Received: 2 February 2020 | Revised: 3 July 2020 | Accepted: 6 July 2020

DOI: 10.1002/ijfe.2184

RESEARCH ARTICLE

WILEY

On the Italian public accounts' sustainability: A wavelet approach

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Abstract

In this paper we analyse the relationship between public primary deficit and debt for Italian sustainability over the 1862–2013 years. Our empirical strategy uses the wavelet analysis. The evidence confirms the absence of fiscal sustainability in the long-run for Italy, reinforcing the need for a rebalancing of the public accounts.

KEYWORDS

fiscal sustainability, Italy, primary deficit, public accounts, public debt, wavelet analysis

1 | INTRODUCTION

The aim of this paper is to empirically reassess the relationship between public primary deficit and debt (as GDP ratios), in order to test for Italian fiscal sustainability over the period 1862–2013, using an innovative approach. Italy has the second largest public debt/GDP ratio and it represents the third economy in the European Union (EU), so that its public accounts stability is crucial for the whole area (Brady & Magazzino, 2017a), also to avoid contagion problem, guaranteeing the financial stability of the European Monetary Union (EMU). In fact, a restructuration or a default of Italian public debt, given the integration of the euro area monetary and financial markets, would certainly affect the economy of the other member states.

The basic framework of the theoretical analysis on fiscal sustainability draws on several outstanding contributions: 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), Vanhorebeek and Van Rompuy (1995), Payne (1997), Bravo and Silvestre (2002), Afonso (2005), and Mendoza and Ostry (2007).

Furthermore, is a large literature on the intertemporal budget constraint exists. The general conclusion 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 & Wickens, 2000).

Time domain analysis is the most widespread approach in the economic literature to study time series. Through such approach, the evolution of individual variables is modelled and multivariate relationships are assessed over time. Another strand of literature focuses on the frequency domain. Wavelet Analysis (WA) reconciles both approaches, in the sense that both time and frequency domains are taken into account. With this approach, we are able to differentiate between short and long-run dynamics across the whole sample period.

The wavelet transform is a powerful tool for the analysis and processing of signals and is extremely efficient in various fields of application, such as compression and denoising, and in general when dealing with non-stationary signals, as pictures. These are in fact characterized by long-term dynamics at low frequencies (backgrounds) also called trends, and short-term dynamics at high frequencies (discontinuity, edges) also called anomalies. The latter, although they occupy a relatively small percentage in the image, have a high information content, and must therefore be adequately represented.

The wavelet transform has several interesting properties:

- it is able to analyse signals with characteristics that vary over time, thanks to its good capacity for time-frequency localization;
- it provides a representation on different scales (multi-resolution representation);
- it is easily achievable through a filter bank.

Though several papers have analysed the sustainability of Italian public finances, to the best of our knowledge the current is the first paper that applies wavelet analysis to the Italian data. The evidence confirms the absence of fiscal sustainability over the whole period for Italy, reinforcing the results presented in previous studies, even if reached with different econometric approaches.

Besides the Introduction, the remainder of this paper is organized as follows. Section 2 gives the theoretical context and the survey of the literature. Section 3 presents the empirical results, while Section 4 concludes.

