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HELP WANTED AND JOB VACANCIES: AN ANALYSIS OF THE PREDICTIVE CAPABILITIES OF THE CSA -ISFOL TIME SERIES FOR EMPLOYMENT AND UNEMPLOYMENT FLUCTUATIONS

Submitted by ISFOL, Italy*

Abstract: *This paper aims at providing an analysis of the dynamic properties of the CSA-Isfol quarterly series on job vacancies, in order to assess the possibility of its use as a leading indicator for the employment and unemployment fluctuations. In particular, we study the cross-correlative structure emerging between definite sections of vacancies and the corresponding sections in the standard employment and unemployment series. The analysis employs both standard descriptive tools, and the modern econometric concepts developed for the multivariate analysis of non stationary time series. The empirical structure of the data is thus estimated employing the VAR-VECM methodology, while persistence profiles, impulse-response analyses and forecast error decompositions are employed for the assessment of the dynamical properties.*
The results suggest that the ISFOL-CSA vacancies series is a valid cyclic predictor for employment and unemployment both at the aggregate level and respect to some interesting decompositions of the aggregate series. As a consequence, a labour market index based on help wanted may constitute a valuable leading indicator of the labour market trends and cycles and of their skill biases implications.

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I. Introduction

1. The job-matching process in Italy is mostly informal. The surveys carried out by Isfol and the Bank of Italy[1] show that the channels represented by *friends, relatives and self-applications* are used by 50% of job seekers (Table 1.1). Newspapers advertisements are the most important channel for the overall formal process. Jobseekers using newspapers advertising were roughly 12% in 2003, of which nearly the half was placed. In the same year companies have recruited approximately 8% of the new personnel by advertisements, the so called *Help Wanted*. Should we compare the results of 2003 with the ones of 1991, we would realise that the percentage of jobseekers using the newspapers advertising has lowered, but the results in terms of actual placements have been more effective.

Table 1.1 - The job-matching process channels

	Isfol survey on jobseeking		**Bank of Italy survey on families**		**Isfol Companies Panel**
	Used	Given job	Used	Given job	Used (***)
Friends, relatives	27,0	38,5	24,5	47,0	48,4
Working experiences (*)	4,1	5,2	0,0	0,0	0,0
Self-applications	22,1	27,0	12,1	20,3	21,5
Public contests	7,5	8,5	15,6	12,8	0,0
Help wanted on the press	12,6	6,0	14,4	3,9	8,6
Training schools and centres	3,3	3,3	2,2	5,3	3,8
Recruiting personnel agencies (*)	4,8	2,8	0,0	0,0	1,0
Temporary-Pres (*)	8,4	4,7	0,0	0,0	6,8
Pes (**)	10,2	4,0	31,2	10,7	7,5
Chamber of Commerce, Social partners	0,0	0,0	0,0	0,0	1,1
Internet	0,0	0,0	0,0	0,0	0,6
Other	0,0	0,0	0,0	0,0	0,7
Total	100,0	100,0	100,0	100,0	100,0

(*) in 1991 these items were not yet present (**) in 1991 they were known as Uffici pubblici per il collocamento (***) in the last 12 months

2. The advertisements on newspapers (from now on HWI) have common characteristics as follows:

- ✓ average high quality of professional profiles searched (qualified job demand);
- ✓ programming of the advertisements (implying an analysis of the requested profile);
- ✓ advertisement formalisation (it is necessary to pay a rather high cost, thus they are not just opinions but realities)[2];
- ✓ short production lag (processing them takes 30-45 days from publication);
- ✓ free frequency: as they are elementary data, they can be grouped according to the preferred frequency[3];
- ✓ more frequent use in rationing situations, such as in cases of search for a rare talent unattractive jobs for the resident jobseekers;
- ✓ they are available and have been classified and filed in the last 25 years by the Centro di Statistica Aziendale in Florence on account of Isfol;
- ✓ free advertisements are non considered, as well as contest reviews, free press and the Gazzetta Ufficiale, as they are not consistent with the criteria and characteristics above.

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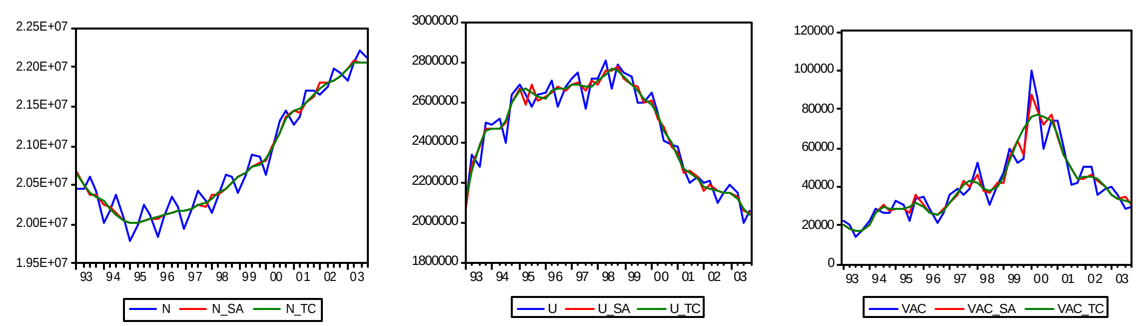
[1] Isfol: *La Ricerca del lavoro* and *the Panel delle Imprese* in 2003; Bank of Italy: *The balances of Italian families in 1991*.
[2] The Excelsior sample survey calculates the “recruitments forecast by companies for the following year” declared by the employer or by the personnel office.
[3] It’s ready, in order to be analysed together with ISTAT new continuous survey concerning the labour force, that will allow monthly findings relative to employment and unemployment.

3. These characteristics are the main reasons why we have decided to check the forecasting capabilities of the Isfol-CSA time series. In our country no data sources on job seeking other than newspapers is so rich, continuous and disaggregated. Hence, this analysis has been made possible by the systematisation work carried out on CSA yearly micro-data[4], whose correspondences were quite fragile and many of the re-codifications had never been communicated[5].

4. Since we are studying roughly 10% of the overall job-matching process, it is necessary to evaluate the ability of this epiphenomenon, generally signalling excess demand situations in the labour market, to represent the overall labour market dynamics. The analyses carried out show that the predictive capabilities of HWI are meaningful and thus that the idea of its use as a leading indicator for employment and unemployment fluctuations is supported by abundant empirical evidence. This possibility is currently acknowledged and implemented in the North American countries. HWI is in fact a largely used indicator of the cyclic conditions of the labour market in the US and Canada[6].

5. The evolution of employment and unemployment during the decade 1993 – 2003 can be distinguished in two stages. The early nineties have witnessed a strong decline in the Italian labour market performance, with unemployment reaching roughly 12% of the labour force. Since 1996 and 1997 an incisive reform of the labour market regulation (Legge Treu), the economic recovery and also the conclusion of the "dramatic juncture" of the Italian public finance inspiring the tight budget policies for joining the Euro area, have enhanced employment and absorbed great part of the unemployment created during the first half of the '90s.

