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Layoffs and economic crisis: a time series analysis on the Italian labor market

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Abstract

The economic crisis that starts in 2007 in the U.S. has had dramatic effects in Italy. The level of GDP in 2009 falls of 5 percentage points, followed by production, employment and wages. This scenario underlines the weaknesses of the Italian labor market and a significant recourse to layoffs especially during the downswing. Although the evidence indicates that there is a link between aggregate supply and labour, researches on this topic are fragmented and they are not as straightforward as they appear. In order to fill this lacuna, by applying a traditional production function we use a bivariate VAR model to assess whether aggregate supply is driven by labour force. We use the industrial production index as proxy of GDP and layoffs as proxy for unemployment. Data are drawn from the Eurostat database and INPS database over the period 2005-2014. To take into account the events connected with the recession we add a dummy variable as an exogenous variable. The Granger causality test shows that in the short run there is a two-way relation from the industrial production index to ordinary layoffs. From these results emerge that layoffs ordinary layoffs may be used as a policy to contrast the economic cycle.

JEL classification numbers: E00, E60, J00, J48, C22
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1 Introduction

Currently, across the OECD countries, labour market conditions are in improving

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and in the first quarter of 2018, the average employment rate was about 2 percentage points above its pre-crisis peak. Moreover, OECD employment and unemployment rates are also projected to keep improving in 2018 and 2019 [12].

However, the Job quality and inclusiveness indicators show a mixed picture for the OECD countries. The italian labour market performs below the OECD average in all key indicators of job quality and inclusiveness. Despite the unemployment rate in Italy has been decreasing at 11.2% in April 2018 it remains the third highest among OECD countries and 4.6 percentage points above its 2008 level [12]. The major gap of employment in terms of the disadvantaged group is for mothers with children, youth, older workers, non-natives, and persons with partial disabilities. Italy with respect to the OECD countries is the fourth highest and also the gender labour gap is above the OECD average. In recent years, in Italy and other European countries, governments have attempted to reduce job loss before the layoff occurs to reduce the length of the unemployment spell. However, in Italy there are still high levels of ordinary and extraordinary layoffs [7-8]. In fact the weakness of the recovery economic makes the reabsorption of the layoffs long and uncertain aggravating the structural unemployment, particularly for young people, with an unemployment rate of women close to 30% in the South Italy. The impact of layoffs on economic growth can be studied in the more general context of the relationship between human capital and economic growth and whether layoffs can be used to contrast the economic cycle. Human capital is closely interrelated with welfare and has an impact on economic growth. In the path for economic development, it is necessary for a country involve working people. In the Italian economy, the mechanisms relating economic growth could be influenced by the unemployment. In 2016 less than one in ten unemployed was receiving unemployment benefits in Italy, one the lowest coverage rate in the European Union as a result of high long-term unemployment and low maximum potential duration of benefits. Thus, became important for the governments support the interventions during the period of the job's loss to realize an early-intervention strategy and to foster rapid re-employment needs to be put in place.With this in mind, the focus of this study is to improve understanding of the consequences of an excessive recurse to layoffs on growth in Italy.

In particular the purpose of this study is to ascertain whether the causal relation between the ordinary layoffs and the labor market is supported by significant empirical evidence. The empirical criterion adopted rests on the use of VAR models in first differences for no-cointegrated series. While the VAR models are nothing new in the literature on the labor market, this paper will take advantage of these models for the specific purpose of investigating both the directions of causality implicit in the functioning of the labor market policy. The geographical area examined is the Italy and they are used monthly data drawn from Eurostat database and the National Social Security Institute (INPS) database. The period considered starts from 2005M1 and ends in 2014M5. Use is made of a VAR model in first differences to analyze a short-run relationship between industrial production index and ordinary layoffs.

In this analysis, the evidence indicates that exist a one-way direction of causality from the industrial production index to the ordinary layoffs. These findings suggest that layoffs may be used as a policy to contrast the economic cycle.
The paper is organized as follows. Section 1 discusses the characteristics of the labor market in Italy, and the reasons for the renewed attention it has recently received in particular after the economic crises of 2007-08. Section 2 describes the data and tests stationarity and cointegration. Section 3 implements the VAR models in first differences and it presents the results of Granger causality test. Finally, Section 4 concludes by giving suggestions for policy makers and for futures investigations.

2 Data, unit roots test and cointegration analysis

This work analyses the relationship between industrial production index and layoffs on the basis of a neoclassical production function. The sample examined regards Italy and covers the period from 2005M1 to 2014M5. The back-to-top data are monthly and drawn from the the Eurostat database and the National Social Security Institute (INPS) database. The analysis focuses on the following time series: the industrial production index as proxy of GDP (ipi) and the layoffs as proxy for unemployment (lfs)[2]**.** The non-stationarity of the series is confirmed by the Augmented Dickey-Fuller (ADF) test, the Phillips Perron (PP) test and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, as shown in Table 1.

