

Interaction between Underground Employment and Unions in Selected Italian Industries

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In this paper we investigated empirically the nature of the relation between underground employment and unions in Italy, focusing on certain productive sectors. The motivation for this analysis is the hypothesis of the existence of two different opposite channels through which unions affect underground employment: a macro-effect, generating shadow activities via higher wages and market rigidities; a micro-effect, entailing a negative impact of trade union power on underground employment. We consider two different measures of the bargaining power of trade unions, i.e. wages and net density. Econometric analysis of Italian data yields three main results. First, mechanisms of interaction between underground employment and unions change profoundly according to the nature of the industry. Second, the two indexes of the trade unions' bargaining power play a different role vis-à-vis the extent of underground employment. Third, there is a counter-intuitive interaction between wage and underground employment, which may be explained in an insider-outsider framework.

L'INTERACTION ENTRE LES SYNDICATS ET LE TRAVAIL NON DÉCLARÉ DANS DES SECTEURS SPÉCIFIQUES EN ITALIE

Nous analysons empiriquement dans cet article, en nous focalisant sur certains secteurs de l'économie italienne, la nature des liens entre la présence syndicale et le niveau de l'emploi au noir. La motivation de cette analyse est l'hypothèse que la présence syndicale peut affecter de deux manières l'emploi au noir : d'une part, un effet macroéconomique qui engendre une hausse de l'emploi au noir, via des salaires élevés et des rigidités réelles accrues ; d'autre part, un effet microéconomique dû au pouvoir des syndicats. Nous considérons, dans cet article, deux mesures du pouvoir de négociation des syndicats : les salaires et la densité net syndicale. Les estimations économétriques montrent trois types de résultats. Tout d'abord, les mécanismes d'interaction entre l'emploi au noir et le pouvoir de négociation des syndicats n'est pas le même selon le secteur d'activité considéré. Ensuite, les

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deux mesures du pouvoir de négociation des syndicats ne jouent pas le même rôle en ce qui concerne l'emploi au noir. Enfin, nous trouvons un résultat contre-intuitif (qui pourrait néanmoins s'expliquer avec un modèle insider-outsider) quant au lien entre salaire et emploi au noir.

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INTRODUCTION

In the literature on economics and industrial relations the determinants of unionism and their effects on labour market behaviour have been extensively examined. However, the effect of labour unions on “undeclared work” is rarely investigated.¹ In a theoretical framework, models of trade unions take into consideration the utility of members, and unemployment caused by rent seeking is counterbalanced by the unemployment insurance for their members. In an insider-outsider perspective, non-unionized employees (outsiders) experience poor job conditions and pay compared to unionized ones. In providing a rationale for the existence of labour unions, the insider-outsider theory also suggests a similarity between outsider non-unionized workers and irregular workers. Undeclared work implies remunerated activities that are lawful but not declared to the public authorities to avoid: taxes or social security contributions, regulations such as health and safety regulations and official procedures.²

This is an important issue in Europe, where over three-quarters of the workforce have wages that are covered by collective or sector bargaining, and most countries show a sizeable underground economy (for a survey on the size of the hidden economy around the world see Schneider and Enste [2002]) as well as undeclared work.³

In this paper we use a dataset from the Italian economy, a country with both a considerable size of underground employment and strong labour unions. In particular, Italian labour unions have often been involved in campaigns

1. ILO [1999] surveys the experience of trade unions in the informal sector in nine countries (Ghana, Kenya; India and the Philippines; Bulgaria, Hungary and Italy; Colombia and El Salvador). The nine national studies represent testimonies that trade unions can contribute to the improvement of working conditions for the informal sector's workers. However, in this paper we don't deal with informal economy, but only with underground economy's employment (OECD [2002]).

2. In this paper we use the terms undeclared work and irregular/underground employment as synonymous.

3. The issue of undeclared work has ranked highly on the European Commission's employment policy agenda for a number of years. Since 2001, it has been systematically reiterated in the Guidelines for employment policies in Member States. The Council resolution on transforming undeclared work into regular Employment (2003/C 260/01) adopted the Employment Policy Guideline No. 9 on transforming undeclared work into regular employment in 2003. It suggested as instruments (i) a simplification of the business environment, (ii) the removal of disincentives and the provision of appropriate incentives in the tax and benefits system; and (iii) an improvement in enforcement.

against undeclared work.¹ The active participation of unions in such matters supports the claim that the interaction between unions and undeclared work could be more complex than expected, especially in countries with high share of undeclared work, such as Italy. There are at least three main reasons for expecting unions to be involved with undeclared work. First, in a unionized labour market, wages lie above the competitive solution and firms adjust upward according to their demand schedules, hiring fewer and more able workers. However, these circumstances may lead firms and “outsiders” to by-pass higher labour costs and rigidity by operating in the underground economy. Second, union power is also reflected in increased worker dignity and legal protection against a number of harassment practices and excessive worker exploitation, whereas avoiding social contributions, health insurance and other extensive labour benefits are the primary “rewards” of underground employment. Third, underground workers tend to reduce union membership, and, hence, union power.

Ex ante, it may be difficult to envisage the net effect. In all likelihood, it is related to, amongst others, the productive sectors, technology, taxation system and evasion possibilities, union power and the industrial relations system.

The aim of this paper is to provide evidence of the statistical significance of the interaction between trade unions and undeclared work, by identifying which of the above described factors dominate in different production sectors.

Our analysis is accomplished using cointegrating bivariate models, to investigate, for the period 1980-2005, long-run and short-run interactions between two proxies of union power, net wage and active density, and the underground employment ratio (underground to total workers) in selected Italian industries.

Econometric investigation yielded three main results. First, interaction mechanisms between underground employment and unions are greatly affected by sectoral peculiarities. Second, the two indexes of trade union bargaining power play a different role vis-à-vis the size of undeclared work. Third, there is a counter-intuitive interaction between wage and underground employment which can be explained within an insider-outsider framework.²

The paper is organized as follows. The next section shows magnitudes and features of underground employment and trade union density in Italy, whereas Section 3 gives some insights into major issues affecting the relationship between trade unions and underground employment. Section 4 describes the main characteristics of the examined productive sectors. Section 5 provides some evidence based on econometric analysis for Italy and Section 6 concludes the article.

1. Evidence is given by the so-called “contratti di riallineamento”, a sort of local bargaining between unions and firms specifically addressed to induce the latter to act above ground, granting them a fiscal amnesty. In addition, the main Italian union, CGIL (Italian general labour confederation), in 2007 launched the action “Against the shadow economy” to help workers involved in the shadow economy as well as elaborate policy proposals.

2. Our empirical analysis doesn’t provide a structural model, since it is based on a reduced form approach. In this sense we do not approach the identification problem (causation versus correlation), as well pointed out by Manon dos Santos.