Figure 1.1 – Employment (N) unemployment (U) and vacancies, raw series, seasonally adjusted data, and trend-cycle components



Sample: 1993:1 – 2003:4, computations executed with Eviews 4.

6. Vacancies only partially reproduce these evolutions. Despite a positive trend is evident for the period in which employment increases and unemployment is significantly reduced, the presence of a peak in 1999 cannot be explained by standard labour market tensions. The steep rise in the vacancy series registered in 1999 and 2000 is in fact due to a widespread race to recruit ICT skills. Coherently, the subsequent decline in vacancies has a twofold meaning: on the one hand it represent the end of the ICTs skills strong recruitment stage; on the other hand it signals the end of the expansionary employment stage beginning in 1996-97 and still ongoing in 2003,

[4] The data relative to the '80s were only on paper.
[5] For a detailed analysis of the data see "*Help Wanted in the Italian Labour Market*", S. Laj – E. Mandrone, 2005.
[6] The context and the use of the tool represent a distinctive experience for these countries.

which effects on the employment and unemployment levels are registered only by the end of 2004 and will be more evident in 2005.

II. Theoretical background

7. The probability of filling a vacancy in *t* depends on the vacancy to unemployment ratio. If a fixed proportion *s* of the employed leaves employment each period, the steady-state equilibrium requires that unemployment and vacancies are stable at levels such that the entry flows, i.e. the probability of filling a vacancy, exactly compensate the exit flows. Formally: P(VAC/U)V-*s*N=0, or P(VAC/U)-*s*=0. Differencing the last relation respect to the unemployment rate[7]:

$$\frac{dv}{du} = -\frac{p_U}{p + p_V v} \qquad (2.1)$$

we obtain the so-called "Beveridge Curve" an inverse relationship between the vacancy rate and the unemployment rate, valid if p+pVv>0, namely if changes in the vacancy rate lead to less than proportional changes in p. The inverse relationship between v e u means that the dismissals rate lowers when the unemployment rate increases and by the fact that in the existing unemployment pool there are workers who are immediately available to be recruited by the same company. Since changes in the vacancy rate produce less than proportional changes in p and in pU, the Beveridge curve is convex respect to the origin of the axes.

8. Vacancies are generally calculated on the basis of "*help wanted*" indicators, vacancy advertisements in newspapers. Actually, the relationship between vacancies and advertisements can change over time in compliance with changes in the advertising costs, with the newspapers diffusion, with the width of the labour market, with the particular stage of the business cycle and with the quality of job openings[8] (Fishelson, 1974). To account for possibility that the cause of the observed movements along the Beveridge curve is the instability of the relationship between vacancies and newspaper advertisements, requires the consideration of all the elements causing changes in the relation between vacancies and advertisements.

9. In order to reduce this risk, we have utilized the Isfol-CSA historical series – *sharers plus newborn* -, namely we have recorded and studied the data relative to vacancies from 1993 to 2003, coming from the always present newspapers in the survey, or from the *new born* ones resulting always present after introduction. This should rule out the possibility of recording spot advertisements, resulting from a non-homogeneous computation of vacancy advertisements.
For years it has been said that the Beveridge relationships was not empirically found as a stable relationship. When proposing this labour market regularity, Lord Beveridge probably faced a much simpler labour market, where the distortions related to aggregation of data were less effective than nowadays. The differences in the relationship emerging when different decompositions of the series are employed (such as the geographical decomposition and the skill grouping) will be explicitly considered in the analysis, while leaving unprocessed the question of the possible interrelationships between different sections of the vacancy-employment-unemployment relationship.

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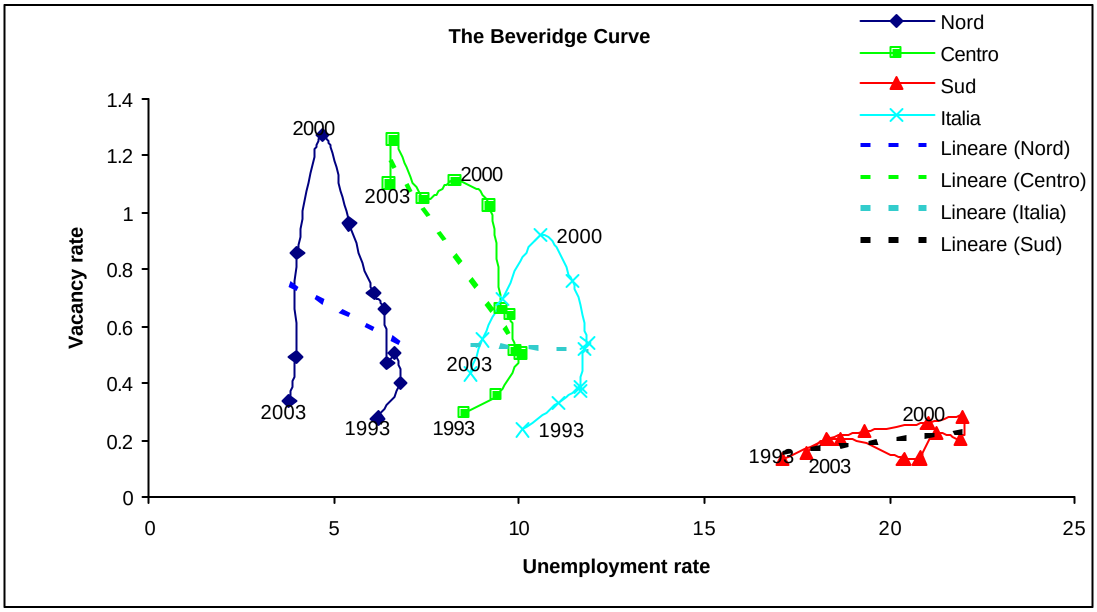
[7] See Abraham, 1987; Burch and Fabricant, 1968, 1971; Cohen and Solow, 1967, 1970;Gujarati, 1969.
[8] An increase in the advertising costs may result in a decline of the number of advertisem ents respect to vacancies; an increase of newspaper diffusion and of the width of the labour market may results in an increase of advertisements respect to vacancies, since the higher is the rate of newspaper diffusion and the width of the market, the lower are the costs to reach a potential jobseeker. Furthermore, during the upturns entrepreneurs will have quite optimistic expectations and will invest in jobseeking more easily.

Figure 2.1– The Beverdige curve for each geographical area, 1993-2003, quarterly series



10. The main objective of this analysis is in fact not specifically that of describing the functioning of the labour market, but the assessment of the predictive capabilities of the vacancy series for the evaluation of the possibility of its use as a leading indicator for employment at a disaggregated level. In fact, in enucleating homogeneous vacancies by areas, professions or sectors, it's possible to see Beveridge relation to re-emerge [9], together with all its drawbacks (see figure 2.1). From figure 2.1 we can in fact perceive that the theoretical negative relationship between unemployment and job vacancy rates "visually" holds for Northern and Central Italy only (approximately 80% of the employment), while no relationship emerges for Southern Italy. As a result, in the aggregate data the relationship is not evident.
In a future work we will analyse the interrelations between different sections, focusing the attention on the attractive effects between submarkets.

