THE INFLUENCE OF DEMAND AND CAPITAL CONSTRAINTS ON SPANISH UNEMPLOYMENT

J.Andrés*, J.J.Dolado, C.Molinas***, M.Sebastián**** and A.Zabalza***

SGPE-D-88005
Mayo 1988

Revised Version, May 1988

* Ministerio de Economía y Hacienda and Universidad de Valencia
** Bank of Spain
*** Ministerio de Economía y Hacienda and Universidad de Barcelona
**** Ministerio de Economía y Hacienda and Universidad Complutense

THE INFLUENCE OF DEMAND AND CAPITAL CONSTRAINTS ON SPANISH UNEMPLOYMENT

J. Andrés, J.J. Dolado, C. Molinas, M. Sebastiàn and A. Zabalza

Introduction

This paper reports some preliminary results on the estimation of a structural model of the Spanish economy centered around the labour and production sectors. Section 1 describes the main facts to be explained and presents an evaluation of how far the results obtained in the paper can help us to understand the recent evolution of unemployment in Spain. This section, therefore, includes both an introduction to the problem and a summary of the main findings. Section 2 presents the theoretical model on which the analysis is based. Section 3 presents a brief outline of the empirical model, which follows closely the common framework agreed for the project "European Unemployment Programm". Section 4 presents the results.

1. Main facts and an attempted explanation

1.1 The facts

The main facts under explanation are summarized in Figure 1.1, which plots the evolution for the last 20 years of the labour force and of employment. Until 1974, the increase in the labour force was easily absorbed by a corresponding increase in employment. From 1964 to 1974 the labour force increased by 10.0 per cent, while employment increased by 7.3 per cent. Since then, however, the situation has changed dramatically. In the last ten years, the labour force has stabilized, with some oscillations, around the level it reached in 1974. Employment, on the other hand, has fallen continuously until

1985, and only in the last two years shows some signs of recovery. In 1974, there were over 13.2 million people employed; by 1985 this figure had fallen to under 10.6 millions. This means the disappearance of over 2.5 millon jobs during the period (almost a 20 per cent fall in employment).

The result of these labour market trends has been a dramatic increase in the rate of unemployment, as can be seen in Figure 1.2. In 1965 the official unemployment rate stood at 1.5 per cent of the labour force and by 1974 it had only increased to 2.6 percent. By 1985, however, the number of unemployed were almost 3 million, which represented a 21.9 per cent of the labour force.

These unprecedented rates have had as a consequence the appearance of a fairly large number of long-term unemployed and, therefore, of a substantial increase in the duration of unemploment. As Figure 1.3 shows, in 1964 about 80 per cent of the unemployment population had been out of job for less than 6 months, and only 10 per cent had been unemployed for more than one year. In 1985, on the other hand, the former category represented only a 25 per cent of the total unemployed population, and the latter almost a 58 per cent.[1]

---

1 Things have began to improve in the last three years, with a halt in the decline of employment which so far seems to be holding. In 1986 employment increased to 10,820 thousands (a 2.4 per cent increase with respect to 1985) and in 1987 it reached 11,156 thousands (a 3.1 per cent annual increase). However, since the labour force has also increased substantially, the creation of jobs is not reflected fully in the unemployment rate, which only went down to 20.5 per cent in 1987 as compared to the 21.9 per cent level it reached in 1985. In 1988 a 2.7 point increase in employment is expected. The unemployment rate, however, is only expected to diminish to 20.0 per cent.

FIGURE 1.1

LABOUR FORCE AND EMPLOYMENT

(IN LOGS)

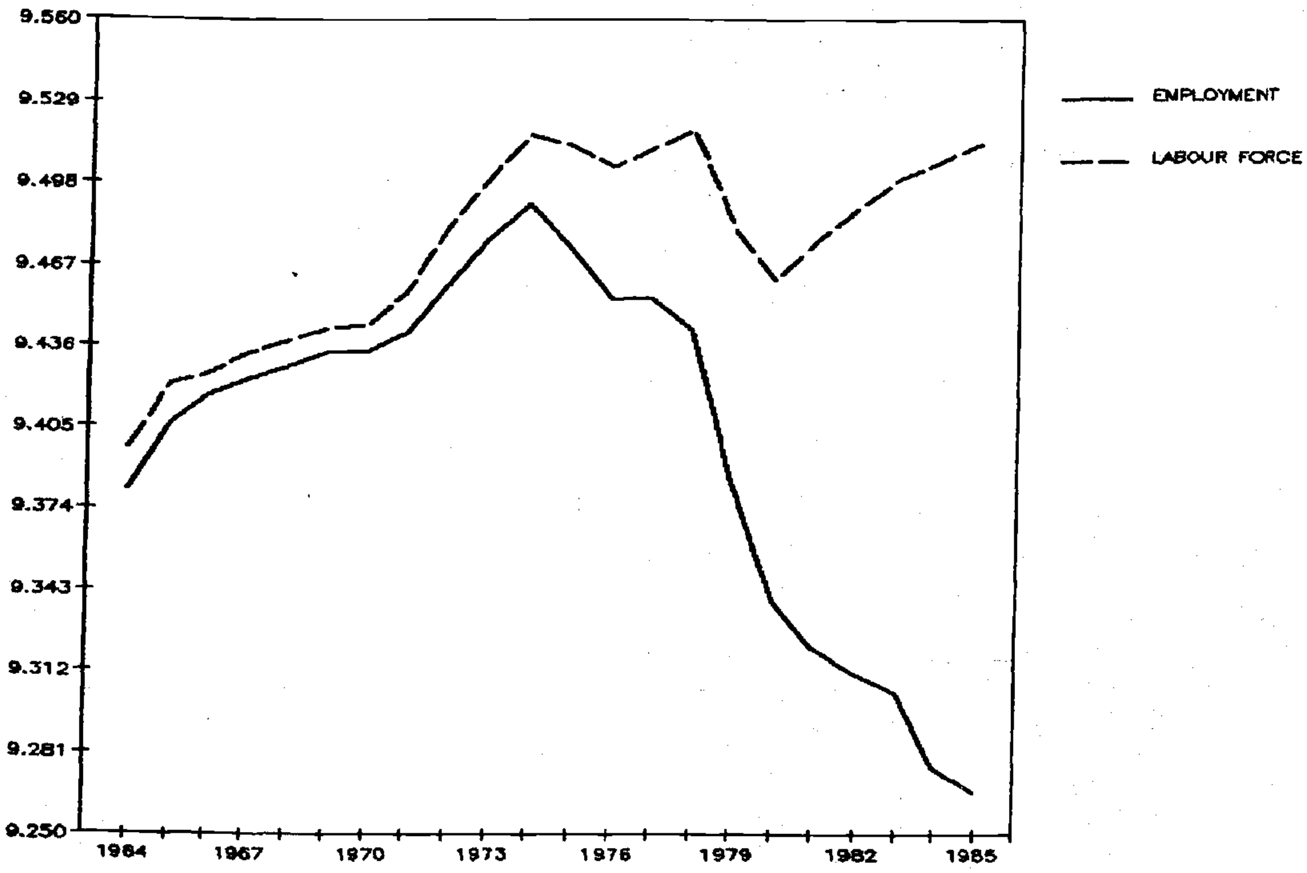
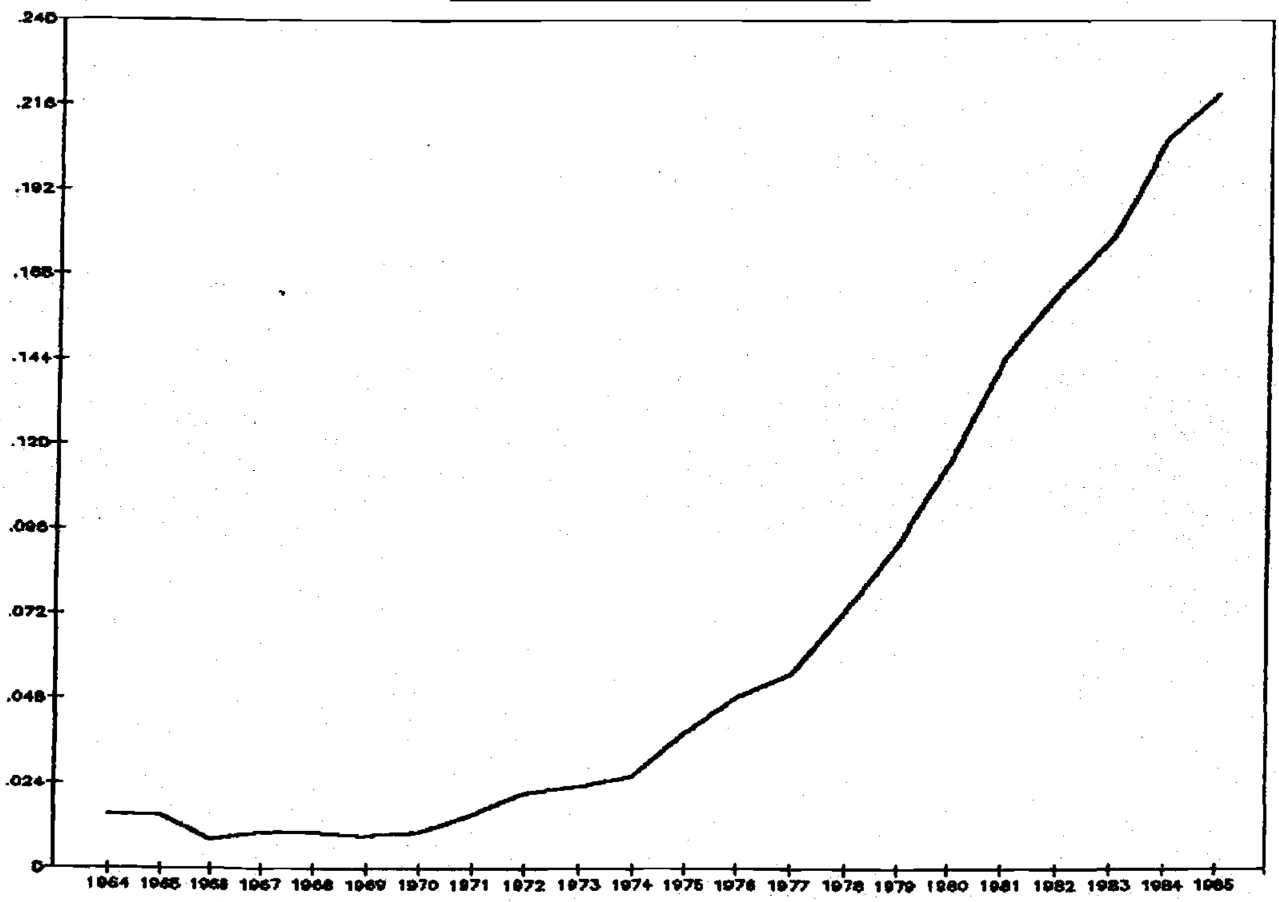


FIGURE 1.2

UNEMPLOYMENT RATE



In the second part of this section we attempt an explanation of these facts based on the empirical results obtained below. Before discussing these results, however, it may be interesting to give a brief account of the evolution of other economic factors which could have had an influence on the rise of unemployment and which give a wider perspective to the problem under study.

One such factor is the substantial change that the Spanish occupational structure has experienced during the last 20 years. There has been a big fall of employment in agriculture and a corresponding rise in services, while the share of building and industry has remained fairly constant (see Figure 1.4). In 1964, agricultural employment represented 36 per cent of total employment, while in 1985 it had fallen to 16 per cent. On the other hand, employment in the service sector represented 31 per cent of total employment in 1964, while in 1985 it had risen to almost 50 per cent. This is a major structural change which has coincided with an important economic crisis and could therefore have had a significant effect on unemployment.

Another factor which could also have influenced unemployment is the reversal in the flow of emigration that took place after the first oil price shock. Although it is difficult to give precise figures, it has been estimated that in 1973 there were more than 600,000 Spaniards working abroad. Since then this figure has decreased substantially. By 1978 it had been reduced to 350,000, and it could be even lower now. Again, the coincidence of this inflow of workers with the decline of the level of economic activity inside the country, must have meant added difficulties to absorb the available labour supply.