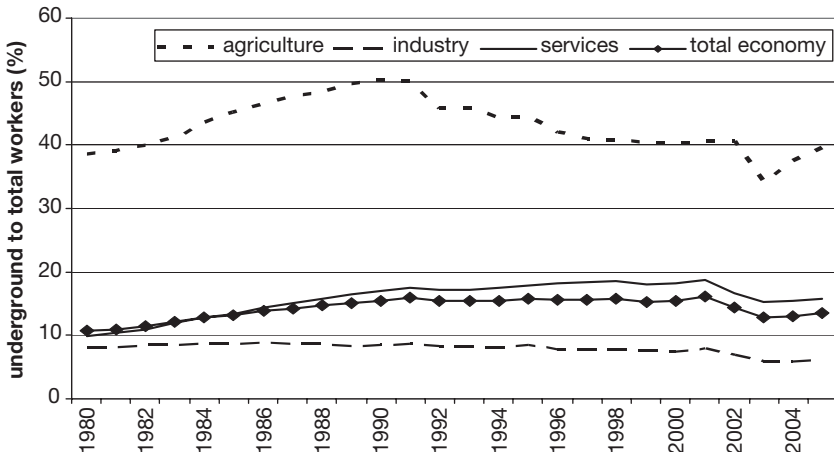
TRADE UNIONS AND UNDERGROUND EMPLOYMENT:
THE EVIDENCE IN ITALY

The Irregular Labour Input

Underground employment is a widespread phenomenon in Italy, and has attracted a great deal of attention from policy-makers as well as researchers.¹ The National Institute of Statistics (Istat) provides a time series estimate of the underground employment covering the period 1980-2005 for the country as a whole, providing data detailed for the main productive sectors. The Istat method of estimating the size of the undeclared work (labour input method) is approved by Eurostat, which requires the exhaustiveness of national accounts, and is well described in OECD [2002]. This procedure is based on a comparison between the labour input estimates based on data from households and enterprises: it is expected that the former give more complete coverage of labour input to GDP than do the enterprise survey data. As the household survey data are expressed in terms of employment and/or hours worked, whereas data from enterprises are usually expressed in terms of jobs, they must be converted to the same standard units of labour input. In fact, Istat estimates are expressed as fulltime equivalent employment, and they are consistent with national accounts aggregates.

The magnitude of underground employment, in the various productive sectors over the period 1980-2005, is described in Figure 1, from which it is clear that differences are remarkable.

Figure 1. *Underground employment ratio by economic sector, 1980-2005*



Source: Istat [2008a].

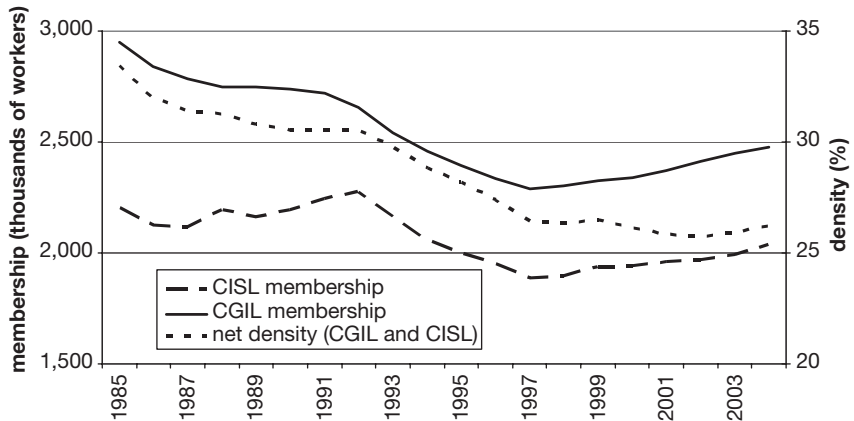
1. See, among others, Busetta and Giovannini [1998]; Camera dei Deputati [1998]; Bianco [2002]; Lucifora [2003]; Bovi [2007]; Chiarini and Marzano [2007].

The largest size of the irregularity ratio (underground to total employees) is recorded in agriculture, amounting to around 40% over the whole period considered, with a 50% peak in the early nineties'. By contrast, industry always displays a lower than 10% value for the underground employment ratio, slightly declining from 8 to 6%. Conversely, in services we observe a notably upward trend with the share of underground employment rising from 9.8% in 1980 to a peak of 18.8% at the beginning of the millennium. The graphs in Figure 1 also emphasize the reduction in the underground employment share in recent years (2002-04), mainly due to a sharp reduction among irregular foreigners workers, resulting from the amnesty given in 2002 (law no. 189).

Trade Unions Membership

As to the trade unions' presence in Italy during recent decades, their evolution has been quite similar to that recorded in other European countries.

Figure 2. *Net membership and net density in the two leading confederations, 1985-2004*



Source: Feltrin [2005] and Istat [2008b].

From 1968 to 1980 Italy experienced a considerable increase in unionization. Subsequently, union membership in industry, agriculture and public services, sectors in which unions were traditionally strongest, was reduced. The rise of employment in market services where unions had greater organizational problems, and changes in the system of industrial relations in a context of high tension between the three union confederations, have generated a downward trend in active union membership.

Figure 2 shows this trend for the two main confederations CGIL (Italian general labour confederation) and CISL (Italian confederation of labour unions). We show membership net of pensioners (see also Chiarini [1999]), and a measure of net density expressed as the ratio of total (CGIL and CISL) active membership to total dependent employees.

These trends have been observed and studied since the 1980s (see amongst others Santi [1988]; and more recently Visser [1991]; CESOS [1995]; Chiarini [1999]; Feltrin [2005]). The latest available data confirm that more than half of total members are now pensioners.

Industrial Relations in Italy

The system of industrial relations in Italy is characterized by three levels of collective bargaining: a central level, where the major confederations and the representatives of the industrial organization negotiate central agreements; industry (sector)-level bargaining; and firm-level bargaining. This process is complex, and, as stated by Visser [1996] also characterized by a low degree of institutionalization.

The Italian law doesn't attribute any special legal strength to collective bargaining, respect to which Italy follows in the voluntaristic tradition. The importance of these three levels of bargaining has changed during decades, confirming, in some way, the low degree of institutionalization of the process.

The national (central) bargaining played a major role in periods of economic crises, involving, especially when the issue of pay costs' control is central, also the government.

The national industry agreement is the one establishing the minimum wage that can be improved by local bargaining.¹ Though sectoral contracts only apply to the members of the signatory union, the coverage is in general quite high. Visser [1996] estimates that in the manufacturing coverage ranges between 70 and 90% of total employees; with metal manufacturing displaying the largest share, and textiles the lowest. By contrast, the degree of coverage is considerably lower in the services and in the construction, and, in general, among small firms.

Finally, the local bargaining, company and workplace levels, has played an increasingly important part since the early 80's, and unions had an important influence on this stage of the process. Treu [1994] shows that the wage gap between the local and the national negotiated wage increased in the period 1982-1990, though with different intensity across industries: from 17% to 36% in metal engineering; from 40 to 60% in chemicals, from -1% to 9% in construction, and from 3% to 16% in the food industries.

However, differences across economic sectors are wide, as witnessed by data about coverage. Ferner and Hyman [1992] argued that in Italy there were two major systems of industrial relations: the first one characterized by collective bargaining and formal employment practises and policies; the second one, mostly associated to southern regions and small sized firms, displays low unionization and adopts less formal practises. This gives an immediate idea of the important connections between informal and/or underground labour practises and trade unions.

In the next section we will give some possible explanations for the relationship between trade unions and underground employment.

1. In fact, though there is no formal norm about the minimum wage, courts have interpreted art 36 of Constitution as requiring adherence to the minima contained in collective agreements.

TRADE UNIONS AND UNDERGROUND EMPLOYMENT: POSSIBLE INTERACTIONS

The role of unions in the dynamics of the underground labour market has two main determinants:

1. the bargaining power of trade unions;
2. the arguments of the utility function of trade unions.

The *first issue* relates to the institutional features of the labour market and, in particular, to the degree of coverage.¹ The presence of unions reduces labour market flexibility and raises wages and therefore should make firms and “outsiders” prone to use the hidden labour market, especially when the coverage is high. In Italy the nature of collective bargaining and the almost general level of the associated coverage generate a sort of closed shop for the regular labour market (actually workers do not join the unions but undergo their sector/national contracts and hence reinforce their power), whereas the underground sector of the market is completely competitive. Therefore, union wage claims, under circumstances which “legitimate” firms’ tax evasion (for instance, a low probability of being detected and fined, and an inappropriate surcharge penalty), may well induce firms to escape the institutional constraints of the regular market by hiring irregular workers.