Table 1: Unit roots test of the series in levels

Variables	**Lags**	**ADF Test (test statistic)[a]**	**KPSS Test (test statistic)[b]**	**PP Test (test statistic)[c]**	**Results**
Ipi	13	-2.65	0.15	-2.34	**I(1)**
lfs_ord	6	-3.17	0.16	-1.72	**I(1)**

Note: It was chosen for the all series a model with trend and constant that both resulted significant on performing an OLS regression on each series.[a ,c] The critical value for both series at the 5% level of significance is equal to -3.45 and at the 1% level of significance is equal to -4.04. [b] The critical value for both series is equal to 0.14 at the 5% level of significance and it is equal to 0.21 at the 1% level of significance.

The ADF and PP tests never reject for all series in levels the null hypothesis of unit root's presence at the 1% significance level. The KPSS test rejects the null hypothesis of unit root's absence at the 10% significance level for the series *ipi*,

[2] According to ISTAT definition the layoffs is an instrument used by State to support the firms that, because of crisis or difficulty, they are temporarily forced to contract or suspend their activity. It is a remuneration in favor of employees suspended from work or subjected to reduction time and it is managed by INPS. The layoffs correspond to the number of hours of which companies have benefited in the reference month.

lfs_ord. It is therefore possible to attempt to make the series stationary by transforming them into first differences. The ADF, PP and KPSS tests confirm the stationarity of the all series in first differences at the 1% significance level (Table 2).

Table 2: Unit roots test of the series in first differences

Variables	Lags	ADF Test (test statistic)[a]	KPSS Test (test statistic)[b]	PP Test (test statistic)[c]	Results
d_ipi	12	-2.96	0.08	-11.19	**I(0)**
d_lfs_ord	5	-2.91	0.12	-9.6	**I(0)**

Note: [a,c] The critical value for both series is equal to -3.49 at the 5% level of significance and it is equal to-2.89 at the 1% level of significance.[b] The critical value for all series is equal to 0.46 at the 5% level of significance and it is equal to 0.73 at the 1% level of siginificance.

In order to confirm the presence of a unit root and to take into account the events connected with the Great Recession, which could be seen as a structural break, separate ADF tests were carried out on the pre-crisis period (2005M1–2008M3) and the post-crisis period (2008M4–2014M5) for both the series considered. The hypothesis of the presence of a unit root is never rejected at the 1% significance level. The obtained results do not support the presence of a structural break.

As the variables are I(1) in levels and they become I(0) in their first order differences, it is possible to apply the Johansen cointegration test [9-10]. This more general test is preferred to the Engle-Granger test [3]. In this case it is assumed that all the variables of the system are endogenous and it is not necessary to establish a direction of causality amongst them *a priori*. The test is carried out by including the option "unrestricted constant" and four lags, which minimise the information criteria of Schwarz Bayesian criterion (BIC). According to the trace test and eigenvalue test, the null hypothesis of the absence of a relation of cointegration between *ipi* and *lfs_ord,* is not rejected. In this case, the presence of a stationary linear combination between the two variables is ruled out. The results are shown in Table 3.

Table 3: Johansen cointegration test (series in levels)

Variables	Lags	H_0	λ_{trace} Stat.	λ_{max} Stat.	Results
ipi, lfs_ord	**4**	**r=0**	7.897 (0.4837)[a]	7.8486 (0.4029)	**NOT COINTEGRATED**

Note: [a] The *p-values* are shown in the brackets.

3 The VAR models and Granger Causality Test

As the VAR models specified on the series in levels proves non-stationary, it was decided to proceed with estimation of the models specified in first differences. In the VAR models estimated in the reduced form, all the variables are endogenous except the dummy (dum1) inserted as an exogenous variable. In order to test for the presence of outliers, the temporal dummy variable (dum1) assumes the value of one in the months 2008M3 and 2008M4, and zero in all the other months. The variable is proved significant by applying the Wald test. The exogenous dummy variable (dum1) is significant. On the basis of the information criteria of Akaike (AIC), Schwartz Bayesian (BIC) and Hannan-Quinn (HQC), it was decided to insert two lags for the series in levels, and one lag for the variables in first differences. The VAR models estimated for each relation are therefore as follows:

$$\begin{bmatrix} \Delta ipi_t \\ \Delta lfs\_ord_t \end{bmatrix} = \begin{bmatrix} a_{ipi\,ipi} & a_{ipi\,lfs\_ord} \\ a_{lfs\_ord\,ipi} & a_{lfs\_ord\,lfs\_ord} \end{bmatrix} \begin{bmatrix} \Delta ipi_{t-1} \\ \Delta lfs\_ord_{t-1} \end{bmatrix} + \begin{bmatrix} dum_{ipi} \\ dum_{lfs\_ord} \end{bmatrix} dum1 - \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \quad (1)$$

The results reported in Table 4 show that in the short term the variation in the industrial production index is negatively influenced by the variation of ordinary layoffs and vice versa.