It is interesting to note that despite this inflow of workers, the labour force remained fairly constant. This suggests the presence of some "discouraged worker" effect, particularly in the height of the crisis, when the labour force actually declined. The

FIGURE 1.3

UNEMPLOYMENT DURATION

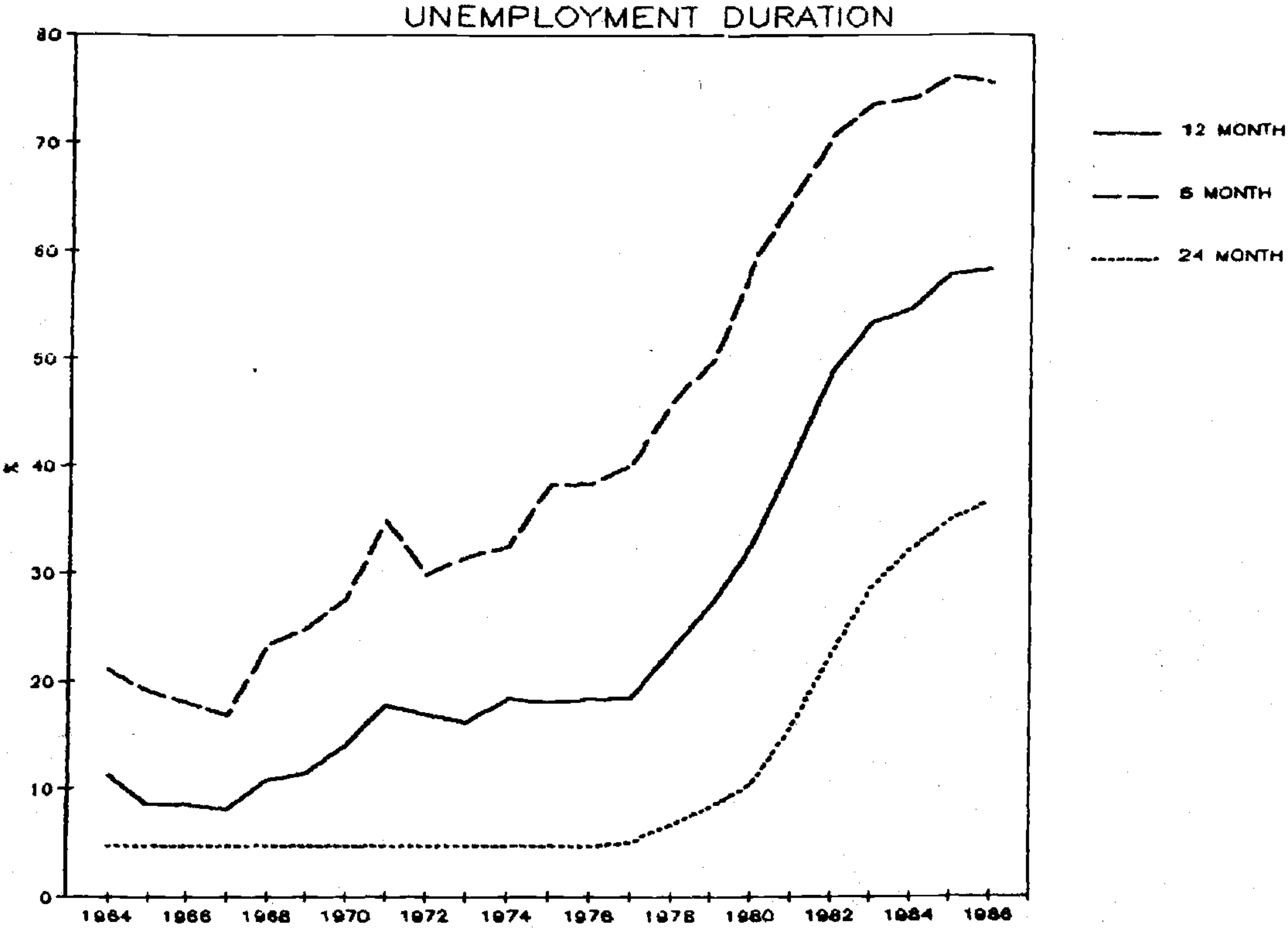
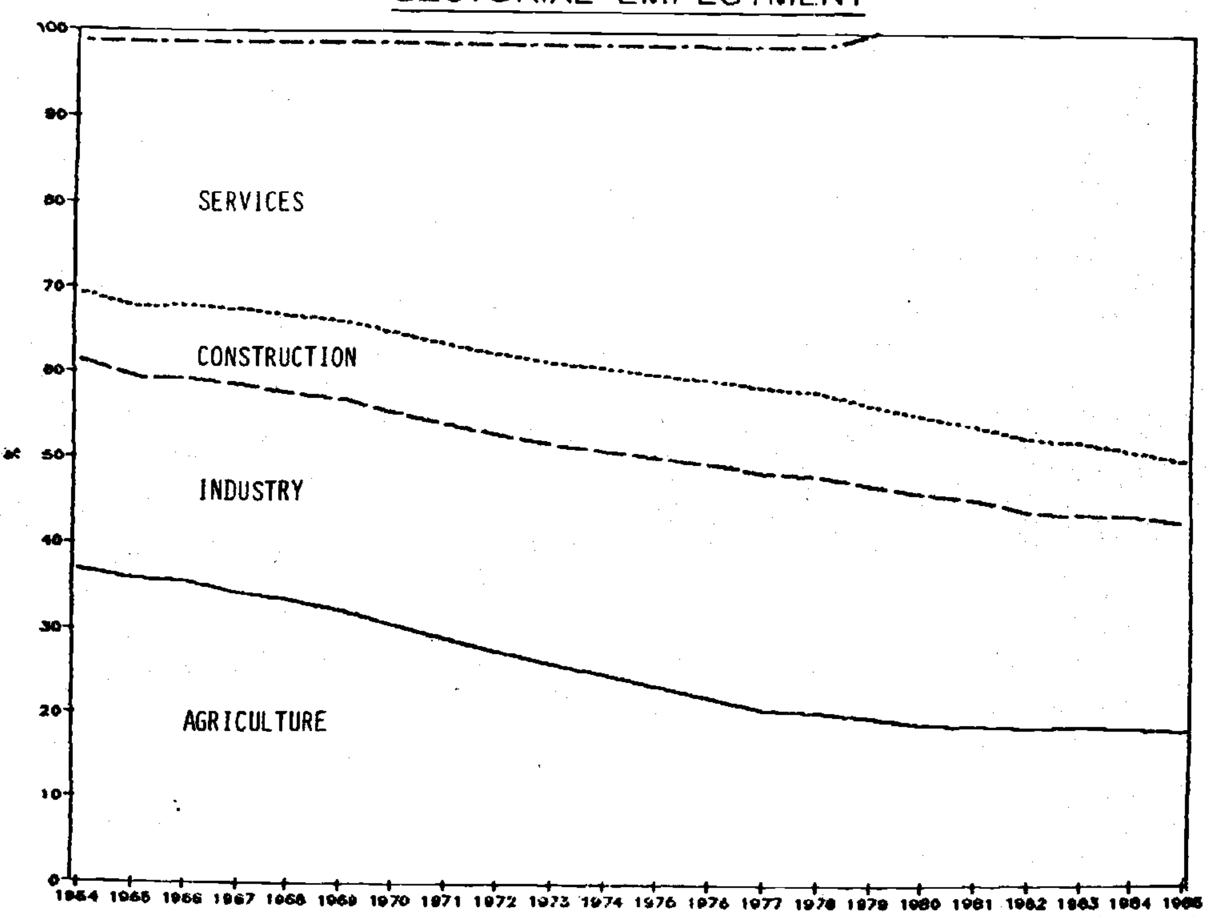


FIGURE 1.4

SECTORIAL EMPLOYMENT



deceleration of the labour force that Figure 1.1 shows must be seen in the context of a participation rate which is the lowest in Europe. In 1984 only a 55.4 per cent of the population aged 15 to 64 were in the labour force. This compares with a 72.8 rate in Great Britain, 66.0 in France, 73.1 in Portugal and 60.0 in Italy.

1.2 An attempted explanation

1.2.1 Employment

Figure 1.1 shows that the main reason behind the increase in Spanish unemployment has to do not so much with the evolution of the labour force, but with the loss of jobs. Therefore, an initial step in the research strategy is to investigate what could explain the very substantial fall of employment since 1974. We have some results about the proximate causes of this fall, which we take from an estimated labour demand equation. This equation makes employment to depend on labour costs, the stock of capital in the economy, an index of technical progress, which has labour augmenting characteristics, and an index of cyclical demand proxied by the degree of capacity utilization (see Annex 1).

Table 1.1 shows how the proximate causes have evolved during the period considered. We divide the whole period in three segments: the first one, 1966-1971, is the pre-crisis period; the second, 1972-1978, includes the first oil price shock and the peak of employment; the third, 1979-1985, includes the second oil price shock and covers the years when most of the effects of the crisis were already showing up. Real labour costs, defined as inclusive of Social Security contributions and relative to the GDP deflator, have increased substantially in the last 20 years. The average for the period 1972-1978 was 35.1 per cent higher than the average for the period 1966-1971, and the average for the period 1979-1985 was 19.0 per cent higher than that for the period 1972-1978. Figures 1.5 and

Table 1.1

Actual Change of Proximate Determinants of Employment

(percentages)

	1966-71/1972-78	1972-78/1979-85
Real labour costs	35.1	19.0
Capital Stock	34.3	20.8
Technical progress	36.4	23.5
Capacity utilization	1.4	-5.4

Table 1.2

Contribution of Proximate Determinants to Employment Growth

(percentages)

	1966-71/1972-78	1972-78/1979-85
Real Labour Costs	-42.1	-22.8
Capital Stock	34.3	20.8
Technical Progress	7.3	4.7
Capacity Utilization	5.1	-19.6
Total Change explained	4.6	-16.9
Actual change	3.5	-15.0

FIGURE 1.5

REAL GDP, EMPLOYMENT AND REAL LABOR COSTS

(ANNUAL RATES OF GROWTH)