III. Descriptive analysis of the dynamic properties of the series

11. The evaluation of the predictive capabilities of the job-vacancies CSA-ISFOL series (henceforth VAC) requires a preliminary analysis on the joint dynamic properties of the VAC, the employment (N) and unemployment (U) series, where the last two are available from the Italian statistical Office's Quarterly Labour Force Survey (Istat-RTFL).
Since our main interest is the evaluation of the possibility of using the ISFOL job vacancies series as a leading indicator for the employment/unemployment mid-term cyclic fluctuations (and also considering the standard production lag of the data), we prefer to employ seasonally adjusted data [10].

12. This choice is also supported by the evident cross-correlative incoherence emerging between the seasonal and cyclic components of the series. The expected positive (negative) correlation between vacancies and employment (unemployment), which is statistically relevant

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[9] Some interpretations relative to the effectiveness of the labour market or to the non univocal relation between workers and vacancies are not adaptable or readable in the same way as Lord Beveridge did. For example, job specialization seriously affect the validity of the idea that vacancies refer to a generally available jobs.
[10] Seasonal adjustment has been obtained employing the X12-Census algorithm.

only dynamically, is stronger when the series are seasonally adjusted, signalling that the presence of the seasonal components weakens the empirical relationships emerging at the lower frequencies. The cross-correlations between the seasonal components of the series have opposite signs, thus confirming that the expected correlations are not found at the higher frequencies.

13. The Beveridge relationship and its employment version hold mostly dynamically. Even if the *contemporaneous* correlations between seasonally adjusted series have the expected signs and are statistically meaningful (for the VAC-N relationship), the *dynamic* correlations between VAC and 16 leads of N and U, always statistically meaningful, are on average and respectively equal to 0.65 and -0.55, while those between VAC and 16 lags of N and U are generally statistically meaningless and on average equal to 0.34 and -0.07 respectively.

14. By repeating the analysis on the geographical breakdown, with the exception of the VAC-U correlations in the South area, we have obtained results in line with the evidence emerging at the national level.

15. Since data on the skill level of the unemployed were unavailable, the cross-correlative analysis by skill level has been performed only for the VAC-N relationship. Interestingly, the dynamic correlations are statistically meaningful but inverted for the low skill group, while those for the mid and high skill groups are in line with the evidence emerging at the aggregate national level. These results, signalling that the Beveridge relationship does not hold for the low skilled group, suggest that, since the cross-correlative structure is substantially balanced, the empirical relationships are not capturing an excess of demand situation, but probably the presence of a market for the absorption of dismissed labour positions. The Granger-causality is thus inverted for the low skill group, in other terms, the employment variations lead the vacancy fluctuations. The overall result of this preliminary descriptive analysis is encouraging. The dynamic properties CSA-ISFOL *help-wanted* series are in fact potentially consistent with the minimal requirements for a proper use as a leading indicator of the labour market fluctuations. In particular, the strong dynamic asymmetry between VAC and N and VAC and U has shown that VAC tends to lead N and U along the cycle and that this behaviour is statistically relevant.

16. In the following section, the dynamic properties of the series will be modelled and studied employing econometric techniques. The resulting estimated structures will be the basis for the simulation of the employment and unemployment responses to vacancies shocks, in other terms, for the impulse response analysis (IR). The IR analysis will give appropriate predictions of the predictive capabilities of the series for the decompositions employed in this analysis.

IV. Econometric formulation and evaluation of the theoretical relationships

17. Since economic theory is not particularly informative on the specific dynamic structure of the Beveridge relationship, a useful starting structure is the Unrestricted Vector Autoregressive representation (UVAR), where each variable is function of the lags of the whole set of variables of the system, which order is chosen according to Bayesian selection criteria such as the SBC. The presence of integrated processes entering the VAR (the series are not stationary), requires of working with its stationary representation, the Vector Error Correction Model (VECM). The VECM also allows a Vector Moving Average (VMA) formulation for the simulation of the Impulse Response Functions (IRFs).

18. First of all, the statistical properties of the series will be appreciated employing the standard tests of integration such as the Dickey-Fuller and the Augmented Dickey-Fuller tests.

On the basis of the results of these tests three different cases can be distinguished: *i)* the series are all stationay in levels; *ii)* the series are all non-stationary in levels and stationary in first differences; *iii)* some of the series are stationary in levels and others are stationary in first differences. The VAR is the standard formulation for the first case with variables entering all in levels, as it is for the third case but with variables entering in levels if stationary and in differences if non-stationary. In the second case it is necessary first to check for cointegration between the variables. If cointegration is not present, then the VAR is still the reference formulation but the variables are entered after first differencing. If there is cointegration, the appropriate formulation is the VECM, where the first differenced variables are entered jointly with the vector of the vector of the deviations from long-run equilibrium.

19. Hence, the second step of the analysis, once the statistical properties of the series have been defined, will be the evaluation of the presence of cointegration. This test is performed, in a VAR context, employing the Johansen (1991, 1995) LR test statistics.
Once the cointegrating vectors are identified and an appropriate formulation has been obtained, the analysis will be focused at obtaining and appreciating the IR results.

4.1. Integration and cointegration

20. The DF-ADF test results show that all the variables considered in this analysis are integrated of order one at the 95% level, i.e. they are I(1) [11]. These results imply that the reference formulations can only be two: the VAR in differences if the variables are not cointegrated or the VECM if cointegration is present.
The starting VAR formulation for the different models is the following:

$$\mathbf{y}_t = \sum_{l=1}^{p} \mathbf{?}_l \mathbf{y}_{t-l} + \mathbf{e}_t, \quad E(\mathbf{e}_t) = \mathbf{0}, \quad E(\mathbf{e}_t \mathbf{e}_t^{'}) = \mathbf{S}, \quad E(\mathbf{e}_t \mathbf{e}_t^{'}) = \mathbf{S} \quad \forall t \neq s \qquad (4.1)$$

where, according to the aggregation employed:

$$\mathbf{y}_t = [n, vac]^{'};\ [u, vac]^{'};\ [n_i, vac_i]^{'};\ [n_j, vac_j]^{'}, \quad i = 1 \ldots 4,\ j = 1,2,3.$$

Lower case letters indicate logs, i indexes the four geographical areas and j the three skill levels.
The order of lag p is chosen according to the Schwartz Bayesian Criterium (SBC).
The generic VAR formulation 4.1 has the following VECM representation:

$$\Delta \mathbf{y}_t = \mathbf{a} - \mathbf{a}\mathbf{ß}^{'}[\mathbf{y}_{t-1} - \mathbf{t}(t-1)] + \sum_{l=1}^{p-1} \mathbf{G}_l \Delta \mathbf{y}_{t-l} + \mathbf{e}_t, \qquad (4.2)$$

where $\mathbf{a}$ is a vector of deterministic terms such as constants and short-run dummies, $\mathbf{ß}$ contains the long-run equilibrium relationships (hence the short-run disequilibrium $\mathbf{ß}^{'}\mathbf{y}_t = \mathbf{z}_t$), $\mathbf{a}$ the loading coefficients (or error-correction terms), $\mathbf{t}$ the restricted deterministic trends [12] and $\mathbf{G}_l$ the coefficients of the lags of the differenced variables.