Table 4: Results of the estimation of the VAR model

	Δ_{ipi_t}	$\Delta_{lfs\_ord_t}$
$\Delta_{ipi_{t-1}}$	0.021 (0.81)	-3.477*** (1.096)
$\Delta_{lfs\_ord_{t-1}}$	-0.015** (0.0079)	0.056 (0.091)
dum1	-0.02** (0.008)	-0.09* (0.013)
AIC	-5.99	
BIC	-5.89	
HQC	-5.95	
ARCH Test	First eq.	Second eq.
Ljung-Box Q' Test	0.9 First eq.	0.62 Second eq.
	0.536	0.369

Notes: The standard errors are shown in the brackets. (*), (**), (***) respectively indicate significance at 10%, 5% and 1%. The dummy (dum1) inserted regards the months 2008M8–2008M9.

Considering the VAR estimated by the equation (1) it has been carried out the Granger causality test to verify if the industrial production index *causes* the

layoffs (ordinary) and vice versa (Table 5). In order to confirm the robustness of the results obtained, the Granger causality test was also repeated varying the number of lags from one to twelve months.

Table 5: Results of the Granger causality test

Variables	Optimal Lags[a] (p.value)	6 Lags (p.value)	10 Lags (p.value)	12 Lags (p.value)
Δ_{ipi_L} - > $\Delta_{ilx\_ord_L}$	0.003***	0***	0.001***	0.008***
$\Delta_{ilx\_ord_L}$ -> Δ_{ipi_L}	0.054*	0.065*	0.0391**	0.0104**
Δ_{ipi_L} - > $\Delta_{ilx\_exord_L}$	0.943	0.833	0.076*	0.015**
$\Delta_{ilx\_exord_L}$ -> Δ_{ipi_L}	0.496	0.177	0.341	0.426

Note: Ho: No Granger-causality. [a] The information criteria of Akaike (AIC), Schwartz Bayesian (BIC) and Hannan-Quinn (HQC) were used to select the optimal number lag that is equal to one. In the table are reported the *p-values*. (*), (**), (***) respectively indicate significance at the 10%, 5% and 1% level.

Bidirectional Granger causality is detected at 1% significance level from the variation of the industrial production index to ordinary layoffs and at 5% significance level from ordinary layoffs to the industrial production index. In particular the last one relation it's stronger when the lags became longer. Therefore appears that the variation of the industrial production index precedes movement of the variation in ordinary layoffs and it's also true the way round.
The results obtained in the VAR model are robust with respect to conditional heteroscedasticity and autocorrelation. The Ljung-Box Q test shows the absence of serial autocorrelation at the 1% significance level for both the equations of the VAR model. The test for the presence of ARCH effects in the residuals confirms homoscedastic residuals. The absence of serial autocorrelation and ARCH effects is also confirmed when the number of lags is varied from one to four. Moreover, the residuals plot shows that the residuals of the VAR model are stationary.

5 Conclusions

Every year, between 1% and 7% of the workforce of OECD countries faces job loss due to economic reasons. During the recent economic crisis, recourse to the layoffs aside of Italian companies was exceptionally high. According to data published by INPS [7], in the period from the first quarter of 1996 until the third quarter of 2008 the number of authorized hours of layoffs (ordinary, extraordinary

and in derogation) remains at relatively low levels, ranging from a minimum of 30 to a maximum of 70 million of total hours. At this stage, the use of this social shock absorber is linked in part to a temporary suspensions of production activities, and in part to a corporate restructuring and reorganization.
Starting from the end of 2008, however, the number of hours of authorized layoffs increases dramatically compared to the pre-crisis period, reaching significantly levels higher up to a peak of 336 million hours in the second quarter of 2010 [7]. From the analysis by sector, a remarkable concentration using layoffs emerges in the manufacturing activity going from 70 per cent in the pre-crisis phase to 80 per cent immediately after and linked to a contraction of production.In this context, studying the relation between economic growth and layoffs could be interesting to evaluate whether layoffs contribute to influence the economic cycle by accelerating the development or whether they are only a social shock absorbers. This work examines the relation between industrial production index and layoffs in Italy over the period from 2005M1 to 2014M5. In order to test this relation, use was made of bivariate VAR models in first differences for no-cointegrated series. The results obtained show that the models are a good fit for the data. In particular the estimation of the unrestricted VAR model shows that in the short term the variation of the industrial production index is negatively influenced by the ordinary layoffs and vice versa (Table 4). This bidirectional relation is confirmed in the period considered by the Granger causality test. The F tests carried out for Granger causality show that the variation of industrial production index is preceded by variations in ordinary layoffs and vice versa. This result is confirmed when the number of lags is varied from one to twelve months (Table 5).
It is therefore possible to draw the conclusion that the decisions of labour market in the Italy appear to be effectively influenced by the dynamics of economic cycle. Moreover, it emerges that ordinary layoffs may be used as a policy to contrast the economic cycle.

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