However, evidence displayed for Italy in Figures 1 and 2 shows that the upward trend in underground employment was associated with a declining power of unions, as measured by net membership and/or density. This remark claims for an alternative interaction between unions and underground labour practises, which we guess could operate through the utility function of the trade union (*second issue*). The simplest traditional interpretation of the unions’ objective function assumes that they are only concerned with the welfare of their members (rent seeking).² However, unions’ social concerns should increase their vigilance on recruitment rules since irregular workers very often experience worse job conditions than regular workers.³ In addition, consistent with dynamic union models (Kidd and Oswald [1987], Chiarini and Marchetti [2000]), unions clearly have a specific interest in opposing underground labour. All of these motivations imply that the stronger the union is, the more difficult it is to employ underground workers.⁴

The two issues described above imply two opposite effects of the power of trade unions on underground employment: a positive one, referred to as *wage/macro effect*, as a consequence of the first type of interaction and a negative one,

1. In Italy there are no official statistics on collective bargaining coverage. However Lawrence and Ishikawa [2005] estimated that in 2000, 84% of total employment was covered by collective agreements.

2. For a survey on the economics of trade unions, see Booth [1995].

3. A different situation occurs when workers divide their working time between regular and underground employment, in other words, when they are moonlighters. See Cowell [1990], for some definitions of firms which operate in the informal sector; Busato and Chiarini [2004] and Busato et al. [2005], provide an application of the moonlighter firm in a general equilibrium framework.

4. Unions are a natural barrier to the exploitation of undeclared work in each single firm; nonetheless, they can adopt a “macro” strategy against the undeclared work. Recent evidence is given in Italy by the so-called *contratti di riallineamento*, and also the strategy of the main Italian union, CGIL, “Against the shadow economy” recently announced on the Web.

referred to as *opposition/micro effect*, which is expected to arise as a consequence of the second type of interaction.

Further, it is also worth mentioning that the influence of undeclared work onto the unions' power is difficult to establish a-priori. On the one hand, the larger the numbers of irregular workers, the lower the membership, since underground workers can not join unions, especially in totally underground firms. On the other hand, the larger the size of undeclared work, the more unions could attract members claiming for more protection. Technically speaking, there is a problem of contemporaneous correlation between union membership and undeclared work, which has important implications for the econometric modelling.

THE MAIN CHARACTERISTICS OF THE SELECTED INDUSTRIES

The aim of this paper is to investigate empirically the interaction between union bargaining power and underground employment. The great differences in underground employment ratios among the macro-productive sectors suggest focusing on a single macro-sector. We exclude the primary sector since, despite its large weight of undeclared work, its contribution to the Italian GDP is marginal. The two remaining sectors, industry and services, have a similar weights in the Italian economy. We prefer to focus on industry for three reasons. First, differently from the services sector, industry displays a strong tradition in terms of union activities. Second, despite the fact that it exhibits the lowest ratio of underground employment (Figure 1), there are remarkable differences amongst the various components of the industrial sector. Last but not least, industry is a sector where detailed data about trade unions' membership are recorded and available.

Therefore, we focus on four different industries –metalworking, textiles, chemicals and construction– which should also allow us to capture the effect of the different degree of substitutability between the two labour inputs across industries.¹

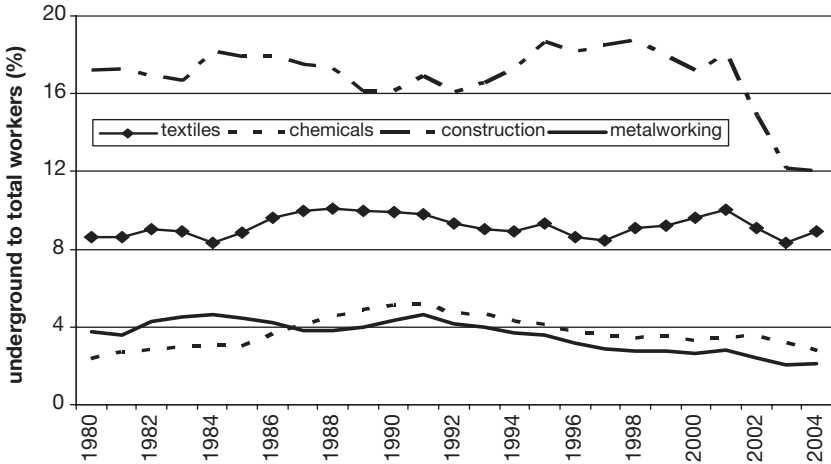
The four industries display distinctive features with respect both to their recourse to undeclared work (Figure 3) and to their degree of unionization (Figure 4). We select two relatively highly-unionized industries, chemicals and construction, with very different sizes of underground employment: the construction sector shows a sizeable underground labour input, whereas the chemical industry employs a very small amount of irregular labour input. The two additional industries, metalworking and textiles, both have a low level of union density and different underground employment ratios: high in textiles and very low in metalworking.

Figure 3 illustrates that the share of underground workers is highest in the building sector, albeit declining during the period considered, from 17% in 1980 to 12% in 2004. By contrast, the metalworking and chemical industries show a

1. The further step, to extend our analysis to other industry and service sectors, is left to future research.

considerably smaller size of undeclared work for the whole period considered, amounting to around 3-4%. Finally, the share of irregular labour in the textile sector was quite stable in the two decades considered, slightly below 9%.

Figure 3. *Underground employment ratios, selected economic sectors, 1980-2005*



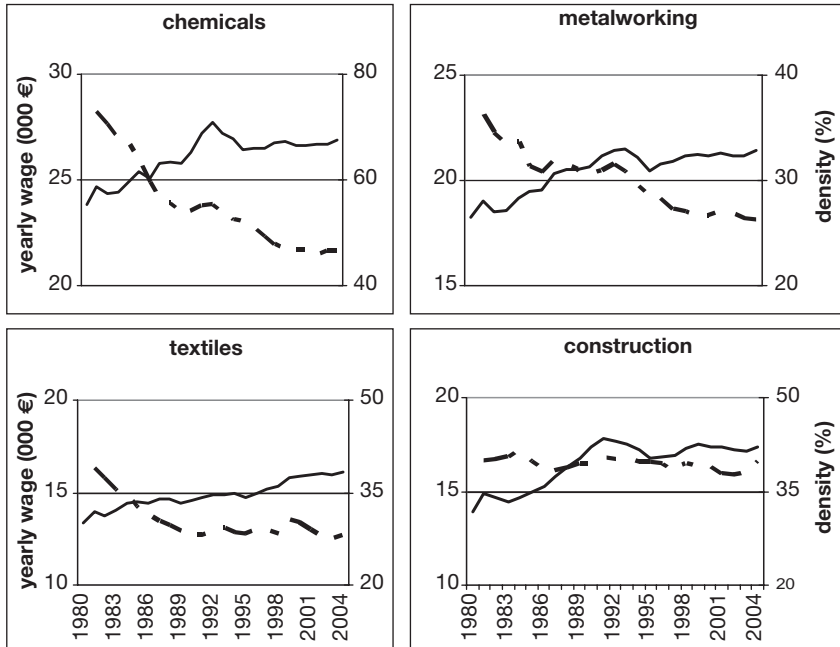
Source: Istat [2008a].

