

Impact of the 2008 and 2012 financial crises on the unemployment rate in Italy: an interrupted time series approach

Impatto delle crisi finanziarie del 2008 e del 2012 sul tasso di disoccupazione in Italia: approccio di analisi basato sulle serie temporali interrotte

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Abstract

One of the most widely recognized indicators of a recession is a rising unemployment rate. In Italy, from the late nineties this indicator continuously decreased over time until 2007. The aim of this paper is to study the immediate impact and persistence of the 2008 global financial crisis and the 2012 European sovereign debt crisis on the Italian unemployment rate by using a segmented regression analysis approach of interrupted time series. Quarterly data were collected from the website of the Italian National Institute of Statistics. In particular, the impact of the financial crises was evaluated across some subpopulations of interest by stratifying unemployment rate for age groups, in order to highlight the effects on youth unemployment, gender and macro-regions. Finally, to provide a more in-depth analysis, some information on the effects of the two economic recessions was also given about the people not engaged in Education, Employment or Training.

Abstract *Uno degli indicatori di recessione più utilizzati è il tasso di disoccupazione. In Italia, dalla fine degli anni novanta tale indicatore è*

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Footnotes

costantemente diminuito fino al 2007. Lo scopo di questo lavoro è quello di studiare l'impatto immediato e la persistenza della crisi finanziaria globale del 2008 e la crisi del debito sovrano europeo 2012 sul tasso di disoccupazione italiano, utilizzando un'analisi di regressione di serie temporali interrotte. I dati sono stati raccolti sul sito dell'Istituto Nazionale Italiano di Statistica. In particolare, l'impatto delle crisi finanziarie è stato valutato per alcune sottopopolazioni di interesse stratificando il tasso di disoccupazione per età, al fine di evidenziare gli effetti sulla disoccupazione giovanile, per genere e per macro-regioni. Infine, per fornire una descrizione più approfondita del fenomeno, l'analisi è stata estesa anche ai giovani non occupati e non in istruzione e formazione.

Key words: unemployment rate, interrupted time series analysis, segmented regression

1 Introduction

During this past decade two economic crises had a severe impact in all countries around the world. More specifically, after the economic decline observed in world markets during the late 2000s and early 2010s, which generated the Great Recession defined by the International Monetary Fund as the worst global recession since the Great Depression of the 1930s, a sovereign debt crisis faced to European countries in 2009, resulting in a second economic recession in the years after (2011–2015). These crises produced negative effects on GDP growth, on economic performance, on the labour productivity and on labour markets. The International Labour Organization (ILO, 2001) revealed that due to the global economic crisis, in 2009 about 22 million people were unemployed worldwide in particular in developed economies and in the European Union. During this period the unemployment rate continued towards a dramatic increase with high and persistent levels of unemployment in young people. In Italy the unemployment problem is worrying since it affects particular segments of the labour market, such as the younger generations and some macro regions.

The aim of this study is to assess and measure whether and how much the aforementioned financial crises have changed the level and trend in the UR and in the young people who are neither employed nor in education or training (NEET), immediately and over time, and to see if these changes are short-or long-term. Whereas UR is a widely recognized indicator of a recession, the NEET has been considered since it provides a measure of disengagement from the labour market and perhaps, more generally, quantifies also how many people are sliding towards the borders of the active society. A segmented regression approach of Interrupted Time Series (ITS) analysis is used by analysing quarterly data collected from the Italian National Institute of Statistics (ISTAT).