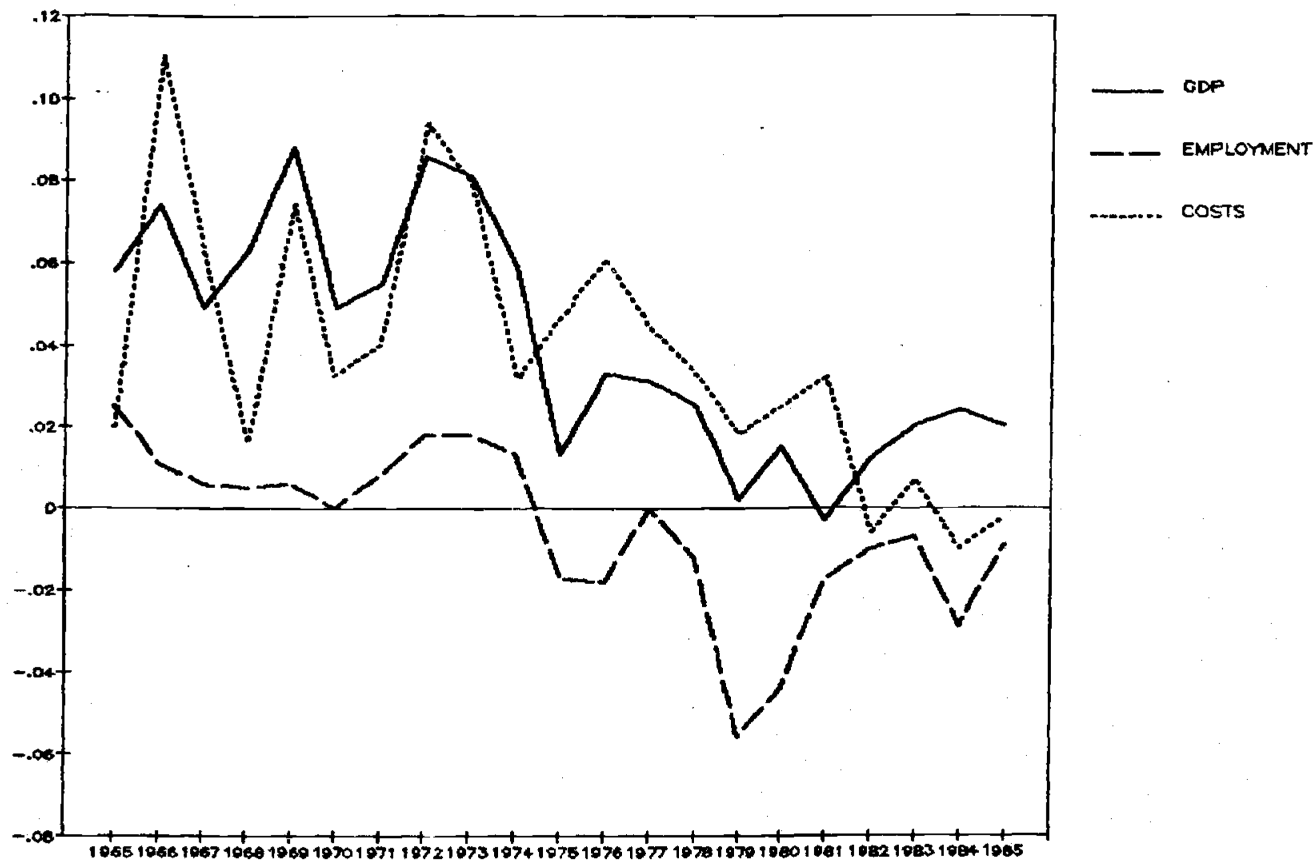
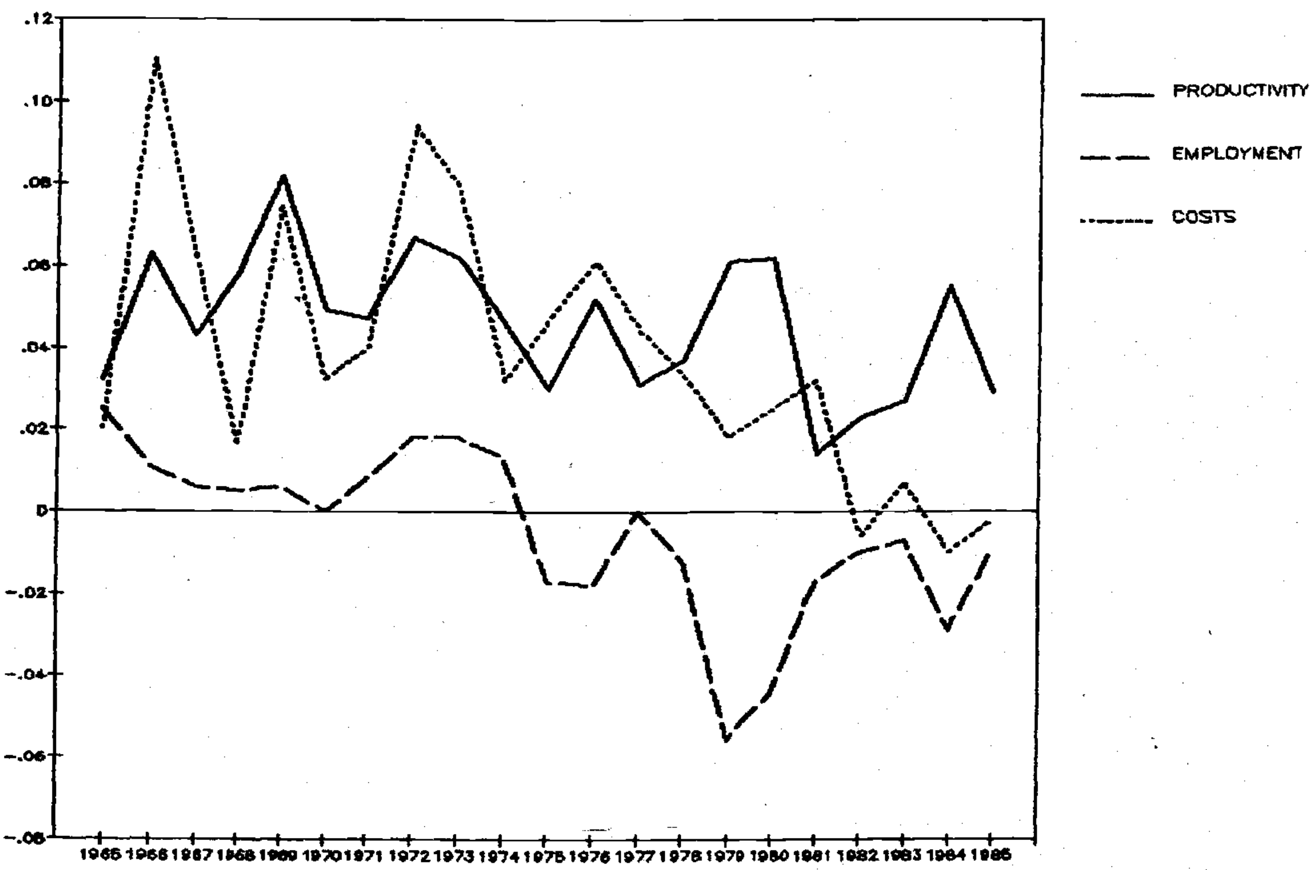


FIGURE 1.6

PRODUCTIVITY, EMPLOYMENT AND REAL LABOR COSTS

(ANNUAL RATES OF GROWTH)



1.6 show the annual rate of growth of real labour costs together with that of employment, output and productivity. Leaving aside the pro-cyclical nature of real labour costs, perhaps the most remarkable feature is their persistent increase during the second half of the seventies in the face of large falls of employment and very small rates of output growth. However, there is a distinct deceleration of labour costs in the last years of the period, which is clearly picked up in Table 1.1.

Figure 1.7 shows the evolution of the rates of growth of the stock of capital and of its potential productivity[2]. This figure suggests the existence of a twenty-year cycle for the capital stock which was just completed in 1985. According to this interpretation, potential productivity would lead the rate of growth of the stock by six to seven years. From 1965 to 1971, both the capital stock and its marginal productivity grew strongly. From 1972 to 1980, capital kept increasing while potential marginal productivity declined reaching negative rates of growth. This fall in productivity could be the reason behind the big drop in the rate of growth of the stock after 1974. By 1985 both variables have started to grow together again and a substantial recovery in the capital stock is expected[3]. Table 1.1 summarizes the behaviour of the capital stock, whose rate of growth between the period 1966-71 and 1972-78 was 34.3 per cent, while that between 1971-78 and 1979-85 was 20.8 per cent. Table 1.1 also shows that the index technical progress advanced more between the first two periods (36.4 per cent) than between the second and third (23.5 per cent).

Finally, the index of capital utilization grew by 1.4 per cent between the two periods, and fell by 5.4 per cent between the second

---

2 Potential productivity of capital is defined as the inverse of the capital to potential output ratio. Potential output, in turn, is defined as that level of output that would be obtained at full capacity utilization. See below.

3 Fixed real investment grew 9.6 per cent in 1986, 14.5 per cent in 1987 and is expected to grow around 12 per cent in 1988.

FIGURE 1.7

CAPITAL STOCK AND POTENTIAL PRODUCTIVITY OF CAPITAL

(ANNUAL RATES OF GROWTH)

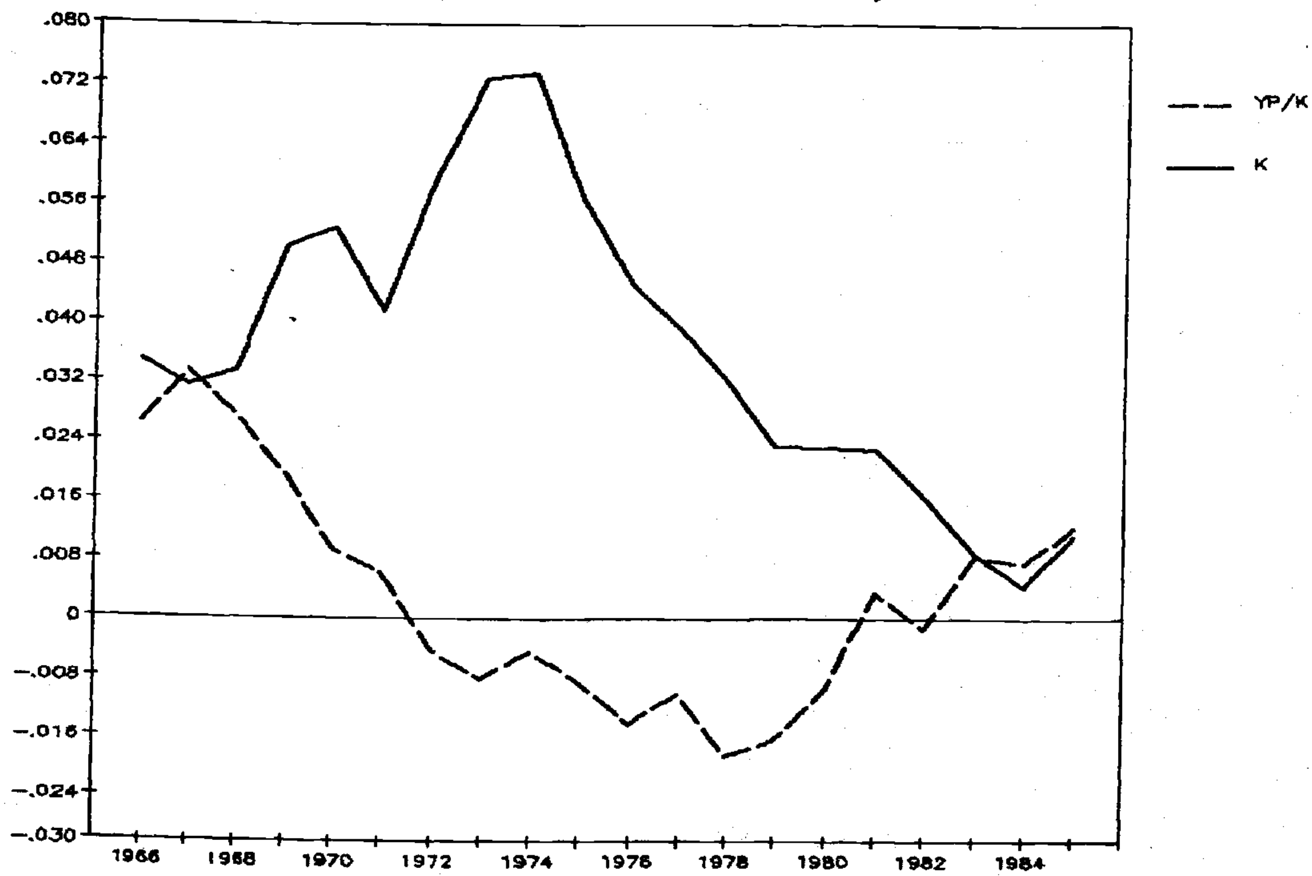
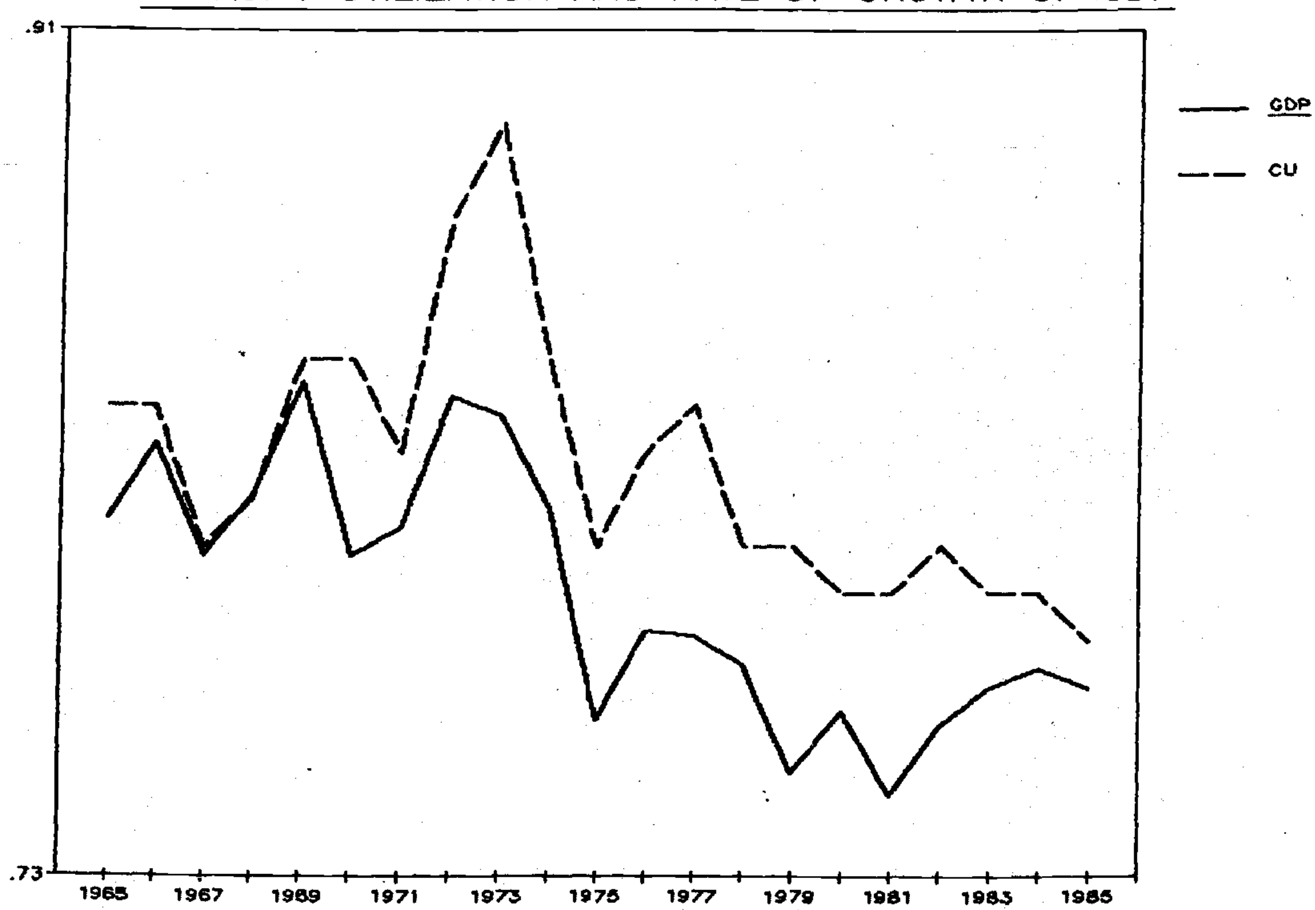


FIGURE 1.8

CAPACITY UTILIZATION AND RATE OF GROWTH OF GDP



and third. Figure 1.8 plots the level of this variable and the rate of growth of output. The figure illustrates that this is a reasonable variable to pick up the cycle, and that there is a clear fall in demand after 1975.

