EUROPEAN UNIVERSITY INSTITUTE
Department of Economics

LABOUR MARKET AND INVESTMENT DECISIONS

THE CASE OF ITALY: 1970-1984

by

Gianna Claudia Giannelli

Thesis submitted for assessment with a view of obtaining the degree of Doctor of the European University Institute

Florence, February 1987

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Florence, February 1987 Gianna Claudia Giannelli

INDEX

CHAPTER 1

INTRODUCTION

1.1.

It is widely agreed that during the last decade, the supply side of the Italian economy, in line with other European countries, has undergone a process of substantial structural change.

Within this period of intense changes, the '70s have been characterized by an unprecedented increase in inflation and wage shares, together with a slowdown in the productivity of labour; the first half of the '80s, instead, has been marked by rising real interest rates, alarmingly high and rising unemployment and a recovery of the productivity of labour. Low rates of growth of the G.D.P. as compared to the '60s, and stagnation of investment have been a constant feature over the whole period.

Economists have developed several theories that aim at explaining the determinants of this rather gloomy scenario. We shall mention briefly just a few of them.

The orthodox keynesians view the source of all troubles in the restrictive policies that have been adopted by the economic authorities. The so-called "Pigouvian" theorists, instead, claim that the rigidity of real wages in the presence of unfavourable exogenous shocks, such as the rise in the price of oil, has undermined the profitability of firms, held down their ability to invest and, therefore, is to be regarded as one of the major causes of the slump (see e.g. M. Bruno, 1985). Another set of theories that is mainly concerned with the labour market, examines analytically the role of social and institutional factors (e.g. trade unions and bargaining strategies) in the determination of unemployment (see for example R. Layard and S. Nickell, 1986). One of the most recent analyses focuses on the links between the U.S. economic policies and the performance of the European countries, and, within the framework of an open economy two-country model, assigns a crucial role to the supply effects of the real interest rate (J.P. Fitoussi and E. Phelps, 1987).

The present study has the aim, like the literature cited above, to analyze the causes of some of the changes which occurred in the different sections of the economy during the '70s and the '80s.

We focus on the Italian economy and, in particular, on the causes of the decline in employment, the stagnation of investment and the increased efficiency of capital stock in the industrial sector as opposed to the increase in employment and the expansion of capital stock in the sector which is sheltered from international competition.

Our aim is to take account of all the factors that were mentioned in our concise review of the literature. We concentrate on the labour market, viewing firms and unions as its main economic agents. For this purpose, we build a theoretical model of the behaviour of firms and unions in an open economy two-sector framework, and derive the relations for the determination of employment, investment, prices and wages. We then proceed to test empirically the model on quarterly data for the period 1970-1984.

1.2. Plan of the thesis

We begin in this chapter by reviewing the facts about employment, investment, prices and wages in the industrial sector and in the sector sheltered from international competition (1.3). We also give a brief account of the institutions and characteristics of the Italian labour market (1.4).

Chapter 2 lays the microeconomic foundations of the behaviour of the firm in our two-sector model. It starts with the static production relations (2.1), and then introduces dynamics assuming adjustment costs in the inputs of labour and capital (2.2-2.3). The employment, investment and price relations are therefore derived.

Chapter 3 reviews the theories of the determination of wages (3.1-3.4) and presents the specification of wage formation for our model (3.5).

Chapter 4 presents the econometric specification of the theoretical model. We discuss first of all our specification strategy (4.1) and then give the list of variables and the specification of the equations (4.2). Finally the econometric results are reported and commented (4.3-4.6).

Our conclusions are given in chapter 5. The Appendix with data and statistical sources then follows.

1.3. A description of employment, investment, wages and prices in two sectors of the Italian economy: 1970-1984.

The aim of our analysis, as we have mentioned in the previous section, is to throw some light on the causes of structural change in employment and in the accumulation process which occurred in the Italian economy in the 70's and 80's. For this purpose, we have built a model of the determination of employment, investment, wages and prices for two sectors of the economy. The choice of the two sectors, that is the sector which is exposed to international competition and the sector which is sheltered from it, was based on the following observations.

The phenomenon of structural change, by its very nature, is usually described by the statistical evidence on the changing characteristics of the sectors forming the supply side of the economy. If we look at the sectoral composition of value added, for example (see table 1), we note that the share of value added of the industrial sector from the 70's to the 80's does not recover its peak level of 1974 and shows a substantial decrease in the 80's. The market services share of value added, instead, is characterized by a steady growth, and in '83-'84, for the first time, it overtakes the share of the industrial sector.

Sectoral composition of value added

Years	Agricolture	Industry	Market services	Non-market services
1970	8.09	42.57	38.21	11.13
1971	7.99	41.77	38.88	11.36
1972	7.17	42.01	39.39	11.43
1973	7.18	42.88	38.87	11.07
1974	7.02	43.04	38.97	10.97
1975	7.50	40.52	40.31	11.67
1976	6.81	42.80	39.51	11.41
1977	6.64	41.95	40.04	11.37
1978	6.70	41.73	40.44	11.13
1979	6.77	42.07	40.47	10.68
1980	6.77	42.31	40.50	10.42
1981	6.74	41.90	40.83	10.53
1982	6.61	41.31	41.42	10.66
1983	6.95	40.33	41.88	10.84
1984	6.70	40.43	42.23	10.64

TABLE 1

Source: ISTAT, Annuario statistico 1985

The purpose of this rough comparison is simply to give an indication of the sections of the economy which are more relevant to our analysis. All the aspects of the increasing weight of the service sector, on the other hand, are well documented by all statistical sources and official reports on the Italian economy [1].

The main focus of the economic analysis of the 70's was concentrated on the leading role of the industrial sector. In the 80's, however, it has become indispensable to reconsider the role of services, in particular after the decline in industrial employment and the consolidation of the positive function they have exerted in containing the already dramatic rise in the unemployment rate. The performance of this sector can no more be regarded as "residual", once the economic relations underlying the industrial production have been understood. The expansion of the service sector, instead, is to be considered a phenomenon which is deeply related to the process of structural change.

The literature on the "deindustrialization process" and on its links with the growth of the service sector is an example of this new stream of analysis [2].

In line with that literature, which is also concerned with the increasing difficulty of the economic system to ensure a net flow of exports of manufactured goods that can keep the balance of trade in a position of long-term equilibrium, we take account of international competition as one of the determinants of this process of structural adjustment.

For the above reasons, the choice to build our model for the sector which is exposed to international competition and the sector which is sheltered from it, seemed the most appropriate for the aims of our analysis.

The exposed sector, which we call sector 1, is represented by aggregate data for the energy and manufacturing industry. The sheltered sector, which we call sector 2, is represented by aggregate data for market services and the building industry. The public sector and agriculture are, therefore, excluded from our analysis. In particular, we have excluded agriculture from the exposed sector, given that its performance is strongly influenced by E.E.C. regulations. The inclusion of the building industry, for its relatively low weight in terms of the main economic variables, does not alter considerably the trend imposed on sector 2 by services [3]. We have included it, anyway, in order to be consistent with the definition of sheltered sector.

The objective of the model we present in the next chapters is to explain the behaviour of employment, investment, wages and prices in these two sectors. We proceed now to describe the performance of these variables in the period 1970-1984.

Employment

The employment structure in the period considered has undergone enormous changes in all industrial countries.

> "In almost all countries, moreover, increases in employment after 1973, even in absolute terms, are concentrated in the service sector. In 1980 the ratio of people employed in services to those in industry was well above unity in all industrial countries, ranging from 2.15 in the United States, to 1.35 in Italy and 1.10 in Germany". (Momigliano and Siniscalco, 1982, p.270)

These changes appear with evidence in the graphs of the employment series of the Italian exposed and sheltered sector as we have defined them (fig.1). The turning point is at the beginning of 1978, when the number of employed people in the sheltered sector becomes larger than that of employed workers in the industrial sector.

The year 1980 marks the beginning of the dramatic decline in industrial employment, a decline which has all the characteristics of a structural change [4].

Employment in the sheltered sector (excluding the public sector) continues its steady growth, though never compensating the decrease in industrial employment (see table 2). As far as the links between the structural change in employment in industry and services are concerned, there is evidence that the process of industrial restructuration imposed by the events of the last

EMPLOYMENT
SOURCE: BANK OF ITALY
SECTOR 1 PLOTTED WITH * (THE SERIES IS NET OF C.I.G. WORKERS)
SECTOR 2 PLOTTED WITH X

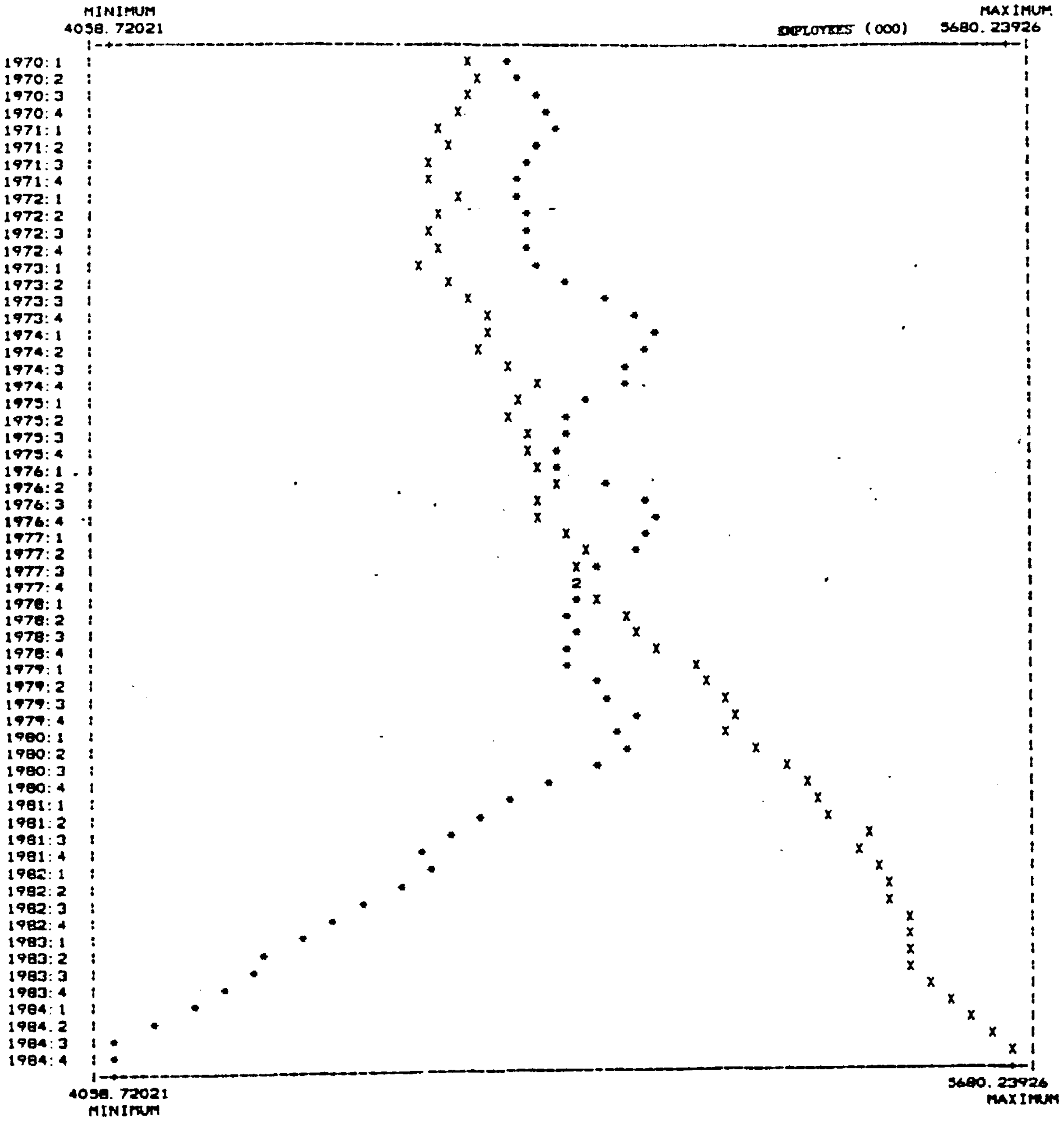


FIG. 1

	QEM1	QOCD2
1971:1	1.88939	-1.13713
1971:2	0.85452	-0.84512
1971:3	-0.25583	-1.42191
1971:4	-1.21275	-1.10323
1972:1	-1.37462	0.58392
1972:2	-0.40966	-0.57456
1972:3	0.06494	-0.03686
1972:4	0.50299	0.46205
1973:1	0.75121	-1.36585
1973:2	1.64621	0.29227
1973:3	3.09522	1.59608
1973:4	3.90914	1.89791
1974:1	4.47260	2.60908
1974:2	2.92319	1.48885
1974:3	0.66952	1.36614
1974:4	-0.18203	1.80734
1975:1	-2.44909	1.38985
1975:2	-2.99733	1.14541
1975:3	-2.34874	0.87448
1975:4	-2.46967	-0.45225
1976:1	-1.06496	0.48455
1976:2	1.43827	1.75077
1976:3	3.20420	0.46978
1976:4	3.70024	0.71306
1977:1	3.40694	1.27597
1977:2	1.28238	0.96104
1977:3	-1.71686	1.22320
1977:4	-3.03550	1.49517
1978:1	-2.50741	1.20139
1978:2	-2.43909	1.47935
1978:3	-1.08069	2.24578
1978:4	-0.11878	2.81825
1979:1	-0.58641	3.41504
1979:2	0.89884	3.04407
1979:3	1.25883	3.39008
1979:4	2.28439	2.71727
1980:1	2.07354	1.15144
1980:2	0.97793	1.84235
1980:3	-0.47418	2.15763
1980:4	-3.05346	2.67102
1981:1	-4.04501	3.06878
1981:2	-5.45414	2.29767
1981:3	-5.48624	2.44888
1981:4	-4.77577	1.56256
1982:1	-2.98111	2.20251
1982:2	-2.77713	1.87798
1982:3	-3.30899	0.72988
1982:4	-3.74952	1.66937
1983:1	-5.24472	0.93631
1983:2	-5.70727	0.69311
1983:3	-4.25472	0.63024
1983:4	-4.14165	0.66721
1984:1	-4.59060	1.27865
1984:2	-4.25605	2.08394
1984:3	-5.97095	2.79501
1984:4	-4.81552	2.55509

TABLE 2 : YEARLY RATES OF CHANGE IN EMPLOYMENT IN SECTOR 1 (QEM1) AND 2 (QOCD2)

decade, has involved the transferring of some functions, which were typical of industrial firms, to the sector of market services. The Bank of Italy reports that the increase in employment in the sector of services to firms has been on average larger than 4% per year from 1980 to 1983 and larger than 15% from 1984 to 1985.

Investment

The aggregate investment series in the period considered shows neither a pronounced trend nor extreme cyclical fluctuations (see fig.2).

Index of total fixed investment

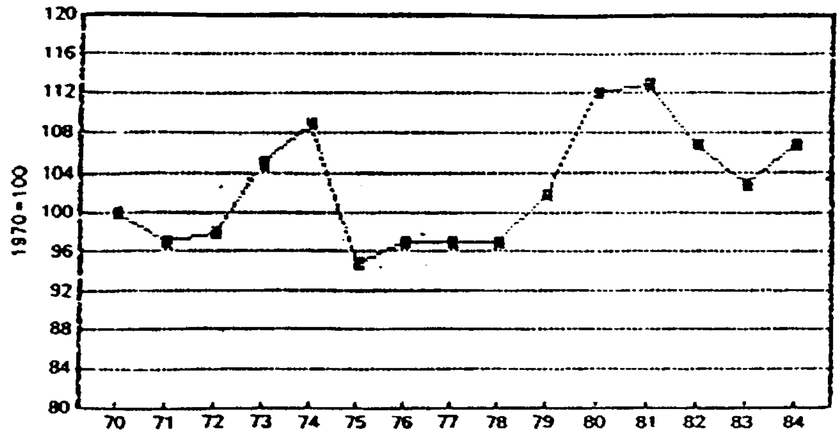


Fig. 2

Source: ISTAT

If we look at the disaggregate series for industry and the sheltered sector (see fig.3) we note the following:

1) the former exhibits a flat trend with accentuated upswings ('73-'74, '79-'80) and downswings ('71, '75', '82-'83);

2) the latter exhibits a moderately increasing trend and fluctuations which occur approximately in correspondence to those of investment in industry, but are less pronounced.

According to the results of several studies (see e.g. Barca and Magnani, 1985) the Italian industrial sector seems to be undergoing a process of substantial technological innovation, which started in 1978-79. This conclusion follows from the observed significant reduction of the average life of capital and its increased efficiency in terms of capital per unit of output. The need to start the process of substitution of the already obsolete existing capital stock, was starting to be felt during the first half of the 70's as the Bank of Italy reports (see the Bank of Italy report for the year 1975, p.89), but a series of adverse circumstances which undermined the profitability rate of firms and their competitive ability (e.g. the increase in the cost of labour and the first oil shock) contributed to delay it. The turning point, according to Barca and Magnani, was the year 1978, when firms seemed to have recovered some profitability margins that allowed them to finance investment with their resources. The second oil shock did not evidently stop this tendency, because the process of energy saving and the increase in imports of intermediate productive inputs as compared to imports of raw materials had already taken place after the first oil shock (see Heimler and Milana, 1984). Essentially, the flat trend of the industrial investment series might be explained with the observation that the recent investment behaviour has been more oriented towards substitution of the existing capital and less towards its expansion.

As far as investment in the sheltered sector is concerned, fig.3 shows that it was not affected so dramatically by the recession of 1974-1975 as it was in the exposed sector. From 1975 onwards, investment in this sector is always higher in absolute value than in the industrial sector, and it is characterized by an increasing trend.

This tendency is mainly due to the behaviour of investment in the market services sector. Investment in the building industry, though following the pattern of aggregate investment in industry, is a relatively small share of total investment in the sheltered sector (4% in 1970, 2.8% in 1985).

Although we are not aware of any specific analysis about the characteristics of accumulation in this sector, there are some elements which would induce us to believe that, at variance with the industrial sector, they are represented substantially by capital-widening processes.

FIXED GROSS INVESTMENT (1970 PRICES)
SOURCE: OUR ELABORATION OF ISTAT DATA
SECTOR 1 PLOTTED WITH *
SECTOR 2 PLOTTED WITH X

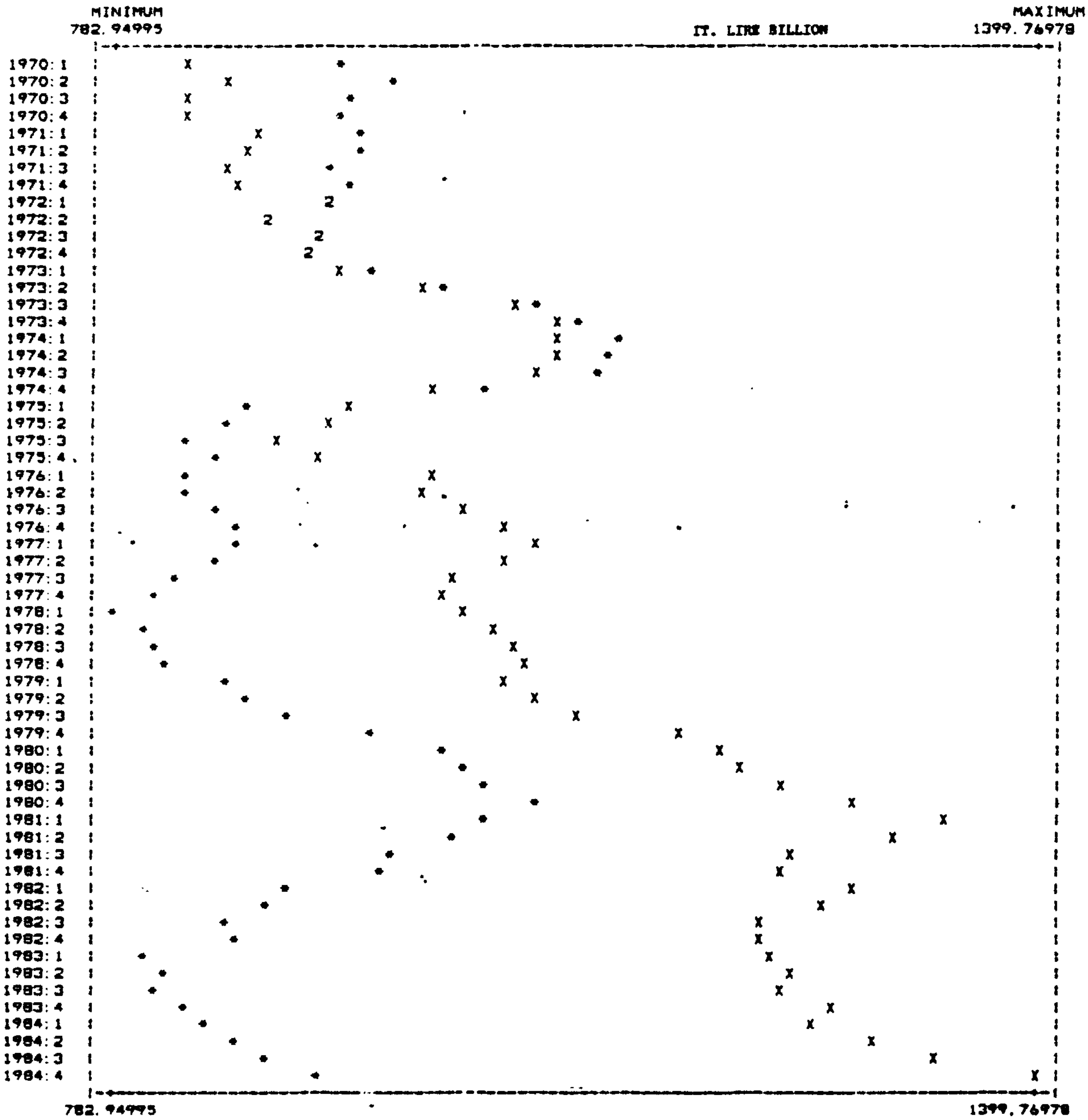


FIG.3

It is a fact that the pillars of accumulation in the sheltered sector have been the compartments of Communications and Trade, two sectors that have relevantly expanded their capital stock in the period considered [5].

The cost of labour, gross earnings and prices

The cost of labour is given by the wage bill, gross of income taxes, augmented by the burden of taxes on employment borne by the firms. Dividing by the number of employees, the cost of labour per employee is derived [6].

The tax rate on labour borne by employers has played a substantial role in the determination of the cost of labour; in the exposed sector in particular.

From the early 70's until 1976, this tax rate was around 48% of gross earnings of industrial employees. In the sheltered sector it started from 44% to reach 48% in 1976.

The introduction of the new wage indexation mechanism (see section 1.2.2.), in the presence of the unprecedented rise in the international inflation rate, led to a substantial reduction of the profitability margins of firms. In January 1977, some measures were taken by the government in order to reduce the burden of taxation on employers. As a result, the tax rate dropped to 39% in industry and 44% in the sheltered sector, reaching its minimum level of 34% in 1981 and 42% in 1979 in the industrial and exposed sector respectively. Since then, the burden of taxes has been increasing again, to reach 43% and 45% in 1984 respectively.

The yearly rates of change of the costs of labour per employee reflect the effects of these measures (see fig.4 and table 3).

We first of all note that, on the whole, the dynamics of the yearly rates of change of the labour costs per employee are more contained in the sheltered sector than in the exposed one.

The big expansion of the cost of labour which was started in 1973, was in fact stopped for a while after 1977, also as a consequence of the reduction of the burden of taxes on labour borne by firms. After the year 1980, the cost of labour had risen again, but its rate of growth was smaller than in the 70's (except for a sudden peak in 1981 in the industrial sector), and this tendency was reinforced from '82 to '84, also as a consequence of a trilateral agreement between firms, unions and the Government of containing the indexation rate of wages (January '83) and of predetermining the inflation rate (February '84).

As far as wages per employees are concerned, their yearly rates of change follow, more or less, the same pattern as for the cost of labour per employee except, of course, when a substantial change in taxes on employers takes place [7].

YEARLY RATES OF CHANGE IN THE REAL COST OF LABOUR PER EMPLOYEE
SECTOR 1 LOTTED WITH *
SECTOR 2 PLOTTED WITH X

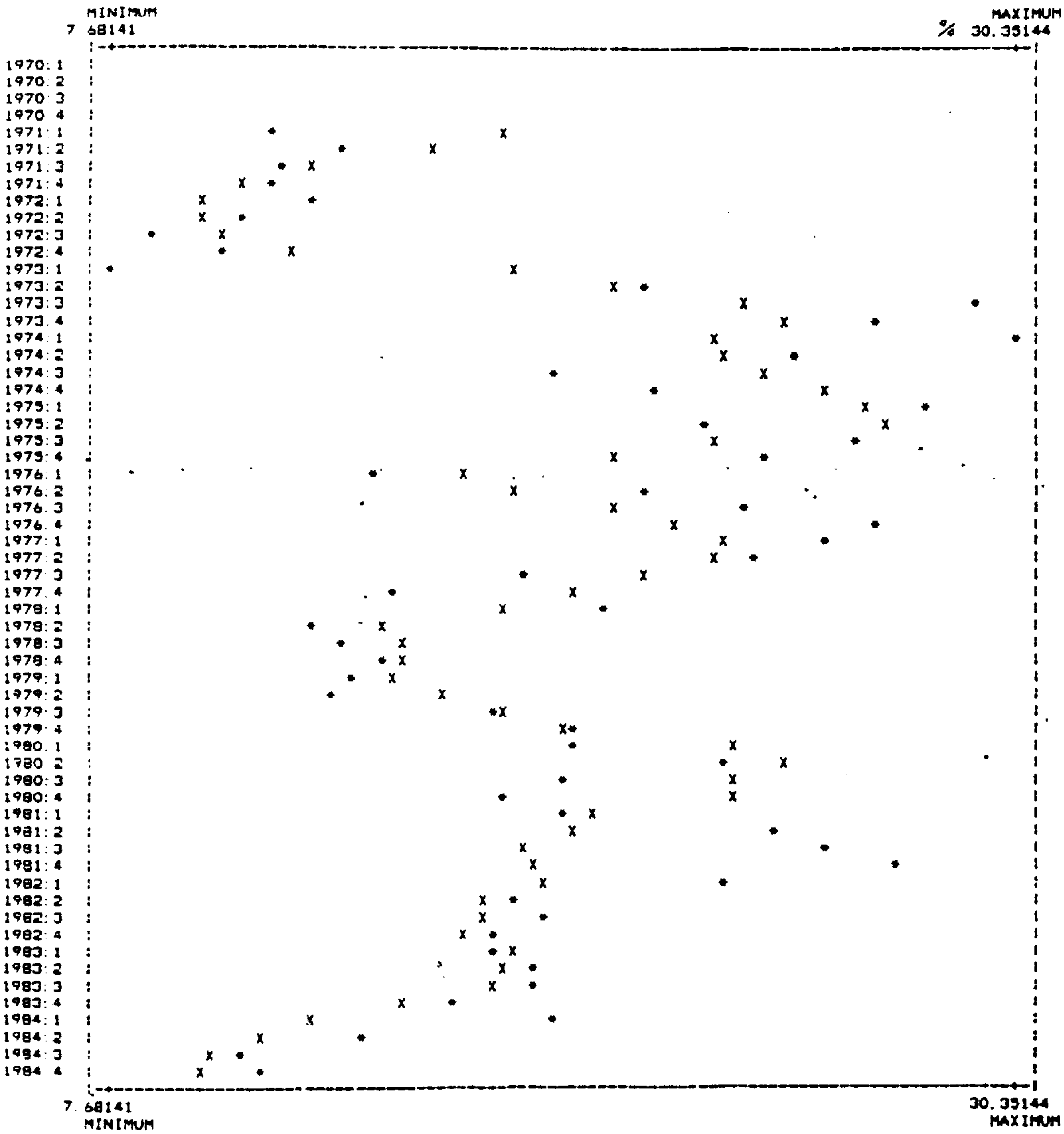


FIG 4

	QCL1	QCL2
1971:1	11.59495	17.40418
1971:2	13.35846	15.73033
1971:3	11.97000	12.74552
1971:4	11.74282	10.91861
1972:1	12.81559	9.93742
1972:2	11.04215	9.98659
1972:3	8.62303	10.48115
1972:4	10.57611	12.28872
1973:1	7.68141	17.63904
1973:2	21.10022	20.32603
1973:3	29.46920	23.47728
1973:4	26.70378	24.64724
1974:1	30.35144	22.69253
1974:2	24.93405	23.04684
1974:3	18.68042	23.99651
1974:4	21.29658	25.60464
1975:1	28.15556	26.60943
1975:2	22.43109	27.04716
1975:3	26.44311	22.84337
1975:4	24.01173	20.19966
1976:1	14.22384	16.54214
1976:2	21.12383	17.74624
1976:3	23.53726	20.34502
1976:4	26.79274	21.88837
1977:1	25.60952	23.00286
1977:2	23.70586	22.71605
1977:3	17.99355	20.99394
1977:4	14.62622	19.18748
1978:1	19.94515	17.58327
1978:2	12.72579	14.51583
1978:3	13.53414	14.93745
1978:4	14.45459	15.02774
1979:1	13.65546	14.75153
1979:2	13.14850	16.05766
1979:3	17.35360	17.62354
1979:4	19.33775	19.10982
1980:1	19.35766	23.29805
1980:2	23.08832	24.46128
1980:3	18.95737	23.37537
1980:4	17.45239	23.18545
1981:1	19.03883	19.80023
1981:2	24.33613	19.15271
1981:3	25.68712	17.94717
1981:4	27.42508	18.15920
1982:1	23.13272	18.58178
1982:2	17.82052	17.08725
1982:3	18.44458	16.99035
1982:4	17.37628	16.56007
1983:1	17.16307	17.70108
1983:2	18.32981	17.43484
1983:3	18.20070	17.26620
1983:4	16.17080	15.04890
1984:1	18.85166	12.79349
1984:2	14.07961	11.36509
1984:3	10.83302	10.20704
1984:4	11.50248	9.96441

TABLE 3 : YEARLY RATES OF CHANGE IN COST OF LABOUR PER EMPLOYEE

So far, we have taken into account nominal values only. To get a measure of the real costs of labour (the product wage) for each sector, we have divided the cost of labour per employee by the respective value added deflator. The series are presented in fig.5.

The real wage (the consumption wage) is derived dividing the wage level by the consumption deflator. Fig.6 and 7 present the level of real wages, and the yearly rates of change of the value added and the households' consumption deflators.

REAL COST OF LABOUR PER EMPLOYEE (AT 1970 PRICES)
SOURCE : OUR ELABORATIONS ON ISTAT AND BANK OF ITALY DATA
SECTOR 1 PLOTTED WITH *
SECTOR 2 PLOTTED WITH X

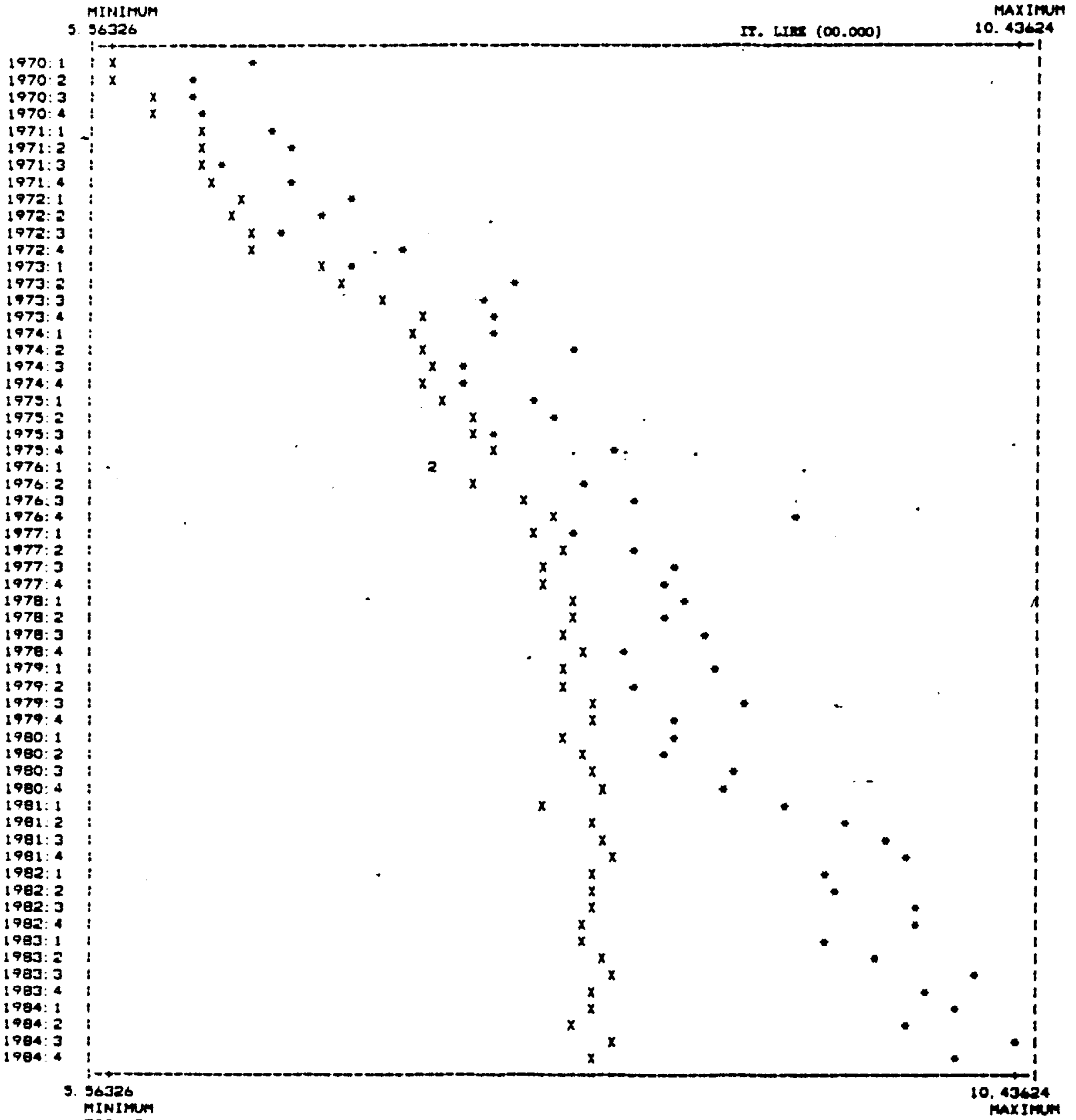


FIG. 5

REAL GROSS WAGES PER EMPLOYEE (AT 1970 PRICES)
SOURCE : OUR ELABORATIONS ON ISTAT AND BANK OF ITALY DATA
SECTOR 1 PLOTTED WITH *
SECTOR 2 PLOTTED WITH X

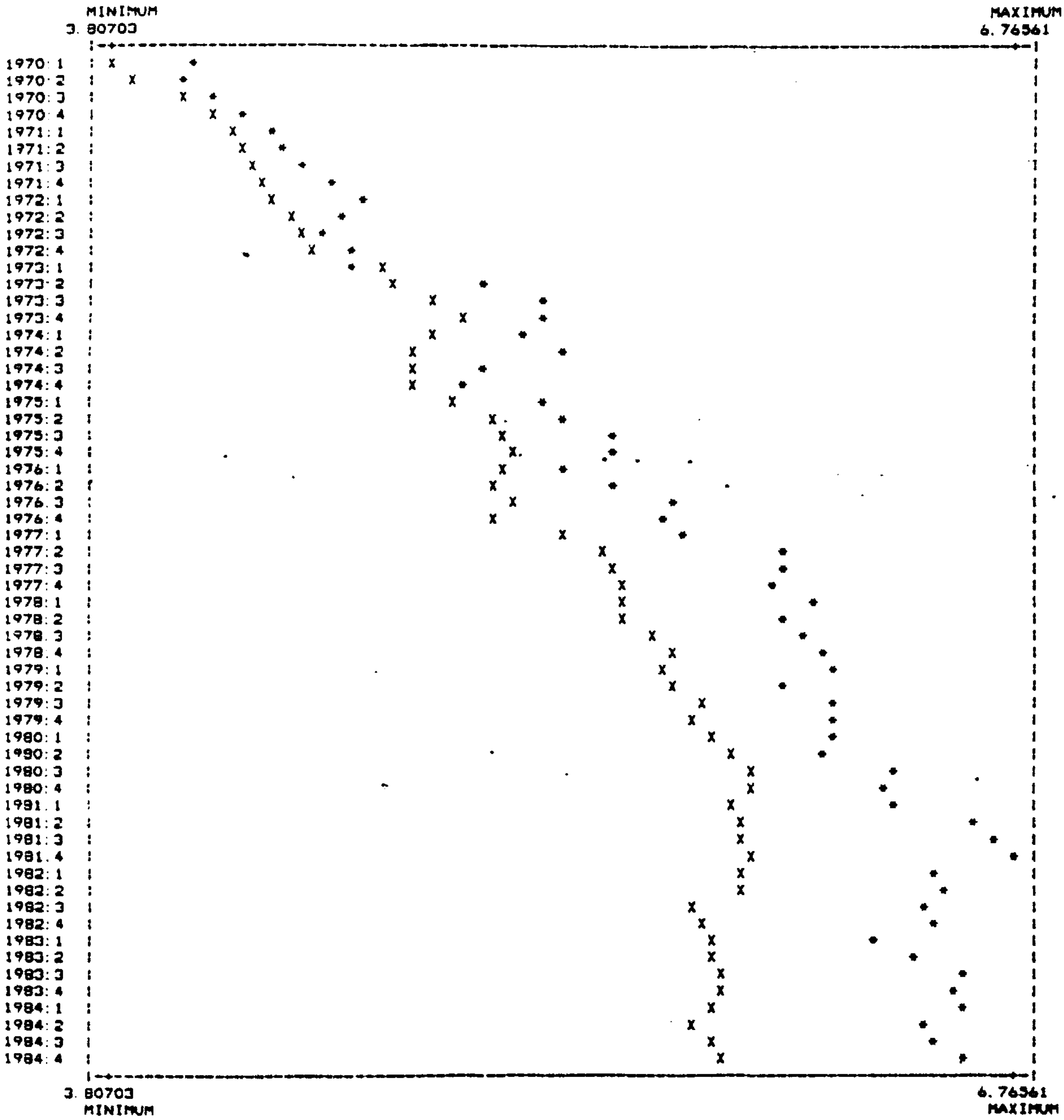


FIG. 6

YEARLY RATES OF CHANGE
GP1 PLOTTED WITH * SECTOR 1 VALUE ADDED DEFLATOR
GP2 PLOTTED WITH X SECTOR 2 VALUE ADDED DEFLATOR
GPCD PLOTTED WITH Y HOUSEHOLDS' CONSUMPTION DEFLATOR