2 Data and empirical strategy

Data were collected from I.Stat, the warehouse of statistics currently produced by the Italian National Institute of Statistics (ISTAT) which provides an archive of about 1,500 time series (<http://dati.istat.it/>). Quarterly data on two different kind of indicators were downloaded from the theme ‘Labour and wages’: UR for the period 1993–2016, overall and stratified by gender, age groups and macro-regions; and the percentage of NEET for the period 2004–2016, overall and stratified by gender. Such data are derived from the official estimates obtained in the Labour force survey, carried out on a quarterly basis interviewing a sample of nearly 77,000 households representing 175,000 individuals. According to the Eurostat definition (Eurostat, 2017), UR is given by the number of people unemployed as a percentage of the labour force. The youth unemployment rate (YUR) is the number of unemployed 15–24 year-olds expressed as a percentage of the youth labour force, and the NEET refers to the percentage of people aged between 15 and 29 years who currently do not have a job, are not enrolled in training or are not classified as a student. Figure 1a illustrates the trend in the overall UR in Italy from 1993 to 2016. The choice of such a long period allows for a more accurate estimate of the secular trend, and this will be useful for the subsequent analysis. As shown, UR rises since the mid-nineties until 1998, when it reaches 11.6%. Thereafter, it steadily declines until the third quarter of 2007 (2007q3), falling to 5.7%, which represents the minimum value observed throughout the period. Starting from the fourth quarter of 2007 (2007q4), period in which the effects of the financial crisis following the bankruptcy of Lehman Brothers begin to appear, UR undergoes a first shock. As a result, it shows a trend reversal, although with some obvious fluctuations, and its value rises in the subsequent two-years period, known as Great Recession, oscillating between 7% and 9% in 2010–2011, when it reaches roughly the same level of a decade before. Afterwards, the European sovereign-debt crisis which occurred in the late 2011 (2011q4) causes a second shock, and UR increases even more dramatically up to 13.5% at the end of 2014 (2014q4), after a six quarter recession for the euro area economy. After this peak, UR seems to show a slight trend reversal, although it is perhaps still too early to consider this as a possible structural change.

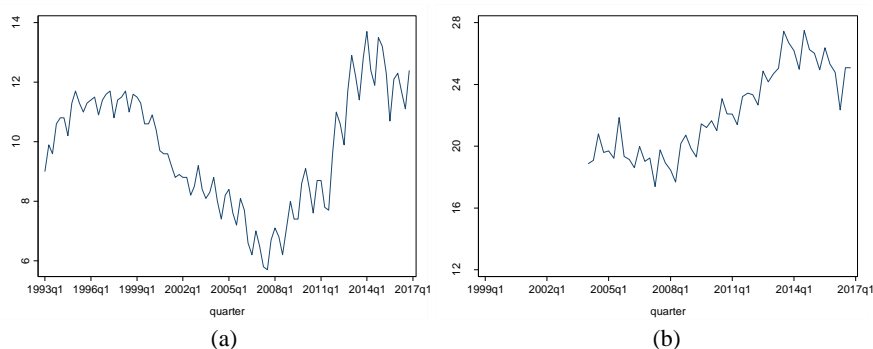


Figure 1: Total UR (a) and percentage of NEET (b) in Italy over the observed period

On the other hand, Figure 1b illustrates the trend of the overall percentage of NEET in Italy from 2004 to 2016. For this indicator, the series is shorter because data from previous years are not available. However, the trend can still be detected and it seems, at least partly, similar to that of UR. Indeed, after a slight decrease in the period before the onset of the global financial crisis (2007q3), the percentage of NEET starts a steeply and steady growth that continues unchanged also after the occurrence of the sovereign debt crisis (2011q3). And here too, a trend reversal seems to occur starting from the end of 2014 (2014q4). In the light of the previous considerations, the analysis period was divided into the following four sub-periods, arising from the two successive financial shocks and by a slight trend reversal observed in the last two years: the period before the so-called 2008 global financial crisis (until 2007q3); the subsequent three-year period known as the Great Recession aftermath of the financial crisis, characterised by a general economic decline observed in world markets (2007q4–2011q3); the period following the European sovereign debt crisis, which resulted in a second economic recession (2011q4–2014q4); and finally, the last two years (2015q1–2016q4), during which it seems to glimpse a slight decrease in both the UR and the percentage of NEET. Consequently, the three breaks in the series were set in 2007q4, 2011q4 and 2015q4. Moreover, as regard the UR, since the historical trend has changed substantially in the late nineties (see Figure 1a), data prior to 1999 were removed from the analysis in order to obtain a more accurate estimate of the underlying trend before the first interruption of the series. Therefore, the analysis period is limited to the years 1999q1–2016q4 for the UR and to 2004q1–2016q4 for the percentage of NEET. The interruptions allow to highlight the severity of the two financial crises, respectively, and continuation of their effects in the subsequent years of recession, as shown by the sharp change observed in UR at the beginning of each period and the successive trend.