As can be seen in Table 1.2, the growth of employment between the first two periods is largely explained by the increase of capacity utilization given that the negative effects due to the growth of labour costs is compensated by the positive effect of the capital stock and technical progress. Similarly, the large fall of employment between the second and third period can be attributed to the strong negative effect of cyclical demand (as proxied by capacity utilization), given that the smaller increase in labour costs is again compensated by the weaker positive effects of the capital stock and technical progress.

1.2.2 Unemployment

The analysis so far, although instructive in order to see the effect of labour costs, is unsatisfactory for two reasons: a) because it does not take into account factors that may have influenced unemployment via labour supply; and b) because it does not say anything about what determines real labour costs and the capital stock.

As we have seen in Figure 1.1, labour supply has been more or less constant during the period in which unemployment has increased most. This, however, does not mean that labour supply effects have been absent in the determination of unemployment, as they could have compensated one another as far as labour supply is concerned. Also, we have identified the effect of labour costs on employment, but real labour costs are endogneous to the model and depend on all factors that determine the wages workers desire and the wages employers are prepared to pay.

We have been able to estimate the influence on unemployment of some of these factors and the overall results are promising. We have identified significative influences from Social Security contributions, indirect taxes and real import prices; that is, three of the four elements (the fourth being direct taxes) that form the wedge between real labour costs and the consumption wage. Also, an index of mismatch in the labour market, the replacement ratio and a proxy for union pressure show up as having significant effects on the level of unemployment.

Another satisfactory result of this exercise has been that we have not been able to reject the hypothesis of absence of long-run effects of the capital-labour ratio and of technical progress on unemployment. The strong effect of the capital stock on employment discussed above should in theory be compensated by an equivalent and opposite effect coming from the labour force so that there is no long-run influence on unemployment. The data clearly accept the restrictions implied by this hypothesis.

Table 1.3 shows the actual changes of the variables determining desired and feasible wages. We see that there has been a fairly steady increase in Social Security contributions (although in the last years they are practically stable), and a moderate fall in indirect taxes (although since 1983 they are rapidly increasing). The import price wedge has gone down by -3.9 per cent between the first and second periods, and up by 1.9 per cent between the second and third periods. The evolution of technical progress and capacity utilization has already been described in Table 1.1. The mismatch index has grown less between the third and second periods than between the second and the first, reflecting an improvement in the occupational structure, whereas the replacement ratio shows an opposite and much higher pattern of growth. The growth of the union pressure dummy has, by construction, opposite signs and the same absolute value in the two comparisons, increasing between the first two periods and falling between the second and third. Finally, we see that the capital labour ratio has increased substantially throughout the whole period, although, as expected, there is an important deceleration after the first oil crisis.

Table 1.4 shows the contribution of these variables to unemployment. Between the first two periods, of the six wage push factors, Social Security contributions, followed by the union pressure variable are the main contributing factors, while the increase in capacity utilization helped to moderate the rise in unemployment. The mild negative effect of the import price wedge is explained by the policy of subsidising the domestic price of energy after the first oil crisis, a policy which disappeared when the second oil price shock occurred. Concerning the comparison between the last two periods, we see that the effect of Social Security contributions is slightly larger than that of the previous comparison. In addition, the replacement ratio becomes a more important contributing factor, while the indirect taxes and the union power dummy help to moderate the increase in unemployment. Cyclical demand (as proxied by capacity utilization) now becomes strongly contractionary and exerts, by far, the most important influence on the rise of unemployment.

According to these results, therefore, cyclical demand appears as the major explanatory factor of the recent evolution of unemployment in Spain. Had capacity utilization remained constant throughout the whole period under consideration, unemployment would have increased by about 4 and a half points between the first and second periods and by about 3 points between the last two. This gives a total rise of 7.5 points, which is much lower than the 14 points rise obtained after considering the effect of demand.

Table 1.3
Actual Change of Variables Determining Desired and Feasible Wages
(percentages)

	1966-71/1972-78	1972-78/1979-85
Social Security contributions	4.4	5.2
Indirect taxes	1.3	-0.6
Real import prices*	-3.9	1.3
Capital-Labour ratio	27.8	24.9
Technical progress	36.4	23.5
Capacity utilization	1.4	-5.4
Replacement ratio	3.0	7.6
Mismatch	1.1	0.4
Union power dummy	71.4	-71.4

*Weighted by share of imports in GDP.

Table 1.4
Explanation of Actual Unemployment
(percentage points)

	1966-71/1972-78	1972-78/1979-85
Social Security contributions	2.3	2.8
Mismatch	0.5	0.2
Indirect taxes	0.7	-0.3
Real import prices*	-0.3	0.1
Union power dummy	1.0	-1.0
Replacement ratio	0.4	1.0
Capacity utilization	-2.2	8.6
Total change explained	2.4	11.4
Actual change	3.5	10.9

*Weighted by share of imports in GDP

Table 1.5
Explanation of Real Labour Costs
(percentage points)

	1966-71/1972-78	1972-78/1979-85
Social Security contributions	1.9	2.3
Indirect taxes	0.6	-0.2
Real import prices	-0.2	0.1
Mismatch	0.4	0.1
Union power dummy	0.8	-0.8
Replacement ratio	0.3	0.8
Capacity utilization	2.4	-9.2
Capital-Labour ratio	23.1	20.7
Technical progress	6.0	3.9
Total change explained	35.3	17.7
Actual change	35.1	19.0

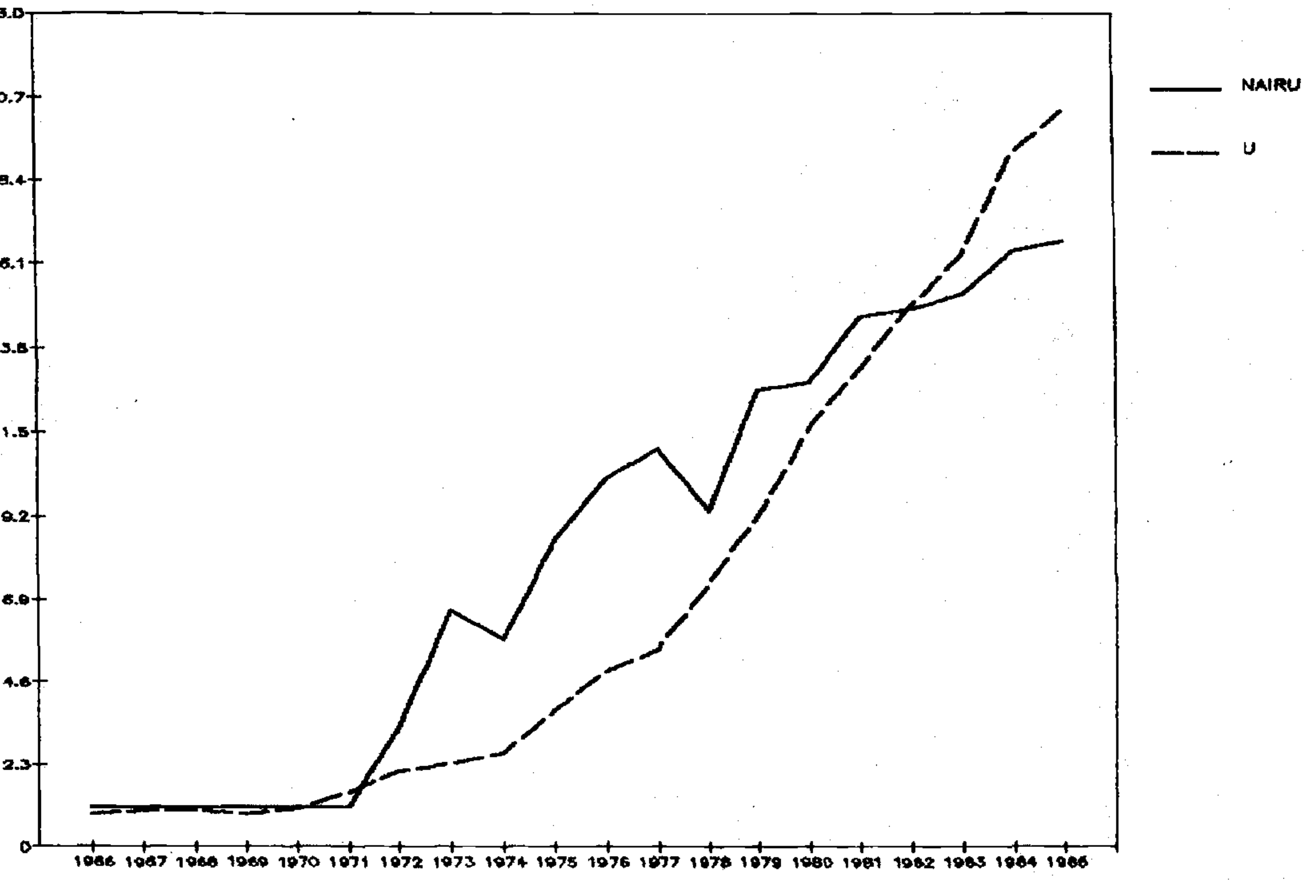
Table 1.6
Changes in the NAIRU, actual unemployment, NAIRUW and actual real labour costs
(percentage points)

	1966-71/1972-78	1972-78/1979-85
NAIRU	8.0	4.7
Actual unemployment	3.5	10.9
NAIRUW	28.0	24.0
Actual Real Labour Costs	35.1	19.0

Table 1.5 repeats the previous exercise to explain the actual change in real labour costs. Between the first two periods, real labour costs grew 6.2 points in excess of what would be explained by productivity factors (capital-labour ratio and technical progress). Of these 6.2 points, the wedge between real labour costs and the consumption wage explains 2.3 points (mostly due to Social Security contributions, which alone explain 1.9 points), cyclical demand 2.4 points, and the push factors (mismatch, union power and the replacement ratio) the other 1.5 points. Between the second and third periods, on the other hand, real labour costs grew 6.9 points less than what would be justified by productivity. Here push factors played practically no role, as the depressing effect of union power was fully compensated by the positive effect of the replacement ratio. The main explanatory factor of the fall in labour costs was cyclical demand, which induced a large fall of 9.2 points, more than sufficient to compensate the 2.2 rise due to the wedge. We have then that, according to these results, demand management has been a crucial factor for explaining both the substantial rise in unemployment and the control of labour costs (and therefore inflation).

What are the implications of these results for the non-inflationary rate of unemployment (NAIRU)? The main ones can be gathered from Table 1.4, as the change in the NAIRU can be deduced from the figures presented there, excluding the influence of cyclical demand whose level is set equal to the value taken during the baseline period. This gives the changes shown in Table 1.6. According to these results, the NAIRU would have grown more than actual unemployment between the first two periods (8.0 points versus 3.5 points respectively), but less between the last two periods (4.7 points versus 10.9 points). Similar considerations can be made with respect to the rate of growth of labour costs which is consistent with the NAIRU (NAIRUW). Between the first and second periods the change in the NAIRUW was about 7 points lower than the actual change

FIGURE 1.9
UNEMPLOYMENT AND NAIRU



in real labour costs whereas between the second and third periods it was 5 points higher.

Figure 1.9 presents the same information, but showing the level of the NAIRU and its annual evolution[4]. We observe that the NAIRU has increased substantially over the whole period and has stayed above or near actual unemployment for most of the sample period. It is only after the beginning of the 80's that the NAIRU begins to slow down its rate of increase, to end in 1985 3.6 points below actual unemployment. It must be noted, however, that these conclusions are somehow sensitive to the period used to define the initial value of the NAIRU. Had this been defined as the average of actual unemployment for the period 1966-73, then the NAIRU would have been 4.2 points below the actual rate in 1985. For this reason, we feel that the information about changes across periods given in Table 1.6 may be more relevant than the plots of Figure 1.9.

.2.3 Demand and Capital constraints

In the previous sections we have seen that both cyclical demand and the capital stock have been relevant factors in the determination of Spanish unemployment. The stock of capital has played an important role in labour demand, and capacity utilization (our proxy for cyclical demand) seems to have had a significant influence on the feasible wage. Now we want to turn back to these two variables but from another perspective.

