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WHY DO FIRMS HIRE ON A FIXED-TERM BASIS? EVIDENCE FROM LONGITUDINAL DATA

by Fabrizio Colonna[♦] and Giulia Giupponi[*]

Abstract

The political and economic debate in Italy accompanying the labour market reforms of recent decades has often focused on the use of fixed-term contracts. Fears have frequently been raised about the possible use of temporary contracts not to satisfy short-term productive requirements (‘buffer-stock’ motive) or to screen suitable candidates for permanent positions, but rather to manage worker turnover by avoiding the higher costs associated with open-ended contracts (especially those related to dismissals). While it is very difficult to separate out the various economic rationales for using fixed-term contracts, this paper aims to assess to what extent Italian firms use fixed-term contracts to meet monthly production needs. A simple correlation analysis shows that firms in sectors with the strongest variations in monthly production levels make more extensive use of temporary contracts: almost one third of fixed-term hiring is attributable to seasonality. Using two behavioural models where firms choose whether to hire and on what contract, it is estimated that monthly production peaks account for a non-negligible share (at least 25 per cent) of fixed-term hires.

JEL Classification: J23, J41.
Keywords: temporary jobs, fixed term contracts, seasonality.

Contents

♦ Bank of Italy, DG Economics, Statistics and Research.
* London School of Economics

Introduction

In the past few decades, the Italian labour market has witnessed a steady increase in the share of temporary employment over total payroll employment; a similar, though smaller increase, has been recorded in OECD countries on average (Figure 1). The rise of the incidence of fixed-term employment on total employment is the consequence of a series of two-tier labour market reforms that increased flexibility at the margin and led to more intensive use of temporary contractual arrangements.

The extant literature has rationalized firms preference for fixed-term contracts over permanent ones, providing several possible motives. Fixed-term contracts may fill a short-term position – working as buffer stocks and providing increased flexibility in response to the seasonality/cyclicality of production (Cahuc et al., 2012.). They can also be used for screening purposes, in order to assess candidates' suitability for a permanent position.

Given a strictly positive (albeit small) probability that even a permanent position may have to be terminated, and depending upon the relative size of the costs incurred for laying off permanent contract workers and those for the hiring process, firms may nonetheless prefer to fill a de facto permanent position by rolling over fixed-term workers. This kind of churning, with worker turnover in excess of job turnover, is more likely to emerge whenever the job in question doesn't hinge heavily on the worker's ability and characteristics and there is not much on-the-job skills acquisition (employers have an incentive to destroy old matches and form new ones (Blanchard and Landier, 2002). It may also depend on the monitoring cost structure of the enterprise (Burgess et al., 2000). While generally speaking, workers on fixed-term contracts suffer in terms of job stability, investment in human capital, and long-term employment prospects compared to permanent workers, the reason why employers choose to hire on a fixed-term basis is crucial for its implications in terms of productivity growth. The use of temporary contracts as buffer stocks facilitates labour adjustments, reduces hoarding and therefore enhances productivity (Autor et al., 2007; Bassanini et al., 2008). Their use as screening devices, instead, is related to enhanced productivity growth arising from better information about match quality, and ultimately more stable employer-employee relationships and a higher investment in human capital (Nagypal, 2001; Faccini, 2007; Portugal and Varejao, 2009). Conversely, the churning of fixed-term workers, the lessening of workers' rights and bargaining position and the weakening of both firms' and employees' incentives to invest in the acquisition and development of job- specific skills, might have adverse effects on productivity. Moreover, exacerbating workers' turnover negatively impacts their welfare, generating job insecurity, which – in a context of financial market imperfections – is likely to translate into income instability.

While separately identifying churning from the other possible uses of temporary contracts would not be an easy task,[1] attempting to assess the relative weight of the 'buffer stock' hypothesis might have significant policy conclusions. For instance, only allowing for an extended probationary period of permanent contracts, while strongly limiting the use of fixed-term ones, might be detrimental if temporary contracts are often used to adjust production to seasonal or cyclical productivity shocks.[2]

Our empirical analysis investigates the relationship at the sector level between the use of fixed-term and permanent contracts, and the seasonal and cyclical components of the index of industrial production. Three

[1] We do not go into the many details of each possible policy tool. In any event we deem unfeasible, or at least extremely costly, the option of attempting to define very narrowly the cases in which the positions to be filled have to be considered as temporary (so allowing the free use of fixed-term contracts but only in those precisely defined cases). Indeed, as a matter of fact such a 'legalistic' approach has been progressively abandoned as legal consultants more than firms or workers appear to benefit from it.

[2] Although some of these shocks might be predictable (for instance those linked to seasonal activities), the analysis makes no distinction between the predictable and unpredictable parts of the various time-series components.

different exercises are carried out. First a cross-sector correlation analysis is performed to measure how much of the differences in the use of fixed-term contracts can be explained by the dispersion of the seasonal component of production. Then, two different dynamic models are estimated, where firms respond to production shock by hiring (or not) on a temporary or a permanent basis. Overall, the findings point out that seasonality explains at least one fourth of firms' hiring on a fixed-term basis.

