What is behind bargaining at firm level ?
An empirical investigation using LISREL techniques[†]

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Abstract

Starting from theoretical literature on bargaining between firm and union, where bargaining exists when rent sharing is possible and unions are sufficiently organised, in this paper we try to identify its empirical counterpart. Moving from a qualitative survey on industrial relationships in a sample of North-Western (Lombardia) Italian firms over 1986-95, we identify a set of relevant variables suitable for a Lisrel analysis. Three unobservable (latent) variables arise, where the first two affect the third one. From regression analysis involving original and latent variables, we are able to characterise the first component as "firm performance" and the second one as "union power" whilst the third one refers to "bargaining outcomes" or agreements. By so doing we find an empirical support for theoretical literature stressing the idea that bargaining is mainly developed when firms are characterised by a good performance and unions are sufficiently representative. Moreover, in a such context, bargaining involves mainly wage related topics.

1. Introduction

An earlier work (Checchi and Flabbi 1999) has analysed firms decentralised bargaining process using a data-set concerning industrial relationship in the North-West (Lombardia) of Italy during 1986-1995[1]. Using factor analysis approach, the authors focused on "firm context" (summed up by

[†] Despite this work comes from a common effort, Daniele Checchi is responsible for sections 1,2 and 4 and Massimo Giannini for sections 3 and 5. The CNR financial support is gratefully acknowledged. We thank Anna di Bartolo for statistical advice.

[1] Data comes from *Rilevazione IRES sulle relazioni sindacali e la contrattazione aziendale nelle imprese lombarde*. This survey started in 1987 (referring to previous year bargaining activity). However it is not a longitudinal survey, i.e. it does not record same firm over different years and for such a reason it allows only cross-sectional analysis. This analysis refers to data ranging from 1986 to 1995, except 1991 since in that year the survey was administrated only to

three unobservable factors, namely "rising firms", "declining firms" and "needs of flexibility") and "extent of formal industrial relations" (also summed up by three factors, such as "search for agreement", "contrast" and "intense bargaining"); these factor were used to investigate the determinants of (formal and informal) agreements between firms and union. The authors concluded that formal agreements were more likely for bigger firms undertaking bargaining, while informal agreements are affected by firm performance.

Nevertheless the question about the reasons why firm and union are induced to meet, independently of achievements, was left open. In other words, the incentives inducing the subjects (firm and union) to seek an agreement remain unknown. Moreover the type of statistical analysis did not allow a straightforward interpretation of the roles played by variables[2].

For such a reason we have reanalysed the same data set under a different perspective, focussing on the inner functioning of the bargaining process. We have also used more suitable statistical tools (latent variables approach, starting from polychoric correlation matrix) in order to overcome the low interpretability of results. Moreover we have followed different logical steps to identify latent variables characterising the bargaining process. Thanks to the Lisrel approach we are able to estimate causal relationship among observed and unobserved variables. Nevertheless the Lisrel approach, which provides a easier interpretability of the causal nexus, can not be applied to large data-sets as the present one. For such a reason, we have restricted the relevant variable set by a careful inspection of polychoric correlation matrix, aiming to identify the most representative variables. This preliminary stage has provided several indications on the causal nexus involved in the bargaining process, providing at the same time a "a-priori" causative scheme to be tested, leaving to the statistical procedure the role of validating and improving this scheme. Hence, instead of carrying out the analysis by arbitrarily splitting in two different tracks, firms context and extent of formal agreement, (later on to be used as independent variables in regression analysis), we have preferred to work simultaneously on an entire subset filtered from the original one, applying the Lisrel approach on it.

Results stress that the bargaining process relies on two necessary requirements: a good firm performance and the presence of a representative and dynamic union. The joint presence of these two conditions appears necessary (at least at statistical level) for a regular negotiation activity. However this result does not close the story because, as estimation shows, there are several statistical relationship among observed and latent variables that our empirical model does not explain at all, although it provides a reasonable interpretative scheme.

2. Collective or Individual Bargaining

Whenever two economic agents have a conflicting behaviour in connection with the same variable, a bargaining process is likely to arise. In a capitalist economy, the labour market shows several conflicting positions between entrepreneur and worker; not only wage but also working time, firm procedures on workers control, job environment, career and dismissal procedures (notably unfair dismissal)[3].

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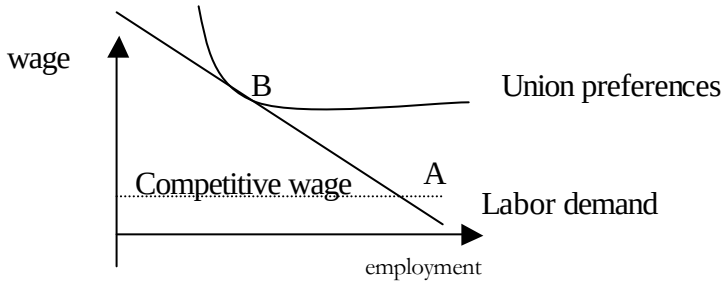
civil servants. Data concern mainly with industrial sector and for firm employing more than 50 workers. Survey has been administered to union members. More information and descriptive statistics are in Regalia-Terragni 1997.

[2] Factor analysis is built on correlation matrix among relevant variables. In our data-set most variables are dummies and the correlation index among dummy variables depends on their joint distribution of the couple of variables (see Checchi and Flabbi 1999, footnote 28).

[3] See Bowles, 1985.

However it is not clear if the negotiation activity on such topics should be conducted on a individual or collective base. Undoubtedly, some topics (such as wage, working hours and career) create limited externalities and therefore induce negotiation on an individual base. Vice versa, other variables (work organisation, relays, work environment) involve more than one worker: in this case a collective bargaining is more likely to appear to the extent that a worker union exists.
The standard theory on bargaining[4] shows that a collective bargaining is possible under two conditions: the presence of a rent (which depends on the existence of a firm market power) and the extent to which workers can be controlled by union. Let us suppose that both conditions are missing, which drives to a competitive model, (represented by point A in figure 1); workers are atomistic (i.e. not organised in union), identical and wage-takers, hence they earn the same wage. Since firm are atomistic and price-taker as well, the free-entry condition guarantees a zero profit. There is full employment and the first welfare theorem assures that such configuration is economically optimal. If we allow firms to have some market power, it will reduce the labour demand, and achieve positive profits. This equilibrium is characterised by sub-optimality since it involves involuntary unemployment. On the other hand, if workers join a union monopolising the labour supply, they will be able to gain a higher wage (point B in figure 1) at the cost of a lower employment, which will affect union members randomly. Once more, this equilibrium is sub-optimal since it involves involuntary unemployment. The only way we can escape the question is offered by the theory on efficient bargaining, where both firm and union achieve Pareto optimal equilibria thanks to the simultaneous bargaining on wage and employment.

Figure 1 - The theoretical bargaining model



Which empirical insights can we obtain from these theoretical observations? Following the above reasoning, bargaining is like to appear when two conditions are simultaneously satisfied:

i) A *favourable course of the firm*, which assures a positive profit. In fact, let us figure what happens in figure 1 when we move rightward the labour demand curve. The firm faces three alternative strategies: given the wage, firm can increase employment or, given the employment, firm can increase wage or a mix of the two strategies. In every case a positive profit calls for a bargaining process over profit sharing.

ii) The *presence of a worker union* representative of the membership. The empirical counterpart to this should be a positive membership rate as a precondition for bargaining. We expect a limited individual bargaining strength (because of the low professional qualification and/or the type of work organisation) in order to induce

[4] See the surveys in Pencavel, 1994, and Booth, 1995, other than Manning, 1987.

workers to join the union; moreover free-riding should be seriously limited in order to gain credibility for the union. By linking the representative power of the union to the level of labour force professional qualification and to work organisation, we could conclude that the second necessary condition for a regular bargaining activity is positively correlated to the homogeneity in professional qualifications of the membership and to the complexity of work organisation, since in both cases there are mutual incentives among workers to override individual bargaining. Obviously this twofold condition is related to an effective capacity of the union to identify targets that are relevant for workers.

These are only some hypothesis we can gather from bargaining theory to which we would like to find an empirical counterpart. This is the aim of the next section.

3. Empirical Analysis

3.1 Data set

The data set includes 1650 firms operating in Lombardia (North-West Italy) during 1986-1995[5]. Differently from other data set on bargaining, that focus only on the presence of formal agreements, our data take into consideration informal ones as well, in addition to a large set of variables describing the interrelationships between firm and union. Among them, presence of bargaining units, extent of union legitimacy, regular meetings, presence/absence of unilateral decisions by firm management, presence/absence of industrial disputes.
Thus we are able to take into account for a large number of variables underlying the bargaining process, independently of final results but knowing if the actors have achieved formal or informal (i.e. without a written document suitable for a Court) agreements as well as the contractual themes involved in the negotiation (such as hiring, firing, wage, working hours, health and environment, career, work organisation and general assurances). Unfortunately we have neither available data on costs and benefits arising from bargaining nor data on the actual firm performance (orders, revenues).
The data bank contains 111 variables referring to nine Lombard districts (Varese, Como, Sondrio, Bergamo, Brescia, Pavia, Cremona, Mantova and Milano). Firm size has been grouped into four groups(0-100, 100-250, 250-500, over 500). Industrial sectors are: chemical, engineering, food, textiles, printing, wood, transport, trade, insurance, sale services and other services. Following Checchi and Flabbi, 1999, some series have been built by aggregating elementary variables (see table 1 in the appendix).

