RELATIVE WAGES IN AN OPEN ECONOMY:

the Post-War Italian Experience[+] .

by

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1. Introduction

National labor markets are composed of sectoral and local labor markets. Inter-industry wage differentials are significant and tend to persist over time[1]. Limited labor mobility is often associated to the presence of significant differences among local markets. Most aggregate models tend to ignore this heterogeneity and focus on symmetric equilibria and on the development of aggregate supply and demand functions[2]. Persistent differences in wage determination at the sectoral or at the local level, however, are likely to matter also for aggregate wage dynamics. To illustrate, suppose that we focus on the relationship between the aggregate real wage and the unemployment rate. With an ever-changing industrial structure, the nature of this relationship varies if there are persistent differences in wage determination at the industrial level.

The heterogeneity of industrial (and local) labor markets has a number of dimensions, and here we only mention two: the degree of unionization and the exposure to international trade. In unionized labor markets, wages are likely to be the outcome of a bargain between the parties. In competitive markets, they tend to be determined by the interaction of demand and supply. On the other hand, wages in sectors that are heavily exposed to international competition are more sensitive to changes in the real exchange rate than in sectors producing home goods.

To illustrate using the Italian case, consider real gross average wages in two sectors, private industry (sector 1) and private services and construction (sector 2)[3]. The former sector is both more heavily unionized and more exposed to international trade. Relative wages, measured as wages in sector 1 over wages in sector 2, are plotted in Figure 1 for the period 1951-1998. They have decreased from 1951 to 1966 to rise again back to 1.18 in 1998[4]. As shown in the figure, part of this variation can be captured by variations in relative real value added per head: overall, relative wages have fallen when relative value added has declined, and vice versa. Notice, however, that relative wages have not mimicked the dynamics of relative productivity. As the figure shows, the shares of gross labor income on sectoral value added have moved rather differently over the years. For instance, while the labor share in industrial value added has constantly declined from 1975 to 1998, the labor share in sector 2 has remained more or less unchanged

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[1] Krueger and Summers (1988), Dickens and Lang (1985) and Nickell and Kong (1992) are examples of contributions that focus on different aspects of the underlying heterogeneity of labor markets.

[2] See for instance Layard, Jackman and Nickell (1991).

[3] We exclude both agriculture and the public sector.

[4] Clearly, composition effects are an important part of the story here.

up to the early 1990s, when it started to fall. Finally, the figure shows the dynamics of the real exchange rate. Visual inspection suggests that these dynamics are positively correlated to the dynamics of the labor share in the sector of tradable goods.

Potential reasons for the observed differences in the dynamics of sectoral labor shares include differences in the technology and the asymmetric effects on wages both of the unemployment rate and the real exchange rate. In a bargaining framework, both these variables affect sectoral wages, conditional on sectoral productivity, because of the impact they have either on the fallback option of the union or on the price mark-up and the elasticity of labor demand[5].
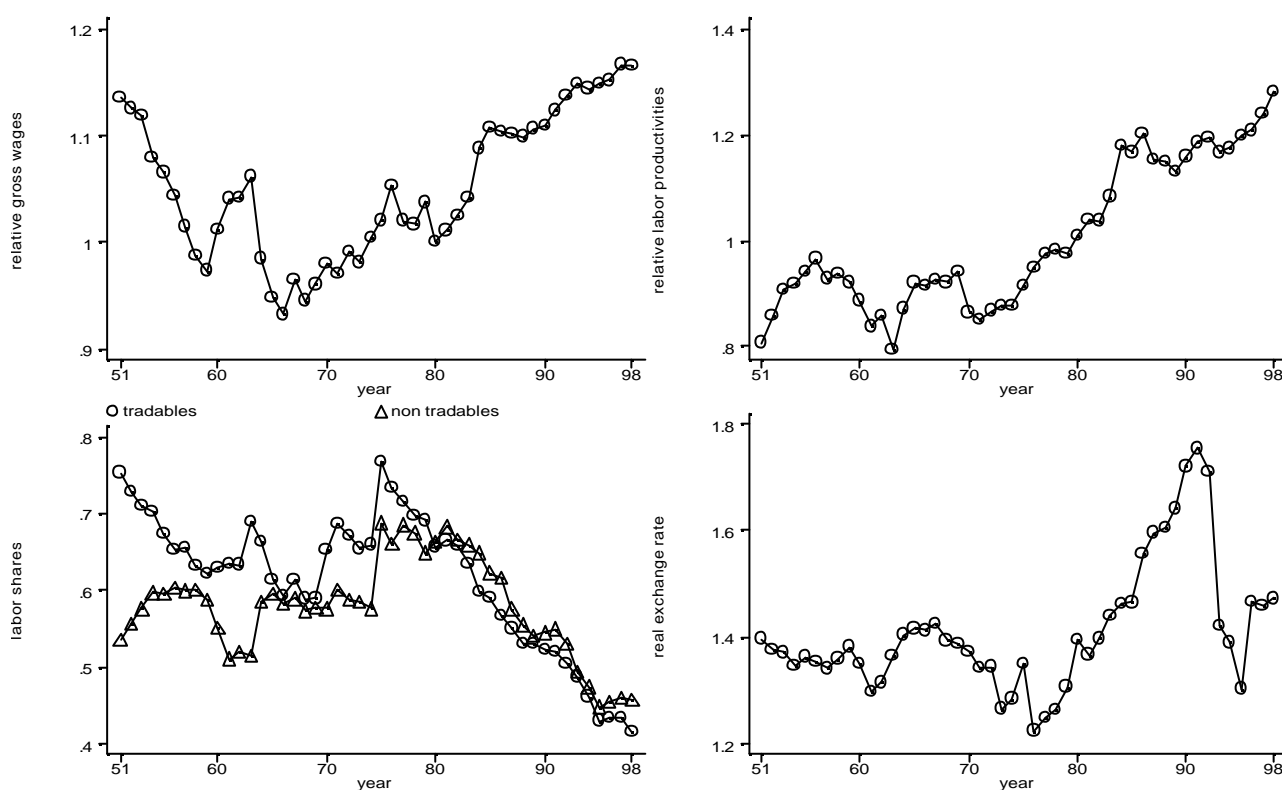