3 Interrupted time series analysis

In this study, a segmented regression approach of interrupted time series (ITS) analysis was carried out in order to assess and measure, in statistical terms, whether and how much the two financial crises have changed the level and trend in the outcome variables, immediately and over time, and to see if these changes are short- or long-term (Wegner, Soumerai and Zhang, 2002).

ITS analysis (Shadish, Cook and Campbell, 2002) is a simple but powerful tool used in quasi-experimental designs for estimating the impact of population-level or large scale interventions on an outcome variable observed at regular intervals before and after the intervention. In such circumstances, ITS allows to examine any change on the outcome variable in the post-intervention period given the trend in the pre-intervention period (Bernal, Cummins and Gasparrini, 2016). In this respect, the underlying secular trend in the outcome before the intervention is determined and used to estimate the counterfactual scenario, which represents what would have happened if the intervention had not taken place and serves as the basis for

Impact of 2008 economic recession on unemployment rate in Italy: an interrupted time series approach comparison. For the purposes of our study the interventions are given by two unplanned and real-world events, the aforementioned and well recognized financial crises. In segmented regression of ITS, each sub-period of the series is allowed to exhibit its own level and trend, which can be represented by the intercept and slope of a regression model, respectively. The intercept indicates the value of the series at the beginning of an observation sub-period; and the slope is the rate of change during a segment (or sub-period). Therefore, by following this approach it is possible to compare the pre-crisis level and trend with their post-crisis counterpart, in order to estimate the magnitude and statistical significance of any differences.

The ITS regression model with a single group under study (here, the Italian population), two interventions, which in this study are given by the two economic recessions in 2007q4 and 2011q4, and a possible UR trend reversal in 2015q1, can be represented as it follows (Linden and Adams, 2011; Bernal, Cummins and Gasparrini, 2016):

$$y_t = \beta_0 + \beta_1 T_t + \beta_2 x_{t2007q4} + \beta_3 T_{t2007q4} x_{t2007q4} + \beta_4 x_{t2011q4} + \beta_5 T_{t2011q4} x_{t2011q4} + \beta_6 x_{t2015q1} + \beta_7 T_{t2015q1} x_{t2015q1} + \varepsilon_t.$$

In particular, y_t is the aggregated outcome variable at each equally-spaced time-points t , here represented by quarters; T_t is the time elapsed since the start of the study, where t varies between 1999q1 to 2016q4 for UR and between 2004q1 to 2016q4 for NEET, respectively; $x_{t2007q4}$ is a dummy variable indicating the onset of the global financial crisis in fourth quarter of 2007, coded as 0 (pre-crisis period) and 1 (post-crisis period); $T_{t2007q4} x_{t2007q4}$ is the interaction term between time and the 2007q4 global financial crisis; $x_{t2011q4}$ is a dummy variable indicating the onset of the 2011q4 European sovereign debt crisis, coded as 0 (pre-crisis period) and 1 (post-crisis period); and $T_{t2011q4} x_{t2011q4}$ is the interaction term between time and 2011q4 European sovereign debt crisis. Finally, $x_{t2015q1}$ is a dummy variable indicating the time in which a trend reversal might have occurred, coded as 0 (before the trend reversal) and 1 (after the trend reversal); and $T_{t2015q1} x_{t2015q1}$ is the usual interaction term. Accordingly, β_0 is the intercept and represents the starting level of the outcome variable at $T = 1999q1$ for UR and $T = 2004q1$ for NEET, respectively; β_1 is the slope and represents the trajectory (or secular trend) of the outcome variable until the 2007q4 global financial crisis; β_2 is the level change that occurs immediately following the 2007q4 global financial crisis (compared to the counterfactual); β_3 is the difference between the slope pre and post the global financial crisis; β_4 is the level change that occurs immediately following the 2011q4 European sovereign debt crisis; β_5 is the difference between the slope pre and post the European sovereign debt crisis; β_6 is the level change that occurs immediately following the 2014q4 (compared to the counterfactual); β_7 is the difference between the slope pre and post the trend reversal; and ε_t represents the random error term which is assumed to follow a first auto-regressive (AR1) process. The regression coefficients are estimated by using Ordinary least-squares (OLS) method with the Newey-West (1987) standard errors.