2 | EMPIRICAL LITERATURE FOR ITALY

Previous studies that investigated the Italian fiscal solvency used traditional time-series econometrics approach. Corsetti and Roubini (1991) reported that the government finances of Italy did not satisfy the Intertemporal Budget Constraint (IBC). Baglioni and Cherubini (1993) explored the sustainability of the Italian budgetary policy between January 1979 and May 1991, applying unit root tests and Forecast Error Variance Decomposition (FEVD) to monthly data. The results show that primary surplus is stationary, but public debt not; permanent shocks explain about 90% of forecast error variance of public debt; in addition, debt is not sustainable even if the discount rates are considered. Caporale (1995) tested the intertemporal balancing of the government budget in 10 EU countries in the 1960–1991 period, founding that the government cannot be considered intertemporally solvent in the case of Italy. Vanhorebeek and Van Rompuy (1995) focused on the solvency and sustainability of eight ERM countries' fiscal policies during the period 1970–1994. They concluded that Italy's fiscal policy undoubtedly leads to insolvency. Payne (1997) examined the sustainability of budget deficits of the G-7 countries for the period 1949–1994. The results show that Italy does not provide a clear evidence of sustainability of its budget deficit. However, this study does not take into account the possible presence of structural breaks. Artis and Marcellino (1998) used data on debt and deficit ratios to test the long-run sustainability condition for 13 EU countries. The principal implication of their findings is that the ratio converges to a constant value, but not to zero. Papadopoulos and Sidiropoulos (1999) tested whether fiscal policy for the period 1961–1994 in the EU economies was consistent with a government intertemporally balanced budget. They tested for a change in the fiscal regime by analysing the parameter's instability in the cointegration relationship between revenue and expenditure due to structural breaks, concluding that there is no evidence that the government of Italy can attain sustainable debts. Uctum and Wickens (2000) analysed the fiscal conditions of USA and 11 EU countries between 1970 and 2000, showing that Italian fiscal policy was not sustainable. 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 EU member states during the period 1960–2000. The results point to the lack of possibility of sustainable budgetary paths in Italy. Afonso (2005) assessed the sustainability of budget deficits performing cointegration tests between public expenditures and revenues, allowing for structural breaks for the EU-15 countries in the 1970–2003 period. This study highlights that Italy faced the problem of having a higher growth rate for expenditures than the growth rate of revenues. Arghyrou and Luintel (2007) re-examined the issue of Italian fiscal solvency by taking into account the structural shifts and non-linear fiscal adjustment. The evidence implies that Italian authorities tend to spend budget surpluses quickly, allowing deficits to take substantial values before taking corrective action; which appears consistent with the fact that Italy has the second highest public debt-to-GDP ratio among all EU members. However, they found evidence of a non-linear fiscal adjustment, and Italy satisfies a weak-form sustainability, which is consistent with the IBC. Greiner and Kauermann (2008) applied the test proposed by Bohn (1998), to see 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 1990s have stabilized the debt. Ricciuti (2008) characterized fiscal policy in terms of non-linear deterministic processes. His findings show that government spending and taxes can be described as being non-linear trend stationary processes instead of unit roots. A long-run equilibrium relationship—a non-linear co-trend—exists between the two series, fulfilling the intertemporal government budget constraint. This suggests a long-run fiscal rule that different policymakers have adopted, putting public finance in balance. Balassone, Francese, and Pace (2011) investigated the link between government debt-to-GDP ratio and real per capita income growth in Italy over 1861–2009, using a Vector Error Correction Model (VECM). The empirical results 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. Casadio, Paradiso, and Rao (2012) analysed possible targets for the Italian debt-to-GDP ratio with a small macroeconomic model, estimating a simultaneous equation model via a Seemingly Unrelated Regression (SUR) method, with annual data for the period from 1970 to 2011. 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. Dalena and Magazzino (2012) analysed the nexus between public revenue and expenditure for the Italian case, in the years 1862–1993. The econometric analysis involved three homogeneous sub-periods (1862–1913; 1914–1946; 1947–1993; Magazzino, 2012), and unit root, structural breaks, cointegration and causality tests. Empirical findings show that, for each subperiod, 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. Legrenzi and Milas (2012a), using long historical data on the debt-to-GDP ratios of the GIIPS, examined the stochastic properties of the debt–GDP ratio series and detect nonlinear mean reversion from 1861 to 2010. The estimated threshold for Italy is 93%, very close to the threshold that Reinhart and Rogoff (2010) deem to be of threat for the growth prospects of a particular country. Legrenzi and Milas (2012b) inspected the sustainability of the government's IBC and the corresponding fiscal reaction function within a nonlinear error-correction framework. The empirical results imply that the short-run adjustment to correct budgetary disequilibria is entirely performed via changes in taxes, rather than changes in government expenditures or some budgetary policy mixes. The empirical evidence by Piergallini and Postigliola (2012) investigated the sustainability of Italy's public finances from 1862 to 2012 adopting a non-linear perspective, through a Smooth Transition Regression (STR) model. The results show the occurrence of a significantly positive reaction of primary surpluses to debt when the debt-GDP ratio exceeded the trigger value of 110%. Bartoletto, Chiarini, and Marzano (2013), following the approach proposed both by Bohn (1998) and Doi, Hoshi, and Okimoto (2011), tested for the sustainability of public debt in Italy. They found that the dynamic of Italian public debt in the period 1861–2010 can be considered as sustainable, with the exception of the two World War years (1914–1945). Accounting for structural breaks, Trachanas and Katrakilidis (2013) used annual data explored the long-run macroeconomic relationship between government spending and revenues for three South-European economies under financial market pressure and insolvency (Italy, Greece and Spain), from 1970 to 2010. The evidence suggests that the sustainability of the fiscal deficits in Italy holds only in a weak sense. Afonso and Jalles (2014) investigated the sustainability of fiscal policy in a set of 19 countries by taking a longer-run secular perspective over the period 1880–2009. Using structural time series models, they conclude that since for Italy non-stationarity can be rejected, longer-run fiscal sustainability is not rejected. Buiatti, Carmeci, and Mauro (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. Magazzino and Intraligi (2015) analyzed the relationship between the primary balance/GDP ratio, the real growth rate, the inflation rate and the average interest rate on Italian government bonds in the period from 1958 to 2013. Causality tests revealed a significant causal relationship 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. Brady and Magazzino (2017b) analysed the sustainability of Italian public debt in the years 1862–2013. The results pointed out the existence of two distinct states, both for public debt and deficit, with means and standard deviations rather different. Both states are extremely persistent. More recently, Brady and Magazzino (2019a) found a long-run relationship between public expenditure and revenues only for the sub-period 1862–1913. In essence, their results reveal that Italy had fiscal sustainability problems in the Republican age.