3.2 Structural Analysis: Introductory Outline and Problems

The empirical analysis used in this paper relies on the Lisrel methodology (Linear Structural Relationship); this technique, introduced in the '70's (Joreskog and van Thillo 1973), allows the estimation of unobservable (latent) variables in the factor analysis. Later this technique was

[5] The original data set included 2251 firms which reduces to 1650 because of missing data. Descriptive statistics for the whole databank are in Checchi and Flabbi 1999.

extended beyond factor analysis, becoming a research field by its own, aiming to estimate causal relationships involving observed as well as unobserved variables. The Lisrel approach joins two fundamental aspects in social science: the first one concerns variable measurability and observability, the second one refers to the causal relationship among them. Often social sciences face unobservable variables which play a key role in establishing and identifying causal relationships among observed ones. As said, Lisrel allows the researcher to analyse not only casual relationships among observed variables, as in standard regression models, but even among observed and unobserved (latent) variables as well as among latent ones only. For such a reason we can ideally separate the Lisrel approach into two different stages: the measurement model and the structural model. The former analyses how unobserved variables can be measured by the observable ones, while the latter identifies the causal relationships among latent variables. By so doing the Lisrel approach encompasses three related fields in social science: measurement models, causal analysis and factor analysis.

In our opinion the Lisrel approach is particularly suitable for the type of empirical analysis we have in mind, in particular because the presence of unobserved variables in the bargaining activity makes standard regression techniques biased because of omitted variables. The identification and construction of latent variables allowed us to use them as predictors, in a second stage, of some observed variables, as shown in section 4.

Generally speaking, we can summarise the Lisrel approach with the following points[6]:

- Variables. They are divided in endogenous, or dependent, and exogenous, or independent. Both of them are divided in observed and unobserved (latent). We call η the endogenous unobserved variables, ξ the exogenous unobserved, **Y** endogenous observed and **X** exogenous observed. Our model involves exogenous and endogenous variables, both observed and unobserved.
- Stochastic Errors. These take into account the residual variance not explained by the theoretical model; they are induced by omitted variables and/or measurement errors. Errors are directly linked to variables. With ζ is represented the error in latent endogenous variables η, ε is the error for **Y** and δ to **X**.
- Structural Coefficients. These are the factor weights or factor loadings among variables in the structural model (causal relationships). With λy is represented the coefficients linking η to **Y**, λx links ξ to **X**, β links endogenous latent variables and finally γ represents the coefficients linking exogenous and endogenous latent variables. By these coefficients is possible to calculate the Factor Scores, according Anderson and Rubin, 1956, by using factor weights and the data covariance matrix. Factor scores are used to build numerically the latent variables allowing to quantify unobserved components.
- Variance and Covariance. With ϕ is meant the elements of the covariance matrix for variables ξ, ψ for errors ζ, $\theta\varepsilon$ for errors ε and finally $\theta\delta$ for errors δ.

Outcomes of a Lisrel analysis are often presented in a graphical view; latent variables are conventionally shown by a circle, or ellipse, while observed ones by a box or rectangle. Causal relationship are presented by a one-way arrow pointing from the exogenous to the endogenous variable. Two-way arrows represent correlation between a couple of variables. Along the arrows, the regression weights are shown (or the correlation index for two-way arrows).

More specifically, the Lisrel model involves three fundamental equation. The first one - the structural model - refers to causal relationships among latent variables, both exogenous and endogenous. The representation in matrix form is:

$$h = Bh + Gx + z$$

[6] See Corbetta, 1992, for an introductory reading or Bollen, 1989, for a more technical presentation.

where B is the structural coefficients matrix among endogenous latent variables while G refers to the exogenous ones. Moreover Φ is the covariance matrix among ξ variables and Ψ to ζ errors.
The second equation represent the measurement model; it reports the causal relationships among endogenous variables, both observed and unobserved:

$$\mathbf{Y} = \Lambda_{\mathbf{y}}\eta + \varepsilon$$

where Λy is the structural coefficient matrix among observed endogenous variables and the endogenous latent ones. $\Theta\varepsilon$ is the covariance matrix for errors ε.
Finally, the equation for the measurement model for exogenous variables

$$\mathbf{X} = \Lambda_{\mathbf{x}}\xi + \delta$$

Where $\Lambda_{\mathbf{x}}$ is the structural coefficient matrix among exogenous observed variables and the exogenous latent ones. $\Theta\delta$ is the covariance matrix for errors δ.
The measurement model, likewise the factor analysis, shows how latent variables can be represented by the observed ones; the structural model shows how latent variables interact among them. Thanks to this twofold point of view, the causal map arising from the analysis is particularly rich in explaining the inner functioning of the phenomenon under investigation. This makes Lisrel particularly useful for this type of analysis with respect to traditional regression model, usually able to capture only one-way causal relationships among observed variables.
Summing up, the Lisrel model involves 8 matrix; 4 comes from structural coefficients and the remaining 4 from the covariance structures. These 8 matrices must be estimated starting from the data. The estimation procedure starts from the covariance matrix implied in the available data; actually is rather common to start from the correlation structure, which is more directly readable, but this does not avoid troubles, however, especially when categorical variables are used, as we do; we shall clear the point later on.
It is worth stressing that the Lisrel approach involves a reasonable *a priori* assumption on the underlying causal relationships involved in the analysis, leaving the last word to the estimation stage. In other words, the Lisrel model is only the last part of a more tricky investigation which involves preliminary analysis aiming to the identification of a reasonable causative map to be submitted to Lisrel; we do this in sections 3.3 and 3.3.1.
The estimation stage can be summarised starting from the relationship existing between the data covariance structure and the theoretical one, i.e. the one implied by the estimation procedure (Bollen 1989). According to the estimated parameters it is possible to build a theoretical covariance matrix to be compared with the actual one; if the difference between the two is statistically not significant, then the estimates are validated and the diagnostic stage opens; conversely, a new specification is put under investigation. Hence, the estimation procedure consists in finding a parameter set minimising the distance (discrepancy) between the "theoretical" and the actual covariance matrix[7].
In this term, the estimation procedure seems easier than it is; in fact, if a given parameter set produces a given covariance matrix, the opposite does not hold (namely, a given covariance matrix is consistent with more than a parameter set). It is the well known problem of identification. This can be avoided by imposing some constraints on the parameters and leaving a certain degree of freedom to the model. A model without constraints has zero degree of freedom and its covariance matrix coincide with the data (this model is called "saturated"); this model does not provide a

[7] However, this procedure has its own rational if and only if the Lisrel model under investigation is very close to the "true" model in the statistical population, such that the discrepancy is only due to random components. Nevertheless, as many authors stress, this requirement is too stringent, because it implies an almost complete knowledge of the phenomenon that usually the researcher does not have. It is more acceptable to argue that the estimated model represents a "good" approximation to the real model. According to Bollen, 1989, page 268: "In virtually all cases we do not expect to have a completely accurate description of reality. The goal is more modest. If the model that leads to $\Sigma=\Sigma(\theta)$ (the estimated covariance matrix) helps us to understand the relation between variables and does a reasonable job of matching the data, we may judge it as partially validated".

clearer description of the causal relationship than the original data. Conversely, the so called "independence" model has the maximum degree of freedom (all parameters are constrained). These two alternative models provide a natural upper and lower bound to the estimated model, playing a role in the validation procedure.

After the estimation stage, the validation procedure must end when the estimated model provides a reasonable description of reality; in other words, we have to check that the discrepancy is only due to stochastic components[8]. Nevertheless, as already stressed, is rather difficult for the discrepancy to be due to stochastic component only because this implies a high extent of knowledge by the researcher about the complex pattern of causal relations. For this reason, it is more common to use a wide set of diagnostic tests[9].

We conclude this brief review with a question. As previously said, it is common practice to start the Lisrel analysis with the data correlation matrix but this opens to two difficulties: the first one is specific to Lisrel, while the second one is general when data contain categorical (dummy) variables. About the first question, some authors stress (see Cudeck, 1989, as an example) that using correlation matrix for estimating a correlation structure in Lisrel, as we do, induce a bias in the standard error hence in the diagnostic tests. This problem can be solved by using a Weighted Least Squares estimator where the weights are provided by the asymptotic covariance matrix calculated by original data. We follow this approach.