4 Results

Four periods of linear trend were considered to analyse UR and NEET, with interruptions at 2007q4, 2011q4 and 2015q1, respectively. Separate segmented regression models were then estimated for age groups, gender and macro-regions via ordinary least-squares by using Newy-West standard errors in order to handle one lag autocorrelation. To account for the correct autocorrelation structure, Cumby-Huizinga test (Cumby and Huizinga, 1992) was performed and results confirm that autocorrelation was present at lag 1, but not at higher orders (up to the 9 lags were tested). Results are shown in Table 1 for the UR and in Table 2 for the NEET. Specifically, for the purposes of this study, will be commented only the coefficients β_0 – β_5 which summarize the trend of the dependent variables before and after the two financial crisis, respectively. In fact, the interruption at 2015q1 was introduced in order to have a more correct estimate of the trend in the previous period so as to have a proper assessment of rate and trend changes. As regards the UR, the 1999 base rate showed some variability in the considered sub-groups. In fact, starting from 11.020 at national level, its value was particularly higher for the age group 15–24 (26.909) and for the South macro-regions (20.683) but lower for the North East (4.640) and North West (5.927) macro-regions, as well as for the males (8.353) and for the 45–54 age group. Moreover, its trend prior to the 2008 global financial crisis (1999q1–2007q3) showed a significant and general decrease, both at national level (-0.138; $p < 0.001$) and for the different age groups, macro regions and gender. Such reduction was more pronounced for the sub-groups traditionally considered as the most vulnerable ones, namely South macro-regions (-0.269; $p < 0.001$), females (-0.205; $p < 0.001$) and YUR (-0.183; $p < 0.001$). The onset of the global financial crisis (2007q4) caused an immediate and substantial UR increase at national level (+0.788; $p < 0.05$) and in almost all the considered sub-groups but no significant change was detected for younger people (age groups 15–24 and 25–34) and the North-East macro region. In particular, the more severe direct consequences were observed among females (+1.061; $p < 0.001$), for people in the central (+1.061; $p < 0.001$) and southern regions (+0.992; $p < 0.05$) and for the intermediate age group 35–44 (+0.997; $p < 0.001$). The aftermath of the financial crisis were quite strong and resulted in the Great recession in the subsequent years during which a substantial and significant trend change was observed compared to the previous period (+0.255 $p < 0.001$). However, in this case, the most serious consequences occurred particularly for YUR (+0.716; $p < 0.001$) and, to a much lesser extent, for the South macro-regions (+0.371; $p < 0.001$). On the other hand, the immediate consequences of the second financial crisis, following the European sovereign debt crisis (2011q4) were even stronger when compared to the previous financial crisis and resulted in a second economic recession, with an UR increase almost double at the national level (+1.583; $p < 0.001$). Such increase was higher for YUR (+3.696; $p < 0.001$) and for the South macro region (+2.634; $p < 0.001$) while there was no significant increase again for North East macro region.

Table 1: Estimates of the impact of the 2007q4 and 2011q4 financial crises on the UR in Italy