The data

The data used for the counting of fixed-term/permanent contracts are taken from the *Campione Integrato delle Comunicazioni Obbligatorie* (CICO), a random sample of employees and quasi-employees from the administrative dataset *Sistema delle Comunicazioni Obbligatorie*.[3] The random sample consists in the population of individuals born on 48 different days of the year, whose employment contracts underwent some modification (hiring, termination, extension, transformation) between 1 January 2009 and 31 December 2013. The database is made of matched employer-employee data for a total of around 8 million observations and provides information on the employee (identification code, year of birth, gender, citizenship, education level, region of birth, residence and work), the contract (start date, termination date, contract type, full/part time, professional qualification, reason for termination, monthly wage at start date, collective labour agreement), the employer (identification code) and the sector of affiliation (Ateco 2007 classification, i.e. the Italian version of NACE Rev. 2).

Table 1 displays some summary statistics on the incidence of different contract types on the total number of contracts started between 2009 and 2013, and the distribution of fixed-term contracts by duration. The statistics are reported for the full sample (including manufacturing, construction and services) and for the subsample of manufacturing firms, on which the analysis focuses. Fixed-term and open-ended contracts account for the bulk of new hiring. The incidence of fixed term-contracts is 20% larger in the manufacturing sector than in the full sample. While in the manufacturing sector the majority of fixed-term contracts has a duration of between one month and one year, in the full sample one quarter of the contracts has a duration of less than one week. Thus, on average, hiring in the manufacturing sector is more concentrated on fixed-term contracts of medium length compared to the overall economy.

Compiled by the Italian National Institute of Statistics (ISTAT), the index of industrial production measures the evolution of the volume of industrial production (excluding construction). The index, based on a survey of a longitudinal panel of enterprises, is calculated with reference to the base year 2010 using the Ateco 2007 classification and is available from January 1990 to May 2014. The series is seasonally adjusted using a six-month moving average; then, the seasonally-adjusted component is decomposed into cycle and trend by means of the Christiano-Fitzgerald filter. The index of industrial production is decomposed as:

$$\begin{aligned} Index\ of\ industrial\ production &= seasonality + seasonally\ adjusted\ component \\ &= seasonality + cycle + trend \end{aligned}$$

Figures 2, 3 and 4 illustrate this decomposition for the natural logarithm of the index of industrial production for the whole industrial sector (excluding construction).

[3] Since 2007 in Italy, employers have been obliged to communicate to the Ministry of Labour and Social Policy the hiring, extension, transformation and termination of each employment relationship, submitting an online form on a dedicated web portal. The obligation concerns all types of payroll employment, some forms of self-employment, and other contractual typologies. The main purpose and advantage of these compulsory communications is that it has unified into a single communication a series of different procedures that were previously required. The administrative nature of the data implies that they do not include illegal work, in which low-skilled immigrants are prevalently employed. Additionally, information about contract transformations and renewals seems to be poorly recorded.

The analysis focuses on the manufacturing sector since the index of industrial production is available on a monthly basis and on a fine//??// Ateco 2007 classification for this subset of the industrial sector. The analysis could be replicated for the service sector using the index of turnover instead of that of industrial production. However, this option has three major drawbacks: first, the index being quarterly, much of the short term dynamics would be lost; second, the data are scarcer and available at sector classifications which are less fine than the index of industrial production; lastly, given that service delivery and turnover are not necessarily concurrent, the association between turnover and employment decisions may be weak or display lags in a heterogeneous way.

Empirical analysis

Analysis of the variances

A first attempt to understand the importance of the 'buffer-stock hypothesis' is to see how much the variance of the index of industrial production explains the average number of new fixed-term and permanent contracts opened each month in each sector. The regression models to be estimated read:

i. $\bar{N}_{ij} = \alpha + \beta_1 Var(\ln Prod\ Ind)_j + \varepsilon_j$

ii. $\bar{N}_{ij} = \alpha + \beta_1 Var(\ln Prod\ Ind\ \ Seas)_j + \beta_2 Var(\ln Prod\ Ind\ \ Seas\ Adj)_j + \varepsilon_j$

iii. $\bar{N}_{ij} = \alpha + \beta_1 Var(\ln Prod\ Ind\ \ Seas)_j + \beta_2 Var(\ln Prod\ Ind\ \ Cycle)_j + \varepsilon_j$

where $\bar{N}_{ij}$ is the average number of new contracts of type i – either fixed-term (T) or permanent (P) – started in sector j each month. $Var(\ln Prod\ Ind)_j$, $Var(\ln Prod\ Ind\ \ Seas)_j$, $Var(\ln Prod\ Ind\ \ Seas\ Adj)_j$ and $Var(\ln Prod\ Ind\ \ Cycle)_j$ indicate the variance in sector j of the natural logarithm of the index of industrial production, its seasonal, seasonally adjusted and cyclical components, respectively. Using the Christiano-Fitzgerald filter, the stochastic cycles are filtered out at periods of less than 6 months, between 6 and 18 months, and between 18 and 36 months, in order to distinguish between short–, medium– and long–term cycles. Table 2 reports the sample mean and standard deviation of the variables used in this and subsequent analyses.