Figure 1

Following the approach suggested by Nickell and Wadhwani (1990), the relative importance of unemployment in wage determination depends on the weight of *outsider* factors. On the other hand, changes in competitiveness, measured by changes in the real exchange rate, influence wages in a number of ways: first, they affect the wedge between consumption and production prices (See Layard, Nickell and Jackman (1991)); second, they modify the perceived elasticity of product demand and the price mark-up

[5] See Blanchflower, Oswald and Sanfey (1996) and Wes (1996) for standard bargaining set-ups in closed and open economies and Freeman and Katz (1988) and Revenga (1992) for competitive models of wage determination that link wages to international competition.

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in the sector producing tradable goods and services[6]; since labor demand is a derived demand, its elasticity is also affected. Third, they influence the relative bargaining power of unions, either because increased international competitiveness affects the probability of layoffs (see Grossman (1994) and Freeman and Katz (1992)) or because it induces unions to play "end-game" strategies (see Lawrence and Lawrence (1985)). Finally, changes in the real exchange rate affects the level of domestic aggregate demand and the rate of unemployment (see Dornbusch (1980)).

Variations in the unemployment rate and/or in competitiveness can affect relative wages if their impact on sectoral wages is not symmetric. On the other hand, the influence of these "external factors" on relative wages can be reduced if sectoral wages interact, either because of centralized wage setting institutions or because of wage leadership. The presence of interactions has important implications for macroeconomic performance in the labor market. To illustrate, consider the Italian experience in the European Monetary System, which lasted from 1979 until 1992. During that period, the positive inflation differential with the main European partners led to a substantial appreciation of the real exchange rate, only partially compensated by subsequent realignments. A real appreciation is likely to exert stronger pressure on wages in the sector of tradable goods (mainly industry) than on wages in the sector producing home goods (mainly services and the public sector), because of the different exposure to international competition. We expect that the restraining effect of a real appreciation on aggregate wage pressure be stronger if it is industrial unions rather than unions in the home goods sector that retain the wage leadership[7].

The purpose of this paper is to study from an empirical viewpoint sectoral wages in the post-war Italian private economy by focusing on two sectors, the sector of tradable goods (mainly industry) and the sector of home goods (mainly services and construction). Needless to say, this classification is an approximation, but has the merit of providing a simple and yet fairly detailed set-up for the discussion of wage interactions and of other key questions such as the effects of a real exchange rate appreciation or of an increase in the rate of unemployment on aggregate wage pressure. In this study, our approach is that the long-run dynamics of sectoral wages can be illustrated as the outcome of wage bargaining. Italy is an excellent example of hybrid wage bargaining institutions, which include national agreements, industry by industry settlements and company agreements. While the relative importance of these institutions has shifted

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[6] See Wes (1996) for a detailed discussion.

[7] Giavazzi and Spaventa (1989) argue that the Italian wage bargaining system did adapt to the changed conditions generated by joining the EMS, because industrial unions internalized the external constraint (see also Baici and Dell'Aringa 1994). On the other hand, Barca and Visco (1992) stress that the service sector took advantage of the different degree of exposure to international competition to increase its share both of value added and of employment.

considerably over time, interactions between sectors and pattern bargaining have remained a constant feature over the whole period[8].

We have three key results. First, using the Johansen's approach to cointegration, we find evidence of long run relationships linking sectoral wages to sectoral output per head. We interpret these relationships as describing rent sharing rules between sectoral unions and firms. Second, while in the sector of home goods real gross wages are correlated in the long run to sectoral real output per head, to gross real wages in the sector of tradable goods and to the rate of unemployment (as measured in the Northern and Central part of the country), real gross wages in the sector of tradable goods are positively correlated to sectoral output per head, to the real exchange rate and to union membership and negatively correlated to the rate of unemployment. Third, permanent shocks to the real exchange rate affect directly the industrial labor share but only indirectly the labor share in the sector of home goods. We use these findings to claim that external discipline in Italy has operated in long run mainly via the real wage in the tradables sector.