The stock of capital sets the size of the productive capacity and, therefore, establishes a limit to the amount of workers that could be employed when using fully this capacity. In the long run, with flexible relative prices, this capacity should adjust to accommodate the available labour supply, but in the short run, a

---

4 The slightly peculiar evolution during the period 1973-1977 is due to the transitory effect of the step dummy proxying union pressure.

given capital stock may impose an effective restriction to the amount of workers that can be employed even in the presence of sufficient demand. It is important therefore to find out to what extent unemployment is due to a deficient use of the available capacity, and by how much could employment increase if this capacity was fully used. For this purpose we define the concept of potential employment as the level of employment corresponding to full use of the available capital stock.

As far as demand is concerned, we could be in a situation in which altough there is capacity, the level of demand is so small that there is no incentive for firms to use fully the capital stock available. In this situation, aggregate demand sets the effective constraint to employment. It is therefore instructive to identify also the extent to which this circumstance has been relevant in explaining the recent evolution of the labour market, and for this purpose we define the concept of Keynesian employment as the level of employment corresponding to full satisfaction of demand for domestic output.

Figure 1.10 plots the evolution of potential employment (LP), Keynesian employment (LK), labour supply (LS) and observed employment (L). Potential employment follows an increasing trend until 1975, growing at an annual rate of 0.7 per cent, and then falls monotonically for the rest of the period, at an annual rate of 2.0 per cent. This pattern can be explained by the evolution of the optimal labour-capital ratio, given relative factor prices and production conditions, and by the evolution of the capital stock. Table 1.7 shows the contribution of these two factors. From 1965 to 1975, the increase of the capital stock was 49.3 per cent and that of the optimal labour-capital ratio -41.7 per cent, which sums up to the estimated increase of potential employment of 7.4 per cent. From 1975 to 1985, the optimal labour-capital stock maintained a similar rate of decline, but the capital stock grew much less than in the previous period, not being able therefore to absorb the amount of workers freed by the much lower requirement of labour per unit of capital.

TABLE 1.7

Decomposition of the Growth of Potential Employment

(percentages)

	1965 - 1975	1975 - 1985
Optimal labour-capital ratio	-41.7	-42.3
Stock of capital	49.3	22.2
Potential employment	7.4	-20.1

We have then that what really explains the evolution of potential employment, is not so much the changes experienced by the factor mix, which maintained a uniformly decreasing trend over the whole period, but the much lower rate of increase of the capital stock after 1975. Figure 1.7 above shows this deceleration in the stock of capital.

Keynesian employment follows a similar pattern as potential employment, although much more cyclical and reaching the peak two years earlier (1973). From 1965 to 1973 Keynesian employment grew at an annual rate of 1.4 per cent, while form 1973 to 1985 it <u>fell</u> at an annual rate of 2.3 per cent. Here again, the evolution of this type of employment depends on two factors: the evolution of demand for domestic output and the evolution of the labour-output ratio. Table 1.8 shows that in this case the main reason for the big fall in Keynesian employment in the period 1973-85 is not the improvement productivity (it in fact decelerated in the second period with an annual rate of increase of 3.9 per cent as compared to 4.4 per cent in the first), but the dramatic fall in demand for domestic output, which in the period 1965-1973 grew at an average annual rate of 5.7 per cent while in the period 1973-1985 grew only at an average annual rate of 1.7 per cent.

TABLE 1.8

Decomposition of the Growth of Keynesian Employment

(percentages)

	1965 - 1975	1975 - 1985
Demand for domestic output	45.8	20.3
Labour-output ratio	-35.5	-47.8
Keynesian employment	10.3	-27.5

Another interesting feature of Figure 1.10 is the relation that LP and LK keep with one another and with observed employment (L) and labour supply (LS). In this respect we can distinguish three periods which roughly coincide with the ones used in the previous section. From 1965 to 1971, LP and LK keep what we consider a normal relationship, with LK above LP in the peak of the cycle and viceversa in the trough. Besides, both LP and LK are above labour supply and employment, thus indicating a fairly well functioning economy where actual employment was very near labour supply and existed a certain amount of excess demand for labour, which in 1970 represented a 2.5 per cent of the labour force. From 1971 to 1978 the relationship between LP and LK is more or less maintained, but LP, practically for the whole period, stays below labour supply, which can be interpreted as a signal of the appearance of some limitations as far as the amount of available capital is concerned. Also, after the peak of 1973 and towards the end of the period, we observe a clear weakening of Keynesian demand for labour, which ends up in 1978 at a level 2.0 per cent below labour supply. The last period, 1978-1985 is

FIGURE 1.10
L, LS, LP and LK

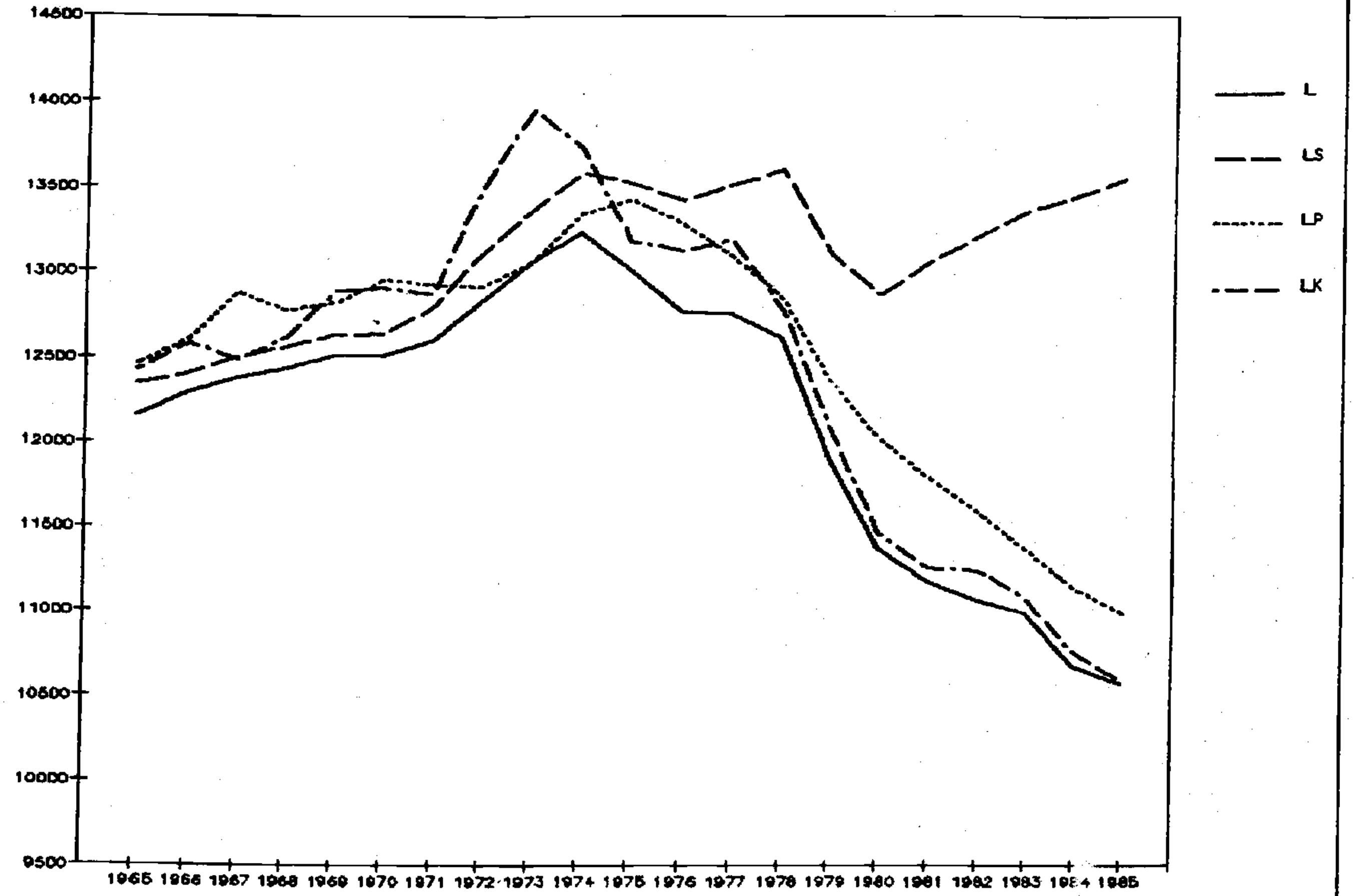
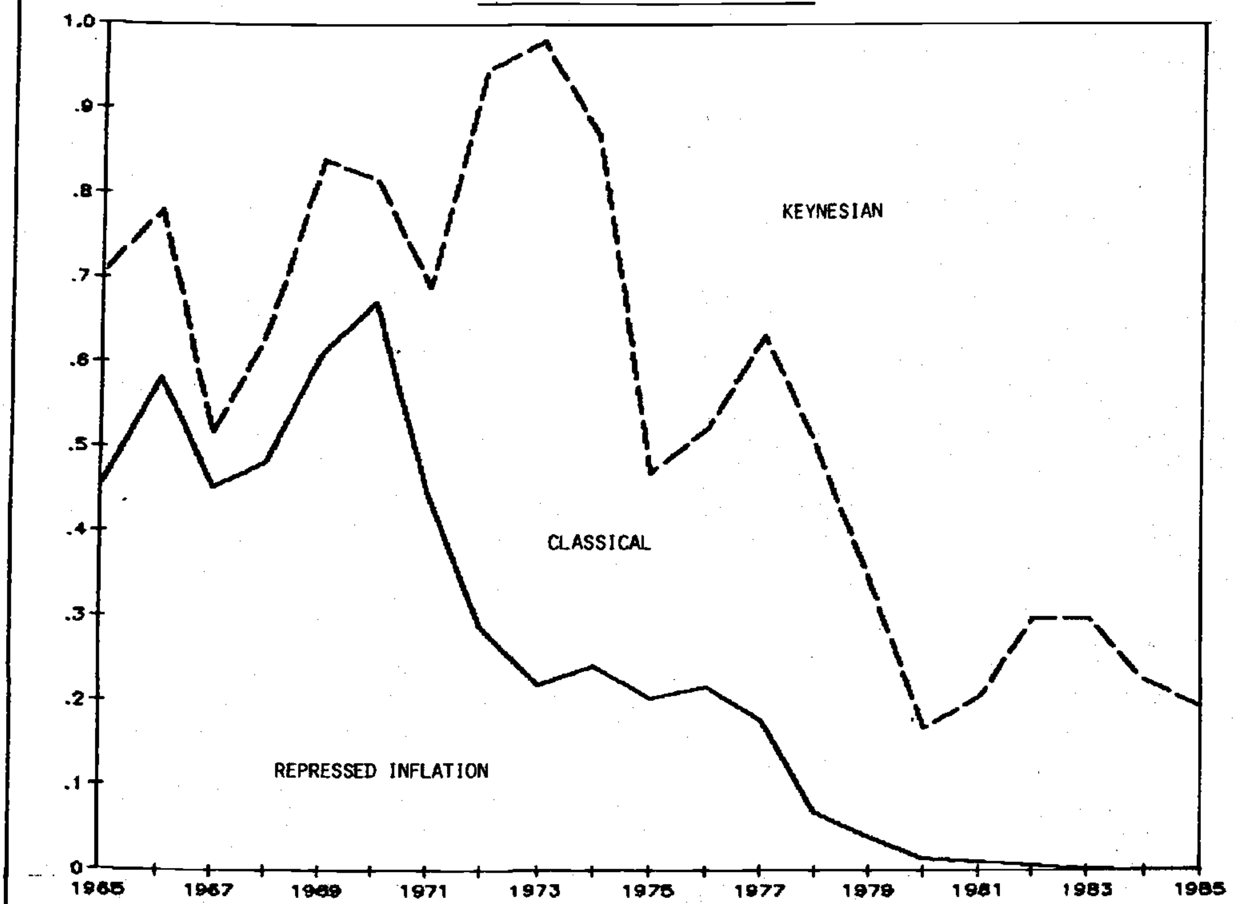


FIGURE 1.11
REGIMES SHARES



completely different from the other two, and picks up the very strong effects of the crisis upon employment. Here, LP stays above LK all the years, thus suggesting that the main constraint to employment growth has been deficient demand, which by 1985 was requiring a level of employment 21.9 per cent below that of labour supply. However, according to our results, demand expansion alone could not have solved this problem as the extra employment required would very soon have met the capital constraint. In 1985, without increasing the capital stock, the maximum amount of employment would still have been 18.9 per cent below labour supply.

In order to analize the incidence of the different constraints on the evolution of actual employment we have decomposed its rates of growth in four layers. These layers go from endogenous determinants to more exogenous ones.