In Figure 4 we plot together the net density rate (active members as a percentage of total workers, right axis) and the yearly average net wage (the ratio of the wage bill to total dependent employees, net of social security contributions, left axis) in each of the four industries.

The first point to note is the divergent path displayed by these two variables in all the industries concerned: a declining trend in trade union membership is jointly observed with an upward pattern for the net wage. As discussed previously (see also Chiarini [1999]), in the same period there was a considerable increase in retired and public sector components of trade union membership, contributing to a rise in trade union bargaining power. Figure 4 also shows that union net density varies considerably among the four productive sectors. The chemical industry exhibits the largest membership rate, despite declining in the examined period. The second largest membership is found in the construction industry, while metalworking and textiles show the lowest density rate.

The selection of the sectors is also motivated by the major differences concerning the production structure and wage structure. In Table 1, we report some characteristics of the four industries, which allow us to distinguish two different groups. The first, comprising the construction and textile industries, has a smaller size in terms of dependent employees, a lower share of overtime hours, and lower wage and profit indicators. We can refer to the first group as the *small-sized industry*, and thus the second would be the *large-sized industry*. Moreover, in both sectors of the *small-sized industry*, the relative share of underground employment is quite high, though in terms of union density the two industries are less homogeneous.

Figure 4. *Union net density (%) and average net wage (000 of euro) in different federations*



The continuous line represents the net wage, and it is measured on the left axis, whereas the dash-dot line represents the net density, measured on the right axis. Source: Feltrin [2005] and Istat [2008a, 2008b].

Table 1. *Main characteristics of the selected industries, Italy*

Industry characteristics	Reference year	Chemical	Metalworking	Textile	Construction
% of firms without employees	2004	25-49	32-53	40.0	40-58
Average no. of employees	2004	12-46	8-39	8	3-9
Overtime per worker (per year)	2000	65-93	67-95	64.0	51.0
Overtime per worker (% of total)	2000	3.3-4.7	3.3-4.9	3.3	2.6
Total Unit Labour cost (000)	2000	36-44	28-34	23.0	27.0
Diff. between wage Max and Min (%)	2000	85-104	50-74	46	54
ROE	2001-2003	2.2-12.4	2.5-28.5	1.3-6.9	3.5-6.9
ROI	2001-2003	6.2-12.8	5.7-9.9	5.6-6.2	6.2-9.8
Union density rate	2000	47.9	28.5	31.8	47.3
Underground employment ratio	2000	0.7-8.5	2.8-7.5	8.8-10.9	9.1-21.3

Source: Confindustria [2005]; Feltrin [2005]; Istat [2006].

Lastly, Table 1 shows that in large-sized industries the amount of overtime per worker is higher with respect to small-sized ones. The high recourse to overtime in some industries is a signal that labour turnover costs, principally training costs, are particularly high. Intuition suggests that it is also more difficult to substitute insider/regular workers with outsider/underground ones. This points to a different use of the two margins of underground labour input, irregular overtime and underground positions. In particular, high labour turn-over costs would suggest a greater use of the intensive irregular margin (irregular overtime), rather than the extensive one (underground positions) in large-sized industries.

ECONOMETRIC ESTIMATES

Our econometric analysis is designed to answer the two questions we posed in the Introduction: whether there is a relationship between undeclared work and union power and, if so, whether this effect is homogeneous across industries. Given the issue of endogeneity highlighted in Section 3, it is advisable to use a Vector Auto-Regressive (VAR) methodology to investigate the interaction between undeclared work and trade unions.

We focus on the four different industrial sectors described above (textiles, metalworking, chemicals and construction), using annual data covering the period 1980-2005. Labour market statistics are from National Accounts (Istat [2008a], [2008b]) while data about unions' membership, as declared by trade unions, are from Feltrin [2005].

An important caveat is that the dataset is annual, therefore we only have 26 observations to run cointegration tests, which could weaken the interpretation/robustness of the results. However, since we are dealing with a long time span, we claim that the approximation of the cointegrating analysis is adequate. However, this does not allow us to specify a structural model, but we can, at best, set up bi-variate statistical models. This means that we are not estimating labour demand or supply for regular or irregular labour input. Quite simply, our analysis is an initial empirical step to draw some aggregate stylized facts from the Data Generating Process.

In order to investigate trade union "pushfulness", the literature has used several proxy variables, such as the density/membership ratio and the hours lost in union strikes and labour conflict. None of them, of course, are completely convincing; moreover, depending upon the degree of coverage, trade union influence has an immediate effect on the bargained wage. The issue of how to measure the union status, as union membership or union coverage, in particular, has received a great deal of attention in empirical literature. In Italy it is possible to be covered by a collective bargaining agreement, but without being a member of the labour union that signed that agreement. The large size of coverage for national contracts and the evidence about the involvement of trade unions also in the local bargaining process point out their remarkable influence on wages. To this end, we intend to use two different kinds of proxies of union influence:

1. *average wages*, as a ratio of the wage bill to the total dependent employees (regular plus irregular) in each industry, net of social security contributions. The latter are not included for two reasons: first, because unions are interested

in wage claims, net of the tax burden; second, because national accounts data include irregular workers in estimating the wage bill but not in estimating social security contributions;

2. *net density*, which is simply calculated as a ratio between active membership and total dependent employees (regular plus irregular) in each industry.

These two proxies, as already highlighted in Figure 4, display quite a different pattern in the considered time span, suggesting underlying determinants that may be used to explain the relationship with the underground labour market.

Statistical Characteristics

Before analysing the relationship between undeclared work and the two proxies of union power it is essential to identify the non-stationary nature of our series and avoid problems of spurious regressions. The results of stationary tests on the variables involved presented in appendix A2 confirm the non-stationary nature of the series that are all I(1) processes.

Given this evidence, we estimate, for all four productive sectors, two different sets of bi-variate Vector Error Correction models (VECM) with, respectively, the following endogenous variables:

1. the ratio of underground to total subordinate employment and net density
2. the ratio of underground to total subordinate employment and the net wage per worker.¹

For each bivariate VAR model we test for the existence of a cointegration relation, relying on the cointegration tests (Johansen). The statistical appendix (section A3) reports tests and technical results for each estimated model.² Once the existence of a long-run relationship is ascertained, we proceed to model a VECM and examine the shape of the reduced form's impulse responses.

Underground Employment and Net Density Model

The first model, estimated for each industry, involves the irregularity ratio and the net density. Our estimation procedure is the following: after setting the appropriate lag-length of the VAR model, we determine whether the system is conditioned on some dummy variable for controlling structural breaks. Then we test for the existence of a cointegration (stationary) relationship, and finally for weak exogeneity.

The procedure is carried out separately for the four industries, and in Table 2 we report the estimated long-run relationship between the variables involved, and the adjustment coefficients to the long-run equilibrium, respectively the β parameters in the cointegration relation and the loading factors α . The coefficient of the first variable, the underground employment ratio, in the cointegration relation is normalized to one. Therefore, in all the specifications, the

1. We refer to full time equivalent workers.

2. The data set and the full set of tests can be provided upon request.

cointegration relation reads as follows (all the variables, except the time trends, are in log):

$$\text{Underground employment ratio} = \text{Constant} + \beta_1 (\text{Net density}) + \beta_2 (\text{Trend}) \quad (1)$$

The Long-Run Equilibrium and the Adjustment Coefficients

Table 2 shows that the long-run elasticities between the underground employment ratio and net density are negative in all the industries, though the intensity varies substantially across industries. The model shows an inelastic relationship between underground ratio and net density for the textile industry (-0.9). By contrast, in the remaining industries the estimated elasticities show an underground ratio which is greatly more sensitive to changes in union power.