The results of the three models for fixed-term contracts are reported in Table 3, those for open-ended ones in Table 4. Although the results are insignificant overall, they suggest that each point of seasonal variance of (log) production is associated with an increase of almost 40 temporary contracts per month; the average variance, 0.16, can therefore statistically explain 6 temporary contracts, one quarter of the use of fixed-term contracts per sector. The same figure increases to 27% if we consider only fixed-term contracts with a duration of up to one month (regression results in Table 5).

Bivariate Heckman Selection Model

A second and more structured approach consists in modelling firms' hiring choices as a two-step process: first, firms decide whether to hire or not (extensive margin); secondly, they choose the number of new activations both on a fixed-term and a permanent basis (intensive margin). This process can be modelled as a bivariate Heckman selection model: the selection equation describes the extensive margin, while the outcome equation describes the intensive one, controlling for the selection process. More formally,

$$\begin{cases} N_j > 0, & if\ \pi_j X + \varepsilon_j > 0 \\ \ln N_j = X\beta_j + \nu_j\,, & if\ N_j > 0 \end{cases} \qquad j = \{T, P\} \qquad \nu_T, \nu_P, \varepsilon_T, \varepsilon_P \sim N(0, \Sigma)$$

where N_j indicates the number of contracts of type j opened in a given sector and month X is a vector of covariates including: the first differences of the natural logarithm of the seasonal (scaled to be non-negative) and cyclical components of the index of industrial production at the sector level; the first difference of the natural logarithm of the index of industrial production for total industry (excluding construction); fixed effects by sector (four digits Ateco 2007 code). The errors are jointly normally distributed with zero mean and variance covariance matrix Σ.[4]

According to this structure, the conditional mean of $\ln N_j$, conditional on selection and covariates, reads:

$$\begin{aligned} E[\ln N_j | X, N_j > 0, N_i > 0] &= X\beta_j + E[\nu_j | X, \varepsilon_j > -\pi_j X, \varepsilon_i > -\pi_i X] \\ &= X\beta_j + \rho_{\nu_j,\varepsilon_j} \frac{\varphi(\pi_j X)}{\Phi(\pi_j X)} + \rho_{\nu_j,\varepsilon_i} \frac{\varphi(\pi_i X)}{\Phi(\pi_i X)} \end{aligned}$$

$$\begin{aligned} E[\ln N_j | X, N_j > 0, N_i < 0] &= X\beta_j + E[\nu_j | X, \varepsilon_j > -\pi_j X, \varepsilon_i < -\pi_i X] \\ &= X\beta_j + \rho_{\nu_j,\varepsilon_j} \frac{\varphi(\pi_j X)}{\Phi(\pi_j X)} - \rho_{\nu_j,\varepsilon_i} \frac{\varphi(\pi_i X)}{1 - \Phi(\pi_i X)} \end{aligned}$$

where $i, j = \{T, P\}$. $\rho_{\nu_j,\varepsilon_j}$ indicates the correlation between ν_j and ε_j; the inverse Mills ratios $\frac{\varphi(\pi_j X)}{\Phi(\pi_j X)}$ and $\frac{\varphi(\pi_j X)}{1-\Phi(\pi_j X)}$ are the control functions that account for selection in the conditional mean.

Following the Heckman procedure, the selection equation is estimated using a bivariate probit model, in which the dependent variable is a dummy taking value 1 if $N_j > 0$ and zero otherwise, while the set of covariates is the vector X described above. The results are reported in Table 6: columns 1 and 3 report the probit estimates for fixed-term and open-ended contracts, while columns 2 and 4 report the corresponding marginal effects. The results suggest that the choice of hiring temporary workers is positively and significantly associated with the growth rate of the seasonal and the medium-to-long-term cyclical components of the index of industrial production. For instance, a 1% monthly increase of the seasonal component is associated with a 2% increase in the probability of hiring under fixed-term contracts (column 2). Concerning the extensive margin of open-ended hiring, instead, the long-term cycle appears significant. A 1% monthly increase of the 36 month cycle would more than double (118%, column 4) the number of permanent contracts activated on average each month.

The outcome equation is estimated by means of a seemingly unrelated regression model, in which the dependent variable is the natural logarithm of new contract openings – $\ln(N_T)$ and $\ln(N_P)$ –, while the set of covariates includes the vector X and the inverse Mills ratios obtained as predicted values from the bivariate probit model. The coefficient estimates, reported in Table 7, are all statistically significant. Comparing the magnitude of the coefficients in columns 1 and 2, it emerges that, along the intensive margin, seasonality and

[4] Identification of the selection equations requires normalizing the variance of ε_T and ε_P to 1; covariance terms can be non-zero.