The second question is more general and affects all statistical methodologies based on the standard Pearson correlation index. This is acceptable only if we are engaged with variables showing a given standard of measurement (usually the real line). However variables in social sciences rarely has such a property and typically we deal with ordinal variables which do not have a natural standard of measurement as the cardinal ones. In this case the Pearson correlation index is a biased indicator for correlation, inducing a serious trouble in statistical methodology based on this type of measure. In order to perform Lisrel analysis even with ordinal variables, Joreskog and Sorbom, 1979 and later Browne, 1984, have developed a statistical methodology aiming to estimate the correlation index in presence of ordinal and dummy variables[10]. The Lisrel software takes into consideration the difference between ordinal and continuous variables and calculate the correlation index appropriately.

3.3 Latent Variables Identification

[8] It can be shown that the discrepancy function is distributed according to a chi-square distribution. The null-hypothesis consists in assuming that the difference between the estimated and the actual covariance matrix is only due to random components. By so doing, if the chi-square test is below the 5% threshold we then accept the estimated model. The chi-square test can be adjusted for the degree of freedom, and in this case it must be close to one in order to have a reasonable estimated model.

[9] In our case, tests are in appendix. They are a large part of the standard tests performed by Lisrel 8 software. Main statistics are: Root Mean Square Error of Approximation (RMSEA) by Browne and Cudeck (5% is considered a good approximation), the Goodness of Fit, GFI, and the adjusted GFI (AGFI by Joreskog and Sorbom); these indicators range between zero and one and the latter is the best value for validating the estimated model. Other tests based on the GFI, are the PGFI and PNFI by James, Mulaik and Brett which weigh up the GFI by a parsimony index. Finally the Hoelter's test, CN, is a general test measuring the goodness of fit; a score above 200 signals a good fit.

[10] Briefly speaking, let us suppose that the ordinal variables X be actually an approximation of an underlying latent variable X* and that the latter can be measured on the Real line (cardinal). By fixing suitable threshold for X*, we can suppose that X assumes a given value only when X* lies into the given range; as an example X=1 when X* lies between a_1 and a_2. The question is to set the thresholds in some optimal way. These authors assume that the latent variable is distributed according to a standard normal distribution. When we are facing two variables, the underlying distribution is characterised by a joint normal distribution; the correlation index is estimated according to this assumption on the distributive law. The estimated correlation index is called "polychoric" ; when the correlation involves continuous and ordinal variables then the correlation index is said " polyserial".

The identification of latent variables has followed a step-by-step procedure. In fact, the main feature of a Lisrel model is the simplicity of the theoretical scheme; for such a reason it is almost impossible to perform a structural analysis on the entire data set (111 variables). We have drastically reduced the number of relevant variables by a careful analysis of the correlation matrix. Our goal was to identify sub-matrix which are relatively independent from the rest of the data-set, in order to identify leading variables in each sub-matrix as representative of the entire sub-set. This first stage of data reduction has been followed by a series of factor analysis aiming to further reduce the relevant space.

By aggregating original series, the number of variables available from the data was in number of 51. As said, by a careful inspection of the correlation matrix provided by the 51 variables has been possible to reduce the space dimension by ignoring correlation indexes below 25%. The view that emerges after deletion confirms that the number of variables which are effectively representative of the phenomenon is smaller than the initial 51. As an example, table 2a shows the correlation index for typical firm input and output variables. Correlations are remarkable; as expectable the variable representing the technological change is highly correlated with the variable measuring the firm investment.[11] The correlation map arising in table 2a induces to retain output, investment, lay-off and technological change as the representative variables for this sub-matrix. Correlations show that a good firm performance implies lower lay-off and a higher technological change rate. For sake of comparison, table 2b shows the correlation obtained by the traditional Pearson coefficient; it is straightforward to note how the Pearson coefficient tends to under-estimate the correlation when ordinal variables are involved.

Table 2a - Polychoric Correlations

	ANDPROD	*V027*	*ANDINV*	*V029*	*V030*	*MUTTEC*	*LAY-OFF*
ANDPROD	1.000						
V027	0.819	1.000					
ANDINV	0.525	0.539	1.000				
V029	0.588	0.523	0.505	1.000			
V030	0.672	0.809	0.506	0.442	1.000		
MUTTEC	-0.17	-0.168	-0.387	-0.13	-0.196	1.000	
LAY-OFF	0.48	0.419	0.215	0.437	0.354	-0.009	1.000

Caption:

ANDPROD - Output trend
V027 - Sales trend
ANDINV - Investment trend
V029 - Employment trend
V030 - Profits trend
MUTTEC - Technical Change
LAY-OFF - Lay-off

[11] The negative sign must not to lead to a wrong conclusion: variables representing factory tendency range from 0 to 3, where the latter means a negative performance.

Table 2b - Pearson Correlations

	ANDPROD	*V027*	*ANDINV*	*V029*	*V030*	*MUTTEC*	*LAY-OFF*
ANDPROD	1.000						
V027	0.706	1.000					
ANDINV	0.424	0.437	1.000				
V029	0.467	0.41	0.393	1.000			
V030	0.557	0.69	0.409	0.355	1.000		
MUTTEC	-0.119	-0.116	-0.275	-0.092	-0.139	1.000	
LAY-OFF	0.356	0.3	0.145	0.282	0.253	-0.009	1.000

Tables 3 and 4 shows a different sub-matrix involving variables characterising union activity. Table 3 reports the regularity in the meeting firm-union and in general the strength of the union. All variables in the table are dichotomous (0 indicating absence). The correlations show that the existence of a bargaining unit induces also a regularity in meeting the firm management.

Table 3

	V031	*V032*	*RIUNORG*	*V120*	*REGINC*
V031	1.000				
V032	0.605	1.000			
RIUNORG	0.345	0.224	1.000		
V120	0.317	0.131	0.101	1.000	
REGINC	0.304	0.28	0.382	0.176	1.000

Caption:

V031 - Personnel management department
V032 - Bargaining unit
RIUNORG - Union activity
REGINC - Meeting regularity
V120 - Presence of independent union

Table 4 shows variables related to the bargaining activity which involves also variables characterising conflicting situations as strike actions and breaks in the bargaining process by the firm management.

Table 4

	RIUNORG	*V063*	*V064*	*STRIKE*	*V111_6*	*COMPDIR1*	*MEMBERS*
RIUNORG	1.000						
V063	0.02	1.000					
V064	-0.013	0.694	1.000				
STRIKE	0.278	0.224	0.235	1.000			
V111_6	0.091	0.23	0.397	0.164	1.000		
COMPDIR1	-0.315	0.243	0.33	-0.053	0.15	1.000	
MEMBERS	0.049	-0.108	-0.125	0.106	-0.049	-0.272	1.000

Caption:

V063 - Meetings denied
V064 - Union proposals refused by firm management
STRIKE - Strike activity
V111_6 - Unsolved disputes in 1987
MEMBERS - Membership
COMPDIR1 - Number of topics where firm management decides unilaterally

A more detailed analysis of table 4 provides further suggestions. There is a strong correlation between V063 e V064 which makes them substitute; in their turn, they have a positive correlation with the strike activity and COMPDIR1, confirming the conflictual role played by these variables. More modest seems the correlation between the membership and the remaining variables with the exception of COMPDIR1; the negative sign means that the stronger the firm management the lower the membership.
By following a similar investigation, it has been possible to extract further variables related to on-the-job training (TRAIN.), part-time (PARTIME), shift work (SHIFTS), work on Saturday (SAT), work on Sunday (SUN). These variables show a sensible correlation with the variables measuring the firm tendency, since they add flexibility to the production process, and the variables related to union activity, since they involve a negotiation process.
Finally a further analysis induce to add to the relevant variable set also INTCAP1 as representative of firm management decision on working hours, wage and work organisation.
The remaining variables have been neglected because either the correlation was very low or their informative power could be absorbed by other variables.
The variables characterising the bargaining outcome, (viz. agreement on hiring, firing, wage, working hours, health and environment, career, work organisation and general issues) are the observed endogenous variables of the model; our aim is to describe how the number and the variety of closed agreements is driven by the observed exogenous variables via latent factors.
At the end of the data reduction stage, we have identified 25 variables as representative of the bargaining process, which constitute the exogenous observed variables for the model. On this sub-set a factor analysis has been carried out to investigate further reduction in the data set; as previously recalled, the Lisrel approach favours particularly simple analytical structures.

3.3.1 Exploratory Factor Analysis

"*Exploratory factor analysis is a technique often used to detect and assess latent sources of variation and covariation in observed measurements. It is widely recognised that exploratory factor analysis can be quite useful in the early stages of experimentation or test development….The results of an exploratory factor analysis may have heuristic and suggestive value and may generate hypotheses which are capable of more objective testing by other multivariate methods*[12]*."*

This citation summarises effectively the way we have carried out factor analysis. In fact this empirical investigation had the twofold role of trying to reduce the number of exogenous variables still further and at the same time providing a first idea about the causal relationships linking the observed variables.
The factor analysis has been performed by the Prelis software which takes into account ordinal variables by calculating polychoric correlations. Moreover this software supplies factor analysis by a Student test on each loading coefficient, making easier the interpretation of unobserved factors.
Results are in table 5 in the appendix; the numbers below each coefficient show, respectively, the standard error and the Student test. The coefficients without figures below them are used by Prelis to normalise each latent factor[13]. This first attempt does not help very much in understanding the causal relationships; in fact there are 5 latent factors which are not easily interpretable. Moreover, as table 6 shows, the correlation among factors 2,3,4, and 5 is too high to conclude for a satisfactory goodness of fit of the analysis.

