 1992).
High interest rates further rose the deficit. During the period 1861-1875, the spread between Italian bonds and foreign bonds remained very large: the average interest rates on long-term government bonds stood at 7.5 percent, more than double of England (3.3 percent). The lack of a central bank made difficult the management of monetary and financial policies.[3]

The year 1866 was very difficult for Italian finances. Government deficit rose significantly due to financing of war against Austria (1866). The reduction of financial markets' trust, had a negative impact on foreign investment. The course of consols fell from 64 in 1865 to 41 in June 1866 and the rise of the long-term interest rates from 8 percent in 1865 to 12 per cent in May-June 1866, along with the drain of metal reserves (on 1 May 1866) associated with the financing of the war against Austria led the Minister of Finance Scialoja to decree the inconvertibility of the lira ("corso forzoso").
Other factors that aggravated the context of political instability as well as Italian public finance, were the annexation of Veneto, the "presa of Rome" (1870) and the transfer of capital of Italy from Florence to Rome.
During the whole period, the level of public expenditure was much higher compared to others European countries like United Kingdom, Germany and France. Despite high military expenses, government decided not reduce public works, railway investments,[4] and a myriad of costs addressed to the construction of the new State.
Since it was not possible to reduce expenses, the government tried to balance the budget by increasing revenues. The tax burden rose dramatically: from 6 percent in 1861 to 12 percent in 1875. Another important measure to cope with the increasing budget unbalance was the expropriation of church property in 1866. The balanced budget was reached in 1876, but after few days, the Right-wing was defeated by the Left-wing of Agostino Depretis.

[3] For further details, see Fratianni and Spinelli (2001), see also Ripa di Meana, Sarcinelli (1993). For the effect of public debt on the sustainability of gold standard see (Padovano, Galli, 1996).

[4] Fenoaltea (2003).

**Table 1 Public debt/GDP, inflation, and rate of growth per capita GDP (1862-2010)**

| | Public debt/GDP | | | Inflation | | | Per capita GDP | | |
|---|---|---|---|---|---|---|---|---|---|
| Period | Media | Min | Max | Media | Min | Max | Media | Min | Max |
| 1862-1875 | 74.00 | 39.83 | 92.81 | 0.37 | -14.72 | 11.48 | 0.54 | -8.68 | 6.05 |
| 1876-1899 | 104.74 | 88.98 | 120.49 | -0.06 | -6.74 | 10.86 | 0.65 | -3.05 | 3.02 |
| 1900-1913 | 89.04 | 72.25 | 107.16 | 1.80 | -3.51 | 8.64 | 1.76 | 0.10 | 4.69 |
| 1914-1921 | 114.05 | 80.97 | 158.38 | 23.32 | 0.16 | 42.80 | -1.18 | -5.44 | 8.25 |
| 1922-1938 | 107.52 | 83.18 | 152.57 | 0.03 | -10.48 | 15.90 | 1.92 | -5.29 | 9.15 |
| 1922-1926 | 130.79 | 93.99 | 152.57 | 3.70 | -1.67 | 15.90 | 4.62 | -0.08 | 8.20 |
| 1927-1934 | 101.91 | 86.86 | 113.00 | -6.37 | -10.48 | 0.46 | -0.25 | -5.29 | 5.36 |
| 1935-1938 | 89.65 | 83.18 | 97.71 | 8.24 | 5.08 | 14.43 | 2.88 | -4.30 | 9.15 |
| 1939-1945 | 93.03 | 68.25 | 113.81 | 55.38 | 3.91 | 142.64 | -7.42 | -19.55 | 5.32 |
| 1946-1950 | 31.18 | 25.17 | 39.76 | 27.88 | -2.68 | 66.23 | 15.00 | 7.01 | 34.37 |
| 1951-1968 | 30.93 | 26.97 | 34.79 | 3.55 | -0.64 | 8.44 | 5.55 | 2.95 | 8.79 |
| 1969-1981 | 43.96 | 30.01 | 55.00 | 13.70 | 3.78 | 20.81 | 3.49 | -2.74 | 6.56 |
| 1982-1992 | 82.65 | 59.63 | 102.25 | 9.02 | 4.40 | 17.55 | 2.28 | 0.33 | 4.17 |
| 1993-2010 | 107.54 | 95.83 | 119.74 | 2.79 | 0.61 | 4.97 | 0.57 | -5.89 | 3.67 |

Source: our elaboration upon Francese, Pace (2008); Vecchi (2011)

*The economics of Left-wing (1876-1899)*

During the period 1876-1895 the Italian economy was characterized by price deflation, on average the inflation index was reduced by -0.06% with a peak of -6.7% in 1892.[5]

Until few years ago within the historiography was prevalent the thesis of the "crisis" of the eighties, especially for wages, consumptions, employment, and product[6]. More recent studies have shown the opposite, denying the "general crisis". Moreover, the world deflation of the grain prices and transportation services was positive for wages, employment and more generally for society[7].

During the Left-wing government, there was a huge growth of national unbalances. Public expenses and public debt grew especially during the Crispi government (1888-96), because of very expensive military expeditions in Africa. Table 1 shows that the public debt/Gdp ratio between 1876-1899 was on average 104.7. Several factors contributed to the sharp increase of the public debt. Amongst these, the elimination of the *corso forzoso* (1881), the nationalization of the railways, railway construction and public works. The international crisis of 1893 reverberated in Italy with grave repercussions for finances[8]. Increasing foreign indebtedness, the crisis and the scandals of the banking system gave rise to the foundation of the Bank of Italy and the end of convertibility of lira

[5] The inflation index is calculated upon the GDP deflator, based on Vecchi (2011).
[6] J. Cohen, G. Federico (2001)
[7] Fenoaltea (2006); Federico (2004).
[8] De Cecco, 1989, p. 269.

in 1894.[9] With the declaration of "corso forzoso" in 1866 and until its abolition it was recorded a significant monetization of debt, with the rise of state notes. Interestingly, when the *corso forzoso* was reintroduced in 1894, a similar path did not occur, confirming the position of various authors who interpret the second *corso forzoso* as an instrument of flexibility, not used to expand the monetary base out of line with the maintenance of exchange rate stability[10]. Following the example provided by the major European countries, another important financial measure was the 1906 conversion[11].

*From the Giolitti period (1900-1913) to the World War I*

After the crisis of 1890s, governments that followed until the First World War were led by different personalities, but between these emerges that of Giovanni Giolitti, hence the name assigned to the period of "Giolitti era". It represent a phase of expansion for the Italian economy, characterized by a significant growth of industrial sector. During this period, many of the main industrial companies were founded and take sharp the so-called industrial triangle Milano, Torino, Genova. Thanks to the growth of Italian GDP, the average of the public debt/GDP ratio reduced to 89 per cent, about 15 percentage points less than the previous period average.

This period represents one of the few ones in which monetary policy and fiscal policy interact positively and play an important role in balancing national budget and in curbing public debt dynamics (Panteghini, Spinelli 2002).

A severe crisis of public finance is related to the Italian participation to the World War I.[12] In the period 1914-21, the average ratio of public debt to GDP rose to about 114 per cent, with a peak of 158 per cent reached in 1920. The inflation rate was high, with an annual average of about 23 per cent (Table.1, Figure. 2), while per capita GDP reduced. The most part of the war was financed by British and American loans: the data show that immediately after the war the size of the foreign debt was considerable.[13]

[9] See Fratianni and Spinelli (2001) amongst the others.

[10] Zamagni (1998), pp. 207-214.

[11] For details on 1906 Italian conversion see De Cecco (1989), pp. 276-280; Panteghini, Spinelli (2002) pp. 145-183. "The freedom offered by the debtor government to its creditors to get their capital back and to lend the principal again to the same government on the new terms the latter had seen fit to offer" (De Cecco 1989). Obviously, a conversion may be desirable only if a sharp decrease of interest changes could be obtained and if most of the creditors were expected to convert their old bonds into the new ones.

[12] Toniolo (1989).

[13] See Feinstein, Temin and Toniolo (2004) amongst others. It should be noted that until the First World War there is no registration of foreign debt, because only the debt issued abroad has been called "foreign debt". But there were significant quantities of Italian bonds held by foreign investors. See Zamagni (1998).

*The fascist Italy and the Second World War*

The years that followed the end of World War I were characterized by a strong social and political tension. The result was the rise of fascism to power in October 1922.

Between 1922 and 1938, GDP increases by 2.7 percent per year, the per capita of 1, 9 percent.

However, we can identify three differents subperiods with reference to the financial and economic variables. In 1922-1926, the average annual growth of GDP was rapid: 5.39 in total terms and 4.62 in per capita terms.

The years 1927-1934 were characterized by stagnation: the annual total GDP increased by 0.57 percent while per capita GDP decreased (-0.27). Italy was strongly affected by 1929 crisis. The structure of the economy was hit by the global crisis to an extent not different from the average of Western European countries, although much less than the limiting cases represented by Germany and the United States.[14]

In the fascist period, years of expansion were followed or preceded by years of stagnation. Real contractions occurred in 1930 (-5.29) and 1936 (-4.30). The period 1935-38 was characterized by a rapid economic expansion. The GDP grew by about 4 per cent in total terms and by 2.8 per cent in per capita terms. The ratio public debt/GDP was on average about 107.5 per cent, with a peak of 152.6 reached in 1924. In 1922, when Mussolini was appointed Prime Minister, the public debt to GDP ratio was about 147.8 per cent.

The problem of debt at the end of the First World War was not only represented by the dimension of debt, but also by its composition. Almost half of the debt was short-term (Alesina, 1988, pp. 58-63). During the first phase of the fascism (1922-1926), De Stefani (the Minister of Finance) was able to significantly reduce the government expenditure and increase in taxes[15].

However, in these years, the reduction of expenditures alone does not explain the reduction in the debt / GDP ratio, despite the persistence of deficits. The reduction in the debt / GDP ratio were mainly related to the growth of GDP (on average of 4.62 per cent between 1922 and 1926 ) and on the growth of inflation. In 1925 the inflation rate reached 15 per cent whereas between 1922 and 1926 the inflation rate was on average about 3.70 per cent. In 1926 the objective of balanced budget was reached.

[14] See Toniolo (1980); Feinstein, Temin and Toniolo (2004).
[15] Confalonieri, Gatti (1986); Fausto (1993).

In addition, between 1925 and 1926 the amount of foreign debt reduced considerably thanks to the signing of treaties, that resulted in a significant reduction of war debts by United States and Great Britain[16].

The monetary stabilization policies are pursued more vigorously in the following years, by the new Finance Minister, Giuseppe Volpi. He believed that the continuous renewal of short-term debt, the amount of which was considerable, constituted a threat to the stability of the exchange rate. To face the problem of composition of debt, in 1926, there was a mandatory conversion of debt ("conversione forzosa"). All government bonds with a maturity shorter than seven years were converted to a consolidated bond, with a maturity of nine years , with an interest rate of 5 per cent (the so called "Prestito del Littorio")[17].

In the years 1927-1934, the ratio of public debt to GDP reduced by about twenty percentage points respect the previous period.

The restrictive monetary policies continue with revaluation of lira in 1927 by "quota '90", according to which the lira exchange rate is set at 90 lire.[18] The same choice for the stabilization of the lira and its gold convertibility results in a deflationary policy that slows GDP growth. With the international Great Depression of 1929-1933 growth further slows.[19]

To face the crisis of industrial and banking italian system, in 1931 was created the IRI, and in 1936 it was issued a new banking law which put an end to the system of "banca mista" in Italy.[20]

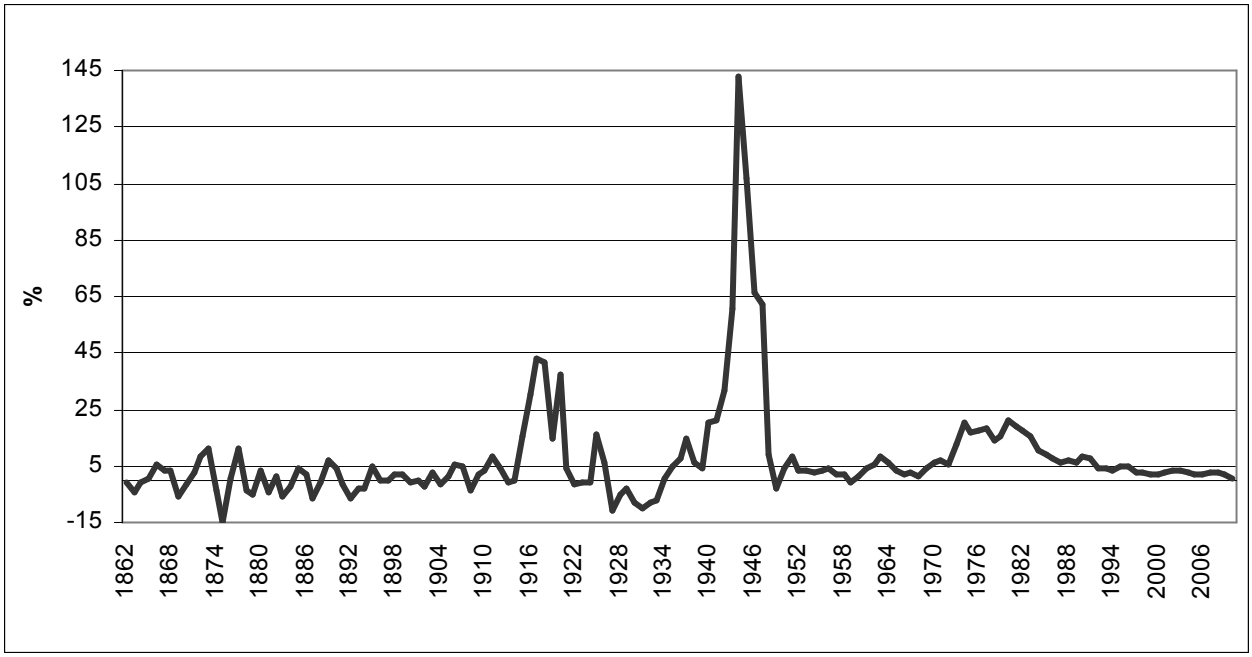
The situation changed in 1935, with measures taken to finance the colonization of Ethiopia. The increase in public spending and arms production drove the recovery of Italian economy. In 1936, the lira is devalued and military spending is financed largely with money issue. The annual inflation rate increases rapidly and this made possible to accumulate budget deficits and achieve both a reduction in the debt / GDP ratio.