Layer one is presented in Table 1.9. The observed rate of growth of actual employment is decomposed as the rate of growth of the potential labour-output ratio (i.e. the inverse of potential productivity) plus the rate of growth of observed output plus a residual coming from the neglected cross-products and the substitution of potential productivity for the observed one. The average of potential productivity in 1972-78 was 32.3 per cent higher than the average in 1966-71, while the average in 1978-85 was only 27.8 per cent higher than in 1972-78. Therefore the fall in employment in the last subperiod is not explained by the evolution of productivity, but by the large fall in output growth. Output grew only 12.7 per cent in 1979-85 with respect to 1972-78, and was unable to offset the effects of productivity growth as it did in 1972-78 when compared with 1966-71.

Next we decompose output growth as determined by Keynesian demand, full capacity (or potential) output and full employment output. At any given moment of time firms produce what they produce, and no more, because they are restricted either by demand or by

TABLE 1.9

DECOMPOSITION OF CHANGES IN EMPLOYMENT

Effects of potential productivity and output growth
(percentages)

	1972-78/1966-71	1979-85/1972-78
Estimated change in potential productivity of labour	32.3	27.8
Actual change in output	35.2	12.7
Explained change in employment	2.9	-15.1
Actual change in employment	3.5	-15.0

capacity or by the availability of labour supply. Therefore the growth in output is explained by the growth in demand in the demand-restricted firms, the growth in capacity in the capacity restricted ones and so on. This second layer is presented in Table 1.10.

Keynesian demand grew, as an average, 35.9 per cent in 1972-78 with respect to 1966-71. However, its contribution to output growth was 10.7 points because roughly a third of firms were demand constrained. Full capacity output grew 34.7 points in that period and its contribution to output growth was 17.4 points, as roughly half of firms were capacity constrained. Full employment output grew 38.9 points, as only a sixth of firms were labour-supply constrained. The annual evolution of regime shares of firms is shown in Figure 1.11.

When we compare the average of the period 1979-85 with the average of 1972-78 we see that Keynesian demand grew an 11.4 per cent and its contribution to output growth was 8.6 points, reflecting that three fourths of firms were demand constrained in this period. The contribution of potential output was 3.6 points, less than one fifth of its growth, and the contribution of full employment output was less than one tenth of its growth. The most generally binding constraint in this period is the demand one, followed closely by capacity restrictions if we consider the situation depicted in Figure 1.10. By the end of the period the labour supply constraint was almost negligible (see Table 4.7 or Figure 1.11).

In the third layer we address the decomposition of Keynesian demand, potential output and full employment output. Table 1.11 shows the changes in consumption, investment, government expenditure and notional external balance. The comparison of the two columns of Table 1.11 reflects the slowdown of the economy in 1979-85. Consumption fell from a growth of 35.5 points to 11.3, diminishing its contribution to Keynesian demand growth in 16.4 points. Investment had a negative contribution of 2.8 points in the last period compared

TABLE 1.10

DECOMPOSITION OF OUTPUT GROWTH

Estimated changes of output growth determinants
(percentages)

	1972-78/1966-71	1979-85/1972-78
Keynesian demand	35.9	11.4
Full capacity output	34.7	15.4
Full employment output	38.9	26.2

Contributions to output growth
(percentages)

	1972-78/1966-71	1979-85/1972-78
Keynesian demand	10.7	8.6
Full capacity output	17.4	3.6
Full employment output	7.8	2.6
Explained output growth	35.9	14.8
Actual output growth	35.2	12.7

to a positive one of 8.4 points in the middle period. Government expenditure proved fairly constant both in its own rates of growth and in its contribution to Keynesian demand growth. The notional external balance contributed decisively to sustaining demand in the last period, contributing 3.5 points to demand growth while, in the middle period, it had only contributed 0.5 points.

In Table 1.12 we decompose potential output in terms of potential productivity of capital and the capital stock. Both rates of growth are depicted in Figure 1.7 on an annual basis. The fall in the estimated change of potential output in the last period is due both to the fall in the rate of growth of capital and to the fall in the potential productivity of capital which seems to be a sort of leading indicator of the former (see Figure 1.7). In the last period the capital stock grew 13.5 points less than in the middle period and potential productivity of capital grew at a negative rate of 5.4 per cent.

Full employment output is decomposed in Table 1.13 in terms of labour supply and potential productivity of labour. The slowdown of full employment output is accounted for both by the decelaration of potential productivity growth and by the diminishing labour force in the last period.

Finally, the fourth layer decomposes the changes in potential productivity of labour in terms of the effects of relative prices and technical progress. As can be seen in Table 1.14 both effects operate in the same direction in determining the deceleration of potential productivity growth. The growth of the cost of labour with respect to the cost of capital has been 6 points less in the last period than in the middle one, but the contribution of relative prices of labour productivity growth was only 3 points less in that period than in the former. Technical progress also slowed down in the last period, diminishing its contribution to productivity growth from 18.5 points in the middle period to 12.8 in the last one.

Annual figures for the four layers are included in an Appendix.

TABLE 1.11

DECOMPOSITION OF KEYNESIAN DEMAND GROWTH

Actual Change in Keynesian Demand determinants

(Percentages)

	1972-78/1966-71	1979-85/1972-78
Consumption	35.5	11.3
Investment	35.2	-11.6
Government expenditure	33.9	31.3
Notional exports(*)	60.1	41.5
Notional imports (*)	55.1	26.3

Contributions to Keynesian Demand growth

(Percentage)

	1972-78/1966-71	1979-85/1972-78
Consumption	24.0	7.6
Investment	8.4	-2.8
Government expenditure	2.9	2.7
Notional external balance	0.5	3.5
Explained growth of Keynesian demand	35.8	11.0
Estimated change of Keynesian demand	35.9	11.4

(*) Estimated

TABLE 1.12

DECOMPOSITION OF FULL CAPACITY OUTPUT
(Percentages)

	1972-78/1966-71	1979-85/1972-78
Actual change in capital stock	34.3	20.8
Estimated change in potential productivity of capital	0.4	-5.4
Estimated change in potential output	34.7	15.4

TABLE 1.13

DECOMPOSITION OF FULL EMPLOYMENT OUTPUT
(Percentages)

	1972-78/1966-71	1979-85/1972-78
Actual change in labour supply	6.6	-1.6
Estimated change in potential productivity of labour	32.3	27.8
Estimated change in full employment Output	38.9	26.2

TABLE 1.14

DESCOMPOSITION OF POTENTIAL PRODUCTIVITY OF LABOUR GROWTH

Actual changes in potential productivity determinants
(Percentages)

	1972-78/1966-71	1979-85/1972-78
Relative prices	32.4	26.4
Technical progress[5]	36.4	23.5

Contributions to potential productivity growth
(Percentages)

	1972-78/1966-71	1979-85/1972-78
Relative prices	15.9	12.9
Technical progress	18.5	12.8
Explained change in potential productivity of labour	34.4	25.7
Estimated change in potential productivity of labour	32.3	27.8

5 Estimated

2. THE MODEL

High inflation and falling employment are the two main features of the recent stagflation period. Any suitable model of stagflation must address these two issues. In this section we present a sketch of the theoretical model used in this paper and based on the work of Layard and Nickell (1985), Sneessens and Drèze (1986) and Sneessens (1987). The empirical framework used and the results obtained are presented in later sections.

Inflationary pressures are mainly caused by distorsions in the distribution mechanism. Changes in the bargaining power of unions and firms over the distribution of income lead, in a non-cooperative setting, to inflationary pressures in the short-run and unemployment in the long-run. Monopoly power on wage and price determination is a feature of our economies and lies behind the so called inflationary bias.

Employment, on the other hand, is affected by a variety of factors. It would be too naive to identify a single cause of the employment slump. The Second Generation Disequilibrium Models constitute a useful framework to assess the relative importance of different factors such as: capital shortages, low agregate demand, labour supply developments, structural mismatches and long-run permanent changes in relative prices[6]. A simple version of this type of models is presented in the last part of this section. Given the importance of the determinants of aggregate demand, especially investment, the labour market block must be enlarged to account for the evolution of investment, consumption, trade balance, etc. and the

---

6 By Second Generation we mean the set of models in which an overall disequilibrium regime characterising the economy at a point in time is substituted by a distribution of regimes across markets which hence can suffer from different disequilibrium situations (see e.g. Muellbaur and Winter (1980)).

initial model becomes an small (albeit non-fully complete) macro model.

The main assumptions of the model can be summarized as follows.

i) Firms and workers (unions) set wages before prices and employment are known. Bargaining refers only to expected real wages **(W/P^e)** and the firm keeps the right to decide about prices and employment.

ii) There are **n** firms which operate in a monopolistic competition set up. Each firm faces a downward sloping demand curve on its price relative to the aggregate price level **$d(P_i/P)$**. Aggregate demand is given by **YD**. The firm sets its price as a mark-up over normal unit costs, taking into account the expected price of its competitors (in aggregate, **P^e**), before the actual value of the exogenous demand **(e_i)**, capacity **(ϵ_i)** and labour supply **(v_i)** random disturbances are known.

iii) Technology is of the putty-clay type, with large ex-ante substitution possibilities and fixed ex-post factor proportions. Assuming separability, the firm's value added is subject to the following short run constraints (Sneesens (1987)):

$$Y_i \leq d \left(\frac{P_i}{P^e}\right) \frac{YD}{n} e_i \qquad (2.1)$$

$$Y_i \leq A \cdot LS_i \, v_i \qquad (2.2)$$

$$Y_i \leq B \cdot K_i \, \epsilon_i \qquad (2.3)$$

The firm chooses ex-ante the optimal technical proportions **(A,B)** and capacity **(K_i)** to minimize long-run costs. **LS_i** is the labour supply exogenously given to the firm. In most of the paper we shall take **K_i** as given by past investment decisions so that we shall focus on the choice of **A** and **B**.

iv) Labour is the only variable factor and it is choosen once **P_i/P**, **e_i, v_i, ϵ_i** are known. Given the ex-post rigidity, the employment function is simply:

$$L_i = A^{-1} Y_i \tag{2.4}$$

v) Finally, we will consider a large number of firms, so that sample moments are equal to population ones.

From now on we define as **YD_i, YS_i, YP_i** as the right hand sides of (2.1), (2.2), (2.3) respectively.

2.1. Wages and Prices

Prices (Feasible mark-up)

Given the stochastic structure of the model we shall assume that each firm sets its price as a mark-up over normal unit costs defined at the full employment level of resources **($E(YP_i)/E(LS_i)$)**. Firms also take into account the expected rival's price and hence prices are set according to:

$$P_i = \bar{h} \left(\mu . W . \frac{E(LS_i)}{E(YP_i)}, \; P^e \right) \tag{2.5}$$

where μ is the mark-up and $E(LS_i)$ represents the expected available labour force and $E(YP_i)$ the expected output at full capacity or potential output as defined in (2.3). If we assume (Nickell (1986)) that $\bar{h}$ is homogeneous of degree one on both arguments we can rewrite:

$$\frac{P_i}{W} = \mu \left[\frac{E(LS_i)}{E(YP_i)}\right] \cdot h \left(\frac{P_i}{P^e}\right) \qquad (2.6)$$

The mark up will usually be a function of cyclical demand pressure which we will represent by:

$$\mu = \mu \left(\frac{E(YD_i)}{E(Y_i)}\right) \qquad (2.7)$$

The sign of $\mu'()$ is ambiguous, and several reasons can be found in support of either a positive reaction or a negative one. Among the main factors behind the explanation that the mark-up moves procyclically lies the increase in marginal costs as demand expands. Among the models that imply a countercyclical movement we can find, in the context of oligopolistic industries, theories based upon the view that collusion is more dificult when demand is high (see Rotemberg and Saloner (1986)) or on the attraction of more "unattached" customers, which increases the elasticity of demand (see Bils, (1985)).

If we now assume point expectations, and given that the random disturbances are distributed with mean equal to one, we can write:

$$\frac{YD_i}{Y_i} = \Omega\ (DUK) \qquad \Omega' > 0 \qquad (2.8)$$

$$\frac{YP_i}{LS_i} = B\ \frac{K_i}{LS_i} \qquad (2.9)$$

where DUK is the degree of capital utilization.

Aggregating over firms and taking logs, our **price equation** is as follows

$$p - w = \alpha_0 - \alpha_1 (p-p^e) - \alpha_2 \, duk - \alpha_3 (k-ls) \qquad (2.10)$$

where lower case letters denote logs, and the coefficients are positive except α_2 which, according to the previous discussion, can be either positive or negative.