However, none of these studies employed the WA to inspect the fiscal sustainability for the Italian case.

3 | METHODOLOGY AND DATA

We enter the debate on Italian debt sustainability by approaching it in a novel manner. Our analysis is not rooted in the time domain. We are interested in detecting and quantifying the time–frequency dependence between primary balance and lagged debt to GDP ratios. For that purpose, we make use of some WA tools by analyzing, firstly, the univariate features of the series through the

Continuous Wavelet Transform (CWT; Grossmann & Morlet, 1984; Mallat, 2008) and the Wavelet Power Spectrum (WPS), which give information simultaneously on time and frequency features of the data. Wavelet analysis reveals the spectral characteristics of a time series (discovering patterns and otherwise hidden information), in particular, the way in which different periodic components of the data on Italian national debt and primary balance evolve over time (Lo Cascio, 2015).

WA is a powerful tool for data compression, processing and analysis. It can be applied to extract useful information from numerous types of data, including images and audio signals in physics, chemistry and biology, and high-frequency time series in economics and finance.

The origin of WA can be traced back to different schools of thought that were isolated. The first work related to the WP is by Haar (1909), who found an orthogonal system of functions, known today as the simplest base of the wavelet family and which takes its name, Haar's wavelet.

With the intense development and expansion of theories, the applications of WA have reached a wide range of sectors, in particular economics and finance. The last few decades have been an era of big data, especially for the financial sector, as it is possible to measure many financial variables such as the prices of shares at very high frequency—based on the minute or even the second. Financial data sets become huge, with large volumes and high variability and complexity. More than ever, this growing sophistication requires the need for data processing tools.

WA is flexible and does not require a strong assumption on the Data Generating Process (DGP): in essence, WA has the ability to represent highly complex data without the need to know the underlying functional form. This is of great benefit to economics and finance, since the underlying process of a data set is not always known precisely. Many economic and financial time series are not stationary, which makes traditional methods ineffective in analysing them. Instead, the WA overcomes this challenge as it does not require the assumption of stationary data.

WA provides information both on the time domain and on the frequency domain: unlike the time series analysis and the spectral analysis, which provide only information, respectively, on the time domain and on the frequency domain, the WA has the capacity to break down the original time series with respect to the time and frequency domains simultaneously. This is of crucial importance in economics and finance, as many of these variables can operate and interact differently depending on dissimilar time scales. The wavelet transformation uses local basic functions that can be lengthened and translated with a flexible resolution both in terms of frequency and time.

Since the publication of Haar's work, many other important contributions have been made in the field of WA. Some of these are the CWT discovery in 1975 by Zweig followed by a more detailed formulation by Goupillaud, Grossmann, and Morlet (1984); the construction of orthogonal wavelets with compact support of Daubechies (1988); the introduction of the multiresolution structure of Mallat (1989), and several others.