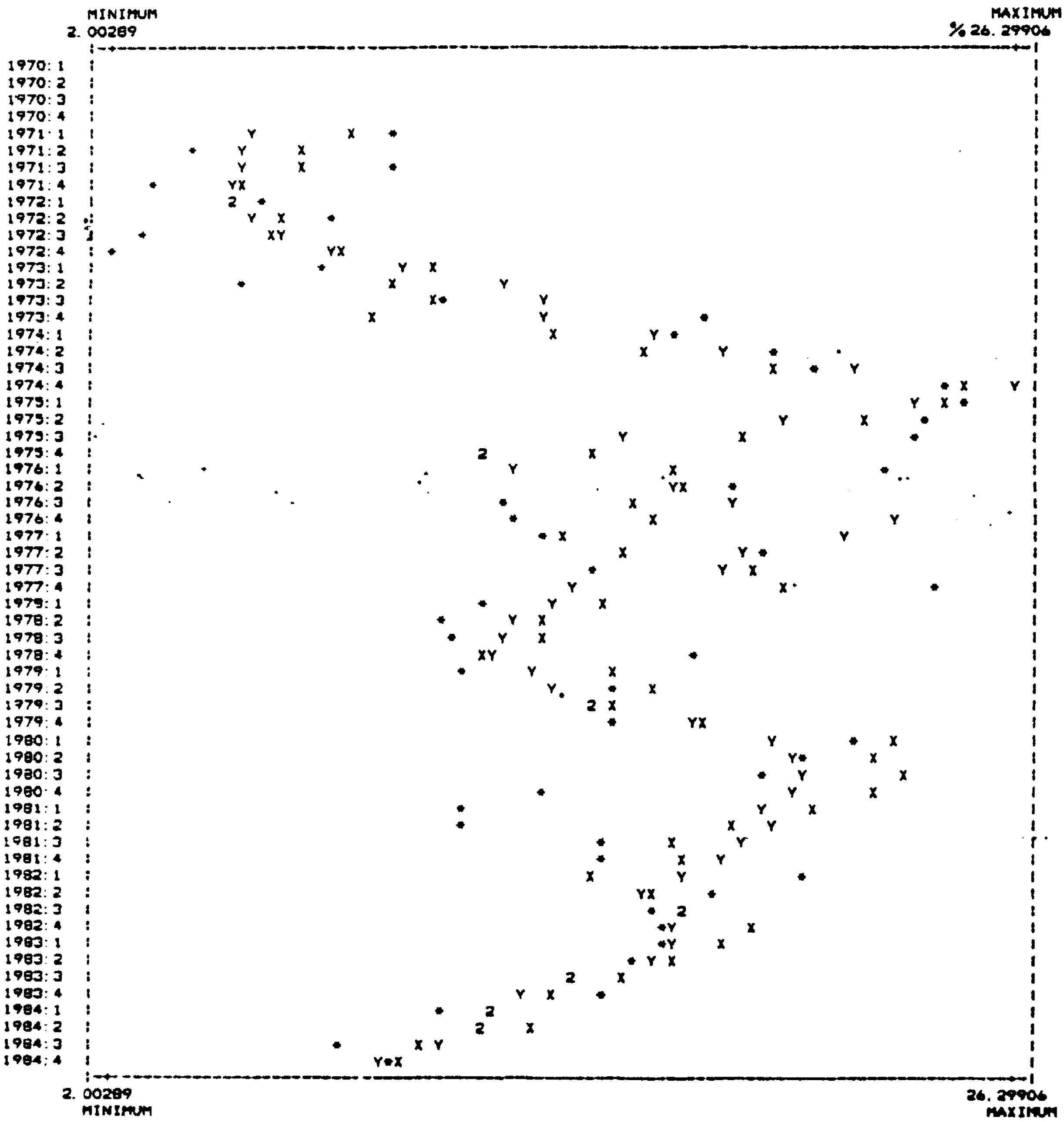


FIG. 7

1.4. Institutions and characteristics of the Italian labour market.

A major aim of our analysis is to build a model of the labour market that explains the determination of employment and wages in the two sectors of the economy we have described above. As we shall see in chapter 2 and 3, we have represented the Italian case with a model of the labour market where unions set wages and firms set employment. In this section we intend to give some evidence for our monopoly union assumption with a brief account of the institutions which characterize the Italian labour market and the role that unions have had in their formation.

1.4.1. Instruments to support the unemployed workers' income

Essentially, two instruments support the unemployed workers' income in the Italian institutional framework:

1) the unemployment benefit scheme;

2) the "Cassa Integrazione Guadagni" (C.I.G.,Income integration fund).

There are other instruments which are indirectly used to this purpose, such as, for example, some categories of disability pensions and family allowances.

Only workers who have been laid off are entitled to the unemployment benefit. The C.I.G. scheme, instead, protects the income of the workers who, after being declared redundant, are suspended from work, but still remain employed by the firm.

First job seekers, in the Italian institutional setting, are not entitled to any unemployment benefit, and might recur only to some indirect instruments of subsidization, that are only to be regarded as a small integration of an already existing family income.

Lay-offs and unemployment benefits

As far as lay-offs are concerned, they are ruled by the Interconfederate Agreement of May 1965 about collective lay-offs and the law of July 1966 (law 604) about individual lay-offs. The agreement of 1965 stipulates that the firm can start a procedure of collective lay-offs if a reduction or a transformation of activity is needed. The workers' unions and the firm's confederations will then meet and judge the applicability of the proceeding. The law of 1966 stipulates that the employer can lay off a worker if a "valid reason" according to the Civil Law exists and can be proved.

In the case of collective lay-offs, the workers are entitled to receive 80% of their gross wage, up to a ceiling of 750 thousand liras for a period of 180 days (renewable). In the case of individual lay-offs the unemployment benefit is just 800 liras per day for 180 days.

The "Cassa Integrazione Guadagni".

A firm facing serious economic difficulties can appeal to the C.I.G.. This institution, which is financed by public funds, operates at an ordinary and extraordinary level. Not all firms, however, can appeal to the C.I.G.. As a matter of fact, this instrument is mainly used by industrial firms of a medium and large size.

The ordinary C.I.G. was created in 1945 to support firms and workers during temporary slowdowns in economic activity. It was given its present set-up in 1975 (law 164). It allows firms that are experiencing a slack in the demand for their output to reduce the number of hours worked by their employees, without having to lay some of them off. The workers who are subject to this measure receive, from this public fund, 80% of their wage for the hours they have been idle. The firm is also relieved of the social contributions for the corresponding number of hours. The firm can appeal to the ordinary C.I.G. for a maximum of one year of work; a further extension involves some costs for the firm. The ordinary

C.I.G. is, therefore, an instrument for stabilization over the business cycle.

The extraordinary C.I.G., instead, was created in 1968 with the aim of supporting industrial reorganization following a structural economic crisis.

The law for industrial reorganization in 1977 (law 675), underlined the role of the extraordinary C.I.G. as an instrument for industrial policy with the aim of encouraging the mobility of the labour force. For this purpose, special unemployment lists and training programmes for workers in the extraordinary C.I.G. scheme were instituted.

Firms can appeal to the extraordinary C.I.G. in case of sectoral or regional crisis, for industrial reorganization or transformation and, since 1977, also for crisis at the firm level.

The access to the extraordinary C.I.G. is free from any charge, no limit of time is fixed, and it pays the same subsidy to the suspended workers as the ordinary C.I.G..

1.4.1. Economic consequences on the labour market and the economy as a whole.

The disagreggate unemployment series for the period 1970-1984 (see table 4) give evidence of some interesting aspects of the effects of the instruments described above on the Italian labour market. we note, first of all, that this labour market is characterized by a low and decreasing level of subsidization to unemployment. That is because the labour force that has never been employed by a firm is not entitled to any subsidy. During the 70's and 80's, the category of first job seekers in particular has shown a more pronounced increasing trend (see fig. 8) than the other components of the unemployed labour force, thus reducing the percentage of unemployed receiving a subsidy. In 1970, for example, the employees laid-off and suspended from work were 25% of the total unemployed, against 19% of 1980 (but in 1984 the figure rose to 32% because of the massive use of the C.I.G.). In this percentage, moreover, are included the unemployed workers receiving 80% of their gross earnings, those who, being laid off individually, receive a subsidy which is worth 1/2 kg. of bread per day and those who, the 180 days having elapsed, do not receive any subsidy at all.

UNEMPLOYMENT RATE, TOTAL LABOUR FORCE, COMPONENTS OF UNEMPLOYMENT.

UR: UNEMPLOYMENT RATE (% UNEMPLOYED OVER LABOUR FORCE); ISTAT
UC: " " NET OF C.I.G. WORKERS; BANK OF ITALY
LF: TOTAL LABOUR FORCE; THOUSAND WORKERS; ISTAT;
UDIS: LAID-OFF WORKERS ; THOUSAND WORKERS; ISTAT;
UFST: FIRST JOB SEEKERS; THOUSAND WORKERS; ISTAT;
UO: OTHER UNEMPLOYED; THOUSAND WORKERS; ISTAT;
C.IG: WORKERS IN C.I.G. ; THOUSAND WORKERS; BANK OF ITALY.

	UR	UC	LF	UDIS	UFST	UO	CIG
1970:1	5.40000	5.45000	20185.00000	336.00000	454.00000	391.00000	9.56896
1970:2	5.50000	5.55000	20219.00000	251.00000	376.00000	332.00000	9.60378
1970:3	5.50000	5.60000	20719.00000	243.00000	493.00000	431.00000	14.51754
1970:4	5.30000	5.50000	20620.00000	247.00000	473.00000	417.00000	34.20514
1971:1	5.30000	5.60000	20251.00000	357.00000	416.00000	376.00000	54.11163
1971:2	5.30000	5.70000	20443.00000	286.00000	363.00000	336.00000	73.60258
1971:3	5.50000	5.90000	20600.00000	237.00000	457.00000	414.00000	78.24910
1971:4	6.00000	6.30000	20326.00000	236.00000	503.00000	457.00000	77.94142
1972:1	6.20000	6.50000	20141.00000	321.00000	541.00000	442.00000	63.19884
1972:2	6.40000	6.70000	20003.00000	238.00000	498.00000	402.00000	58.46278
1972:3	6.60000	6.80000	20571.00000	242.00000	629.00000	515.00000	38.83423
1972:4	6.50000	6.70000	20456.00000	247.00000	608.00000	505.00000	38.85087
1973:1	6.90000	7.10000	20096.00000	345.00000	523.00000	484.00000	43.90379
1973:2	6.70000	6.80000	20339.00000	269.00000	466.00000	658.00000	29.53325
1973:3	5.80000	6.00000	20777.00000	190.00000	550.00000	525.00000	29.96675
1973:4	5.50000	5.70000	20750.00000	189.00000	525.00000	497.00000	35.28783
1974:1	5.20000	5.40000	20547.00000	241.00000	481.00000	427.00000	30.48599
1974:2	5.20000	5.40000	20394.00000	176.00000	408.00000	351.00000	40.61047
1974:3	5.50000	5.90000	20913.00000	154.00000	530.00000	467.00000	76.10757
1974:4	5.50000	6.10000	21002.00000	203.00000	538.00000	475.00000	128.12094
1975:1	5.70000	6.60000	20807.00000	247.00000	480.00000	414.00000	189.29639
1975:2	5.90000	6.80000	20646.00000	250.00000	416.00000	496.00000	177.16751
1975:3	6.00000	6.90000	21137.00000	234.00000	552.00000	467.00000	187.51077
1975:4	6.30000	7.10000	21194.00000	253.00000	592.00000	520.00000	176.75238
1976:1	6.50000	7.30000	20675.00000	248.00000	547.00000	514.00000	161.13562
1976:2	6.80000	7.30000	20959.00000	256.00000	552.00000	515.00000	127.05170
1976:3	6.90000	7.30000	21889.00000	259.00000	652.00000	612.00000	87.10507
1976:4	6.90000	7.20000	21614.00000	256.00000	661.00000	632.00000	76.95897
1977:1	7.00000	7.40000	21357.00000	253.00000	619.00000	587.00000	87.16901
1977:2	7.30000	7.70000	21616.00000	191.00000	627.00000	613.00000	102.41959
1977:3	7.30000	7.90000	21899.00000	196.00000	754.00000	742.00000	126.92946
1977:4	7.20000	7.90000	21559.00000	203.00000	773.00000	622.00000	161.99133
1978:1	7.20000	7.80000	21389.00000	231.00000	754.00000	535.00000	146.76315
1978:2	7.20000	7.90000	21502.00000	204.00000	711.00000	540.00000	156.63644
1978:3	7.30000	8.00000	22117.00000	208.00000	840.00000	610.00000	146.24698
1978:4	7.50000	8.10000	21914.00000	205.00000	864.00000	582.00000	140.99142
1979:1	7.60000	8.30000	21613.00000	269.00000	845.00000	518.00000	151.08926
1979:2	7.90000	8.40000	21745.00000	227.00000	796.00000	556.00000	116.29855
1979:3	7.80000	8.40000	22568.00000	203.00000	904.00000	772.00000	142.83438
1979:4	7.60000	8.00000	22375.00000	206.00000	921.00000	575.00000	91.76379
1980:1	7.60000	7.90000	21978.00000	248.00000	903.00000	552.00000	91.40254
1980:2	7.60000	8.10000	22069.00000	188.00000	815.00000	550.00000	117.43588
1980:3	7.60000	8.40000	22801.00000	211.00000	902.00000	699.00000	163.13660
1980:4	7.60000	8.50000	22642.00000	200.00000	939.00000	583.00000	212.77783
1981:1	8.00000	9.20000	22374.00000	222.00000	938.00000	556.00000	262.45795
1981:2	8.50000	9.80000	22445.00000	205.00000	908.00000	713.00000	285.08429
1981:3	8.90000	10.20000	22893.00000	209.00000	1003.00000	801.00000	302.99548
1981:4	9.20000	10.60000	22946.00000	232.00000	1144.00000	720.00000	342.52283
1982:1	9.00000	10.30000	22555.00000	315.00000	1149.00000	625.00000	301.56805
1982:2	9.00000	10.40000	22634.00000	271.00000	1089.00000	594.00000	329.28479
1982:3	9.20000	10.80000	22948.00000	277.00000	1202.00000	640.00000	355.14124
1982:4	9.40000	11.10000	22846.00000	271.00000	1221.00000	618.00000	376.31946
1983:1	9.90000	11.60000	MISSING VALU	MISSING VALU	MISSING VALU	MISSING VALU	398.13763
1983:2	9.90000	11.80000	MISSING VALU	MISSING VALU	MISSING VALU	MISSING VALU	432.84680
1983:3	10.00000	11.80000	MISSING VALU	MISSING VALU	MISSING VALU	MISSING VALU	406.28198
1983:4	10.50000	12.20000	MISSING VALU	MISSING VALU	MISSING VALU	MISSING VALU	406.32294
1984:1	10.60000	12.40000	MISSING VALU	MISSING VALU	MISSING VALU	MISSING VALU	410.00330
1984:2	10.30000	12.10000	MISSING VALU	MISSING VALU	MISSING VALU	MISSING VALU	424.46674
1984:3	10.20000	12.20000	MISSING VALU	MISSING VALU	MISSING VALU	MISSING VALU	471.26233
1984:4	10.20000	12.10000	MISSING VALU	MISSING VALU	MISSING VALU	MISSING VALU	450.96893

TABLE 4

UDIS PLOTTED WITH * LAID OFF WORKERS
UFST PLOTTED WITH + FIRST JOB SEEKERS
UO PLOTTED WITH X OTHERS
CIG PLOTTED WITH Y WORKERS IN C. I. G.
THOUSAND OF WORKERS

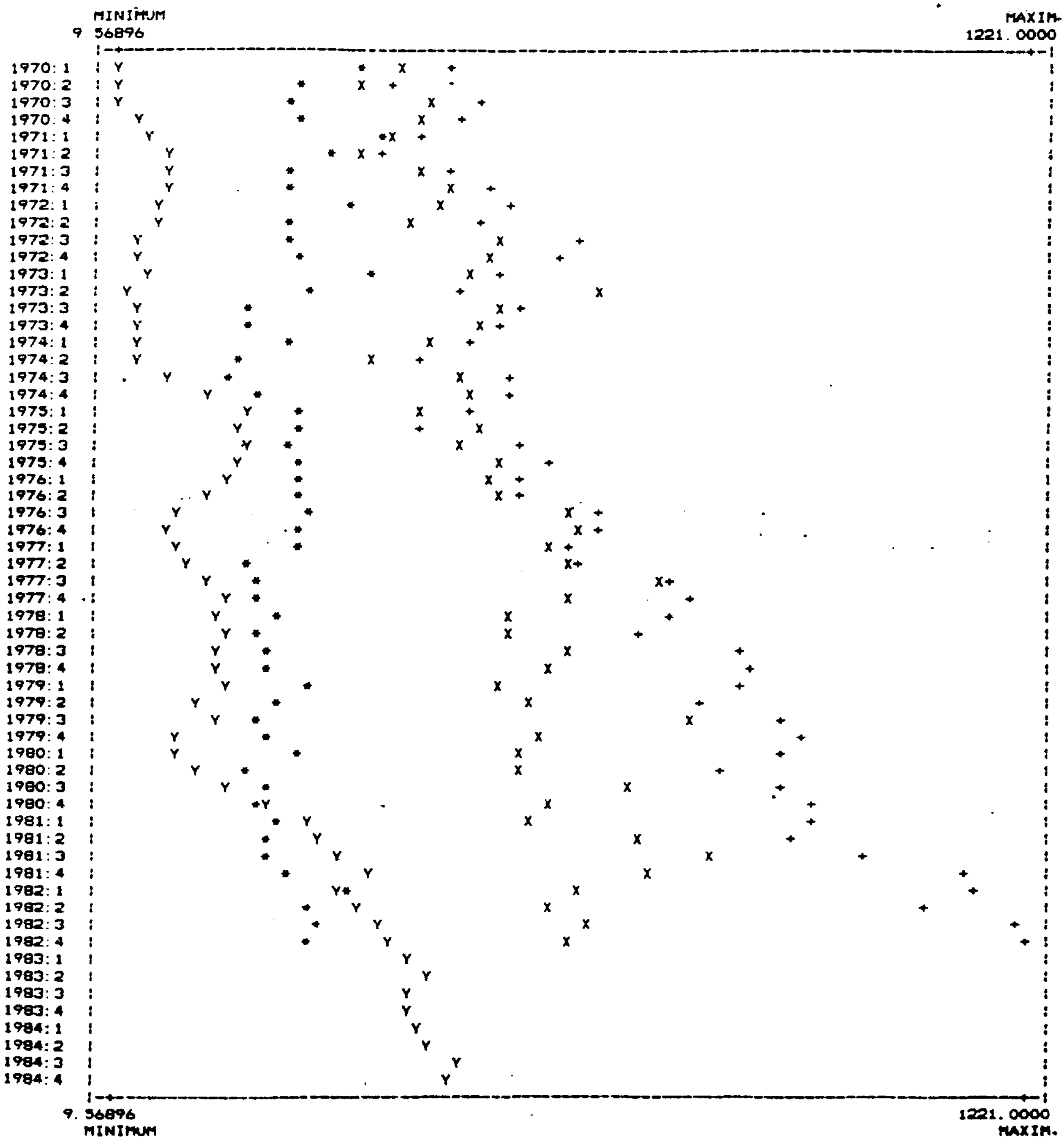


FIG. 8

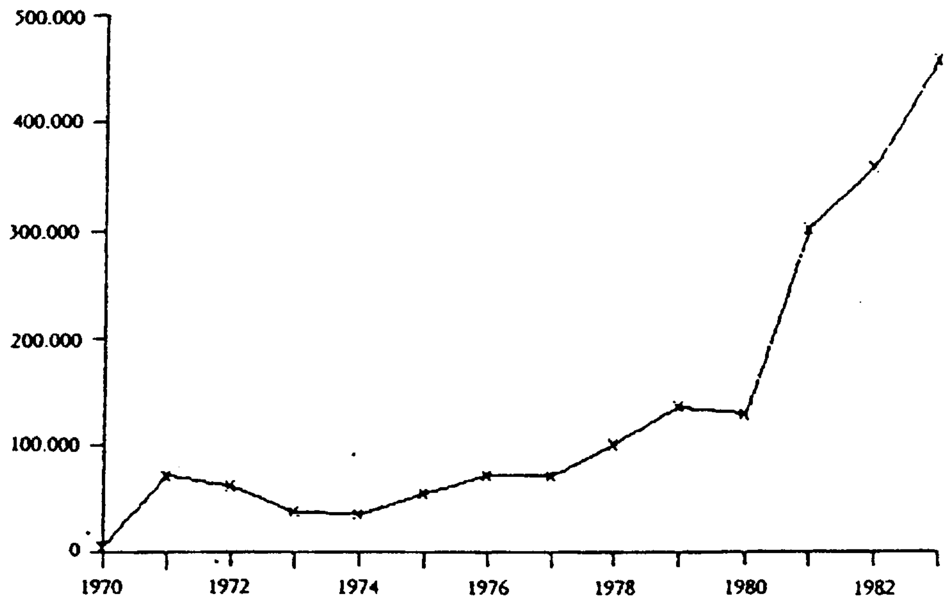
According to these observations, explanations of aggregate unemployment based on the disincentive effects of the unemployment benefit system on the labour force would not seem to be relevant for the Italian case [8].

The comparison of the series of laid-off workers with that of workers in the C.I.G. scheme shows that, since 1975, firms have increasingly appealed to it, thus contributing to consolidate the intrinsic rigidity of the Italian labour market.

Since 1980, in conjunction with the process of structural change and the reorganization of the Italian industry, the number of workers "suspended" from work has become greater than that of laid-off workers. This phenomenon has regarded all industrial sectors, with a slightly higher concentration in the mechanical industry. Firms have appealed, in particular, to the extraordinary intervention of the C.I.G. so that its number of hours has registered an exponential growth from the late 70's onwards (see fig.9a). The ordinary C.I.G., instead, has confirmed its role of stabilizer over the business cycle (see fig. 9b).

The following figures [9] might serve to give an idea of the phenomenon: in 1970 the total number of C.I.G. hours (extraordinary and ordinary) was 25 million against 237 million in 1980 and 670 million in 1983. In 1984 the number of workers in C.I.G. was 10% of the total employees of industry in the strict sense; the unemployment rate without them (ISTAT source) was 10%, with them it was 12% (Bank of Italy source)(see fig.10).

A - Hours of C.I.G. for extraordinary intervention
(Thousand hours)



B - Hours of C.I.G. for ordinary intervention
(Thousand hours)

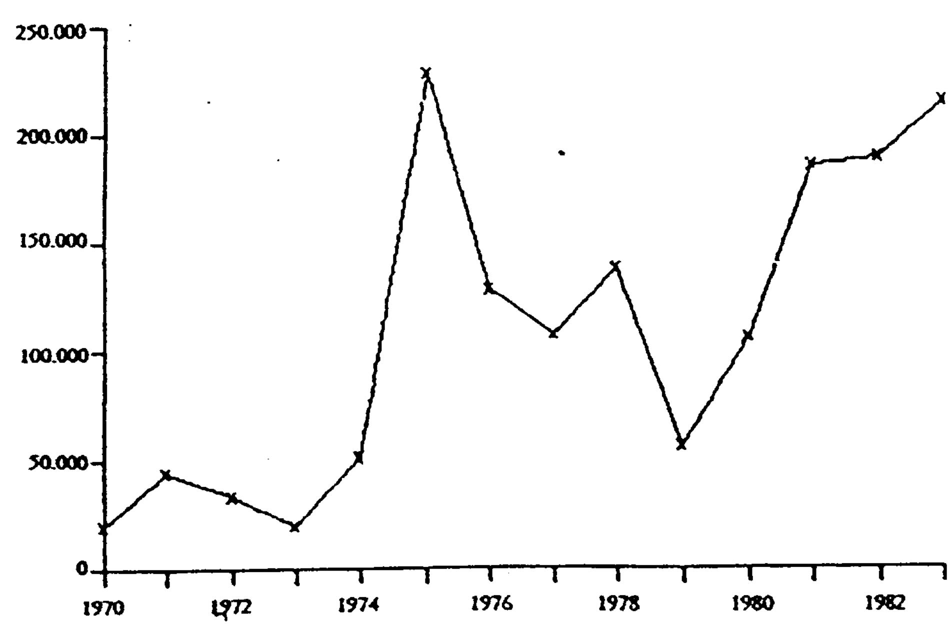


Fig. 9

Source: V. Ceriani (1985)

UNEMPLOYMENT RATES (% OF LABOUR FORCE)
C. I. G. WORKERS INCLUDED (SOURCE ISTAT): PLOTTED WITH *
C. I. G. WORKERS EXCLUDED (SOURCE BANK OF ITALY): PLOTTED WITH X

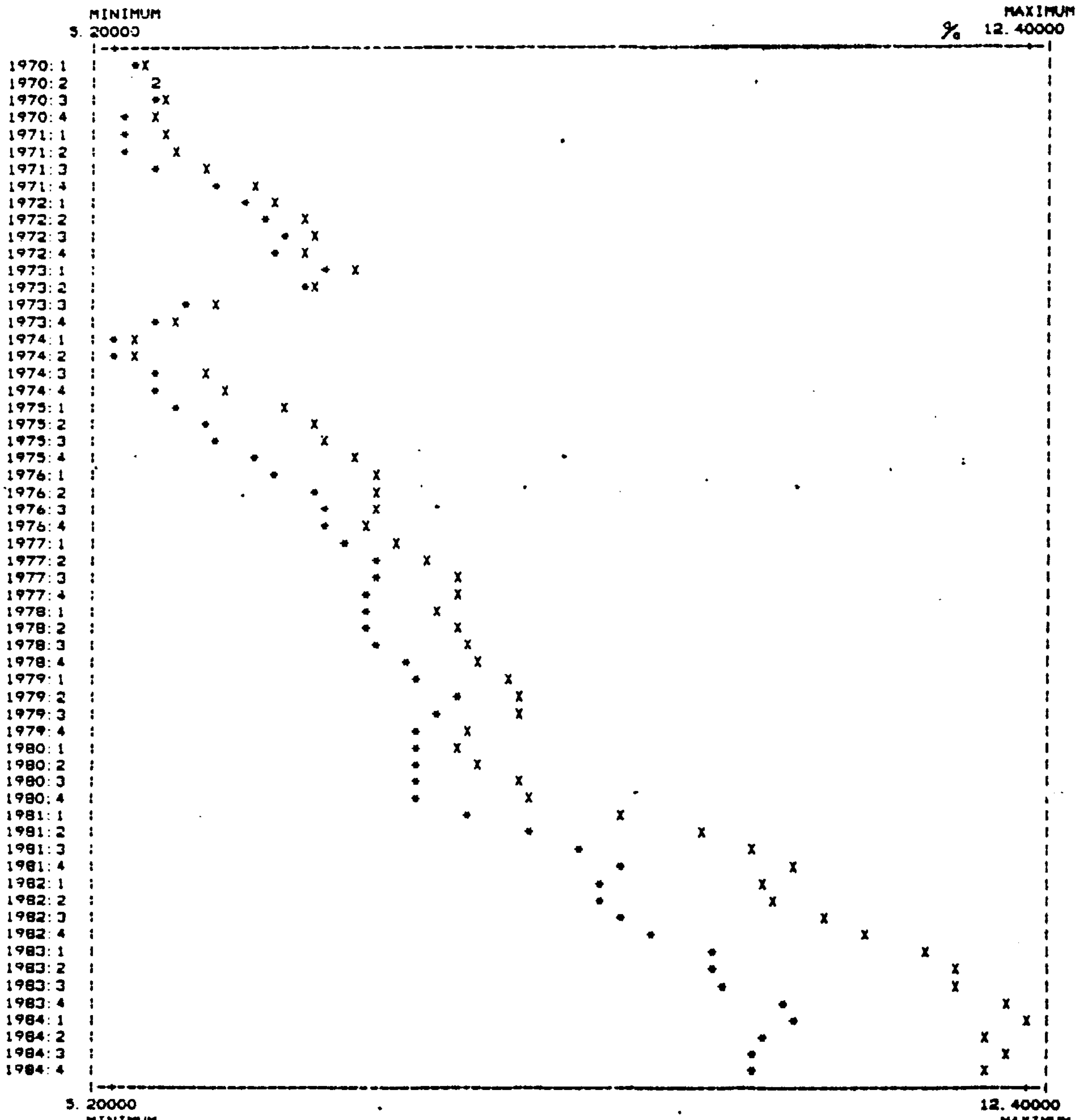


FIG. 10

In conclusion, the main reasons why firms appeal and have appealed to this instrument are the following:

1) it transfers the costs of labour-hoarding from the private to the public sector (ordinary C.I.G.);

2) it has made possible the massive process of industrial restructuration which has occurred in the period considered, allowing firms a wide margin of flexibility, relieving them of hiring and firing costs, sustaining demand and mitigating the social conflict (extraordinary C.I.G.).

The drawbacks, however, have become more and more evident with time. If this scheme has fulfilled the task of supporting industrial transformation, it has failed completely on the ground of promoting the labour mobility. The special unemployment lists and training programmes for people in the extraordinary C.I.G., which were instituted by the law of 1977, have never been implemented, and this instrument has revealed to have the characteristics of a pure unemployment benefit scheme. The workers in the C.I.G., who are still employed by the firm have no incentive to look for another job, given that they have to bear the risk of disposing of a certain income for an unlimited time, and a job which might eventually be reinstated. This system has generated alarmingly high costs for the public sector: in 1983, for example, the deficit of the C.I.G. was 4% of the total financial requirements of the public sector.

We can conclude that the market rigidity of the demand of labour which has characterized particularly the industrial sector suggests that firms have considered labour as a "quasi-fixed" factor of production [10]. Moreover, the distortions of the Italian labour market were consolidated by the C.I.G., aggravating the discrimination between people who have been employed and first job seekers. This fact has confirmed the tendency of the Italian Unions, which have strongly supported the C.I.G. scheme, to guarantee exclusively the insiders of the labour market, disregarding the interests of the outsiders and, in particular, of young and female unemployment.

1.4.2. Collective bargaining and the role of unions in the 70's and 80's.

At the beginning of the 70's the Italian wage bargaining scenario has the following characteristics:

1) the three confederations of workers (C.I.G.L., C.I.S.L. and U.I.L.) bargain with the associations of firms over wage indexation clauses (interconfederate agreements);

2) minimum contractual wages are bargained by the single federations of workers at a national level and every three years (national agreements of categories);

3) wage agreements at the firm level and wage increases unilaterally set by the firm determine the difference between

actual wages and minimum contractual wages (the so called "wage drift").

Wage indexation

Up to 1975 wage indexation was proportional to the level of contractual earnings (gross of direct taxation) for each category of activity. The mechanism of adjustment was based on an ad hoc cost of living index (the "sliding scale" index) which was calculated as a weighted average of the indexes of prices of goods and services in a special basket. Every quarter, the contractual wage was increased by an amount which was directly proportional to its level (the "contingency point"). In such a way, all the percentage differences in wages were reproduced. These differences in wages depended, among other things, on the specific sectoral employment contracts, on the workers' qualifications, age and sex, and also had some territorial characteristics. Moreover there were some discrepancies between the wage indexation systems of agriculture, industry, private and public services.

In January 1975 the Trade Unions Confederations signed an agreement with the Confederation of Industrial Associations which completely changed the nature of the "sliding scale" mechanism.

The essential modification was that the contingency point was equalized across different industrial activities and employment contracts. The law no.91/1977 settled the matter definitively, extending the validity of this agreement to all employees, therefore abolishing all the differences between productive sectors. Since then, the increases in contractual wages were represented by a "fixed contingency point" which was the same for each employee and corresponded to that of the better paid category of industrial employees. Wage differentials were therefore reduced, thus favouring the low paid workers.

This measure was the product of the egualitarian principles that inspired the policy of the Italian trade unions from the late 60's all through the 70's [11]. It marked the moment of trade unions' maximum power in industrial relations [12] .

Shortly after the implementation of this measure, the economic debate on the cost of labour concentrated on the issue of the degree of coverage of gross earnings and its relation to inflation. By coverage it is intended the ratio between changes in wages due to indexation and the changes in the sliding scale index.

From 1956 to 1973 the coverage on average was under 60% . The coverage has reached a peak of 100% in 1977 [13], and then stabilized around 70% until 1983. It is to be noted, moreover, that if we consider the differences between the consumer price index and the sliding scale index in periods of accelerating inflation the purchasing power of wages is lower than their coverage.

The wage drift

The year 1980 signed a break in the advance of the Italian trade unions. The tendencies of the 70's were partially stopped, because the unprecedented high inflation rates combined with the indexation mechanism of the "fixed contingency point" flattened wages and salaries up to a point which was no more acceptable by workers themselves.

The recent return of interest in the non-automatic components of wages and salaries has its roots in the observation that the forces counteracting the wage equalization movement have been increasingly gaining weight in the recent past.

It has been noted that in the period 1977-1985 the increments in wages that were unilaterally conceded by industrial firm to their employees reached their maximum and minimum values at the highest and lowest levels of labour skill respectively.

> "Firms have favoured the employees with more responsability. The aim of this manoeuvre, which has taken place at the firm level, has been to counterbalance the egualitarian effects of collective bargaining and, above all, of the indexation mechanism." (Dell'Aringa and Presutto, 1986, pp.120-121).

The same authors have calculated that in the period 1976-1985 the wage drift amounted to an increase of 6% in the average earnings of industrial white collar workers. These increments have halved the flattening effects of indexation clauses.

We observe, to conclude, that the massive use of the C.I.G. and the widening of wage differentials which have characterized the 80's have gone pari passu with the weakening of the Italian trade unions. From the second half of the 80's onwards, economists certainly face the task of reconsidering the unions' role.

Footnotes

1 See, for example, the yearly reports of the Bank of Italy and of the Ministry of the Budget.

2 See e.g. Momigliano and Siniscalco (1980, 1982, 1984); Valcamonici (1985); Bruno and Sachs (1982).

3 That is not completely true for employment in the building industry, which in 1984 represented 23% of total employment in industry. The trend of employment in this sector hss been steadily decreasing since 1970.

4 The employment series for the industrial sector is net of the workers who are under a special unemployment subsidy scheme (Cassa Integrazione Guadagni) as we shall explain at length in the next section.

5 See the I.S.T.A.T. series on the composition of investment per sector of production: Annuario di Contabilita' Nazionale. Several years.
The wholesale trade sector, in particular, has experienced a period of intense growth in the '80s. This is to be connected to the process of industrial restructuration, which has involved the transferring of some functions (e.g. marketing) to newly created firms in this sector. See Fornari (1985).

6 Data on hourly costs of labour are only available for the industrial sector.

7 A complete survey on the cost of labour and wages in the 70's and 80's is in the A.S.A.P. Report (1986).

8 They have been developed, in fact, in countries such as the U.K. were the unemployment benefit system covers a higher proportion of the labour force. (See e. g. Minford 1983).

9 These figures and graph 9 are taken from Ceriani (1985). The source is the Bank of Italy.

10 See Oi (1962).

11 Another important achievement of trade unions was the approval of the Workers' Statute (law 300/1970), a set of rules that guarantee the labour force and impose some constraints on firms.

12 For a complete survey of the wage indexation in Italy see Lungarella (1981).

13 It is of the same year (1977) the study by Modigliani and Padoa Schioppa about the management of an open economy with 100 % plus wage indexation.

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CHAPTER 2 THE BEHAVIOUR OF THE FIRM

Introduction

The aim of this chapter is to lay the microeconomic foundations of the behaviour of the firm underlying our two-sector macro-model.

We shall start with the static production relations (sect. 2.1.) and then introduce dynamics in a step by step fashion, assuming first adjustment costs in the input of labour (sect.2.2) and, subsequently, in the capital stock (sect. 2.3.).