During the second World War, there is a strong reduction of per capita GDP. Despite the huge budget deficit, due to the strong increase of expenses, the ratio of public debt to GDP rose less than four percentage points respect to previous period, because of the rapid inflation growth.

Between 1943 and 1947 hyperinflation allows a nominal growth of income by far superior to that of debt. This allows a drastic reduction in the debt / GDP ratio. Hyperinflation cancel interest payments which had so weighed national budget in previous periods [21].

[16] Toniolo (1980).
[17] Toniolo, Ganugi (1992).
[18] De Cecco (1993).
[19] Kindleberger (1973); Feinstein, Temin and Toniolo (2004).
[20] Guarino and Toniolo (1993).
[21] Toniolo (1992).

**Figure 2 Inflation rate, GDP deflator (1862-2010)**




Source: our elaboration upon Vecchi (2011).

*From the second post-war to 1968*

The second post-war (1946-50) was characterized by a progressive accumulation of debt which ended in 1994. We can distinguish in particular the reconstruction in the years immediately following the end of the War (1946-50) and the long period of growth without inflation of economic boom (1950-68)[22].

The new Italian Republic was born with a weight of public debt lower than the new Kingdom of Italy formed in 1861. The weight of public debt between 1946 and 1950 is on average about 31 percent. In 1947, the debt / GDP ratio reached the lowest record, amounting to 25 percent. However, hyperinflation and the sharp devaluation of the lira were not compatible with the system of fixed exchange rates established by the Bretton Woods Agreements of 1944. For this reason, with the 1947 credit crunch, Luigi Einaudi fight inflation and allowed Italy to join the International Monetary Fund.

From 1951 to 1968, the Italian society undergoes important transformations. This phase is characterized by an exceptional growth of the economy and by the strong growth of industrial production. During the fascist period, the industry added value had exceeded that of agriculture. But it's during the Italian "economic miracle" (1953-1968), that the number of industry workers exceeds the number of agricultural ones.

[22] See amonst others, Masera (1979), Graziani (1988), Salvemini (1992), Fratianni and Spinelli (2002).

The strong GDP growth leads to a reduction of the ratio of public debt to GDP. However, in the new series, the reduction is only 4 percentage points between 1950 and 1963.

*From "autunno caldo" until now*

The historical period starting from 1969 has been characterized by common shocks which hit all the industrialized economies and by specific events.

A conflictual climate in social and industrial relations (the so-called "autunno caldo") distinguished the late '60 and was accompanied by two important supply-side shocks, common to all the industrialized countries: the oil shocks (1973-74 and 1979-'80) and the slow-down of Total Factor Productivity. Not surprisingly, the joint outcome of upward pressure for wages, originated by social conflicts, associated to the supply side shocks caused a sudden increase in unemployment (Blanchard, 2006) and an upward pattern of the inflation rate (Bruno and Sachs, 1985) .

The public finances have been characterized by a progressive debt increase. From 1969 to 1983, the debt /product ratio increased by 35 percentage points, from 30 per cent to 65 percent of GDP. The increase of the public debt was the result of two factors that have operated in the opposite direction, that is the expansionary effect of the primary deficit and, secondly, the dampening effect caused by the positive difference between the nominal growth rate of the product and the average cost of debt.

In the years of the economic miracle began the construction of the Italian welfare state, in the absence of a general reference model. The expansion of health spending was very high between 1960 and 1972. By Act of 1963 was enshrined the setup of the retirement system. By the end of the seventies pensions represented the largest item of expenditure, almost three times higher than health spending. Thus was built a complex system without considering the long-term sustainability. These interventions had an immediate impact on the dynamics of public spending between 1964 and 1983 that increased by about 20 percentage points of GDP. The acceleration in the construction of the welfare state, in the absence of a tax reform, could only negatively affect the public imbalances.

As to the conduct of monetary policy, it pursued a mixed strategy, looking at the full employment and to the external equilibrium (Azzolini and Marani, 1984; Andreatta and D'Adda, 1985; Giavazzi and Spaventa, 1989), paying a cost in terms of the high inflation rate (on average 13.5% during the seventies). In addition, in order to support the firms, several competitive devaluations of the Lira were accomplished, to help the Italian productive system to cope with the international competitors (see, amongst others, Graziani and Meloni, 1993). This mechanism, associated with the strong mechanism of wages indexation, caused a perverse effect in terms of inflation, which peaked, according to GDP deflator constructed upon the data by Vecchi (2011), to 20.8% in 1980.

During the eighties', there was a strong change in conduct of the monetary policy in Italy, consistently with what occurred in European countries, where governments and central banks decided to reduce inflation through tight monetary policy (starting with Mrs Thatcher in the UK in 1979). In this period, the main goal pursued by Bank of Italy was the disinflation, and this aim was successfully achieved since beginning form the 1981 the inflation index (GDP deflator) declined to reach the 6% in 1989. Several innovations were accomplished by monetary authorities: the divorce between the bank of Italy and the commitment to a stable exchange rate are among the most important.

This change of the monetary stance was associated to a perseverant expansionary policy, which, coupled to the increase in the interest rates, caused during the eighties, a veritable debt explosion, from 52 to 90% in 1980 an 1989, spurring a the large debate about debt sustainability (see the essays collected in Ente Einaudi, 1992 and Alesina et al., 1989). During this decade the rate of growth of real GDP was on average 2.6%, but policy maker did not try to recue the public imbalances, until the second half of the '80 (Paesani and Piga, 2002).

The last decade of the XXth century was characterized by strong measures aiming to restore public finances. As to the macroeconomic performance, Italy has been characterized, since the early nineties, by a very slow growth rate, on average 1.3% during the decade.

The signature of the Maastricht treaty in 1992 marked a turning point in the conduct of fiscal policy, which was constantly committed to meet the requirement to join the EMU. The debt ratio peaked to 122% in 1994, when the fiscal policy adjustment was already working, but two years after the start of the currency crisis which caused the temporary exit of the Lira from the EMS. According to Paesani and Piga (2002) this pattern of the debt ratio was mainly caused by the risk premium required by the markets on the Italian bonds, with a peak in spending for interest payment in 1993 amounting to 12.2% of GDP. During this period the most of the fiscal adjustment were got through large primary surplus, financed by a contemporaneous reduction in the primary spending as a share of GDP and an increase in tax revenues.

In the very recent years, the participation to the EMU has deeply affected the conduct of the fiscal policy, and the current financial crisis started in 2007 is still causing serious risks of debt default.

## 3. The pattern of fiscal data in Italy

In this section we examine the long run pattern of the components of the budget identity, i.e.

revenues and spending, distinguishing between with-interest and primary outlays. The dynamic pattern of the government debt, $B_t$, in presence of a constant interest rate, $i$, and a given level of primary deficit reads as follows:

$$B_t = (1+i)B_{t-1} + D_t^P, \qquad (1)$$

where $D_t^p$ stands for the primary deficit, i.e. the difference between fiscal revenues and spending net-of-interest payments.

Before proceeding in the analysis, it is important to mention the sources of the data we use in this paper. As to the public deficit, we don't have a measure consistent with the definition of General Government (GG), since the only long time series of the public expenditures and revenues we are aware of is the one recently reconstructed by General Accounting Office, covering the period 1861-2009, which refers to the Central Administration of the State (Bilancio dello Stato), a subsector of the GG which include many of the statistical units belonging to the Central Government sector (ESA95). Therefore, we are able to compare a measure of the deficit, as approximated by data recorded in the Bilancio dello Stato, with the time path of the Central Government debt starting from 1861.[23] Though the Ministry of Economy and Finances has recently provided the reconstruction of the time series of public spending (RGS, 2011) we are not aware of any similar reconstruction for the revenues, with the exception of the period 1861-1967 (Ministero del Tesoro, 1967). Therefore, we have collected, starting form 1968, the data for final revenues items as officially recorded in the Rendiconto Generale dello Stato, so that we have a complete data set containing the level of debt, public spending and total revenues, all at current prices.[24] In addition, since RGS (2011) also provides a measure of public spending at 2009 prices, we are able to calculate the deflator of public spending, which can be used to convert at 2009 prices all the public finances variables.[25]

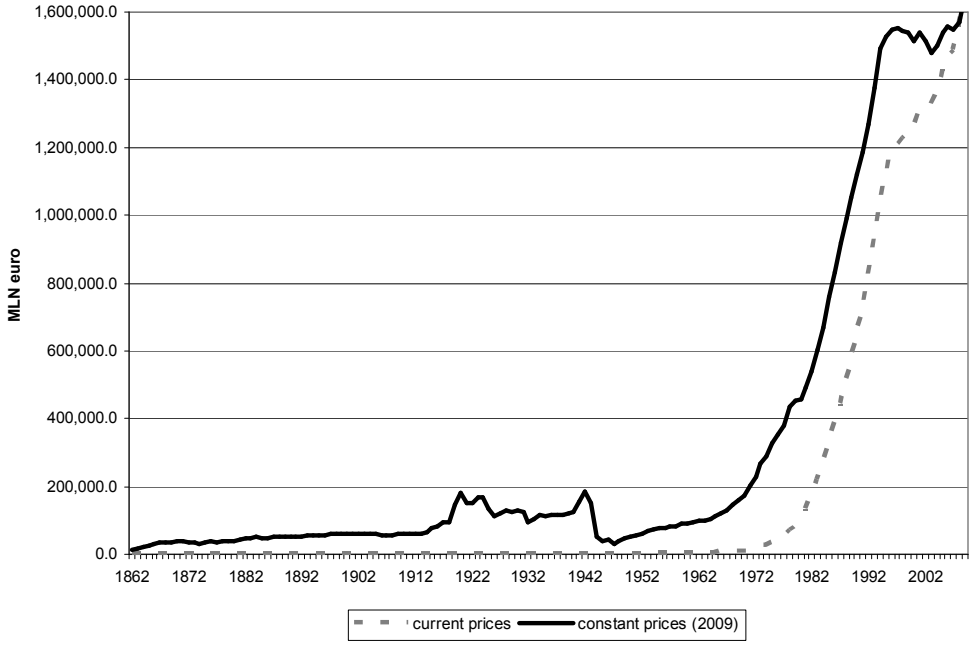
Figure 3 displays the Italian public debt in nominal and real terms for 1861-2010. It is clear that the inspection of the debt series in level does not add useful insights to the analysis already developed in the previous section, it simply helps us to have an idea of the difference between the real and the nominal debt growth.

[23] Francese and Pace (2008) provide a time series for the debt of the Italian General government sector distinguishing the three level subsector structure defined by ESA95: central government, local government, social security funds.

[24] For the time series of revenues until 1967 see Ministero del Tesoro, Ragioneria Generale dello Stato, Il bilancio dello Stato Italiano dal 1862 al 1967, Volume II, Table 5, pp.140-170, in particular the row "Operazioni Finali".

[25] It should be stressed that our measure of the public deficit is consistent with the net borrowing monitored by National Accounts for the European Union excessive deficit procedure, since we exclude from the deficit the financial aggregates pertaining to debt reimbursement.

**Figure 3: Italian public debt (central government), current prices and constant prices (2009)**

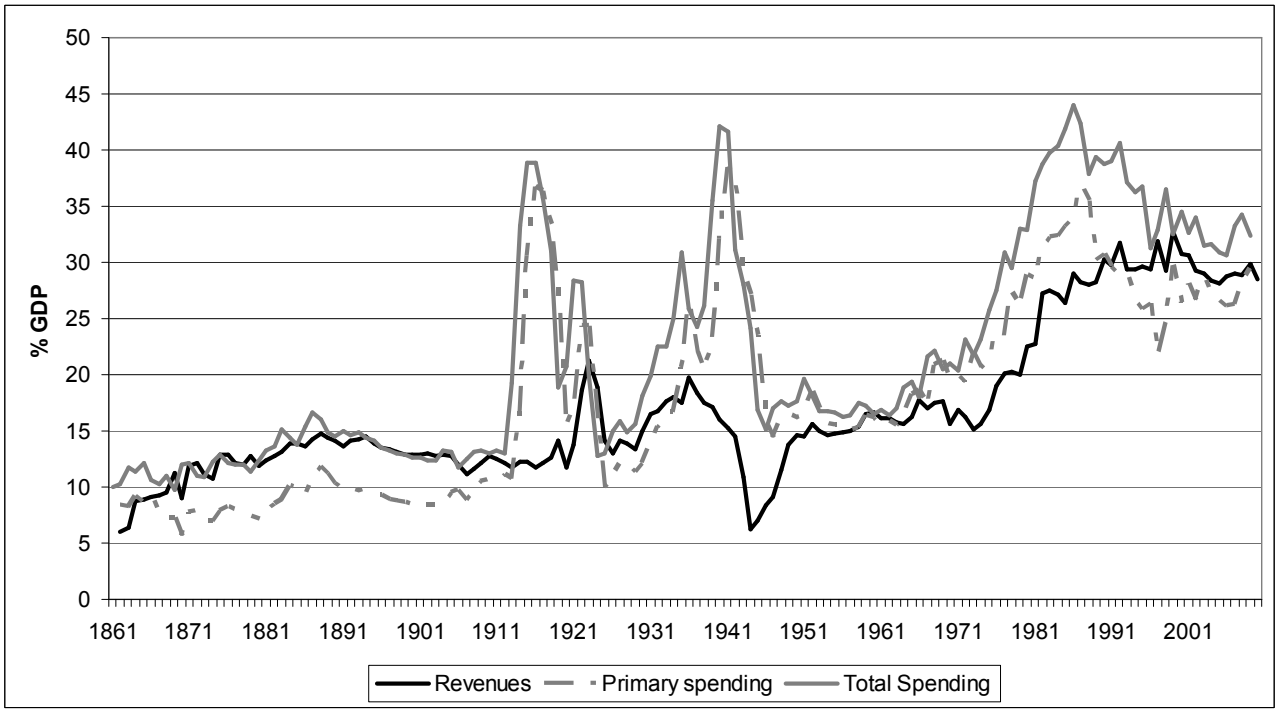



Sources: Authors' elaboration upon Francese and Pace (2008) and RGS (2008)

Nominal debt is barely visible until the 1914, when it amounted to 9.4 millions of current euros, though the total deficit was only 0.8 millions; the debt dynamics was very flat until the 1970, when it reached 10 billions of euros, and a similar growth was registered for the deficit, amounting to 1.7 billions. The post-1970s debt growth reflects the strong increase of deficits due to the large growth in public spending related to the creation of a welfare state (health care and retirement systems), the institution of the local administration (Regioni, in 1972), and large transfers to households and firms. Despite the fiscal reform, involving the indirect taxation in 1973 and the direct taxation in 1974, the fiscal receipts were not sufficient to offset the structural and remarkable growth in public spending, as witnessed by the pattern of the expenditures and revenues displayed, as a proportion of GDP, in Figure 4 (see Ceriani et al.1992). The peak of government expenditures amounting to 44%, reached in 1987, was only 2 percentage points below the dimension reached during the WWII (for a detailed analysis of the evolution of public spending in Italy during the period 1960-'90 see Franco, 1992). However, this large size of public spending is a relatively recent phenomenon, since, during the first 50 years of the Unitary State, government expenditures ranged between 10 and 15% , and were basically coupled to similar dimension of government revenues.