The paper is organized as follows. Section 2 introduces a simple model of sectoral wage determination. Section 3 is a brief historical overview of the main features of wage determination in Italy. Section 4 is devoted to the presentation of the data, the description of the estimation technique and the presentation of the results. Section 5 concludes.

2. A Simple Model of Wage Bargaining

Consider an economy composed of two heterogeneous sectors (say, industry and services), that produce respectively tradable and non-tradable goods. Each sector is populated by a given number of firms, each producing a different variety of a horizontally differentiated good and facing the same cost function. With monopolistic competition, firms set prices and employment.

Wages in each sector are the outcome of a bargain between the industrial union and the firms operating in the sector. Both sectors are unionized and unions are assumed to maximize rents[9]. Hence, the union objective in sector i is

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[8] Despite the clear importance of the issue, little empirical work has been produced to date that clarifies the interactions among sectors and its implications for aggregate wage determination. Gavosto and Sestito (1991) focus on the private sector and use Granger causality tests and cointegration techniques to reject the idea of wage leadership by the metal-mechanical sector. Brunello (1996) investigates the relationship between private and public sector wages during the period 1960-1990 and finds evidence of wage imitation *only* by the public sector. From a slightly different perspective, Ordine (1994a) and (1994b) studies the interrelation between the *tariff wage*, set at the national level, and the *local wage,* and finds evidence of mutual interaction between the central and local level; however her data refer to the period 1983-87, a period of relative stability in the structure of wage determination, and the results could be different in a comparison of the 70's with the 80's.

$$(1) \qquad\qquad U_i = N_i\left(W_i - W_a\right)$$

where U_i is the union utility in sector i, N_i is sectoral employment, W_i is the real wage in sector i (deflated by the consumer price index) and W_a is the alternative real wage expected to prevail elsewhere. If the possibility of re-employment in the same sector is excluded, the alternative wage is given by

$$(2) \qquad\qquad W_a = UN \cdot B + \left(1 - UN\right) \cdot W_j, \quad j \neq i$$

where *UN* is the unemployment rate and *B* is real unemployment benefits[10].

     Since wages are determined by bargaining between (identical) firms and the sectoral union, the optimal wage is obtained by solving the following program

$$(3) \qquad\qquad \max_{W_i} \quad U_i^{\beta_i} \Pi_i^{1-\beta_i}$$

where $\Pi_i = P_i Y_i - W_i N_i$ are real profits of firms in sector i, P_i are prices in sector i relative to consumer prices, and β_i is the relative bargaining power of the sectoral union. Notice that we have implicitly assumed that fallback profits and utility are zero. Assuming that unions and firms bargain over the sectoral wage by taking both the wage in the other sector and the consumer price as given, the first order condition associated to program (3) is

$$(4) \qquad\qquad \frac{\beta_i}{\left(W_i - W_a\right)N_i}\left[N_i + \frac{\partial N_i}{\partial W_i}\left(W_i - W_a\right)\right] = \frac{1 - \beta_i}{\Pi_i}N_i$$

[9] See Layard, Nickell and Jackman (1991) and Wes (1996) for a similar set-up. Booth (1995) is a recent review of union models.

[10] The interaction between wages in union preferences can also be introduced by assuming that each sectoral union cares about its own wage relative to the wage prevailing in the other sector. See Oswald (1979). Even abandoning the framework of wage bargaining, when individual effort is proportional to a "fair" wage, that depends upon wages prevailing in other sectors, the efficient wage prevailing in one sector is correlated to the wages paid in the other sectors. See Akerlof (1984).

A similar condition holds for the bargain in sector j. Using equation (2) and the fact that the optimal sectoral price is a mark-up on the marginal cost in the same sector, we can write the optimal wage in each sector as a reaction function that depends on the wage prevailing in the other sector. The following pair of equations then describes the Bertrand equilibrium with heterogeneous labor inputs

$$(5a) \qquad W_1 = W_1\left(W_2, UN, B, \frac{Y_1}{N_1}, |\rho_1|, \mu_1, \beta_1\right)$$

$$(5b) \qquad W_2 = W_2\left(W_1, UN, B, \frac{Y_2}{N_2}, |\rho_2|, \mu_2, \beta_2\right)$$

where $\rho_i = \frac{dN_i}{dW_i} \cdot \frac{W_i}{N_i}$ is the wage elasticity of employment and μ_i is the mark-up of prices over marginal costs in sector i.

The brief discussion above is based on the assumption that the bargains in the two sectors occur simultaneously. An alternative characterization is that unions and firms in one sector act as a Stackelberg leader and bargain over the sectoral wage by taking explicitly into account the decision rule adopted in the sector that acts as a follower. As pointed out by Pencavel (1991), however, the Bertand model and the Stackelberg model do not imply simple exclusion restrictions that effectively discriminate between them.