The theoretical analysis will enable us to derive the employment, price and investment equations of the econometric model presented in chapter 4.

2.1. The static production relations

We assume that the supply side of the economy consists of two representative firms that produce two composite commodities: firm 1 produces a tradeable good (i.e. exposed to international competition), firm 2 produces a non-tradeable good (i.e. sheltered from international competition). Demand for the tradeable good produced by firm 1 depends on its relative price with respect to the competing good produced abroad. Demand for the non-tradeable good produced by firm 2 is independent of foreign variables.

The production function of the tradeable good is:

(1) $$Y_1 = f(L_1, K_1, M_1, N_1)$$

where Y_1 is the supply of output, L_1 is the input of labour, K_1 is capital stock, M_1 is the input of imported raw materials and N_1 is the input of non-tradeable good.

The production function of the non-tradeable good is:

(1') $$Y_2 = f(L_2, K_2, M_2, T_2)$$

where T_2 is the input of tradeable good.

We start with the static relations and treat capital as fixed.

Firm 1

The firm minimizes costs subject to production function (1). From this minimization the firm's cost function is derived:

$$(2) \qquad C_1 = C(\ w_1, p^m, p_2, Y_1, K_1)$$

where w_1 is the cost of labour per worker, p^m is the price of imported raw materials, p_2 is the price of the tradeable good.

The firm then maximizes its revenue:

$$(3) \qquad \max_{Y_1} R_1 = p_1 Y_1 - C_1$$

The firm faces a downward sloping demand curve. Demand for the tradeable good (Y_1^d) depends on the relative price of good 2 with respect to good 1 (p_2/p_1), on its relative price w.r.t. to the foreign competitive good (p^F/p_1), and on real aggregate expenditure (z/p_1). That is:

$$(4) \qquad Y_1^d = Y_1^d\left(\frac{p_2}{p_1}, \frac{p^F}{p_1}, \frac{z}{p_1} \right)$$

Now, the model works as follows. The firm sets its level of output such that marginal cost equals marginal revenue.

Translated into formulae, that amounts to set:

(5) $$Y_1 = Y_1^d$$

and solve the maximization problem (3) to get:

(6) $$\frac{dR_1}{dY_1} = p_1 + \frac{dp_1}{dY_1} Y_1 - \frac{dC_1}{dY_1} = 0$$

or:

(7) $$p_1 \left(1 - \frac{1}{e_1} \right) = \frac{dC_1}{dY_1} = \tilde{C}_{Y_1} (w_1, p^m, p_2, Y_1, K_1)$$

which is the standard equilibrium relation between the monopolistic marginal revenue and marginal cost and represents the firm's pricing rule deriving from profit-maximization. e_1 is the price elasticity of demand for good 1.

As for labour demand (L_1^d) we derive it applying duality theory and Shephard's lemma:

(8) $$L_1^d = \frac{dC_1}{dw_1} = C_{w_1}(w_1, p^m, p_2, Y_1, K_1).$$

(5) (7) (8) form the structure of firm's 1 behaviour [1]. We can reduce it to our fundamental price equation substituting out Y_1 in (7) with (4) thus obtaining :

(9) $$p_1 = g(w_1, p^m, p_2, K_1, e_1, p^F, z)$$

and to our fundamental equation for labour demand substituting into (7) Y_1 derived from (8) so as to get:

(10) $$L_1^d = h(p_1, w_1, p^m, p_2, K_1, e_1)$$

For the homogeneity of degree 1 in prices of the cost function and, by consequence, the homogeneity of degree zero of the labour demand, (10) can be rewritten as [2]:

(11) $$L_1^d = h^*\left(\frac{w_1}{p_1}, \frac{p^m}{p_1}, \frac{p_2}{p_1}, K_1, e_1\right)$$

If the production function exibits constant returns to scale in labour and capital (11) becomes [3] :

$$(12) \qquad \frac{L_1^d}{K_1} = h^{**}\left(\frac{w_1}{p_1}, \frac{p^m}{p_1}, \frac{p_2}{p_1}, e_1 \right)$$

Note that, in this framework, Y_1^d influences L_1^d only if:

$$(13) \qquad e_1 = e(Y_1^d)$$

as it is evident from (12).

Let's see the implications of the two cases of constant and variable price elasticity of demand. From profit maximization we have:

$$(14) \qquad p_1\left(1 - \frac{1}{e_1} \right) = \frac{dC_1}{dY_1} = C_{Y_1}(w_1, p^m, p_2, Y_1, K_1) = MC(Y_1)$$

which can be interpreted as a mark-up M_1 over unit costs c (i.e. costs per unit of input) pricing-rule:

$$(15) \qquad p_1 = M_1 \; c(w_1, p^m, p_2)$$

where M_1 itself is a function :

$$(16) \qquad M_1 = M(e_1, Y_1, K_1)$$

with K_1 constant by assumption. If e_1 is constant the mark-up will increase if Y_1 increases, because of the assumption of increasing marginal costs (necessary condition for profit-maximization). That is:

$$(17) \qquad \frac{dM_1}{dY_1} > 0 \qquad e_1 \text{ constant.}$$

The evidence, however, is that the mark-up over unit costs is rather unresponsive to demand fluctuations [4]. The extreme assumption that the mark-up over unit costs is completely unaffected by demand fluctuations would imply that the elasticity of demand for output depends on the level of demand in such a way that if demand rises the mark-up does not change. Substituting (13) in (16) this means:

$$(18) \qquad \frac{dM_1}{dY_1} = \frac{dM}{de_1}\,\frac{de_1}{dY_1} + \frac{dM}{dY_1} = 0$$

Without constraining ourselves to the above extreme hypothesis, we assume that e_1 depends on demand and, substituting from (4), we get:

$$(19) \quad e_1 = e\left(\frac{p_2}{p_1}, \frac{p^F}{p_1}, \frac{z}{p_1}\right)$$

It is through this channel that demand variables affect labour demand, and we rewrite (12) as:

$$(12') \quad \frac{L_1^d}{K_1} = h^{***}\left(\frac{w_1}{p_1}, \frac{p^m}{p_1}, \frac{p_2}{p_1}, \frac{p^F}{p_1}, \frac{z}{p_1}\right)$$

Firm 2

Firm 2 is not exposed to international competition. We therefore apply the same model as for firm 1 the crucial difference being the exclusion of p^F from the demand for output equation (Y_2^d).

(9), (12) and (12') will be the reference equations for our empirical analysis.

2.2. Introducing dynamics: adjustment costs in the input of labour.

So far, we have assumed that labour is a completely flexible factor of production. We now proceed to relax this hypothesis and assume that the firm incurs costs which are generated by the turnover of its employees. Such costs of hiring and firing employees are connected, for example, with advertising, interviewing, training, compensation for break of contract, loss of output due to vacancies (see e.g. Oi 1962, Rees 1973).

On the empirical side, the introduction of this assumption allows us to give theoretical foundations to the well estabilished econometric specification of labour demand which has between its regressors the lagged dependent variable.

Hence, demand for labour depends not only on current and expected exogenous variables but also on the existing "stock" of workforce. This is the intrinsic dynamics of the labour demand.

Before proceeding to the analytical derivations, one point more must be stressed.

As far as the structure of adjustment costs is concerned, the only assumption which allows to derive a testable labour demand equation is that of their strict convexity. In economic terms, this means that rapid changes in the labour force are discouraged.

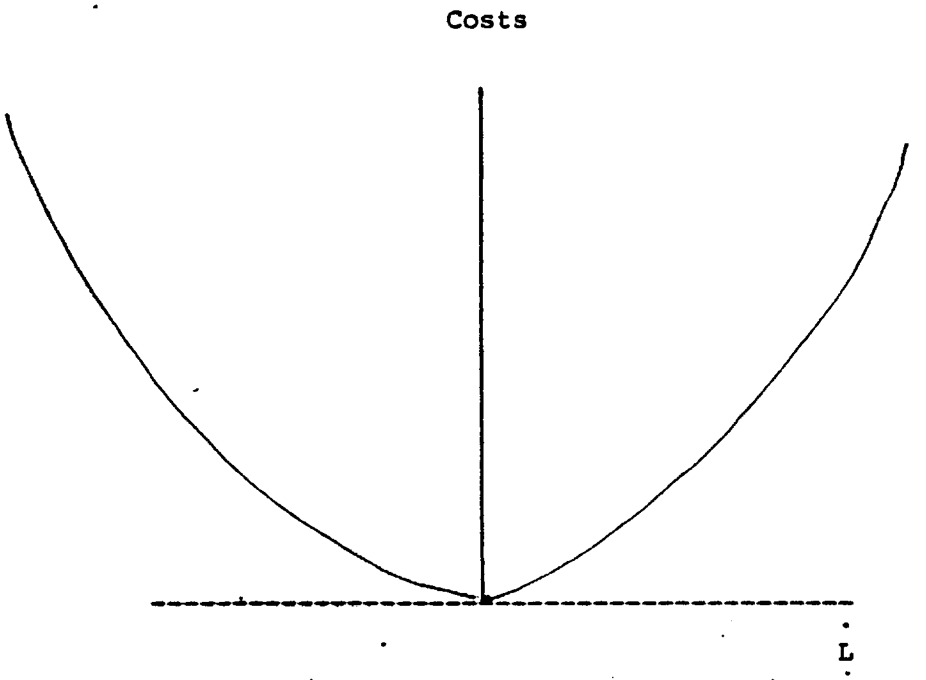

Figure 1

Strictly convex adjustment costs

in the workforce of the firm

Figure 1 exemplifies this concept and shows that if the firm splits a given rate of change of hiring over two years, say, it incurs in lower adjustment costs than if it realizes the same change in one year only.

Evidence on this issue, however, does not give strong support to the strict convexity assumption. There does not seem to be any particular reason why adjustment costs should not be linear.

Nickell (1984) has developed a theoretical model of labour demand with linear adjustment costs and found that the difference between his model and that with strictly convex adjustment costs is that the former never yields the equilibrium level of labour demand (whereas the latter does), but always follows a partial adjustment mechanism.

> "The reason [however] for emphasising the crucial difference between the models is that when we come to empirical work, it turns out that the only tractable model is that with strictly convex adjustment costs. If it happens to be the case that in reality adjustment costs are more or less linear over the relevant range then the strict imposition on the data of a dynamic model derived under the assumption that such costs are strictly convex will lead to incorrect inferences being drawn "(Nickell 1984, pp.29-30).

Having made clear this limit in the analysis of the demand for labour on which our model is centered, we shall now proceed to consider its analytical derivation.

2.2.1. Adjustment costs and the dynamic demand for labour.

We shall now consider the theoretical derivation of labour demand for firm 1 under the assumption of the existence of adjustment costs. Suppose that the firm faces costs of changing the "stock" of its workforce and maximizes the following discrete-time present value function where L_t is the only decision variable (i.e. I_t is decided independently; for simplicity we assume a production function in L and K only and omit the subscript 1) :

$$(1) \qquad V_t = \sum_{i=0}^{\infty} \sum_{j=0}^{i} (1+r_{t+j})^{-1} p_{t+i} [\, f(L_{t+i}, K_{t+i}) - (\frac{w}{p})_{t+i} L_{t+i} - (\frac{w}{p})_{t+i} \frac{b}{2} (\, L_{t+i} - L_{t+i-1})^2]$$

where V_t is the present value of the sum of current revenue and the stream of all future revenues, p is the price of output, w is the level of wages, r is the nominal interest rate, and $b>0$ is the quadratic adjustment costs parameter .

As in the preceding section we assume that supply and demand are in equilibrium at each point in time so that the same kind of monopoly price equation holds (see sect.2.1. eq.7).

Maximizing V_t with respect to L_t yields the following first order condition:

$$(2) \qquad f_L(L_t, K_t) - (\frac{w}{p})_t - (\frac{w}{p})_t \, b \, (L_t - L_{t-1}) + \frac{p_{t+1}}{p_t} \frac{1}{1+r_t} \frac{w_{t+1}}{p_{t+1}} b \, (\, L_{t+1} - L_t) = 0$$

Define:

$$\frac{p_{t+1}}{p_t} \frac{1}{1+r_t} = \frac{1}{1+R}$$

where R is the real interest rate and assume it to be constant and greater than zero.

We may define the equilibrium level of employment as that value corresponding to zero adjustment costs and linearize the f.o.c. (2) around it.

For this purpose, let's impose some structure on the production function (a Cobb Douglas function, for example) :

$$(3) \qquad f(L_t, K_t) = A\, L_t^a K_t^c$$

where A is a constant, a and c are the output elasticities of labour and capital respectively.

Let's define L^* as the employment level which would rule in the absence of adjustment costs. Substituting (3) and setting b=0 in (1) we derive the following first order condition:

$$(4) \qquad a\, A\, L_t^{*\,a-1}\, K_t^{c} = \left(\frac{w}{p}\right)_t$$

and rearranging:

$$(5) \qquad L_t^* = \left[\frac{1}{aA} \left(\frac{w}{p}\right)_t K_t^{-c} \right]^{(a-1)^{-1}}$$

If we linearize f_L around L^* we obtain:

$$(6) \qquad f_L(\cdot) = \left(\frac{w}{p}\right)_t + \left[\left(\frac{w}{p}\right)_t (a-1) \frac{1}{L_t^*} \right] (L_t - L_t^*)$$

Substituting (6) in the f.o.c. (2) we get:

$$(7) \qquad \left(\frac{w}{p}\right)_t \frac{a-1}{L_t^*} \left(L_t - L_t^* \right) - \left(\frac{w}{p}\right)_t b \left(L_t - L_{t-1}\right)$$

$$+ \frac{1}{1+R} \left(\frac{w}{p}\right)_{t+1} b \left(L_{t+1} - L_t\right) = 0$$

and dividing by w/p :

$$(8) \qquad \frac{a-1}{L_t^*} \left(L_t - L_t^* \right) - b \left(L_t - L_{t-1}\right)$$

$$+ \frac{1}{1+R} \frac{(w/p)_{t+1}}{(w/p)_t} b \left(L_{t+1} - L_t\right) = 0$$

where:

$$\frac{a-1}{L_t^*} = \theta < 0$$

since $0<a<1$. Since we want to derive a linear difference equation with constant coefficients, we assume:

$$\frac{(w/p)_{t+1}}{(w/p)_t} = g+1$$

constant and rewrite (8) as:

$$(8') \qquad \theta \left(L_t - L_{t-1}\right) + \frac{1+g}{1+R} b \left(L_{t+1} - L_t\right) = 0$$

Set $\frac{1+g}{1+R} = h$ constant and assume $0<h<1$

We can now derive the second order linear difference equation whose solution yields the optimal demand for labour of the firm:

(9) $$h\,b\,L_{t+1} - [(1+h)b - \theta\,]\,L_t + b\,L_{t-1} = \theta L_t^*$$

where L^*_t is given by (5). We shall now proceed to discuss the solution to (9).

2.2.2 The solution.

Sargent (1979, ch.9) has shown the solution to problem (1) for the finite horizon case of i=0,...,T. He derives the system of Euler's Equations for i=0,...T-1 and the terminal condition for i = T. To solve the second order difference equation (9) we need two boundary conditions. One of them is given by the historically given L_{t-1}. The other one is a necessary condition for the optimality of the solution: the so-called "transversality condition". The solution yields a stable and an unstable root (one inside and one outside the unit circle), and in order to satisfy the transversality condition we have to set the coefficient on the unstable root equal to zero.

The solution is then :

(10) $$L_t = \mu L_{t-1} + (1-\mu)\,(1-h\mu) \sum_{i=0}^{\infty} (h\mu)^i\, L^*_{t+i}$$

where μ is the stable root, function of h, a, θ and b.

According to (10) employment is a function of its lagged value, the real interest rate (through h), the coefficient of adjustment to costs of hiring and firing (through μ which is influenced by b), the technology parameter (via θ which determines μ) and a geometric distributed lag of the current and all the future values of the equilibrium level of employment (L^*).

2.2.3. The specification of expectations.

We now introduce uncertainty about the future values of L^* and rewrite (10) as :

$$(10') \qquad L_t = \mu L_{t-1} + (1-\mu)\ (1-h\mu) \sum_{i=0}^{\infty} (h\mu)^i\ E_t L^*_{t+i}$$

We therefore have to specify the mechanism of expectation formation.

A partial adjustment mechanism follows from the assumption of static expectations, that is L^*_t constant over time, and of quadratic adjustment costs. That is, in our case :

$$(11) \qquad L_t = \mu L_{t-1} + (1-\mu)\ (1-h\mu)\ L^*_t\ \left(\frac{1}{1-h\mu}\right)$$

which yields:

$$(12) \qquad L_t - L_{t-1} = (1-\mu)\ (L^*_t - L_{t-1})$$

where L^* is given by (5).

We assume, instead, that firms have rational expectations about the future values of equilibrium employment L^* and, by consequence, about its exogenous determinants (in this example real wages and capital). Suppose that:

(13) $L_t^* = \beta' \underline{\bar{x}}_t + \underline{u}_t$

where $\underline{x}_t$ is the column vector of the exogenous variables determining L_t^*. Assume the stochastic process generating these variables to be a $(n+1)^{th}$-vector first-order Markov process of the form:

(14) $\underline{x}_{t+1} = \underline{c}_o + \underline{c}_1 \underline{x}_t + \underline{c}_2 \underline{x}_{t-1} + \cdots + \underline{c}_{n+1} \underline{x}_{t-n} + \underline{v}_t$

which we write for convenience in matrix notation:

(15) $$\begin{bmatrix} \underline{x}_{t+1} \\ . \\ . \\ . \\ \underline{x}_{t-n+1} \\ 1 \end{bmatrix} = \begin{bmatrix} \underline{c}_1 & \underline{c}_2 & & & \underline{c}_{n+1} & \underline{c}_0 \\ I & 0 & . & . & 0 & 0 \\ 0 & I & . & . & 0 & 0 \\ . & . & . & . & . & . \\ 0 & 0 & I & . & . & 0 \\ 0 & 0 & 0 & 0 & 0 & I \end{bmatrix} \begin{bmatrix} \underline{x}_t \\ . \\ . \\ . \\ \underline{x}_{t-n} \\ 1 \end{bmatrix} + \begin{bmatrix} \underline{v}_t \\ 0 \\ . \\ . \\ . \\ 0 \end{bmatrix}$$

where $\underline{c}_1, \ldots, \underline{c}_{n+1}$ are matrices and $\underline{c}_o$ is the column vector of constants.

Or, more concisely:

(16) $\underline{X}_{t+1} = \underline{A}\, \underline{X}_t + \underline{V}_t$

and we assume that the eigenvalues of $\underline{A}$ lie inside the unit circle. Assume, moreover, that :

(17) $E(\underline{V}_t) = 0$

then:

(18) $\quad {}_t\underline{X}_{t+1} = [\, E_t(\underline{X}_{t+1}) \,/\, \Omega_t] = \underline{A}\,\underline{X}_t$

where Ω_t is the information set containing current and lagged variables.

More generally, (18) can be rewritten as:

(18') $\quad {}_t\underline{X}_{t+s} = \underline{A}^s\,\underline{X}_t$ with $s>0$

If we specify a matrix $\underline{e}_1=[I,O]$ where the dimension of I is that of the length of the $\underline{x}$ vector we can pick out:

(19) $\quad E_t\,\underline{x}_{t+s} = \underline{e}_1\,\underline{A}^s\,\underline{X}_t$

and from (13) derive:

(20) $\quad E_t L^*_{t+s} = \underline{\beta}'\; E_t\underline{x}_{t+s} + E_t\,\underline{u}_{t+s}$

Substituting (20) in (10') we obtain:

(21) $$L_t = \mu L_{t-1} + (1-\mu)\,(1-h\,\mu)\sum_{i=0}^{\infty}(h\,\mu)^i\,[\underline{\beta}'\quad \underline{e}_1\,\underline{A}^i\,\underline{X}_t + E_t\,\underline{u}_{t+i}]$$

which can be semplified to:

(22) $$L_t = \mu L_{t-1} + (1-\mu)\,(1-h\mu)\,[\underline{\beta}'\;\underline{e}_1\,(I - h\,\mu\,\underline{A})^{-1}\underline{X}_t + \sum_{i=0}^{\infty}(h\,\mu)^i\,E_t\underline{u}_{t+i}]$$

Equation (22) is an expression which is specified in terms of the observable values of the variables determining the equilibrium level of employment.

In our model, production is a function also of raw materials and of the good produced in the other sector. That means that L^* is also a function of current and expected values of p^m/p_1 and p_2/p_1 (we assume that they are used optimally). Since p_1 is a monopolistic price, L^* is also dependent on real expenditure (and competitiveness if we are dealing with firm 1) if the price elasticity of demand is variable (see sect. 2.1).

We assume rational expectations and, using the technique developed above, substitute out the expected values of the exogenous determinants of L^*, so that their lagged values appears as explanatory variables in our equation (see (15) and (22)). Note that the error term can only be specified if we assume a specific generation process for $\underline{u}_t$. We shall leave this problem to the empirical analysis.

2.3. Introducing dynamics: adjustment costs in the capital stock.

So far, we have concentrated on the firm's demand for labour assuming the capital stock to be fixed and optimal utilization of the other inputs of production.

We now proceed to relax the hypothesis of the fixity of the capital stock, and turn to another fundamental issue in the analysis of firm's behaviour, that is the theory of investment decisions.

One way of laying sound microfoundations to the investment function is that of assuming the existence of adjustment costs in the capital stock. This approach has been developed by Eisner and Strotz (1963), Lucas (1967a), Gould (1968), Treadaway (1969) and, more recently, by Yoshikawa (1980), Abel (1980) and Hayashy (1982) who linked it with the work by Tobin (1969).

In order to make the accumulation decisions dependent on the existing capital stock, they assume that there are costs associated with adjusting the capital stock that increase exponentially with the absolute size of investment.

Basically, there are two ways of introducing adjustment costs: one is to assume that they enter as arguments in the production function (Lucas 1967a) and the other is to assume that they are subtracted separately to the revenue function in the present value maximisation problem of the firm.

In the former approach, which is usually referred to as <u>non-separable</u> or <u>internal adjustment costs</u> case, it is assumed that investment, requiring the same inputs needed to produce the final good in order to be put in operation, draws resources away from the productive sections of the firm thus causing current output to decrease. If the firm has decreasing returns to scale in labour and capital, progressively larger amounts of investment will cause increasing reductions in output. Under these hypothesis, the production function may be rewritten as :

(1) $Y = f(I,K,L)$

where $f_I<0$, f_K, $f_L>0$ and $f_{KK},f_{LL},f_{II}<0$.

It is evident from (1), that these adjustment costs are interrelated with the production process, since the marginal products of L and K depend on I and viceversa.

In the latter case, of <u>external</u> or <u>separable adjustment costs</u>, these costs are simply added to the firm's other costs.

We shall see in what follows how different assumptions on the adjustment costs lead to different specifications of the investment function.

2.3.1. Separable adjustment costs.

In this case the firm maximizes the following present value function :

(2.1) $V_t = \sum_{i=0}^{\infty} \sum_{j=0}^{i} (1+r_{t+j})^{-1} p_{t+i} [\ f(L_{t+i},K_{t+i}) -$

$$(\frac{w}{p})_{t+i}L_{t+i} - (\frac{p_I}{p})_{t+i}I_{t+i} - (\frac{p_I}{p})_{t+i} \ C \ (\ I_{t+i})]$$

subject to the capital accumulation constraint:

$$(2.2) \qquad [\ K_{t+i} - I_{t+i} - (1-d)K_{t+i-1}] = 0 \quad \text{for } i= 1,\dots,\infty$$

where p_I/p is the relative price of the investment good , $C(.)$ is the adjustment costs function, with $C(0)=0$, $C'(I)>0$, $C''(I)>0$, and d is the rate of depretiation of capital assumed to be constant. The first order conditions are:

$$(3) \qquad f_L(K_t,L_t)= (w/p)_t$$

$$(4) \qquad p_{It}C'(I)_t + p_{It} = \lambda_t$$

$$(5) \qquad p_t f_K(K_t,L_t) + \lambda_{t+1}\ (1-d)/(1+r_t) = \lambda_t$$

By forward substitution (5) can be rewritten as:

$$(5') \qquad \lambda_t = \sum_{i=0}^{\infty} \sum_{j=0}^{i} (1+r_{t+j})^{-1} \ (1-d)^i \ p_{t+i}f_K \ .$$

since $[(1-d)/(1+r_t)]<1$.

Equation (3) is the equality condition between the marginal productivity of labour and the real unit cost of labour. (4) and (5') say that the firm will invest up to the point where the marginal cost of new investment equals the marginal increase in the value of the firm originating from that new investment (λ_t). We can therefore define the ratio of the marginal increase in the value of the firm due to a unit of new investment and the replacement cost of that unit of new investment as Tobin's marginal q, namely:

$$(6) \qquad q_t = \lambda_t / p_{It}.$$

The investment function can therefore be derived from (4) (see e.g. Hayashy 1982) as:

$$(7) \qquad I_t = C_{It}^{-1}(q-1)$$

which clearly states that when q achieves its steady-state value (q=1), gross investment equals zero.

2.3.2. Non-separable adjustment costs.

With non-separable adjustment costs the maximization problem is:

$$(8.1) \qquad V_t = \sum_{i=0}^{\infty} \sum_{j=0}^{i} (1+r_{t+j})^{-1} p_{t+i} [f(L_{t+i}, K_{t+i}, I_{t+i}) - (\frac{w}{p})_{t+i} L_{t+i} - (\frac{p_I}{p})_{t+i} I_{t+i}]$$

subject to the capital accumulation constraint:

$$(8.2) \qquad [K_{t+i} - I_{t+i} - (1-d)K_{t+i-1}] = 0 \quad \text{for } i = 1, \ldots, \infty$$

where f_L, $f_K>0$, $f_I<0$; $f_{LL}, f_{KK}, f_{II}<0$. The first order conditions are:

$$(9) \qquad f_L(L_t, K_t, I_t) = (\frac{w}{p})_t$$

$$(10) \qquad p_t f_I(L_t, K_t, I_t) \quad - p_{It} + \lambda_t = 0$$

$$(11) \qquad \lambda_t = \sum_{i=0}^{\infty} \sum_{j=0}^{i} (1+r_{t+j})^{-1} (1-d)^i \; p_{t+i} f_K$$

In this case the current levels of investment and labour are jointly determined [5]. Moreover, the marginal cost of one unit of investment is equal to its price plus the corresponding loss in output.

If we assume constant returns to scale [6] and substitute L/K in (10) so that :

$$(12) \qquad p_t g_I [\frac{L}{K}((\frac{I}{K})_t, (\frac{w}{p})_t), (\frac{I}{K})_t] - p_{It} + \lambda_t = 0$$

we get the following specification for the investment function:

$$(13) \qquad (\frac{I}{K})_t = f[(\frac{p}{p}I)_t, (\frac{w}{p})_t \; , q_t]$$

where investment is not only a function of current q, but also of current real prices for all inputs.

In our investment equation we shall substitute to q its function as given by (5') and (6).

2.4. Expectation formation

We now turn to the relation between the preceding model of investment and the accelerator approach to investment theory.

Introducing adjustment costs in the accelerator model we get that investment decisions are taken according to the following relation:

$$(1) \qquad I_t = (\bar{K}_t - K_{t-1}) - d\, K_{t-1}$$

where $\bar{K}_t$ is a convex combination of the desired capital stock K^*_t and the existing K_{t-1}:

$$(2) \qquad \bar{K}_t = K^*_t + (1-\gamma)\, K_{t-1},$$

where $0<\gamma<1$ and $\gamma=1$ in the case of no adjustment costs. (1) and (2) yield the so called "flexible accelerator" model of investment where:

$$(3) \qquad I_t = \gamma(K^*_t - K_{t-1}) + d\, K_{t-1}.$$

Nickell (1978, ch.11) has shown that the multiperiod maximization of a revenue function with separable quadratic adjustment costs can be reduced to the expression:

$$(4) \qquad \bar{I}_t = \gamma \{ K^*_t + (\gamma + r)/(1+r) \sum_{i=t+1}^{\infty} [(1-\gamma)/(1+r)]^{i-t} [K^*_i - K^*_t] - K_{t-1} \} + d\, K_{t-1}$$

where K^*_t and K^*_i depend on the expectation of all future values of the real prices of the inputs.

Equation (4) states that:

> " ...the firm aims at the desired capital stock for the next period plus an exponential weighted sum of the differences between the desired capital stocks for all future periods."(Nickell 1978, p.259)

It is now clear that if real prices are assumed to be constant over time, those differences are equal to zero and we have the flexible accelerator model. Lucas (1967b) has shown how the same model can be derived assuming static expectations and internal adjustment costs. If we assume non-static expectations we can derive an equation like (4) above in all the future expected values of the desired capital stock K^*_i for $i = t+1, \ldots, \infty$ which, in turn, depends on the expected future values of all the exogenous variables, that is:

$$_t E\,(w/p)_i, \quad _t E\,(p^m/p)_i, \quad _t E\,(p_I/p)_i, \quad _t E\,(\, r_i\,)$$

for $i = t+1, \ldots, \infty$.

Assuming rational expectations and a first order Markovian generation process (see section 2.2.2.) for the exogenous variables, substituting and linearizing testable investment equation can be derived:

$$(5) \qquad I_t = b_0 + b_1 K_{t-1} + \sum_{i=o}^{*} a_{1i} (w/p)_{t-i} + \sum_{i=o}^{*} a_{2i} (p^m/p)_{t-i} + \sum_{i=o}^{*} a_{3i} r_{t-i} + \sum_{i=o}^{*} a_{4i} (p_I/p)_{t-i}.$$

In the empirical part we shall stick to the standard assumption of external adjustment costs for labour. As far as capital is concerned, we test the alternative hypotheses of external or internal adjustment costs in both sectors. As we have already seen, this will make a difference in labour demand, since investment will appear as one of its explanatory variables when adjustment costs for capital are non-separable [7].

Footnotes

1 In order to justify the fact that we are not deriving the demand equation for the other variable inputs, we assume optimal use of M_1 and N_1 . This device, which is used in empirical work to avoid the econometric estimation of the demand for those inputs, has its formal justification in duality theory. As M. Bruno 1978 p.3) puts it:

> " Discussion of duality in production theory and in the analysis of costs and profit functions usually centers around 'completely' dual structures. In other words, the relationships are analysed between the underlying production structure and its dual, where all quantities of commodities are replaced by their prices and viceversa. However, the same theory can also be extended and applied to 'mixed' systems in which a partial set of "primal" variables is replaced by their dual."

The production function (1) can be rewritten as:

$Y_1 = f(L_1, K_1, p^m/p_1, p_2/p_1)$

where p^m/p_1 and p_2/p_1 are the relative price of imported raw materials and of final goods respectively. This assumption justifies and does not change our following results.

2 L^d can be expressed as a function of real prices. In fact, since C(...) is homogeneous of degree one, in prices dC/dY will be the same and we get:

(7') $1-(1/e)= C_Y(w/p, p^m/p, p_2/p, Y, K)$

(8) is homogeneous of degree zero and therefore:

(8') $L^d = \frac{dC}{dw}(w/p, p^m/p, p_2/p, Y, K)$.

So, (7') and (8') yield (11).

3 In fact, if the production function exibits constant returns to scale the cost function may be written as :

$C^* = KC(w, p^m, p_2, Y/K)$

and:

$L^d = \frac{dC^*}{dw} = K\frac{dC}{dw}$

from which we derive our result.

4 See e.g. P. Sylos Labini (1967) and K. Coutts et al.(1978). It is to be noted, however, that in this literature marginal costs are usually assumed to be constant. We assume, instead, increasing marginal costs.

5 Assuming for example:

$f_L = f_L(L,K,I) = aAL^{a-1}K^c g(I)$

with $0<a<1$, $0<c<1$, $g'(I)<0$, $g''(I)<0$, we get:

$$\frac{dL}{dI} = -[aAL^{a-1}K^c g'(I)]/[(a-1)aAL^{a-1}K^c]<0$$

6 With c.r.t.s. the production function is:

$Y=f(L,K,I)=Kg(\frac{L}{K},\frac{I}{K})$.

Its derivatives w.r.t. L and I are:

$f_L = g_{L/K}(L/K,I/K)$; $f_I = g_{I/K}(L/K.I/K)$.

The derivative w.r.t. K is:

$f_K = g(L/K,I/K) - \frac{L}{K} g_{L/K}(\cdot) - \frac{I}{K} g_{I/K}$.

which is obviously a function of L/K, and I/K.

7 Brechling (1975) and Meese (1980) have developped the formal solution to the model with adjustment costs in both inputs of labour and capital. The technique is analogue to Sargent's (1978).

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CHAPTER 3. THE DETERMINATION OF WAGES

Introduction

The aim of this chapter is to review the present state of the theory of the determination of wages and derive our specification of wage formation.

We start with the competitive models of the labour market and present the Lucas microfoundations of the Phillips curve (sect.4.1).

We then discuss some recent competitive market theories of the labour market based on the "efficiency wage" hypothesis (sect.4.2).

Next, we build a simple competitive model of the labour market in order to compare its predictions with those of the non-competitive model we use for the specification of our wage equation (sect. 4.3).

We proceed with the discussion of labour market models with unions and present different theories pertaining to this approach (sect. 4.4).

Finally, we derive the specification of wage formation for our two-sector model (sect.4.5).

3.1. The Phillips curve and its microeconomic foundations

The Phillips curve is, we believe, one of the most popular examples in Economics of how an empirical finding, such as the negative correlation between inflation and unemployment, can rapidly gain a great success and be included in macroeconometric models without having a well developed theory to support it.

With the increasing instability of the empirical trade-off between inflation and unemployment [1], a decade after its "discovery" in the late 50's (Phillips 1958, Lipsey 1960), a substantial effort in the direction of the construction of its theoretical foundations was made. The coexistence of an accelerating rate of inflation and a non-decreasing rate of unemployment was becoming a lasting feature in the economic scene which stimulated the reformulation of the Phillips relation. The idea was to take into account workers' concern about real wages by means of the introduction of inflationary expectations and explain why the Phillips curve could shift over time, thus determining an equilibrium rate of unemployment , the 'natural rate', which was consistent with an infinity of inflation rates.

The success of the 1958 Phillips curve had offuscated the notion of the labour market, especially because of the standard practice in macroeconometric models of relegating the determination of wages to a wage-price block. The late 60's, however, marked a revival of interest in the labour market and the joint determination of employment and wages, in conjunction with the development of the microeconomic foundations of the Phillips curve (Phelps 1967,1970).

In the '70s and 80's the literature on the microeconomic foundation of the Phillips curve reaffirmed, even more strongly, the labour market concept.

Basically, we may identify two categories :

1) the competitive models, where employment and wages are determined by the free market forces;

2) the non-competitive models where the level of wages may be set either unilaterally by unions ('monopoly wage' models), or by means of a bargaining process over wages and employment between firms and unions (efficient bargaining models).

3.1.1. Competitive models of the labour market: Lucas' model of the Phillips curve.

A significant example of the former category of models is Lucas' Phillips curve.

Lucas' justification for the Phillips curve is derived from the interconnection of the concepts of the worker's intertemporal substitution between leisure and consumption (Lucas and Rapping 1969) and misperception of aggregate shocks (Lucas 1973, 1975).

In Lucas-Rapping model the following worker's labour supply function (in logs) is derived from utility maximization [2]:

$$L^s_t = a_o + a_1(w-p)_t - a_2(w^e_{t+1} - p_t - r_t) - a_3(p^e_{t+1} - p_t - r_t)$$

where w is the nominal wage, p is the price level, r the nominal interest rate and a_2, a_3 measure the intertemporal substitution effects between working more now (in the future) and consuming more in the future (now).

This relation gives a 'micro' motivation for the Phillips curve: an unexpected increase in w_t and p_t, say, given r_t rises L^s_t (since w^e_{t+1} and p^e_{t+1} are given) by $a_2 + a_3 > 0$. Intuitively, this means that an unexpected increase in current inflation following an expansionary manoeuvre decreases unemployment under its "natural rate" because the worker supplies more labour. If this relation could be embedded in a general equilibrium model with imperfect information, we would have a theoretical confirmation of Friedman's message that the Phillips trade-off holds only after unanticipated aggregate shocks (which may be the result of economic policy decisions) because of temporary money illusion effects which prevent the workers from realizing that their real wage has actually changed.

Bull and Frydman (1983) have shown that this unification of intertemporal substitution and misperception in a general equilibrium model is indeed possible. They derive Lucas' Phillips curve by integrating this micro-model of labour supply in Lucas' "island parable" according to which the economic agents can observe the local conditions of production but can only predict the current values of aggregate variables. That means that the labour demand in each micro-market is known with certainty, since it depends on the observable product wage. The labour supply is instead subject to uncertainty because the workers base their labour supply decisions on the consumption wage, which is a random variable since it involves the prediction of the aggregate consumption price (the workers are assumed to consume also other goods which are not produced on their 'island').

Hence, integrating the Lucas-Rapping model in Lucas' rational expectations-general equilibrium model with individuals' misperception of aggregate shock and market-clearing in both the labour and the product markets, we obtain Lucas' aggregate supply curve, whereby changes in output are a consequence of expectational errors following an unexpected shock in aggregate demand. The expectations-augmented Phillips relation is naturally derived inverting this supply function.