The WA allows the identification, within a time series, of the short and long term periodic components, representing a valid alternative to the ARIMA X-11 and the ARIMA X-12 for the identification of the long-term component, and frequency analysis for identification of cyclical components.

The wavelet transformation is a tool that allows us to divide functions, operators or data into components of different frequencies, allowing us to study them separately. WA can be thought of as a generalization of analysis with the Hilbert space method, in which the equations in this space can be solved in terms of bases (Daubechies, 1992).

In the WA it is possible to express a given function as a linear combination of elementary functions (on different scales and positions) called wavelets. The latter are functions obtained by the translation and expansion of a single function called 'mother wavelet', with zero media, compact support, oscillatory behaviour, and which decays to 0 for $t \to +\infty$. Some wavelets in addition to having compact support are also well localized, and they decay rapidly to 0 at a predetermined rate (Priestley, 1996). Starting from the 'mother wavelet' it is possible to define the CWT of the signal.

The period or scale parameter is defined as the reciprocal of the frequency, and intuitively can be compared with the scale of the maps, since in this case a high scale parameter corresponds to a global and not detailed view of the signal, while a parameter on a reduced scale corresponds to a detailed view. In the same way, in terms of frequency, the low frequencies (high scale) correspond to a global signal information (which usually lasts for the entire signal), while high frequencies (low scale) correspond to the detailed information on the pieces of hidden signals (which usually have a relatively short duration).

The balancing operation ('scaling') consists in the expansion and compression of the signal, so at larger scales there is a dilated (or stretched) signal, while at smaller scales there is a compressed signal.

Following all the macroeconomic applications of wavelet analysis in Aguiar-Conraria, Martins, and Soares (2012), and Aguiar-Conraria and Soares (2014),

we decided to use the Morlet wavelet as a mother wavelet in all our numerical computations, with the particular choice of $\omega_0 = 6$, where ω_0 is the only parameter to choose when using the Morlet wavelet. According to Aguiar-Conraria and Soares (2014), the Morlet wavelet is the most popular among the complex valued wavelets mainly because of four interesting properties. First, for numerical purposes because it can be treated as an analytic wavelet. Second, because the peak frequency, the energy frequency, the central instantaneous frequency, and ω_0 are all equal, facilitating the conversion from scales to frequencies, and for the most common choice of $\omega_0 = 6$, we have that Fourier frequency is approximately equal to one divided the scaling factor. Third, because the Heisenberg box area reaches its lower bound with this wavelet. Finally, the time radius and the frequency radius are equal, therefore this wavelet represents the best compromise between time and frequency concentration. According to Aguiar-Conraria and Soares (2014) knowledge, at least in economics, every paper uses some values of $\omega_0 \in [5; 6]$.

Furthermore, the wavelet cohesion developed by Rua (2010) is defined as the weighted mean of the wavelet-based measures between all possible pairs of the time-series. The unique characteristics of the wavelet cohesion is that it measures the spread of cohesion among different series at various frequencies and also examines whether such cohesion is variable across time and frequency. The value of cohesion lies between -1 and $+1$.

Moreover, we define the absolute value of the complex wavelet coherency as wavelet coherency and it assumes values between 0 and 1, the angle of the complex coherency is called phase-difference.

For completeness of analysis in our paper, we make use of an additional wavelet tool, the Partial Wavelet Coherence (PWC), which enables to account for the interaction with other control variables when assessing the association between two series. The partial wavelet coherency is a simple generalization of the corresponding concepts of (Fourier) multiple partial coherency to the time-frequency plane and details can be found in Aguiar-Conraria and Soares (2014).

A phase difference of 0 indicates that the time series move together with a specified time-frequency; if $\varphi_{xy} \in (0; \pi/2)$, then the series move in phase, but the time series x leads y; if $\varphi_{xy} \in (-\pi/2; 0)$, then y is driving. A phase difference of π (or $-\pi$) indicates an anti-phase relationship (negative correlation); if $\varphi_{xy} \in (\pi/2; \pi)$, again y is driving; while it is the series x to drive if $\varphi_{xy} \in (-\pi; -\pi/2)$.