Equations (5) describe a rent sharing mechanism whereby real sectoral wages increase with sectoral labor productivity (Y_i / L_i), the wage in the other sector, the price mark-up (μ_i), unemployment benefits B and the relative bargaining power of the union (β_i) and decrease when the unemployment rate and the absolute value of the elasticity of labor demand increase. Notice that a measure of competitiveness, given by the real exchange rate Q, affects most variables included among the determinants of sectoral wages. For instance, a lower value of Q (a real appreciation), by switching demand from domestic to foreign goods and by increasing the elasticity of product demand faced by domestic producers, increases the elasticity of labor demand. At the same time, it reduces the price mark-up (See Wes (1996)). As a consequence, real wages tend to fall.

On the other hand, a real appreciation could affect the bargaining power of the union because of the competition of foreign goods. If increased competition threatens employment levels by reducing the profit margins of domestic producers, unions could accept substantial wage concessions to save jobs. Finally, one can combine a standard IS-LM model of aggregate demand with the Okun Law to generate a

negative relationship between Q and the rate of unemployment UN (see Dornbusch (1980) and Layard, Nickell and Jackman (1991)).

Some of the mentioned effects of a real appreciation are clearly asymmetric. First of all, the sector of home goods is by definition less exposed to international trade so that both the price mark-up and the demand for labor in that sector are less sensitive to changes in the real exchange rate than in the exposed sector of tradable goods. Similarly, increased competitiveness of foreign goods is more likely to threaten jobs in the sector of tradable goods than in the sector of home goods.[11] Hence, the relative bargaining power of the union in the home goods sector is not going to change much as a result of the real appreciation.

Wages in the sector of home goods could be influenced in an indirect way, however, because of the increase of the rate of unemployment, or because the changes in the relative price of tradable goods modify the relative price of home versus tradable goods (See Corden (1985) and Sandemann (1992)). Overall, it is reasonable to expect that, conditional on unemployment and output per head, the real exchange rate has little impact of the wage set by unions in the home goods sector and a significant impact on the wage in the sector of tradable goods.

Equations (5a) and (5b) relate sectoral wages to income from unemployment. In the Italian institutional set-up, this income is proportional to earnings in the last job, and the proportion varies both according to the type of separation and to the industry where the separation took place. The measure of union bargaining power, β, varies not only with the real exchange rate but also with the rate of unemployment UN. Similarly, both the price mark-up and the elasticity of labor demand are likely to be affected by variations in the levels of aggregate and sectoral demand. These arguments can be used to write equations (5a) and (5b) as follows

(6a) $$W_1 = W_1\left(W_2, UN, \frac{Y_1}{N_1}, Q, Z_1\right)$$

(6b) $$W_2 = W_2\left(W_1, UN, \frac{Y_2}{N_2}, Q, Z_2\right)$$

where Z_i are vectors of exogenous variables.

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[11] These effects are restricted to employment: Borjas and Ramey (1995) explain wage inequality in the US with differences in the degree of exposure to international trade.

Following Layard, Nickell and Jackman (1991) and most of the related literature, we assume absence of real wage resistance in the long run. This implies that an increase in the tax wedge does not have a significant effect on gross real wages, because net wages adjust in the opposite direction. If the equations above can be interpreted as informative of wage determination in the long run, no real wage resistance in the long run implies that we should exclude the tax and the price wedges from the list of explanatory variables and define real sectoral wages as gross of taxes.

Needless to say, equations (6a) and (6b) are not sufficient to describe the general equilibrium of this two-sector economy. In order to do so, we need to specify how sectoral output per head, unemployment and the real exchange rate are determined. These equations are useful, however, because they allow us to restrict the empirical analysis to a limited sub-set of variables that can influence the long-run evolution of wages.

3. Unions and Wage Bargaining in Italy: a Brief Overview.

Unions in Italy play a key role in wage determination. Union membership was over 50 percent in the early fifties and fell to about 30 percent in the late sixties. The social unrest of the late sixties brought the unionization rate back to about 45 percent in the mid-seventies. After that, the rate fell back again to the current 30 percent of total dependent employment. While union membership is not high by international standards, at least when compared to continental Europe, unions do wield significant power in wage negotiations. One reason is that national contracts signed by large unions are usually extended to all workers in the sector involved.

The Italian bargaining structure lies between the two extreme cases of centralized and decentralized wage setting. Italy has always been identified as a country with an intermediate degree of wage centralization, but a more appropriate description is that the system is based upon a three-tier system, with some overlap between the different levels of wage setting. First, price indexation clauses, retirement and layoff payments, worker representation rules and income policy guidelines are discussed at the national level. Second, wage increases applicable to all workers, independently of union status, are negotiated at sectoral level. Third and final, wage increases associated to productivity gains are bargained at the firm level, and usually involve the local work councils.[12]

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[12] The composition of a typical wage package is roughly as follows: indexation (*scala mobile*, settled at the national level) ranges from about 50% of total pay for blue collars to about 28% of total pay for high-ranked white collars (Eriksson and Ichino 1995, Table 4). Base pay is set at the sectoral level, varies with the job grade (the so-called *inquadramento unico*, which is specified in the national contract) and covers about 30% of the total. Local bargaining