This approach is theoretically perfect in that it supplies a complete microfoundation to the Phillips curve from the qualitative point of view. It suffers, however, from the heavy drawback that it is not confirmed by evidence. In other words, the concept of the worker who decides how much labour to supply today on the basis of his wage and price expectations for tomorrow and on the level of the rate of interest is not confirmed by the data (Altonji 1982, Ashenfelter and Card 1982, Andrews and Nickell 1982)[3].

This criticism goes pari passu with the observation that in this model, the labour demand is fixed and it is the labour supply which has the task of reequilibrating the labour market after an unexpected policy shock, because the introduction of uncertainty about the level of consumption wages makes it shift along the demand curve. This mechanism rules out the existence of involuntary unemployment which, instead, has always been, in our view, one of the most challenging and real problems economic theory is confronted with.

3.2. Alternative theories of the competitive labour market: the "efficiency wage" hypothesis.

Since one of the main qualities of an economic theory is to fit the stylized facts, it seems quite extraordinary that a lot of energies have been devoted to convince the economic profession that unemployment is essentially voluntary. One might think that the main reason of the failure of this sort of studies to explain involuntary unemployment is that they are founded on the assumption that the labour market is essentially competitive. In fact, even if imperfect information is introduced in that framework, such as in Lucas' or in certain implicit contract theories [4], it is hard to believe that a worker is involuntarily unemployed because if he "knew" more about the conditions of production he would not choose to remain idle.

There is a field of research, however, that retaininig the competitive market assumption has made some progress towards an explanation of involuntary unemployment. These theories are founded on the "efficiency wage" hypothesis.

We shall discuss them briefly before turning to the non-competitive theories and to the discussion of the reasons why we believe that they offer a more convincing explanation of the stylized facts which have characterized the Western labour markets in the last fifteen years.

The hypothesis of the "efficiency wage" is concerned with the explanation of why firms find it unprofitable to cut wages in the presence of involuntary unemployment [5].

The central hypothesis is that the single worker's productivity is closely related to the wage he earns in such a way that the firm may choose to retain a wage that is above the market clearing level, on the grounds that, by lowering it, it would reduce the average productivity of its workers and, by consequence, raise labour costs. Unemployment is involuntary because the unemployed worker keeps offering his labour, trying without any success to underbid his employed rivals.

The equilibrium wage lies on the profit maximizing labour demand curve, but persistently above the labour supply.

Basically, we identify three groups of models:

1) the quitting models. Because quitting imposes costs on firms, employers have an incentive to discourage it by rising wages.[6]

2) The shirking model. It is based on the hypothesis of imperfect information about the workers' "on the job" behaviour:

> In the competitive paradigm, in which all workers receive the market wage and there is no unemployment, the worst that can happen to a worker who shirks on the job is that he is fired. Since he can immediately be rehired (because of full employment) he pays no penalty for this misbehaviour. With imperfect monitoring and full employment the worker will choose to shirk. To induce its workers not to shirk the firm attempts to pay more than the 'going wage'. Then if a worker is caught shirking he will pay a penalty. If it pays one firm to raise its wage, it will pay all firms to raise their wages. When they all raise their wages the incentive not to shirk again

> disappears. But as all firms raise their wages their demand for labour decreases and unemployment results. With unemployment, even if all firms pay the same wage a worker has an incentive not to shirk. For, if he is fired, he won't obtain immediately another job. The unemployment rate must be sufficiently large that it pays workers to work rather than take the risk of being caught shirking." (Shapiro and Stiglitz,1984,p.433)

3) The adverse selection model. It is based on the assumption of imperfect information about the intrinsic productivity of each worker. If workers differ because of the degree of their ability they are likely to have different reservation wages. The firm, in order to screen itself from bad workers, will choose the policy of offering higher than average wages so as to attract more able job candidates (Weiss, 1980).

4) The gift exchange model. It is a sociologically oriented explanation of the occurrence of higher wages based on the concepts of loyalty of the firm towards the group of its most capable and faithful workers in the form of higher pay in exchange of higher quality of labour services (Akerlof,1982).

These models, therefore, are concerned with involuntary unemployment. Although no explicit macromodel exists, the explanation of the rise in unemployment in the 70's one can draw from them is that firms, given their concern for attracting good workers and for keeping their morale high, did not reduce real wages enough to cope with the increase in input prices and the productivity slowdown.

We think that this interpretation is not convincing. The major criticism is that it is seldom observed that firms set wages unilaterally, since in most European countries at least, collective bargaining is the basic determinant of wages (7).

Our main focus, therefore, will be on the non-competitive models of the labour market which make a more substantial effort to explain what we observe in the real world; we devote to them a large part of this chapter and base on them our econometric specification of wage formation . We want, however, to show first a very simple version of a competitive model of the labour market in order to compare its predictions with those derived from the non-competitive models we shall discuss later.

3.3. A competitive model of the labour market

It is convenient to start with a simple model of the labour market where wages and employment are determined by the demand for and the supply of labour. In order to make our comparison with the non-competitive models we shall derive later (sect. 3.5) we just need a very naive specification of the labour supply function and therefore we ignore the intertemporal substitution assumption.

Let's recall our two-sectors hypothesis of section 3.1 and assume that there is perfect competition both in the labour market and the output market. The sectoral demand for labour is derived from the profit maximizing behaviour of the firm as follows [8]:

$$(1) \qquad \max_{L} \; p_i Y_i - cl_i L_i$$

(the subscript i refers to the sector :i=1,2)

subject to:

$$Y_i = f(L_i, K_i)$$

$$cl_i = w_i(1+T_i)$$

where Y is output, L is labour, K is capital stock, p is the product price, cl is the cost of labour per employee inclusive of employers contributions (T) and w is the nominal wage.

The demand for labour is derived from the first order condition

$$p_i f_L(L_i,K_i) = cl_i \tag{2}$$

which yields the standard neo-classical demand for labour:

$$L_i^d = L^d[(\overset{-}{\frac{cl}{p}})_i,\ \overset{+}{K_i}] \tag{3}$$

As for labour supply, we have to stress first that we are not going to explain any participation phenomena. Throughout our analysis, therefore, the labour force will be an exogenous variable and we condition the labour supply of this competitive model on it.

We assume the sectoral labour supply to be a positive function of the consumption wage, defined as the ratio of gross earnings per employee (i.e.inclusive of direct taxation) over an index of the cost of living (p_c). Moreover, the worker, when confronted with the decision of how much labour to supply to a firm in one sector, makes a comparison between what he would earn there and what he would get if he worked for a firm in the other sector or if he stayed unemployed. On this basis, we introduce between the exogenous variables determining the supply of labour the "alternative wage" (w^a) and the unemployment subsidy (b).

The supply of labour equation is therefore:

$$(4) \qquad L_i^s = g[(\overset{+}{\frac{w_i}{p_c}}),\ \overset{-}{w^a},\ \overset{-}{b}\ ]\ L^p$$

where g represents the proportion of the total labour force (L^p) which is supplying its labour to the sector under consideration.

Assuming constant returns to scale in production and taking a log-linear specification we rewrite (3) and (4) as (we omit the subscript i for convenience):

$$(5) \qquad \ln L^d = a_0 - a_1 \ln(\frac{cl}{p}) + \ln K$$

and

$$(6) \qquad \ln L^s = c_0 + c_1 \ln(\frac{w}{p_c}) - c_2 \ln w^a - c_3 \ln b + \ln L^p$$

We can rewrite (6) as:

$$(7)\ \ln L^s = c_0 + c_1 \ln \frac{cl}{p_c(1+T)} - c_2 \ln w^a - c_3 \ln b + c_1 \ln p - c_1 \ln p + \ln L^p$$

Equating (5) and (7) and solving for ln cl/p we get:

$$(8) \qquad \ln(\frac{cl}{p}) = \frac{a_o - c_o}{a_1 + c_1} + \frac{1}{a_1 + c_1}\ \frac{K}{L^p} + \frac{c_1}{a_1 + c_1} \ln \frac{(1+T)p_c}{p}$$

$$+ \frac{c_2}{a_1 + c_1} \ln w^a + \frac{c_3}{a_1 + c_1} \ln b$$

It is worth commenting this relation at some length since some of the explanatory variables of the real cost of labour are crucial in the non-competitive model as well.

Let's start with the 'wedge', namely the $\frac{(1+T)p_c}{p}$ term which basically accounts for two effects on the real cost of labour:

1) the influence of the discrepancy between the deflator used by the workers to calculate their consumption wage and that used by the firm to derive its product wage;

2) the influence of the burden of direct and indirect taxation.

This term also measures the influence on wages of the price of imported final goods. In fact, since the consumer price index is a weighted average of the index of prices of domestic and imported goods, $c_1/(a_1+c_1)$ accounts for the effects of changes in the terms of trade on the consumption wage and, by consequence, for the rise in the workers' pressure over the nominal wage which increases the product wage. In particular, considering explicitly all forms of taxation and defining the consumption wage as:

$$w^c = \left(\frac{w\,(1-T_2)}{p_c}\right) \tag{9}$$

and the consumer price index as:

$$p_c = p^a p_{imp}^b (1+T_3) \tag{10}$$

where T_1 is taxation on employers, T_2 and T_3 are direct and indirect taxation rates respectively, p_{imp} is the price of imported final goods in domestic currency and a, b are the shares in value added of domestic and imported goods respectively, we get that the wedge is :

$$(11) \qquad d = \frac{w_c}{cl/p} = \frac{1-T_2}{(1+T_3)(1+T_1)} \left(\frac{p_{imp}}{p}\right)^{-b}$$

which linearized becomes:

$$(12) \qquad \dot{d} = 1 - T_1 - T_2 - T_3 - b \left(\frac{p_{imp}}{p}\right)$$

The term d measures the total wedge between the consumption and the product wage.

In our two-sector economy with a domestic tradable good and a domestic non-tradable good, in order to get the total wedge of one sector we have to add to (12) the relative price of the other domestic good multiplied by its relative share in value added.

The terms w^a and b exert a positive pressure on the cost of labour given the way they enter our labour supply function.

The ratio of the capital stock to the labour supply has a crucial role in accounting for the influence of the secular rise in the productivity of labour. The sign of its coefficient is positive, since a higher productivity of labour due to an increase in the capital stock will induce an upward shift in the demand for labour and, therefore, an increase in the real wage.

Now that we have the labour demand and the wage equations, we can derive the predictions of this model about unemployment.

Let's define the unemployment rate as [9]:

$$u \cong \ln L^P - \ln L = \ln L^P + \ln(L_1 + L_2) \qquad (13)$$

Substituting (3) for i=1,2 and the solution for $(cl/p)_i$ in (13), we get that unemployment is a function of the exogenous variables determining the labour demand and the labour supply in the two sectors.

Moreover, had we assumed imperfect competition in the labour market, aggregate demand would have entered as a determinant of the demand for labour (see sect.3.1). Through this channel aggregate demand shift would have influenced the unemployment rate. The intertemporal substitution hypothesis implies this effect as well, even assuming perfect competition in the output market. The labour supply function of section 3.1.1 is in fact coupled with a competitive labour demand. The policy effects on unemployment come through their infuence on the real rate of interest which is an argument of labour supply.

Finally, it is trivial to add that there is no room in this model for involuntary unemployment. If the market clears, unemployment is simply voluntarily chosen leisure. In this sort of model involuntary unemployment can arise only when the government introduces some rigidities or distortions such as administered minimum wages (Hamermesh 1980, Meyer and Wise 1983), or different types of employment subsidies (Johnson and Layard, 1984).

Since we are mostly concerned with the issues of market determined wage rigidities and involuntary unemployment, it is to those theories that we shall now turn.

3.4. The role of unions: the bargaining theory of the labour market.

The role of unions in the labour market is not a new topic in economic theory. The interest in this issue dates back at least to the mid '40s with the works of Dunlop (1944), Leontief (1946) and Ross (1948).

In these studies unions start to be seen as entities with a well defined set of preferences, the real counterpart of firms.

Since then the subject has been more or less ignored until quite recently. With the increasing difficulty in explaining the economic performance of the Western countries, economists have realized that such important economic subjects as unions could no longer be ignored .

In the late '70s and in the '80s, therefore, we have assisted to the consolidation and refinement of the microeconomic theory of trade unions [10]. This theory turned out, last but not least, to serve as a new microfoundation for the Phillips curve.

A lot of work, however, remains to be done on the empirical side. The econometric literature has just started to emerge and it seems that, until now, there has not been a lot of progress on this ground [11]. We shall come back to this point later on in the chapter.

In its most general terms, the theory of trade union behaviour is concerned with the effects on wages and employment of bargaining between the firm and its unionized members.

The firm is assumed to have a utility function over profits and the union over wages and employment [12]. Depending on the bargaining rule we can consider three cases:

1) the firm sets employment and the union sets the wage (monopoly union model);

2) the firm sets employment and then both the union and the firm bargain over the wage (the'right to manage'model);

3) the firm and the union bargain over both the wage and employment (the 'efficient bargaining'model).

The obvious theoretical tool for the analysis of the interplay between two parties is to be found in game theory. The most popular formal solution to a bargaining problem is Nash's. According to his result , the function to be maximized is the product of the parties gain over the non-bargaining outcome [see appendix A]. The Nash solution is the best suited to derive the equilibrium wage and employment of the three types of bargaining problems we have mentioned above.

We obtain the three models as special cases of a general specification of the Nash solution :

$$(1) \qquad \max\ [V(\pi(w,L)) - V(\bar{\pi})]^{b}[U\ (w,L) - \bar{U}\ ]$$

where L is employment, w is the real wage, V and U are the utility functions of the firm and the union respectively; are profits

$\bar{\pi}$ and $\bar{U}$ are the fall-back levels of profits and unions utility if no bargaining takes place; b is a parameter. The two differences represent the firm's and union's gain over the non-bargaining outcome.

The maximization of (1) with respect to L and w yields the efficient bargaining solution. Assuming L to be the labour demand function, that is L=L(w), the maximization of (1) with respect to w yields the 'right to manage'model. Assuming $L=L(w)$, $b=0$ and maximizing (1) with respect to w we get the monopoly union outcome.

Let's discuss the three cases in detail.

3.4.1 The efficient bargaining model.

In this model (McDonald and Solow, 1981) the firm and the union bargain over both the wage and the employment levels. The equilibrium value of employment L^* and real wage w^* are found making use of Nash's solution, that is solving the maximization problem (1).

For simplicity, let's assume that:

$$(2) \qquad V(\pi)=\pi= R(L) - w L$$

where R is the revenue function and $R'(L)>0$, $R''(L)<0$;if no bargaining takes place the firm does not employ any worker and has no revenue:

$$(3) \qquad \bar{\pi}= 0 \text{ , } V(0)=0;$$

the workers are all identical and the union's utility is the same as the sum of their individual utilities:

$$U(w, L) = L\,u(w) \text{ and } \bar{U} = L\,\bar{u} \tag{4}$$

where u is the worker's utility function; $\bar{u}$ is the worker's fall-back utility if he does not work for that firm and might be determined by employment benefits and/or by an alternative wage but, for the moment we write:

$$\bar{u} = u(\bar{w}) \tag{5}$$

where $\bar{w}$ represents any alternative wage.

Given these assumptions, the maximization problem (1) can be rewritten as:

$$\max_{L,w}\ [R(L) - wL]\,[u(w) - u(\bar{w})]\,L \tag{6}$$

Maximizing with respect to L yields:

$$R'(L) - 2wL + R(L) = 0 \tag{7}$$

so that the real wage is given by:

$$(8) \qquad w = (1/2)[\ R(L)/L + R'(L)]$$

Hence w is a decreasing function of L because of the form of the revenue function.

Maximizing (6) w. r. t. w yields:

$$(9) \qquad L\ [\ u(w) - u(\bar{w})]/\ u'(w) = -R'(L)L + 2\ w\ L - w\ L$$

substituting $R(L) = -R'(L)L + 2wL$ from (7) in the r.h.s. of (9) we get:

$$(10) \qquad [u(w)-u(\bar{w})]/\ u'(w) = w - R'(L)$$

(10) yields the so called "contract curve" which is upward sloping in the L,w plane.

The intersection of (8) and (10) gives the Nash equilibrium solution L* and w*.

The economic intuition behind this analytical solution is as follows.

The firm is a profit maximizer and it is indifferent between the combination of employment and wages that leave its level of profits constant. That is:

$$(11) \qquad R(L) - w L = \bar{C}$$

There are an infinite number of these isoprofit curves (see fig.1) and the lowest denotes the highest level of profits, since for any given L a lower w means higher profits. The firm's demand for labour curve is the locus of. the maxima of the isoprofit curves [13].

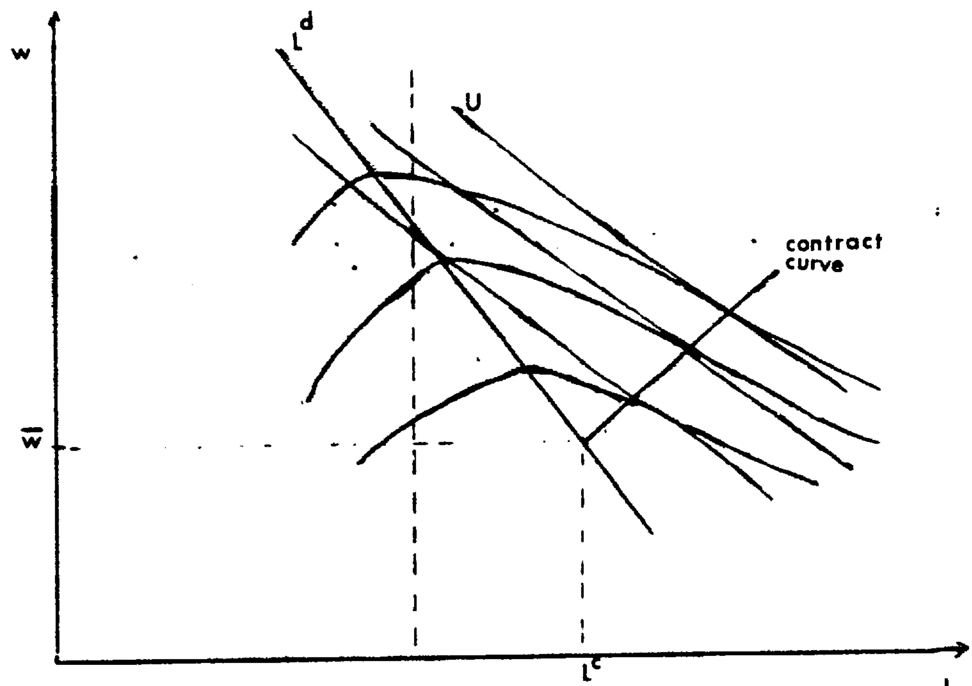


FIG.1

The union has M identical members; L of them are employed by the firm. The expected utility of a union member is:

$$e(u)=(L/M)\ u(w) + [\ (M - L)/M\ ]\ u(\bar{w}) \tag{12}$$

The union is indifferent between different combinations of w,L which leave the total gain in utility from employment constant, i.e.:

$$L\ (\ u(w) - u(\bar{w})\ ) = \bar{g} \tag{13}$$

Graphically, the equilibrium values L* and w* are given by the tangency points of the firm's isoprofit curves and the union's indifference curves. Their locus defines the "contract curve".

Finding the slopes of (11) and (13) in the L,w plane and equating them we get:

$$\frac{u(w) - u(\bar{w})}{u'(w)\ L} = \frac{w - R'(L)}{L} \tag{14}$$

equal to (10) which we derived using the Nash bargaining function.

Another interesting iterpretation of this result is that the worker, whose expected utility is:

(15) $$p\, u(w) + (1-p)\, u(\bar{w})$$

where $p=L/M$ is the probability of being employed by the firm, equates at equilibrium, the marginal utility of one unit more of income multiplied by the probability of being employed with the marginal loss derived from the increased probability of not finding a job given his new request.

In formulae this is:

(16) $$\frac{d(1-p)}{dw}\,(\,u(w) - u\,(\bar{w})\,) = p\,\frac{du(w)}{dw}$$

and:

(17) $$\frac{d(1-p)}{dw} = -\frac{dp}{dw}$$

(16) implies again the Nash solution since substituting $p=L/M$ in it we get:

(18) $$\frac{u(w) - u(\bar{w})}{u'(w)}\,\frac{M}{L} = \frac{dw}{dL}$$

where dw/dL is the slope of the isoprofit curve which then yields the contract curve [14].

If such contracts are enforced in the labour market, the employer will, in all probability, be off his labour demand curve. In fact, the contract curve coincides with the labour demand curve at $\bar{w}$ only, which can be interpreted as the competitive level of the real wage. Otherwise, at any other equilibrium point, the wage is higher than the marginal productivity of labour. The efficiency of the contract lies in the fact that both the firm and the union are better off if they choose an agreement on the contract curve than in any other region of the L,w plane (Pareto optimality is achieved) [15]. Here, as in many models that attempt to explain wage rigidity and involuntary unemployment, it is assumed that a perfect insurance market does not exist. If it existed, workers could go and insure themselves against the fluctuations in their income. Here, instead, workers look for an indirect way to overcome this market imperfection. From this observation Oswald (1985) draws the intuition as to why a Pareto-optimal wage bargain is likely to increase employment rather than reduce it:

> "In an ideal world each union member would like to purchase full insurance - that is , insurance which equates his or her marginal utility of income across all states of nature - against the risk of unemployment. That possibility is assumed away here: an unemployed person receives only government benefit, b. There is a way to achieve insurance indirectly, however, because the union can reduce the risk of any individual being laid off. Hence it sets employment above the level which it would desire if insurance markets were perfect (that is also the competitive level).

> Overemployment is rational; it is the optimal way to reduce risk at the expense of technical efficiency."

The question concerning which point on the contract curve will be chosen is merely a matter of power: higher levels of wages and employment will be the signal of a more powerful union, whereas a more profitable firm is behind lower levels of both these variables. To derive a unique solution we therefore need a rule determining the distribution of revenue between the employer and the workers.

In our Nash solution this sort of "equity locus", as McDonald and Solow (1981) call it, is given by (8), which states that the real wage is equal to the mean of the average and marginal revenue product of labour.

Once the formal structure of the efficient bargaining model is set up, it is possible to see how the equity locus and the contract curve shift with aggregate demand changes. If these changes cause the two loci to shift in an offsetting fashion it is possible to explain the stylized fact of wage rigidity and employment fluctuations over the business cycle.

Let's now turn to the two other bargaining models.

3.4.2. The right to manage model and the monopoly union model.

We consider now the case of the firm setting employment according to the profit maximizing rule:

$$(18) \qquad \max_{L} \quad (w,L)$$

which yields:

$$(20) \qquad L^{*} = L^{*}(w)$$

In the right to manage model the firm sets employment and bargains over wages with the union (Nickell and Andrews, 1983). Although this model has the appealing property of being more realistic than the other two, it yields the same predictions of the monopoly model: the explanatory variables of the wage level and their predicted sign are identical. On this issue there are some problems which have not been settled yet.

For simplicity, we shall concentrate on the monopoly model which will be the basis of our empirical specification.

Using the same simplifications of section 4.4.1, the equilibrium combination of wages and employment is given by the tangency point of the labour demand curve with the union's indifference curve (see fig.2).

The labour demand curve is given by:

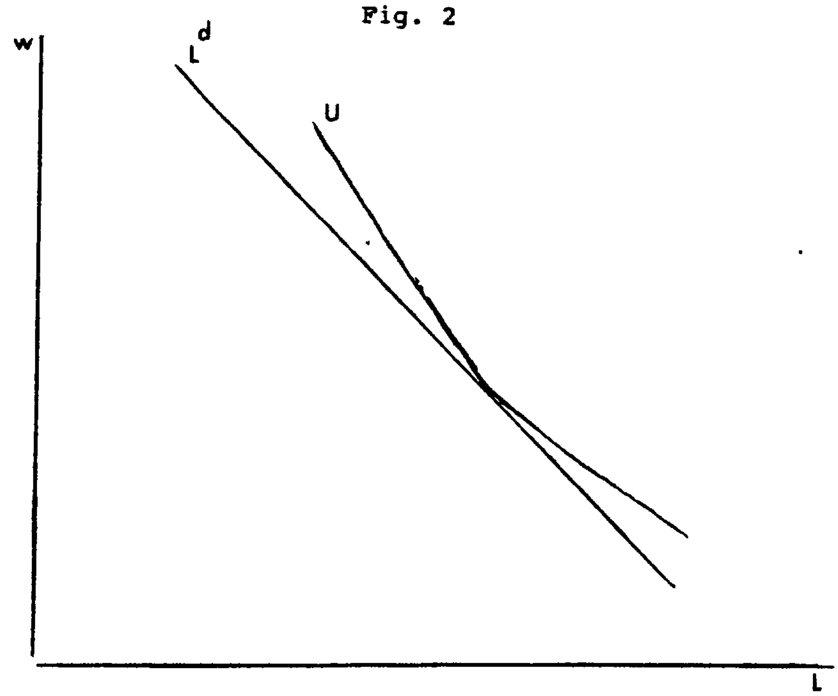
$$R'(L) - w = 0 \tag{21}$$

The solution is therefore:

$$\frac{u(w) - u(\bar{w})}{u'(w)\, w} = \frac{L\, R''(L)}{w} \tag{22}$$

(22) says that the reciprocal of the elasticity of the gain on employment with respect to wages is equal to the wage elasticity of demand for labour taken positively.

Fig. 2



3.4.3. Some critical observations on trade union theories.

It is now time to ask if the above models supply an explanation for the existence of involuntary unemployment and wage rigidity.

The models where the firm sets employment say that the equilibrium wage is on the labour demand curve, but above the competitive level, because of the action of the union which exerts some of its monopoly power. Wage rigidity with respect to demand changes arises only if specific assumptions on the structural form of the labour demand function are made, such that the wage elasticity of demand in (22) is constant.

The efficient bargaining model , as we have seen, predicts overemployment, thus failing to give an answer to one of the two crucial issues. Wage rigidity, as in the monopoly union models, arises only if specific parameters are chosen such that the contract curve and the equity locus shift in an offsetting way after demand shocks.

As far as the bargaining set up of the efficient bargaining model is concerned, the criticism that is usually raised about this model is that it is not clear if, in reality, unions bargain about the level of employment. There are some papers based on survey data which yield contradictory results for Britain [16]. Nickell and Andrews (1983, p.509) say on this point:

> Since the previous model [the monopoly model] does not have this rather appealing property [Pareto efficiency], it is worth considering why firms might wish to impose the negotiating rule that they will only talk about wages when the outcome is such that futher discussion about employment could yield higher profits without impairing the union's welfare. One powerful argument is that, as we have already noted, firms find it desirable to make continuous adjustment to their total level of employment. They would presumably find the idea of continual negotiation on this issue, with possible discussion on wages thrown in, as simply too costly an interference with their managerial function."

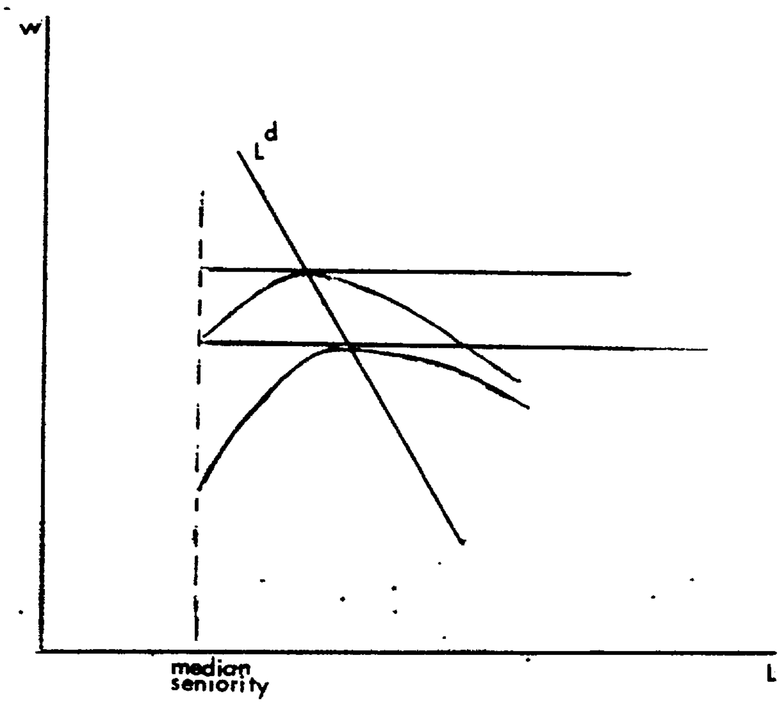
And also (p. 510):

> This model has the strong implication that a rise in union power will raise employment. Since we know of no evidence either in our results or elsewhere, to support this contention, this is an additional reason for not pursuing this particular model any further."

The monopoly union model, on the other hand, has the unrealistic feature that unions set the wage without having to negotiate with firms.

It must be added that there are some special cases in which efficient bargains and monopoly equilibria are identical, that is they lie on the labour demand curve. These special cases arise if the union's indifference curve has some flat segments and it touches the firm's isoprofit curve there. In this case the contract curve and the labour demand curve coincide (fig.3)

Fig. 3



When is the union's indifference curve flat?

One possible explanation might be given using the "seniority " model (Grossmann 1983). This model is based on the assumption that lay-offs follow a "last in first out" rule and that the union takes its decisions according to a majority rule. Hence, if the majority of its members are senior workers in the firm and they are mostly concerned with wage increases, the indifference curve of the union will be flat starting from the median seniority voter.

Once account is taken of the institutional setting of the specific sector or industry under study, the last word about the superiority of one model over the other is left to econometric testing.

Some econometric studies about specific industries or sectors are already available [17]. What seems to be quite a difficult task, is to construct a statistical test that would allow to reject either the efficient bargaining model or the monopoly union model. Ashenfelter and Brown (1985) and Card (1985) use the following method.

Since wage and employment in the efficient bargaining model are jointly determined, all the variables determining wages should influence employment and viceversa. In the monopoly union model, instead, the wage is chosen given the level of employment. If empirically, it turns out that employment is not affected by the variables determining wages, then one might not reject the hypothesis of a monopoly union framework.

These are only preliminary results, however, and a lot of work is required before we can confidently rely on them.

After this rapid survey of trade union theories of wage determination and related criticisms, we turn to the details of our specification.

3.5. Our specification of wage formation.

We have considered so far some micro-theories of trade union behaviour. We shall proceed now to derive the specific wage equations we are going to estimate in the empirical part.

We have chosen the monopoly union framework mainly for one institutional and one theoretical reason.

The former is that the Italian labour market in the period 1970:1 1984:4 which we want to study is characterized by a mixture of sector-wide and firm-level bargaining. It is in a median position, with France, Great Britain and West Germany, between the highly centralized collective bargaining of the Scandinavian countries and the decentralized bargaining coupled with large non-union sectors of the U.S., Canada and Japan. Moreover, in the period studied and particularly during the '70s, unions have considerably increased their contractual power and deeply affected the performance of the Italian economy [18].

The latter is that the monopoly union model is the only one, among those we have considered, that explains involuntary unemployment, given that we exclude the efficiency wage models on the grounds that the assumption of firm wage-setting does not fit the Italian case in the period studied (see, however, ch.1 where we mention the rising weight of wage drift in the determination of labour costs).

We assume that the economy consists of two sectors. Each sector has its own union which has the task to set the level of the real wage. Profit maximizing firms set the employment level in such a way that their labour demand is :

$$(1) \qquad L^d = L \left(w(1+t)/p,\ p^m/p,\ K,\ e_{qp} \right)$$

where L is the number of workers, w is the nominal wage level, t is the taxation rate on employers, p^m is the index of prices of imported raw materials, K is the capital stock, e_{qp} is the price elasticity of demand for output.

The monopolistic role of the union may be interpreted in the Italian institutional framework as follows.

Any worker willing to be employed may choose to register with his local employment agency (a public institution) which puts him in a waiting list for the requested sector of the economy. Every worker registered with the agency will be guaranteed all the advantages (national collective labour contracts, training schemes, etc.) achieved with collective bargaining.

Since in Italy registration with the union itself is not compulsory [19], we can't use 'membership' to represent the number of workers the union actually cares about. We assume, instead, that the union is concerned with the welfare of the workers employed in its sector, L, and of the workers registered with the employment agency for that sector, whose number we denote by $M-L>0$

All workers in each sector are assumed to be identical and to have a concave utility function. The argument of the utility function of the worker if he is employed in the sector considered is the difference between the consumption wage and a baseline real wage $\bar{w}$ which captures the fact that the subsistence real wage has risen steadily over time with the secular increase in productivity. That is:

$$(2) \qquad u = u\ (w/p_c - \bar{w})$$

where p_c is the consumer price index. In this way, the worker is assumed to base his requests on a relative magnitude, since he is able to observe the secular characteristics of the increase in wages.

Each of the M-L workers who are not employed in this sector may find a job in the other sector or stay unemployed. We denote their fall-back utility, which we are going to explain shortly, by $\bar{u}$

The union seeks to maximize the welfare of the M workers in its sector in the form of the following expected utility fuction:

$$(3) \qquad U = L\ u\ (w/p_c - \bar{w}\ ) \ + (M - L)\ \bar{u}$$

We choose this utility function to skip the problem of considering M as depending either on the union's behaviour or being merely exogenous. Maximizing (3) with respect to w/p_c in fact, does not involve M. It would make no difference to have (3) or an expected utility objective function as we had in sect. 3.4.2 if we assumed M to be exogenous [20].

3.5.1. The outside opportunity of the worker.

The $\bar{u}$ term represents the worker's opportunities outside the sector. Intuitively, these will depend on the state of the labour market, whose best indicator is the unemployment rate. In fact, the higher the unemployment rate, the lower the probability of a worker who is not employed in one sector, to find a job in the other one, and, by consequence, the lower the pressure of the union on the real wage of the sector considered. Moreover, a considerably higher wage in the other sector will exert a positive pressure on the consumption wage.

We rewrite the union's utility function to take into account these facts:

$$(4) \qquad U = L\ u(\ w/p_c - \bar{w}\ ) + (M-N)\ [(UR\ v(b) + (1-UR)\ v(w^a)) - \bar{w}\ ]$$

where v is a utility function, UR is the unemployment rate, w^a is the alternative wage, b is the unemployment benefit and:

$$\bar{u} = [(UR\ v(b) + (1-UR)\ v(w^a)) - \bar{w}].$$

The introduction of the w^a term in the union's utility function measures what has been called a "direct jealousy effect" by someone (Oswald 1979) or a "solidarity policy" wage effect by some others (Edgren, Faxen and Odhner 1973)[21]. It measures the interrelation of wages in different unionized sectors due to unions following each other's wage increases.

A formal justification of the introduction of the outside opportunities in the union's utility function can also be found in bargaining theory. In many of the models we have just considered we may invoke the "outside option principle" which says that the determinants of the outside option available to the partner who decides to quit bargaining influence the bargaining outcome (Sutton, 1985).

In this light we can interpret $\bar{u}$ as the union's threat point and state that its determinants will influence the negotiated real wage. We therefore have a microeconomic justification for the variables which have often been added in the Phillips-type wage models in a rather ad hoc way [22].

Moreover, we may use another property of the "outside option principle" to discard the rational expectations argument of the inexistence of the Phillips curve in a perfectly informed environment. This argument says, as we have already seen, that rational agents will not wait to see the effects on the unemployment rate to renegotiate a contract after a nominal shock, but will recalculate, immediately after the news, the equilibrium values of the nominal variables, in such a way that no trade-off between inflation and unemployment takes place. The property of the outside option principle says that only threats that are credible will have an effect on the bargaining outcome (Sutton, Shaked and Binmore, 1985). What is required, instead, by the rational expectations solution, as Pissarides puts it (1985, p. 388):

> ...in the present bargaining environment is that the union should be capable of drawing the firm into negotiations for raising wages because in some future date wages elsewhere would be higher. But since wages elsewhere [and unemployment] are important in the union's threat point, it seems natural for the firm to refuse to engage in such negotiations, until it <u>observes</u> a stronger threat point for the union members. Union's threats can be credible when the alternative opportunities are available , not when they are expected to be available at some future date."

3.5.2. The equation to be estimated.

In order to derive analytically the real wage function, we simplify further the problem and assume that the union maximizes the sum of the surpluses gained from an employment condition of its members, that is:

$$\text{(5)} \qquad \max_{cl/p} \; U = L\,(w/p_c - \bar{w}) + (M-L)[(UR\; b + (1-UR)\; w^a) - \bar{w}]$$

subject to the labour demand (1) and to $cl/p = w(1+t)/p$.

Since we look for a solution for cl/p we rewrite (5) as:

$$\text{(6)} \qquad \max_{cl/p} \; U = L\,\frac{cl}{p\cdot wedge} + (M-L)[(UR\; b + (1-UR)\; w^a) - \bar{w}]$$

where $wedge = p_c(1+t)/p$.

The first order condition is:

$$\text{(7)} \quad L\,\frac{1}{wedge} + [\frac{cl}{p\cdot wedge} - UR\; b - (1-UR)\; w^a]\frac{dL}{d(cl/p)} = 0$$

which rewritten becomes:

$$\text{(8)} \qquad \frac{cl}{p\cdot wedge} - UR\; b - (1-UR)\; w^a = - L\,[\frac{dL}{d(cl/p)}]^{-1}\,\frac{1}{wedge}$$

Dividing both sides by $\frac{cl}{p \cdot wedge}$:

(9) $$1 - \frac{UR\ b + (1-UR)w^a}{cl/p} \cdot wedge = -\frac{1}{e_{Lw}}$$

and

(10) $$UR\ b + (1-UR)\ w^a = \left(\frac{1}{e_{Lw}} + 1\right) \frac{cl}{p \cdot wedge}$$

where e_{Lw} is the wage elasticity of demand for labour and

$$\frac{cl}{p \cdot wedge} = w/p_c.$$

(10) is the typical equilibrium condition for a monopoly regime. It says that the marginal (utility of) revenue from employment must be equal to the expected (utility) from the outside opportunities open to the worker. $1/e_{Lw}$ measures the degree of monopoly power of the union, since the lower the employment response of the firm to a change in wages the higher the union's pressure on wages.