The empirical analysis uses the time series data of lagged public debt (% of GDP, B) and primary deficit (% of GDP, PD) for Italy in the 1862–2013 years. Moreover, we derived the inflation series (calculated as the variation of the Consumer Price Index), using the data recently reconstructed by ISTAT.[1] The dataset is freely consultable online as Supporting Information.

4 | RESULTS

In Figure 1, we have, on the left, the public/GDP and primary deficit/GDP ratios observed over the 1862–2013 period. On the right side of the figure, we have the wavelet power spectra (WPS) of the series. The analysis has been carried out by using the ASToolbox provided, and freely available through their website, by Aguiar-Conraria and Soares.[2] The colour code for power ranges from blue (low power) to red (high power).

Looking at the debt as share of GDP, we can identify five major events, which in chronological order are due to the Great Depression (1897, with the fall of aggregate income), World War I (1920), World War II (1943), the EMS and political crises (1994), and the recent Great Recession (2013). Regarding the series of deficit as a share of GDP we observe two negative peaks during the interwar period. However, it is interesting to note how, in general, the primary balance improved soon after the debt crisis events.

The colour contour for each of the two series shows that the wavelet power is not constant over time as well as across frequencies. The public debt and deficit over GDP series do not share common features in terms of wavelet power. In fact, deficit has high power at high frequencies (3–6 years) around 1915–1940. On the contrary, debt exhibits very high power at low frequencies (10–16 years), in almost all the period of the sample (1883–2013); in particular, we especially observe deep red (high power) at low frequencies (12–16 years) in the period 1903–2003. Moreover, for the two series, volatility is very low at all other (not mentioned) frequencies across time.

The thick black curve in the right panel of Figure 1 represents the Cone Of Influence (COI). Black and grey contours designate, respectively, the 5 and 10% significance levels against an ARMA (1,1) null and the values for the significance were obtained from Monte Carlo simulations. The white lines show the maxima of the undulations of the WPS.

In Figure 2, on the left we compute the wavelet coherency between public deficit and debt. On the right, we compute the partial wavelet coherency, after controlling for inflation. The concept of wavelet partial coherency is an extension of the concept of wavelet coherency just like partial correlation is an extension of the simple correlation. We show, in Panel (a) and (b), the wavelet