Table 2. *Cointegration parameters (β) and loading factors (α).
Underground ratio-union density model*

	Chemicals	Metalworking	Textiles	Construction
Constant	13.8 (1.7)	7.9 (3.9)	2.31 (0.2)	60.3 (11.1)
Net density	-7.1 (0.9)	-4.9 (2.5)	-0.9 (0.15)	-36.8 (6.9)
Trend (<i>^Trend shift dummy</i>)	-	-0.03 (0.01) [^]	0.002 (0.001)	-
<i>Level Shift dummy</i>				0.7 (0.3) [”]
<i>Loading factors</i>				
α_1 (Undergr. Ratio)	-0.22 (0.07)	-0.09 (0.03)	-0.34 (0.19)	0.06 (0.02)
α_2 (Net density)	-0.05 (0.02)	0.03 (0.01)	-0.33 (0.09)	-0.01 (0.005)

Standard errors are given in parenthesis.

[^] Trend shift dummy, with zero values before 1991; [”]Level shift dummy, with value equal to one for the period 2002-2005[”].

The α terms of the dynamic part of the model measure the speed of adjustment of the underground employment and the net density towards the equilibrium once a shock occurs.

In the VECM, the lower limit on the adjustment coefficients of -1 implies that there is no distinction between the short run and the long run. Moving on to our estimates, for the underground ratio the coefficient α_1 indicates that 22% of the disequilibrium is removed in a year in the chemical industry. This size rises to 34% in textile while it is under 10% in the construction and metalworking.

The speed of the adjustment of net density is much slower: only 5% of the disequilibrium is now removed after a year in the chemical industry, and in the textile sector the yearly adjustment achieves its maximum value of 33%.

Estimates of the underground ratio's loading factor highlight how the industry attempts to reallocate labour inputs (regular and irregular) whenever a shock impinges on the sector, changing the equilibrium relationship. This reallocation mechanism, as expected, is stronger than the one operating through the net density. Of course it is easier to adjust the size and “quality” of a firm's labour force than to influence union membership; this is supported by the high volatility of the underground employment found in Chiarini and Marzano [2007].

Impulse Response Analysis

The decomposition of long-run equilibrium coefficients, error correction coefficients and short-run dynamic is important to help us understand the characteristics of the relations. However, the analysis requires that long-run equilibrium, short-term dynamics and intertemporal adjustment processes generated by equilibrium errors are simultaneously taken into account. Indeed, Lutkepohl [1991], [1994] shows that it is problematic to interpret the coefficients of cointegrating relations as long-run elasticities, since such an interpretation ignores the dynamic of the system. Impulse-response analysis, relying upon the full system, may provide a more reliable conclusion. To this end we perform impulse response analysis, allowing a standard deviation innovation to hit each variable for each industry.

Figures 5 and 6 report the change in the variables involved, respectively underground employment ratio and net density, on the vertical axis, and the time span in years on the horizontal axis.¹ Both Figures reveal that each innovation induces the variables involved to change for several periods and then taper off to a stable equilibrium. This indicates that the system is stable (stationary), although the endogenous variables are all I(1) type.

The results shown in Figure 5 stress that all the industries considered, with the single exception of construction, display a negative reaction of the underground employment ratio to a positive shock in the net density. The size of the reaction and persistence of the shock differs greatly among industries, as the bands for the estimated confidence intervals amply show. In particular, we observe that in all industries but the chemicals, the dynamic interaction identifies a new and stable equilibrium level for underground employment significantly lower than the previous one. As to the reaction registered in the construction sector, we highlight that the response is positive and slightly significant only on the impact, not in the long run.

This evidence suggests that unions counteract underground employment through active membership.

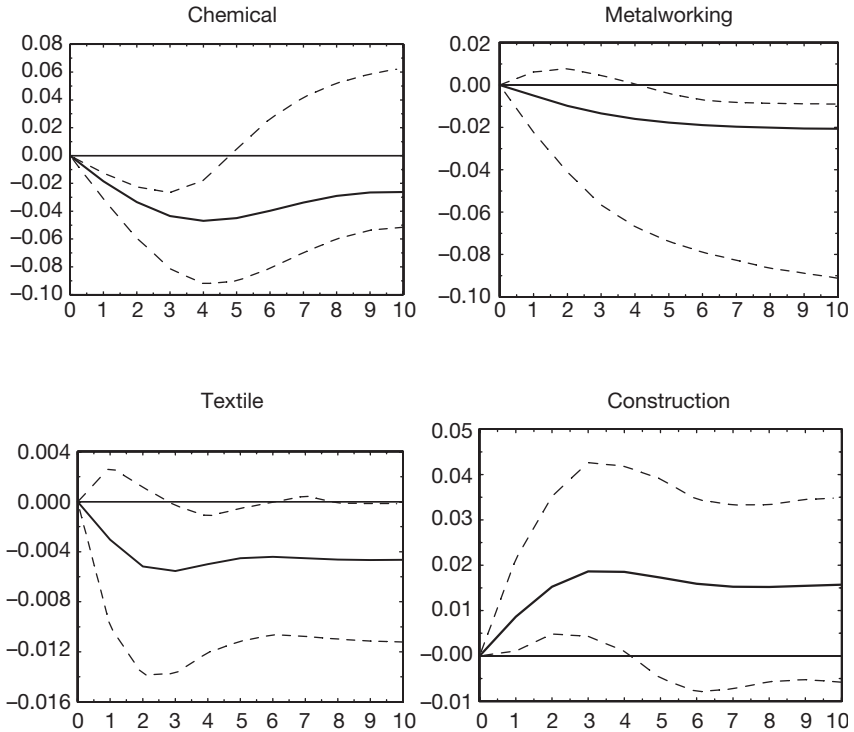
Looking at the effect of innovations in underground employment, Figure 6 shows that in all the examined industries, with the exception of construction, the net density is negatively affected by a rise in the relative size of undeclared work. The impact is statistically different from zero in three out of four sectors (chemicals, textiles and construction), whereas the long run effect is significant only for textiles.

Indeed, the impulse responses depicted in Figures 5 and 6 suggest that an asymmetric mechanism functions in the industries in question:

- *large-sized industries* (metalworking and chemicals): underground employment dynamics has a negligible impact on union membership, whereas underground employment is influenced by net density;
- *small-sized industries* (construction and textiles): underground employment ratio and net density influence each other, though with different characteristics.

1. We use orthogonalized impulse response, based on an innovation of size one standard deviation in the transformed model, *i.e.* a model where the matrix of residuals is orthogonalized using a Cholesky decomposition. Hence, variables ordering may influence the effect of the shock. However, the impulse responses with alternative ordering of the endogenous basically confirm the results shown in the text, and are available upon request.