Adjusting the public debt for inflation clearly emphasizes some peaks reached by the debt, mainly associated to the World War I; to the great depression of 1929-33, that led to the institution of IRI (1931) and the set up of the complex system of the public intervention in the economy referred to as "Partecipazioni Statali"; the World War II.

**Figure 4 Final Revenues and Outlays (Bilancio dello Stato), proportion of GDP**




Sources: Authors'elaboration upon Ministero del Tesoro (1967), RGS (2008), Camera dei Deputati (several years).

Focusing on the eighties, the pattern of the public debt displays a very rapid growth (debt explosion) until the stabilization of the end of nineties; this is due, in large part, to an important innovation in the conduct of monetary policy. In fact, from 1950 to the seventies, a large part of public debt was financed by an expansion of the monetary base; by contrast, starting from 1981, with the "divorce" between the Bank of Italy and the Italian Treasury, the contribution of monetary authorities to the funding of fiscal policy considerably reduced.[26]

This change of stance caused an increase in the spending for the debt service also due to an unusual jump in nominal interest rates, as stressed, among others, by Spaventa (1987), Galli and Giavazzi (1992) who pointed out that the interest rates pattern observed during the period 1980-'90 represented a structural break compared to the historical trend previously recorded.

Moreover, during this period, there is a growing deficit (see Fig. 5) and it persists a pathological discrepancy between fiscal revenues and the interest spending, this latter by far larger with respect to other European countries.

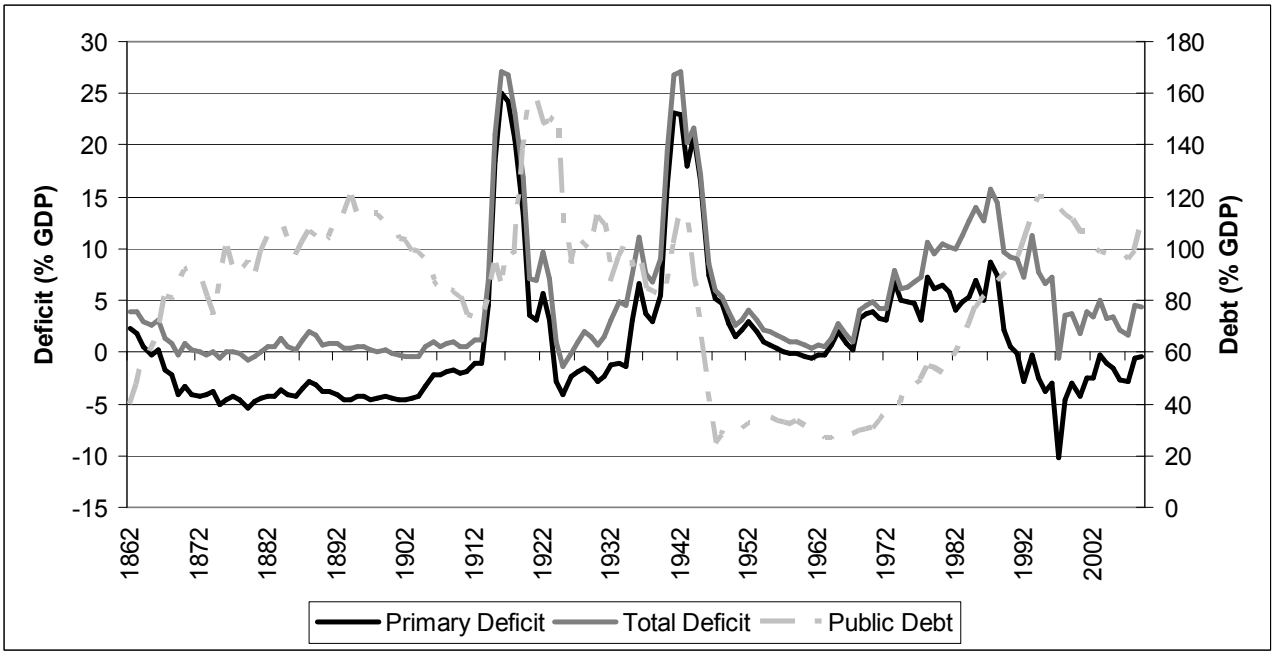
In the early nineties, after the currency and financial crisis of the 1992 and the disintegration of the European Monetary System, began an important process of adjustment of the public finance accounts (Paesani and Piga, 2002). The financial law for 1992 was a fiscal contraction amounting to 6% of GDP, and it helped to avoid the bail out of public debt. The restoring of public finance

[26] For a detailed analysis of the monetary policy in Italy and money-financing of fiscal deficit focused on the period 1970-1987 see Cotula (1989b) and Salvemini (1989).

equilibrium was pursued through important cuts to public spending, with some structural reforms, such as the privatizations and the end of the system of "Partecipazioni Statali" and the reform of the social security system. The process was also accompanied by a stronger fiscal pressure, with a sharp rise in the tax rate and a peak reached in 1997, mainly due to extraordinary revenues connected to the so-called tax for Europe, raised to comply with the requirement to join the European Monetary Union (1997). In the last years of the sample, the conduct of the fiscal policy and the pattern of the public debt has been strongly affected by the budgetary rules imposed by the Stability and Growth Pact.

It is an interesting exercise to compare the pattern of the debt with the deficit, total and primary, as shown in Figure 5.

**Figure 5: public debt (right axis) and with-interest and primary deficit (left axis), proportion of GDP.**




Sources: Authors'elaboration upon Camera dei Deputati (several years), Francese and Pace (2008), Ministero del Tesoro (1967), RGS (2008), Vecchi (2011).

Several issues are worth to be commented upon. First, the deficit-GDP ratio illustrates the extraordinary magnitude of wartime deficits, the persistently high deficits in the period 1972-'92, and the late-1990s primary surpluses. Interestingly, during the first period of the sample, i.e. 1862-1912 there was a substantial budget balance. Second, there are remarkable differences between the primary and the total deficits, in particular at the beginning and at the end of the sample period, when a primary surplus was run, though the two episodes have very different characteristics. Interest payments on government debt were quite high from 1870 until early years of the XX century (almost always above 4% of GDP), due to the large size of the public debt inherited by the new State and to large spending for wars and infrastructuring, whereas the net-of-interest deficit

observed during the last decades of the previous century (when interest payments peaked to 11.73% in 1993) was basically commanded to meet the requirements to participate to the EMU.

Finally, the contrast between the flat path of deficit during the first 50 years of the State and the increasing debt to GDP ratio, in Figure 5, might at first glance seem unrealistic. Provided that our measures of debt and deficit unfortunately do not refer to completely consistent aggregates (see the methodological appendix for further details) the figure 5 illustrates a key point well stressed by Bohn (2005) who refers to a growth dividend effect. Actually, the dynamic of the debt-GDP ratio differ from the deficit-GDP ratio by a nominal growth term, as it can be better appreciated by writing the government budget constraint as a proportion of GDP:

$$\frac{B_t}{Y_t} = \frac{B_{t-1}}{Y_{t-1}(1+g)} + \frac{iB_{t-1} + D_t^p}{Y_t}, \qquad (2)$$

Where g stands for the nominal growth rate. By reformulating Eq. 2 to highlight the dynamic of the debt to GDP ratio we get:

$$\frac{B_t}{Y_t} - \frac{B_{t-1}}{Y_{t-1}} = \frac{B_{t-1}}{Y_{t-1}} \frac{-g}{(1+g)} + \frac{D_t^{tot}}{Y_t}. \qquad (3)$$

The first term of the right side of Eq. 3 shows that the evolution of the debt ratio can differ from the total deficit by a component which is a negative function of the growth rate of the economy, opportunely weighted by the debt ratio. For instance, during the period 1895-1912, when the debt ratio fallen from 120% to 79% of GDP, the contribution of the growth dividend was negative, amounting, on average, to -3.5% per year, compared to a positive contribution by total deficit, precisely +0.3%.

## 4. Is the Italian public debt sustainable?

### 4.1 Budget Equation and Present Value Budget Constraint

The dynamic pattern of the government debt, $B_t$, in presence of a constant interest rate, $i$, and a given level of primary deficit reads as follows:

$$B_t = (1+i)B_{t-1} + D_t^P. \qquad (4)$$

The government budget identity can be stated in terms of real variables, nominal variables, or relative to a scale variable, like GDP; the only important difference among the alternative formulations is the appropriate definition of the accumulation factor, $i$, respectively the real and nominal interest rate, rather than the real interest rate net of the economic growth rate.[27]

[27] The assumption of a constant interest rate simplifies the algebra, and it is the most common in literature Bohn (2007). However, it is not neutral with regard to the analysis of the sustainability, as well demonstrated by Thran and Walsh (1991).

Solving the equation (4) forward implies the respect of the inter-temporal budget constraint:

$$B_t = \sum_{j=0}^{\infty} \frac{-D^P{}_{t+j}}{(1+i)^{t+j}} + \lim_{j\to\infty}\left(\frac{1}{1+i}\right)^j B_{t+j+1}, \qquad (5)$$

where $D^P{}_t$ is the primary fiscal deficit. The compliance with the inter-temporal budget constraint, or fiscal solvency, requires that the difference between the current level of government debt and the present value of the terminal debt stock must be covered by future primary surpluses.

Though the terminal level of the debt stock can be positive, a transversality condition is typically assumed in order to preclude a government attempting to run a Ponzi game:

$$\lim_{j\to\infty}\left(\frac{1}{1+i}\right)^j B_{t+j+1} = 0, \qquad (6)$$

and, therefore, constraining the debt to grow at a rate lower than the interest rate. Once having excluded the full roll-over of the public debt, the inter-temporal budget constraint reduces to the so called Present Value Budget Constraint (PVBC):

$$B_t = \sum_{j=0}^{\infty} \frac{-D^P{}_{t+j}}{(1+i)^{t+j}} \qquad (7)$$

### 4.2 The time series approach to sustainability

In the time series approach to sustainability, a number of stationarity and cointegration tests are recommended to verify whether the PVBC holds, though, this approach is not unanimously accepted as a signal of fiscal solvency. An alternative approach is the so called indicator approach, which pays less attention to the PVBC, focusing instead on indicators of sustainability that are not grounded in theory.

Within the time series approach, Trehan and Walsh (1988, 1991) demonstrate that if public debt is difference stationary, a simple test of intertemporal budget balance reduces to a check for the stationarity of the deficit inclusive-of-interest.

According to Trehan and Walsh (1988), this condition is necessary and sufficient under the assumption that the expected value of the real interest rate be constant. In this case the debt and the net-of-interest deficit are of the same order of integration and cointegrated, with the cointegrating vector being (1, -r), or, equivalently, that revenues, non-interest spending and debt are cointegrated with vector (1, -1, -r).

Moreover, Trehan and Walsh (1991) show that the test based on the stationarity of the deficit inclusive-of-interest continues to be valid, i.e. it is a sufficient condition to ensure intertemporal budget balance, as long as the expected real rate of interest is allowed to vary but is strictly positive.

This latter result is independent of any assumption about possible cointegration between the debt and the net-of-interest deficit.

Bohn (2007) casts doubts on the necessity of stationarity and cointegration restrictions, claiming that the class of tests commonly used in literature (Hamilton and Flavin, 1986; Trehan and Walsh, 1988; Quintos, 1995; ) are special cases of a more general sufficient condition for sustainability, i.e. that a debt series is integrated of any finite order $m \geq 0$. Bohn (2005) criticizes the definition of sustainability based on the PVBC ("ad hoc sustainability"), claiming that there is no "economic argument why potential buyers of government bond should care" about it. Alternatively, the author recommend to adopt a "model-based" approach to sustainability, suggesting that sustainability can be tested by estimating an appropriate policy rule, i.e. a reaction function for the primary surplus to the debt-GDP ratio. However, if the debt to GDP ratio is a variable integrated of order one, I(1), the policy rule would imply cointegration between debt and primary surplus, satisfying the sufficient condition, in presence of a constant interest rate, stated by Threan and Walsh (1988).