The relative importance of each tier has varied substantially over the past four decades, without any clear and consistent pattern of dominance. There have been periods when national bargaining was the prevalent tier and periods of dominance by the sectoral and even the local level.[13] The fifties were broadly characterized both by weak unions and by strong centralization. The economic boom of the late fifties and early sixties ushered in a period of increasing union power, that led to a number of important strikes and to substantial pay hikes. Wage pressure in this period was swiftly quenched by the economic recession in the mid-sixties and did not resume until the late sixties, with the outburst of social and economic conflicts that led to an unprecedented period of substantial union strength. During this key period, local bargains rapidly became the dominating form of wage settlement. High inflation and high coverage by the indexation scheme dominated wage dynamics. At the same time, real wage increases often exceeded productivity growth (see Figure 1). The eighties were characterized by massive industrial restructuring and substantial job losses, especially among large industrial firms. Local bargains progressively lost steam and were replaced first by national agreements and later by industrial settlements. Furthermore, reduced union influence, together with lower inflation, led to an increase in wage differentials[14]. Only recently a national agreement, signed by the parties in July 1993, has abolished the indexation scheme (that covered only less than 50% of price increases since 1984) and introduced a clear hierarchical bargaining structure, based on national and local contracts. While national contracts, signed every two years in each sector, deal with wage increases, that are related to past and expected inflation, local contracts can be signed any other year, and should focus only on sharing productivity gains.

The sequence of periods of dominance by the national, the sectoral and the local level makes it difficult to establish the extent of wage co-ordination taking place in the Italian economy. One cannot deny that some degree of formal centralization has characterized, with varying intensity, the Italian economy in the post-war period. The relative importance of the sectoral and local levels, however, suggests that centralized wage setting is not an accurate description of Italian institutions. On the other hand, the characterization of wage determination in Italy as a process involving a leading sector has been fairly popular, both in policy discussions and in the design of macroeconometric models. The common view is

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account for an additional 3-4% (Sestito 1995). The rest is set by the firm and can be as high as 30-40% for high-ranked white collars.

[13] A very good account of the evolution of the bargaining structure in post-war Italy can be found in Ferner and Hyman (1992). See also Regini (1979), Cella and Treu (1989), Reichlin and Salvati (1990), Accornero (1992), Brunello (1993a), Sestito (1994) and Checchi (1995).

[14] The relative importance of inflation and union bargaining power for the dynamics of wage differentials is discussed in Brunello (1993b).

that the metal and private engineering sector has retained the *wage leadership* for important spells of the post-war period, and especially during the high inflation years, when the metal worker union was often indicated as the "engine" of the shifts in income distribution that occurred during that period[15]. Some observers have argued that recent developments in the late eighties and early nineties have brought about a change in pattern setting, with the leadership shifting from the metal and engineering sector to the public sector. Up to date, the empirical evidence on this is, however, rather scant[16].

4. The Empirical Analysis.

Based on the above discussion, we focus on the Italian private sector (excluding agriculture), and organize sectoral data into two main sectors, according to the degree of exposure to international competition[17]: the sector producing tradable goods (**sector 1**), that includes industry net of construction, and the sector producing home goods and services (**sector 2**), that includes primary services, distribution and construction. Both sectors in Italy are partly unionized, and the degree of coverage of collective contracts is almost 100% in each sector.

Our data are drawn mainly from the National Accounts and span the period from 1951 to 1998.[18] These data have both advantages and disadvantages. Among the advantages, we mention the relatively long time span, the fairly high disaggregation into 18 sectors (including the public sector) and a definition of earnings that includes both national and local bargains. A disadvantage is the inclusion in the definition of earnings of unilateral payments by firms that are not bargained over by unions.[19] Our data include information on standardized employment and value added, both at current and at constant 1985 prices. As a measure of aggregate labor market slack, we prefer the unemployment rate in the Northern and Central areas of the country to the overall unemployment rate. According to Soskice (1990), the Italian unemployment figures are "..the most misleading of all unemployment figures, and have become more so as

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[15] See Reichlin and Salvati (1990) and Accornero (1992). In particular, the strong homogeneity of rank-and-file workers in that sector (the so called *operaio massa*) was considered instrumental for that outcome.

[16] See Bordogna (1988) and the empirical work by Gavosto and Sestito (1991) and Brunello (1996). Wage leadership has often been perceived not as instrumental to aggregate wage restraint but rather as key for the wage-price spiral. See Barca and Visco (1992).

[17] If the degree of exposure to international competition is measured by the ratio of sectoral imports and exports to sectoral value added, all industrial sectors, including energy, have values higher than a 30% threshold and all the other sectors have lower values.

[18] Golinelli and Monterastelli (1990) provide the link between old and new accounts.

[19] An alternative to these data is the series of earnings determined at the industrial level (*retribuzioni contrattuali*), used by Gavosto and Sestito (1991), that excludes both unilateral payments and local bargaining.

the 1980s have progressed..." (p.47). There are two reasons for this. First, the bulk of the workforce is in the Northern and Central part of Italy. Here, the unemployment rate has been lower compared to the national average. Second, the increase in Italian unemployment in the eighties and nineties is mainly a phenomenon confined to the South. As pointed out by Brunello, Lupi and Ordine (2000), it is unemployment in the Northern and Central areas rather than overall unemployment that is likely to exert a disciplinary role on aggregate wage pressure[20].