Using this simplified solution we can finally write our general function for the cost of labour in the form of:

(11) $$\frac{cl}{p} = g\ (\overset{-}{UR},\ \overset{+}{b},\ \overset{+}{wedge},\ \overset{+}{w^a},\ \overset{?}{e_{Lw}})$$

We have already discussed the expected sign of the relation between cl/p and all these variables in the preceding section [23].

As for the effect of e_{Lw} on cl/p, some comments are in order.

Making use of the Slutsky equation and decomposing the factor demand components into the output and substitution effects, we can rewrite e_{Lw} as:

$$(12) \qquad e_{Lw} = v_L \,(e_{pq} + \sigma_{Lw})$$

where v_L is the share of labour in the total cost of production and σ_{Lw} is the Allen own elasticity of substitution [24].

σ_{Lw} is defined as:

$$(13) \qquad \sigma_{Lw} = e^*_{Lw} \,/\, v_L$$

where e^*_{Lw} is the output constant wage elasticity of demand for labour.

Therefore (12) becomes [25]:

$$(14) \qquad e_{Lw} = v_L \, e_{pq} + e^*_{Lw}$$

What we want to explore is the effect of aggregate demand changes on the real wage through e_{Lw} . Let's assume, consistently with our section on production theory, that the price elasticity of demand for output is a positive function of the business cycle, which we proxy by B= (p^F/p, REXP). That means that during expansions the firm's monopoly power in the product market increases.

Therefore:

(15) $$e_{pq} = e_{pq}(\overset{+}{p^F}/p, \overset{+}{REXP}) = e_{pq}(\overset{+}{B})$$

We have seen, moreover, that if there is imperfect competition in the product market and (15) holds, the demand for labour is a positive function of aggregate demand changes in such a way that, coeteris paribus, during an expansion the labour share in total production cost will increase. That is:

(16) $$v_L = v_L(\overset{+}{B})$$

Assuming e^*_{Lw} to be constant we get:

(17) $$\frac{de_{Lw}}{dB} = \frac{\overset{+}{d}v}{dB}\ \overset{-}{e_{pq}} + \frac{\overset{+}{d}e_{pq}}{dB}\ \overset{-}{v_L}$$

The wage elasticity of labour demand depends on B if the two components of (17) are not offsetting.

If they are offsetting, e_{Lw} is constant and the real wage will be rigid over the business cycle; fluctuations will fall entirely on employment. In all other cases, we can only write:

$$(18) \qquad e_{Lw} = e_{Lw}(\overset{?}{p^F/p}, \overset{?}{REXP})$$

where the direction of change is indeterminate.

In this light, we may rewrite (11) as:

$$(19) \qquad \frac{cl}{p} = h(\overset{-}{UR}, \overset{+}{b}, \overset{+}{wedge}, \overset{+}{w^a}, \overset{?}{p^F/p}, \overset{?}{REXP})$$

So the monopoly wage may move either procyclically or countercyclically (if e_{Lw} is variable) thus dampening or magnifying the procyclical fluctuations in employment. If e_{Lw} is constant, instead, we have an explanation of the wage rigidity over the business cycle.

The business cycle, in our model, will be proxied in both sectors by total real expenditure and by competitiveness in the sector exposed to international competition. The other element of openness of the model is to be found in the wedge, which, as we showed in section 3.3. accounts for the pressure exerted on the consumption wage of both sectors by changes in the relative price of imports.

In our specification we do not impose any structure on the form of the utility function, so that our problem is to maximize:

$$(20) \quad U = U\,(\,UR, L, \bar{w}, w^{a}, wedge, b, cl/p)$$

with respect to cl/p, subject to labour demand (1).

From the f.o.c. we derive the final specification:

$$(21) \quad cl/p = f(UR, K, p^{m}/p, \bar{w}, w^{a}, wedge, b, B)$$

Comparing this result with that we derived for the competitive model of section 3.2., we observe that the crucial difference is given by the unemployment rate which does not appear in that specification. All the remaining variables have the same interpretation as in the competitive model, had we assumed there the same demand for labour as here.

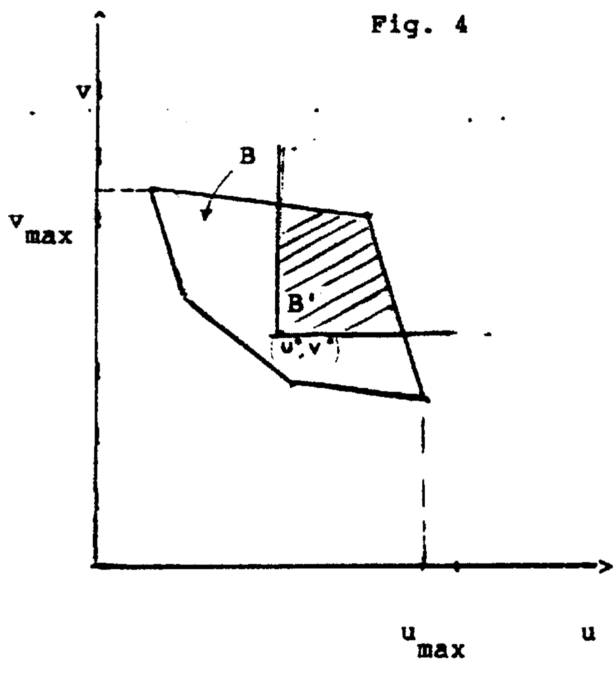
The role of the capital labour ratio which does not appear here, is taken up by $\bar{w}$ which is the subsistence reference wage and represents the effect on wages of the secular growth in productivity.

APPENDIX I

Let's assume that the bargaining set B, that is the set of pairs of firm's and union's utilities (v and u respectively), is closed, bounded and convex.

Let's represent it in the v,u plane [26].

Fig. 4



Suppose that the point $(u^*,v^*) \in B$ is the payoff of the union and firm when no bargaining takes place. Of course, the firm would rather obtain v_{max} and the union u_{max}, but these two wishes are incompatible. Any bargaining point in the shaded area, however, would be preferred by both to the point (u^*,v^*) and considered a fair outcome.

Nash shows that if we displace the origins of the axis so that $(u^*,v^*) \in B=(0,0) \in B'$ and chose (u'_o,v'_o) in such a way that:

a) $(u'_o, v'_o) \in B'$ and $u'_o, v'_o > 0$;

b) $u'_o v'_o \geq uv$ for all $(u,v) \in B'$,

then the point (u'_o, v'_o) is the solution to the bargaining game in B'.

Since $u'_o = u_o - u^*$, and $v'_o = v_o - v^*$ where $(v_o, u_o) \in B$ we get that:

(A1) $$(u_o - u^*)(v_o - v^*) \geq (u - u^*)(v - v^*)$$

for all $u,v \in B$ and such that $u \geq u^*$, $v \geq v^*$.

This functional form is the only one which satisfies the following four axioms required for a bargaining solution:

1) invariance w.r.t. utility transformations;

2) Pareto optimality;

3) independence of irrelevant alternatives;

4) symmetry [27].

There are many objections to the axioms that underly the Nash solution but, as far as we know, solutions based on more satisfactory axioms have led to complicated arithmetic solutions and messy comparative static results (Kalai and Smorodinsky,1975).

Footnotes

1 This fact has been well documented for the U.S. by R. J. Gordon (1970,1971,1977).

2 This result is obtained from the maximization of an individual's two-period utility function of consumption and leisure subject to his two-period budget constraint.

3 Until recently, econometricians have not paid much attention to the intertemporal substitution hypothesis despite its theoretical importance. Solow (1980, p.7) literally attacks its believers:

> "It is astonishing that believers have made substantially no effort to verify this central hypothesis. I know of no convincing evidence in its favour, and I am not sure why it has any claim to be taken seriously."

Altonji (1982) provides a careful investigation of whether the intertemporal substitution model can explain the annual time series data for the U.S. His results, and much other evidence he cites, raise serious doubts about the empirical viability of the intertemporal substitution-market equilibrium view of the labour market. Ashenfelter and Card(1982) estimate a simplified model with intertemporal substitution but their results as well confirm the incapability of this assumption to explain the U.S. labour market in the years 1956:1-1980:1. Andrews and Nickell (1982) estimate a competitive model for the U.K.(1948-1979) and contrast its results with those of a non-competitive one. They draw the conclusion that the competitive model does not fit the facts.

4 The theory of implicit contracts must be included among the present most popular theories of the labour market. See the seminal papers by Azariadis (1975) and Hart (1983).

5 For an excellent survey of this literature see Yellen (1984).

6 See e.g. Calvo(1979), Salop (1979), Stiglitz (1974).

7 The efficiency wage hypothesis, anyway, might prove to be useful for explaining other important components of the determination of wages such as, for example, the wage drift.

8 We use an extremely simplified version of the labour demand function since we have already thoroughly treated its specification in chapter 2.

9 Since:

(1) $$u = (L^P - L)/L^P$$

then:

(2) $$-\ln(1-u) = \ln L^P - \ln L$$

Linearizig (2) around u=0 we get that :

(3) $$u \doteq -\ln(1-u)$$

from which we get the result.

10 See the majority of Oswald's papers, and in particular Oswald (1979, 1982, 1985)

11 See the survey papers by Farber (1985) and Pencavel (1985).

12 There is a vast literature concerning the choice of the union's utility function. In recent contributions to this issue two main streams may be identified :
1) studies that make use of an expected utility or utilitarian function (e.g. McDonald and Solow, 1981);
2) studies which assume a specific structural form to replace the general quasi-concave utility function (e.g. Pencavel, 1984a,b who chooses a Stone-Geary utility function).
See on this point Oswald (1985).

13 The isoprofit curves are given by the implicit derivation of (11):

(11a) $$dw/dL = [R'(L) - w]/L$$

Their maxima are given equating (11a) to zero so that:

(11b) $$R'(L) = w$$

which is the labour demand equation.

14 Sutton (1985) shows how any Nash equilibrium of a wide range of non-cooperative games will, in the limit, coincide with the Nash bargaining solution.

15 The idea that the union and the firm are better off above and to the right of the labour demand curve is originally due to Leontief (1946)

16 See for the British economy e.g. Oswald and Turnbull (1985) for evidence against this hypothesis, and Daniel and Millward (1983) for evidence in favour.

17 See e.g. Carruth and Oswald (1985), who focus on the British post war coal sector and the role of the National Union of Mine workers; MaCurdy and Pencavel (1985) focus on data on U.S. typographical unions.

18 See e.g. Modigliani and Tarantelli (1977) and Sylos Labini (1977).

19 Note the difference with Anglo-Saxon countries where most of the unions are closed shops.

20 We believe that M does not directly depend on union behaviour. The decision to register at the employment agency is influenced by other, even sociological, factors which we may assume to be exogenous to our analysis. Nonetheless, we prefer the specification where M does not appear for the trivial reason that there are difficulties in finding data for this variable.

21 To be precise, in the E.F.O. Scandinavian two-sector model it is assumed that there is only one union which determines a unique wage level for both sectors. The institutional framework of the Italian labour market is characterized by a lower degree of centralized bargaining than the Scandinavian countries and this allows us to assume the existence of two sectoral wages.

22 Although we are deriving a relation between the level of the real wage and unemployment it is easy to show that this is easily transformable into a relation between money wage changes and the unemployment rate (cfr. Nickell, 1984, p.33).

23 For the derivation from a specific utility function of the effects of changes in benefits, membership income and employment subsidies on the monopoly wage see Oswald (1982).

24 For this derivation see e.g. Layard and Walters (1978) ch.9 appendix 8.

25 This is the general case for more than two factors of production. In the two-factor constant returns to scale case (12) reduces to :

$$e_{Lw} = v_L\, e_{pq} - (1 - v_L)\, s_{LK} \quad .$$

where s_{LK} is the elasticity of substitution between labour and capital.

26 This short exposition of Nash's solution follows Luce and Raiffa (1957), pp.124-28.

27 See assumptions on p.126-7 and proof of unicity p. 128 by Luce and Raiffa (1957).

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CHAPTER 4 THE ECONOMETRIC MODEL

4.1. The econometric model: specification strategy and the specification of the equations.

We now come to the presentation of the econometric specification of the theoretical model of firms' and unions' behaviour derived in the preceding chapters.

It is a two-sector quarterly econometric model of the labour market and the accumulation process in Italy for the period 1970-1984. The two sectors are industry in the strict sense, which we call sector 1, and services plus the construction industry, which we call sector 2 [1]. They can also be regarded loosely as the sector which is exposed to and sheltered from international competition respectively.

The theoretical model presented in ch.2 and ch.3 has primarily the aim of identifying the determinants of employment, investment, prices and wages under a specific set of hypotheses. This being our main target, we have not specified any functional form for the technology of production or the demand for goods. As for expectations, we have assumed them to be rational and invoked Sargent's technique together with some simplifying assumptions.

We are not in a position, therefore, to impose any restriction derived from the assumptions on the form of technology or expectations and we simply estimate reduced form equations.

4.1.1. The specification strategy

Our model consists of a system of four simultaneous equations for each sector: employment, investment, prices and wages.

The specification search was carried out at the single equation level by means of instrumental variables. We started from a very general specification, estimating initially fourth-order autoregressive equations and then "testing down" to more parsimonious specifications. We have then proceeded to take into account the cross-equation correlation reestimating the whole model by Three Stage Least Squares (see Appendix III). To this end, we have simply imposed the cross-equation restrictions.

As far as the specification tests are concerned, we did not merely rely on t ratios of the individual coefficients , Durbin Watson and Durbin-h statistics. More sophisticated tools are needed when dealing with simultaneous equation systems: we concentrated mainly on three major characteristics an estimated equation might show and that are all connected to the problem of misspecification. They are: serial correlation, predictive failure and correlation of instruments with the residuals [2]. The method we have followed is based on the analysis of estimated residuals by means of auxiliary regressions.

Serial correlation.

Durbin Watson and Durbin-h statistics detect only first-order serial correlation, and, as Godfrey (1978) has shown, they are not valid even for that when simultaneous equations systems are being estimated. We have therefore followed the method developed by Godfrey (1976) and Breusch and Godfrey (1981) for testing for serial correlation in dynamic simultaneous equations models. In our case the test was built to detect serial correlation of the 4^{th} order, which is one of the most informative when using quarterly data. Note, however, that this test, cannot discriminate between autoregression and moving-average hypothesis.

Predictive failure.

If an estimated equation exhibits poor goodness of fit for predicted values, there might be two major problems: either there is a structural break (that is, the coefficients change) over the period considered, or the equation is misspecified. In order to take into account this problem we have tested each specifioation by means of a Chow test (Davidson,1984).

Instruments validity.

The two properties a suitable set of instruments must have are that they should be highly correlated with the explanatory variables and uncorrelated with the disturbance terms, in order to ensure consistency of the I.V. estimator.

As far as the first property is concerned, we have run auxiliary single variable A.R. or multivariate regressions for the endogenous variables which were not explained in our system of equations. Once a set of instruments was found, we have proceeded to test for their validity, regressing the estimated residuals on them (Sargan, 1964).

We present, in what follows, all these results.

For each equation we derive the long-run coefficients of the long-run solution which corresponds to the theoretical model in its static form. We also discuss the dynamics of adjustment to the steady-state solution.

4.1.2. The specification of the equations.

In this section we set out our empirical versions of the equations of labour demand, investment, prices and wages.

Table 1 lists the symbols used and table 2 lists the descriptive and test statistics reported with each estimated equation.

The test on the form of adjustment costs of capital was carried out including investment between the explanatory variables of labour demand. When its coefficient turned out to be significant we did not reject the hypothesis of non-separable adjustment costs.

In sector 1 we have imposed, after testing, long-run constant returns to scale [3] and we have not rejected the

Table 1

List of symbols.

[The subscript i=1,2 refers to sector 1 (industry in the strict sense) and sector 2 (private services + construction industry).]

L_i: number of employees;

K_i: capital stock;

I_i: gross investment;

cl_i: cost of labour per employee (inclusive of employers' contributions, tl);

w_i: gross earnings per employee i.e. cl= w (1+t2);

p_i: value added deflator;

p^m: index of prices of imported raw materials in liras (index in dollars multiplied by the exchange rate liras per dollar);

p^F: index of prices of imported competing goods in liras (index in dollars multiplied by the exchange rate);

${}_tR_{t+i}$ real interest rate expected next period. It is the difference between the rate of interest on bank loans and next period expected rate of inflation of the sectoral value added deflator;

p_I: deflator of investment in machinery;

ER: domestic exchange rate (liras per dollar);

p_c: households consumption deflator;

tl_i: taxation rate on employers;

$t2_i$: direct taxation rate on labour income;

U : unemployment rate net of workers in the wage supplementation fund (C.I.G.);

AW1,AW2 : alternative wage for sector 2 and sector 1 respectively. Defined as the real gross earnings per employee in sector 1 and 2, that is gross earnings over the consumption deflator;

REXP: real final expenditure.

Table 2

List of descriptive and test statistics

S.E.R. : standard error of regression;

M.O.D.V.: mean of dependent variable;

$\bar{R}^2$: corrected R^2.

D.W. : Durbin Watson.

N.OBS. : number of observations.

SC(x) : Sargan criterion for independence of errors of instrumental variables in the sample period. The x in parenthesis is the number of instruments minus the number of regressors.

GC(p) : Godfrey criterion for serial correlation. In parenthesis is the order of the correlation.

CC(y) : Chow criterion for predictive failure. In parenthesis is the number of predicted quarters.

LM(p) : Lagrange Multiplier test for serial correlation; p is the order of the correlation.

CT(y) : Chow test for predictive failure; y is the no. of predicted quarters.

The numbers in parenthesis beside the coefficients are t statistics.

hypothesis of internal adjustment costs for capital (see sect. 4.2.).

The log-linear specification for the demand for labour in sector 1 is therefore the following (we omit the subscript 1 for simplicity) :

$$\text{(1)}\quad \ln(L/K)_t = a_o + a_1 \ln(L/K)_{t-1} + \sum_{i=o}^{n} a_{2i} \ln(I/K)_{t-i} + \sum_{i=o}^{n} a_{3i} \ln(cl/p)_{t-i} + \sum_{i=o}^{n} a_{4i} \ln(p^m/p)_{t-i} + \sum_{i=o}^{n} a_{5i} \ln(p_2/p)_{t-i} + \sum_{i=o}^{n} a_{6i} (p^F/p)_{t-i} + \sum_{i=o}^{n} a_{7i} \ln REXP_{t-i} + \sum_{i=o}^{n} a_{8i} R^e_{t-i}$$

and the specification for investment is :

$$\text{(2)}\quad \ln (I/K)_t = b_0 + b_1 \ln(I/K)_{t-1} + \sum_{i=o}^{n} b_{2i} \ln(p_I/p)_{t-i} + \sum_{i=o}^{n} b_{3i} \ln(cl/p)_{t-i} + \ldots$$

and all the other explanatory variables of the labour demand (1).

The log-linear specification for labour demand in sector 2 is (we omit the subscript 2 for simplicity):

$$\text{(3)}\quad \ln L_t = c_o + c_1 \ln L_{t-1} + \sum_{i=o}^{n} c_{2i} \ln(cl/p)_{t-i} + \sum_{i=o}^{n} c_{3i} \ln (p^m/p)_{t-i} + \sum_{i=o}^{n} c_{4i} \ln(p_1/p)_{t-i} + \sum_{i=o}^{n} c_{5i} \ln REXP_{t-i} + \sum_{i=o}^{n} c_{6i} R^e_{t-i}$$

and the specification for investment is:

$$\text{(4)} \qquad \ln I_t = d_0 + d_1 \ln I_{t-1} + \sum_{i=o}^{n} d_{2i} \ln(p_I/p)_{t-i} + \sum_{i=o}^{n} d_{3i} \ln(cl/p)_{t-i} + \ldots$$

and all the other explanatory variables of the labour demand (3).

The crucial difference between (1) and (3) is the presence in (1) of current investment as explanatory variable of current labour demand. The test for this sector led us to reject the hypothesis of internal adjustment costs for capital. Demand is represented by real expenditure only, since we assume that sector 2 is sheltered from foreign competition (which we have proxied by p^F/p_1).

The specification for the price equation is the following:

$$\text{(5)} \qquad \ln p/cl_t = e_0 + e_1 \ln p/cl_{t-1} + \sum_{i=o}^{n} e_{2i} \ln p^m/cl_{t-i} + \sum_{i=o}^{n} e_{3i} \ln p^F/cl_{t-i} + \sum_{i=o}^{n} e_{4i} \ln K_{t-i}.$$

where the reparameterization into p/cl comes from the theory [4].

The specification for the real cost of labour is the following:

$$\text{(6)} \qquad \ln cl/p_t = f_0 + f_1 \ln cl/p_{t-1} + \sum_{i=o}^{n} f_{2i} \ln wedge_{t-i} + \sum_{i=o}^{n} f_{3i} \ln AW2_{t-i} + \sum_{i=o}^{n} f_{4i} \ln U_{t-i} +$$

$$\sum_{i=o}^{n} f_{5i} \ln p^F/p_{t-i} \quad + \sum_{i=o}^{n} f_{6i} \ln K_{t-i}$$

(5) and (6) are for sector 1. For sector 2 we adopt the same specifications except we do not have competitiveness between the explanatory variables and have AW1 in the equation for the cost of labour.

The dynamics of our model is, therefore, ad hoc. We can justify the introduction of the lagged dependent and independent variables invoking Sargent's technique (1978, 1979) and the fact that we are estimating reduced forms only. We note, however, that estimation of structural equations based on particular untested functional forms is an equally ad hoc procedure [5].

Equations 1-6 represent the general specification we have tested for our stochastic difference equations, before "testing down" to obtain the restricted and more robust specifications that we proceed to present in the following subsections.

4.1.3. Definition of the expected real interest rate.

As we have previously seen, the presence of adjustment costs involves the term (see sect.2.2.1.):

$$({}_tp_{t+1}/p_t)/[1/(1+r_t)] = 1/(1+{}_tR_{t+1}).$$

This term appears between the explanatory variables of labour demand where:

$$ {}_{t}\tilde{R}_{t+1} = r_t - ({}_{t}p_{t+1} - p_t)/p_t $$

and r_t is the nominal interest rate.

We have defined it as:

$$ {}_{t}\tilde{R}_{t+1} = r_t - {}_{t}\pi_{t+1} $$

[6] and we have used in the regression the following variable:

$$ R_{t+1} = {}_{t}R_{t+1} + e_{t+1} $$

where ${}_{t}R_{t+1}$ is the true value, R_{t+1} is the observed value and e_{t+1} is the error of measurement.

We have thus estimated the following regression equation:

$$ L_t = a + b\ {}_{t}R_{t+1} + c\ Z_t + u_t = a + b\ R_{t+1} + c\ Z_t - b\ e_{t+1} + u_t = $$

$$ = a + b\ R_{t+1} + c\ Z_t + v_{t+1} $$

where Z_t represents all the other regressors. Hence:

$$ v_{t+1} = u_t - b\ e_{t+1}. $$

We have thus an example of the situation when the dependent variable is measured with error. Even if:

$$ E(u_t) = E(e_{t+1}) = E(v_{t+1}) = 0 $$

the Ordinary Least Squares technique yields inconsistent estimates of the coefficient of the wrongly measured independent variable.

We have overcome this problem assuming rational expectations and using the Instrumental Variables estimation technique [7]. As McCallum (1976) has shown, this approach exploits the fact that, under rational expectations, realized variables equal their conditional expectations plus a forecast error orthogonal to all variables in the conditioning set. This approach, however, leads to inefficient parameter estimates since, in general, v_{t+1} is serially correlated as Hayashi (1980) has noted. In order to overcome this drawback Cumby, Huizinga and Obstfeld (1983) have developed a two-step estimator which is applicable when equation's residuals are autocorrelated.

As we are going to show, we did not incur this problem, since we have not detected serial correlation of the residuals in our employment equation.

4.2. Econometric results: labour demand equation.

4.2.1. The exposed sector: industry in the strict sense.

We start with the employment equation of sector 1 whose estimated specification is reported in table 3.

It is important to stress again that the employment series we use for our regressions is the number of dependent workers net of the employees who are in the wage supplementation fund (C.I.G.).

These workers are kept idle but are still considered as employees in the ISTAT (Italian National Institute of Statistics) employment series. We have used, instead, the employment series supplied by the Bank of Italy, which, after estimating the number of workers subject to the C.I.G., gives the net series.

Table 3

LABOUR DEMAND EQUATION, QUARTERLY, 1971(I)-1984(IV)
Sector 1

Independent variables	Dependent variable $\log (L/K)_t$
constant	-.07 (-2.3)
$\log L_{t-1}/K_t$	1.33 (10.4)
$\log L_{t-2}/K_t$	-.36 (-2.7)
$\log (cl/p)_{t-4}$	-.067 (-2.7)
$\log (p^m/p)_{t-3}$	-.033 (-3)
$\log (p^F/p)_t$	.044 (2.1)
$\log (I/K)_t$	-.04 (-3.2)
R^e_{t-1}	-.084 (-3.5)
S.E.R.	.0064
M.O.D.V.	-2.03
$\bar{R}^2$	.99
D.W.	1.98
N.OBS.	56
SC(3)	4
GC(4)	4.8
CC(8)	19.15

Instruments: $D\log(p^F/p)_{t-2}$, $\log (I/K)_{t-1}$, $\log ER_{t-1}$, $\log p_t^{*F}$, $\log p_{t-1}$.

The adjustment process is a transformation of the specification presented in section 2.2.1., where we had only one lagged dependent variable. It can easily be derived as follows.

Assume a simple demand for labour equation of the form:

$$(1) \quad L_t = a_o + a_1 \ln L_{t-1} + a_2 w_t \qquad a_o, a_1 > 0 \ , \ a_2 < 0$$

Subtracting b L_{t-1} from both sides and substituting L_{t-1} with eq.(1) we get:

$$(2) \quad L_t = d_o + d_1 L_{t-1} + d_2 L_{t-2} + d_3 w_t + d_4 w_{t-1}$$

where: $d_o = (1-b)a_o$; $d_1 = a_1 + b$, $d_2 = -ba_1$, $d_3 = a_2$, $d_4 = -ba_2$.

The equation was estimated on quarterly data for the period 1971-1984.

All the variables are in natural logarithms except the expected real interest rate [8] so that the coefficients are elasticities.

The coefficient on ${}_tR_{t+1}$ can be interpreted as the elasticity of employment with respect to $(1+{}_tR_{t+1})$ since ${}_t\bar{R}_{t+1} = \ln(1+{}_tR_{t+1})$.

The equation performs rather well. We reject both the null hypothesis of serial correlation and of instrument correlation with the residuals.

The Chow test, instead, is between the 2.5% and 1% thresholds. This outcome was, in a way, expected since a simple look at the series for industrial employment reveals a conspicuous turning point approximately in correspondence with the second quarter of 1981 (see sect.1.3.). Up to that point the series exhibits fluctuations around a nearly flat trend; from that point on the trend is strongly negative and the cyclical fluctuations disappear. Since the value of the Chow test is not so strongly against the specification and the period for which a different set of coefficients would be appropriate is quite short, we do not reject the equation. We take into account for further research, however, that around 1981 there is a structural break.

Turning now to the coefficients themselves we note that they are all significant at the 97.5% confidence interval.

The coefficients on the relative price of sector 1 and on real expenditure were not significant and we have estimated the equation excluding these two explanatory variables. The real expenditure variable might have introduced serious multicollinearity problems given its high correlation with the cost of labour variable. Both of them, in fact, are highly trended.

The lagged employment coefficients indicate a fairly slow response to changes in all the independent explanatory variables.

Employment reacts to a change in the cost of labour after one year (the short-run elasticity is -.067) and it takes on average 6 years for a change in cl/p to be transmitted to employment (the mean lag is approximately 24 quarters).

The adjustment process with respect to the other independent variables has more or less the same speed (the shorter mean lag is that of competitiveness with 20 quarters).

The long-run elasticities of the independent variables are given in table 4 below. Wald's test for the restriction on the long-run coefficient of the capital stock is given in parenthesis [9].

The conclusion that can be drawn from these results is that employment is more than proportionately responsive to changes in its explanatory variables, but the speed of adjustment is slow.

Our specification contains some standard and some new elements when compared with the employment equations available in other studies on the Italian labour market that we shall see later.

We have already justified theoretically all the included variables and we proceed now to give them an economic interpretation in the Italian economic context.

The standard explanatory variables are the cost of labour and the price of imported raw materials. The empirical analysis leads not to reject the assumption that producers in the industry sector have been on their labour demand curve and that there is complementarity between the inputs of labour and the inputs of imported raw materials.

This is in line with the results obtained by Heimler and Milana (1984) with a completely different approach, that is an input-output analysis of the demand of productive factors in Italian industry for the period 1956-1982. One of their findings is that after the 1973 increase in the relative prices of raw materials with respect to the intermediate inputs, the Italian producers were led

> "... to a vertical disintegration of the productive processes, causing an increase in

> the demand for intermediate labour-incorporating inputs and a relative decrease in the demand for labour itself." (Heimler and Milana, p.145).

It is also standard practice to introduce a demand term in the labour demand equation, although at a theoretical level its inclusion is not so straightforward as we have seen in ch.2 .

The demand effect in our equation is represented by the coefficient on competitiveness, which is defined as:

$$p^F / p = ER^* (p^{F^*} / p)$$

where p^{F^*} is the index in dollars of the price of imported competing goods. This coefficient measures the employment effects of terms of trade changes . It says that, in the period studied, the Italian industrial producers when faced by a one percentage point increase in ER or in p^{F^*}/p or in the sum of their changes, have increased their demand for labour by .044% in the short-run and 1.5% in the long-run.

The novelty elements are represented by the introduction of the real interest rate and investment in the employment equation.

The coefficients of these two explanatory variables might be helpful at giving some insight on the thorny question of the employment effect of the accumulation process in the Italian industrial sector [10].

The negative coefficient on current investment can be interpreted as the effect of technological progress on employment.

Table 4

LABOUR DEMAND EQUATION, QUARTERLY, 1971(I)-1984(IV)
Sector 1
Long-run estimated elasticities of employment w.r.t. a 1% point change of the independent variables.

Independent variables	Dependent variable L
cl/p	-2.23
p^m/p	-1.1
p^F/p	1.5
I	-1.3
$1+R^e$	-2.8
K	1 (1.5)

Note: the number in parenthesis is a Wald test in its t-ratio form of the unit long-run elasticity of capital restriction.

The impact on employment of the more technologically advanced new vintage of capital has a negative effect on employment [11].

Capital and labour, however, are complementary factors as it is implied by the negative coefficient on the real interest rate which might be interpreted as a proxy of the cost of capital services.

4.2.2. The sheltered sector: services and the construction industry.

We turn now to the employment equation of sector 2 whose specification is given in table 5.

The equation was estimated for the period 1971:1 1984:4.

All the variables are expressed in natural logarithms.

The included variables, that are significant at the 97.5% confidence interval are the real cost of labour, real expenditure and capital.

The equation passes all the specification tests.

The lagged employment coefficient indicates a fairly rapid response to changes in the exogenous variables, but the long-run elasticities are considerably lower than the corresponding elasticities for sector 1, as is shown in table 6.

The fact that the employment elasticities in this sector are lower than in the industry sector is to be expected, given the far higher degree of openness of the latter.

Table 5

LABOUR DEMAND EQUATION, QUARTERLY, 1971(I)-1984(IV)
Sector 2

Independent variables	Dependent variable log L_t
constant	.60 (1.9)
log L_{t-1}	.74 (10.4)
log $(cl/p)_{t-4}$	-.077 (-2.6)
log $REXP_{t-1}$	.094 (2)
log K_t	.076 (2.4)
S.E.R.	.005
M.O.D.V.	8.5
$\bar{R}^2$	.99
D.W.	2.12
N.OBS.	56
SC(8)	~ 0
GC(4)	.282
CC(8)	3.57

Instruments: log K_{t-1}

Table 6

LABOUR DEMAND EQUATION, QUARTERLY, 1971(I)-1984(IV)
Sector 2
Long-run estimated elasticities of employment w.r.t.
a 1% point change of the independent variables.

Independent variables	Dependent variable L
cl/p	-.30
REXP	.36
K	.29

The real expenditure term which represents the pressure of demand on employment, is significant and it has a more rapid and larger effect than the real cost of labour.

We have assumed that the production function of this sector is characterized by adjustment costs in the inputs of labour and capital. Our results might be interpreted in the sense that these adjustment costs are external for both labour and capital, since investment does not turn out to be a significant explanatory variable of employment.

Moreover, the raw materials price shock which occurred in 1973 and 1979 has left the employment level in this sector unaffected.

The problem with this equation is that the real expected interest rate is not significant in this sector. This seems in contrast with the assumption of the existence of adjustment costs in labour input. As we have just seen, we have a justification for the exclusion of investment from this labour demand equation. This explanation is based on inferences that we can draw on the kind of technology adopted by the firms in sector 2. We do not have, instead, an economic explanation for the non significance of the expected real interest rate. The only explanation we can attempt is that the chosen definition of ${}_{t}R_{t+1}$ is not relevant for the demand for labour in this sector. It might be the case, for example, that the relevant interest rate is a long-term rate. Given the difficulty of finding a good measure for the real expected interest rate relevant for this sector, we prefer to leave this issue unsettled at this stage.

4.2.3. Other studies on employment in the Italian economy.

As far as we know, only one other model of the Italian economy exists which distinguishes between the sheltered and the exposed sector (Zandano et al.,1982). It is estimated on quarterly data over the period 1968:1 1976:4 and it is based on theoretical foundations which differ from ours, so that any comparison is impossible [12].

The majority of the existing models estimate employment equations for the whole economy or for the manufacturing sector only.

Modigliani, Padoa Schioppa and Rossi (1986), in their model on unemployment in Italy, estimate an aggregate employment equation on annual data for the period 1960-1983. Their equation as well differs strongly from ours. We note, however, that their long-run elasticity of the cost of labour with respect to employment is -.346 (and the mean lag is 5.1 years). This value is slightly higher than the value we have estimated for the sheltered sector.

The discrepancy with the elasticity we obtained for the industry sector is to be expected, since Modigliani's equation explains aggregate dependent and independent employment, whereas ours explains only dependent employment in industry. The need of disaggregated studies on such important issues as employment finds, therefore, a further confirmation.

The result by Modigliani is confirmed also in two other studies that present an aggregate employment equation for Italy based on O.E.C.D. yearly data (Bean, Layard and Nickell, 1986; Newell and

Symons,1985). They report a long-run employment elasticity with respect to the real cost of labour of -.37 (1953-1983) and -.37 (1963-1981) respectively.

M. Bruno (1985) estimates an employment equation for the Italian manufacturing industry for the period 1965-1982. The employment elasticity with respect to the real cost of labour is -1.01. This result is nearer to ours, but it still differs substantially, presumably because of the different sample period and specification of the equation.

4.3. Econometric results : the investment equation.

4.3.1. The exposed sector.

We present in table 7 the investment equation for sector 1.

The dependent variable is $(I/K)_t$, that is real gross investment over the capital stock, since we have imposed constant returns to scale in this sector (see sect. 4.1.2.).

All the variables are in natural logarithms.

The equation was estimated for the period 1971:2 1984:4.

It passes all the specification tests.

The coefficient on the real cost of labour and the investment deflator [13] are fully significant, whereas the coefficients on the real interest rate and the change in real expenditure are significant at the 95% confidence interval.

Table 7

INVESTMENT EQUATION, QUARTERLY, 1971(II)-1984(IV)
Sector 1

Independent variables	Dependent variable $\log (I/K)_t$
constant	-.26 (-1.9)
$\log (I/K)_{t-1}$	1.17 (15.5)
$\log (I/K)_{t-3}$	-.35 (-4.8)
$\log (cl/p)_{t-3}$	-.19 (-3.5)
$\log (p_I/p)_t$	-.24 (-2.2)
$\log (1+R^e)_{t-2}$	-.15 (-1.5)
$\log [1+(DREXP/REXP)]_{t-4}$	.51 (1.4)
S.E.R.	.033
M.O.D.V.	-3.7
$\bar{R}^2$	.95
D.W.	2.22
N.OBS.	55
SC(3)	.274
GC(4)	1.26
CC(8)	7.3

Instruments: $\log (p_I/p)_{t-1}$, $\log (p_I/p)_{t-2}$, $\log (p_I/p)_{t-3}$, $\log (p_I/p)_{t-4}$.

The lagged investment coefficients indicate a fairly rapid response to changes in all the independent explanatory variables.

Table 8 reports the long-run elasticities.

Looking at the size of the short-run coefficients it emerges that the variables representing profitability have a major role in determining the changes in investment. In particular, it turns out that the real cost of labour has a relatively small direct role in the slowdown of industrial capital accumulation, while changes in aggregate demand played a more substantial role in the profit squeeze and resulting contraction in investment.