### 4.3 The sustainability of fiscal policy in Italy since the reunification

In this section we investigate whether fiscal policy in Italy has been following a sustainable pattern by testing the unit root properties of the public debt and deficit (constant interest rate hypothesis).

A further aim of the paper is checking whether the hypothesis of a constant interest rate may be removed, and verify under this condition if there evidence of sustainable fiscal policy, by using cointegration analysis of revenues and spending.

Since the PVBC, to which Tehran and Walsh (1988, 1991) refer to, is valid either for variables expressed in nominal/real terms and for GDP-ratios, and provided that Bohn (2005) recommends to use variables scaled by GDP in order to avoid misleading results due to excessive non stationarity in variance, our tests are based on fiscal variables all scaled by GDP (see the Appendix).[28]

#### 4.3.1Unit root analysis

First of all we test for the presence of unit root in the debt series. Since we are examining a quite long time period, 1862-2009, during which several structural changes could have occurred, it is important to control for possible structural breaks. The stock of debt, as all the stock variables, usually display a slow dynamic, though it can changes suddenly in response to exceptional events, such as wars. The availability of a long sample, during which two world wars had occurred and a

[28] Bohn (1998, 2005) emphasises that the unit root tests for the debt series (nominal or real) are biased toward non rejection of the unit root hypothesis, and that the most correct method to avoid problems of covariance non stationarity is to construct fiscal variables scaled by GDP. This is confirmed in our data set, as shown in the appendix.

myriad of political and economic events have impinged upon the stance of fiscal policy, allows us to correctly consider this specific pattern.

Table 2 presents unit root tests for GDP-ratio variables—for public debt, the with-interest deficit, the primary deficit, revenues, total and non-interest outlays. The augmented Dickey- Fuller (ADF) test examines the null hypothesis of a unit root against a trend-stationary alternative; whereas the KPSS test (Table 3) examines the null hypothesis of trend-stationarity (Kwiatkowski et al., 1992). The lags included in the ADF test are consistent with the lag order selection criteria and with the evidence provided by the Partial Autocorrelation Function, whereas in the KPSS test we considered 4 and 13 lags.[29]

**Table 2: Augmented Dickey Fuller Test for unit root. Null Hypothesis: unit root**

| | Level | | First Difference | |
|---|---|---|---|---|
| | Test statistic | Deterministic (lags) | Test statistic | Deterministic (lags) |
| Public Debt | -2.2935 | intercept, time trend (1) | -9.11*** | intercept (0) |
| Total deficit | -3.89*** | intercept (1) | | |
| Primary deficit | -3.77*** | intercept (1) | | |
| Revenues | -2.19 | intercept, time trend (1) | -11.7*** | intercept (0) |
| Primary Spending | -3.66** | intercept, time trend (2) | -9.28*** | intercept (1) |
| Government total Spending | -3.26* | intercept, time trend (2) | -9.03*** | intercept (1) |
| Government total Spending | -2.02 | intercept (2) | -9.03*** | intercept (1) |
| Government total Spending net-of-military | -2.28 | intercept, time trend (0) | -12.4*** | intercept (0) |
| Military spending | -3.92*** | intercept (2) | -8.40*** | 1 |

Thresholds (constant and trend): 1% (-3.96) 5% (-3.41) 10% (-3.13)
Thresholds (constant): 1% (-3.43) 5% (-2.86) 10% (-2.57)

**Table 3: KPSS Test for unit root. Null Hypothesis: no unit root**

| | Level | | First Difference | |
|---|---|---|---|---|
| | Test statistic: 4 (13) lags | Alternative hyp. | Test statistic: 3 (12) lags | Alternative hyp. |
| Public Debt | 0.29*** (0.13*) | Trend stationarity | 0.11 (0.12) | Level stationarity |
| Total deficit | 0.46* (0.29) | Level stationarity | 0.02 (0.04) | |
| Primary deficit | 0.42* (0.25) | Level stationarity | | |
| Revenues | 0.45*** (0.2***) | Trend stationarity | 0.06 (0.09) | Level stationarity |
| Primary Spending | 0.07 (0.05) | Trend stationarity | | Level stationarity |
| Government total Spending | 0.11 (0.06) | Trend stationarity | | Level stationarity |
| Government total Spending net-of-military | 0.38*** (0.17***) | Trend stationarity | 0.06 (0.07) | |
| Military spending | 0.32 (0.22) | Level stationarity | | |

Thresholds (constant and trend): 1% (0.216) 5% (0.146) 10% (0.119)
Thresholds (constant): 1% (0.739) 5% (0.463) 10% (0.347)

The test results in Tables 2 an 3 are statistically clear-cut for debt and revenues, which appear to be I(1) : KPSS is rejecting trend-stationarity whereas ADF is not rejecting unit roots.

[29] Suitable choices of the lag length for the computation of the so-called long-run variance may be: $l_4 \approx 4(T/100)^{1/4}$ and $l_{12} \approx 12(T/100)^{1/4}$.

As to the deficit measures, the two test display contrasting evidence: while ADF rejects a unit root there is some weak evidence for the KPSS rejecting level stationarity.
Finally, with regard to public spending, there is evidence for primary spending to be trend stationary, whereas for the with-interest spending the tests are less clear, and a stochastic trend could be conceivable. Moreover, the choice of the deterministic component seems to be crucial: with a linear trend, the with-interest spending seems to be I(0), whereas ADF suggest that total spending has a unit root when keeping only a non-zero mean (Table 3 and the Appendix for detailed analysis).

The previous results assume that there is no structural break in the series, whereas the historical analysis reported above depicts a debt dynamics characterized by swings, peaks and remarkable changes in trend. In presence of structural changes in the trend function the basic ADF test is biased toward the non-rejection of the unit root. Saikkonen and Lütkepohl (2002) and Lanne et al. (2002) propose unit root tests for the following model:

$$y_t = \mu_0 + \mu_1 t + f_t' \gamma + x_t \qquad (8)$$

Where the term $f_t$ identifies the a structural break, $\gamma$ is an unknown parameter and the errors $x_t$ are generated by an *AR(p)* process with possible unit root. In our case the break is simply a shift in the level starting in date $T_B$:

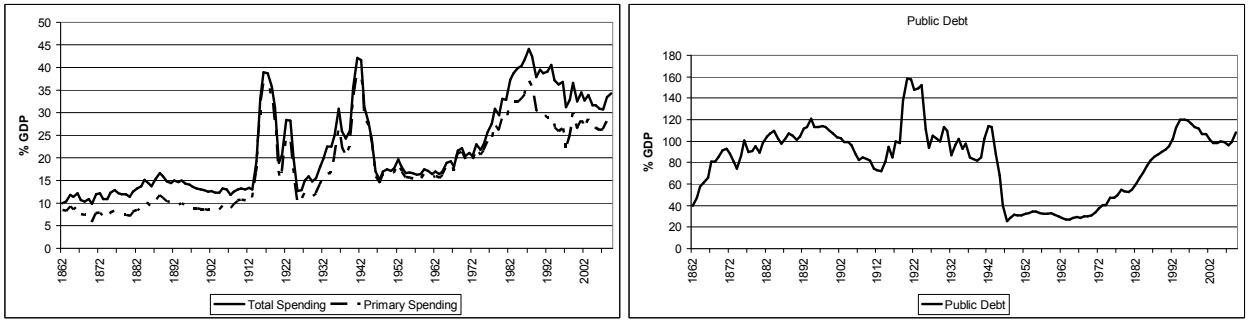
$$f_t^{(1)} = d_{1t} = \begin{cases} 0, & t < T_B \\ 1, & t > T_B \end{cases}$$

The test is based on estimating the deterministic term first by a generalized least squares (GLS) procedure under the unit root null hypothesis and subtracting it from the original series. Then an ADF type test is performed on the adjusted series which also includes terms to correct for estimation errors in the parameters of the deterministic part. As in the case of the ADF statistic, the asymptotic null distribution is nonstandard. Critical values are tabulated in Lanne et al. (2002), and the results for the above listed variables are shown in Table 4.

Tests accounting for a structural change are particularly important in modelling the debt and the public spending series. While for the former it is clear the presence of a deterministic trend and a break occurring in 1944, when considering public spending it is not immediate to decide which deterministic component drives the series, whether a linear trend or a level shift affecting a non zero

mean (see Figure 6, where the two variables, expressed as a proportion of GDP, are shown for convenience).[30]

**Figure 6: public expenditures (left) and debt, GDP share**




This is the reason why, when testing for the presence of unit root with structural break, we display two different alternative with regard to public spending: a level shift with a linear trend and a level shift without linear trend (Table 4 and the Appendix for detailed analysis).

**Table 4: Unit root test with structural break (Lanne et al., 2002). Null Hypothesis: unit root**

| | Test statistic | Deterministic (lags) | Break Date | Type of break |
|---|---|---|---|---|
| Public Debt | -1.75 | intercept, time trend, (1) | 1944 | level shift |
| Total deficit | -3.41** | intercept (1) | 1915 | level shift |
| Primary deficit | -3.41** | intercept (1) | 1915 | level shift |
| Primary Spending | -3.42** | intercept, time trend (2) | 1915 | level shift |
| Government total Spending | -3.01* | intercept, time trend (2) | 1920 | level shift |
| Government total Spending | -2.85* | intercept, time trend (2) | 1915 | level shift |
| Primary Spending | -2.80* | intercept, (2) | 1915 | level shift |
| Government total Spending | -2.45 | intercept, (2) | 1915 | level shift |
| Government total Spending | -1.55 | intercept, (2) | 1920 | level shift |
| Thresholds (constant, trend, level shift): | 1% (-3.55) | 5% (-3.03) | 10% (-2.76) | |
| Thresholds (constant, level shift): | 1% (-3.48) | 5% (-2.88) | 10% (-2.58) | |

Once we account for the structural breaks, the overall evidence of the ADF test doesn't change at all: deficit is still stationary, whereas debt and revenues display a stochastic trend.

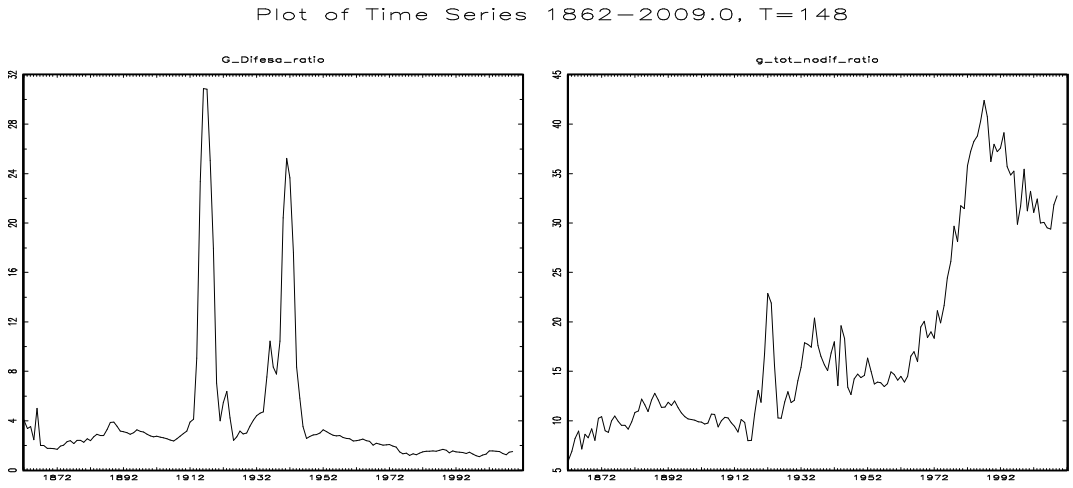
By contrast, the evidence for public spending still is controversial, depending upon the deterministic elements modelled in the regression: once allowing for a trend the total expenditures seem to be stationary, whereas controlling only for a non-zero mean, the test suggests that total expenditure are I(1).

[30] The choice of the deterministic components have been tested following Dickey and Fuller (1981), which allows to test, through appropriate F-statistics (called $\Phi_1, \Phi_2, \Phi_3$), joint hypotheses about deterministic elements of the regression. See the appendix for details about the stationarity tests performed.

This latter statement is corroborated by the fact that total spending is a linear function of primary spending and debt, and given a non stationary debt, this suggests that the series of total spending is best treated as I(1).

However, either the ADF and the unit root test with structural break might be affected by the presence of the anomalous peaks associated to the World War I and II. To appreciate how important it is the role played by military spending on total outlays during the war times, we compare, in Figure 7, military spending with total net-of-defence spending, both as a proportion of GDP.

**Figure 7: military spending (left) and total final spending net of military spending (right)**




The two spending indexes, as confirmed by the autocorrelogram and the test displayed in the appendix, have very different statistical properties: while the military spending display ACF consistent with a stationary process, the remaining total spending exhibits a correlogram characteristic of non-stationary data, with an estimated $\rho_1$ close to unity and sample autocorrelations that die out slowly. The results of the ADF test displayed in Table 3, consietntly with the KPSS statistics (Table 4) confirm this interpretation, clearly rejecting the unit root hypothesis for the former outlays ratio ($\tau_\mu = -3.92***$, 1% significance level), whereas it is not possible to reject the null hypothesis for the total spending net of military outlays ($\tau_\tau = -2.28$).[31]

To sum up, since total outlays are the sum of stationary (military spending) plus an I(1) process (net of military spending), we can trust that total outlays are driven too by a stochastic trend.

Therefore, the analysis of the fiscal policy in Italy, over the one hundred and half century since the unification, shows that public debt is driven by a stochastic trend, i.e. it is potentially unbounded, but we have also provided evidence for a stationary with-interest deficit in a setting with non-

[31] In the appendix it is shown that the ADF residuals, estimated for the public spending net-of-military outlays, do not display any significant correlation neither provide evidence of further structural break.

stationary revenues and outlays, a configuration that satisfies Trehan-Walsh's (1988) sustainability condition.