cycle are associated more strongly with the use of fixed-term contracts, while the growth rate of i production in industry as a whole has a stronger association with the use of permanent contracts. The estimates in column 1 suggest that, on average, a 1% monthly increase of the seasonal component is associated with a 36% increase in fixed-term hiring. The overall impact of the seasonal component is computed by the following expression:

$$E\left[\frac{\partial \widehat{N}_T}{\partial SEAS}\cdot\frac{1}{\overline{N}_T}SEAS\right]=E\left[\left[\frac{\partial\Phi(\widehat{\pi}_T X)}{\partial SEAS}\cdot\ e^{X\widehat{\beta}_T}+\frac{\partial e^{X\widehat{\beta}_T}}{\partial SEAS}\cdot\Phi(\widehat{\pi}_T X)\right]\cdot SEAS\cdot\frac{1}{\overline{N}_T}\right]$$

That amounts to 24.8 %. All in all, the analysis seems to indicate that fixed-term contracts respond to short-to-medium term production trends, while open-ended hiring is more closely associated with long-term and aggregate ones.

Panel Vector Autoregression (VAR)

A third approach to analyze the ‘buffer-stocks hypothesis’ is to use a panel vector autoregression model (panel VAR) to account for potential lagged effects of production trends on hiring choices. The panel VAR model reads:

$$Y_{i,t}=\sum_{k=1}^{2}C_k Y_{i,t-k}+Bu_{i,t} \qquad Y_{i,t}=\begin{bmatrix}\Delta\ \text{ln Prod Ind Cycle}\\ N_P\\ \Delta\ \text{ln Prod Ind Seas}\\ N_T\end{bmatrix}$$

The vector Y is specified according to a Cholesky ordering, whereby variables placed higher in the vector contemporaneously affect those placed below, but not vice versa; for instance, N_P contemporaneously affects Δ ln Prod Ind Seas and N_T, but neither Δ ln Prod Ind Seas nor N_T contemporaneously affect N_P.

The resulting impulse-response functions are shown in Figures 5, 6 and 7, where the cycles are, respectively, less than 6 months, between 6 and 18 months, and between 18 and 36 months. In each figure, the second panel of the first column shows the response of N_P to a shock to Δ ln Prod Ind Cycle, while the fourth panel of the third column shows the response of N_T to a shock to Δ ln Prod Ind Seas. Interestingly, the panel VAR seems to confirm the previous results. Indeed, N_P is significantly sensitive to shocks to the long-term cyclical component of the index of industrial production (Figure 7), while N_T responds significantly to seasonality. In particular, the change of N_T in the first month after one standard deviation of the seasonality shock amounts to around 7 workers, corresponding to approximately 28% of the monthly average of N_T.

Conclusion

This paper investigates the ‘buffer stock hypothesis’ using three different analytical approaches. First, it looks at the simple correlation between measures of variability of the seasonal and cyclical components of the index of industrial production, and the average number of contract openings in each sector and month. Second, a bivariate Heckman selection model distinguishes an extensive and intensive margin of firms’ hiring choices, and looks at hiring as a selection process. Lastly, a panel VAR is used to allow for the presence of potential lagged effects of production dynamics on hiring choices. The findings seem to suggest that the use of temporary contracts is mainly associated with short-term dynamics of production (seasonality and cycle), while that of open-ended ones is linked to long-term and aggregate trends.

In the current debate on the dualism of the Italian labour market, there have been attempts at drastically limiting the scope of fixed-term contracts. However, the above evidence highlights that a considerable share of temporary work serves an important role of adjustment to production dynamics. Thus, completely depriving firms of this tool would appears unwarranted. Policy interventions should be capable of improving job stability and limiting the detrimental effects associated with the abuse of fixed-term contracts, but at the same time granting firms the flexibility they need.

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Tables

Table 1

New contracts by type and duration (%)	Full sample	Manufacturing
Open-ended contracts	20.69	19.75
Fixed-term contracts	53.13	74.29
Duration in days:		
0-5	25.54	3.81
6-30	15.11	2.57
31-90	19.59	29.29
91-365	34.69	42.70
365+	5.07	3.64
Observations	4086043	1298571
Apprenticeship	2.90	2.53
Collaboration	7.10	1.91
Domestic work	4.24	0.01
Partnership	0.33	0.17
Public administration	3.54	0.02
Other contract types	8.07	1.33
Observations	7957893	1801326

Table 2

Descriptive statistics of variables used in the analysis	Mean	Standard deviation
N_T	24.764	66.926
N_T with duration up to 1 month	3.72	12.482
N_P	12.340	32.223
Var ln Prod Ind	0.184	0.932
Var ln Prod Ind Seas	0.164	0.944
Var ln Prod Ind Seas-Adj	0.020	0.076
Var ln Prod Ind Cycle (6 months)	0.000	0.001
Var ln Prod Ind Cycle (18 months)	0.001	0.003
Var ln Prod Ind Cycle (36 months)	0.007	0.016
Δ ln Prod Ind Seas	0.0034	0.479
Δ ln Prod Ind Cycle (6 months)	0.0001	0.008
Δ ln Prod Ind Cycle (18 months)	0.0003	0.008
Δ ln Prod Ind Cycle (36 months)	0.0008	0.010
Δ ln Prod Ind Aggr	-0.0016	0.255