4.3.2. The sheltered sector.

Table 9 reports the estimated investment equation for sector 2 and table 10 the long-run elasticities.

The dependent variable is real gross investment and the sample period is 1971:1 1984:4. All the variables are in natural logarithms.

The equation passes all the specification tests.

The first thing we note is the absence of the real investment deflator. We tested the inclusion of p_I/p, but this was insignificant. This outcome was to be expected since, presumably, the investment deflator which is relevant for sector 2 is that of private non-residential investment, for which, unfortunately, data are not available.

Table 8

INVESTMENT EQUATION, QUARTERLY, 1971(II)-1984(IV)
Sector 1
Long-run estimated elasticities of investment w.r.t. a 1% point change of the independent variables.

Independent variables	Dependent variable I/K
cl/p	-1.05
p_I/p	-1.3
$1+R^e$	-.83

Table 9

INVESTMENT EQUATION, QUARTERLY, 1971(I)-1984(IV)
Sector 2

Independent variables	Dependent variable $\log I_t$
constant	-1.46 (-2.3)
$\log I_{t-1}$	.735 (8)
$\log (cl/p)_{t-3}$	-.38 (-2.8)
$\log (1+R^e)_{t-1}$	-.29 (-1.7)
$D^2\log REXP_t$	1.54 (1.8)
$\log K_t$	.38 (3.1)
S.E.R.	.031
M.O.D.V.	6.98
$\bar{R}^2$	.94
D.W.	1.84
N.OBS.	56
SC	~ 0
GC(4)	.15
CC(8)	6.5

Instruments: $\log K_{t-1}$, $D^2\log REXP_{t-1}$.

Table 10

INVESTMENT EQUATION, QUARTERLY, 1971(I)-1984(IV)
Sector 2

Long-run estimated elasticities of investment w.r.t. a 1% point change of the independent variables.

Independent variables	Dependent variable I
cl/p	-1.4
K	-1.4
$1+R^e$	-1.1

As for the other variables, we observe the significative role of real expenditure changes and of the real cost of labour as determinants of real gross investment.

4.3.3. Other studies on investment in the Italian economy.

We can compare our results with those by Faini and Schiantarelli (1984) who follow an approach which is very similar to ours.

They estimate the investment equation for the industrial sector in the period 1969-1980. They constrain the long-run elasticity on the price of investment and nominal wages to be the same (that is they use the p_I/w ratio as regressor and estimate a long-run elasticity of -.4). This results is therefore in contrast with ours, since we estimate a negative coefficient for the real cost of labour. Their long-run elasticity on the expected real interest rate, which they define as the nominal interest rate minus the rate of expected wage inflation, is negative and higher than ours (-1.7). No demand variables appear in their equation, but they claim that this effect is caught by the expected rate of growth in production over the next quarter.

In another recent study by the Bank of Italy, (Magnani and Valcamonici, 1984) the authors estimate an accelerator model and a profit-maximizing model of aggregate investment in Italy (excluding constructions) for the period 1970:1 1982:4. Their results show that a "pure" accelerator model with distributed changes in value added as explanatory variables is not sufficient to explain the Italian accumulation process and has a limited forecasting capacity. The introduction of the expected real interest rate improves the equation considerably and the authors cannot reject the hypothesis of a profit-maximizing model of investment fitting the Italian case [14].

Unfortunately, we are not aware of any study on investment in the service sector that could allow a comparison with the results obtained fot the sheltered sector.

4.4. Econometric results: the price equation.

4.4.1. The exposed sector.

The price equation for sector 1 was estimated over the period 1971:1 1984:4.

The results are reported in table 11.

It is a very simple equation. It performs well, passing all the tests for serial correlation and parameter stability.

The coefficients are all significant at the 95% confidence interval.

The estimated price equation reflects the assumed pricing rule we have discussed in chapter 2, according to which prices are determined with a mark-up over unit costs.

Table 11

PRICE EQUATION, QUARTERLY, 1971(I)-1984(IV)
Sector 1

Independent variables	Dependent variable $\log (p/cl)_t$
constant	11.7 (4.8)
$\log (p/cl)_{t-4}$	.256 (2.1)
$\log (p^m/cl)_{t-4}$	.14 (3.5)
$\log K_{t-1}$	-.84 (4.8)
S.E.R.	.036
M.O.D.V.	4.78
$\bar{R}^2$	.93
D.W.	1.97
N.OBS.	56
Durbin h	.27
LM(4)(autocorrelation)	2.4
Chow test(8), F(8,52)	.27
p^m/cl elasticity (long-run)	.2
K elasticity (long-run)	-1

Notes: There are no current endogenous variables on the right, so estimation is by OLS.

Strictly speaking, since we are explaining the industrial value added deflator, we should not have included in the equation the index of prices of imported raw materials. Nonetheless, we have put it between the explanatory variables, in order to take into account the degree and velocity of adjustment of domestic prices to international prices of raw materials (which in the 70's have represented the major component of international inflation). Its long-run elasticity is, in fact, quite low, but fully significant and the adjustment is completed in $1\frac{1}{4}$ years.

We did not find any effect of the demand variables, real expenditure or competitiveness, on industrial prices.

The empirical results suggest that the Italian industrial entrepreneurs apply a demand invariant mark-up over unit costs. The constancy of the mark-up is implied, at a theoretical level, by the assumption that the price elasticity of demand depends on the determinants of demand (p^F, REXP) (cfr. sect. 2.1.). This price equation is therefore consistent with the specification of industrial labour demand where competitiveness appears as a significant explanatory variable.

This equation does not show any element of novelty as far as its specification is concerned, and is consistent with the evidence supplied by other studies on industrial pricing in Italy [15].

4.4.2. The sheltered sector.

The price equation for sector 2 was estimated for the period 1971:1 1984:4. The results are reported in table 12. It passes all the specification tests.

It must be noted, first of all, that we have estimated an equation for the quarterly rate of change of p/cl. The coefficient on $(p/cl)_{t-1}$ is in fact approximately equal to one. We also find an influence of the rate of acceleration of sectoral price inlation, which, in the long-run, can be assumed to be equal to zero.

As far as the coefficient on the price of imported raw materials is concerned, the same observation as for sector 1 applies, except that here the coefficient is even smaller.

We find in this sector a small influence on prices of real expenditure. This is consistent with the theory since we have not ruled out a priori the dependence of the mark-up on demand variables.

Note that the capital stock is not present in the equation as it should be. Complications might have arisen because of the high degree of correlation between the real expenditure variable and the capital stock.

Table 12

PRICE EQUATION, QUARTERLY, 1971(I)-1984(IV)
Sector 2

Independent variables	Dependent variable log $(p/cl)_t$
constant	-1.3 (-1.67)
log $(p/cl)_{t-1}$	1.02 (22.3)
log $(p^m/cl)_{t-4}$	.04 (2.37)
log $REXP_{t-1}$	.1 (1.99)
DD log p_t	.443 (5.16)
S.E.R.	.011
M.O.D.V.	4.88
$\bar{R}^2$	.99
D.W.	1.99
N.OBS.	56
SC	.459
GC(4)	.8
CC(8)	5

Instruments: log p_{t-1}, log p_{t-2}.

4,5. Econometric results : the cost of labour equation.

4.5.1. The exposed sector.

The real cost of labour was estimated for the period 1971:1 1984:4. All the variables are in natural logarithms. As can be seen in table 13 all the coefficients are highly significant.

Since no lagged dependent term appears on the left hand side, the coefficients are to be interpreted as long-run elasticities.

As we have explained in sect. 3.3., the coefficient on $[p_c(1+tl)/p]$ measures the effect on the cost of labour of the discrepancy between the product and the consumption wage. The higher $p_c(1+tl)$ (the lower p) the higher (the lower) the pressure on the real cost of labour. In sector 1, this effect is nearly one, reflecting the high level of wage indexation which has characterized the Italian industry in the period under study.

The high coefficient on the alternative wage (real gross earnings in sector 2) might be interpreted as reflecting a high degree of union strength in sector 1. In other words, an increase of 1% in the real gross earnings of sector 2 is efficaciously used by the union as a threat to induce employers to raise wages in sector 1 by .7%.

Table 13

COST OF LABOUR EQUATION, QUARTERLY, 1971(I)-1984(IV)
Sector 1

Independent variables	Dependent variable $\log (cl/p)_t$
constant	.49 (2.2)
$\log [p_c(1+tl)/p]_t$	.86 (6.5)
$\log AW2_{t-1}$	.73 (5.7)
$\log (p^F/p)_{t-1}$	.13 (3.2)
$D\ln U_t$	-.23 (-1.9)
time	.003 (3.5)
S.E.R.	.021
M.O.D.V.	2.12
$\bar{R}^2$	.98
D.W.	1.73
N.OBS.	56
SC(8)	13
GC(4)	8.13
CC(8)	4.12

Instruments: $\log p_{t-1}$, $\log p_{t-2}$, $\log p_{t-4}$, $\log (cl/p)_{t-1}$, $\log U_{t-1}$, $\log U_{t-2}$, $\log U_{t-3}$, $\log U_{t-4}$, $\log [p_c(1+tl)/p]_{t-1}$, $\log [p_c(1+tl)/p]_{t-2}$.

The coefficient on competitiveness conveys the effect on wages of labour demand shifts due to changes in aggregate demand. This coefficient is quite small, as it is reasonable to expect, since firms do not usually allow short-run demand fluctuations to influence longer term wage agreements.

Industrial wages, therefore, are influenced by the degree of openness of the economy through two channels: the effect on consumption wage of changes in the price of imported consumption goods and the effect on demand for labour of changes in competitiveness.

As far as the unemployment rate is concerned, its level, or the logarithm of it, were found to be insignificant [16]. The change in the unemployment rate, however, is significant at the 95% confidence interval.

Our interpretation of this result is tentative and relies on the distinction of unionized members between insiders (employed union's members) and outsiders (unemployed union's members) [17].

Suppose the union is split between insiders who have the power to choose the policy of the union in the form of wage requests, and outsiders. Suppose, moreover, that the insiders have acquired some firm (or industry) specific skills required by the employers and do not regard the outsiders as potential competitors.

In this scenario, the wage requests of the "insiders' " union will not be damped by the number of unemployed workers, that is, by the current state of the labour market. What will worry the union mostly, instead, will be the <u>change</u> in the number of unemployed, which the employed worker will regard as a market indicator of a potential change in his current state.

We think that this could be a reasonable interpretation of what has been happening in the Italian industrial sector, which has been characterized, especially from the late '70s onward, by a massive and rapidly increasing decline in employment [18].

The coefficient on the change in the unemployment rate is the elasticity of the real cost of labour with respect to (1+ DU); the term Dln U can also be interpreted as the change in the probability of being employed [19].

We have used a trend to proxy the tendency of the productivity of labour which has determined a steady increase in the baseline level of wages (cfr. sect.3.5.2.).

When comparing our equation with analogous equations for other European countries (in particular the U.K.), we note the absence of unemployment benefits. The Italian institutional setting of the labour market is characterized by a nearly inexistent unemployment benefit system (cfr. sect.1.4.). The wage supplementation fund (C.I.G.) is something completely different, as we have already seen. It can not be considered as a benefit system and even if we did so, our benefit variable would be perfectly correlated to the wage, the so-called wage supplement being fixed to 80% of the normal pay by law.

4.5.2. The sheltered sector.

The real cost of labour equation was estimated for the period 1971:1 1984:4 (see table 14).

All the variables are in natural logarithms. Here, as in sector 1, the coefficients are to be interpreted as long-run elasticities.

The first observation concerns the coefficient of the wedge and of the alternative wage (real gross earnings in sector 1): they are both lower than the corresponding coefficients of sector 1. This difference might reflect a lower degree of union strength in the sector of services and construction industry. That means, for example, that an increase in the industrial real earnings by 1% induces an increase of .26% only in the real cost of labour of the sheltered sector. A higher wage request of the union would not represent a credible threat of its employed members' quitting the job.

It must be stressed, however, that it is very difficult to say a final word on sectoral differentials in earnings. It is even more so when we group in the same sector a wide variety of activities, as we do here in particular for sector 2.

Table 14

COST OF LABOUR EQUATION, QUARTERLY, 1971(I)-1984(IV)
Sector 2

Independent variables	Dependent variable $\log (cl/p)_t$
constant	1.29 (6.8)
$\log [p_c(1+tl)/p]_t$	.53 (7)
$\log AWl_t$	.26 (2.2)
$D\ln U_t$	-.24 (-3.4)
$\ln U_{t-1}$	-.075 (-3)
time	.012 (5.6)
$time^2$	-.0001 (5.8)
S.E.R.	.0105
M.O.D.V.	2.02
$\bar{R}^2$	.99
D.W.	2.12
N.OBS.	56
SC(5)	7.35
GC(4)	6.6
CC(8)	3.38

Instruments: $\log p_{t-1}$, $\log p_{t-4}$, $\log AWl_{t-1}$, $\log AWl_{t-2}$, $\log AWl_{t-3}$, $\log AWl_{t-4}$, $\log [p_c(1+tl)/p]_{t-1}$, $D\ln U_{t-1}$.

Given these unsolvable difficulties due to the aggregation, we may anyway report the observation that in the period 1970-1978 the Italian industrial sector seems to have gained a definite advantage over services, as far as real earnings are concerned. From the '80s onwards, in correspondence with the massive decline in industrial employment, the industrial sector looses this advantage and services recover from this weaker position to regain the lost approximate parity of 1970 with the industrial sector [20].

The second difference we note is the fully significative coefficient of the logarithm of the unemployment rate level (-.075) together with its change (- .24).

Applying the tentative interpretation we used in the preceding subsection, we may infer that the union in this sector is not only concerned with the increasing rate of unemployment, but also with its level. That is because the insiders regard the unemployed workers as potential competitors to whom the employers might resort if the union's wage requests are excessive.

This interpretation might be substantiated by observing two features of the Italian sheltered sector:

1) this sector includes the majority of the activities that do not require specific labour skills;

2) when some skills are required, they are precisely those supplied in excess of actual demand (this type of excess supply

is to be found especially among young people with a diploma or a university degree).

Since we have taken the logarithm of the unemployment rate, we have implicitly assumed that the long-term unemployed exert less pressure on wages than the short-term unemployed (see footnote 16). This assumption follows from the observation that the Italian unions, like other Western countries' unions, seem to have neglected the weakest components of the labour force [21].

As far as the productivity trend is concerned, the linear and quadratic time trends were chosen as most satisfactory in terms of goodness of fit and reasonable coefficient estimates.

The demand variable (i.e. real expenditure here) does not enter significatively the wage equation for this sector, even if it appears in the labour demand equation. We are therefore induced to conclude that wage agreements in this sector are not influenced at all by cyclical fluctuations in aggregate demand, at variance with the exposed sector where we have found a small influence on wages of changes in competitiveness.

Footnotes

1 The public sector and agriculture are exogenous to our analysis. In particular, we have excluded the agricultural market from the exposed sector, given that its performance is strongly influenced by E.E.C. regulations.

2 As far as the specification tests are concerned, we have followed the approach developed by Desai and Weber (1986) and Sargan and Weber (1986).

3 We have imposed long-run constant returns to scale in labour investment and capital. We use Lucas' production function (1967, p.323) where the assumption of homogeneity of degree one

> "...differs from constant returns to scale in the usual sense, since a doubling of capital and labour and the investment rate will double output, but a doubling of capital and labour with a fixed investment rate will yield a more than doubled output."

4 Since the cost function is homogeneous of degree one in prices then:

$$C_y(w,p^m,p_2,Y,K)= w\, C_y(1,p^m/w,p_2/w,Y,K)$$

and expression 7 in sect. 2.1. can be rewritten as follows:

$$p/w= f(K,Y,p^m/w,p_2/w)(1-\frac{1}{e})^{-1} .$$

5 Sargent (1978) himself recognizes this weakness in the technique he has devised. He writes:

> "It is important to emphasize that this view [of a negative relationship between employment and real wages] has content (i.e. imposes overidentifying restrictions) because I have a priori imposed restrictions on the orders of the adjustment-costs processes and on the Markov process governing disturbances. At a general level, without such restrictions, it is doubtful whether the equilibrium view has content."(pp.1041-1042)

6 That is easy to show.
In fact:

$$R_t^e = [\, p_t(1+r_t)]/p_{t+1}^e - 1$$

Then:

$$\ln(R_t^e+ 1)= \ln [[\, p_t(1+r_t)]/p_{t+1}^e]$$

so that:

$$\ln (R^e_t + 1) \cong R^e_t,\ \ln [[\ p_t(1+r_t)]/p^e_{t+1}] \cong r_t - \pi_{t+1}\ .$$

7 See on this issue e.g. Pyndick and Rubenfeld (1976) (p.128-132).

8 It is trivial to note that since R can assume negative values it can not be transformed in logarithms.

9 We use a Wald test in its t-ratio form. The unrestricted equation is:

a) $\ln L_t = const + a\ln L_{t-1} + b\ln L_{t-2} + c\ln I_t + d\ln K_t +$ all other regressors.

The restriction we want to test is:

$$a+b+c+d=1$$

To do that in the simplest way, we estimate the following transformation of a):

a') $\ln L_t = const + e\ln L_{t-1} - b\ (\ln L_{t-1} - \ln L_{t-2})$
$- c(\ln I_t - \ln L_{t-1}) - d\ (\ln L_{t-1} - \ln K_t) +$
all other regressors.

Given that:

$$e-b-c-d=a$$

we test the hypothesis: H_0: e=1.

10 For the description and qualitative evaluation of the employment-investment relation in Italy in the '60s '70s and '80s see, for example, G. Faustini (1984).

11 The contemporaneity of the demand for labour to new investment might be questioned. It has to be noted, however, that the wage supplementation fund (C.I.G.) has allowed industrial producers, especially in the '80s, to have a higher degree of flexibility. The C.I.G. in fact, allows to suspend employees from work quite rapidly, when the need of restructuration has been ascertained for the firm who has asked the C.I.G. intervention.

12 Also the definition of the two sectors is different. They include in the exposed sector agriculture as well, which we have excluded because its performance is strongly affected by E.E.C. regulations.

13 Note that p_I is the deflator of investment in machinery. Data on the price of private investment in constructions net of residential investment are not available in the Italian statistics even on a yearly basis.

14 An estimation of a profit-maximizing investment equation of the Italian manufacturing sector from 1965 to 1982 can also be found in Bruno (1986).

15 See for example Sylos Labini (1967).

16 If we use the logarithm of the unemployment rate we implicitly assume that the pressure on wages of the unemployment rate increases less than proportionately the higher its absolute value (as is implicit in the concave shape of the logarithmic function). That leads us to assume that the short-term unemployed workers exert a greater downward pressure on wages than the long-run unemployed. See, on this point, Layard and Nickell (1986).

17 The insider-outsider approach has been developed theoretically in the last few years, mainly by Lindbeck and Snower (1984a,1984b). They work on the following idea:

> " We represent involuntary unemployment as a condition which the insiders (the currently employed workers) impose on the outsiders (the currently unemployed workers). The insiders set the wages above the minimal level at which the outsiders would be willing to work, but the employers have no incentive to fire the insiders and hire the outsiders.
> The reason is that the employers face costs of hiring which, in practice, are commonly quite substantial. Insiders take these costs into account in making their wage demands. Unionization may be explained as an effective way of doing so." (1984a,p.1-2)

18 One could imagine an even more extreme hypothesis, according to which the union, in forming its wage requests, looks at the rate of sectoral unemployment. According to our scenario this could be proxied by the percentage of workers in the wage supplementation fund (C.I.G.) over the total employed in the industrial sector. We do not use this variable, however, in order to be consistent with the wage equation of sector 2, for which a proxy for sectoral unemployment is impossible to build.

19 In fact:

$$\ln (1+ DU_t)= \ln U_t - \ln U_{t-1} \cong DU_t$$

and:

$$\ln U_t = \ln (1-(L_t/L_t^P)) \cong - L_t/L_t^P = - p_t$$

where L_t^P is the total labour force and p_t is the probability of being employed. Hence: $DU_t \cong p_{t-1} - p_t$.

20 This observation is by Faustini (1986), in: "Retribuzioni e costo del lavoro in Italia tra il 1970 e il 1985", A.S.A.P. Report on Wages, p.61. See also table C, p.59. This inference is highly dependent on how wage differentials are defined and measured.

21 See on this point, Modigliani, Padoa Schioppa e Rossi (1986). They estimate a wage equation for the aggregate Italian economy on yearly data (1960-1983) and find that the long-term unemployment rate (i.e. with duration greater than one year) has a lower coefficient than that of the total unemployment rate .

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CHAPTER 5 CONCLUSIONS

In this study we have presented a theoretical model of the behaviour of firms and unions, viewing them as the main economic subjects in the labour market.

The model is built on the assumption that employment, investment and price decisions are taken by firms, whereas wage decisions are taken by unions.

Assuming imperfect competition in the product market and the existence of adjustment costs for the inputs of labour and capital we have derived, from a problem of intertemporal profit-maximization, the equations of labour demand, investment and prices.

The specification of the equation of the real cost of labour is derived integrating the firm's and union's behaviour in a monopoly union model where the union sets wages and the firm sets employment.

Econometric estimation of the model based on Italian data for the sector which is exposed to international competition and the sector which is sheltered from it has allowed us to analyze the differences between the main causes of change in these two sectors, thus giving some insight into the question of structural change.

Our estimated equations track the data for the sample period 1970-1984 quite accurately, and we proceed to summarize the main findings of our research with a reasonable degree of confidence.

As far as employment is concerned, we note that firms in both sectors have been on their labour demand curve. The real cost of labour is, therefore, to be regarded as one of the main determinants of employment in the period considered. More specifically, our analysis was oriented to measure the different speed and degree of adjustment of employment in each sector to changes in the real cost of labour. Even if the short-run impact of the cost of labour on employment is approximately of the same size (-.067 and -.077 in the exposed and sheltered sector respectively), the lagged employment coefficients indicate a fairly slow response of sector 1 as compared to sector 2. Moreover, the long-run elasticity of employment with respect to the cost of labour is far higher in the exposed sector (-2.2) than in the sheltered sector (-.3).

These results give some insight into the issue of the rigidity of the Italian labour market (at least on the demand side; cfr.ch.1) in that they supply some econometric evidence on the role of adjustment costs that are connected to the input of labour. Hiring and firing costs seem to be particularly high in the industrial sector, since they reduce considerably, as compared to the sheltered sector, the speed of adjustment of employment to changes in its explanatory variables.

Proceeding further with the supply side effects, the empirical analysis suggests that the rise in the price of imported raw materials has contributed to the decline in industrial employment, since labour and raw materials appear to be complementary factors of production. As it was reasonable to expect, moreover, we did not find any significative effect of the price of imported raw materials on employment in the sheltered sector.

A test on the form of the adjustment costs of capital in the industrial sector led us not to reject the hypothesis of internal adjustment costs, that is costs that are interrelated with the production process. A consequence of this assumption is that, as we have seen in chapter 2, investment appears between the explanatory variables of employment.

Our empirical finding leads us not to reject the hypothesis of a negatively relation between current investment and employment. This result seems to catch the effects of the intensive labour-substituting capital-deepening processes that have characterized industrial accumulation from the late '70s onwards, so as to be considered, by some economists, one of the major causes of the structural decline of employment in industry. Note that we do not get a similar effect in the sheltered sector, but we do not have enough elements to draw any conclusion on this result.

The last supply effect we want to mention is that of the expected real interest rate (${}_tR_{t+i}$, i= 1,..n). This effect might be the result of different mechanisms. Just to mention two examples, an increase in ${}_tR_{t+i}$ might lead the firm to make a more intensive use of productive capacity today, since future revenues are more heavily discounted. In this case, employment might increase, but its cumulative change depends on the effect on capital. Alternatively, an increase in the expected real interest rate might discourage production and affect negatively employment in firms that expect to suffer from credit rationing.

In our model, the employment effect of the real interest rate is derived from the assumption that the firm is subject to costs of adjusting its labour stock that are external to the productive process. According to this hypothesis, the firm's marginal cost is the sum of additional wage costs and the cost connected to changing its workforce. The latter is assumed to be more than proportionately increasing with the level of employment. In this framework, an increase in ${}_tR_{t+i}$ decreases the flow of expected marginal revenues and the equilibrium condition of the profit maximizing firm is affected. The employer, in order to re-equate marginal cost and marginal revenue, decreases employment until the loss in revenue is exactly compensated by the reduction in the cost of replacing the vacancies (the assumption of increasing marginal adjustment costs is therefore crucial for this result).

Our econometric analysis has given evidence of a strong negative employment effect of the expected real interest rate in the industrial sector. No effect, instead, has been found in the sheltered sector.

Turning now to demand variables, they affect employment in our theoretical model if imperfect competition and a variable price elasticity of demand is assumed in the product market.

Our econometric estimates seem to support these hypotheses. Competitiveness is the crucial variable that influences industrial employment through demand for tradeable goods. This result is in line with the predictions of the theory on the "deindustrialization process", according to which the low degree of competitiveness of the Italian tradeable goods in the period studied has some part in the transformation of a slowdown in employment growth in this sector in a merely structural decline.

In the sheltered sector, real expenditure conveys the positive employment effect of changes in demand for non-tradeable goods. It must be stressed, moreover, that, at variance with sector 1, real expenditure is the major cause of change in employment in this sector.

The estimated equations for investment lead us not to reject the profit maximizing model derived in ch.2. Our results show, in fact, that profitability has had a major role in determining investment decisions in both sectors. As in the case of employment, demand variables, proxied here by real expenditure changes, enter significatively both our investment equations.

A last observation, to conclude with firms' decisions, concerns prices. Our estimates seem to show that prices in sector 1 are the result of a demand invariant mark-up over unit costs. In sector 2, instead, a small influence of demand on price changes can be observed.

All these results, therefore, support the hypothesis of a variable elasticity of demand for goods trough which demand affects, according to our model, the decisions of firms.

Turning now to the cost of labour, we have chosen to embed its theoretical determination in a monopoly union framework.

There are essentially two reasons for this choice, as we have explained in ch.3, one institutional and one theoretical. The former is based on the observation that, in the period studied and particularly during the '70s, unions have considerably increased their bargaining power and deeply affected the performance of the Italian economy. The latter concerns the capacity of this model to explain involuntary unemployment.

On the empirical side, however, it must be stressed again that a lot of work remains to be done in order to devise an econometric methodology which allows to ascertain the superiority of one model over the other among trade union theories. This issue, on the other hand, goes beyond the object of this research.

Our result are quite satisfactory and allow us not to reject the model. The real cost of labour in each sector is significatively affected by the discrepancy between the consumption and the product wage, the alternative wage of the other sector and unemployment.

In the exposed sector we also find a small but significative positive effect of competitiveness on wages. Its coefficient conveys the influence on wages of labour demand shifts due to changes in aggregate demand. Industrial wages, therefore, are influenced by the degree of openness of the economy through two channels: the effect on consumption wage of changes in the price of imported consumption goods and the effect on demand for labour of changes in competitiveness.

The coefficient on the alternative wage can be interpreted as reflecting the degree of union strength. In other words, it measures the union's reaction in terms of wage pressure to an increase in the wage of the other sector. Our empirical finding indicates a higher degree of union strength in the industrial sector as compared to the sheltered sector.

We have shown in ch.3 that the unemployment rate is the crucial variable which distinguishes a trade union model from a competitive model of the labour market. In the sheltered sector we have found the coefficients of both the level and the change of the unemployment rate to be negative and significant. In the exposed sector, instead, only the change in the unemployment rate is significant.

Our tentative interpretation of this result relies on the distinction of unionised members between "insiders" (employed) and "outsiders" (unemployed). If the insiders have acquired a higher degree of monopoly power (e.g. some firm-specific skills) as compared to the outsiders, they will not regard them as potential competitors. If the insiders have the power to chose the policy of the union, they will not be concerned with the current state of the labour market (whose best indicator is the unemployment rate) but with its changes. Changes in the unemployment rate, in fact, represent the probability of a change in the insider's current state.

In the sheltered sector, instead, the insiders regard the outsiders as potential competitors to whom the employers might resort if the union's wage requests are excessive.

We have attempted, in this study, to focus on firms' and unions' decisions within a unified framework, with the aim of taking account of supply and demand factors by means of a rigorous theoretical analysis. More work is needed to improve the model from the theoretical point of view.

At this stage, however, we think that econometric estimation of the model has given some insight into the issue of structural change of the Italian economy.

APPENDIX II

DATA AND STATISTICAL SOURCES

SECTOR 1 : ENERGY + MANUFACTURING INDUSTRY
SECTOR 2 : MARKET SERVICES + BUILDING INDUSTRY

ALL SERIES ARE DESEASONALIZED

PRAW: INDEX OF PRICE IN DOLLARS OF IMPORTED RAW MATERIALS 70=100
SOURCE: PROMETEIA
PMF INDEX OF PRICE IN DOLLARS OF IMPORTED MANUFACTURED COMPETING GOODS 1970=100
SOURCE: PROMETEIA
ER : INDEX OF THE LIRA/US$ EXCHANGE RATE 1970=100
SOURCE: BANK OF ITALY
P1 : VALUE ADDED DEFLATOR OF SECTOR 1 70=100
SOURCE: OUR ELABORATION ON ISTAT DATA
P2 : VALUE ADDED DEFLATOR OF SECTOR 2 70=100
SOURCE: OUR ELABORATION ON ISTAT DATA

	PRAW	PMF	ER	P1	P2
1970:1	99.38599	98.74300	100.32999	93.50978	95.61113
1970:2	100.37999	101.56000	100.29997	98.54605	98.81898
1970:3	100.53999	101.56999	100.00998	102.52844	100.96803
1970:4	99.69299	98.12700	99.33298	105.50465	104.41776
1971:1	102.14999	98.75999	99.35298	102.34473	103.61955
1971:2	102.31999	99.52499	99.37198	102.75230	105.89645
1971:3	101.56000	102.17999	98.62099	112.23987	108.11879
1971:4	101.62000	101.89000	97.08698	108.85457	110.12376
1972:1	107.56999	109.01999	93.55899	108.54440	109.12715
1972:2	108.20000	109.81000	92.83699	110.92168	112.89137
1972:3	110.84000	111.45999	92.68098	115.46172	114.80888
1972:4	114.70000	112.48000	93.05698	111.03481	119.05669
1973:1	136.88998	119.64999	92.20999	116.77708	120.60527
1973:2	149.42999	130.47998	94.34099	116.95862	123.64799
1973:3	169.98999	143.42999	91.32399	128.03973	127.08800
1973:4	181.00000	146.12997	93.79398	130.85480	129.65253
1974:1	198.03000	149.51999	102.93999	136.65833	137.43692
1974:2	217.21997	166.62997	101.80997	140.21100	143.96881
1974:3	222.03000	176.62997	104.19998	154.75583	152.19952
1974:4	224.87000	180.25998	105.85999	162.72928	162.16504
1975:1	223.53000	189.64999	101.68997	170.58203	170.94049
1975:2	213.37000	187.69998	100.23999	173.54575	176.09613
1975:3	202.53998	179.88998	105.97998	191.32214	181.24512
1975:4	200.28998	177.16998	108.43999	182.41452	186.21024
1976:1	189.72998	164.12000	121.74998	209.31027	200.23727
1976:2	206.82999	182.56000	137.41998	205.98401	206.65341
1976:3	213.44998	185.18997	133.87997	215.32999	210.36594
1976:4	223.34000	190.75998	137.56998	205.92499	217.05408
1977:1	226.87000	189.93997	140.74997	237.95047	228.70081
1977:2	230.59000	195.59000	141.31998	246.34677	239.21017
1977:3	228.84000	198.07999	140.74997	247.54715	251.03836
1977:4	222.16998	199.28000	140.01999	255.64087	260.46649
1978:1	237.84998	211.56000	137.42996	266.33478	263.22815
1978:2	234.07999	217.32999	137.51996	273.54468	271.50317
1978:3	236.81000	222.45999	133.62000	275.37708	285.08105
1978:4	249.73999	228.48999	132.73999	300.70258	291.93127
1979:1	277.83997	246.81998	133.80997	296.55017	304.22443
1979:2	296.57996	253.95999	135.06998	315.89624	316.81207
1979:3	315.35999	266.19995	130.22998	316.49744	329.64032
1979:4	321.33997	276.12994	130.86996	347.62677	344.03900
1980:1	340.79895	292.83899	131.64999	361.79675	374.38184
1980:2	335.46295	288.27399	135.26999	381.09875	388.13391
1980:3	344.91699	303.32300	134.53998	378.11768	406.68207
1980:4	338.25696	297.49298	144.16998	394.73663	421.66400
1981:1	322.36597	296.31696	159.77997	403.02893	452.67438
1981:2	321.68896	279.46198	180.85999	424.48352	461.16150
1981:3	318.85797	287.34796	193.79999	435.90448	476.07922
1981:4	319.30396	282.58295	191.09998	454.41266	495.20294
1982:1	310.32697	277.79596	201.21997	485.76385	520.30396
1982:2	274.14398	270.16998	210.54996	502.11938	537.84790
1982:3	267.45398	277.39294	222.22995	507.77924	558.92310
1982:4	263.60297	259.78894	228.77997	530.96155	591.09766
1983:1	267.95996	280.40594	223.15997	567.68872	616.85925
1983:2	264.04797	243.13599	235.64996	583.34033	629.89575
1983:3	260.19299	252.04099	251.04999	581.16272	647.43542
1983:4	256.39496	236.09698	259.12994	611.41968	672.83154
1984:1	256.75397	243.37299	265.10992	629.20593	692.26123
1984:2	254.40997	244.28098	267.17993	652.77942	713.17505
1984:3	251.79700	234.74298	287.03998	629.57715	715.15735
1984:4	248.92200	220.36798	301.48993	670.30322	739.82764

RPRAW1 : (PRAW*ER)/P1

RPRAW2 : (PRAW*ER)/P2

COMP : (PMF*ER) /P1

PCD : DEFLATOR OF HOUSEHOLDS' CONSUMPTION '70=100
SOURCE: ISTAT

PI : DEFLATOR OF FIXED GROSS INVESTMENT IN MACHINERY '70=100
SOURCE: ISTAT

	RPRAW1	RPRAW2	COMP	PCD	PI
1970:1	106.63478	104.29115	105.94489	97.74149	99.75819
1970:2	102.16655	101.88437	103.36755	99.20761	99.44987
1970:3	98.07037	99.58600	99.07507	100.63054	97.86874
1970:4	93.86128	94.83830	92.38689	102.35432	102.94093
1971:1	99.16394	97.94394	95.87305	103.51512	106.41801
1971:2	98.95390	96.01587	96.25084	104.65854	109.57335
1971:3	89.23698	92.63837	89.78175	106.11725	112.15746
1971:4	90.63449	89.58992	90.87531	107.61760	113.44102
1972:1	92.71910	92.22397	93.96892	109.07161	113.03606
1972:2	90.55905	88.97900	91.90656	110.58878	114.31401
1972:3	88.97113	89.47705	89.46881	113.05214	116.18529
1972:4	96.12874	89.65170	94.26817	116.13039	118.32379
1973:1	108.09161	104.66063	94.47850	119.78549	124.73550
1973:2	120.53300	114.01215	105.24756	124.30553	132.55246
1973:3	121.24489	122.15288	102.30106	128.34708	138.04184
1973:4	129.73700	130.94006	104.74290	131.91534	141.15652
1974:1	149.16913	148.32407	112.62822	139.70761	157.86676
1974:2	157.72769	153.61075	120.99332	147.16376	165.08936
1974:3	149.49692	152.00784	118.92824	156.71127	176.98007
1974:4	146.28427	146.79324	117.26421	166.60785	191.71567
1975:1	133.25412	132.97470	113.05707	172.51529	194.11758
1975:2	123.24246	121.45755	108.41547	176.76352	198.64429
1975:3	112.19394	118.43179	99.64731	181.49106	203.17117
1975:4	119.06641	116.63936	105.32227	186.63013	207.92090
1976:1	110.36067	115.36125	95.46405	194.56268	214.83478
1976:2	137.98434	137.53738	121.79291	207.23309	230.48398
1976:3	132.71109	135.84271	115.14064	215.58038	240.22406
1976:4	149.20422	141.55405	127.43887	229.50522	249.76501
1977:1	134.19577	139.62323	112.35130	236.83716	258.21753
1977:2	132.28088	136.22736	112.20271	246.42813	272.87085
1977:3	130.11346	128.30399	112.62401	255.31866	274.16315
1977:4	121.68726	119.43279	109.14992	262.35760	285.97845
1978:1	122.73167	124.18016	109.16592	269.47113	287.13611
1978:2	117.67976	118.56462	109.25899	278.21350	288.97205
1978:3	114.90627	110.99492	107.94327	287.60156	297.31219
1978:4	110.24342	113.55579	100.86298	294.55737	308.61902
1979:1	125.36752	122.20505	111.37062	305.08698	317.06946
1979:2	126.81078	126.44420	108.58746	316.54388	323.67151
1979:3	129.76196	124.58830	109.53395	330.30872	337.14728
1979:4	120.97386	122.23543	103.953[illegible]8	346.96393	352.89551
1980:1	124.00934	119.84068	106.55775	365.69067	374.62341
1980:2	119.07169	116.91344	102.32208	381.02039	384.19202
1980:3	122.72667	114.10664	107.92690	398.76770	398.74127
1980:4	123.54187	115.65251	108.65361	417.49170	401.06189
1981:1	127.80130	113.78516	117.47423	436.76550	432.85956
1981:2	137.06223	126.16115	119.07056	456.86218	449.32666
1981:3	141.76193	129.79913	127.75282	474.75238	462.20966
1981:4	134.28098	123.22014	118.83823	495.09235	476.41248
1982:1	128.54800	120.01443	115.07257	513.09424	484.32532
1982:2	114.95474	107.31845	113.28836	531.56189	510.03760
1982:3	117.05142	106.34071	121.40121	557.41284	508.90283
1982:4	113.58087	102.02557	111.93750	579.82617	528.69763
1983:1	105.33578	96.93935	110.22833	600.66443	526.63672
1983:2	106.66653	98.78284	98.21880	619.53491	548.03784
1983:3	112.39786	100.89261	108.87636	637.18762	550.89600
1983:4	108.66449	98.74628	100.06187	656.23486	560.58704
1984:1	108.18085	98.32709	102.54289	674.01392	579.50439
1984:2	104.12897	95.31075	99.98320	693.48926	614.66882
1984:3	114.80055	101.06281	107.02519	706.09814	608.18127
1984:4	111.96049	101.43915	99.11743	718.00403	612.33948