However, according to Trehan and Walsh (1991), the finding that the debt stock is I(1) whereas the exclusive of interest deficit process is stationary "is inconsistent with intertemporal budget balance in a world in which the real rate of interest is constant". [32]

### 4.3.2 Cointegration analysis

So far we have not discussed the issue of cointegration among the component of the public deficit, but we have shown that this latter is mean reverting, though there is also evidence of a non constant interest rate. This latter information automatically excludes some linear combinations from the range of possible cointegrating vectors, since the interest rate cannot be considered a constant $\beta$ coefficient. Precisely, we can't test for cointegration vectors containing the level of public debt as an endogenous variable.

One of possible long run relationships to investigate is between public expenditures and revenues, both taken as percentage of GDP.

The previous Univariate analysis about public deficit helps to correctly model the cointegration relationship between revenue and spending. First, since the total deficit does not seem to show a linear trend, then testing for cointegration we can exclude the trend in the vector. With regard to structural breaks, usually difficult to identify, we can exploit again the information form Univariate analysis, and control for one shift in 1915.

We perform a trace test for cointegration between total spending and total revenues controlling for one level shift in 1915 (Johansen et al., 2000). The null of no cointegration can be rejected with confidence of 5%, whereas the null of one vector cannot be rejected (pi-value 0.94).

According to Afonso (2005), the intensity of the relationship between revenue and expenses becomes relevant to the sustainability. In particular, once having normalized the cointegration vector on revenues, (1,-b), the condition ensuring sustainability reads as follows:

$$b \leq 1,$$

and if the constraint is not binding, the pattern of revenue can not cover that of expenses, with the stock of debt being unbounded.

[32] Alternatively, as stressed by Bohn (2005), provided that the with-interest deficit is a linear function of the primary deficit and debt, this latter with a plausibly small weight/coefficient, one should guess that the unit root tests are not powerful enough to distinguish the stationarity of the primary deficit, $D_t^P$, from stationarity in $D_t^P + rB_{t-1}$.

This restriction is necessary also to comply with the issue of weak sustainability raised by Quintos (1995). In fact the cointegration between revenues and total spending, with some vector *(1, -b)*, implies that the first difference of public debt can be stationary or not depending upon the size of *b*:

$$\Delta B_t = G_t - T_t = \varepsilon_t + (1-b)G_t \approx \begin{cases} I(1) & \text{if } b \neq 1 \\ I(0) & \text{if } b = 1 \end{cases} . \qquad (9)$$

In our case the estimated b-coefficient amounts to 0.85 and the Wald test for the restriction *b=1* cannot be refused, with a pi-value equal to 0.20.

This striking finding suggests that, during the period whole 1862-2009, government expenditures and revenues followed a pattern consistent with fiscal policy sustainability, as defined by the compliance with the Present Value Budget Constraint.

**5. Some critical issues about public debt sustainability**

A no-Ponzi game restriction is typically regarded as synonymous with sustainability; in the time series approach to sustainability, a number of stationarity and cointegration tests are recommended to verify whether the PVBC holds, though the consequences of the sustainability test are worth to be better clarified.

The most intuitive representation of debt sustainability calls for a relationship between public debt and primary surplus: when the debt rises, a sustainable fiscal policy requires an increase in primary surplus.

Theoretically, consistently with the PVBC, the government could issue any level of debt to pursue its own goals, provided that in some instant of time it starts to raise positive surpluses. Actually, the transversality condition on the terminal debt stock, constraints the debt to grow non faster than the real interest rate (adjusted by the growth rate), but does not exclude an unbounded ratio of debt to GDP (amongst a vast literature, see McCallum, 1984).

However, a clear limitation to this never ending debt policy relies in the fact that it is not possible to raise tax revenues beyond a threshold consistent with the macroeconomic framework.

This raises doubt about the existence of sustainability in presence of stochastic process for public debt driven by an unit root. In this case, by definition, the level of public debt is unbounded, and every shock has a permanent effect.

Therefore, in presence of upper bounds to public debt imposed by political agreements, the compliance with the PVBC is not necessarily a condition ensuring that lenders will be ready to

subscribe public debt. It is not surprise to see that the PVBC plays almost no role in the policy debate, which are mostly focused on limits to the debt-GDP and /or deficit-GDP ratios.[33]

Bohn (1998, 2005, 2007) critically examines the time series approach to sustainability, either the necessary conditions stating the ramdom walk nature of the public debt and the theoretical foundations of the approach, namely the ad hoc assumptions about the discount factor in the PVBC. Rather than focusing on stationarity and cointegration restrictions, Bohn (1998, 2005) suggests to estimate reaction functions for primary surpluses to the debt-income ratio, demonstrating that a stable, positive feed-back from debt to surplus would be consistent with the intertemporal budget constraint.

According Bohn (2005), the result we found for the Italian experience are not comforting, since the different order of integration found for the debt and the primary surplus implies that any regression equation using these variables are meaningless (Enders,1995). Actually, when we consider a regression equation:

$$D_t^P = b_0 + b_1 B_t + e_t \qquad (10)$$

similarly to what demonstrated by Granger and Newbold (1974) as to the spurious regression, we get a residual series, $e_t$, which is non stationary because of the unit root in $B_t$ . This means that any deviation from the estimated model is permanent, therefore the estimate of the $b_1$ feed-back coefficient would not be reliable, because there is an accumulation of permanent error.

This suggests that finding a sequence for public debt and primary surplus integrated of different order can be considered as evidence against the hypothesis of sustainability as interpreted by Bohn (2005).

## 6. Concluding Remarks

In this paper we analyse the dynamic and the effects of the Italian public debt since the Italian unification. We tackle this task setting up three routes, using a historical, statistical and econometrics analysis. However, the first aspect considered was that of the comparison of the different sources on the available data (GDP, taxation, public spending and public debt) and their reconstruction.

The first part of the work is essentially an historical analysis, aimed at identifying the political elements and the economic shocks (both domestic and international) which had an impact on the debt (and its dynamics) and its determinants.

[33] For a survey of the method currently used by IMF to assess fiscal sustainability see Chalk and Henning, (2000).

The second type of analysis is statistical, namely it is a univariate analysis of each time series of debt and its components. This study is particularly important to define the various breaks and trend reversal in the various series of public expenditure, revenue and debt (in nominal terms and relative to GDP). The historical analysis produces a valuable aid to the interpretation of the dynamics of the statistical series, and they together contribute to the third part of the work that aim to analyze the sustainability of the Italian public debt. To this end we follow Trehan and Walsh (1988), Bohn (1998) and several other authors and perform an integration and cointegration analysis of the Italian series.

We highlight different aspects of the comparative dynamics of debt and its economic determinants, in particular the role of primary surpluses, inflation and growth for the reduction of fiscal imbalances in different historical periods. The time-series econometric analysis emphasizes that the dynamics of debt can be considered essentially sustainable, the with-interest deficit appears to be stationary whereas the debt shows a stochastic trend. Thus, the dynamic of the debt in the last 150 years seems to be unbounded although, during the period examined, the patterns of government expenditures and total revenues seem to be consistent with fiscal policy sustainability as defined by the compliance with the Present value Budget Constraint.

Using a model approach à la Bohn, this result is more problematic: the different order of integration found for the Italian series of debt and primary surplus represents an evidence for unsustainability.

Although we are unable to say if the Italian debt is unsustainable we emphasize that the crucial aspect that makes a very different situation between the previous high public debts and the current one, is the growth dividend effect. In the period 1895-1912, for instance, when the debt ratio dropped from 120 to 79% of GDP, the contribute of the growth dividend in breaking down the debt dynamics was strong and amounted about 3.5% per year, compared to a positive effect of total deficit (0.3%). Now, the European constrains dramatically limit the growth dividend effect.

APPENDIX

As shown in Table A1, the time series of fiscal policy variables, observed on a such long time span, suffer from non stationarity in variance. In the table, the standard deviations are calculated for selected sub-samples. In each cell, in parenthesis, it is recorded the ratio of the St. Dev. of the cell over the St. Dev. recorded during the first period (1862-1913). It is clear that the volatility has grown remarkably over the observed historical period. Such a large non stationarity in variance has serious consequences in testing for the presence of unit root, casting doubts on the reliability of the tests' results. Scaling fiscal variable by GDP (see Table A2) largely compensate this instability, therefore we prefer to base the econometric analysis on fiscal variables expressed as a share of GDP.

**Table A 1 Standard Deviations of fiscal variables, real values**

| | 1862-1913 | 1914-1947 | 1948-68 | 1968-87 | 1988-2009 |
|---|---|---|---|---|---|
| Final Revenues | 1835 | 5804<br>(3) | 19385<br>(11) | 73295<br>(40) | 42737<br>(23) |
| Final spending | 1836 | 13264<br>(7) | 21143<br>(12) | 114760<br>(63) | 26332<br>(14) |
| Debt | 12584 | 39173<br>(3) | 27170<br>(2) | 224037<br>(18) | 186182<br>(15) |
| Interest spending | 452 | 1691<br>(4) | 753<br>(2) | 26948<br>(60) | 23724<br>(53) |
| Total deficit | 465 | 11355<br>(24) | 4052<br>(9) | 42607<br>(92) | 39954<br>(86) |
| Primary deficit | 797 | 11309<br>(14) | 4045<br>(5) | 18962<br>(24) | 44656<br>(56) |

**Table A 2 Standard Deviations of fiscal variables, GDP share**

| | 1862-1913 | 1914-1947 | 1948-68 | 1969-87 | 1988-2009 |
|---|---|---|---|---|---|
| Final Revenues | 1.92 | 3.53<br>(1.8) | 1.34<br>(0.7) | 4.78<br>(2.5) | 1.23<br>(0.6) |
| Final spending | 1.53 | 8.44<br>(5.5) | 1.31<br>(0.86) | 7.95<br>(5.2) | 3.37<br>(2.2) |
| Debt | 17.4 | 29.05<br>(1.7) | 2.32<br>(0.13) | 16.34<br>(0.94) | 9.54<br>(0.55) |
| Interest spending | | | | | |
| Total deficit | 1.04 | 8.96<br>(8.6) | 1.36<br>(1.3) | 3.4<br>(3.3) | 3.52<br>(3.4) |
| Primary deficit | 1.73 | 9.39<br>(5.43) | 1.4<br>(0.81) | 1.5<br>(0.87) | 3.11<br>(1.8) |

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Figure A1: Spending and Revenues

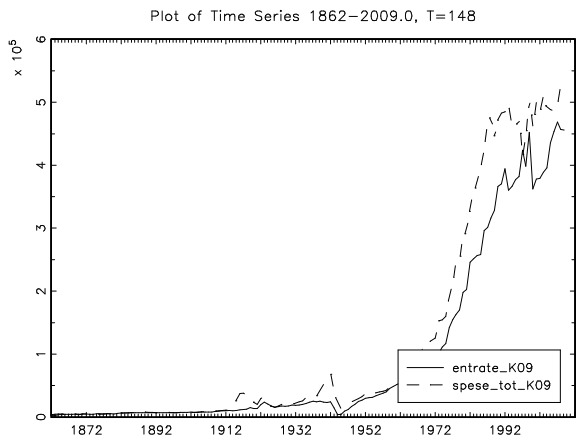



Figure A2: Debt

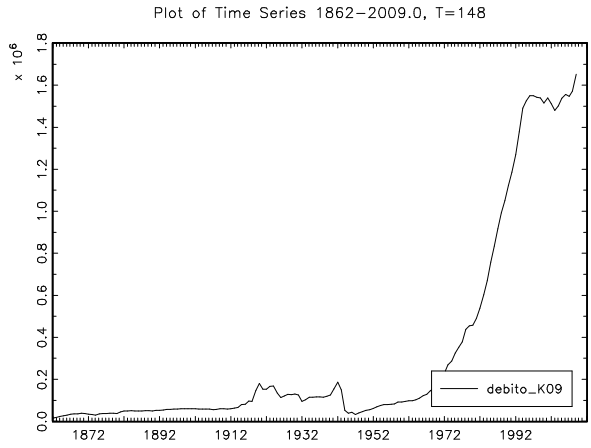



Figure A3: with-interest deficit

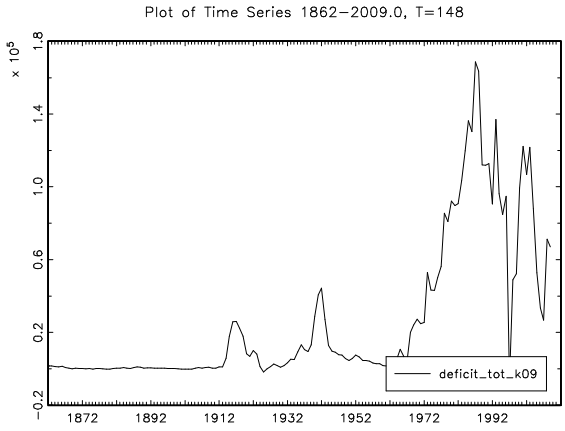
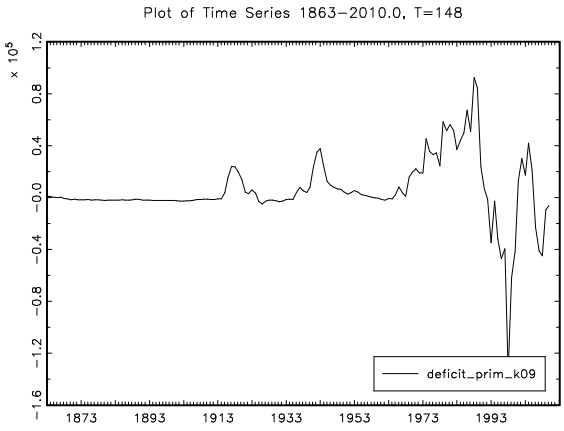