[12] Joreskog, Sorbom, du Tolt, 1999 page 147.
[13] See Joreskog, Sorbom, du Tolt, 1999, for technical details.

Table 6 - Correlation indexes among factors

	Factor 1	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
Factor 1	1.000				
Factor 2	-0.02	1.000			
Factor 3	-0.032	-0.033	1.000		
Factor 4	0.027	0.347	0.267	1.000	
Factor 5	-0.071	0.28	0.172	0.16	1.000

The analysis of results induces to conclude that likely the number of latent factors effectively representative of the phenomenon is lower than 5 and that factors 2,3,4, and 5 are capturing a common unobserved variable related to union activity. Hence, in a further application of factor analysis, we have retained only ANDINV and ANDPROD as representative of firm performance, V120 has been abandoned because its role could be played by other variables already contained in the sub-set. The variable REGINC has been replaced by INCFISS because the latter shows a higher correlation index but has same interpretation. V063 and V064 have a higher correlation index (0.67) which allows us to retain only one out of two, namely V063. V111_6 has been neglected because of the high correlation with V063 and V064. For the same reason in the couple measuring working activity during the week-end, namely SAT and SUN, we have retained only the former.

After this further data reduction, the data set reduces to 17 variables relatively to the measurement model for the exogenous variables. On this sub-sample we carried out a third factor analysis whose results are in table 7. The reduction in the number of relevant variables produced a remarkable gain: the common factors reduce to 2 which can be easily interpreted as *firm performance* and *union activity*. The correlation among these two factors amounts to only 0.001.

Looking at results shown in table 7, the variables related to the firm performance (ANDPROD and ANDINV) interacts mainly with the variables related to lay-off, training, work shift and part-time. According to the coefficient signs, there is a positive relationship between a good firm performance (low values for ANDPROD and ANDINV) and the use of flexibility in production (namely training, work shift, part-time) and the technological change. There is instead a negative relation with strike activity and lay-off, confirming that a good firm performance tends to reduce conflictual behaviours between management and union. A minor role is played by the membership and in general by union activity, confirming that this first factor is mainly related to firm activity rather than union behaviour.

The second factor is mainly related to variables representative of the union activity. Looking at the coefficients, there is a set of variables which have a negative sign, namely, regularity of meetings (INCFISS), strike activity (STRIKE) and membership (MEMBERS). Moreover there is a variable set presenting a negative sign and that are in common with the first factor, i.e. part-time and training while ANDINV and V063 have a positive sign. Trying to understand the underlying meaning of this pattern, one could argue that union activity involves a regularity in meetings which in its turn are subordinate, at some extent, to the real possibility of agreement with firm management. This conclusion can sound trivial, but the coefficient signs lead to the idea that the more the firm management tends to decide uncompromisingly (COMPDIR1 and V063 exhibit positive values) the less likely are meetings, union involvement in decisions concerning lay-off, training and work shift, and union density as well. Data also suggest that a bad firm performance tends to induce a harder behaviour of the management with unions, increasing the number of subjects where it decides unilaterally (COMPDIR1) and denying meeting proposals (V063) with the result of reducing meeting regularity (RIUNORG), increasing strike activity (STRIKE) and finally reducing membership (MEMBERS).

Concluding, we can carefully interpret factor analysis results by identifying two latent factor; the first one represents *firm performance* - measured by a good firm tendency in output and investment, flexibility, i.e. training on the job, low lay-off and technological change - whilst the second one refers to an *intense bargaining activity* - measured by regularity in meetings, high membership and low strike activity.
This first draft of the causal relationship between observed variables and latent factors provides the necessary initial step for the Lisrel analysis. We have then to conclude in favour or against not of the causal scheme depicted by factor analysis and at the same time describe how latent factors affect bargaining outcomes, measured by agreements on specific issues, like hiring, firing, wage, work hours, work organisation, health and work environment, general guarantees and employees career.

Table 7 - Exploratory Factor Analysis

	Factor 1	*Factor 2*
CONTRFL	-0.408	-0.038
t	*-11.433*	*-0.886*
ANDPROD	0.838	0
ANDINV	0.531	0.179
t	*14.815*	*4.752*
V032	0.017	0.478
t	*0.489*	*7.903*
RIUNORG	0.082	-0.41
t	*2.273*	*-9.050*
INCFISS	-0.153	-0.236
t	*-4.200*	*-5.291*
V063	-0.069	0.184
t	*-1.933*	*4.061*
STRIKE	0.166	-0.214
t	*4.315*	*-4.629*
TRAIN.	-0.23	-0.287
t	*-6.337*	*-6.502*
SHIFTS	-0.173	-0.303
t	*-4.828*	*-6.861*
PARTIME	0.099	-0.06
t	*2.736*	*-1.361*
SAT	-0.227	-0.124
t	*-6.167*	*-2.770*
MUTTEC	-0.382	-0.261
t	*-10.318*	*-5.804*
INTCAP1	-0.097	0.089
t	*-2.685*	*2.005*
LAY-OFF	0.4	-0.329
t	*10.223*	*-8.226*
COMPDIR1	0	0.754
MEMBERS	0.073	-0.26
t	*2.070*	*-5.767*

3.3.2 Lisrel Analysis

As previously pointed out, the Lisrel technique aims to investigate causal relationships between exogenous and endogenous variables, both observed and unobserved. The factor analysis shown in the previous section provides a good initial step. We then assume that the measurement model (confirmatory factor analysis) for the observed exogenous variables take into consideration the 17 variables shown in the previous section relatively to two latent factors (*firm performance* and *union activity*). These two latent variables should help to explain the bargaining outcome. Following this

line of argument, we now postulate that the two latent variables act as regressors for a third unobserved variable representing the presence of agreement; this third factor is in its turn measure by observed variables characterising presence of agreements on the nine bargaining items: hiring, firing, wage, work hours, work organisation, health and work environment, general guarantees, employees career and workplace services.
The estimated model is shown in figure 2. For sake of simplicity the picture refers only to the relationship that are statistically significant; the whole model implies a complex net of correlations among errors of observed variables[14]. Coefficients and t-statistics test are shown in table 8. Tables 9 and 10 in appendix summarise Factor Scores and goodness of fit. Variables in figure 2 have been re-labelled for a better reading.

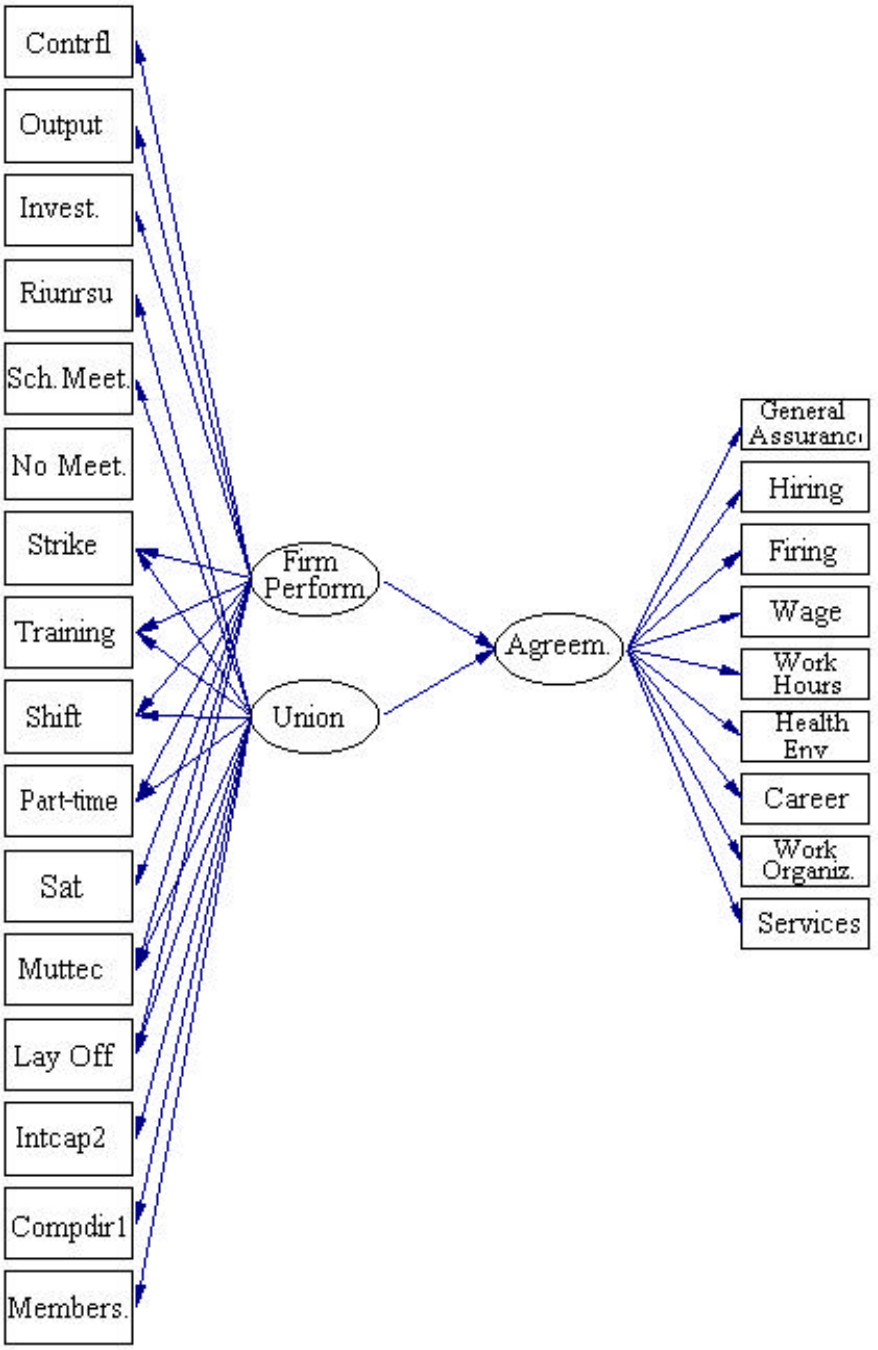
As previously recalled, the Lisrel graphical language shows unobserved variables by an ellipse and the observed one by a rectangle; the left part of the picture refers to the measurement model for observed exogenous variables and the right one to the measurement model for the endogenous. The causal relations among latent variables represents the structural model. The correlation between latent factors meaning "firm performance" and "MEMBERS" amounts to 0.22