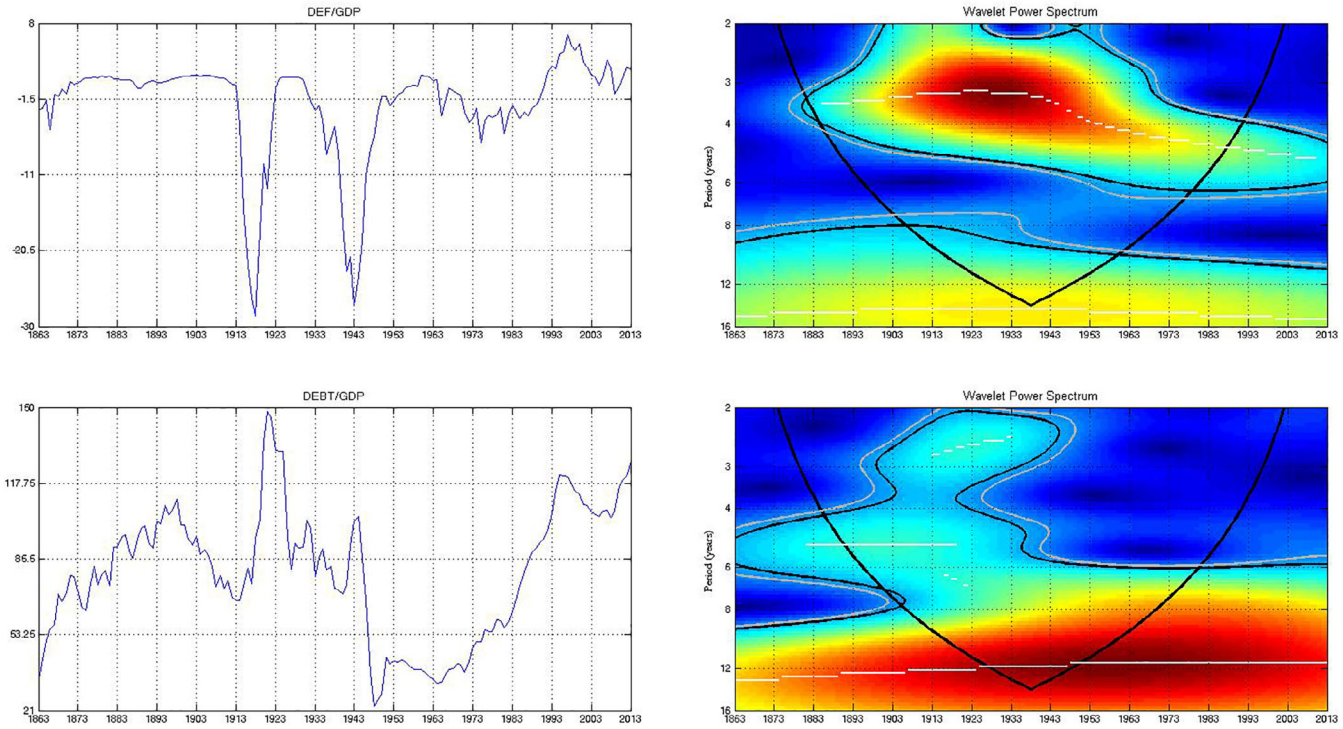

FIGURE 1 Public debt and primary deficit over GDP and their power spectrum (Italy, 1862–2013). Sources: Our elaborations on ISTAT data [Colour figure can be viewed at wileyonlinelibrary.com]

coherency (and partial coherency after controlling for inflation) between lagged debt and deficit to output ratios and the phase difference for two different frequency bands, corresponding to cycles of 3–8 and 8–16 years, respectively. The local correlation was high and statistically significant (red colour) during the periods of range 1863–1875 (around 8–12 years), 1883–1893 (around 4–6 years), 1900–1920 (around 12–16 years), 1943–1970 (around 8–16 years), whilst the period 2003–2013 (around 12–16 years) is outside the COI. Moreover, it exhibits some cycles with low periodicity (essentially 2–3 years). In the shorter period cycle (3–8 year scales) the phase difference lies almost continuously between $-\pi/2$ and $\pi/2$, indicating that the two series move in phase—so that they are positively correlated—but sometimes debt is leading deficit, and vice versa. Occasionally, the phase-difference lies outside the interval $-\pi/2$ and $\pi/2$; however, those periods are essentially of low coherency (blue colour) and, therefore, is not much meaning attached to the phase-difference. In the longer period cycle (8–16 year scales) the phase difference lies continuously between $-\pi/2$ and 0 until 1930, the series move in phase and public debt is leading: deficit (surplus) decreases (increases) follow lagged debt decreases. In the years 1930–1960 and 1973–1981 the phase difference lies between $-\pi$ and $-\pi/2$, indicating an antiphase relation (negative correlation), with public deficit leading. Between 1982 and 1993 the phase difference relies in the interval $(0; \pi/2)$, the series move in phase with public deficit leading: this implies a non-sustainable fiscal policy, since growing budget disequilibria undermines Italian fiscal solvency. Effectively, it is recognized that in the 1980s the foundations for the collapse of public accounts were laid (Ciocca, 2007; Forte, 2011; Franco, 1993; Graziani, 2000; Magazzino, 2012; Morcaldo, 1993; Rossi, 2000). Between 1982 and 1993 the public debt/GDP ratio increased by 46.99% (from 68.10 to 115.09%), and public expenditure (as GDP ratio) by 8.09% (from 45.30 to 53.39%; Magazzino, 2012). This result roughly confirms the conclusions of Baglioni and Cherubini (1993), who found that Italian fiscal policy did not follow a sustainable path in the 1980s. From 1993, the phase information shows a positive correlation (phase relation, between $-\pi/2$ and 0), that is debt is leading deficit. It is true that the phase-difference between the two series for the periods 1930–1960, 1973–1982 and 1983–1992 lies outside the interval $(-\pi/2; 0)$. Nevertheless, those periods are essentially of low coherency and, therefore is not much meaning attached to the phase-difference. Thus, the information related to periods of significant coherence shows a phase relation (positive correlation between public deficit and debt, with the