[11] See the appendix at the end of the paper for the table containing the DF-ADF tests (table A1).
[12] The inclusion of a restricted deterministic trend aims at accounting for constant modifications of the equilibrium relationship. These modifications are equilibrium-consistent if related to modifications in variables not considered in the model. In our case, since U is the ratio between unemployed and labour force, the trend can be assumed as produced by a trending labour-force. Hence, the restricted trends are zero when the VAC-N relationship is considered.

21. Notice that, since only differenced variables and deviations from equilibrium enter the VECM, in the presence of cointegration, i.e. of stationary deviations from equilibrium, all the elements are I(0), hence the system is balanced.

22. The Johansen tests show that a long-run relationship is found at the 95% level for all the specifications except those between VAC and U in the second and fourth geographical areas, where it is evident only at the 90% level. The deterministic trend is negative and generally meaningful.

23. Since we are dealing with bivariate structures, the identification of the generic long-run relationships is obtained by means of the normalisation only. Hence, the generic cointegratin vector is $[1, b]'$ while the (stronger) theoretical long-run restriction leads to the $[1,-1]'$ and $[1,1]'$ vectors for respectively the VAC-N and VAC-U relationships. The further restrictions are over-identifying, hence they are testable employing standard Wald tests [13]. The results of the cointegration tests and of the over-identifying restrictions for the associated cointegrating vectors are reported in table A2 in the appendix.

24. The signs and the statistical relevance of the loading coefficients suggest two important considerations. First, since they are always negative and meaningful in the ECMs for N and U and not in the ECMs for VAC, this implies that N and U respond to disequilibrium more than VAC does. In other terms, VAC is weakly exogenous (Hendry, 1995) for N and U [14]; second, since their dimensions are moderate, the equilibrium properties of the relationship are expected to be weak and thus the disequilibrium persistence profiles defined over extended periods.

4.2. Persistence profiles, impulse responses and variance decompositions

25. The persistence profiles (PPs) provide estimates of the time elapsed by the system's long-run relations to attain their equilibrium status once a generalised shock hits the system (Lee e Pesaran, 1993, Pesaran e Shin, 1996) [15]. The usefulness of dealing with PPs is that they give a guess of the time interval upon which it is reasonable to focus the attention when assessing the predictive capabilities of the VAC series.

26. The PP of the aggregate long-run VAC-N relationship shows that half-life disequilibrium (i.e. the time elapsed for a 50% absorption of disequilibrium) is approximately 5-6 quarters (see

[13] The identification of the long-run equilibrium relationships can be obtained employing purely statistical methods (Johansen, 1988, 1991) or imposing restrictions based on economic reasoning (King, Plosser, Stock e Watson, 1991, Pesaran, 1997, Pesaran and Smith, 1999, Garratt *et al.*, 2000, 2003).

[14] This implies that the dynamic relationship for VAC can be conveniently marginalised. Furthermore, since the SBC often preferred a first order lag structure for the levels VAR (see table A2), this means that the lags of N and U do not enter the equation for VAC. When a second order is chosen, the N and U lags are generally meaningless. Hence, there are signals of "strong exogeneity" of VAC and this reinforces the evidence that VAC is a good predictor for N and U.

[15] The persistence profiles in the bivariate case are given by: $PP(\boldsymbol{\beta}'\mathbf{y}_t, N) = \frac{\boldsymbol{\beta}'\mathbf{A}_N \boldsymbol{\Sigma} \mathbf{A}'_N \boldsymbol{\beta}}{\boldsymbol{\beta}' \boldsymbol{\Sigma}_N \boldsymbol{\beta}}$, $N = 0,1,2,\ldots$, where N is the simulation horizon and $\mathbf{A}_N = \mathbf{C}(1) + \mathbf{C}^*_N$ is the coefficients matrix of the MA representation of the VECM. If there is cointegration $\mathbf{A}_t$ tends to a non-zero limit value $\mathbf{C}(1)$ while at time zero we have $\mathbf{A}_0 = \mathbf{I}_m$. The $\mathbf{C}^*_t$ matrix contains the transitory components of the system, which values converge towards zero while N goes to infinity. This implies that the ratio written above is unity at the impact and converges towards zero as N grows, since the presence of cointegration also establishes that $\boldsymbol{\beta}'\mathbf{C}(1) = \mathbf{0}$.

figure A1 in the appendix). Concerning the geographical areas, the maximum persistence is obtained for NW (half life disequilibrium is approximately 36 quarters), while the minimum persistence is obtained for South, where the half life deviation is approximately 1 quarter (figure A1 in the appendix). PPs are more homogeneous for the long-run VAC-U relationship, for which the half-life deviations are always below six quarters (figure A2 in the appendix).

27. Interestingly, the PPs of the long-run VAC-N relationship for the different skill-groups show very different dynamics. The low skill group PP is aligned with that obtained at the national level, while persistence appears increasing with the skill level considered (see figure A3 in the appendix). This may signal that skilled labour scarcity of supply may affect the equilibrating response, which is strong for the low skill group and weak for the high skill group. As long as the vacancies registered in the NW are proxies for the most specialised positions and those in the South for the less specialised, this scarcity explanation would explain also the geographical differences in persistence.

28. The impulse response analysis tracks the dynamics of each variable of the system stimulated by an impulse shock hitting a definite variable or equation of the system itself. In a CI VAR-VECM environment, the long-run response is dominated by the number of unit roots of the system, i.e. the difference between the order and the rank of **ß**[16]. A complementary indicator is the Forecast Error Variance Decomposition[17]. It provides a decomposition of the relative weights of the single variables shocks in explaining the variability of the other variables errors at different time leads. If the FEV of a variable at a given horizon is explained entirely by idiosyncratic shocks, then its forecast at that horizon does not improve when considering the behaviour of other variables. Symmetrical considerations are valid in the case in which the FEV of a variable is dominated by other variables shocks.

29. The IRFs and FEVDs highlight some interesting dynamical properties of the series. The figures below show the IRFs and the FEVDs for the N-VAC and the U-VAC VECMs in the aggregate, or national, version (the figures relative to the geographical and the skills decompositions are given in the appendix).