Figure 5. Response of underground employment ratio to one standard deviation impulse in net density

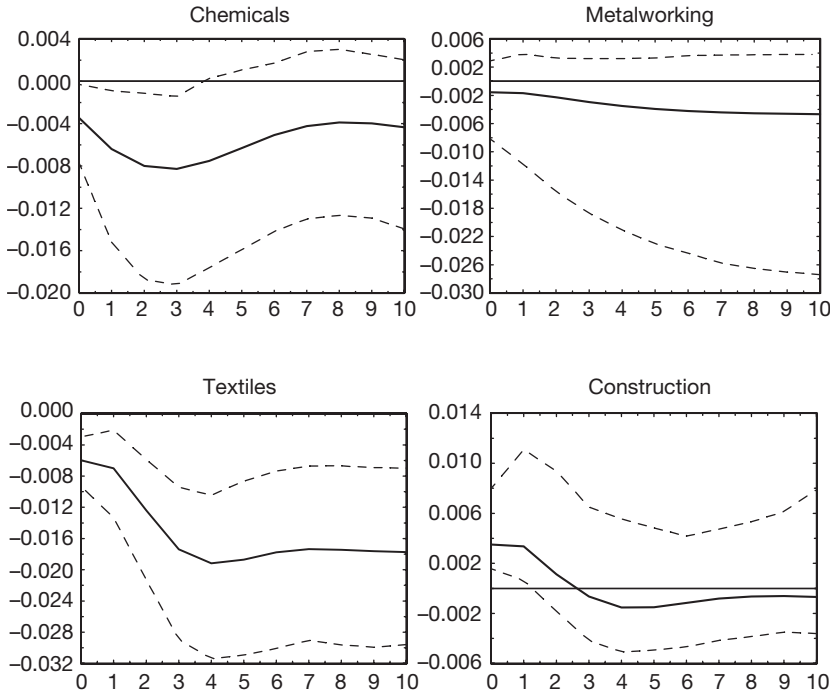


Number of periods displayed on the X axes. Dashed lines represent 95% Hall Percentile Confidence Intervals.

The evidence displayed in Figure 6 for construction is quite peculiar. It may suggest that in industries with a high risk of underground employment, when the irregularity ratio rises, the reaction of regular workers is to join the union to claim for more protection. Since the risk of being irregularly employed is already high, a further increase calls for more protection, and hence the net density increases.

The weak reaction in net density to a shock in underground employment recorded in metalworking and chemicals deserves a comment. Indeed, one would expect a negative reaction, originating from the fact that underground workers are not union members. Lacking a theoretical model, a possible explanation could be the following: in industries with more sophisticated technologies and a lower incidence of underground employment, such as chemicals and metalworking, the irregular labour practice should be mainly related to the intensive margin, *i.e.* regularly employed workers (skilled workers, see also Section 3). These workers, possibly by joining a trades union, are willing to experience some kind of irregular arrangement with their employer in order to gain some extra hours of work free of tax. In this case, a rise in the irregularity ratio is more likely to have a negligible impact on net density.

Figure 6. Response of net density to one standard deviation impulse in underground employment ratio



Number of periods displayed on the X axes. Dashed lines represent 95% Hall Percentile Confidence Intervals.

Underground Employment and Net Wage Model

In a second set of estimates we investigate interaction between underground employment ratio and net wage, calculated as the average workers' remuneration, net of the social security component. The long-run estimated coefficients, which characterize the stationary relationship between the variables, are displayed in Table 3.

Long-Run Elasticities and Error Correction Coefficients

The long-run elasticities shown in Table 3 do not confirm the equilibrium featured in the previous underground ratio-union density model. This casts some doubt on the equivalence of the proxies selected for union power.¹ In all likelihood, they are reflecting different aspects of union influence, and along with the

1. As pointed out by a referee, the net wages' fluctuations may be due to technology changes and not reflect simply the unions' power. The inclusion of a deterministic trend into the estimated model might partly control the effect of exogenous technological progress. In addition, we want to emphasize that in settings with high coverage, a large part of wage claiming is traceable back to unions' bargaining power. However, we are aware that this does not ensure that wages are a solely indicator of unions' power.

structural features of the industries, these proxies reveal different channels available to unions to impinge on the labour input. Now, the equilibrium relationship reports a different sign for large-sized industries: increases in union wage claims entail a long-run increase in the underground ratio.

According to the evidence displayed in Table 3 the adjustment to disequilibrium is faster for the irregular workers rather than wages. The change in irregular workers accounts for at least 47% adjustment in period t to the disequilibrium in period $t-1$, whereas the net wage adjustment coefficient is rather low. In one year less than 10% of the disequilibrium has been removed *via* wages.

Table 3. *Cointegration parameters (β) and loading factors (α).
Underground ratio-wage model*

	Chemicals	Metalworking	Textiles	Construction
Constant	-10.8 (0.8)	-4.9 (0.86)	-0.96 (1.15)	2.1 (0.3)
Net wage	8.1 (0.6)	4.4 (0.7)	-1.7 (1.01)	-0.71 (0.24)
Trend (\wedge Trend shift dummy) "Level Shift dummy"	-0.01 (0.001) [^]	-0.02 (0.002)	-	0.004 (0.001) -0.17 (0.16)**
<i>Loading factors</i>				
α_1 (Undergr. Ratio)	-0.81 (0.2)	-0.47 (0.12)	-0.61 (0.13)	-0.7 (0.06)
α_2 (Net wage)	0.07 (0.03)	0.08 (0.03)	0.02 (0.04)	-0.02 (0.04)

Standard errors are given in parenthesis.

[^] Trend shift dummy, with zero values before 1991; "Level shift dummy, with value equal to one for the period 2002-2005.

Impulse Response Analysis

The estimated impulse responses are shown in Figures 7 and 8. In Figure 7 we report the estimated responses of the underground employment ratio, for each sector, with respect to the innovations in net wage.

The result seems to indicate that in all the industries except construction, the so-called *wage/macro* effect does occur. Indeed, the chemical, metalworking and textile industries react with a rise in the underground employment ratio after a rise in net wage paid in the regular sector. Moreover, this reaction appears to be powerful and permanent in large-sized industries, but less remarkable and temporary in the textile one.

A wage rise provides a drop in the underground employment ratio only in construction, though it is not significantly different from zero: in this sector recourse to underground employment is not linked to the high cost of regular employment, but to more general structural advantages.¹

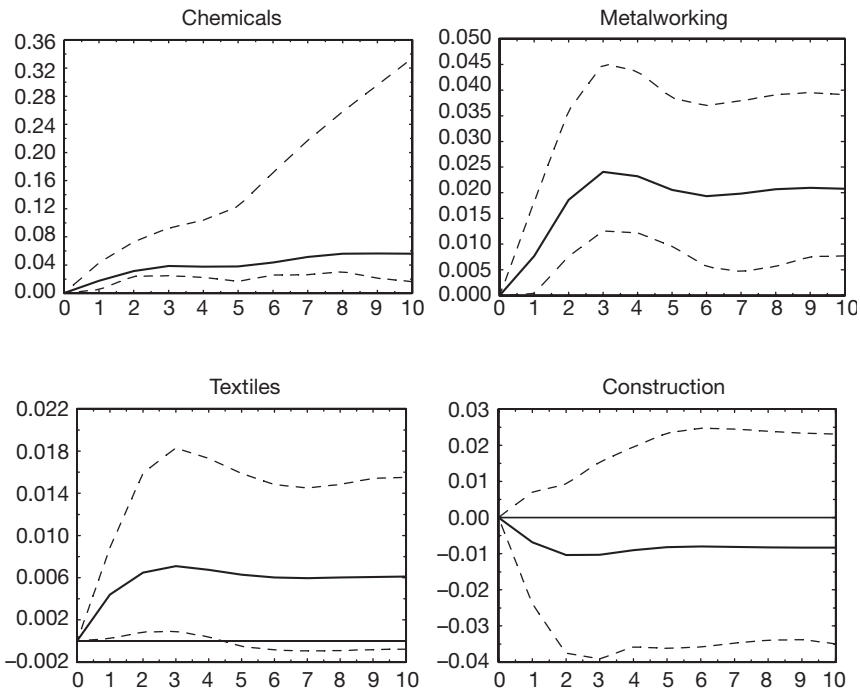
With regard to the response of net wage, we can draw the following insights about the effect of a shock in undeclared work. The innovation immediately pushes wages up in *large-sized* industries and in textiles, whereas no effect is observed in the construction sector. However, whilst for textiles this effect is not significant, the upward jump observed in large-sized industries is statistically

1. As is well known, what affects the demand for labour is also the size of so-called adjustment costs.

different from zero, though only in short term for chemicals (up to 3 years). The simulations imply that innovations in the size of undeclared work have a long-run effect on bargained wages only for metalworking.