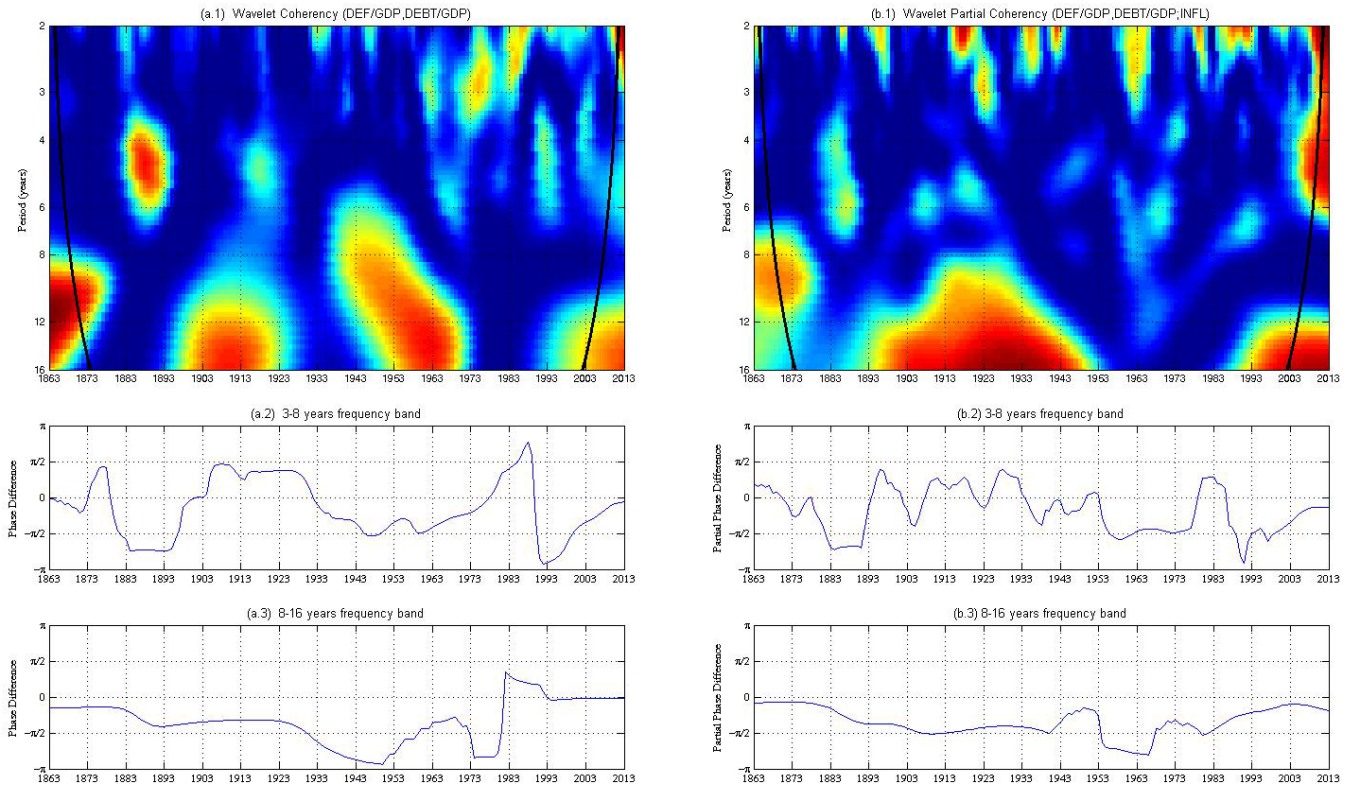

FIGURE 2 Wavelet coherence and partial wavelet coherency (Italy, 1862–2013). Sources: our elaborations on ISTAT data [Colour figure can be viewed at wileyonlinelibrary.com]

series that move together in phase), and the deficit is leading. However, because debt changes gradually, only a long time scale is meaningful for fiscal sustainability. In the bargain, it is worth to underline that since 1999 (the starting period of the common money) the phase difference lies continuously around 0 and the series move together at a specified time-frequency. Furthermore, even though outside the COI, in the final part of the sample period it is evident a red area of high power, which suggests some pressures on Italian public accounts with a strong menace to its fiscal solvency.