Figure 4.1: Impulse responses and variance decomposition for the N-VAC and U-VAC relationships

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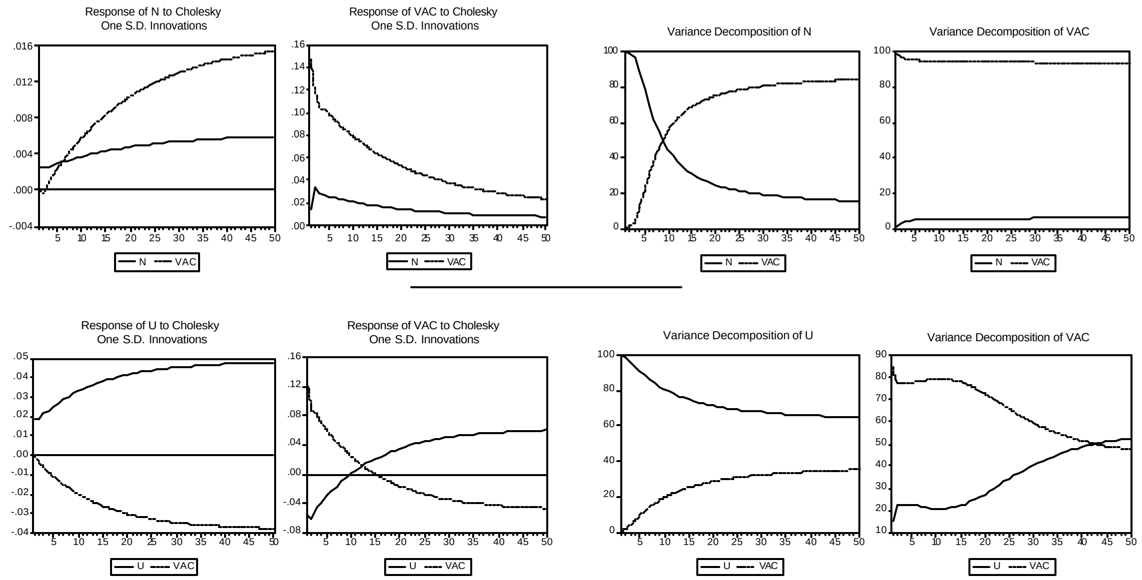
[16] The formulation employed here for the impulse responses is valid for orthogonalised shocks and is the following: $IR_{ijN} = \mathbf{e}'_j \left(\mathbf{C}(1) + \mathbf{C}^*_N\right)\mathbf{T}\mathbf{e}_i = \mathbf{e}'_j \mathbf{A}_N \mathbf{T}\mathbf{e}_i, \quad i, j = 1,\ldots, \quad m = 2$, where $\mathbf{T}$ is a triangular matrix such that $\mathbf{S} = \mathbf{T}\mathbf{T}'$, $\mathbf{e}$ is a shocks selection vector and $\mathbf{C}(1)$ e $\mathbf{C}^*_N$ are, respectively, the permanent and transitory components responses of the MA VECM representation. Since $\lim_{t\to\infty} \mathbf{A}_t = \mathbf{C}(1)$, the impulse responses of the two variables of the system will converge towards non zero limiting values and their ratio will be synthesized by the cointegrating vector $[1, b]$. Notice that the orthogonalised impulse responses are not invariant to the variables ordering, since $\mathbf{T}$ is not unique in the possible decompositions of $\mathbf{S}$. The decomposition substantially induces a recursive system. We are thus assuming that the employment shock (on N) has immediate effects on VAC while the opposite is not true. This hypothesis is not particularly restrictive for a bivariate system. Furthermore, it is not theoretically heroic to assume that the employment shock has contemporaneous effects on vacancies, while the vacancy shock has not immediate effects on employment.

[17] The othogonalised forecast error decomposition is given by the following ratio: $FEV_{ijN} = \dfrac{\sum_{t=0}^{N} \left(\mathbf{e}'_i \mathbf{A}_t \mathbf{T}\mathbf{e}_j\right)^2}{\sum_{t=0}^{N} \mathbf{e}'_i \mathbf{A}_t \mathbf{S}\mathbf{A}'_t \mathbf{e}_i}$, where the matrices are known from the previous formulae. Even in this case results may depend on the particular ordering of the variables in the system.



Sample: 1993:1-2003:4. Computations executed with Microfit 4.0

30. The total employment response to innovations in N and VAC clearly show the predictive capability of VAC for N. Differently from the employment shock, the vacancy shock has a considerable lagged impact on employment. The impulse response of N to a shock in VAC is approximately zero for the first two quarters, then it shows a steep increase, with logistic evolution, for stabilising after 40-50 quarters. The response of N to the shock in VAC becomes bigger than the response to an idiosyncratic shock after only 6 quarters. Contrary, the impulse response of VAC to an employment shock is moderate and always below the response to idiosyncratic shocks.

31. A confirmation of the IRF results comes from the analysis of the FEVDs. The percentage of employment error variance explained by a vacancy shock is zero at lead 1 quarter, 50% at lead 10, 65% at lead 15, 75% at the lad 20 and 80% at the simulation horizon, fixed at 50 quarters. Contrary, the error variability for VAC explained by an employment shock is negligible for the whole simulation window, showing that its variance depends mostly by idiosyncratic shocks.

32. Results are qualitatively in line, even if weaker, when the U-VAC relationship is considered. As expected, in this case the vacancies shock leads to (lagged) reductions in unemployment. Anyway, the percentage of error variability of U explained by the vacancy shock is lower than those of N. It is in fact approximately 20% at the lead 10, 25% at the lead 15, 30% at lead 20 and only 40% at the 50 periods ahead horizon. Differently from the employment dynamics, the unemployment fluctuations appear dominated by idiosyncratic shocks, but the predictive capabilities if the VAC series, even if quantitatively reduced, are qualitatively confirmed.

33. The IR and FEVD analysis for the geographical decompositions [18] substantially confirms the results of the national aggregate, showing also the presence of some interesting peculiarities. When the N-VAC relationship is considered, the IRs are strictly comparable with the national outcomes only in the first two geographical areas. The response is in fact strong but slower in the Central Italy and weak but quicker in Southern Italy. Accordingly, the error variance of

[18] The tables of results are given in the appendix.

employment explained by a vacancy shock for the third area is 25% at lead 10, 45% at lead 15, 60% at lead 20, and 75% at lead 50. For the South the same error variance is instead 30% at lead 10, 40% at lead 15, 42% at lead 20 and then stable for the further leads until the simulation orizon is reached.

34. When the U-VAC relationship is considered results are newly different. We have seen at the aggregate level that the relative weight of idiosyncratic shocks as a source of fluctuations is bigger for unemployment than for employment. The application of the analysis to the geographical breakdown shows that this outcome is explained by the results obtained for the second and third geographical areas. In these areas the percentage of employment variance explained by the vacancy shock a the 50 quarters ahead horizon is only 25%, while the percentage of variance explained by the same shock is approximately 65% in the first and fourth areas.

35. The repetition of the analyses for the different skill groups provides further indications on the heterogeneous dynamical properties of the series. From the cross-correlative and the PPs analyses we have obtained almost contradictory results for the low skill group. In particular, we observed an inverted correlative structure at all leads and lags, while the PPs have shown that the long-run equilibrium properties for the first group are the most similar to those observed at the aggregate level.

36. The impulse response functions and the forecast error decompositions confirm the results obtained with the persistence profiles. The IRs show that the employment response to a vacancy shock is positive for each skill group considered, and that for the second and third groups the saturation of the effects is not fully completed at the 50 periods ahead horizon. The dynamic response of the low skill group, coherently with its PP, is instead in line with that obtained at the aggregate level. Since the aggregate behaviour is the outcome of the underlying dynamics of the different decompositions, it appears dominated by the behaviour of the low skill labour market partition.