Figure A4: net-of-interest deficit



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ENDOGENOUS VARIABLES, **GDP SHARES**

**Figure A5: total revenues, primary and total spending**

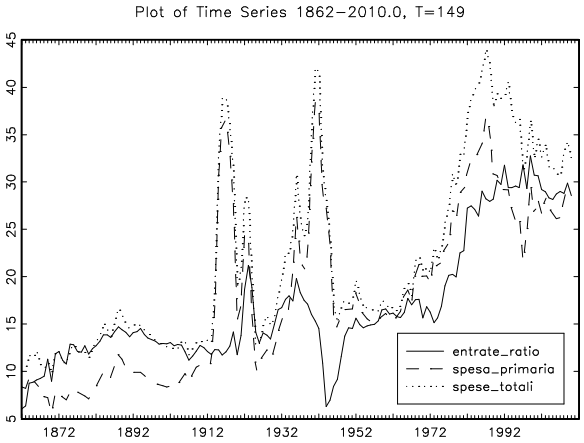



**Figure A6: public debt**

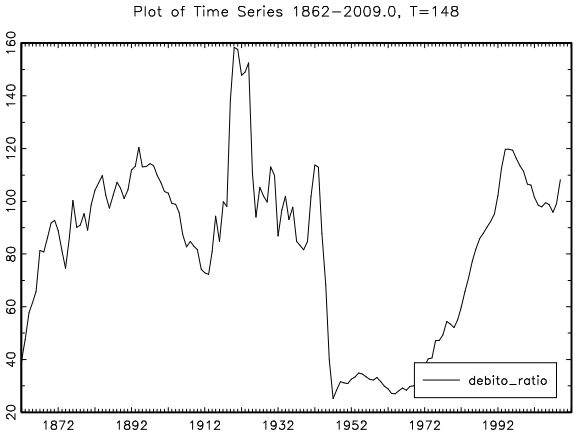



**Figure A7:primary spending: with and without military**

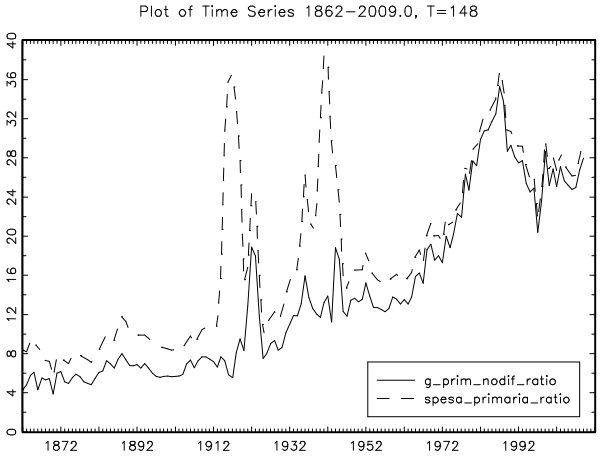



**Figure A8: total spending: with and without military**

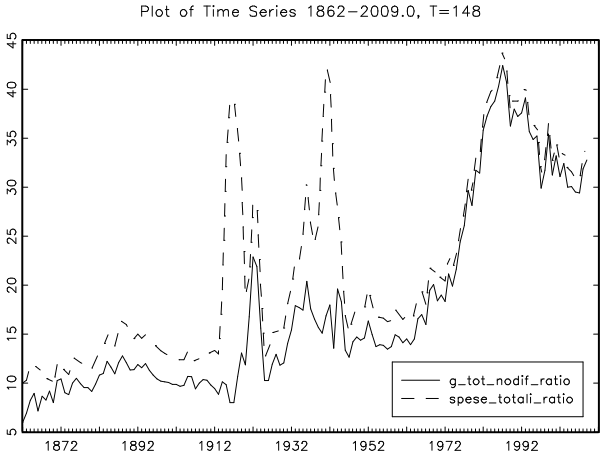



**Figure A9: primary deficit: with and without military**

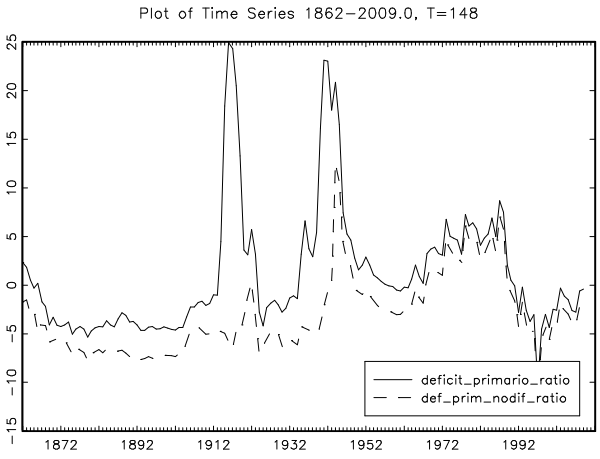
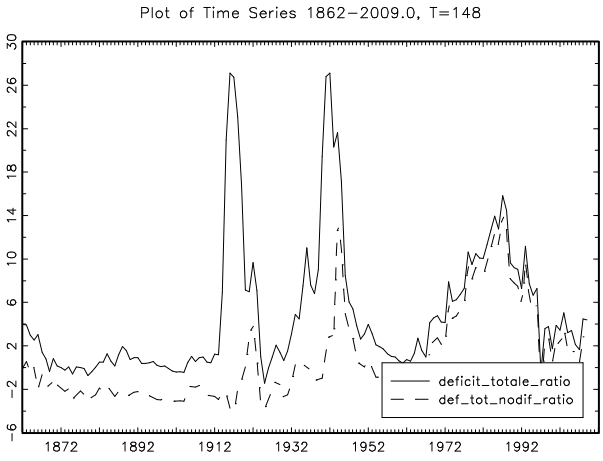



**Figure A10: total deficit: with and without military**



**Summary of descriptive statistics, variables as a proportion of GDP**

| variable | mean | min | max | std. dev. |
|---|---|---|---|---|
| Prim. Spending, net of military | 1.39327e+01 | 3.87644e+00 | 3.52716e+01 | 8.36276e+00 |
| Tot. Spending, net of military | 1.77766e+01 | 6.92862e+00 | 4.24144e+01 | 9.56592e+00 |
| Total spending | 2.19340e+01 | 9.77352e+00 | 4.40297e+01 | 9.78523e+00 |
| Primary spending | 80900e+01 | 5.64735e+00 | 3.84559e+01 | 8.85088e+00 |
| Total Revenues | .69825e+01 | 6.28931e+00 | 3.27522e+01 | 6.57802e+00 |
| Public Debt | .27598e+01 | 2.51666e+01 | 1.58384e+02 | 3.19251e+01 |
| Total deficit | 95149e+00 | -1.44033e+00 | 2.71124e+01 | 6.29267e+00 |
| Primary deficit | 1.10751e+00 | -1.01258e+01 | 2.49603e+01 | 6.52356e+00 |
| Primary deficit, net of military | -3.04986e+00 | -1.14280e+01 | 1.25183e+01 | 4.06969e+00 |
| Total deficit, net of military | 7.94118e-01 | -4.07648e+00 | 1.41978e+01 | 4.21445e+00 |

**Table A 3: Unit root test, ratio to GDP**

| variable | test | lags | deterministic | T statistics |
|---|---|---|---|---|
| Debt | ADF | 1 (all) | C, trend | -2.30 |
| | | 1 (all) | constant | -2.22 |
| | Lanne et al. (2002) | 1 | constant break:1944 | -2.35 |
| | | | C, trend break:1944 | -1.75 |
| Total expenditure | ADF | 2 (AIC, FPE) | C, trend | -3.28* |
| | | 2 (AIC, FPE) | c | -2.02 |
| | Lanne et al. (2002) | 2 | C, trend, break:1915 | -2.85* |
| | | | C, trend, break:1920 | -3.01* |
| Primary expenditure | ADF | 2 (AIC, FPE) | C, trend | -3.63** |
| | | 2 (all) | c | -2.13*** |
| | Lanne et al. (2002) | | C, trend, break:1920 | -3.05** |
| | | | C, trend, break:1915 | -3.43** |
| | | | | |
| Total expenditure net of military spending | ADF | 0 (all) | C, trend | -2.28 |
| Military spending | ADF | 2 (all) | c | -3.92*** |
| Total Final revenues | ADF | 1 (AIC, FPE) | C, trend | -2.19 |
| Total Deficit | ADF | 1(all) | c | -3.88*** |
| | Lanne et al. (2002) | 1(all) | C, break:1915 | -3.42** |

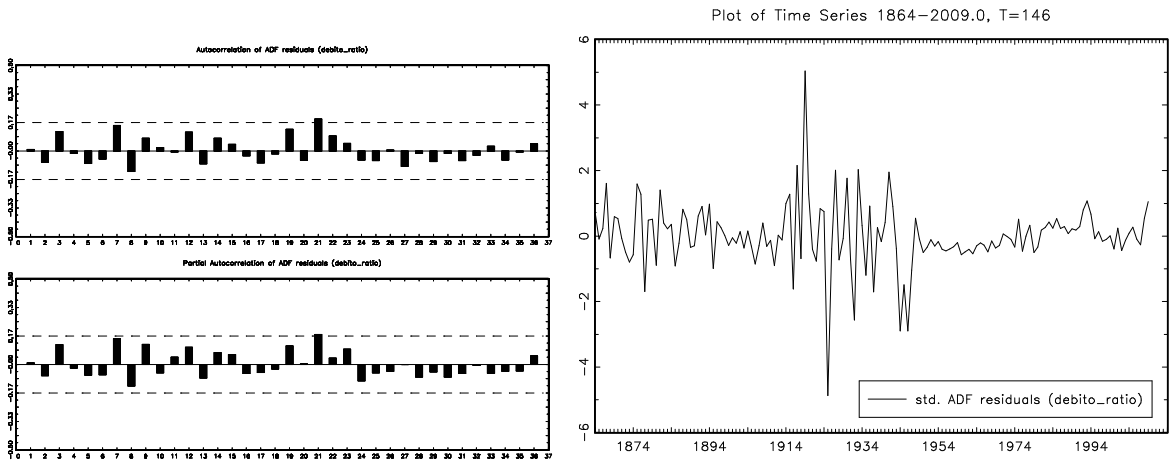
| | | | | |
|---|---|---|---|---|
| ADF theresholds (C and trend): | -3.96 | -3.41 | -3.13 | (1%, 5%, 10%) |
| ADF theresholds (C): | -3.43 | -2.86 | -2.57 | (1%, 5%, 10%) |
| Lanne et al (2002) threshold (c): | -3.48 | -2.88 | -2.58 | (1%, 5%, 10%) |
| Lanne et al (2002) threshold (c and trend): | -3.55 | -3.03 | -2.76 | (1%, 5%, 10%) |

### *Public debt*

One of the critical issues in using the ADF tests to investigate the presence of unit root is whether an intercept and /or time trend has to be included in the regression equation. The power of the DF test is negatively affected by misspecification concerning the deterministic part of the regression. When the form of the data generating process is unknown, Enders (1995) suggests as an appropriate strategy to start from the less restricted specification, i.e. with a trend and a drift, and, in case of non-rejection of the unit root hypothesis, to proceed to determine whether too many deterministic terms are included. This may been done, by using the appropriate test statistics tabulated by Dickey and Fuller (1981) to test joint hypotheses on the coefficients. Since for the public debt it is not clear whether the Data Generating Process includes a linear trend, we follow the above described estimation strategy. If we consider the debt variable as driven by a linear trend, the ADF statistics for the hypothesis of the unit root is -2.3, suggesting a unit root. However, the *t*-statistics for the trend is very low, -0.61, therefore we repeat the ADF test omitting the trend component. Again, the unit root hypothesis cannot be rejected (-2.22); moreover, the *F* test statistics is very low, 0.31, suggesting that the null hypothesis, i.e. the data are generated by the restricted model, i.e. without the trend, cannot be rejected.

In order to check the adequacy of the lag order, we display the graphs of the standardized ADF residuals, and the correlogram of the residuals. Looking at Figure A11, there is some evidence of structural change in the late 40's, with a reduced variance; focusing on the serial correlation, there is no evidence of it, as confirmed by the inspection of the correlogram, which does not show significant autocorrelations until lag 36.

**Figure A 11**



The presence of structural changes makes the basic ADF test biased toward the non-rejection of the unit root. To control for this problem, related to the power of the test, Saikkonen and Lütkepohl (2002) and Lanne et al. (2002) propose unit root tests for the following model:

$$y_t = \mu_0 + \mu_1 t + f_t' \gamma + x_t$$

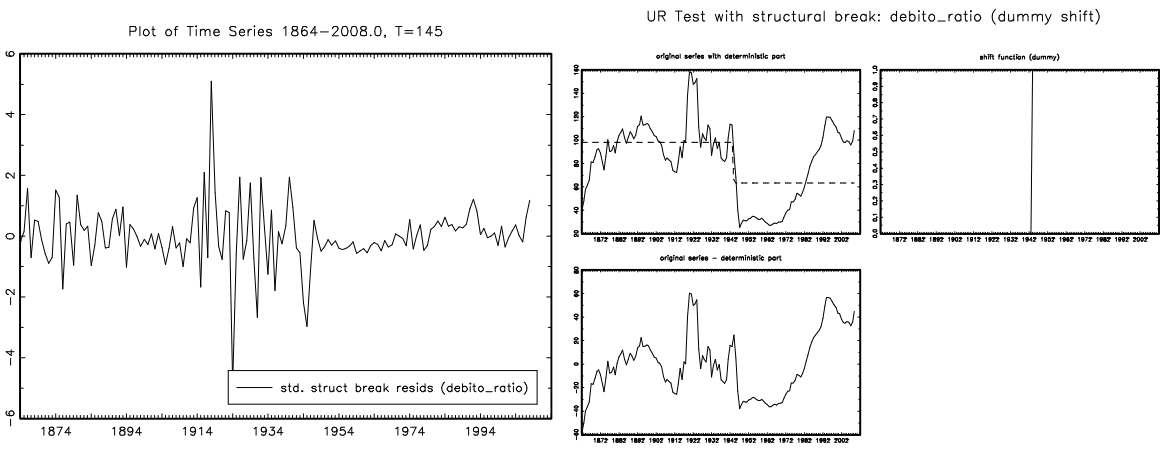
where the term $f_t$ identifies the a structural break, $\gamma$ is an unknown parameter and the errors $x_t$ are generated by an *AR(p)* process with possible unit root. In our case the break is simply a shift in the level starting in date $T_B$=*1944*:

$$f_t^{(1)} : d_{1t} : \begin{cases} 0, & t < T_B \\ 1, & t > T_B \end{cases}$$

The test is based on estimating the deterministic term first by a generalized least squares (GLS) procedure under the unit root null hypothesis and subtracting it from the original series. Then an ADF type test is performed on the adjusted series which also includes terms to correct for estimation errors in the parameters of the deterministic part. As in the case of the ADF statistic, the asymptotic null distribution is nonstandard. Critical values are tabulated in Lanne et al. (2002), and the results for the above listed variables are shown in Table A3. However, our sample dimension is lower than the one used by Lanne et al. (2002) to tabulate the *t* statistics (1000 versus 130).