Regarding the wavelet partial coherency, we considered the coherency of the debt and deficit conditionally to the inflation rate, observing strong partial coherency for the period 1895–1945 at low frequencies (12–16 years). Moreover, for the period 2003–2013 we registered strong partial coherency at both low and high frequencies. Concerning the phase-difference, for both frequency periods, the graphs exhibit the same pattern of the wavelet coherency indicating that the inflation rate does not add anything to the relationship between public debt and deficit.

Therefore, in the longer-period cycle the phase difference is always in a range of fiscal insolvency. These empirical results clearly confirm those due to previous studies, which also indicated the absence of Italian fiscal sustainability. These empirical findings are in line with previous results by Corsetti and Roubini (1991), Baglioni and Cherubini (1993), Vanhorebeek and Van Rompuy (1995), Caporale (1995), Payne (1997), Artis and Marcellino (1998), Papadopoulos and Sidiropoulos (1999), Uctum and Wickens (2000), Bravo and Silvestre (2002), Afonso (2005), and Brady and Magazzino (2019b), who found empirical evidence against fiscal policy sustainability in Italy. On the contrary, Afonso and Jalles (2014) concluded that the solvency condition would be satisfied for Italy.

5 | CONCLUSIONS AND POLICY IMPLICATIONS

The sustainability of public accounts is a well-debated issue in economics, especially in those countries with high public debt/GDP and deficit/GDP ratios. In this study, we reassess the relationship between public debt and primary balance (both as GDP ratio) for Italy over the years 1862–2013 by using a wavelet coherence approach. Given the fact that in the longer-period cycle (8–16 year scales)—which is meaningful for fiscal

sustainability—the phase difference continuously relies outside the interval between $\pi/2$ and π, our results suggest the presence of fiscal insolvency. In particular, the phase difference lies without interruption in the interval $(-\pi/2; 0)$ until 1930, the series move in phase and public debt is leading. On the other hand, in the period 1982–1993 the phase difference lies between 0 and $\pi/2$, confirming the well-consolidated result of the literature, which judges the 1980s the 'black hole' of Italian public finance, and its economy, more in general.

The results of this paper clearly confirm those due to previous studies, which also indicated the absence of Italian fiscal sustainability. However, we adopted a longer time horizon and a new analytical framework, the wavelet analysis. Therefore, policymakers should pay close attention to the status of Italian public accounts and their equilibrium. Indeed, the high public debt/GDP ratio, the inability to restructure and cut public expenditures, the excessive tax evasion, the modest productivity growth, poor investments in research and development and in infrastructure, the age-old gap between North and South, low levels of competitiveness and competition, a high tax wedge, reduced flexibility and mobility of workers, unsustainable bureaucratic and judicial inefficiency, a heavy taxation on energy, an obsolete banking system, and a diffuse corruption undermine Italian economic growth as well as its fiscal sustainability (Bini Smaghi, 2013; Brady & Magazzino, 2019a; Magazzino, 2012; Savona, 2015).

In order for the public budget to contribute to a lasting increase in the growth rate of output, profound interventions are needed on the composition of public expenditures and revenues. A larger space should be used—rather than subsidies and transfers—for programs that are most capable of stimulating economic activity, accompanied by measures aimed at containing the distortions induced by taxation. All this should be included in a framework that guarantees financial sustainability, specifying intentions, priorities and sources of funding, with the prospect of a broad tax and social security reform (Visco, 2019). Furthermore, it should be considered that the reduction of current account public expenditures could stimulate the process of economic growth, freeing up resources that would be used by private individuals in a more efficient way (De Romanis, 2017; Forte & Magazzino, 2011; Magazzino, 2011). All this should result in a reshape of public intervention in the economy, with effects on the size of the state (Forte & Magazzino, 2011, 2016; Magazzino, 2014; Mutascu & Milos, 2009).

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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ENDNOTES

[1] http://www.istat.it/it/archivio/30440.

[2] https://sites.google.com/site/aguiarconraria/joanasoares-wavelets/the-astoolbox.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Magazzino C, Forte F, Giolli L. On the Italian public accounts' sustainability: A wavelet approach. *Int J Fin Econ*. 2020;1–10. https://doi.org/10.1002/ijfe.2184