The analysis of coefficients[15] confirm results previously obtained by factor analysis; the first latent factor, firm performance, measures a positive tendency for the factory; in fact variables referring to output and investment have a negative sign which means that this factor is lower when output and investment are low (variables span from 0, good performance, to 3, bad performance). Further, the higher the firm performance the more is the incentive to training, work shift, work on week-end and the lower lay-off and strike activity.

The latent factor labelled as "union" is represented by variables measuring regularity and smoothness in the meetings and by membership. Moreover, variables related to lay-off, work shift and training have also a role in explaining such factor. The variable measuring strike activity has a positive role, confirming the threatening role played by this variable in the bargaining process.

[14] The estimated covariance matrix for the stochastic components is available upon request.
[15] It is worth stressing that V032 has never been statistically significant and for such a reason it has been erased. Also V063 is not statistically significant but it has shown a certain correlation with the error components.

Figure 2 - The Estimated Model.



Caption:
Contrfl = *Young worker fixed-term contracts*
Output = *Output trend*
Invest = *Investment trend*
Riunrsu = *Work council meetings*
Sch. Meet. = *Scheduled meeting union-firm*
No. Meet. = *Meeting denied*
Sat = *Work on Saturday*

Muttec = *Technological change*
Intcap2 = *Topics where firm management decides in agreement with unions*
Compdir1 = *Topics where firm management decides unilaterally*
Members = *Membership*

Finally, it is worth stressing that the variables measuring unilateral decision by firm management have a negative sign, which seems to conclude for a weakening in union strength.
The first two latent factors have a positive and significant role in explaining the latent variable related to richness in agreement. The arising pattern confirms that a good firm performance jointly to the presence of an active union unit are two necessary pre-conditions for achieving positive agreement between firm management and workers union.

Table 8 - Final model estimates

Coefficients

	Agreements
General guarantees	0.8
t	*30.11*
Hiring	1.03
t	*17.08*
Firing	0.28
t	*11.39*
Wage	0.87
t	*33.21*
Work Hours	0.9
t	*36.24*
Health and Job Env.	0.87
t	*32.02*
Career	0.82
t	*33.21*
Work Organis..	0.81
t	*30.27*
Services	0.76
t	*28.53*

	Firm Performance	*Union*
Agreements	0.21	0.39
t	*5.85*	*10.41*

Coefficients		
	Firm Performance	*Union*
Contrfl	0.56	- -
t	*14.25*	
Output	-0.47	- -
t	*-11.99*	
Invest.	-0.53	- -
t	*-12.74*	
Riunrsu	- -	0.45
t		*12.84*
Sch. Meet.	- -	0.51
t		*12.31*
No Meet.	- -	- -
Strike	-0.09	0.35
t	*-2.17*	*8.87*
Train.	0.27	0.29
t	*7*	*8.28*
Shifts	0.28	0.31
t	*7.1*	*8.9*
Part-time	-0.22	0.17
t	*-5.27*	*4.56*
Sat	0.39	- -
t	*9.94*	
Muttec	0.35	0.14
t	*8.97*	*4.26*
Lay-Off	-0.16	0.14
T	*-4.01*	*4.17*
Intcap2	- -	-0.11
t		*-3.19*
Compdir1	- -	-0.6
t		*-15.34*
Members	- -	0.2
t		*4.94*

Up to now we have commented only direct nexus among variables; actually the final model shows a complex feedback net among stochastic components which are taken into consideration by Lisrel estimation. The latent factors can be built by calculating Factor Scores (shown in appendix) which take into account direct as well as feedback nexus among variables[16].

The tests of goodness of fit are encouraging; validation indexes are well into the threshold required for a good fit. In particular RMSEA is 5% and GFI, AGFI and NFI are close to one. From this point of view, the strong data reduction presented in section 3.3 and 3.3.1 has not altered remarkably the empirical model and the causative map captured by it.

We conclude this part with the squared multiple correlations among endogenous variables (table 11); these coefficients, ranging from zero to one, measure the percentage of variance of a given variable which is explained by the model; the remaining part to one must be instead attributed to the exogenous stochastic component. Generally these coefficients are satisfactory with the exception of the variable related to firing although the error component of this variable has a strong correlation with the variable representing the lay-off.

[16] Factor Scores have been used in section 4 as regressors of further endogenous observed variables. Technically speaking, factor scores represent the regression weights of all observed variables on latent factors, making easier to build numerically the latent factors.

Table 11 - Squared Multiple Correlations

Gen. Guar.	*Hiring*	*Firing*	*Wage*	*Work Hours*	*Health Work Env.*	*Career*	*Work Organis.*	*Services*
0.63	0.91	0.08	0.77	0.81	0.75	0.68	0.66	0.58

4 - Latent variables validation and their interpretation

The previous analysis has shown that starting from the 150 original variables it is possible to extract a small sub-sample, made of 25 variables, characterising the bargaining process. The estimation results allows us to identify the three latent variables as "firm performance", "union" and "agreements", where the first two factors affect positively the third. This result is particularly encouraging since it basically confirms the theoretical literature stressing that *bargaining is present when there is an available rent (and the latter is likely to appear when there is a good firm performance) and when the union (or its representative) has a strong bargaining power to induce firm to cooperate for an agreement*.

Nevertheless, as a further investigation on the role played by the latent factors, we report some distributive features which can help to understand how the latent variables summarise the bargaining activity.

Table 12 shows the distribution of the unobserved factors with respect to firm size while table 13 reports it with respect to the respondent expectations (variable ANDPERC). From the first one it seems that firm performance is not closely related to firm size although larger firms tend to do better; conversely the union strength is increasing in the firm size. If we could conclude that performance and union activity are positively related to the size of the firm, this would mean that the average and large firm has a relative advantage with respect to the traditional atomistic microeconomic model, since a more regular bargaining activity means a lower strike action and lay-off as well as a more co-operative behaviour between firm and workers (which in turns means less wasting of work hours due to conflictual positions)[17].

It must noted that bargaining tends to decrease with respect to firm size[18]. From table 13 is instead possible to conclude that the first latent factors captures effectively a good firm performance as comes from respondent expectation relatively to output, employment, profits and investment[19] although the union power does not seem affected by this variable. Bargaining outcomes are instead affected by firm performance.

[17] A further observation on this matter relates to the literature on workers shirking (although it is only a simple remark because the model has not enough statistical information to support it); a higher co-operation between union and firm management should increase the relationship between union management and workers, assuring a higher control on the latter by the former and so reducing opportunistic behaviours (free-riders). In this perspective, the higher wage induced by bargaining with respect to the competitive solution could be justified by a sort of risk premium that firm pays to workers to prevent free-riding behaviours.

[18] Firm size is statistically significant in explaining bargaining outcome in Bordogna, 1997, while in Checchi and Flabbi, 1999, this is true only for formal agreements.

[19] It was easily expected, since this variable is affected by the variable measuring output and investment.