Table 3

VARIABLES	(1) Mean of fixed-term hiring	(2) Mean of fixed-term hiring	(3) Mean of fixed-term hiring
Var ln Prod Ind Seas		-0.828	39.553
		(4.263)	(26.784)
Var ln Prod Ind Cycle (6 months)			-45,424.884*
			(26,501.587)
Var ln Prod Ind Cycle (18 months)			3,386.798
			(3,751.273)
Var ln Prod Ind Cycle (36 months)			-376.555
			(443.127)
Var ln Prod Ind Seas-Adj		-46.808	
		(52.855)	
Var ln Prod Ind	-1.437		
	(4.306)		
Constant	24.871***	25.659***	26.244***
	(4.066)	(4.169)	(4.397)
Observations	191	191	191
R-squared	0.001	0.005	0.025

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4

VARIABLES	(1) Mean of open-ended hiring	(2) Mean of open-ended hiring	(3) Mean of open-ended hiring
Var ln Prod Ind Seas		-0.976	9.183
		(2.295)	(14.509)
Var ln Prod Ind Cycle (6 months)			-11,112.529
			(14,355.630)
Var ln Prod Ind Cycle (18 months)			877.795
			(2,032.025)
Var ln Prod Ind Cycle (36 months)			-183.085
			(240.037)
Var ln Prod Ind Seas-Adj		-20.726	
		(28.449)	
Var ln Prod Ind	-1.273		
	(2.316)		
Constant	12.575***	12.907***	13.424***
	(2.187)	(2.244)	(2.382)
Observations	191	191	191
R-squared	0.002	0.004	0.012

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 5

VARIABLES	(1) Mean of fixed-term hiring – duration up to 1 month	(2) Mean of fixed-term hiring – duration up to 1 month	(3) Mean of fixed-term hiring – duration up to 1 month
Var ln Prod Ind Seas		-0.187	6.104
		(0.790)	(4.971)
Var ln Prod Ind Cycle (6 months)			-7,416.096
			(4,918.561)
Var ln Prod Ind Cycle (18 months)			676.891
			(696.218)
Var ln Prod Ind Cycle (36 months)			-71.084
			(82.242)
Var ln Prod Ind Seas-Adj		-7.253	
		(9.790)	
Var ln Prod Ind	-0.283		
	(0.797)		
Constant	3.755***	3.876***	3.945***
	(0.753)	(0.772)	(0.816)
Observations	191	191	191
R-squared	0.001	0.003	0.020

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 6

VARIABLES	(1) $\Pr(N_T > 0)$	(2) Marginal effect	(3) $\Pr(N_P > 0)$	(4) Marginal effect
Δ ln Prod Ind Seas	0.170***	0.019***	0.058	0.009
	(0.048)	(0.005)	(0.042)	(0.007)
Δ ln Prod Ind Cycle (6 months)	-2.035	-0.226	-1.531	-0.235
	(2.140)	(0.237)	(2.079)	(0.320)
Δ ln Prod Ind Cycle (18 months)	6.068***	0.673***	2.988	0.460
	(2.081)	(0.230)	(1.938)	(0.298)
Δ ln Prod Ind Cycle (36 months)	10.592***	1.174***	7.651***	1.176***
	(1.952)	(0.215)	(1.766)	(0.271)
Δ ln Prod Ind Aggr	0.320***	0.035***	0.762***	0.117***
	(0.103)	(0.011)	(0.090)	(0.014)
Constant	-1.281***	-	-0.250	-
	(0.220)	-	(0.165)	-
Observations	11060	11060	11060	11060
Sector Fixed Effect	YES	YES	YES	YES

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7

VARIABLES	(1) $\ln(N_T)$	(2) $\ln(N_P)$
Δ ln Prod Ind Seas	0.358***	0.102***
	(0.020)	(0.019)
Δ ln Prod Ind Cycle (6 months)	-3.032***	-1.999**
	(0.847)	(0.871)
Δ ln Prod Ind Cycle (18 months)	3.758***	1.404*
	(0.807)	(0.785)
Δ ln Prod Ind Cycle (36 months)	12.729***	9.622***
	(0.747)	(0.688)
Δ ln Prod Ind Aggr	0.296***	0.753***
	(0.034)	(0.037)
Mills ratio (T)	1.987***	0.204***
	(0.163)	(0.016)
Mills ratio (P)	0.202***	1.370***
	(0.012)	(0.120)
Constant	-0.006	-0.005
	(0.016)	(0.012)
Observations	11100	11100
R-squared	0.840	0.831
Sector Fixed Effect	YES	YES