The means and standard deviations of the variables used in the paper are presented in Table 1. The plots of the key variables, including the rate of unemployment in the whole country and in the Northern and Central areas, are presented in Figure 2. Further details on the data are provided in the Appendix at the end of the paper.

Table 1 - Means and standard deviation of the main variables - Italy 1951-98

Variable	label	mean	stnd.dev.
Sector 1 (tradable goods):			
annual real gross earnings (1985 million lire)	**RW1**	19.203	8.522
real value added per worker (1985 million lire)	**YL1**	33.489	14.143
Sector 2 (home goods):			
annual real gross earnings (1985 million lire)	**RW2**	18.081	7.431
real value added per worker (1985 million lire)	**YL2**	31.766	14.491
Unemployment rate in Northern and Central Italy (percent)	**UNE**	0.069	0.018
Real effective exchange rate	**EXC**	1.409	0.119
Unionization rate (percent)	**MEM**	0.355	0.068
tax wedge (percent)	**WE**	0.387	0.080

The basic empirical model is the following vector autoregression

$$(7) \qquad \Delta \mathbf{X}_t = \nu + \Gamma_1 \Delta \mathbf{X}_{t-1} + \Pi \mathbf{X}_{t-1} + E_1 SME_t + G_1 STA_t + Z_1 D_t + \varepsilon_t,$$

where $\mathbf{X}$ is a vector that includes $\left(RW_1, RW_2, YL_1, YL_2, UNE, EXC, MEM, WED, trend \right)$, MEM is union membership, WED is the tax wedge, $trend$ is a linear trend, ν is a constant, STA and SME are dummies that take the value of 1 respectively after 1971 and between 1979 and 1992, the period of Italian participation in the European Monetary System, D_t is a set of year dummies and $\varepsilon \approx N(0, \Sigma)$. Notice that, with the exception of UNE, MEM and $trend$, we use the logarithms of all the variables included in $\mathbf{X}$.

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[20] See also Sestito (1994) and the references therein for a detailed discussion.
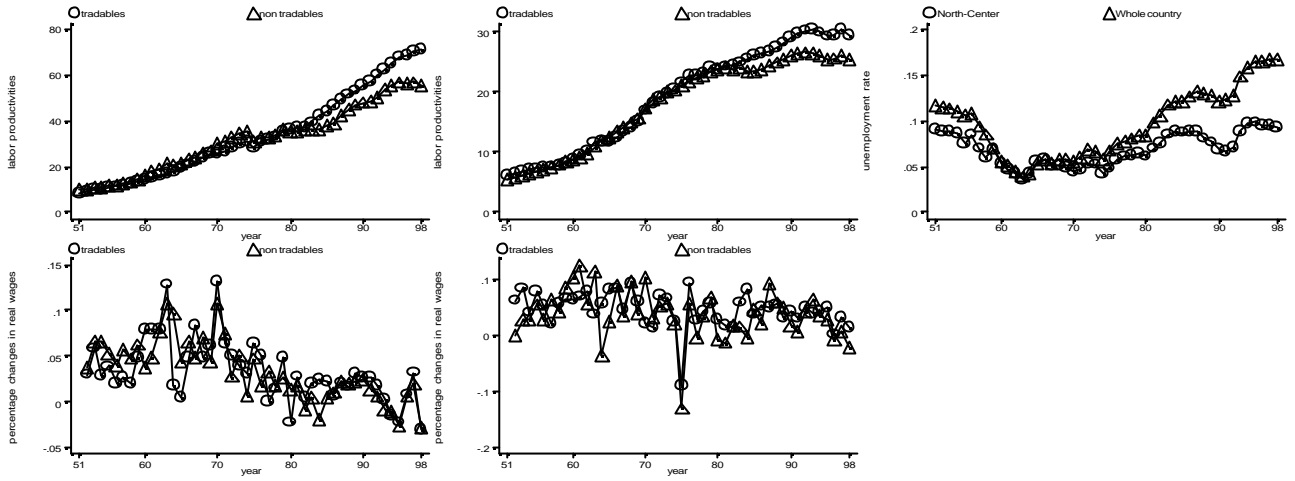
Figure 2

Notice that the matrix Π incorporates all the relevant information on the long-run relations among the variables included in $\mathbf{X}$. If the rank r of this matrix lies between 0 and n, where n is the number of variables in the vector $\mathbf{X}$, there are r cointegrating vectors and the data can be described by an error correction model[21].

We start from a specification with 4 lags in each variable and use sequential simplification to reduce the number of lags to 1[22]. Since we can never reject the null of lack of real wage resistance (the tax wedge does not affect the gross wage in the long run), we drop the variable *WED* from the vector $\mathbf{X}$. The existence of cointegration relationships involving the variables included in the vector $\mathbf{X}$ is tested using the trace test proposed by Johansen and given by

$$(8) \qquad \eta_r = -T \sum_{i=r+1}^{n} \log(1-\lambda_i)$$

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[21] See Campbell and Perron (1992).