Real Wages (Desired mark-up)

We obtain our **wage equation** as the outcome of a bargaining process over ex-ante desired real wages. There is no uncertainty about the rival's fall back position so that the outcome can be thought of as coming from a Nash bargaining type model:

$$w - p = \beta_0 - \beta_1 (p-p^e) - \beta_2 U + \beta_3 (k-ls) + Z \qquad (2.11)$$

where U is the unemployment rate and Z is a vector of push factors including the replacement ratio **(rr)**, union power **(PS)**, and the variables driving a wedge between the producer's price **(p)** and the consumer price index. Among these we find the income tax **(t_2)**, indirect taxes **(t_3)** and Social Security contributions **(t_1)**,as well as some function of the ratio of imported goods prices over the CPI, **($P_m - \overline{P}$)**.

$$Z = Z (rr, PS, (P_m - \overline{P}), t_1, t_2, t_3) \qquad (2.12)$$

Inflation and the distribution of income

Solving out (2.10) and (2.11) under the assumptions that

$$\beta_3 = \alpha_3$$
$$p - p^e \doteq \Delta^2 p \qquad (2.13)$$

we get the following unemployment-inflation trade-off[7].

$$U = -\frac{1}{\beta_2}(\beta_0 + \alpha_0) - \frac{1}{\beta_2}(\beta_1 + \alpha_1)\Delta^2 p - \frac{\alpha_2}{\beta_3}(duk) - \frac{1}{\beta_2} Z \qquad (2.14)$$

Expression (2.14) has the conventional Phillips Curve interpretation where distributional factors are explicitly allowed for. It is not a theory of unemployment, for it involves other endogenous variables such as $\Delta^2 p$ and **duk**. What this expression shows is how much inflation is required to make the desired and feasible mark ups consistent for a given level of unemployment and demand pressure. If we want to turn (2.14) into an operative theory of inflation we need independent explanations of unemployment and demand. This is the main subject of the next pages, although this task is only partially carried out. As we shall see we only explain one side of the unemployment rate leaving the labour supply exogenous; similary demand pressure is explained in terms of a set of variables some of which are themselves endogenous (mainly **duk**).

Equation (2.14) captures the underlying inflationary pressure of an economy. In particular, it gives the amount of unemployment needed to keep inflation constant; i.e., the NAIRU. Keeping inflation constant makes not only consistent the desired and feasible actual mark-ups, but the actual and perceived ones too. The determinants of

---

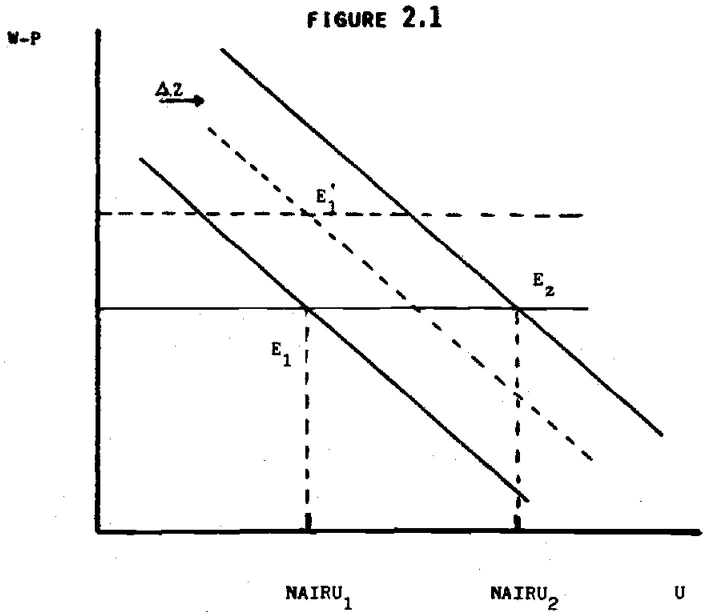
7 The underlying idea behind the approximation used for the price surprise is that the rate of inflation follows a random walk, a hypothesis which is not rejected by the data.

the NAIRU are the ultimate causes of inflation and (2.14) shows to what extent inconsistent distributional demands could lie behind the inflationary bias of an economy.

Figure 2.1 gives an idea of the inflationary impact of a supply shock represented by an increase in any of the push factors in Z. If we start in a long-run equilibrium at E_1 with $p = p^e$ (or $\Delta^2 p = 0$), an increase in Z shifts the wage equation rightwards.

In the short run (for a given U at $NAIRU_1$) inflation must rise to make compatible the new distribution on expected terms. Notice that workers are pushing for higher real wages and the firm tries to recover costs, at least partially, through price surprises. This offsetting behaviour cannot be taken too far, for it may weaken the firm's position in the goods market, and this leads to a situation like E'_1 in which everybody accepts their expected income, although workers are getting in real terms less than what they believe .

FIGURE 2.1



This situation is not a stable one. In the long-run actual and perceived incomes cannot differ and the only way in which the new income distribution can be made acceptable to workers is at a higher unemployment level such as $NAIRU_2$. In other words, a depressing effect on union's bargaining position (achieved through the rise in unemployment) must follow the increase in Z if firms are to keep their mark-up without accelerating inflation.

The wage-price formation mechanism just described is the crucial element of the theory of inflation contained in this model. However, it is also an explanation of the evolution of relative factor prices, which are the main determinants of the technological and investment decisions described the employment block.

Unfortunately, we do not have at this stage a model to explain either the price of investment goods, nor the user's cost of capital. These are considered exogenous to avoid the explicit modelling of the financial sector and the investment goods market. Therefore, in what follows, any impact of relative factor prices should be understood as being caused by changes in the underlying push factors in wage and price formation.

2.2. The determinants of employment

The Production Function

The joint choice of factor proportions and firm's size is the outcome of the following cost minimization problem (Gagey, Lambert and Ottenwaelter (1987)), where ex-ante substitution possibilities are represented by a CES function:

$$\text{Min } (W\ LP_i + CC\ K_i) \tag{2.15}$$

s.t.

$$YP_i = \left(\tau \left(e^{\beta_L T} LP_i\right)^{-\alpha} + (1-\tau)\left(e^{\beta_K T} K_i\right)^{-\alpha} \right)^{-1/\alpha} \tag{2.16}$$

where **W** and **CC** are the nominal wage rate and user cost of capital respectively, LP_i is the level of employment corresponding to a full utilization of K_i, which is required to produce YP_i. Finally, β_L and β_K are the labour and capital augmenting technical progress coefficients, and T is a time trend.

Assumming that in the long-run prices are set as a mark up over total unit costs, the first-order conditions result in the following expressions:

$$\frac{K_i}{LP_i} = \left(\frac{1-\tau}{\tau}\right)^{\sigma} e^{(\beta_L - \beta_K)(1-\sigma)T} \left(\frac{W}{CC}\right)^{\sigma} \tag{2.17}$$

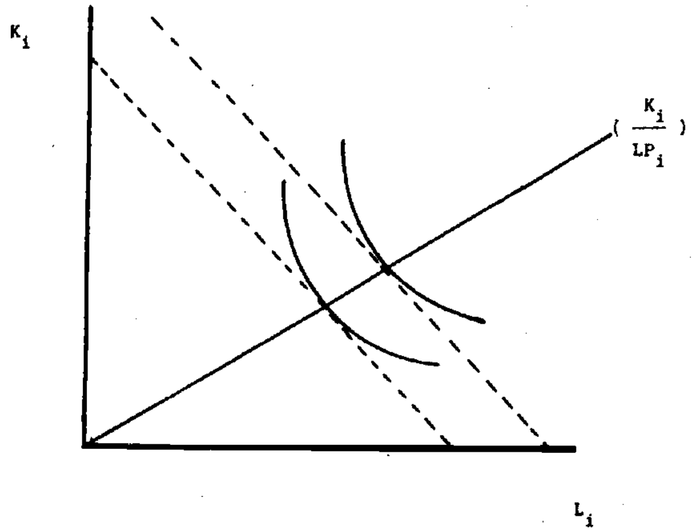
$$\frac{YP_i}{K_i} = (1-\tau)^{\sigma} e^{(1-\sigma)\beta_K T} \left(\frac{CC}{P}\right)^{\sigma} \tag{2.18}$$

where

$$\sigma = \frac{1}{1+\alpha}$$

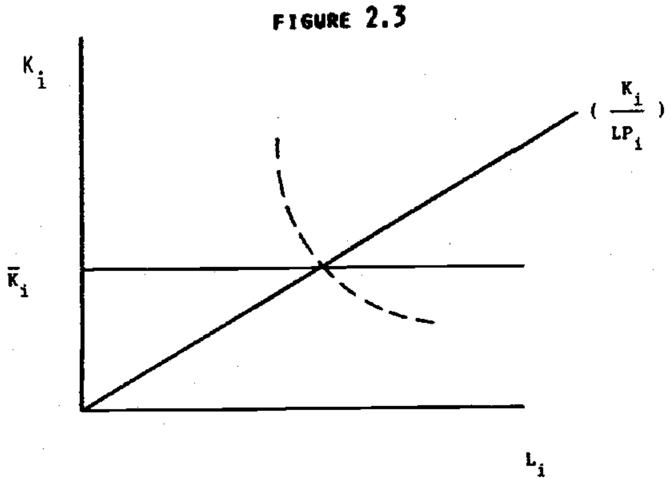
Equation (2.17) determines the optimal capital-labour ratio, and (2.18) can be interpreted either as an investment function or as a capacity (YP_i) equation (we will come back to this point).

FIGURE 2.2



Given constant returns to scale, to find out the desired level of labour (LP_i), we need to fix either K_i or the desired capacity (YP_i). In the long-run K_i is going to be endogenous, and we shall establish a target capacity level which will turn (2.18) into an investment function. In the medium term however, we consider the installed capacity as predetermined and therefore (2.17) and (2.18) give us the optimal capital/labour ratio (K_i/LP_i) and capacity level (YP_i). This is shown diagramatically in Figure 2.3.

FIGURE 2.3



Expression (2.17) is therefore the potential labour demand conditional on the capital stock:

$$LP_i = A^{-1} B K_i \qquad (2.19)$$

where

$$A.B^{-1} = \left(\frac{K_i}{LP_i}\right) = g\left(T, \theta(\Lambda)\left(\frac{W}{CC}\right)\right) \qquad (2.20)$$

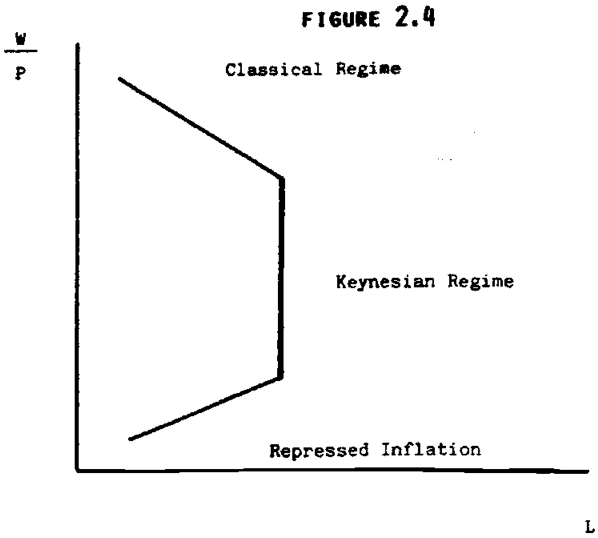
where actual (W/CC) has been substituted out by a distributed lag $\theta(\Lambda)$ (where Λ is the lag operator) of relative prices. This works as a proxy for relative price expectations as determinants of the ex-post fixed proportions decisions. Notice that (2.19) and (2.20) look very much like a classical labour demand equation, in which relative prices do not have an inmediate impact given the sluggish technological adjustment. The smaller the mean lag in $\theta(\Lambda)$, the closer the model to a conventional putty-putty competitive labour demand equation. We can also write LP_i as a function of YP_i:

$$LP_i = A^{-1} YP_i \qquad (2.21)$$

Employment Function

So far we have obtained an expression for labour demand when the firm is only constrained by its past investment decisions. However, the firm can also be either unable to sell all its output or to hire as much labour as it wants to. Therefore these two other constraints must also be taken into account.

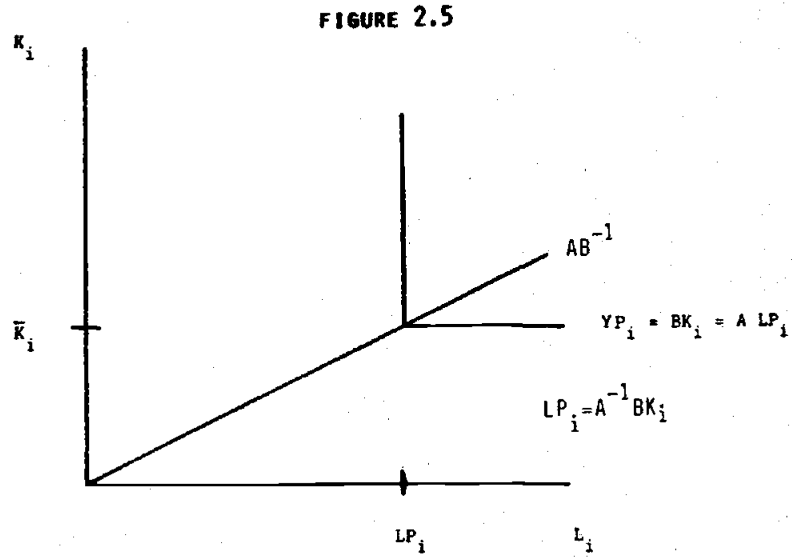
FIGURE 2.4



The conventional representation of the three employment regimes, such as that shown in Figure 2.4, is no longer appropiate here, for it is based on a putty-putty technology. Nevertheless, it is easy to gain some intuition of the short run employment decisions of the firm as follows.