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Figures

Figure 1

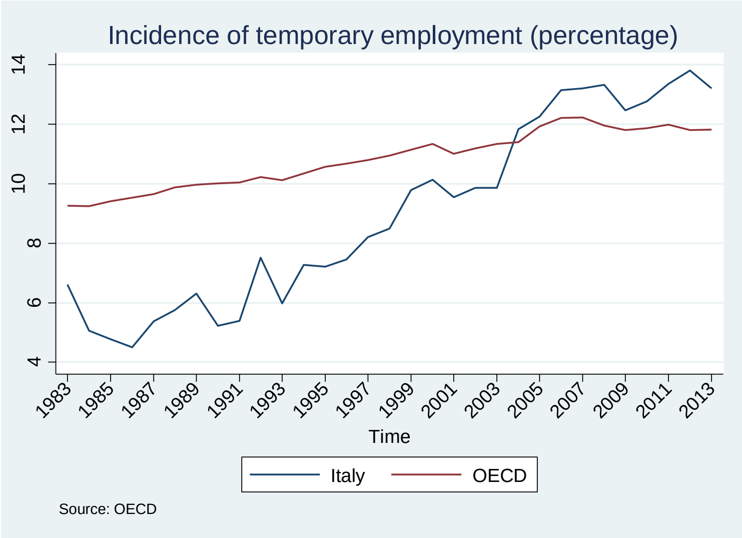


Figure 2

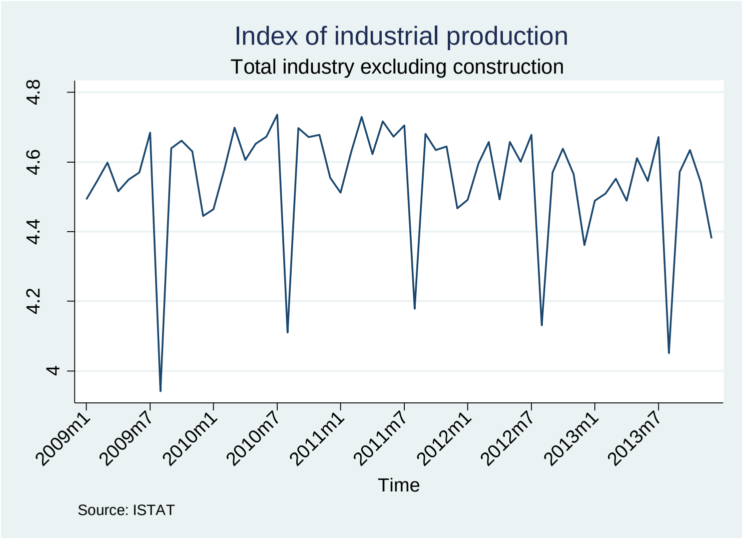


Figure 3