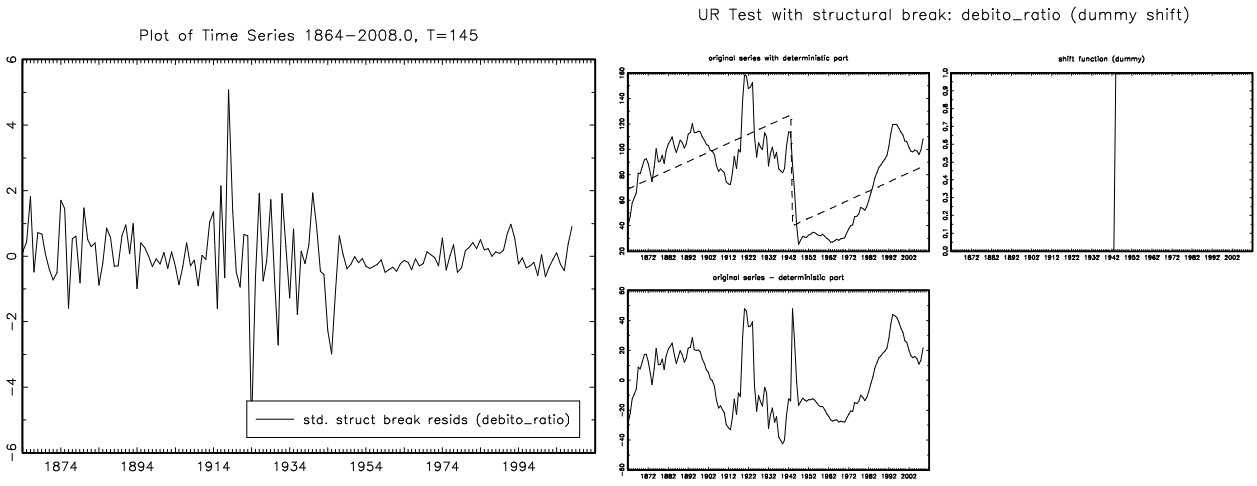
Also in this case the test statistics' suggest to not reject the null hypothesis. In Figure A12 we show the graph of the standardised residuals and the pattern of the debt net of the estimated structural break.

**Figure A 12**



However, the right graph in Figure A12, shows that modelling the deterministic component as a drift plus a structural shift does not seem appropriate in catching the true DGP. Considered that the choice to exclude the linear trend has been based on the ADF statistics, which have a low power in presence of structural breaks, we decide to reintroduce the linear trend in the Lanne et al. (2002) test, and the test's residuals diagnostic are plotted in Figure A13, suggesting a better fit to the data with respect to the deterministic component modelled in Figure A12.

**Figure A13**

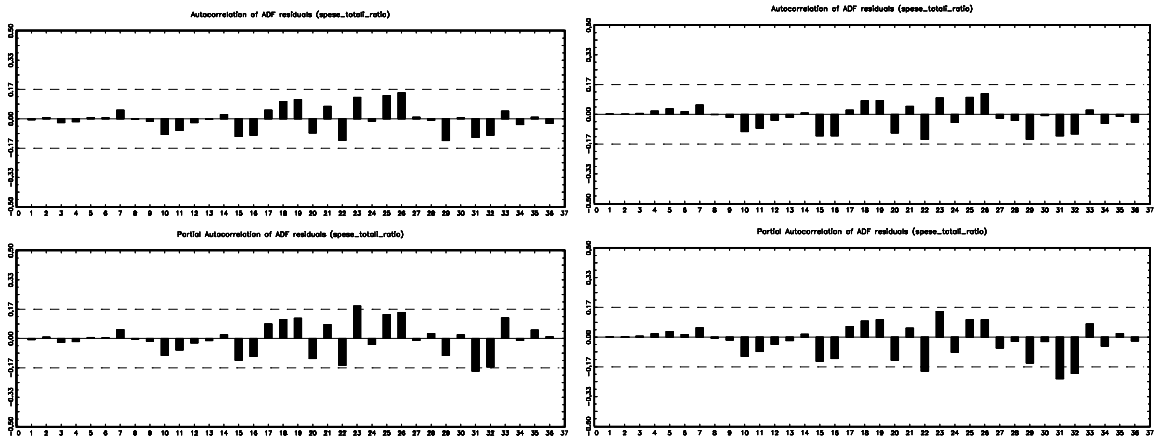



### *Public expenditures*

Figure A5 displays the two measures for the public outlays: total (with interest) final expenditures and net-of-interest final expenditures.

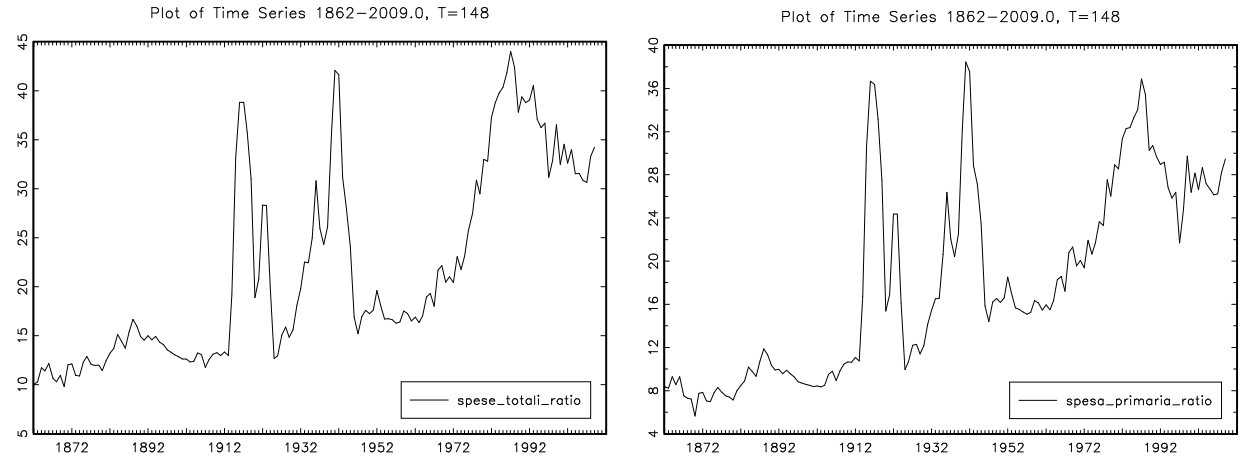
As shown in Table A3, the result of the ADF crucially depends upon the deterministic components included in the regression: when testing the unit root hypothesis allowing for a linear trend the null cannot be rejected, whereas when modelling a unit root with only a drift the null is rejected with 10% confidence. Given the above mentioned test's power problems with the ADF, it is necessary to check the appropriate deterministic components. By using the $\Phi_3$ statistic to test the null of no trend, we find the *F* statistic equal to 5.45, a value which is on the border line between rejection with a sample size of 122, since the 10% thresholds tabulated by Dickey and Fuller (1981) are 5.47 with sample size of 100, and 5.39 with sample size 250. Therefore, according to Dickey and Fueller (1981), we are not yet able to clearly distinguish which deterministic component is the one to include in the regression.

**Figure A 14 autocorrelations ADF residuals: model with trend (left) and without trend (right)**



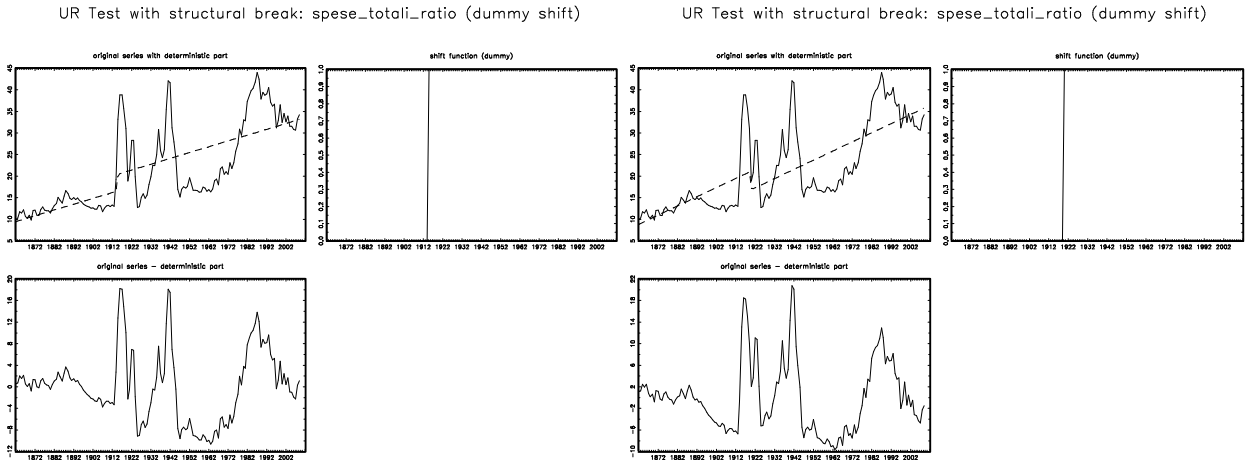

Another problem with the outlays series is the presence of two important shocks, corresponding to the jump in military spending during the two World Wars, clearly discernible in the Figure A15.

**Figure A 15: total and primary spending, total final outlays**



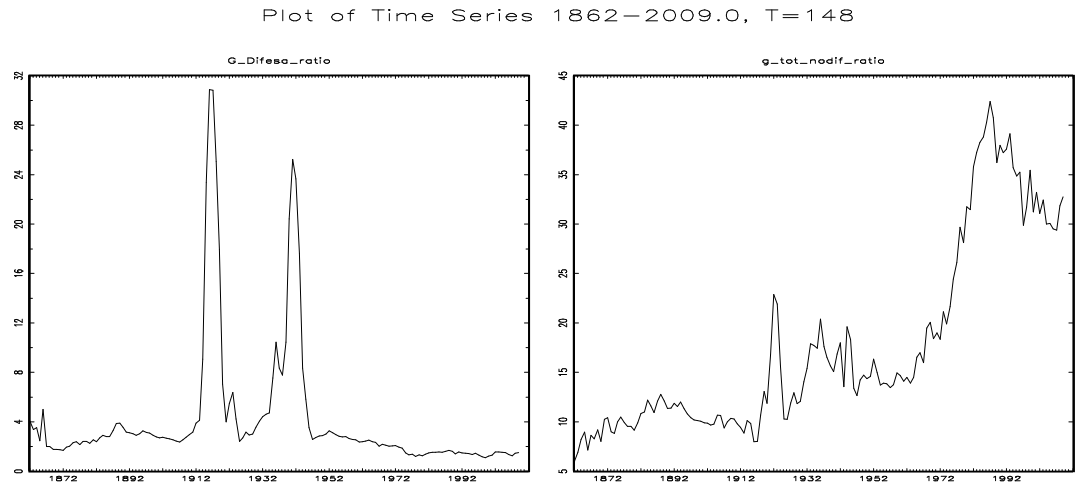

Therefore, we test the hypothesis of unit root (for total spending and primary) allowing for a deterministic trend and for structural break alternatively either in 1915 (at the beginning of the first world war) or in 1920 (suggested by the automatic procedure). The graphs below compare the effect of the two alternative break date for total spending. In both cases, the null of unit root hypothesis can be rejected with 10% confidence for the with-interest expenditures, and at 5% confidence for the primary spending.

**Figure A16: unit root with structural break, the deterministic component, total spending. Break date 1915 (left) and 1920 (right)**




To appreciate how important it is the role played by military spending on total outlays during the war times, we compare, in Figure A17, military spending with total net-of-defence spending, both as a proportion of GDP.

**Figure A 17: military spending (left) and total final spending net of military spending (right)**




Most importantly, we compare in Figure A18 the correlogram of the two spending measures, which show clearly that they have very different statistical properties: while the military spending display ACF consistent with a stationary process (ARMA), the remaining total spending exhibits a correlogram characteristic of non-stationary data, with an estimated $\rho_1$ close to unity and sample autocorrelations that die out slowly. The results of the ADF test confirm this interpretation, clearly rejecting the unit root hypothesis for the former outlays ratio ($\tau_\mu = -3.92***$, 1% significance level), whereas it is not possible to reject the null for the total spending net of military outlays ($\tau_\tau = -2.28$). The graphs of the ADF residuals in the two cases are shown in Figures A19 and A20.

Since total outlays are the sum of stationary plus an I(1) process, we can trust that they are driven too by a stochastic trend.