EM1 NO. OF EMPLOYEES IN SECTOR 1 (THOUSAND)
SOURCE: BANK OF ITALY; THE SERIES IS NET
OF WORKERS IN C. I. G.
OCD2 NO. OF EMPLOYEES IN SECTOR 2 (THOUSAND)
SOURCE: ISTAT
CL1 : COST OF LABOUR PER EMPLOYEE SECTOR 1:
TOTAL LABOUR COST / EM1
MILLION LIRAS
SOURCE: ISTAT
CL2 : COST OF LABOUR PER EMPLOYEE SECTOR 2:
TOTAL LABOUR COST / OCD2
MILLION LIRAS
SOURCE: ISTAT
RCL1 : REAL COST OF LABOUR PER EMPLOYEE SECTOR 1
CL1/P1 ; MILLION LIRAS
RCL2 : REAL COST OF LABOUR PER EMPLOYEE SECTOR 2
CL2/P2 ; MILLION LIRAS

		EM1	OCD2	CL1	CL2	RCL1	RCL2
1970:1	:	4774.91016	4708.42969	0.58972	0.53191	0.63065	0.55633
1970:2	:	4792.28516	4716.51953	0.59240	0.55138	0.60114	0.55796
1970:3	:	4824.66211	4705.65918	0.61711	0.58189	0.60189	0.57631
1970:4	:	4852.24316	4685.37988	0.63865	0.60352	0.60533	0.57799
1971:1	:	4865.12695	4654.88867	0.65810	0.62448	0.64302	0.60267
1971:2	:	4833.23633	4676.65918	0.67154	0.63811	0.65355	0.60258
1971:3	:	4812.31934	4638.74902	0.69098	0.65605	0.61563	0.60679
1971:4	:	4793.39746	4633.68945	0.71364	0.66942	0.65559	0.60788
1972:1	:	4798.25000	4682.06934	0.74244	0.68654	0.68400	0.62912
1972:2	:	4813.43652	4649.78906	0.74569	0.70183	0.67226	0.62169
1972:3	:	4815.44434	4637.03906	0.75056	0.72481	0.65005	0.63132
1972:4	:	4817.50781	4655.09961	0.78912	0.75168	0.71069	0.63136
1973:1	:	4834.29492	4618.11914	0.79947	0.80764	0.68461	0.66966
1973:2	:	4892.67578	4663.37891	0.90303	0.84449	0.77209	0.68298
1973:3	:	4964.49316	4711.04980	0.97175	0.89498	0.75894	0.70422
1973:4	:	5005.83105	4743.44922	0.99984	0.93695	0.76408	0.72266
1974:1	:	5050.51367	4738.60937	1.04212	0.99092	0.76257	0.72100
1974:2	:	5035.69824	4732.80957	1.12819	1.03912	0.80464	0.72176
1974:3	:	4997.73145	4775.40918	1.15327	1.10974	0.74522	0.72914
1974:4	:	4996.71875	4829.17969	1.21277	1.17685	0.74527	0.72571
1975:1	:	4926.82227	4804.46875	1.33553	1.25459	0.78293	0.73393
1975:2	:	4884.76172	4787.01953	1.38126	1.32017	0.79590	0.74969
1975:3	:	4880.34766	4817.16895	1.45823	1.36325	0.76219	0.75216
1975:4	:	4873.31641	4807.33984	1.50398	1.41457	0.82449	0.75967
1976:1	:	4874.35352	4827.74902	1.52550	1.46213	0.72882	0.73020
1976:2	:	4955.01758	4970.82910	1.67303	1.55445	0.81221	0.75220
1976:3	:	5036.72363	4839.79883	1.80146	1.64060	0.83661	0.77988
1976:4	:	5053.64062	4941.61914	1.90694	1.72420	0.92604	0.79436
1977:1	:	5040.41992	4889.34961	1.91617	1.79846	0.80528	0.78638
1977:2	:	5018.55957	4917.63965	2.06964	1.90756	0.84013	0.79744
1977:3	:	4950.25000	4898.99902	2.12561	1.98503	0.85867	0.79073
1977:4	:	4900.23730	4914.00977	2.18585	2.05503	0.85505	0.78898
1978:1	:	4914.03613	4948.08984	2.29835	2.11469	0.86296	0.80337
1978:2	:	4896.15234	4990.38867	2.33301	2.18445	0.85288	0.80458
1978:3	:	4896.75293	5009.01953	2.41329	2.28154	0.87636	0.80031
1978:4	:	4894.41699	5052.49902	2.50181	2.36386	0.83199	0.80973
1979:1	:	4885.21973	5117.06934	2.61221	2.42664	0.88086	0.79765
1979:2	:	4940.16113	5142.29980	2.63977	2.53523	0.83565	0.80023
1979:3	:	4958.39453	5178.82910	2.83209	2.68363	0.89482	0.81411
1979:4	:	5006.22461	5189.78906	2.98560	2.81559	0.85885	0.81839
1980:1	:	4986.51660	5175.98926	3.11787	2.99200	0.86177	0.79918
1980:2	:	4988.47266	5237.03906	3.24925	3.15538	0.85260	0.81296
1980:3	:	4934.88281	5290.56934	3.36897	3.31093	0.89099	0.81413
1980:4	:	4853.36133	5328.40918	3.50666	3.46839	0.88835	0.82255
1981:1	:	4784.81152	5334.82910	3.71147	3.58442	0.92089	0.79183
1981:2	:	4716.39453	5357.36914	4.03999	3.75972	0.95174	0.81527
1981:3	:	4664.14355	5420.12891	4.23437	3.90515	0.97140	0.82027
1981:4	:	4621.57617	5411.66895	4.46837	4.09822	0.98333	0.82758
1982:1	:	4642.17090	5452.32910	4.57004	4.25047	0.94079	0.81692
1982:2	:	4585.41406	5457.97949	4.75994	4.40215	0.94797	0.81847
1982:3	:	4509.80762	5459.68945	5.01538	4.56865	0.98771	0.81740
1982:4	:	4448.28906	5502.00977	5.24480	4.77689	0.98779	0.80814
1983:1	:	4398.70215	5503.37988	5.35440	5.00284	0.94319	0.81102
1983:2	:	4323.71191	5495.80957	5.63243	5.16966	0.96555	0.82072
1983:3	:	4317.92773	5494.09863	5.92821	5.35748	1.02006	0.82749
1983:4	:	4264.05664	5538.71973	6.09293	5.49576	0.99652	0.81681
1984:1	:	4196.77539	5573.74902	6.36379	5.64288	1.01140	0.81514
1984:2	:	4139.69238	5610.33887	6.42545	5.75719	0.98432	0.80726
1984:3	:	4060.10645	5647.65918	6.57042	5.90432	1.04362	0.82560
1984:4	:	4058.72021	5680.23926	6.79377	6.04338	1.01354	0.81686

GWE1 : GROSS WAGES PER EMPLOYEE SECTOR 1
TOTAL GROSS WAGES / EM1
MILLION LIRAS
SOURCE : ISTAT

GWE2 . GROSS WAGES PER EMPLOYEE SECTOR 2
TOTAL GROSS WAGES / OCD2
MILLION LIRAS
SOURCE : ISTAT

RGW1 : REAL GROSS WAGES PER EMPLOYEE SECTOR 1
GWE1 / PCD

RGW2 : REAL GROSS WAGES PER EMPLOYEE SECTOR 2
GWE2 / PCD

T11 : TAX RATE ON LABOUR COSTS BORNE BY FIRMS
IN SECTOR 1; % ON GWE1

T12 : TAX RATE ON LABOUR COSTS BORNE BY FIRMS
IN SECTOR 2; % ON GWE2

	GWE1	GWE2	RGW1	RGW2	T11	T12
1970:1	0.39823	0.37210	0.40744	0.38070	48.08401	42.94613
1970:2	0.40056	0.38547	0.40376	0.38855	47.89201	43.03888
1970:3	0.41727	0.40659	0.41466	0.40404	47.89201	43.11327
1970:4	0.43239	0.42198	0.42245	0.41228	47.70001	43.02023
1971:1	0.44771	0.43332	0.43251	0.41860	46.99203	44.11756
1971:2	0.45806	0.44193	0.43767	0.42226	46.60402	44.39056
1971:3	0.47194	0.45333	0.44474	0.42720	46.41202	44.71828
1971:4	0.48742	0.46233	0.45292	0.42960	46.41202	44.79256
1972:1	0.50346	0.47425	0.46158	0.43481	47.46801	44.76353
1972:2	0.50566	0.48491	0.45724	0.43848	47.46802	44.73349
1972:3	0.50897	0.50084	0.45020	0.44301	47.46800	44.72076
1972:4	0.53511	0.51944	0.46078	0.44729	47.46799	44.70904
1973:1	0.55124	0.56192	0.46019	0.46910	45.03201	43.72921
1973:2	0.62345	0.58778	0.50155	0.47285	44.84400	43.67452
1973:3	0.67089	0.62294	0.52272	0.48536	44.84399	43.67000
1973:4	0.68939	0.65198	0.52260	0.49424	45.03201	43.70870
1974:1	0.71858	0.67662	0.51435	0.49431	45.02400	46.45017
1974:2	0.77592	0.70596	0.52725	0.47971	45.39999	47.19252
1974:3	0.78608	0.75155	0.50161	0.47958	46.71201	47.66065
1974:4	0.82692	0.79617	0.49633	0.47787	46.66201	47.81477
1975:1	0.90332	0.84915	0.52361	0.49222	47.84800	47.74704
1975:2	0.93424	0.89305	0.52853	0.50522	47.84801	47.82653
1975:3	0.98695	0.92129	0.54380	0.50762	47.75201	47.97099
1975:4	1.01857	0.95522	0.54577	0.51182	47.65600	48.08943
1976:1	1.02927	0.98737	0.52902	0.50748	48.21200	48.08355
1976:2	1.12881	1.04684	0.54471	0.50515	48.21201	48.48896
1976:3	1.21625	1.10199	0.56418	0.51117	48.11601	48.87566
1976:4	1.28810	1.15938	0.56125	0.50517	48.04301	48.71722
1977:1	1.34667	1.25199	0.56860	0.52863	42.28999	43.64837
1977:2	1.48202	1.33386	0.60140	0.54128	39.64999	43.01044
1977:3	1.53120	1.38989	0.59972	0.54437	38.82000	42.81898
1977.4	1.57210	1.43833	0.59922	0.54823	39.04000	42.87592
1978:1	1.65029	1.47846	0.61242	0.54865	39.27000	43.03275
1978:2	1.67313	1.52681	0.60138	0.54879	39.44000	43.07342
1978:3	1.74320	1.60251	0.60612	0.55720	38.44001	42.37283
1978:4	1.80806	1.66216	0.61382	0.56429	38.37002	42.21642
1979:1	1.88621	1.71581	0.61825	0.56240	38.49000	41.42808
1979:2	1.90240	1.79159	0.60079	0.56599	38.76000	41.50684
1979:3	2.03997	1.89650	0.61759	0.57416	38.83002	41.50416
1979:4	2.14114	1.98744	0.61711	0.57281	39.44001	41.66897
1980:1	2.25410	2.10998	0.61639	0.57698	38.32001	41.80211
1980:2	2.34315	2.22370	0.61497	0.58362	38.67001	41.89773
1980:3	2.53497	2.35504	0.63570	0.59058	32.89999	40.58898
1980:4	2.64714	2.46931	0.63406	0.59146	32.47001	40.46026
1981:1	2.78221	2.55569	0.63700	0.58514	33.40001	40.25249
1981:2	3.02848	2.68021	0.66289	0.58666	33.39999	40.27686
1981:3	3.17419	2.78371	0.66860	0.58635	33.40000	40.28602
1981:4	3.34960	2.92160	0.67656	0.59011	33.39999	40.27334
1982:1	3.33093	3.02389	0.64919	0.58934	37.20000	40.56294
1982:2	3.46934	3.13137	0.65267	0.58909	37.20000	40.58224
1982:3	3.59990	3.18758	0.64582	0.57185	39.32000	43.32650
1982:4	3.76457	3.33256	0.64926	0.57475	39.32001	43.34006
1983:1	3.79556	3.46738	0.63189	0.57726	41.07001	44.28324
1983:2	3.99265	3.58288	0.64445	0.57832	41.07001	44.28791
1983:3	4.20232	3.71396	0.65951	0.58287	41.07002	44.25246
1983:4	4.31786	3.80898	0.65797	0.58043	41.11002	44.28448
1984:1	4.44641	3.89269	0.65969	0.57754	43.12199	44.96107
1984:2	4.48949	3.97140	0.64738	0.57267	43.12200	44.96631
1984:3	4.59078	4.07252	0.65016	0.57676	43.12202	44.97953
1984:4	4.74684	4.16826	0.66112	0.58053	43.12202	44.98591

```
WED1    :  TAX WEDGE IN SECTOR 1
           (PCD*(1+T11)/P1
WED2    :  TAX WEDGE IN SECTOR 2
           (PCD*(1+T12)/P2
RBC     :  NOMINAL RATE OF INTEREST ON BANK LOANS
           %
           SOURCE : PROMETEIA
RRBC1   :  EXPECTED REAL INTEREST RATE IN SECTOR 1
           RBC - ((P1(1)-P1(-3))-1)*100
           %
RRBC2   :  EXPECTED REAL INTEREST RATE IN SECTOR 2
           RBC - ((P2(1)-P2(-3))-1)*100
           %
```

	WED1	WED2	RBC	RRBC1	RRBC2
1970:1	1.54785	1.46131	8.22000	MISSING VALU	MISSING VALU
1970:2	1.48885	1.43601	9.15000	MISSING VALU	MISSING VALU
1970:3	1.45154	1.42635	9.58000	MISSING VALU	MISSING VALU
1970:4	1.43290	1.40194	9.66000	0.21185	1.28396
1971:1	1.48673	1.43972	9.53000	5.26169	2.36795
1971:2	1.49324	1.42703	9.14000	-0.33193	2.05780
1971:3	1.38425	1.42039	8.86000	5.68486	3.39540
1971:4	1.44748	1.41497	8.60000	2.54236	3.28479
1972:1	1.48184	1.44690	8.32000	0.36945	1.71457
1972:2	1.47025	1.41781	7.91000	5.03950	1.72227
1972:3	1.44390	1.42506	7.74000	5.73711	-0.37171
1972:4	1.54236	1.41152	7.56000	-0.02462	-2.95811
1973:1	1.48768	1.42752	7.61000	2.16747	-1.91829
1973:2	1.53943	1.44439	7.56000	-3.33367	-3.13526
1973:3	1.45192	1.45093	8.57000	-9.28025	-0.32983
1973:4	1.46207	1.46217	9.51000	-7.51495	-4.44598
1974:1	1.48260	1.48870	10.09000	-9.79086	-6.34441
1974:2	1.52610	1.50459	13.02000	-7.84547	-6.73916
1974:3	1.48566	1.52038	16.38000	-7.97866	-8.69665
1974:4	1.50158	1.51864	17.37000	-7.45374	-7.00742
1975:1	1.49524	1.49108	17.90000	-5.87470	-4.41547
1975:2	1.50589	1.48387	15.92000	-7.70839	-3.16389
1975:3	1.40160	1.48172	14.26000	2.16307	-0.56761
1975:4	1.51068	1.48423	12.25000	-10.45359	-4.88859
1976:1	1.37769	1.43887	12.81000	-5.88148	-4.54261
1976:2	1.49111	1.48905	17.63000	5.08161	1.56291
1976:3	1.48288	1.52566	19.27000	6.38151	2.70601
1976:4	1.64995	1.57248	19.60000	5.91687	5.38510
1977:1	1.41624	1.48759	19.71000	0.11491	3.95572
1977:2	1.39696	1.47326	19.32000	4.35824	-0.01413
1977:3	1.43178	1.45254	18.27000	-5.87271	-1.73074
1977:4	1.42693	1.43913	17.02000	5.09134	1.92283
1978:1	1.40910	1.46425	16.50000	5.45950	3.00015
1978:2	1.41820	1.46610	16.19000	4.94773	2.62925
1978:3	1.44586	1.43632	16.06000	-1.56696	3.97983
1978:4	1.35542	1.43496	15.26000	3.91511	-0.31443
1979:1	1.42477	1.41829	15.30000	-0.18250	-1.38816
1979:2	1.39044	1.41387	15.03000	0.09762	-0.60039
1979:3	1.44888	1.41791	15.01000	-0.59485	-2.83931
1979:4	1.39174	1.42873	16.36000	-5.64187	-6.70107
1980:1	1.39809	1.38510	18.73000	-1.91048	-3.78235
1980:2	1.38641	1.39297	19.15000	-0.31943	-4.22146
1980:3	1.40158	1.37853	19.51000	5.95815	-3.05285
1980:4	1.40106	1.39070	20.25000	8.85349	-0.66249
1981:1	1.44567	1.35323	20.63000	9.24587	1.81495
1981:2	1.43575	1.38969	21.86000	6.57724	4.79577
1981:3	1.45289	1.39895	22.54000	7.42206	5.09982
1981:4	1.45342	1.40242	22.29000	1.76171	7.34999
1982:1	1.44919	1.38615	22.11000	3.82051	5.48103
1982:2	1.45245	1.38939	21.83000	5.34135	4.42872
1982:3	1.52938	1.42939	21.65000	4.80432	2.28527
1982:4	1.52142	1.40607	20.99000	4.12484	2.43252
1983:1	1.49264	1.40495	20.67000	4.49438	3.55590
1983:2	1.49823	1.41915	19.60000	5.14815	3.76377
1983:3	1.54669	1.41969	19.08000	3.92671	5.25252
1983:4	1.51453	1.40725	19.00000	8.16357	6.77647
1984:1	1.53314	1.41140	18.38000	6.47630	5.15887
1984:2	1.52048	1.40965	17.61000	9.27938	7.14997
1984:3	1.60518	1.43143	17.43000	7.79937	7.47266
1984:4	1.53307	1.40709	17.49000	MISSING VALU	MISSING VALU

RIFLI REAL INVESTMENT OF SECTOR 1 PRICES OF 1970
BILLION LIRAS
OUR ELABORATION ON ISTAT SERIES
RI2 REAL INVESTMENT OF SECTOR 2 PRICES OF 1970
BILLION LIRAS
OUR ELABORATION ON ISTAT SERIES
K1 : CAPITAL STOCK OF SECTOR 1 PRICES OF 1970
BILLION LIRAS
OUR ELABORATION ON ISTAT SERIES
K2 : CAPITAL STOCK OF SECTOR 2 PRICES OF 1970
BILLION LIRAS
OUR ELABORATION ON ISTAT SERIES
REXP REAL EXPENDITURE PRICES OF 1970
INVESTMENT+CONSUMPTION+TRADE BALANCE
SOURCE : ISTAT
UC : UNEMPLOYMENT RATE NET OF WORKERS IN C. I. G.
SOURCE : BANK OF ITALY

	RIFLI	RI2	K1	K2	REXP	UC
1970:1	935.18994	830.45996	27421.79687	25622.00000	15356.68750	5.45000
1970:2	964.92993	858.55994	27836.00000	26119.00000	15387.29883	5.55000
1970:3	938.02991	833.96997	28272.00000	26638.00000	15533.75781	5.60000
1970:4	933.62988	831.26990	28672.89844	27126.00000	15527.87891	5.50000
1971:1	948.37988	877.43994	29061.74609	27604.00000	15598.01953	5.60000
1971:2	944.16992	873.69995	29457.95703	28123.00000	15853.14844	5.70000
1971:3	924.13989	855.38989	29842.39844	28631.00000	15972.56836	5.90000
1971:4	938.14990	868.48999	30199.55859	29114.00000	16093.84766	6.30000
1972:1	923.62988	925.79993	30563.89844	29604.00000	16410.63672	6.50000
1972:2	887.70996	888.55994	30906.79687	30145.00000	16391.65625	6.70000
1972:3	918.05994	919.67993	31207.29687	30642.00000	16335.41797	6.80000
1972:4	910.67993	911.62988	31532.39844	31163.00000	16412.89844	6.70000
1973:1	954.51990	936.37988	31844.00000	31670.00000	16513.68750	7.10000
1973:2	1003.00000	986.92993	32193.49609	32194.00000	16911.86719	6.80000
1973:3	1066.79980	1053.19995	32584.79687	32763.00000	17304.95703	6.00000
1973:4	1088.69995	1075.29980	33032.49219	33390.00000	17701.92578	5.70000
1974:1	1119.09985	1080.25977	33493.59375	34031.00000	17644.87891	5.40000
1974:2	1113.49976	1075.38989	33976.29687	34669.00000	17913.37500	5.40000
1974:3	1101.89990	1063.19995	34444.19531	35294.00000	17937.93750	5.90000
1974:4	1030.49976	992.23999	34891.69531	35898.00000	17843.02734	6.10000
1975:1	873.81995	940.09998	35259.29687	36424.00000	17787.17578	6.60000
1975:2	860.73999	926.03992	35463.19531	36891.00000	17652.21484	6.80000
1975:3	831.48999	892.96997	35650.09375	37337.00000	17672.28906	6.90000
1975:4	852.71997	918.02991	35804.19531	37745.00000	17881.51562	7.10000
1976.1	830.00000	992.43994	35976.69531	38172.00000	18026.87891	7.30000
1976:2	829.38989	991.60999	36123.09375	38668.00000	17946.27734	7.30000
1976:3	849.94995	1017.44995	36266.19531	39157.00000	18667.34766	7.30000
1976:4	868.56995	1041.55981	36427.09375	39665.00000	18505.26562	7.20000
1977:1	863.73999	1065.33984	36603.49219	40191.00000	18637.44922	7.40000
1977:2	848.98999	1046.62988	36771.79687	40734.00000	18887.40625	7.70000
1977:3	822.30994	1012.34998	36922.09375	41251.00000	18944.47656	7.90000
1977:4	812.95996	998.87000	37042.89844	41727.00000	19062.75781	7.90000
1978:1	782.94995	1012.90991	37152.00000	42576.00000	19150.03516	7.80000
1978:2	800.09998	1037.69995	37229.09375	43040.00000	19401.80859	7.90000
1978:3	807.54993	1046.95996	37321.89844	43522.00000	19417.23437	8.00000
1978:4	815.24988	1057.59985	37420.29687	44008.00000	19831.50781	8.10000
1979:1	859.83997	1043.48999	37758.39844	44498.00000	19766.71875	8.30000
1979:2	873.25989	1062.46997	37862.00000	44967.00000	20274.15625	8.40000
1979:3	898.37988	1094.29980	37978.00000	45450.00000	20473.53516	8.40000
1979:4	951.67993	1162.95996	38116.89844	45958.00000	20474.92969	8.00000
1980:1	1004.79993	1189.27979	38306.19531	46528.00000	20690.64453	7.90000
1980:2	1013.79993	1202.54980	38544.89844	47117.00000	20787.26172	8.10000
1980:3	1032.39990	1227.75977	38787.79687	47712.00000	20185.33594	8.40000
1980:4	1065.89990	1273.28979	39044.39844	48324.00000	20789.54687	8.50000
1981:1	1031.00000	1338.07983	39329.49219	48974.00000	20931.98828	9.20000
1981:2	1010.00000	1304.86987	39573.89844	49680.00000	21194.79297	9.80000
1981:3	966.12000	1236.87988	39792.39844	50344.00000	21516.06641	10.20000
1981:4	957.81995	1225.56982	39962.69531	50932.00000	21589.85547	10.60000
1982:1	902.33997	1278.17993	40121.19531	51812.00000	21207.49609	10.30000
1982:2	886.28992	1254.01978	40221.09375	52426.00000	21301.12500	10.40000
1982:3	858.43994	1212.64990	40303.00000	53009.00000	21058.60937	10.80000
1982:4	861.89990	1217.38989	40355.39844	53543.00000	21262.67578	11.10000
1983:1	803.81995	1219.04980	40410.19531	54075.00000	21044.97656	11.60000
1983:2	814.31995	1238.24976	40405.79687	54602.00000	21233.74609	11.80000
1983:3	810.62000	1231.10986	40412.00000	55141.00000	21089.57422	11.80000
1983:4	828.10999	1265.59985	40414.39844	55667.00000	21716.24609	12.20000
1984:1	843.45996	1248.79980	40434.19531	56220.00000	21546.73437	12.40000
1984:2	862.90991	1290.96997	40469.00000	56749.00000	21483.91406	12.10000
1984:3	886.31995	1331.69995	40522.49219	57314.00000	21875.71484	12.20000
1984:4	917.27991	1399.76978	40598.39844	57912.00000	21868.56641	12.10000

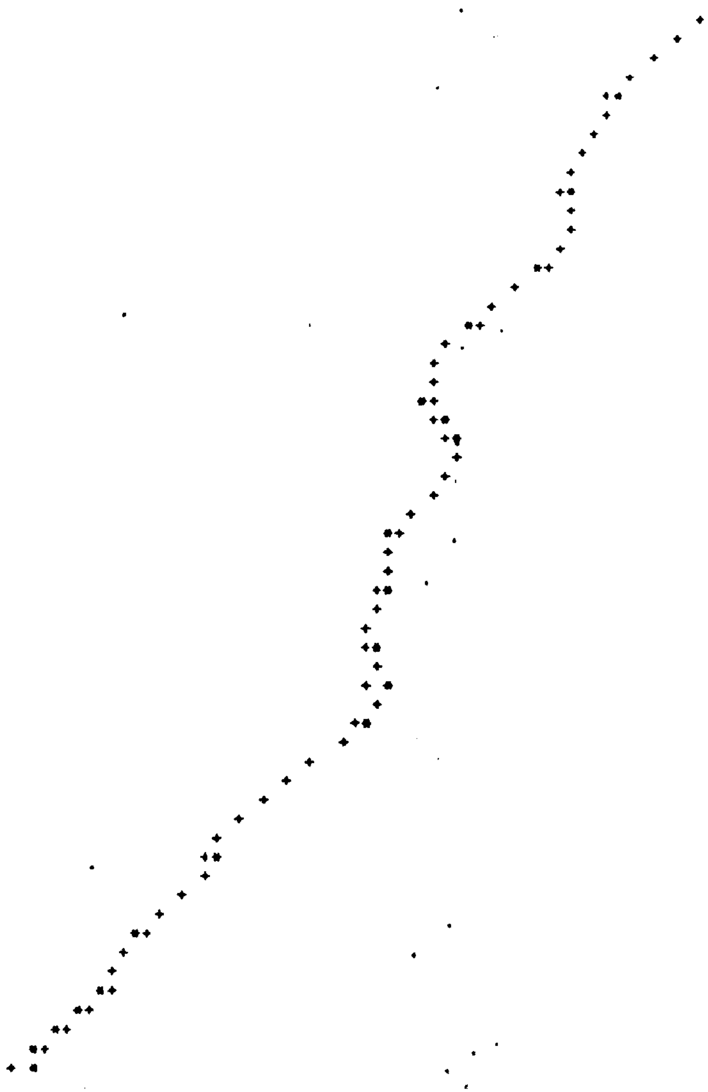
APPENDIX III

PLOTS OF ACTUAL, FITTED VALUES AND RESIDUALS OF THE REGRESSIONS

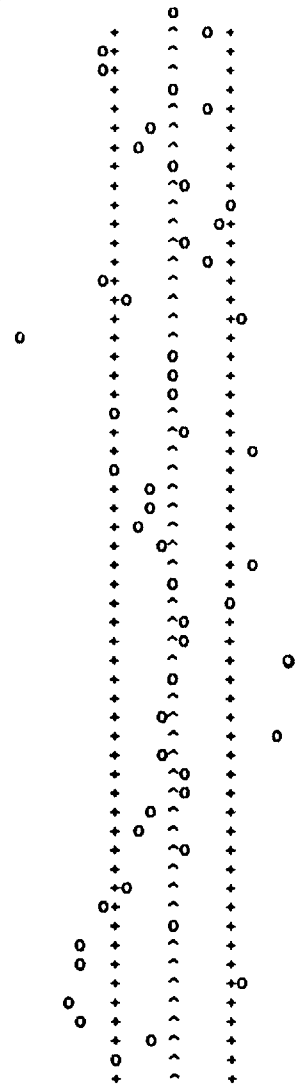
METHOD OF ESTIMATION : INSTRUMENTAL VARIABLES

THREE STAGE LEAST SQUARES ESTIMATES OF THE MODEL

PLOT OF ACTUAL(*) AND FITTED(+) VALUES



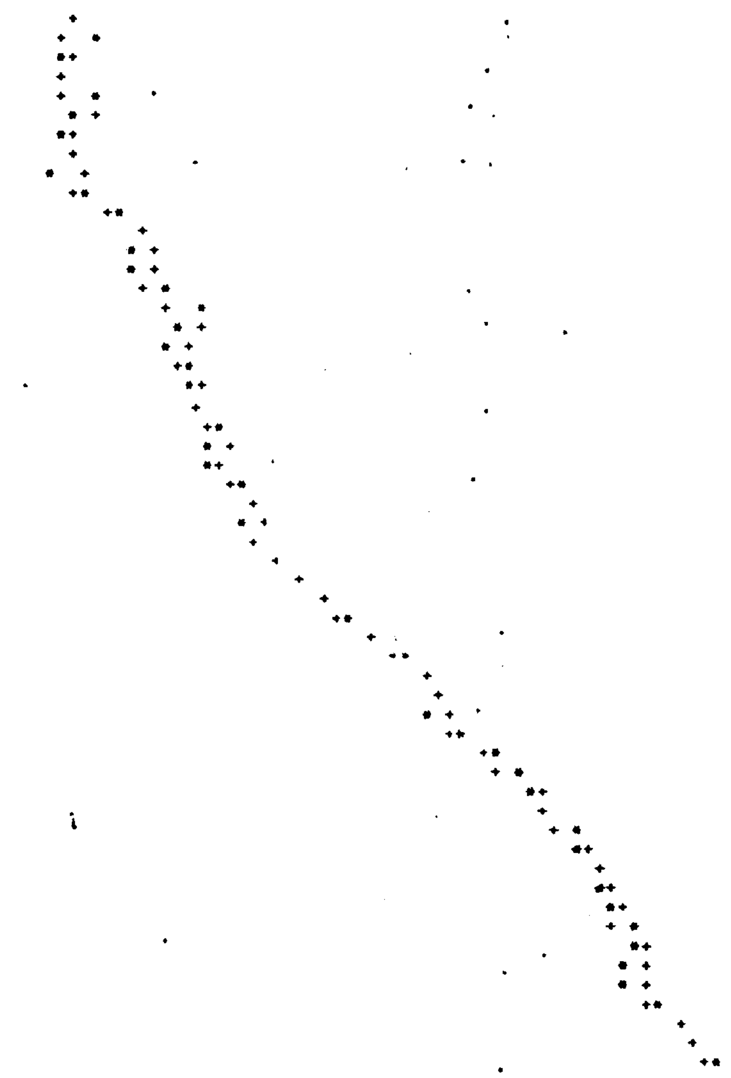
PLOT OF RESIDUALS(O)



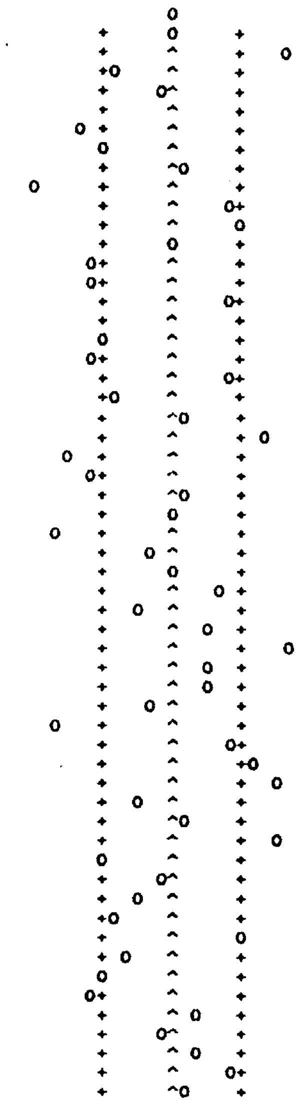
ID	ACTUAL	FITTED	RESIDUAL
1971:1	-1.7873	-1.7904	0.0031
1971:2	-1.8074	-1.8008	-0.0067
1971:3	-1.8248	-1.8186	-0.0061
1971:4	-1.8406	-1.8404	-0.0002
1972:1	-1.8516	-1.8545	0.0029
1972:2	-1.8596	-1.8573	-0.0023
1972:3	-1.8688	-1.8654	-0.0035
1972:4	-1.8788	-1.8785	-0.0002
1973:1	-1.8851	-1.8863	0.0012
1973:2	-1.8840	-1.8894	0.0053
1973:3	-1.8815	-1.8853	0.0038
1973:4	-1.8869	-1.8877	0.0008
1974:1	-1.8919	-1.8954	0.0035
1974:2	-1.9091	-1.9029	-0.0062
1974:3	-1.9304	-1.9258	-0.0045
1974:4	-1.9435	-1.9498	0.0063
1975:1	-1.9680	-1.9541	-0.0139
1975:2	-1.9824	-1.9825	0.0001
1975:3	-1.9885	-1.9886	0.0000
1975:4	-1.9943	-1.9944	0.0001
1976:1	-1.9989	-1.9938	-0.0051
1976:2	-1.9865	-1.9879	0.0014
1976:3	-1.9741	-1.9815	0.0074
1976:4	-1.9752	-1.9701	-0.0051
1977:1	-1.9827	-1.9801	-0.0026
1977:2	-1.9916	-1.9895	-0.0021
1977:3	-2.0094	-2.0062	-0.0032
1977:4	-2.0228	-2.0215	-0.0013
1978:1	-2.0229	-2.0305	0.0076
1978:2	-2.0286	-2.0285	-0.0001
1978:3	-2.0310	-2.0364	0.0054
1978:4	-2.0341	-2.0353	0.0011
1979:1	-2.0450	-2.0459	0.0009
1979:2	-2.0366	-2.0475	0.0110
1979:3	-2.0359	-2.0362	0.0003
1979:4	-2.0300	-2.0436	0.0136
1980:1	-2.0389	-2.0379	-0.0010
1980:2	-2.0447	-2.0549	0.0102
1980:3	-2.0618	-2.0607	-0.0010
1980:4	-2.0850	-2.0857	0.0007
1981:1	-2.1065	-2.1073	0.0007
1981:2	-2.1271	-2.1251	-0.0020
1981:3	-2.1438	-2.1404	-0.0034
1981:4	-2.1572	-2.1584	0.0012
1982:1	-2.1567	-2.1693	0.0126
1982:2	-2.1715	-2.1674	-0.0041
1982:3	-2.1902	-2.1838	-0.0064
1982:4	-2.2052	-2.2053	0.0000
1983:1	-2.2178	-2.2094	-0.0084
1983:2	-2.2349	-2.2262	-0.0087
1983:3	-2.2364	-2.2428	0.0065
1983:4	-2.2490	-2.2394	-0.0095
1984:1	-2.2654	-2.2566	-0.0087
1984:2	-2.2799	-2.2780	-0.0019
1984:3	-2.3006	-2.2948	-0.0059
1984:4	-2.3029	-2.3192	0.0163

EMPLOYMENT : SECTOR 2

PLOT OF ACTUAL(*) AND FITTED(+) VALUES



PLOT OF RESIDUALS(O)