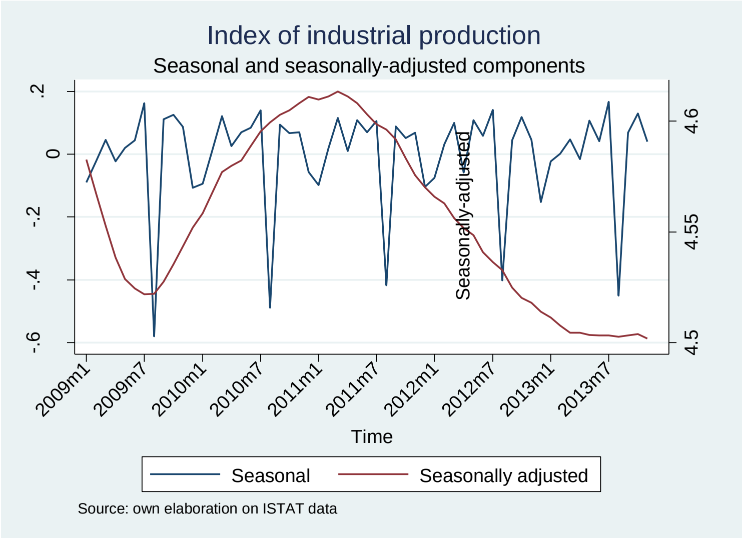


Figure 4

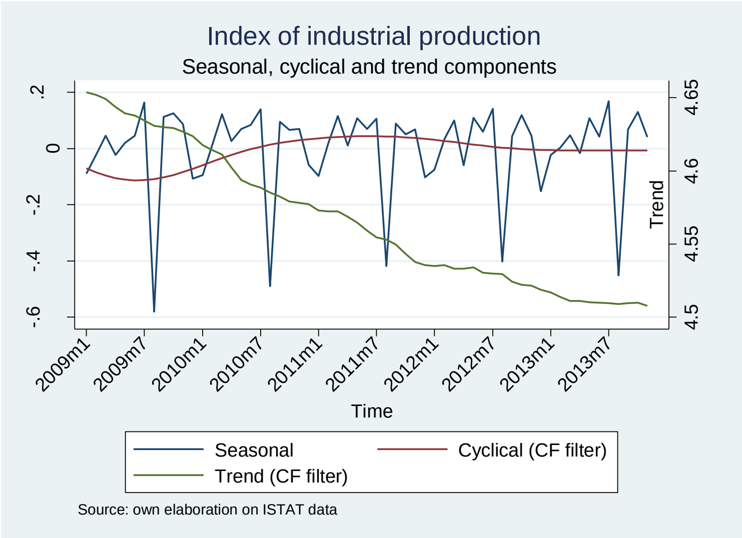


Figure 5

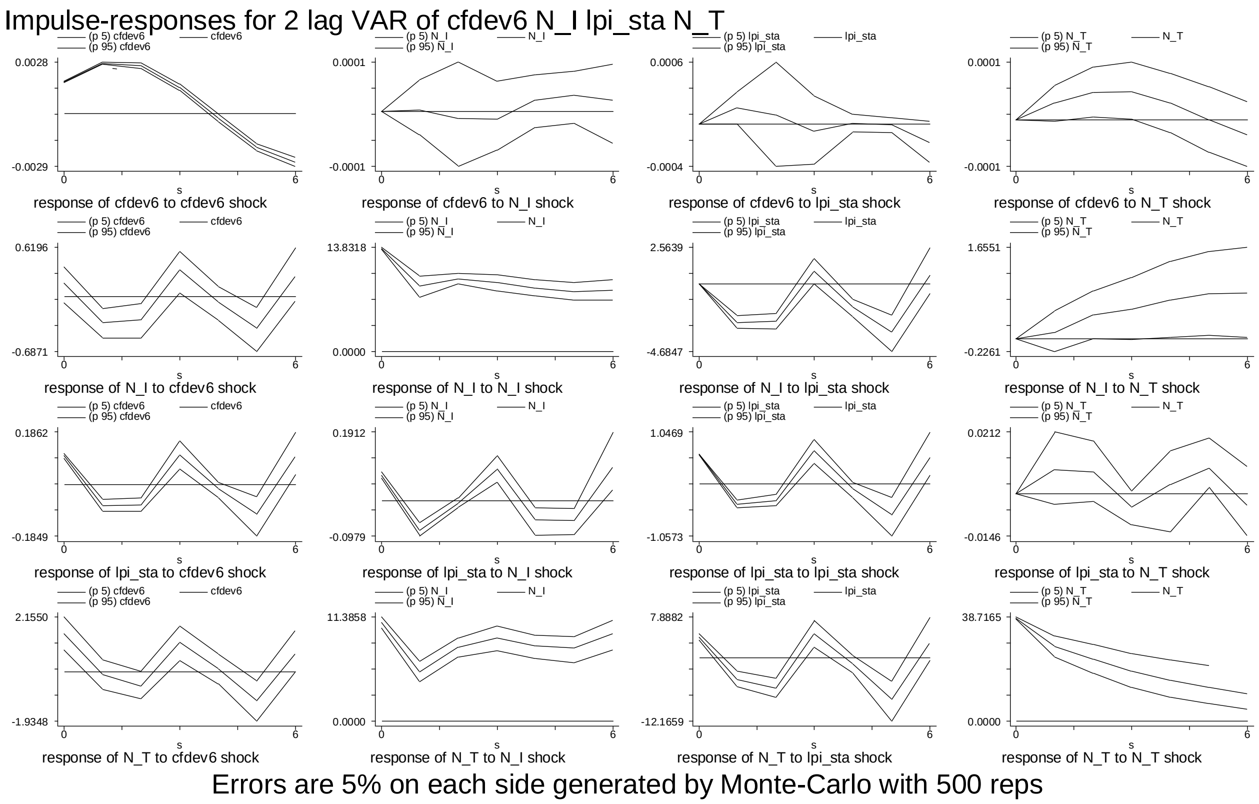


Figure 6

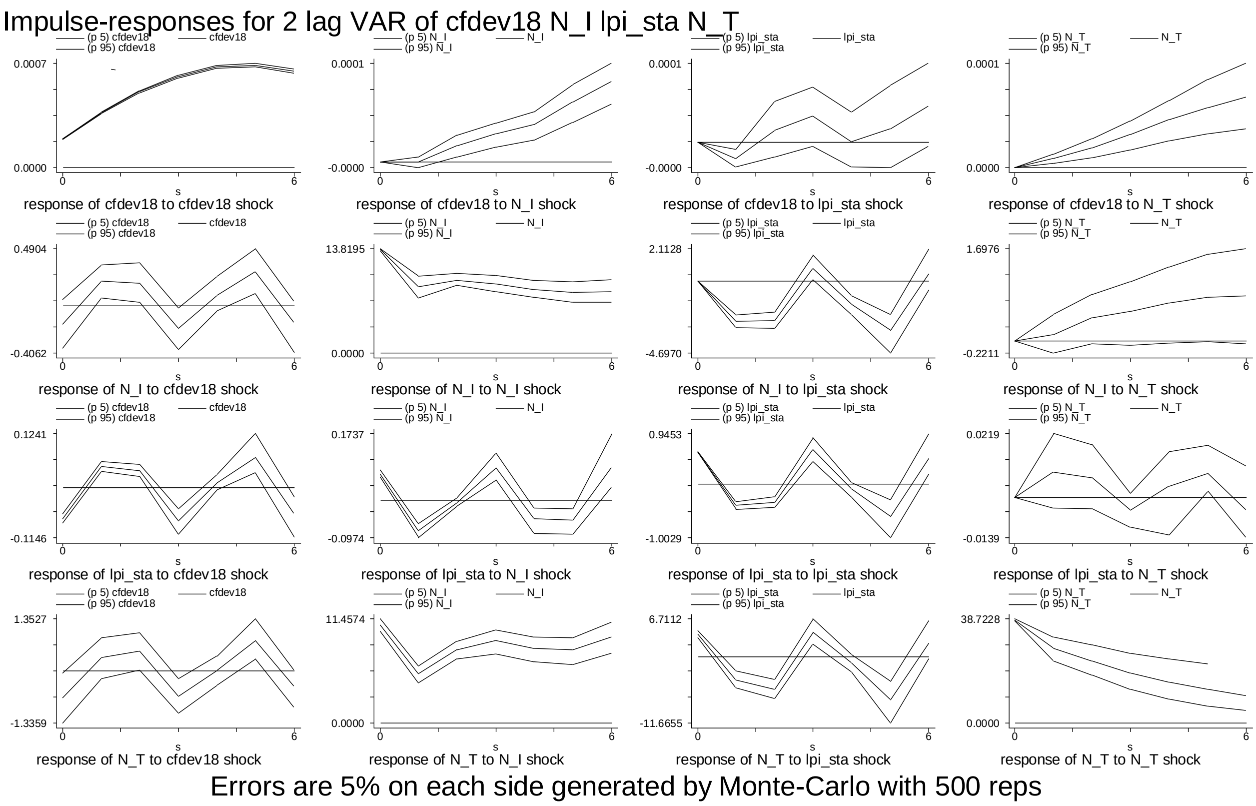