A wage drop should be the expected outcome when the relative size of underground employment increases, for it is tantamount to a weaker demand for regular workers. The results found for metalworking and chemicals evokes a worrying scenario, namely the vicious circle of irregular labour input and wages: when wages rise, underground employment does too; yet an increase in underground employment also generates an upward jump in net wages.

Figure 7. *Response of underground employment ratio to one standard deviation impulse in net wage*

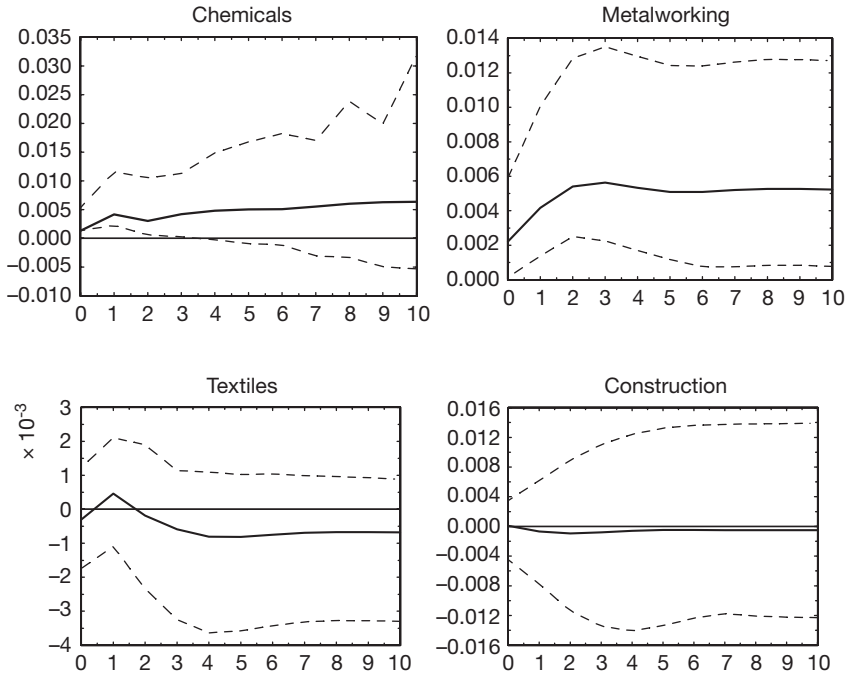


Number of periods displayed on the X axes. Dashed lines represent 95% (90% for textiles) Hall Percentile Confidence Intervals.

CONCLUDING REMARKS

In this paper we investigated the nature of the relation between underground employment and unions. The starting hypothesis is the existence of two different and opposite channels through which unions affect underground employment: the wage/macro effect, that would generate a rise in underground employment; and the opposition/micro effect, that would generate a drop in underground labour input.

Figure 8. Response of net wage to one standard deviation impulse in underground employment ratio



Number of periods displayed on the X axes. Dashed lines represent 95% (90% for textiles) Hall Percentile Confidence Intervals.

Econometric investigation, substantially based on statistical models, yielded three main results. First, the nature of the relationship between underground employment and unions' strength is not definite. The so called macro-effect (the presence of unions generates shadow activities via higher wages and market rigidities) occurs when considering time series data for underground employment and net wages for Italian industry strictly defined, but not in the construction sector. This effect does not operate when considering a different measure of union influence, *i.e.* active membership. Indeed, in this case, data show that unions are effective in countering underground practices in all industries but construction, through their active involvement in the regular market, *i.e.* through net density.

Second, the relationship between union-wages and underground labour input is strongly affected by sectoral peculiarities. The most important features that may explain the different interaction observed in the industries concern cyclical behaviour, recourse to overtime, the different degree of substitutability of the two labour inputs (skilled and unskilled and/or intensive extensive margin), sectoral size and technology.

Finally, a shock in underground employment raises wages in all industries, with the exception of construction, though it is not always statistically significant. This counter-intuitive effect can be traced back to the insider-outsider framework of the labour market (for a survey, see Lindbeck and Snower [2002]),

where labour turnover costs explain the market power of insiders/regular workers. When these costs are particularly high, insiders can demand higher wages, even when outsider size rises. Conversely, when turnover and training costs are low, the two labour inputs are easily substitutable, due to the very simple content of the work activity; in this situation (for instance the construction sector) the pressure of a rising size of outsiders is a threat to insider/regular workers, which impacts upon the wage size.

In terms of future research, these results call for the setting up of a model structure which can provide theoretical predictions consistent with observations and empirical analyses.

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APPENDIX¹

A1. THE STATISTICAL MODEL

Although we are dealing with two variables and one cointegrating relationship, we use Johansen's [1995] technique to estimate and test the time series models. This procedure is used for a single equation as a tool for checking the validity of the weak exogeneity hypothesis and for investigating the strength of feedback coefficients to disequilibrium. Our estimation procedure is the following: after setting the appropriate lag-length of the VAR model, we determine whether the system is conditioned on some dummy variable for controlling structural breaks. Then we test for the existence of a cointegration vector, and finally for weak exogeneity of the wage variable. All the variables are in log.

Estimated equations are derived by a two variable system with one cointegrating equation and a lag structure p . Consider the following VAR (ECM error correction) model, written in the usual notation:²

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma \Delta y_{t-i} + Bz_t + \varepsilon_t \quad (2)$$

where

$$\Pi = \sum_{i=1}^p A_i - I; \quad \Gamma_i = - \sum_{j=i+1}^p A_j$$

In our case, y is a k -vector and contains two non-stationary variables (possibly $I(1)$), z is a vector of deterministic variables and ε_t is a vector of innovation. A_i and B are matrices of coefficients to be estimated. It is well known that if the coefficient of the matrix Π has a reduced rank ($r < k = 1$ the number of cointegrating relations in our case), there exist 2×1 matrices α and β such that $\Pi = \alpha\beta'$ where β is a cointegrating vector.

We have seen that our series are characterized, other than stochastic trends, by non-zero means and deterministic trends. In a similar way, the stationary relations may call for intercepts and trends.