37. On this regard, it is useful to highlight that the first group contains not only the vacancies for which unskilled workers are requested, but also those for which no explicit skill request is made in the newspaper advertising, on the grounds that if a skill distinction is absent, the vacancy can be considered suitable for low skilled also. If the skill request is instead relevant also in the absence of an explicit request, for example when it is implicit in the task being searched, the meaning of the low skill group is highly distorted[19].

38. The analysis of the forecast error decompositions shows that the percentage of employment variance explained by a vacancy shock in the different skill groups is always bigger than that explained by the same shock in the aggregate case at the simulation horizon, even if different are the speeds of convergence towards the respective thresholds. For the first, second and third skill groups respectively, this percentage is of the order of 40%, 25% and 20% at the lead 10; of nearly 50% at lead 15, 60% at lead 20 and of 90% at the 50 periods ahead horizon for the second and third skill group, while the percentage of variance explained reaches a maximum of approximately 80% for the first skill group.

[19] Since there is a majority of cases in which the skill request is absent, the distortion of the meaning of the first skill group is highly probable.

39. Coherently with the results obtained at the national level, the percentage of error variance of VAC explained by an employment shock is virtually zero for all the groups and at all leads in the simulation window.

40. These results, even considering the drawbacks and precautions emerged during the analysis, signal that the vacancies are a potential predictor of the employment fluctuations and that thus they can be employed in the definition of a leading indicator for the labour market trends. The fact that the relationships hold also when the series are decomposed suggests a selective definition and use of the leading indicator.

V. Conclusions

41. The main objective of this analysis has been the assessment of the predictive capa bilities of the vacancy series for the evaluation of the possibility of its use as a leading indicator for employment at a disaggregated level. According to the historical data, our modelling and testing strategy has shown that employment and unemployment fluctuations can be predicted by movements in the vacancy series. The impulse response functions and the forecast error variance decompositions in particular have highlighted the predictive implications implicit to the cross-correlative structure of the series considered in the analysis.

42. The identification of these time dependencies allows the use of the Isfol-CSA survey on job vacancies for the definition of a labour market index or simply for its use as a detailed leading indicator for labour market fluctuations. The availability of the sectional dimension of the data with moderate production lags permits the calibration of the indicators respect to important aspects/decompositions of the employment and unemployment series. In principle, this fact implies that they can be employed by the policy makers not only for forecasting purposes, but most importantly for targeting detailed policy actions towards specific groups and sections of the labour market.

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Appendix for results

Table A1. DF-ADF tests results

variable	lag (SBC)	first differences test	P(H0)	lag (SBC)	levels test	P(H0)
VAC	0	-6.384	0.000	0	-1.743	0.403
VACga1	0	-5.176	0.000	0	-1.245	0.646
VACga2	0	-10.324	0.000	1	-1.911	0.324
VACga3	0	-9.781	0.000	1	-1.307	0.618
VACga4	0	-8.914	0.000	1	-2.560	0.109
VACsk1	0	-7.354	0.000	0	-2.018	0.279
VACsk2	0	-12.023	0.000	1	-1.863	0.346
VACsk3	0	-4.019	0.003	1	-1.724	0.412
N	0	-4.165	0.002	0	1.878	1.000
Nga1	0	-6.702	0.000	0	0.986	0.996
Nga2	1	-5.973	0.000	2	0.815	0.993
Nga3	0	-6.411	0.000	0	1.645	0.999
Nga4	0	-5.089	0.000	0	0.228	0.971
Nsk1	0	-4.838	0.000	0	-2.698	0.083
Nsk2	0	-8.952	0.000	0	1.063	0.997
Nsk3	0	-7.192	0.000	0	0.187	0.969
U	0	-6.384	0.000	0	-1.743	0.403
Uga1	0	-6.252	0.000	0	-0.065	0.947
Uga2	2	-4.059	0.003	3	0.133	0.964
Uga3	0	-9.029	0.000	1	0.262	0.973
Uga4	1	-3.373	0.018	2	-0.903	0.777
Usk1	0	-7.753	0.000	0	0.551	0.987
Usk2	0	-6.369	0.000	1	-2.343	0.164
Usk3	0	-7.587	0.000	0	-4.453	0.001

Sample: 1993:1-2003:4. Computations executed with Microfit 4.0

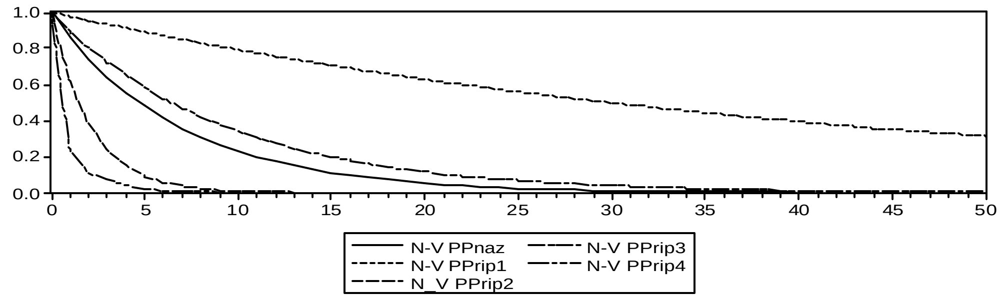
Table A2. LR Johansen test results, over-identification tests and cointegrating vectors

Relation	VAR order (SBC)	Det. Components	P (H1: 1CV)	Chi-sq LR over. Id	CV
N - VACnaz	1	No int., no trend	95%	12.48	[1, -0.964]
N - VACrip1	1	No int., no trend	95%	3.254*	[1, -1]
N - VACrip2	1	No int., no trend	95%	3.196*	[1, -1]
N - VACrip3	1	No int., no trend	95%	0.523*	[1, -1]
N - VACrip4	2	No int., no trend	95%	14.97	[1, -1.114]
U - VACnaz	1	UR int., restr. Trends	95%	1.608*	[1, 1, 0.02]
U - VACrip1	1	UR int., restr. Trends	95%	2.196*	[1, 1, 0.03]
U - VACrip2	2	UR int., restr. Trends	90%	0.263*	[1, 1, 0.01]
U - VACrip3	2	UR int., restr. Trends	95%	0.039*	[1, 1, 0.02]
U - VACrip4	1	UR int., restr. Trends	90%	3.373*	[1, 1, 0.03]
N - VACsk1	1	No int., no trend	95%	36.59	[1, -0.883]
N - VACsk2	1	No int., no trend	95%	14.51	[1, -1.382]
N - VACsk3	2	No int., no trend	95%	9.454	[1, -1.226]

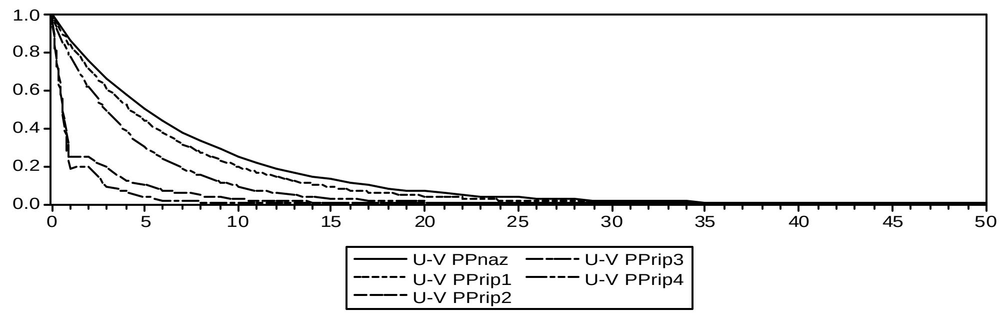
Sample: 1993:1-2003:4. Computations executed with Microfit 4.0