[22] The vector error autocorrelation test for lags 1 to 2 has a p-value of 0.39. An F test that compares the model with 1 lag to the model with 4 lags cannot reject the more parsimonious model at the 5% level of confidence.

where r is the number of cointegration vectors, T the number of observations, and λ_i are the (estimated) eigenvalues of the Π matrix, ordered in a descending order[23]. The results of the test are reported in Table 2 and show that we cannot reject the hypothesis that there are 2 cointegration vectors in the data.

Table 2 - Cointegration analysis: 1952 to 1998

Eigenvalue λ_i	log-likelihood	rank	Ho:rank=p	η_r	95%
	1256.12	0	p == 0	195.4**	146.8
0.8322	1298.07	1	p <= 1	124*	114.9
0.6923	1325.77	2	p <= 2	76.8	87.3
0.4944	1341.80	3	p <= 3	49.5	63.0
0.4413	1355.48	4	p <= 4	26.3	42.4
0.1950	1368.50	5	p <= 5	12.7	25.3
0.0974	1370.91	6	p <= 6	4.1	12.2

If we interpret cointegrating vectors as long run relationships among the variables under study, the non-uniqueness of these long-run relationships is exacerbated by the well-known property that linear combinations of cointegrating vectors themselves form cointegrating combinations. When the rank of the Π matrix is greater than one, it is always possible to decompose it as $\Pi = \alpha\beta'$, where α is a matrix of loading factors and β' is a matrix of eigenvectors. We use the wage bargaining model discussed in section 2 to impose and test a set of restrictions both on α and on β. Table 3 below reports the restricted matrix of loading factors and eigenvectors.

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[23] See Johansen and Juselius (1990), Banerjee and oth. (1993) and Favero (1996) for details.

Table 3 - Cointegrating vectors

	loading factors		eigenvectors	
	α_1	α_2	β_1	β_2
UNE	0.00	0.00	14.51 (4.38)	2.39 (0.93)
RW1	0.02 (.004)	-0.14 (0.029)	1.00	-0.83 (0.10)
RW2	0.04 (0.003)	-0.15 (0.019)	0.00	1.00
YL1	0.01 (0.004)	0.00	-1.00	0.00
YL2	0.00	0.00	0.00	1.00
EXC	0.00	0.00	-2.47 (0.68)	0.00
MEM	0.00	-0.12 (0.014)	-2.79 (0.98)	0.00
Trend	--	--	-0.06 (0.005)	0.03 (0.004)
LR-test, rank=2; p-value: 0.228				

standard errors in parenthesis

restricted long-run matrix $\Pi = \alpha\beta'$*, rank 2*

	UNE	RW1	RW2	YL1	YL2	MEM	EXC	Trend
UNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RW1	0.004	0.14	-0.14	-0.02	0.14	-0.06	-0.06	-0.005
RW2	0.18	0.17	-0.16	-0.04	0.16	-0.11	-0.09	-0.007
YL1	0.18	0.01	0.00	-0.01	0.00	-0.03	-0.03	-0.00
YL2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EXC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEM	-0.30	0.10	-0.12	0.00	0.12	0.00	0.00	-0.003

The likelihood ratio test of the restricted model versus the unrestricted model has a p-value of 0.228. Hence, the imposed restrictions cannot be rejected by the data. In the last part of Table 3, we report the restricted long-term matrix Π. This matrix shows that output per head in sector 2, the real exchange rate and the rate of unemployment are weakly exogenous for the long-run parameters of the remaining equations. Next, we consider the two cointegrating vectors in turn. The first vector is

$$RW_1 - YL_1 + 14.51UNE - 2.43EXC - 2.79MEM - 0.06Trend = z_1$$

We interpret this relationship as the real wage equation in the tradables sector of the economy. According to this interpretation, wage pressure in the tradables sector is closely related to output per head in the same sector in the long run, to the rate of unemployment in the North – Center, to union membership and to the real exchange rate. Since both the unemployment rate and the exchange rate are weakly exogenous, we interpret this vector as suggesting that wages in the sector are directly affected by internal (via unemployment) and external (via the exchange rate) discipline. Moreover, the wage in the other sector does not play any significant role.

The second cointegrating vector is

$$RW_2 - YL_2 - 0.84RW_1 + 1.87UNE + 0.030Trend = z_2$$

We interpret this relationship as the wage pressure equation in sector 2. First, notice that both union membership and the real exchange rate do not enter in this relation. There is a close relationship, however, between real wages in the home goods sector and in the tradables sector. According to our reading of the data, the labor share in sector 2, which is not exposed to international trade, is indirectly affected in the long run by the the real exchange rate via the impact that these variables have on the real wage in sector 1. We interpret this evidence as suggestive of the fact that both external and internal discipline are induced in the home goods sector by the close relationship that the real wage in this sector has with the real wage in the tradables sector.

With the above information on cointegrating vectors, we estimate the full model, including the short-term dynamics, by using an error correction formulation. We condition the model on the weakly exogenous variables *EXC,* the real exchange rate, on the unemployment rate *UNE,* and on real output per head in sector 2, *YL2*, on the exchange rate regime, *SME*, to capture the years of participation of Italy in the European Monetary System, and on *STA*, to account for changes in the overall performance of the economy since the early seventies. The within-sample dynamic forecasts are plotted in Figures 3 and 4. The estimation method is full information maximum likelihood[24].