A2. THE DATASET CHARACTERISTICS

CODE	VARIABLE (all variable are in log)	SOURCE
LDensity	Net density (active membership/total subordinate workers)	Author elaboration upon Istat [2008a, 2008b] and Feltrin [2005].
LWage	Wages Net of social security contributions (thousands of euros per unit of full time equivalent subordinate workers)	Istat [2008b]
LURatio	Ratio underground to total full time equivalent subordinate workers (%)	Istat [2008a]

1. Further tests and plots can be provided by the authors upon request.
 2. See, for instance, Johansen [1995].

Stationarity tests

		ADF		KPSS		Pp	
		T stat.	Pi value	T stat.	Pi value	T stat.	Pi value
Chemicals							
LURatio	<i>level</i>	-1.72	0.71	0.18**	<0.05	-1.71	0.71
	<i>1st difference</i>	-3.43**	0.02	0.51**	<0.05	-3.41**	0.02
LDensity	<i>level</i>	-2.12	0.50	0.13*	<0.1	-1.4	0.82
	<i>1st difference</i>	-2.42	0.14	0.36	<0.1	-2.41	0.15
LWage	<i>level</i>	-1.98	0.58	0.17**	<0.05	-2.04	0.55
	<i>1st difference</i>	-4.85***	0.000	0.25		-4.83***	0.000
Metalworking							
LURatio	<i>level</i>	-3.54*	0.06	0.18**	<0.05	-2.24	0.45
	<i>1st difference</i>	-3.61***	0.001	0.32		-3.67***	0.01
LDensity	<i>Level</i>	-4.13**	0.02	0.06		-2.85	0.2
	<i>1st difference</i>	-4.48***	0.002	0.17		-4.7***	0.001
LWage	<i>Level</i>	-1.91	0.61	0.17**	<0.05	-1.84	0.65
	<i>1st difference</i>	-5.29***	0.000	0.31		-5.24***	0.000
Construction							
LURatio	<i>Level</i>	-0.91	0.94	0.12*	0.1	-1.11	0.91
	<i>1st difference</i>	-7.76***	0.01	0.29		-3.7***	0.01
LDensity	<i>Level</i>	-3.32*	0.09	0.06		-2.51	0.32
	<i>1st difference</i>	-3.10**	0.04	0.05		-3.05**	0.04
LWage	<i>Level</i>	-1.09	0.91	0.17**	<0.05	-1.66	0.74
	<i>1st difference</i>	-4.32***	0.003	0.32*		-4.29***	0.003
Textile							
LURatio	<i>Level</i>	-3.19**	0.03	0.10		-2.44	0.14
	<i>1st difference</i>	-4.21***	0.003			-4.51***	0.000
LDensity	<i>Level</i>	-2.21	0.46	0.16**	<0.05	-2.21	0.46
	<i>1st difference</i>	-3.16**	0.04	0.46**	<0.05	-3.07**	0.04
LWage	<i>Level</i>	-1.89	0.62	0.13*	<0.1	-3.37*	0.08
	<i>1st difference</i>	-6.96***	0.000	0.15		-7.12***	0.000

A3. VECM ESTIMATION OUTPUT

Underground Employment Ratio and Net Density Model

CHEMICAL INDUSTRY

Johansen Trace Test for: luratio ldensity

sample range: [1982, 2004], T = 23; included lags (levels) 1; dimension of the process: 2; trend and intercept included; response surface computed:

r0	LR	pval	90%	95%	99%
0	34.54	0.0025	23.32	25.73	30.67
1	6.95	0.3601	10.68	12.45	16.22

VEC REPRESENTATION

endogenous variables: luratio ldensity; deterministic variables: CONST TREND

endogenous lags (diffs): 1, exogenous lags: 0; sample range: [1983, 2004], T = 22

estimation procedure: One stage. Johansen approach

Correlation: 1 -0.45
 -0.45 1

METALWORKING INDUSTRY

Johansen Trace Test for: luratio ldensity

sample range: [1982, 2004], T = 23; included lags (levels): 1; dimension of the process: 2; trend and intercept included

response surface computed:

r0	LR	pval	90%	95%	99%
0	24.11	0.0803	23.32	25.73	30.67
1	4.14	0.7223	10.68	12.45	16.22

VEC REPRESENTATION

endogenous variables: luratio ldensity; deterministic variables: trendshift (1991 ONWARD) CONST; endogenous lags (diffs): 1; exogenous lags: 0; sample range: [1983, 2004], T = 22

estimation procedure: One stage. Johansen approach

Correlation: 1 -0.16
 -0.16 1

TEXTILE INDUSTRY

Johansen Trace Test for: luratio ldensity

sample range: [1983, 2004], T = 22; included lags (levels): 2; dimension of the process: 2; trend and intercept included

response surface computed:

r0	LR	pval	90%	95%	99%
0	28.50	0.0209	23.32	25.73	30.67
1	6.37	0.4258	10.68	12.45	16.22

VEC REPRESENTATION

endogenous variables: luratio ldensity; Deterministic variables: CONST TREND; endogenous lags (diffs): 1

sample range: [1983, 2004], T = 22; estimation procedure: One stage. Johansen approach

Correlation: 1 -0.6091
 -0.609 1

CONSTRUCTION INDUSTRY

Johansen Trace Test for: luratio ldensity

sample range: [1982, 2004], T = 23; included lags (levels): 1; dimension of the process: 2; trend and intercept included

response surface computed:

r0	LR	pval	90%	95%	99%
0	25.75	0.0497	23.32	25.73	30.67
1	5.78	0.4993	10.68	12.45	16.22

VEC REPRESENTATION

endogenous variables: luratio ldensity; deterministic variables: shift(2002-05) CONST
TREND; endogenous lags (diffs): 1 sample range: [1983, 2004], T = 22

estimation procedure: One stage. Johansen approach

Correlation: 1 0.54
 0.54 1

Underground Employment Ratio and Net Wage Model

CHEMICAL INDUSTRY

Johansen Trace Test for: luratio lwage

sample range: [1981, 2005], T = 25; included lags (levels): 1; dimension of the process:
2; trend and intercept included

response surface computed:

r0	LR	pval	90%	95%	99%
0	24.15	0.0795	23.32	25.73	30.67
1	7.63	0.2918	10.68	12.45	16.22

VEC REPRESENTATION

endogenous variables: luratio lwage; deterministic variables: trendshift (1980-91) CONST;
endogenous lags (diffs): 3 sample range: [1984, 2005], T = 22 estimation procedure: One
stage. Johansen approach

Correlation: 1 0.32
 0.32 1

METALWORKING INDUSTRY

Johansen Trace Test for: luratio lwage

sample range: [1982, 2004], T = 23; included lags (levels): 1; dimension of the process:
2; trend and intercept included

response surface computed:

r0	LR	pval	90%	95%	99%
0	24.59	0.0700	23.32	25.73	30.67
1	5.67	0.5136	10.68	12.45	16.22

VEC REPRESENTATION

endogenous variables: luratio lwage; deterministic variables: TREND CONST; endogenous
lags (diffs): 1 sample range: [1982, 2005], T = 22 estimation procedure: One stage.
Johansen approach

Correlation: 1 0.37
 0.37 1

TEXTILE INDUSTRY

Johansen Trace Test for: luratio lwage

sample range: [1982, 2005], T = 24; included lags (levels): 2; dimension of the process: 2; intercept included

response surface computed:

r0	LR	pval	90%	95%	99%
0	21.46	0.0322	17.98	20.16	24.69
1	5.25	0.2663	7.60	9.14	12.53

VEC REPRESENTATION

endogenous variables: luratio lwage; deterministic variables: CONST, TREND, D84; endogenous lags (diffs): 1 sample range: [1982, 2005], T = 24; estimation procedure: One stage. Johansen approach

Correlation: 1 -0.074
 -0.074 1

CONSTRUCTION INDUSTRY

Johansen Trace Test for: luratio lwage

unrestricted dummies: D[2001] D[2002]; restricted dummies: S[2001]; sample range: [1982, 2005], T = 24; included lags (levels): 2; dimension of the process: 2 trend and intercept included

response surface computed:

r0	LR	pval	90%	95%	99%
0	37.20	0.0041	26.71	29.29	34.56
1	2.85	0.9520	12.57	14.47	18.49

VEC REPRESENTATION

endogenous variables: luratio lwage; deterministic variables: CONST, TREND, shift level dummy (2002-05); endogenous lags (diffs): 1 sample range: [1982, 2005], T = 24; estimation procedure: One stage. Johansen approach

Correlation: 1 0.01
 0.01 1