Figure A1. Persistence profiles

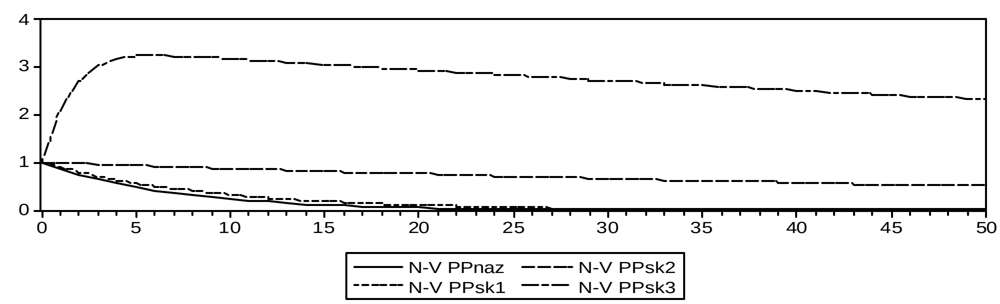
a) N-VAC relations, national level and geographical areas decompositions



b) U-VAC relations, national level and geographical areas decompositions



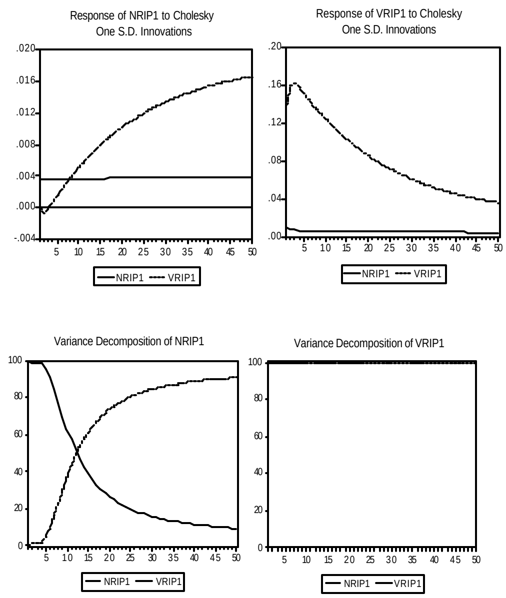
c) N-VAC relations, national level and skill groups decompositions



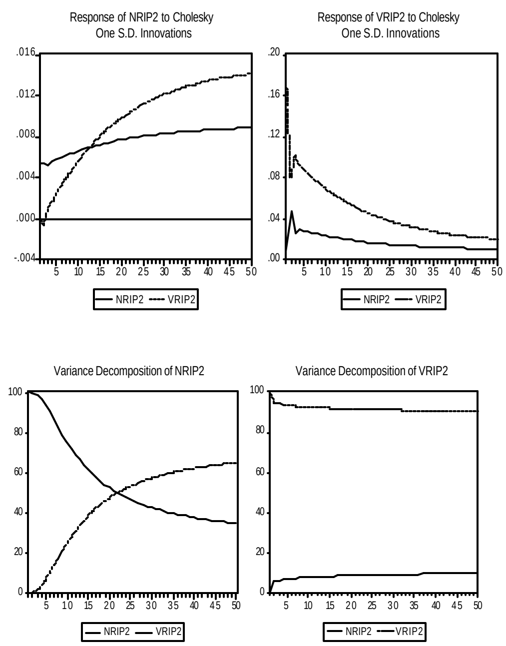
Sample: 1993:1-2003:4. Computations executed with Microfit 4.0

Figure A2: Impulse responses and variance decompositions in the four geographical areas for the relationship N-VAC

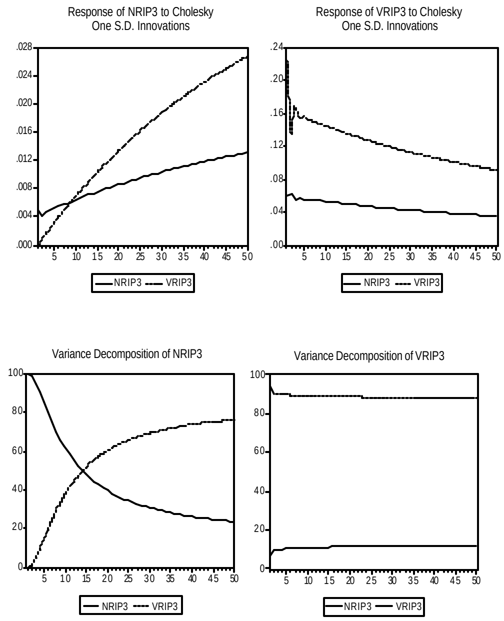
a) First geographical area: North West



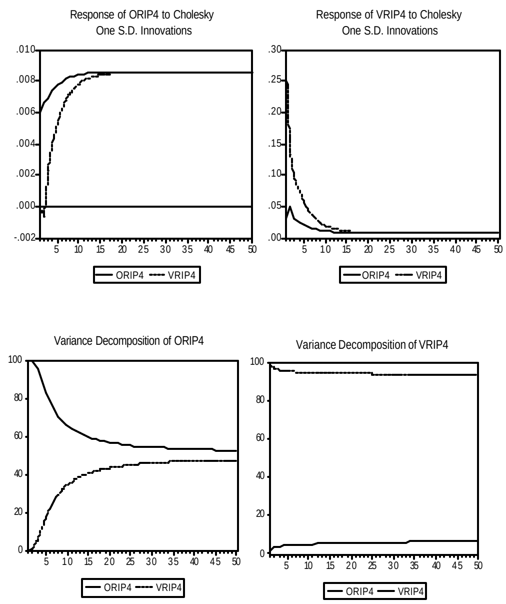
b) Second geographical area: North East



c) Third geographical area: Central Italy



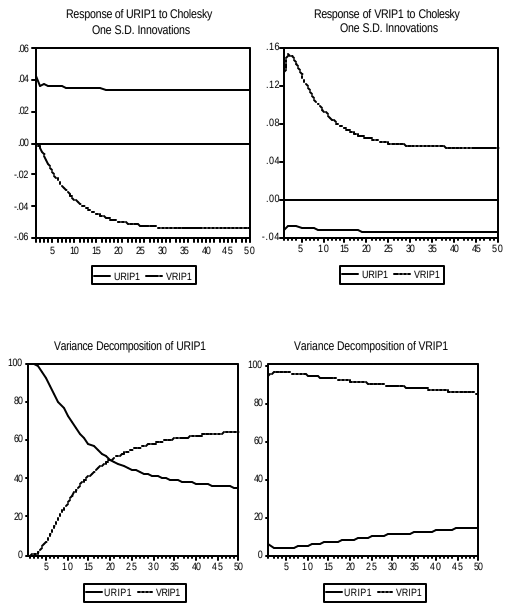
c) Fourth geographical area: Southern Italy and islands