Table 12 - Latent variables distribution – sample averages w.r.t. firm dimension

	Employees			
	0-100	101-250	251-500	>500
var1 (firm performance)	-0.5077	-0.4573	-0.4375	-0.399
var2 (union power)	0.0535	0.4202	0.774	1.038
var3 (bargaining activity)	0.0209	-0.0648	-0.2949	-0.3583

Table 13 - Latent variables distribution – sample averages w.r.t. respondent expectations

	Expectation		
	Declining	stable	growth
var1 (firm performance)	-1.06	-0.5281	-0.0841
var2 (union power)	0.5008	0.5037	0.4849
var3 (bargaining activity)	-0.0624	-0.1295	-0.1893

Table 14 - Latent variables distribution – sample average w.r.t. industrial sector

	Industrial sector								
	Chemical	Food	Steel	Textile	Printing	Wood	Transport	Trade	Cred/ins
var1 (firm performance)	-0.3976	-0.481	-0.4622	-0.5152	-0.3263	-0.2899	-0.5323	-0.5693	-0.4042
var2 (union power)	0.7372	0.62861	0.6138	0.4296	0.7026	0.1807	0.2243	-0.121	0.045
var3 (bargaining activity)	-0.2064	-0.13023	-0.1947	-0.1687	-0.2262	0.0485	-0.0516	0.0222	0.0824

It does not seem easy to achieve same conclusions by looking to the industrial sector of reference(see table 14). Firm performance seems to work properly for the chemical and wood sectors but because of a cyclical shift between these two sectors, this type of information has a low interpretative power. The temporal shift in the implementation of bargaining agreements makes it difficult to interpret the third latent variable representing them. More interesting is to list the industrial sectors according to union power; it comes out that unions in chemical and printing sectors, jointly with food and steel sectors, are the strongest while trade and services are at the bottom of the range.

Finally we have considered the latent variables distribution with respect to the way bargaining can occur, i.e. no agreement (when one player denies the agreement), informal agreement[20] (which represents a "weak" agreement since it could not be enforced in a Court), and formal agreements (which the most typical outcome of bargaining). For sake of comparison we report also firms that do not undertake bargaining activity. From table 15 it is possible to show that bargaining is triggered off by firm performance beyond a given threshold (note at the difference between the first latent variable when there is not bargaining w.r.t. the other three cases). When there is no bargaining, because of data temporal length, we can not distinguish between firms that does not open to negotiation because they are currently running under a previous agreement and firms that do not bargain. Vice versa, when a bargaining activity is undertaken, we observe that the outcome depends on union power: if it is low, no agreement is achieved; informal agreement arise when union power grows and formal agreements are the most likely result at the highest level of strength. Seen in this perspective, informal agreements do not represent a form of flexibility in bargaining process rather they are a sign of union weakness. Finally, the interpretation of the third variable is rather fuzzy, since it should present higher value when formal agreements are achieved while it shows the opposite tendency.

[20] This type of agreement is rather common since 20% of firms involved in the survey concludes for informal agreement. It refers especially to work organisation and hours, while wage usually leads to formal agreements.

Table 15 - Latent Variables Distribution – sample average w.r.t agreement type

	Bargaining outcomes			
	No bargaining	No agreement	Informal agreement	Formal agreement
var1 (firm performance)	-0.57	-0.4761	-0.4324	-0.4224
var2 (union power)	0.1736	0.0604	0.2268	0.7432
var3 (bargaining activity)	0.0307	0.0342	-0.0707	-0.24

If we have convinced the reader that our analysis is effectively able to identify unobserved variables that are a reasonable approximation of what we mean for "*a good firm performance*", "*union power*" and "*bargaining activity*", then we can use these variables to remark some historical aspects of bargaining activity. Looking at figure 3 (showing latent variables average values for each single year) one can note that firm performance and union power are not perfectly correlated. At the end of '80's, a good firm performance was correlated with a strong union but the latter declined just one year before than the recessive phase experienced in Italy, which our data record to 1990[21]. This union weakness seems to last for the first half of 90's, although the growth phase in Italy during 1994-95 induced, at a certain extent, a recover in union power. Nonetheless, figure 4 suggests that a declining phase in union strength does not necessarily involve a reduction in bargaining activity, since the wave of formal re-negotiation after July 1993 happened in a phase of union weakness and it involved a higher number of bargained topics. This suggests that bargaining activity underwent a remarkable change during last decade, since local bargaining made up for the lack of the national one in ensuring a wage growth and this phenomenon involved also other type of agreements (work hours in particular).

[21] It must be recalled that the survey was not administrated during 1991. Nevertheless the recorded tendency are coherent with aggregate data.

Figure 3

Figure 4

However, a more detailed investigation into the explanatory power of latent variables in describing bargaining requires more robust analysis where unobserved variables act as independent regressors. Table 16 shows results coming from six different models representative of several features of bargaining[22].

The first model shows a probit analysis on the presence of bargaining (dependent variable is one when there is an agreement, both formal and informal, and zero otherwise). It confirms that there is bargaining, whatever the outcome, when firm shows a profitable performance and union is strong and this is particularly true when firm size increases.

The second model, still a probit one, takes into account the probability of not achieving an agreement (dependent variable equals to one). We can conclude that this probability is not dependent on firm performance but it is correlated to union weakness, and is also increasing in firm size.

The third model sums up previous two by estimating an ordered-probit model on the different bargaining outcomes: 0 - no bargaining (benchmark), 1- denied agreement, 2 - informal agreement, 3 - formal agreement. Better results, at least in a union perspective, are achieved when firm performance is good, union power is high and firm size is high.

The fourth model takes into account the "richness" of bargaining, i.e. the number of bargained topics. The estimation uses OLS (adjusted for heteroschedasticity according to Huber-White

[22] All models control for year, firm county and sector, in order to be read as a representative firm under these characteristics.

estimator); it is shown that firm performance, union power and factory size are not only responsible for better bargaining outcome but also for the richness of the agreements.
Finally, last two models refers to incentives system. In fifth column a probit maximum likelihood estimator analyses the probability of finding individual wage incentives (unilaterally decided by the firm); this probability grows with firm size and union weakness. Vice versa, in sixth column, collective wage incentives are related to firm performance and union power, independently of firm size.

Table 16 - Latent Variables Effects on Bargaining Features
(t-statistics in parenthesis)

Model 1: bargaining (probit)
Model 2: no agreement (probit)
Model 3: different outcomes (ordered probit)
Model 4: bargaining richness (ols)
Model 5:individual wage incentive (probit)
Model 6:collective wage incentive (probit)

Model :	*1*	*2*	*3*	*4*	*5*	*6*
# obs :	1647	1415	1647	1647	1146	1146
Depvar:	Bargain	Noagreem.	Agreem.	Form.Agrem.	Ind.Inc.	Coll. Inc.
var1 (performance)	0.347	-0.096	0.32	0.794	-0.116	0.272
	(4.30)	*(-1.09)*	*(4.72)*	*(7.16)*	*(-1.19)*	*(3.03)*
var2 (power)	0.302	-0.169	0.404	0.958	-0.159	0.272
	(6.27)	*(-3.29)*	*(10.39)*	*(14.27)*	*(-2.81)*	*(5.13)*
dim2 (101-250)	0.208	0.104	0.198	0.099	0.318	0.002
	(2.23)	*(0.90)*	*(2.56)*	*(0.77)*	*(2.89)*	*(0.02)*
dim3 (251-500)	0.244	0.318	0.249	0.26	0.743	-0.088
	(2.10)	*(2.35)*	*(2.58)*	*(1.56)*	*(5.30)*	*(-0.70)*
dim4 (beyond 500)	0.383	0.454	0.285	0.488	0.934	0.051
	(2.80)	*(3.17)*	*(2.59)*	*(2.51)*	*(6.46)*	*(0.38)*
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
County	Yes	Yes	Yes	Yes	Yes	Yes
Sect	Yes	Yes	Yes	Yes	Yes	Yes
PseudoR²	0.088	0.054	0.079	0.233	0.12	0.058

Let us summarise our results in table 17 which splits firms according the two latent variables distribution above or below their median value[23] and distribute them according to bargaining outcome. It is straightforward to see that a profitable firm performance (available rent) and union power (negotiation) are individually and independently necessary for an effective bargaining outcome; two third of firms where there is no bargaining are characterised by union weakness while a corresponding extent of firms signing a formal agreement are characterised by union strength. It seems possible to argue that a profitable firm performance is only a necessary condition while union power is the true driving variable in bargaining.[24] However the final picture is more complex since it is the content of agreement which is changing with firm performance and union power and not the presence of agreement by itself. Table 18 distributes the topics bargained over according to latent variables: when firm performance is low, then bargaining concerns mainly lay-off and conversely, when the former is good, it deals with work hours. When firm performance is good and union is strength is high, bargaining concerns wage, career, health and environment, workplace services and employment. This has already emerged in table 12, using squared multiple correlations. In fact, the

[23] A low performance firm where union is weak lies below the median value for both variables.
[24] Nevertheless, when replicating the six models with the introduction of a variable obtained as the interaction of the two latent variables, it is always statistically insignificant.

highest values of this index refers mainly to employment, wage and environment; with our interpretation of latent variables, this means that when firms are good performer and unions are stronger, they bargain mainly over these topics. By looking also to factor analysis results, one should be convinced that negotiation w.r.t employment reduction is poorly represented in our data-set. Nevertheless, we cannot infer not conclude that this variable is left to a unilateral firm behaviour, but requires weak unions and bad firm performance.