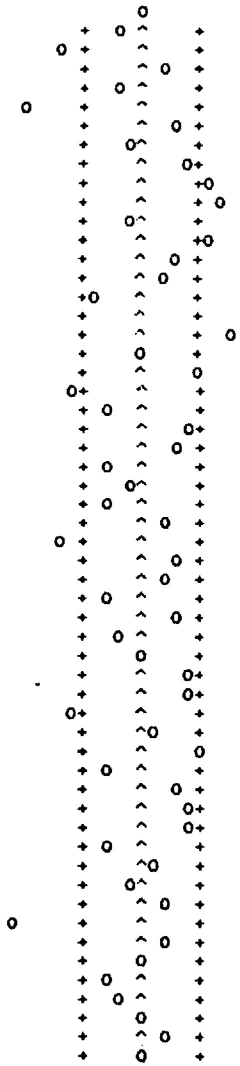


ID	ACTUAL	FITTED	RESIDUAL
1971:1	8.4457	8.4454	0.0002
1971:2	8.4503	8.4422	0.0081
1971:3	8.4422	8.4461	-0.0039
1971:4	8.4411	8.4418	-0.0007
1972:1	8.4515	8.4397	0.0118
1972:2	8.4446	8.4507	-0.0061
1972:3	8.4418	8.4462	-0.0043
1972:4	8.4457	8.4449	0.0008
1973:1	8.4377	8.4469	-0.0091
1973:2	8.4475	8.4437	0.0038
1973:3	8.4577	8.4533	0.0043
1973:4	8.4645	8.4645	0.0000
1974:1	8.4635	8.4687	-0.0052
1974:2	8.4623	8.4675	-0.0052
1974:3	8.4712	8.4670	0.0042
1974:4	8.4824	8.4731	0.0093
1975:1	8.4773	8.4822	-0.0049
1975:2	8.4737	8.4790	-0.0054
1975:3	8.4799	8.4757	0.0042
1975:4	8.4779	8.4817	-0.0038
1976:1	8.4821	8.4813	0.0008
1976:2	8.4910	8.4846	0.0065
1976:3	8.4846	8.4914	-0.0068
1976:4	8.4850	8.4906	-0.0056
1977:1	8.4948	8.4941	0.0007
1977:2	8.5006	8.5008	-0.0003
1977:3	8.4968	8.5046	-0.0078
1977:4	8.4998	8.5015	-0.0016
1978:1	8.5068	8.5067	0.0000
1978:2	8.5153	8.5120	0.0033
1978:3	8.5190	8.5211	-0.0021
1978:4	8.5276	8.5249	0.0027
1979:1	8.5403	8.5328	0.0075
1979:2	8.5453	8.5426	0.0026
1979:3	8.5523	8.5499	0.0024
1979:4	8.5544	8.5560	-0.0016
1980:1	8.5518	8.5597	-0.0079
1980:2	8.5635	8.5594	0.0041
1980:3	8.5737	8.5682	0.0055
1980:4	8.5808	8.5736	0.0072
1981:1	8.5820	8.5845	-0.0025
1981:2	8.5862	8.5858	0.0004
1981:3	8.5979	8.5911	0.0068
1981:4	8.5963	8.6012	-0.0049
1982:1	8.6038	8.6046	-0.0008
1982:2	8.6048	8.6072	-0.0023
1982:3	8.6051	8.6087	-0.0036
1982:4	8.6129	8.6080	0.0049
1983:1	8.6131	8.6164	-0.0033
1983:2	8.6117	8.6162	-0.0044
1983:3	8.6114	8.6169	-0.0054
1983:4	8.6195	8.6176	0.0019
1984:1	8.6258	8.6268	-0.0010
1984:2	8.6324	8.6306	0.0018
1984:3	8.6390	8.6353	0.0037
1984:4	8.6447	8.6437	0.0010

INVESTMENT : SECTOR 1

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(O)



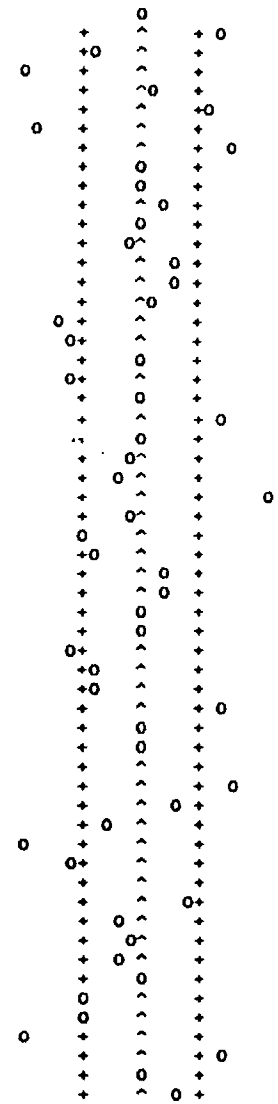
ID	ACTUAL	FITTED	RESIDUAL
1971:2	-3.4404	-3.4237	-0.0167
1971:3	-3.4748	-3.4273	-0.0476
1971:4	-3.4717	-3.4864	0.0147
1972:1	-3.4993	-3.4861	-0.0132
1972:2	-3.5501	-3.4815	-0.0685
1972:3	-3.5261	-3.5492	0.0231
1972:4	-3.5446	-3.5408	-0.0038
1973:1	-3.5074	-3.5368	0.0294
1973:2	-3.4688	-3.5117	0.0430
1973:3	-3.4192	-3.4694	0.0502
1973:4	-3.4125	-3.4048	-0.0077
1974:1	-3.3988	-3.4401	0.0413
1974:2	-3.4182	-3.4364	0.0183
1974:3	-3.4423	-3.4524	0.0101
1974:4	-3.5222	-3.4954	-0.0268
1975:1	-3.6976	-3.5969	-0.10080
1975:2	-3.7185	-3.7715	0.0530
1975:3	-3.7583	-3.7592	0.0009
1975:4	-3.7374	-3.7718	0.0344
1976:1	-3.7692	-3.7317	-0.0375
1976:2	-3.7740	-3.7508	-0.0232
1976:3	-3.7535	-3.7803	0.0268
1976:4	-3.7362	-3.7537	0.0175
1977:1	-3.7466	-3.7291	-0.0176
1977:2	-3.7684	-3.7648	-0.0037
1977:3	-3.8044	-3.7838	-0.0206
1977:4	-3.8192	-3.8297	0.0105
1978:1	-3.8597	-3.8143	-0.0454
1978:2	-3.8401	-3.8619	0.0218
1978:3	-3.8333	-3.8443	0.0110
1978:4	-3.8265	-3.8092	-0.0173
1979:1	-3.7834	-3.8066	0.0233
1979:2	-3.7695	-3.7574	-0.0120
1979:3	-3.7442	-3.7433	-0.0009
1979:4	-3.6902	-3.7177	0.0276
1980:1	-3.6408	-3.6660	0.0251
1980:2	-3.6381	-3.6010	-0.0371
1980:3	-3.6262	-3.6337	0.0075
1980:4	-3.6009	-3.6360	0.0351
1981:1	-3.6414	-3.6232	-0.0183
1981:2	-3.6682	-3.6869	0.0187
1981:3	-3.7181	-3.7451	0.0269
1981:4	-3.7310	-3.7587	0.0277
1982:1	-3.7947	-3.7714	-0.0232
1982:2	-3.8151	-3.8251	0.0100
1982:3	-3.8491	-3.8453	-0.0037
1982:4	-3.8463	-3.8612	0.0149
1983:1	-3.9175	-3.8452	-0.0722
1983:2	-3.9044	-3.9147	0.0104
1983:3	-3.9091	-3.9114	0.0023
1983:4	-3.8878	-3.8653	-0.0225
1984:1	-3.8699	-3.8590	-0.0110
1984:2	-3.8480	-3.8488	0.0008
1984:3	-3.8225	-3.8380	0.0155
1984:4	-3.7901	-3.7893	-0.0008

INVESTMENT : SECTOR 2

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(O)

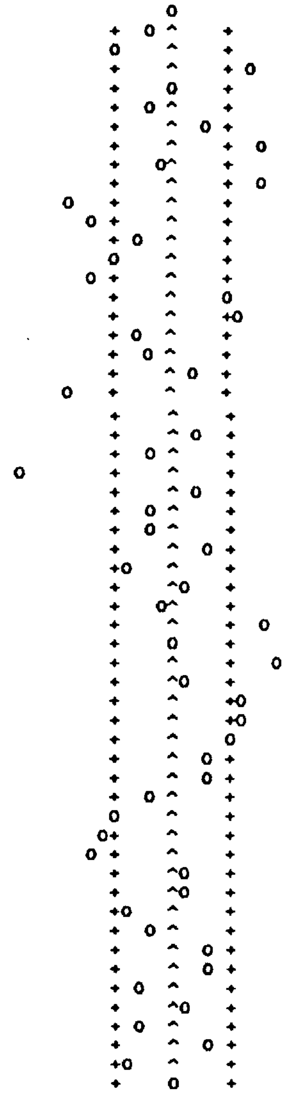
ID	ACTUAL	FITTED	RESIDUAL
1971:1	6.7770	6.7380	0.0390
1971:2	6.7727	6.7950	-0.0223
1971:3	6.7516	6.8031	-0.0516
1971:4	6.7668	6.7606	0.0061
1972:1	6.8307	6.7971	0.0336
1972:2	6.7896	6.8394	-0.0498
1972:3	6.8240	6.7793	0.0447
1972:4	6.8152	6.8130	0.0022
1973:1	6.8420	6.8396	0.0024
1973:2	6.8946	6.8862	0.0084
1973:3	6.9596	6.9612	-0.0016
1973:4	6.9804	6.9837	-0.0033
1974:1	6.9850	6.9701	0.0149
1974:2	6.9804	6.9626	0.0179
1974:3	6.9690	6.9644	0.0046
1974:4	6.9000	6.9375	-0.0375
1975:1	6.8460	6.8800	-0.0340
1975:2	6.8309	6.8302	0.0008
1975:3	6.7946	6.8285	-0.0339
1975:4	6.8222	6.8240	-0.0018
1976:1	6.9002	6.8638	0.0363
1976:2	6.8993	6.8967	0.0006
1976:3	6.9251	6.9298	-0.0048
1976:4	6.9485	6.9590	-0.0105
1977:1	6.9710	6.9122	0.0589
1977:2	6.9533	6.9563	-0.0049
1977:3	6.9200	6.9481	-0.0281
1977:4	6.9066	6.9259	-0.0193
1978:1	6.9206	6.9102	0.0104
1978:2	6.9448	6.9353	0.0094
1978:3	6.9536	6.9535	0.0002
1978:4	6.9638	6.9659	-0.0021
1979:1	6.9503	6.9831	-0.0328
1979:2	6.9684	6.9899	-0.0206
1979:3	6.9979	7.0197	-0.0218
1979:4	7.0587	7.0188	0.0399
1980:1	7.0811	7.0793	0.0018
1980:2	7.0922	7.0926	-0.0004
1980:3	7.1129	7.0432	0.0698
1980:4	7.1494	7.1075	0.0419
1981:1	7.1990	7.1819	0.0171
1981:2	7.1739	7.1898	-0.0160
1981:3	7.1203	7.1766	-0.0562
1981:4	7.1112	7.1414	-0.0302
1982:1	7.1532	7.0725	0.0807
1982:2	7.1341	7.1125	0.0216
1982:3	7.1006	7.1123	-0.0117
1982:4	7.1045	7.1108	-0.0063
1983:1	7.1058	7.1181	-0.0122
1983:2	7.1215	7.1189	0.0025
1983:3	7.1157	7.1433	-0.0277
1983:4	7.1433	7.1685	-0.0252
1984:1	7.1299	7.1821	-0.0521
1984:2	7.1631	7.1275	0.0356
1984:3	7.1942	7.1951	-0.0009
1984:4	7.2441	7.2257	0.0183



X

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(O)

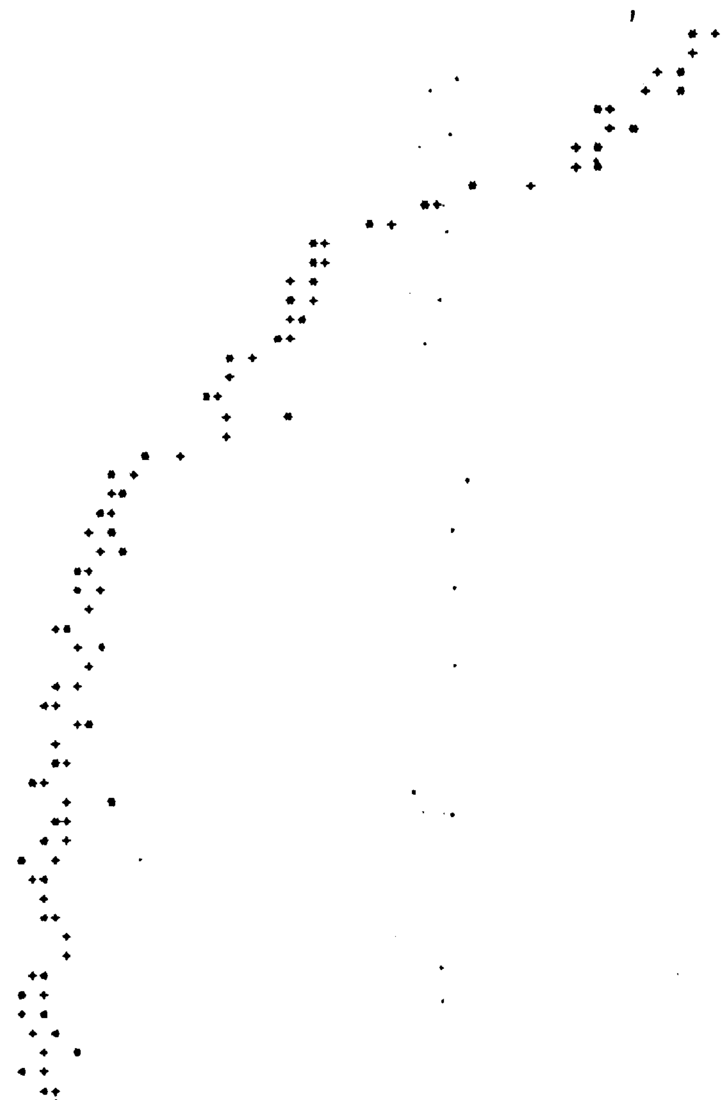


ID	ACTUAL	FITTED	RESIDUAL
1971:1	5.0467	5.0612	-0.0144
1971:2	5.0305	5.0628	-0.0323
1971:3	5.0903	5.0452	0.0451
1971:4	5.0274	5.0259	0.0015
1972:1	4.9850	4.9996	-0.0147
1972:2	5.0023	4.9828	0.0194
1972:3	5.0359	4.9826	0.0533
1972:4	4.9467	4.9518	-0.0051
1973:1	4.9841	4.9294	0.0546
1973:2	4.8638	4.9247	-0.0609
1973:3	4.8810	4.9263	-0.0453
1973:4	4.8742	4.8917	-0.0175
1974:1	4.8762	4.9115	-0.0353
1974:2	4.8225	4.8675	-0.0450
1974:3	4.8992	4.8631	0.0361
1974:4	4.8992	4.8584	0.0408
1975:1	4.8499	4.8679	-0.0180
1975:2	4.8334	4.8457	-0.0122
1975:3	4.8767	4.8637	0.0131
1975:4	4.7982	4.8562	-0.0580
1976:1	4.9215	4.8199	0.1016
1976:2	4.8132	4.7984	0.0147
1976:3	4.7836	4.7990	-0.0154
1976:4	4.6820	4.7729	-0.0909
1977:1	4.8217	4.8073	0.0144
1977:2	4.7794	4.7917	-0.0124
1977:3	4.7575	4.7707	-0.0131
1977:4	4.7618	4.7435	0.0183
1978:1	4.7526	4.7812	-0.0286
1978:2	4.7643	4.7599	0.0044
1978:3	4.7371	4.7472	-0.0101
1978:4	4.7891	4.7374	0.0517
1979:1	4.7320	4.7327	-0.0007
1979:2	4.7847	4.7239	0.0608
1979:3	4.7163	4.7075	0.0088
1979:4	4.7573	4.7197	0.0376
1980:1	4.7539	4.7121	0.0419
1980:2	4.7646	4.7304	0.0343
1980:3	4.7206	4.7013	0.0193
1980:4	4.7236	4.7024	0.0212
1981:1	4.6876	4.6990	-0.0114
1981:2	4.6546	4.6914	-0.0368
1981:3	4.6342	4.6730	-0.0388
1981:4	4.6220	4.6705	-0.0485
1982:1	4.6662	4.6574	0.0088
1982:2	4.6586	4.6508	0.0078
1982:3	4.6175	4.6454	-0.0278
1982:4	4.6175	4.6312	-0.0138
1983:1	4.6637	4.6415	0.0222
1983:2	4.6402	4.6217	0.0186
1983:3	4.5853	4.6080	-0.0227
1983:4	4.6087	4.6037	0.0050
1984:1	4.5938	4.6113	-0.0175
1984:2	4.6210	4.6034	0.0176
1984:3	4.5625	4.5883	-0.0258
1984:4	4.5917	4.5917	0.0000

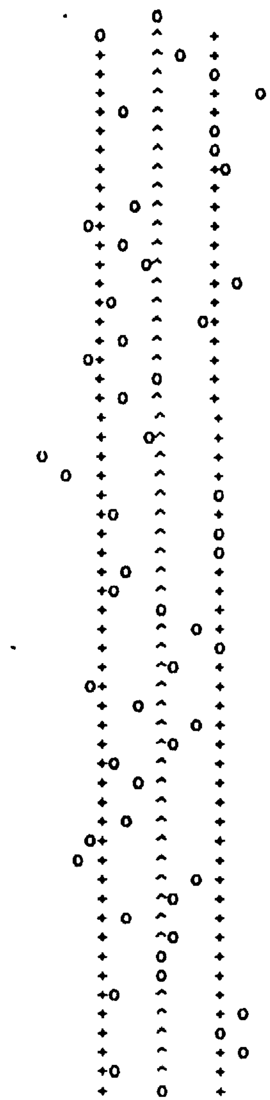
PRICES : SECTOR 2

ID	ACTUAL	FITTED	RESIDUAL
1971:1	5.1116	5.1203	-0.0088
1971:2	5.1117	5.1085	0.0032
1971:3	5.1047	5.0948	0.0099
1971:4	5.1029	5.0859	0.0170
1972:1	5.0686	5.0734	-0.0048
1972:2	5.0805	5.0709	0.0096
1972:3	5.0651	5.0547	0.0104
1972:4	5.0650	5.0535	0.0115
1973:1	5.0062	5.0348	-0.02860
1973:2	4.9865	4.9902	-0.0037
1973:3	4.9558	4.9680	-0.0122
1973:4	4.9300	4.9348	-0.0049
1974:1	4.9323	4.9347	-0.0024
1974:2	4.9312	4.9170	0.0142
1974:3	4.9211	4.9282	-0.0071
1974:4	4.9258	4.9190	0.0067
1975:1	4.9145	4.9198	-0.0053
1975:2	4.8933	4.9039	-0.0106
1975:3	4.8900	4.8905	-0.0005
1975:4	4.8800	4.8857	-0.0057
1976:1	4.9196	4.8937	0.0260
1976:2	4.8899	4.8922	-0.0023
1976:3	4.8538	4.8726	-0.0188
1976:4	4.8354	4.8509	-0.0155
1977:1	4.8455	4.8357	0.0098
1977:2	4.8315	4.8396	-0.0081
1977:3	4.8400	4.8297	0.0103
1977:4	4.8422	4.8329	0.0092
1978:1	4.8241	4.8291	-0.0050
1978:2	4.8226	4.8304	-0.0078
1978:3	4.8279	4.8271	0.0008
1978:4	4.8162	4.8110	0.0052
1979:1	4.8313	4.8209	0.0103
1979:2	4.8280	4.8261	0.0020
1979:3	4.8108	4.8231	-0.0122
1979:4	4.8056	4.8087	-0.0031
1980:1	4.8293	4.8238	0.0055
1980:2	4.8122	4.8103	0.0019
1980:3	4.8108	4.8183	-0.0075
1980:4	4.8005	4.8036	-0.0030
1981:1	4.8386	4.8163	0.0222
1981:2	4.8094	4.8156	-0.0062
1981:3	4.8033	4.8153	-0.0120
1981:4	4.7944	4.8062	-0.0138
1982:1	4.8074	4.8015	0.0059
1982:2	4.8055	4.8039	0.0015
1982:3	4.8068	4.8128	-0.0061
1982:4	4.8182	4.8161	0.0020
1983:1	4.8146	4.8146	0.0000
1983:2	4.8027	4.8019	0.0008
1983:3	4.7945	4.8030	-0.0084
1983:4	4.8075	4.7947	0.0128
1984:1	4.8096	4.7996	0.0099
1984:2	4.8193	4.8062	0.0131
1984:3	4.7968	4.8037	-0.0069
1984:4	4.8075	4.8081	-0.0007

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

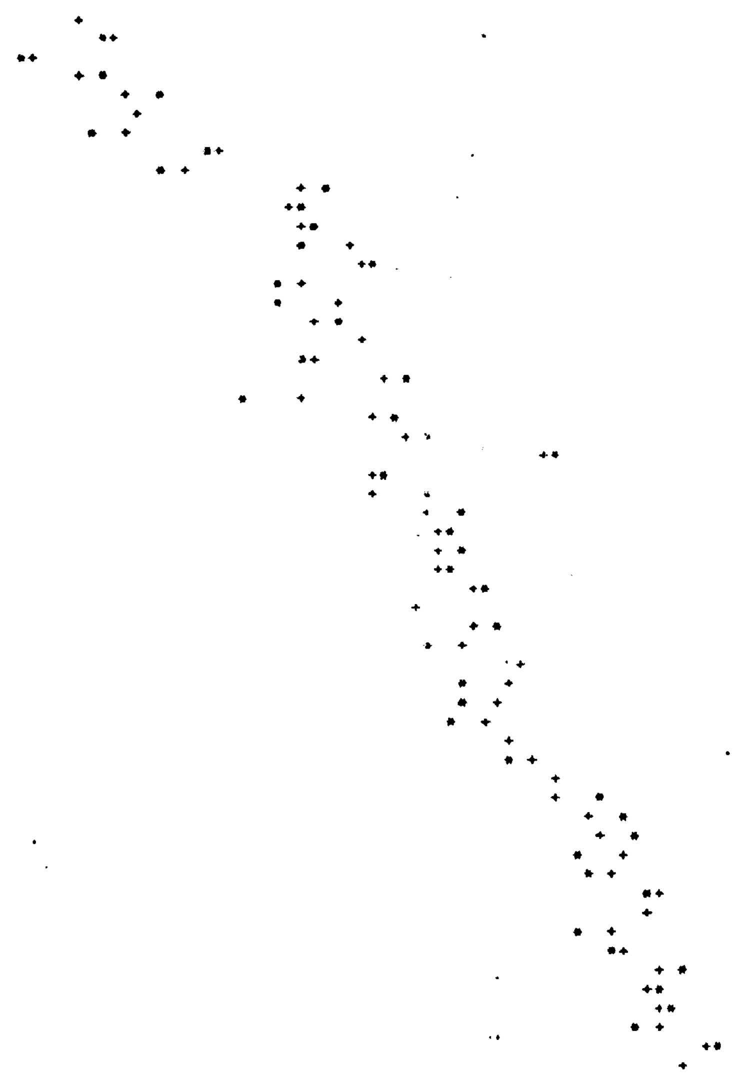


PLOT OF RESIDUALS(O)

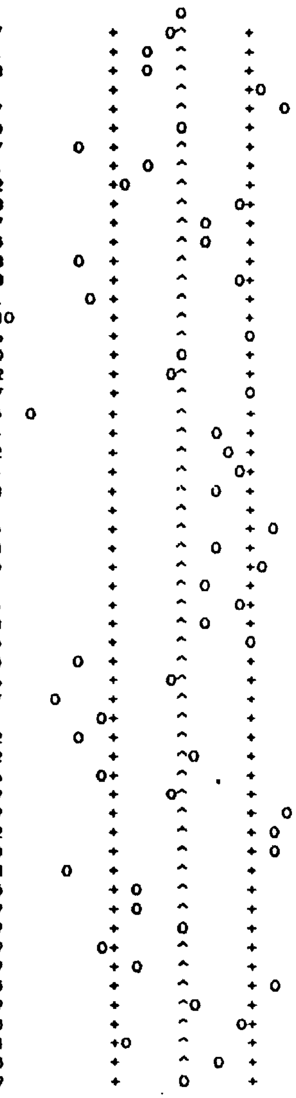


REAL COST OF LABOUR : SECTOR 1

PLOT OF ACTUAL(*) AND FITTED(+) VALUES



PLOT OF RESIDUALS(O)

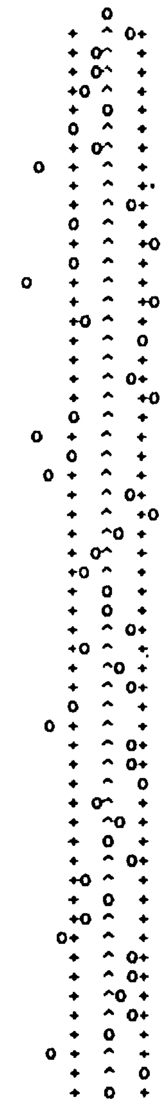


ID	ACTUAL	FITTED	RESIDUAL
1971:1	1.8610	1.8627	-0.0017
1971:2	1.8772	1.8854	-0.0081
1971:3	1.8175	1.8258	-0.0083
1971:4	1.8804	1.8593	0.0211
1972:1	1.9228	1.8960	0.0267
1972:2	1.9055	1.9055	-0.0000
1972:3	1.8719	1.8996	-0.0277
1972:4	1.9611	1.9702	-0.0091
1973:1	1.9237	1.9389	-0.0152
1973:2	2.0439	2.0296	0.0143
1973:3	2.0268	2.0211	0.0057
1973:4	2.0335	2.0280	0.0055
1974:1	2.0315	2.0599	-0.0283
1974:2	2.0852	2.0699	0.0153
1974:3	2.0085	2.0316	-0.0231
1974:4	2.0086	2.0540	-0.04540
1975:1	2.0579	2.0382	0.0196
1975:2	2.0743	2.0753	-0.0010
1975:3	2.0310	2.0332	-0.0022
1975:4	2.1096	2.0899	0.0197
1976:1	1.9863	2.0267	-0.0405
1976:2	2.0946	2.0852	0.0094
1976:3	2.1242	2.1120	0.0122
1976:4	2.2257	2.2114	0.0144
1977:1	2.0860	2.0777	0.0083
1977:2	2.1284	2.0823	0.0461
1977:3	2.1502	2.1267	0.0235
1977:4	2.1460	2.1372	0.0088
1978:1	2.1552	2.1332	0.0220
1978:2	2.1435	2.1363	0.0071
1978:3	2.1706	2.1562	0.0144
1978:4	2.1186	2.1129	0.0058
1979:1	2.1757	2.1562	0.0195
1979:2	2.1230	2.1516	-0.0285
1979:3	2.1915	2.1940	-0.0026
1979:4	2.1504	2.1851	-0.0347
1980:1	2.1538	2.1749	-0.0211
1980:2	2.1431	2.1704	-0.0272
1980:3	2.1872	2.1830	0.0042
1980:4	2.1842	2.2068	-0.0226
1981:1	2.2202	2.2231	-0.0029
1981:2	2.2531	2.2262	0.0269
1981:3	2.2736	2.2484	0.0252
1981:4	2.2858	2.2608	0.0250
1982:1	2.2416	2.2719	-0.0303
1982:2	2.2492	2.2626	-0.0135
1982:3	2.2902	2.3011	-0.0109
1982:4	2.2903	2.2894	0.0009
1983:1	2.2441	2.2650	-0.0209
1983:2	2.2675	2.2785	-0.0109
1983:3	2.3224	2.2989	0.0235
1983:4	2.2991	2.2952	0.0039
1984:1	2.3139	2.2984	0.0155
1984:2	2.2868	2.3032	-0.0164
1984:3	2.3453	2.3358	0.0095
1984:4	2.3160	2.3169	-0.0009

REAL COST OF LABOUR : SECTOR 2

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

PLOT OF RESIDUALS(O)



ID	ACTUAL	FITTED	RESIDUAL
1971:1	1.7962	1.7916	0.0046
1971:2	1.7960	1.7995	-0.0035
1971:3	1.8030	1.8065	-0.0035
1971:4	1.8048	1.8096	-0.0048
1972:1	1.8392	1.8399	-0.0007
1972:2	1.8273	1.8344	-0.0071
1972:3	1.8426	1.8443	-0.0016
1972:4	1.8427	1.8607	-0.0179
1973:1	1.9016	1.8594	0.0422
1973:2	1.9213	1.9168	0.0045
1973:3	1.9519	1.9616	-0.0096
1973:4	1.9778	1.9661	0.0117
1974:1	1.9755	1.9845	-0.0091
1974:2	1.9765	1.9960	-0.0195
1974:3	1.9867	1.9756	0.0111
1974:4	1.9820	1.9865	-0.0045
1975:1	1.9933	1.9847	0.0086
1975:2	2.0145	1.9975	0.0170
1975:3	2.0178	2.0126	0.0052
1975:4	2.0277	2.0168	0.0109
1976:1	1.9881	1.9968	-0.0086
1976:2	2.0178	2.0336	-0.0158
1976:3	2.0540	2.0619	-0.0079
1976:4	2.0724	2.0859	-0.0136
1977:1	2.0623	2.0566	0.0057
1977:2	2.0762	2.0664	0.0099
1977:3	2.0678	2.0637	0.0041
1977:4	2.0656	2.0678	-0.0022
1978:1	2.0836	2.0905	-0.0069
1978:2	2.0851	2.0860	-0.0008
1978:3	2.0798	2.0805	-0.0007
1978:4	2.0915	2.0865	0.0050
1979:1	2.0765	2.0822	-0.0057
1979:2	2.0797	2.0781	0.0017
1979:3	2.0969	2.0921	0.0048
1979:4	2.1022	2.1108	-0.0087
1980:1	2.0784	2.0920	-0.0136
1980:2	2.0955	2.0893	0.0063
1980:3	2.0970	2.0902	0.0067
1980:4	2.1072	2.0998	0.0075
1981:1	2.0692	2.0715	-0.0024
1981:2	2.0984	2.0958	0.0025
1981:3	2.1045	2.1041	0.0004
1981:4	2.1133	2.1073	0.0061
1982:1	2.1004	2.1047	-0.0043
1982:2	2.1023	2.1013	0.0009
1982:3	2.1010	2.1072	-0.0062
1982:4	2.0896	2.0999	-0.0104
1983:1	2.0931	2.0868	0.0063
1983:2	2.1050	2.1005	0.0045
1983:3	2.1132	2.1094	0.0039
1983:4	2.1002	2.0958	0.0044
1984:1	2.0982	2.0990	-0.0009
1984:2	2.0885	2.1012	-0.0127
1984:3	2.1109	2.1036	0.0074
1984:4	2.1003	2.1008	-0.0005

THREE STAGE LEAST SQUARES: SECTOR 1

ALL VARIABLES ARE IN LOGARITHMS

DEPENDENT VAR.: L/K	PARAMETER ESTIMATE	STANDARD ERROR	T-STATISTIC
CONST	-0.6620333E-01	0.2717269E-01	-2.436392
L(-1)/K	1.302167	0.1116485	11.66310
L(-2)/K	-0.3362428	0.1165757	-2.884329
CL/P(-4)	-0.7275651E-01	0.2166982E-01	-3.357504
PM/P(-3)	-0.3285117E-01	0.9247893E-02	-3.552287
PF/P	0.4964200E-01	0.1440479E-01	3.446215
I/K	-0.4066885E-01	0.1053200E-01	-3.861456
R(-1)	-0.8163270E-01	0.2072916E-01	-3.938061
DEPENDENT VAR.: CL/P			
CONST	0.4429200	0.1441683	3.072243
WEDGE	0.8301193	0.7435402E-01	11.16442
AW2(-1)	0.7679302	0.8623117E-01	8.905493
PF/P	0.1015841	0.3156827E-01	3.217920
DU	-0.1335544	0.7619079E-01	-1.752894
TIME	0.2671534E-02	0.5562183E-03	4.803031
DEPENDENT VAR.: P/CL			
CONST	12.63060	2.129913	5.930103
P/CL(-4)	0.2149825	0.1063283	2.021875
PM/CL(-4)	0.1306666	0.3586882E-01	3.642903
K(-1)	-0.9084908	0.1573909	-5.772192
DEPENDENT VAR.: I/K			
CONST	-0.3249162	0.1120409	-2.899980
I/K(-1)	1.139630	0.6521666E-01	17.47452
I/K(-3)	-0.3367883	0.6308414E-01	-5.338716
CL/P(-3)	-0.1890917	0.4668147E-01	-4.050680
PI/P	-0.1480492	0.7858055E-01	-1.884044
R(-2)	-0.9213515E-01	0.8501871E-01	-1.083704
DREXP(-4)	0.3752751	0.3201130	1.172321

THREE STAGE LEAST SQUARES: SECTOR 1

ALL VARIABLES ARE IN LOGARITHMS

EMPLOYMENT EQUATION

DEPENDENT VARIABLE: L/K

SUM OF SQUARED RESIDUALS =	0.199673E-02
STANDARD ERROR OF THE REGRESSION =	0.602530E-02
MEAN OF DEPENDENT VARIABLE =	-2.03378
STANDARD DEVIATION =	0.133996
NUMBER OF OBSERVATIONS =	55
DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) =	1.8568

WAGE EQUATION

DEPENDENT VARIABLE: CL/P

SUM OF SQUARED RESIDUALS =	0.221821E-01
STANDARD ERROR OF THE REGRESSION =	0.200826E-01
MEAN OF DEPENDENT VARIABLE =	2.12742
STANDARD DEVIATION =	0.134328
NUMBER OF OBSERVATIONS =	55
DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) =	1.6556

PRICE EQUATION

DEPENDENT VARIABLE: P/CL

SUM OF SQUARED RESIDUALS =	0.675221E-01
STANDARD ERROR OF THE REGRESSION =	0.350382E-01
MEAN OF DEPENDENT VARIABLE =	4.78033
STANDARD DEVIATION =	0.134328
NUMBER OF OBSERVATIONS =	55
DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) =	1.9811

INVESTMENT EQUATION

DEPENDENT VARIABLE: I/K

SUM OF SQUARED RESIDUALS =	0.484392E-01
STANDARD ERROR OF THE REGRESSION =	0.296768E-01
MEAN OF DEPENDENT VARIABLE =	-3.69174
STANDARD DEVIATION =	0.154215
NUMBER OF OBSERVATIONS =	55
DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) =	2.1749

THREE STAGE LEAST SQUARES: SECTOR 2

ALL VARIABLES ARE IN LOGARITHMS

DEPENDENT VAR.: L	PARAMETER ESTIMATE	STANDARD ERROR	T-STATISTIC
CONST	0.6149980	0.2978995	2.064448
L(-1)	0.7493013	0.6741465E-01	11.11481
CL/P(-4)	-0.7318885E-01	0.2787816E-01	-2.625311
REXP(-1)	0.8771872E-01	0.4328117E-01	2.026718
K2	0.7591635E-01	0.3009467E-01	2.522651
DEPENDENT VAR.: CL/P			
CONST	1.264994	0.1022121	12.37617
DU	-0.1614045	0.4447261E-01	-3.629301
U(-1)	-0.6885550E-01	0.1890450E-01	-3.642280
WEDGE	0.5208022	0.5069229E-01	10.27379
AW1	0.2747152	0.6380473E-01	4.305561
TIME	0.1171325E-01	0.1173140E-02	9.984533
TIME SQUARE	-0.1094415E-03	0.1119727E-04	-9.773949
DEPENDENT VAR.: P/CL			
CONST	-1.582303	0.6585720	-2.402627
P/CL(-1)	1.033879	0.3887241E-01	26.59673
DDP	0.5499828	0.5578459E-01	9.859046
PM/CL(-4)	0.4403330E-01	0.1319924E-01	3.336048
REXP(-1))	0.1206441	0.4383909E-01	2.751977
DEPENDENT VAR.: I			
CONST	-1.356562	0.4854527	-2.794426
I(-1)	0.7502000	0.7411752E-01	10.12176
CL/P(-3)	-0.3678752	0.1150494	-3.197542
D2REXP	1.312275	0.3624490	3.620577
K	0.3602928	0.9215269E-01	3.909737
R(-1)	-0.2589807	0.1330643	-1.946282

THREE STAGE LEAST SQUARES: SECTOR 2

ALL VARIABLES ARE IN LOGARITHMS

EMPLOYMENT EQUATION

DEPENDENT VARIABLE: L

SUM OF SQUARED RESIDUALS	=	0.128066E-02
STANDARD ERROR OF THE REGRESSION	=	0.478214E-02
MEAN OF DEPENDENT VARIABLE	=	8.52520
STANDARD DEVIATION	=	0.658704E-01
NUMBER OF OBSERVATIONS	=	56
DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS)	=	2.1206

WAGE EQUATION

DEPENDENT VARIABLE: CL/P

SUM OF SQUARED RESIDUALS	=	0.457936E-02
STANDARD ERROR OF THE REGRESSION	=	0.904292E-02
MEAN OF DEPENDENT VARIABLE	=	2.02400
STANDARD DEVIATION	=	0.989431E-01
NUMBER OF OBSERVATIONS	=	56
DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS)	=	1.9908

PRICE EQUATION

DEPENDENT VARIABLE: P/CL

SUM OF SQUARED RESIDUALS	=	0.529630E-02
STANDARD ERROR OF THE REGRESSION	=	0.972506E-02
MEAN OF DEPENDENT VARIABLE	=	4.88375
STANDARD DEVIATION	=	0.989432E-01
NUMBER OF OBSERVATIONS	=	56
DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS)	=	1.9021

INVESTMENT EQUATION

DEPENDENT VARIABLE: I

SUM OF SQUARED RESIDUALS	=	0.453483E-01
STANDARD ERROR OF THE REGRESSION	=	0.284568E-01
MEAN OF DEPENDENT VARIABLE	=	6.98329
STANDARD DEVIATION	=	0.134291
NUMBER OF OBSERVATIONS	=	56
DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS)	=	1.8133

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