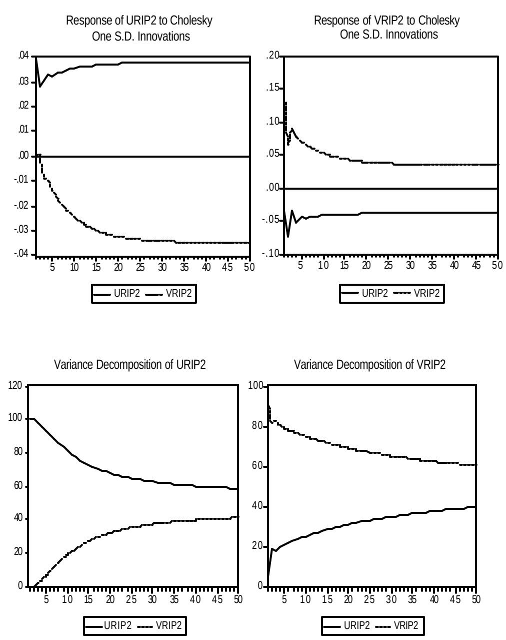
Sample: 1993:1-2003:4. Computations executed with Microfit 4.0

**Figure A3: Impulse responses and variance decompositions in the four geographical areas
for the relationship U-VAC**

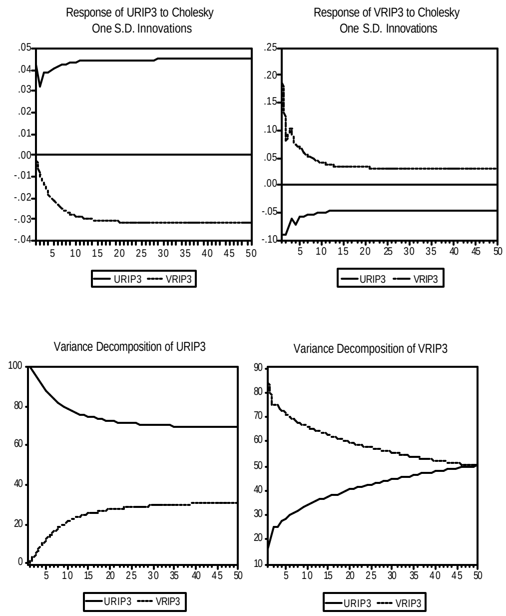
a) First geographical area: North West



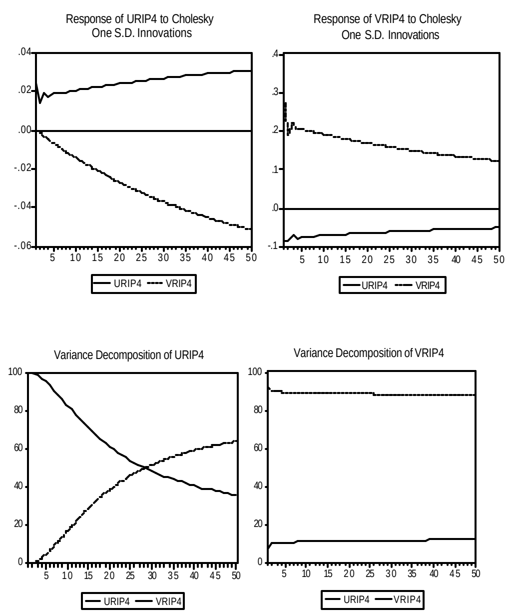
b) Second geographical area: North East



c) Third geographical area: Central Italy



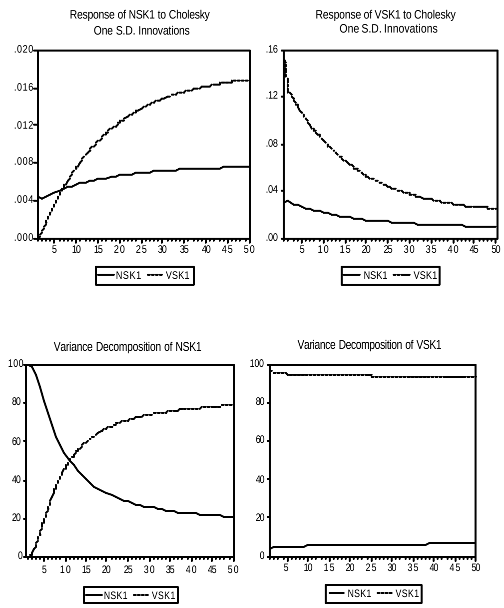
c) Fourth geographical area: Southern Italy and islands



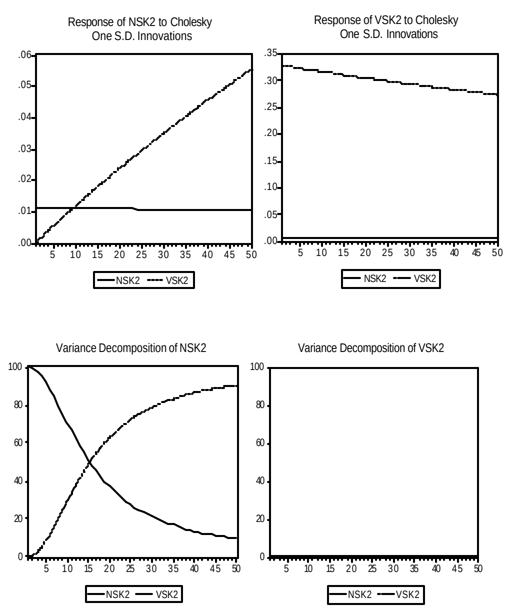
Sample: 1993:1-2003:4. Computations executed with Microfit 4.0

Figure A4: Impulse responses and variance decompositions in the three skill groups for the relationship N-VAC

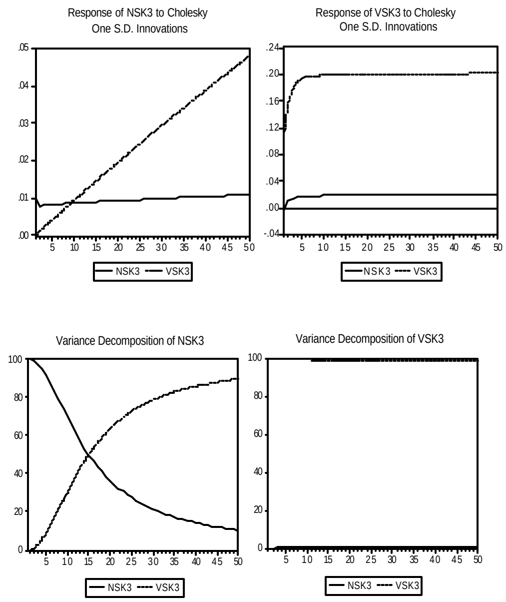
a) First skill group: low skills



b) Second skill group: medium skills



c) Third skill group: high skills



Sample: 1993:1-2003:4. Computations executed with Microfit 4.0