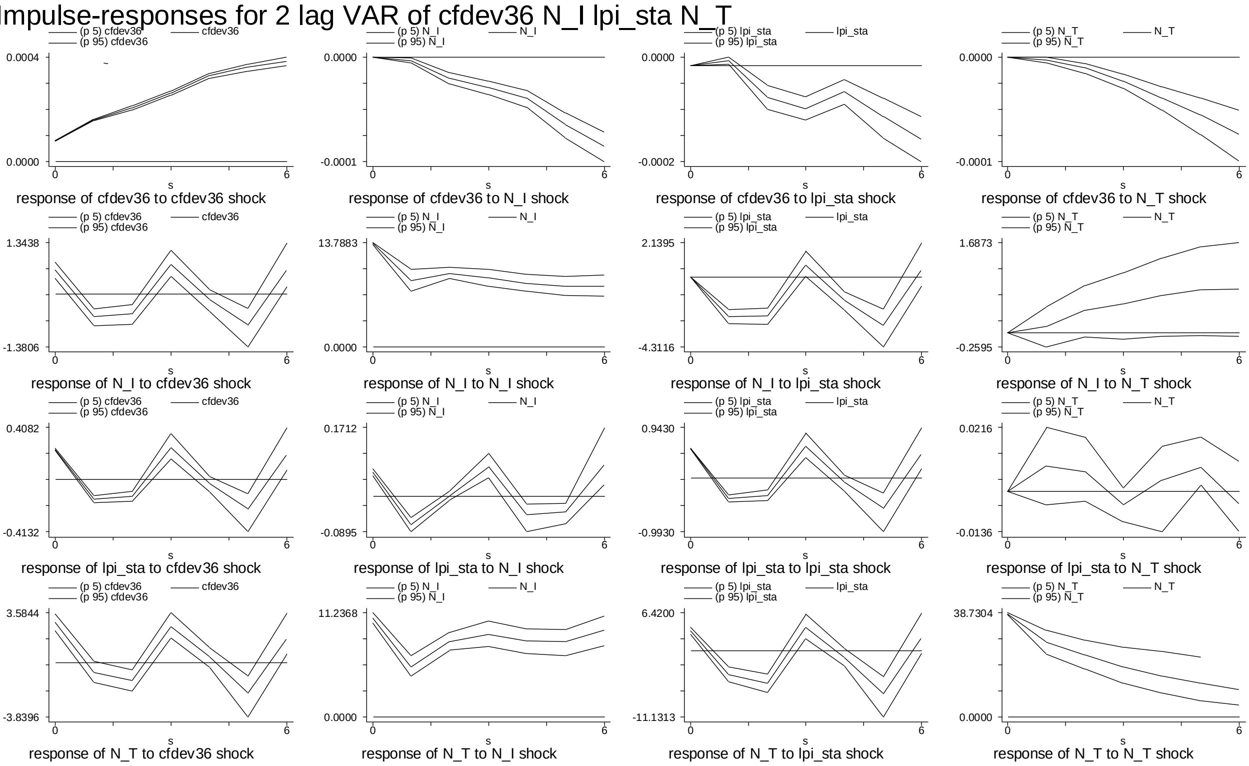


Figure 7

Impulse-responses for 2 lag VAR of cfdev36 N_I lpi_sta N_T



Errors are 5% on each side generated by Monte-Carlo with 500 reps