5. *Conclusions*

The empirical model presented and discussed in previous sections points to the presence of interesting asymmetries in sectoral wage determination. First, real gross wages in the sector of tradable goods are associated in the long-run not only to sectoral output per head but also to a measure of "internal discipline", the rate of unemployment in the Northern and Central part of the country, and "external discipline", the real exchange rate. In sharp contrast, real gross wages in the sector of home goods are associated to real output per head in that sector, to the rate of unemployment and to the real wage in the tradables sector. The direct effect of the unemployment rate is much smaller in this sector than in the tradables sector. Second, the real exchange rate does not directly affect real wages in the home goods sector in the long run, but does so in an indirect way, by influencing the real wage in the tradables sector.

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[24] The estimates and the relevant diagnostics are obtained after a sequential simplification of each equation based upon the T-ratios of estimated coefficients. Results are available from the authors upon request.

We interpret these results as suggestive of the fact that both "internal" and "external" discipline have affected wage determination in the sector of home goods mainly in an indirect way, because of the influence exerted by wage determination in the sector of tradable goods.
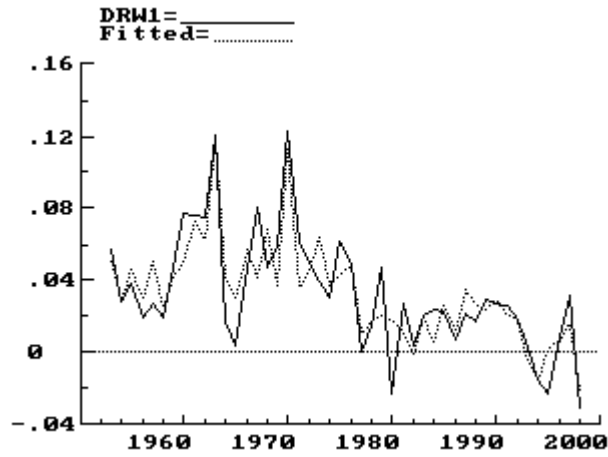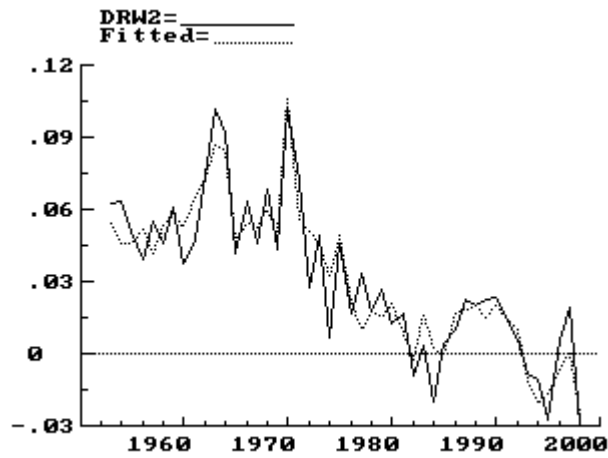
Figure 3 - Tradable sector

Figure 4 - Non tradable sector

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Appendix - **Data source**

The definition of the variables used in the paper is as follows

W_i= gross annual earnings, inclusive of income taxes and of social security contributions. Source: National Accounts.[25]

R_i= nominal value added. Source: National Accounts.

L_i= standardised labour units. Employees only. Source: National Accounts

P_c= consumer price index. Source: ISTAT, Bollettino Statistico.

EXC = real exchange rate, obtained as a weighted average of bilateral rates with the US, Germany and France. Weights are shares of each country in Italy's total exports. Source: Bank of Italy, *Relazione economica*, various issues. The data are available from 1977. For the years before 1977, bilateral rates are defined as the ratio of the GDP deflator in Italy to the GDP deflator in the other country, converted in by the spot exchange rate. Source: IMF, *IFS Statistics*, several issues. The data for the period 1951-1954 are obtained by applying the average rate of change in the first six available years.

UNE = unemployment rate in the Northern and Central regions of Italy. Source: Bank of Italy.

MEM = Active union members in industry enrolled in the two largest confederations (CGIL+CISL) relative to total employment . Source: Di Nicola (1989) and Cella-Treu (1989).

The variables used in the empirical analysis have been constructed as follows:

$$\text{real wage} = RW_i = \frac{W_i}{L_i P_c}, \quad i = 1,2$$

$$\text{labour productivity} = YL_i = \frac{R_i}{L_i P_c}, \quad i = 1,2$$

$$\text{wage share on value added} = \frac{W_i}{R_i} = \frac{RW_i}{YL_i}, \quad i = 1,2$$

The sector of tradable goods of tradable goods (*sector 1*) includes all industrial sectors except construction (energy, chemicals, metals, mining, engineering, vehicles, foodstuffs, textiles, wood and paper), while the sector of home goods (*sector 2*) includes construction and private services (transport and communications, banking and insurance, distribution, hotels). Agriculture and public services are not considered in this study.

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[25] National account data refer both to the original data and to the extension back to 1951 by Golinelli and Monterastelli (1990).