...	<i>Base rate (1999)</i>	<i>Trend 1999q1- 2007q3</i>	<i>Rate change 2007q4</i>	<i>Trend change 2007q4</i>	<i>Rate change 2011q4</i>	<i>Trend change 2011q4</i>	<i>Rate change 2015q1</i>	<i>Trend change 2015q1</i>
Overall	11.020***	-0.138***	0.788**	0.255***	1.583***	0.137	-0.492	-0.425***
Males	8.352***	-0.095***	0.602*	0.250***	1.459***	0.112	-1.303	-0.428***
Females	14.989***	-0.205***	1.061***	0.267***	1.653***	0.190***	-1.638**	-0.280**
15–24	26.909***	-0.183***	0.970	0.716***	3.696**	0.345	-3.350	-1.611***
25–34	11.142***	-0.068***	0.127	0.290***	1.566**	0.246**	-1.873	-0.588***
35–44	7.863***	-0.095***	0.997***	0.177***	1.245***	0.166***	-1.333***	-0.245**
45–54	6.505***	-0.099***	0.725***	0.196***	1.111***	0.109*	-0.748	-0.296***
55–64	8.076***	-0.166***	0.847***	0.219***	1.350***	-0.005	-0.167	-0.029
Northwest	5.927***	-0.067***	0.826**	0.222***	0.888**	0.014	-0.895	-0.307***
North	4.640***	-0.038**	0.244	0.171***	0.842	0.011	-0.637	-0.306***
Center	8.736***	-0.098***	1.061***	0.193***	1.319**	0.140**	-1.022	-0.356**
South	20.683***	-0.269***	0.992**	0.371**	2.634***	0.360***	-2.445**	-0.478***

Table 2: Estimates of the impact of the 2007q4 and 2011q4 financial crises on the percentage of NEET in Italy

...	<i>Base rate (2004)</i>	<i>Trend 2004q1- 2007q3</i>	<i>Rate change 2007q4</i>	<i>Trend change 2007q4</i>	<i>Rate change 2011q4</i>	<i>Trend change 2011q4</i>	<i>Rate change 2015q1</i>	<i>Trend change 2015q1</i>
Overall	19.973***	-0.061	-0.358	0.352***	0.006	0.032	-1.673**	-0.542***
Males	15.148***	0.013	-0.410	0.361***	0.309	0.004	-1.507**	-0.744***
Females	24.713***	-0.127*	-0.346	0.332***	-0.302	0.062	-1.841**	-0.331**
Northwest	12.639***	-0.078	0.607	0.400***	-1.161	0.067	-1.734*	-0.634***
North East	10.521***	-0.008	0.521	0.377***	0.113	-0.144	-0.791	-0.653***
Center	15.479***	-0.089***	-1.243	0.477***	0.157	-0.055	-1.808**	-0.538***
South	29.884***	-0.074	0.385	0.297***	0.549	0.132**	-2.001**	-0.445**

* p < 0.10; ** p < 0.05; *** p < 0.01

After this second financial shock, the UR seems to further accelerate its increase only in some sub-groups while at national level no significant trend difference was observed. In particular, such acceleration was particularly higher for the South macro-regions (+0.360; $p < 0.001$), age group 25–34 (+0.246; $p < 0.05$) and females (+0.190; $p < 0.001$) while no significant further rate increase was detected for YUR. However, it should be emphasized here that this further increase, although lower than the one highlighted during the Great Recession, where present has to be added to that already existing, thus making particularly critical the situation. As regards the percentage of NEET, a considerable heterogeneity was found in the 2004 base rate, which was 19.973 at national level. Its value was higher for the South macro-regions (29.884) but lower for the North East (10.521) and North West (12.639) macro-regions; moreover, it was higher for females (24.713) than males (15.148). On the other hand, its trend prior to the 2008 global financial crisis (2004q1–2007q3) was basically constant at national level, with the only exception for the macro-regions of Center, which showed a slightly descending trajectory (-0.089 ; $p < 0.001$). The onset of the of the global financial crisis (2007q4) did not cause an immediate impact on the percentage of NEET, overall and in any of the considered sub-groups. However, a significant trend change was found both at national level ($+0.352$; $p < 0.001$) and for all the analysed sub-groups; such change was particularly higher only for the macro-regions of Center ($+0.477$; $p < 0.001$). The European sovereign debt crisis (2011q4) does not seem to alter this situation, neither for the rate change nor for the trend change. Therefore, this means that after this second financial crisis the rise of the percentage of NEET remains steady and equal to the previous period without showing any jump.

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