Table 17 – Firm performance, Union Power and Bargaining

No Bargaining

	Weak Union	*Strong Union*
Good performance	33.24	23.21
	30.95	12.61

Formal Agreement

	Weak Union	*Strong Union*
Good performance	16.48	31.44
Bad performance	23.03	29.04

Table 18 – Firm performance, Union Power and Bargaining Outcomes

	Weak Union	*Strong Union*	*Weak Union*	*Strong Union*
	Bad Performance	*Bad Performance*	*Good performance*	*Good performance*
Guarantees	0.185	**0.469**	0.318	0.466
Hiring	0.060	0.167	0.171	**0.282**
Firing	**0.285**	0.236	0.185	0.248
Wage	0.411	0.542	0.659	**0.748**
Work hours	0.629	**0.837**	0.517	0.782
Work Env.	0.126	0.274	0.374	**0.489**
Career	0.199	0.358	0.346	**0.470**
Work Org.	0.146	0.313	0.218	**0.353**
Services	0.344	0.378	0.374	**0.410**

Note: Outcome frequency w.r.t. bargaining activity (formal agreements)
In bold the most frequent occurrences.

5. Conclusions

We started with a brief review of theoretical literature on bargaining between firms and unions stressing two necessary conditions: a firm rent available and the presence of a representative and active union. While the form is measurable thanks to firm accounting, it is more difficult to quantify the latter. Standard measure of union power by aggregate data (wage/GDP, density, strike activity) are not very useful for local bargaining. For such a reason, starting by a qualitative survey on industrial relationship on a sample of North- West Italian firms during 1986-95 we have identified a sub-set of variables suitable for factor analysis based on polychoric correlations. From this analysis three latent variables emerge, where the first two affect the third one. Thanks to regression analysis among observed and unobserved variables we have identified the first latent one as "firm performance", the second one as "union power" and the last one as "bargaining outcomes".
The distribution of latent variables w.r.t. firm characteristics (size, sector, respondent expectations) and bargaining outcomes (no agreement, informal agreement, formal agreement) provides an empirical support to the theoretical literature. Local bargaining arises mainly when firms are good

performer and unions are strong. These two conditions affect also the type of agreements achieved: these are mainly of formal type and refers especially to wage when union power is high. Obviously this does not close the question and bargaining is possible even when firm performance is bad and union power is low but in this case it concerns mainly reduction in employment and individual guarantees.

References

Booth A.1995, *The economics of the trade union*, Cambridge University Press 1995

Booth A. e M.Chatterji 1995. Union membership and wage bargaining when membership is not compulsory. *Economic Journal* 105: 345-360.

Bollen, K.A., 1989, *Structural equations with latent variables*, New York, Wiley.

Browne, M.W., 1984, Asymptotically distribution free methods for the analysis of covariance structures, *British Journal of Mathematical and Statistical Psychology*, 37, 62-83.

Bordogna L. 1997, Un decennio di contrattazione aziendale nell'industria - Tendenze qualitative (1984-94) in Bellardi L. e L.Bordogna (eds) 1997, *Relazioni industriali e contrattazione aziendale - Continuità e riforma nell'esperienza italiana recente*, F.Angeli

Bordogna L. 1998, La contrattazione decentrata nell'industria, in CESOS, *Le relazioni sindacali in Italia 1996-97*, Edizioni Lavoro, Roma

Bowles S. 1985, The production process in a competitive economy: Walrasian, neo-Hobbesian and Marxian models, *American Economic Review* 75, 16-36.

Checchi D. e L.Flabbi 1999, Dieci anni di contrattazione aziendale in Lombardia – 1986-95, *Lavoro e Relazioni Industriali* 2, 3-54 (versione ridotta di: Procedure e risultati negoziali della contrattazione decentrata in Lombardia - 1986-95, *Ires Papers*, Collana Ricerche n.47/99).

Corbetta, P., 1992, *Metodi di analisi multivariata per le scienze sociali*, Bologna, Il Mulino.

Corneo G. 1995. Social custom, management opposition, and trade union membership, *European Economic Review* 39, 275-292.

Cudek, R., 1989, Analysis of correlation matrices using covariance structure models, *Psychological Bullettin*, 105: 317-327.

Joreskog, K.G., 1994, On the estimation of polychoric correlations and their asymptotic covariance matrix, *Psycometrica*, 59: 381-389

Joreskog, K.G., Sorbom, D., 1979, *Advances in factor analysis and structural equation models*, Cambridge, Mass. Abt Books.

Joreskog, K.G., Sorbom, D., 1996, *Lisrel 8: User's Reference Guide*, pubblicato dalla Scientific Software International, Chicago

Joreskog, K.G., Sorbom, D., du Tolt, S., du Tolt, M., 1999, *Lisrel 8: New Statistical Features*, pubblicato dalla Scientific Software International, Chicago.

Joreskog, K.,G., van Thillo, M.1973, *Lisrel: A general computer program of estimating a liner structural equation system involving multiple indicators of unmeasured variables*. Research Report 73-5, Università di Uppsala.

Manning A. 1987, An integration of trade union models in a sequential bargaining framework, *Economic Journal* 97, 121-139

Naylor R. e M.Cripps 1993. An economic theory of the open shop trade union. *European Economic Review* 37: 1599-1620.

Pencavel J. 1994, *Labor markets under trade unionism - employment, wages and hours*, Basic Blackwell.

Regalia I. e L.Terragni 1997, Contrattazione e relazioni industriali in Lombardia. 1993-1996, *Ires Papers*, Collana Ricerche 43.

Rossi F. 1997, La contrattazione aziendale nel triennio 1994-1996, *CSC Ricerche n.123*
Sestito P. 1995, Il livello aziendale della contrattazione sindacale in Italia: una rassegna delle evidenze e alcune considerazioni, *Banca d'Italia 1995*.

Table 1 - Transformed variables list and original series

v002 presence of bargaining unit
v006 industrial sector
dim firm size (1∈[0,100], 2∈[101,250], 3[251,500], 4∈[501,9999])
dim1 dim=1
dim2 dim=2
dim3 dim=3
dim4 dim=4
built from original series
v007 number of employees
lay-off lay-off (1 no 2 Extraordinary CIGS 3 ordinary CIG 4 Extraordinary and ordinary)
built from original series
v020 Extraordinary Lay-off (0 no 1 yes)
v021 Ordinary Lay-off (0 no 1 yes)
andperc respondent expectation on employment (1 declining 2 stable 3 growth)
built from answers on recent trends in
andprod output (over last 3 years)
v027 sales (over last 3 years)
Andinv investments (over last 3 years)
v029 employment (over last 3 years)
v030 profits (over last 3 years)
assunz new hiring (over last 3 years) (0 no 1 yes)
v011 employment reduction (over last 3 years) (0 no 1 yes)
contrfl fixed term contract for young workers (0 no 1 yes)
shifts work shifts (0 no 1 yes)
partime part-time (0 no 1 yes)
sat work on Saturdays (0 no 1 yes)
sun work on Sundays (0 no 1 yes)
mutorg work organisation change (0 no 1 yes)
muttec technological change (0 no 1 yes)
v031 personnel management department (0 no 1 yes)
v032 presence of bargaining unit (0 no 1 yes)
ultrin years from last work council replacement
built from [year - v037 + 1]
v037 last work council replacement.
riunorg work council meeting over last 3 months (0 no 1 yes)
rsuorg work council share elected by union members
built from rsuorg= v040/v041 and summarising
v039 members appointed by workers
v040 members appointed by union members
v041 total members in a work council
reginc meeting regularity (1 absence 2 not scheduled meetings 3 scheduled meetings)
built from
v061 presence of regular meetings (0 no 1 yes)
incfiss scheduled meetings (0 no 1 yes)
v071 presence of meetings unanimously agreed (0 no 1 yes)
intcap1 nr. topics where intermediate management decides unilaterally
intcap2 nr. topics where intermediate management decides in agreement with unions
it summarises

intorg decision on work organisation (0 no 1 yes)
intcont decision on dispute (0 no 1 yes)
intaum decision on wage growth and career (0 no 1 yes)
intor decision on work hours (0 no 1 yes)

compdir1 nr. topics where firm managers decide unilaterally

it summarises

v075 decision on overtime work (0 no 1 yes)
v076 decision on holidays (0 no 1 yes)
v077 decision on mobility (0 no 1 yes)
v078 decision on work organisation (0 no 1 yes)
v079 decision on training (0 no 1 yes)
v080 decision on white-collar training (0 no 1 yes)

volacc willingness to achieve an agreement:

1 low (strike and disputes)
2 medium (strike or disputes)
3 high (no strike nor disputes)

built from

strikes strikes (0 no 1 yes)
v109 court disputes (0 no 1 yes)

v111_6 unsolved disputes (0 no 1 yes)
v063 meetings denied (0 no 1 yes)
v064 unions' proposals refused by firm management (0 no 1 yes)
sandip sanctions to employees (0 no 1 yes)
totcdq quality control (0 no 1 yes)

members union density at firm level

built from

v116c CGIL total members
v116f CISL total members
v116i UIL total members
v116n CGIL-CISL-UIL total members

v120 presence of independent unions (0 no 1 yes)

acc presence of formal and informal agreements (0 no agreement 1 informal 2 formal)

built from

v082 formal agreements
v110 informal agreements

naccform n.r. topics involved in formal agreements

it counts how many topics have been bargained over using the following variables

garanzie general guarantees (0 no 1 yes)
assunzioni hiring (0 no 1 yes)
riduzioni firing (0 no 1 yes)
salario wage (0 no 1 yes)
orario working hours (0 no 1 yes)
amb.salute health and environment (0 no 1 yes)
inquadr. career (0 no 1 yes)
organizzaz. work organisation (0 no 1 yes)
servizi workplace services (0 no 1 yes)
incind presence of individual worker incentives (0 no 1 yes)

it summarises

ineino blue-collar wage incentives (0 no 1 yes)
ineini white-collar wage incentives (0 no 1 yes)

inccoll presence of collective incentive (0 no 1 yes)
it summarises
inecolo blue-collar collective wage incentives (0 no 1 yes)
inecoli white-collar collective wage incentives (0 no 1 yes)
train on the job training

Table 5 - Exploratory Factor Analysis

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
CONTRFL	-0.318	0.153	0.026	-0.170	0.143
	(0.03)	(0.05)	(0.04)	(0.06)	(0.04)
	-10.935	2.963	0.718	-2.726	3.995
ANDPROD	0.832	0.026	0.040	0.015	-0.059
	(0.02)	(0.03)	(0.02)	(0.04)	(0.02)
	45.737	0.871	1.922	0.431	-2.773
V027	0.947	0.000	0.000	0.000	0.000
ANDINV	0.610	-0.117	0.099	0.185	0.102
	(0.03)	(0.05)	(0.03)	(0.05)	(0.03)
	22.986	-2.560	3.163	3.406	3.192
V029	0.650	0.062	0.030	0.159	0.029
	(0.02)	(0.04)	(0.03)	(0.05)	(0.03)
	26.192	1.438	1.018	3.103	0.965
V030	0.781	-0.033	0.025	0.030	0.078
	(0.02)	(0.03)	(0.02)	(0.04)	(0.02)
	39.737	-1.016	1.137	0.776	3.469
V031	-0.018	0.343	-0.037	0.384	0.020
	(0.03)	(0.05)	(0.04)	(0.06)	(0.04)
	-0.578	6.318	-1.035	6.178	0.540
V032	-0.025	0.479	-0.157	0.195	0.093
	(0.03)	(0.06)	(0.04)	(0.07)	(0.04)
	-0.760	8.576	-4.063	2.951	2.359
RIUNORG	0.000	0.682	0.000	0.000	0.000
V063	0.075	-0.012	0.560	0.058	0.132
	(0.02)	(0.04)	(0.04)	(0.05)	(0.03)
	3.319	-0.286	15.642	1.251	4.701
V064	0.000	0.000	0.998	0.000	0.000
STRIKES	0.049	0.404	0.328	0.044	-0.076
	(0.03)	(0.05)	(0.03)	(0.06)	(0.04)
	1.671	7.893	9.429	0.720	-2.108
V120	0.000	0.000	0.000	0.601	0.000
TRAIN.	-0.220	0.293	-0.029	0.304	0.006
	(0.03)	(0.05)	(0.03)	(0.06)	(0.04)
	-7.520	5.776	-0.849	4.734	0.162
SHIFTS	-0.062	0.433	0.019	-0.258	0.317
	(0.03)	(0.06)	(0.04)	(0.07)	(0.04)
	-1.911	7.413	0.479	-3.750	7.501
PARTIME	0.084	0.057	0.001	0.346	-0.141
	(0.03)	(0.05)	(0.04)	(0.07)	(0.04)
	2.639	1.035	0.025	5.305	-3.667
SAT	-0.163	0.088	0.107	-0.274	0.517
	(0.02)	(0.04)	(0.03)	(0.05)	(0.04)

	-6.933	2.171	3.856	-5.061	12.466
SUN	0.000	0.000	0.000	0.000	0.925
V111_6	-0.035	-0.022	0.335	0.192	0.005
	(0.03)	(0.05)	(0.03)	(0.06)	(0.03)
	-1.219	-0.441	9.770	3.287	0.145
MUTTEC	-0.279	0.182	-0.113	-0.007	0.013
	(0.03)	(0.05)	(0.04)	(0.06)	(0.04)
	-9.131	3.452	-3.140	-0.109	0.348
LAY-OFF	0.484	0.232	-0.124	-0.024	0.043
	(0.03)	(0.05)	(0.03)	(0.06)	(0.03)
	18.383	4.358	-3.885	-0.403	1.272
REGINC	-0.093	0.495	-0.171	0.178	0.000
	(0.03)	(0.05)	(0.03)	(0.06)	(0.04)
	-3.258	9.657	-5.100	3.028	0.008
INTCAP1	-0.001	0.051	-0.105	0.050	0.138
	(0.03)	(0.05)	(0.04)	(0.06)	(0.04)
	-0.023	0.969	-2.939	0.800	3.749
COMPDIR1	0.078	-0.407	0.360	-0.032	0.074
	(0.03)	(0.05)	(0.03)	(0.06)	(0.03)
	2.772	-8.225	10.679	-0.554	2.161
MEMBERS	0.035	0.175	-0.109	-0.270	0.116
	(0.03)	(0.05)	(0.04)	(0.07)	(0.04)
	1.131	3.266	-3.011	-4.095	3.133

Table 9 Factor Scores Regressions

	GEN. Assur.	Hiring	Firing	Wage	Work.Hour	Health Env.
Agreem.	-0.50	1.48	0.10	-0.06	-0.93	0.62

	Career	Work. Org.	Services	CONTRFL	ANDPROD	ANDINV
Agreem.	0.36	0.68	0.22	-0.32	0.18	-0.09

	RIUNORG	INCFISS	V063	Strikes	TRAIN.	SHIFTS
Agreem.	0.14	-0.12	0.04	-0.01	-0.21	0.01

	PARTIME	SAT	MUTTEC	Lay-Off	INTCAP2	COMPDIR1
Agreem.	-0.07	-0.20	0.08	-0.14	-0.04	0.22

	Members
Agreem.	-0.07

	GEN. Assur.	Hiring	Firing	Wage	Work.Hour	Health Env.
Firm Perf.	-0.19	-0.09	0.50	0.19	-0.39	0.24
Union	0.18	0.13	-0.59	-0.10	0.63	-0.10

	Career	Work Org.	Services	CONTRFL	ANDPROD	ANDINV
Firm Perf.	0.04	0.09	-0.03	0.43	-0.25	-0.22
Union	-0.34	-0.03	0.00	-0.15	0.07	-0.03

	RIUNORG	INCFISS	V063	Strikes	TRAIN.	SHIFTS
Firm Perf.	0.02	0.00	0.05	-0.05	0.08	0.10
Union	0.19	0.34	-0.02	0.17	0.23	0.17

	PARTIME	SAT	MUTTEC	Lay-OFF	INTCAP2	COMPDIR1
Firm Perf.	-0.13	0.15	0.11	-0.14	-0.01	0.05
Union	0.07	0.02	-0.04	0.25	-0.07	-0.42

	Members
Firm Perf.	0.04
Union	0.10

Table 10 Goodness of fit

Degrees of Freedom = 193
Minimum Fit Function Chi-Square = 659.21 (P = 0.0)
Normal Theory Weighted Least Squares Chi-Square = 659.42 (P = 0.0)
Estimated Non-centrality Parameter (NCP) = 466.42
90 Percent Confidence Interval for NCP = (392.13 ; 548.30)

Minimum Fit Function Value = 0.66
Population Discrepancy Function Value (F0) = 0.47
90 Percent Confidence Interval for F0 = (0.39 ; 0.55)
Root Mean Square Error of Approximation (RMSEA) = 0.049
90 Percent Confidence Interval for RMSEA = (0.045 ; 0.053)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.62

Root Mean Square Residual (RMR) = 0.044
Standardized RMR = 0.044
Goodness of Fit Index (GFI) = 0.95
Adjusted Goodness of Fit Index (AGFI) = 0.92
Parsimony Goodness of Fit Index (PGFI) = 0.56
Normed Fit Index (NFI) = 0.95
Non-Normed Fit Index (NNFI) = 0.94
Parsimony Normed Fit Index (PNFI) = 0.61
Comparative Fit Index (CFI) = 0.96
Incremental Fit Index (IFI) = 0.96
Relative Fit Index (RFI) = 0.91
Critical N (CN) = 367.17