**Figure A 18: military spending (left) and total final spending net of military spending (right), correlogram**

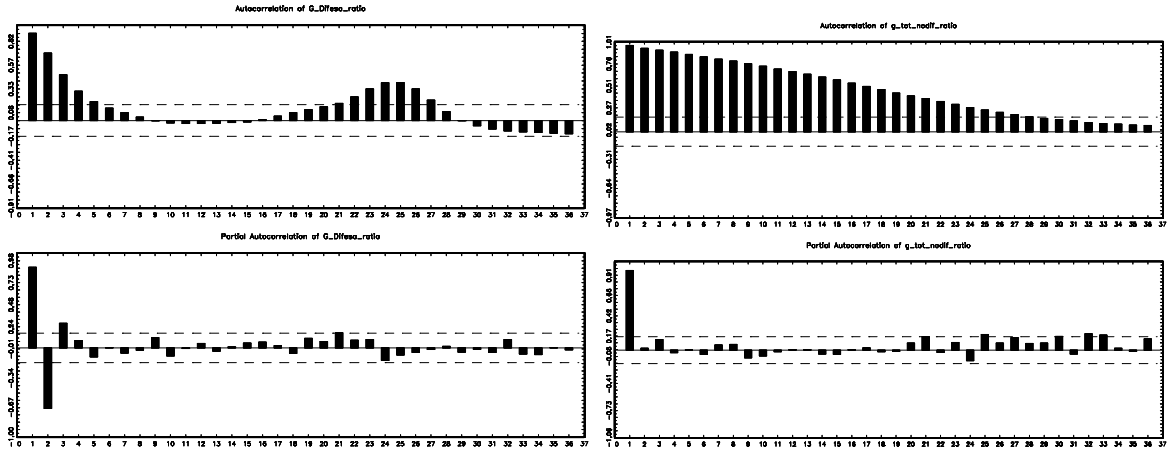



**Figure A 19: ADF residuals and auto-correlations, total spending net of military outlays**

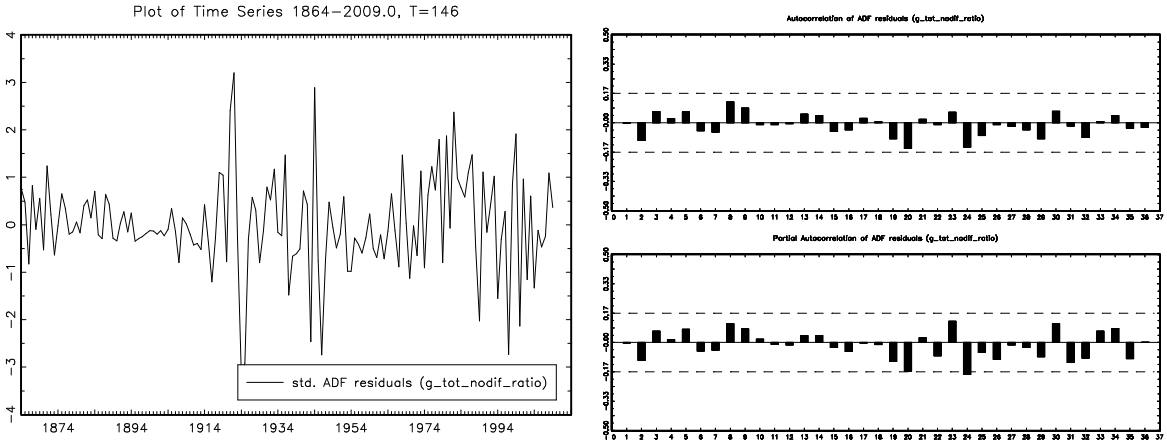
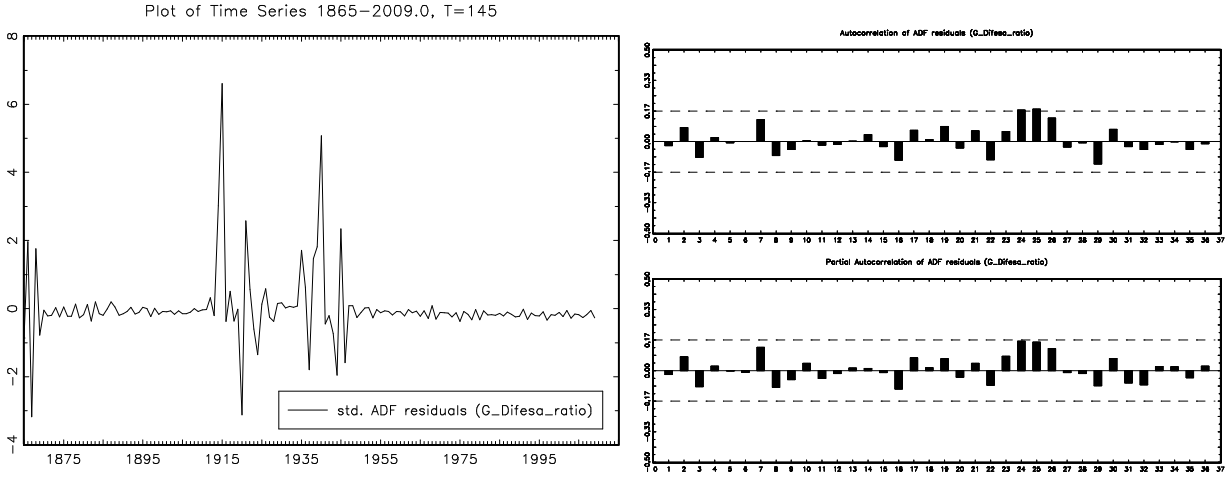


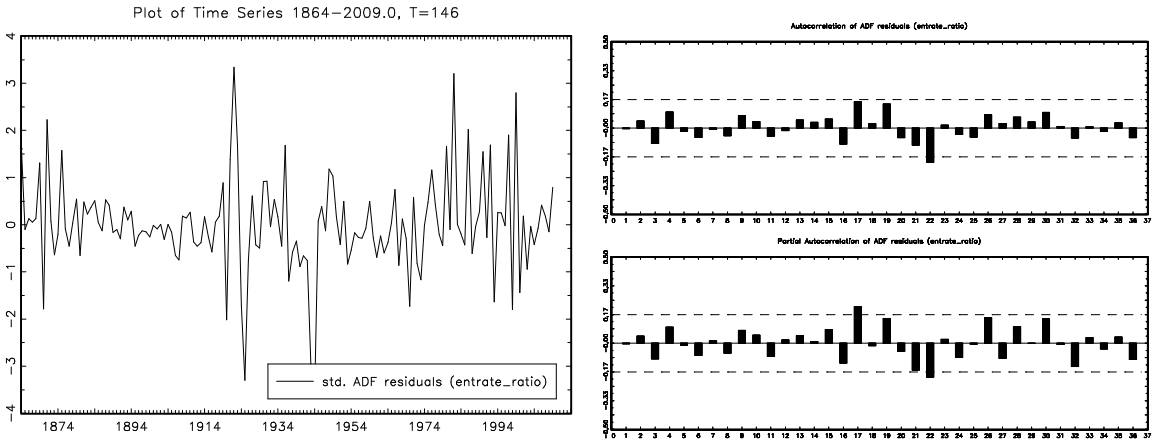

**Figure A 20: ADF residuals and auto-correlations, military outlays**



### *Total final revenues*

The pattern of total final revenues showed an upward trend for the series. The ADF test cannot reject the null of unit root, and the residuals' diagnostic, as summarized in Figure A21 do not exhibit neither autocorrelation nor structural breaks.

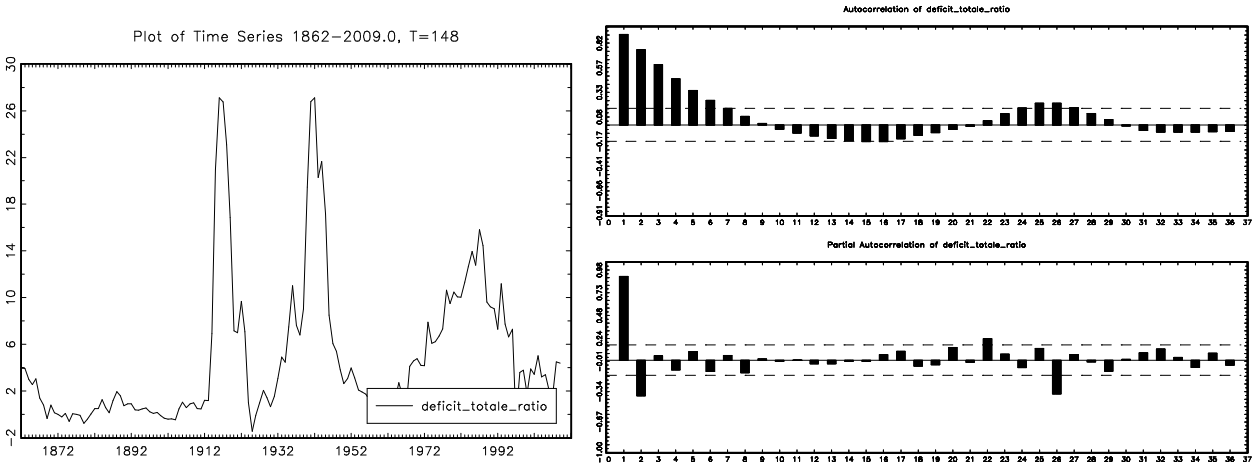
**Figure A 21: ADF residuals and auto-correlations, total final revenues**




### *With-interest deficit*

The pattern of total deficit, as well as its correlogram, are displayed in Figure A22, providing evidence of a autoregressive but stationary process, plausibly with a moving average component.

**Figure A 22: total deficit (left) and auto-correlations (right)**




The ADF test cannot reject the null of unit root, and the residuals' diagnostics, as summarized in Figure A23, do not exhibit neither autocorrelation nor structural breaks, though there is some evidence of larger volatility during the wars. Given the spikes observed during the war periods,

1915-47, and provided that tests performed for the spending clearly this period was crucial, as a further check we perform a unit root test with structural break for the with-interest deficit variable, using as break date those identified for the public outlays.

The regime shift in 1915 (identified by the automatic procedure and consistent with the evidence available for military spending), matches well the upward jump in Data Generating Process, and the Lanne et al. (2002) test confirm the stationarity of the deficit series.

**Figure A 23: ADF residuals and auto-correlations, total deficit**

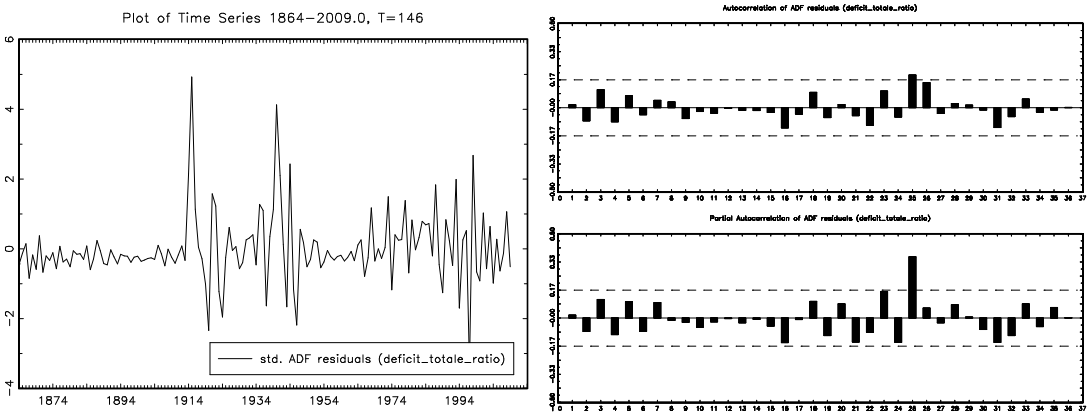
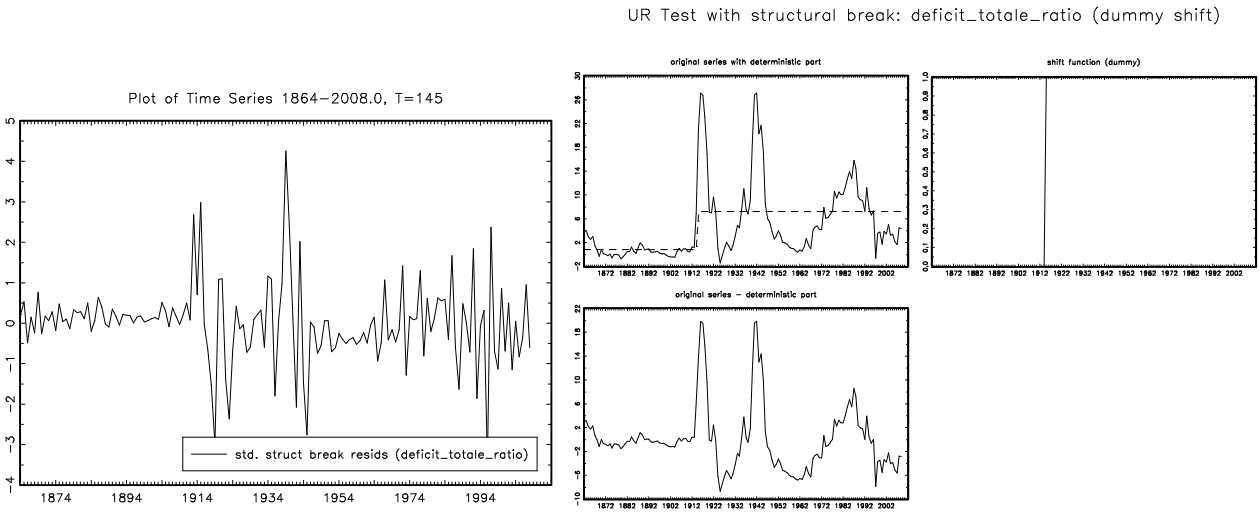



**Figure A 24: Unit root test with structural break (1915). Residuals' and deterministic component, total deficit**



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