At a given point in time, t, the firm takes K_i, A and B as given, and therefore there are no substitution possibilities. The production set is then represented by right angle isoquants as in Fig. 2.5.

FIGURE 2.5



If there are no constraints elsewhere, labour demand must lie along the ray through the origin. Clearly, installed capital is the binding constraint. Employment is then given by the labour demand (LD_i) at its potential level.

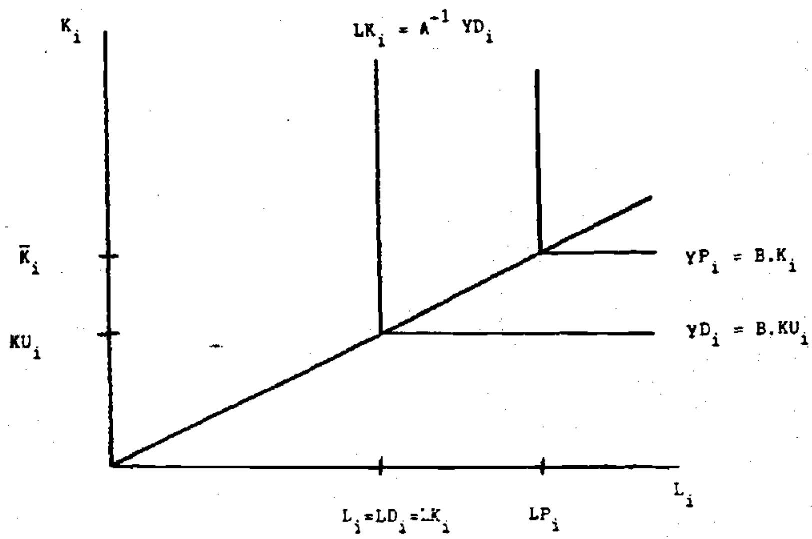
$$L_i = LD_i = LP_i = A^{-1} B K_i \quad \text{if} \quad \begin{array}{l} LD_i < LS_i \\ YP_i < YD_i \end{array} \tag{2.22}$$

Let us consider now the possibility of the firm being in a sales constraint. Once prices are set and e_i and v_i are realized, it may be the case that the firm's demand (YD_i) falls short of YP_i. If that is the case, employment is no longer given by (2.22) but

$$L_i = LD_i = LK_i = A^{-1} YD_i \quad \text{if} \quad \begin{array}{l} LD_i < LS_i \\ YP_i > YD_i \end{array} \tag{2.23}$$

This is the situation portrayed in Fig. 2.6:

FIGURE 2.6



where KU_i stands for used capital, and where we assume that the degree of labour hoarding is constant so that effective labour input is a constant proportion of employment[8]. For the case of no rationing in the labour market, employment is given by the labour demand side, which can be represented in a more compact fashion by the traditional min condition,

$$L_i = LD_i = \min (LP_i, LK_i), \qquad \text{if } LD_i < LS_i , \qquad (2.24)$$

which can also be written as,

$$L_i = LD_i = A^{-1} (\min (YP_i, YD_i)) \qquad (2.24')$$

If the number of firms is very large, the aggregate demand for labour is given by:

$$L = LD = nE(LD_i) = nA^{-1} E(\min (YP_i, YD_i)) \qquad (2.25)$$

Under some assumptions about the joint distribution of e_i, ϵ_i, it can be shown (Lambert (1987)) that (2.25) can be written as

$$E(\min (YP_i, YD_i)) = (E(YD_i)^{-\delta_1} + E(YP_i)^{-\delta_1})^{-1/\delta_1} \qquad (2.26)$$

where $(1/\delta_1)$ is an increasing function of the variances and covariances of the stochastic vector. Proceeding in the same way for $E(YD_i)$, $E(YP_i)$, $E(K_i)$, (2.26) can be written as

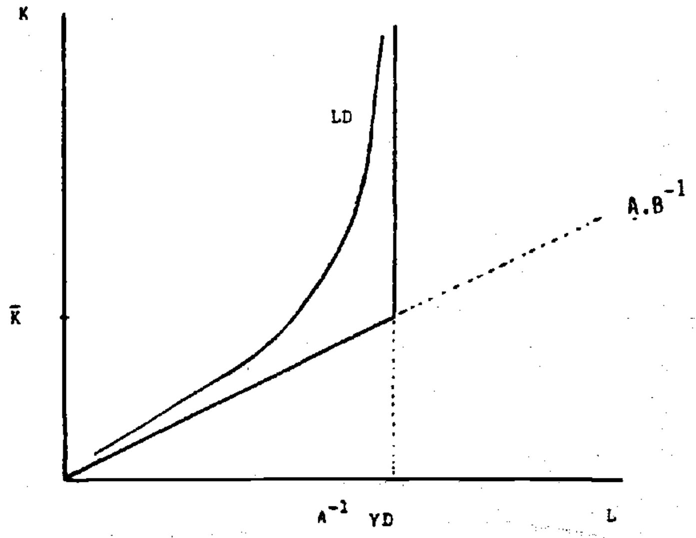
$$LD = ((A^{-1} YD)^{-\delta_1} + (A^{-1}BK)^{-\delta_1})^{-1/\delta_1} \qquad (2.27)$$

---

8 This is assumed for simplicity. The whole argument would still go through in the presence of varying labour hoarding.

The parameter δ_1 is an index of the degree of uncertainty about demand and capacity. This introduces a friction element that makes employment always lie below its Keynesian and potential level. The effect of increasing uncertainty can be easily understood using Figure 2.7.

FIGURE 2.7



The smaller $1/\delta_1$, the closer the employment schedule to the two boundaries given by:

$$LP = A^{-1} BK$$

and

$$LK = A^{-1} YD$$

Actually, in the non-stochastic case (2.27) collapses to the min condition:

$$LD = \min (LK, LP) \qquad (2.27')$$

The story goes as follows. When the capital constraint is very tight, most firms are in a classical restriction and the aggregate capital properly represents the actual economywide regime. As capital gets larger the probability of some firms falling into a sales constraint increases; total capital is no longer a good representation of the overall constraint, because those firms in a

Keynesian regime drive the employment schedule leftwards. It should be clear that in the non-stochastic case all firms are in the same regime and so employment must be given by either LP or LK. Similarly, as the variance of the shocks gets higher, for a given predominant regime, the proportion of firms in the alternative regime increases, and hence the whole employment schedule shifts to the left. At a macroeconomic level these stochastic disturbances mainly represent structural shifts and relative price changes among sectors.

So far we have been dealing with a labour market that shows no rationing. When the labour supply lies, at the prevailing real wage, below the labour demand, employment is given by the labour supply. Therefore,

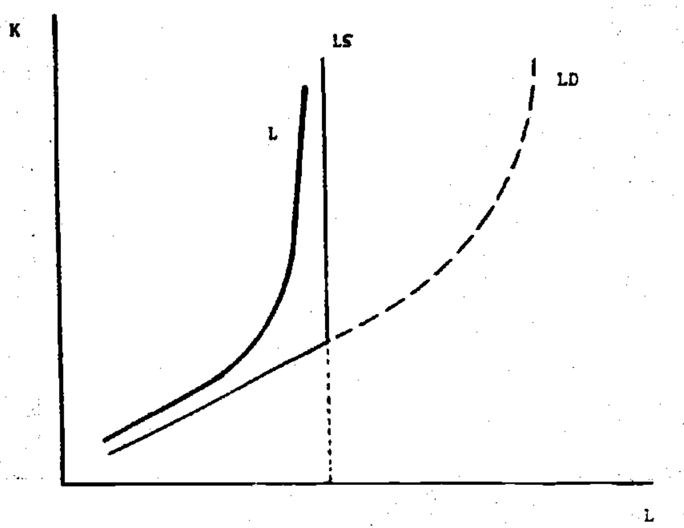
$$L_i = \min (LD_i, LS_i) \tag{2.28}$$

Following the same steps as before, the aggregate employment function takes the form

$$L= \left((LD)^{-\delta_2} + (LS)^{-\delta_2} \right)^{-1/\delta_2} , \tag{2.29}$$

where $(1/\delta_2)$ is an increasing function of the variances and covariances of the stochastic vector (e_i, ϵ_i, v_i). It represents the degree of labour market mismatch between demand and supply, which introduces an additional friction. The larger the mismatch $(1/\delta_2)$, the smaller the observed employment for given levels of demand and supply. Figure 2.8 represents diagramatically this case.

FIGURE 2.8



The employment function can then be written as in Gagey, Lambert, Ottenwaelter (1987),

$$L = \left[\left[(LK)^{-\delta_1} + (LP)^{-\delta_1} \right]^{\delta_2/\delta_1} + (LS)^{-\delta_2} \right]^{-1/\delta_2} \qquad (2.30)$$

and assuming that $\delta_1 = \delta_2 = \rho$[9]

$$L = [(A^{-1} YD)^{-\rho} + (A^{-1}BK)^{-\rho} + (LS)^{-\rho}]^{-1/} \qquad (2.30')$$

Notice that each of the following changes will shift the L locus leftwards: a fall in the labour supply, a fall in LP, a fall in LK and an increase in the structural mismatch (measured by $1/\rho$). The fifth element behind the fall in L is the change in the technical coefficients A, B, induced by technical progress and long lasting changes in relative prices. These are probably the two factors behind the continuous fall in A^{-1} and $(A^{-1}B)$, which in the context of this model can only be compensated by increases in aggregate demand and the capital stock.

Demand and Investment

Let us now deal with two of the main determinants of L, namely YD and K. If we want to explain the ultimate causes of the labour slump, we need to know the determinants of both notional demand and investment. YD itself is unobservable, so we start by searching an operational expression for it.

---

9 Under this assumption we don't discriminate among the two different sources of mismatch on an empirical basis. There is a trade off between a more sophisticated especification for ρ, and the discrimination among δ_1 and δ_2. We have chosen the first option, although further research will be done to deal with the two alternatives at the same time.

Notional demand can be expressed as:

$$YD = CD + ID + GD + XD - MD \qquad (2.31)$$

We shall assume that domestic absorption, A, is never rationed and that any potential excess demand is satisfied increasing imports or reducing exports. Hence:

$$YD = A + XD - MD \qquad (2.32)$$

or

$$YD = Y + X \left(\frac{XD - X}{X} \right) - \left(\frac{MD - M}{M} \right) M \qquad (2.32')$$

Taking logs, we can approximate this expression as follows

$$\log \left(\frac{YD}{Y} \right) \doteq S_X \left(\frac{XD - X}{X} \right) - S_M \left(\frac{MD - M}{M} \right) \qquad (2.33)$$

where S_X, S_M are the shares of exports and imports in total GDP.

The discrepancies among actual and notional values of foreign trade will depend on how tight domestic markets are. Using the deviations of DUK with respect to some the historical minimum value as a proxy for such tightness, we can specify these discrepancies as follows.

$$\frac{XD - X}{X} = \phi_X \log \left(\frac{DUK}{DUK_{min}} \right) \qquad (2.34)$$

$$\frac{MD - M}{M} = -\phi_M \log \left(\frac{DUK}{DUK_{min}}\right) \qquad (2.35)$$

where XD and MD are functions of the fundamental determinants of exports and imports, and ϕ_X, ϕ_M should both be positive (as internal demand overheats, actual exports go below their "notional" level, and actual imports go above theirs).

To isolate the spillover from the fundamental effects, we need an estimate of ϕ_X, ϕ_M. These are obtained from the following regressions:

$$\log X \doteq \log XD - \phi_X \log \left(\frac{DUK}{DUK_{min}}\right) \qquad (2.36)$$

$$\log M \doteq \log MD + \phi_M \log \left(\frac{DUK}{DUK_{min}}\right) \qquad (2.37)$$

Therefore:

$$YD \doteq Y + (\hat{\phi}_X X + \hat{\phi}_M M) \log \left(\frac{DUK}{DUK_{min}}\right)$$

or

$$\log \left(\frac{YD}{Y}\right) = (S_X \hat{\phi}_X + S_M \hat{\phi}_M) \log \left(\frac{DUK}{DUK_{min}}\right) \qquad (2.38)$$

Consumption and **investment** are left unrationed and therefore they have not been considered to correct GDP for spillovers[10]. However, it is still interesting to analyze these two components of GDP, not only as major determinants of total demand, but also to provide an explanation of the evolution of the stock of capital and of savings.

The departures from the long run relationship between consumption expenditures (in both durables and non-durables) and disposable income are specified as an error correction mechanism . A long run effect for inflation is also allowed, in the form of an inflation tax. Spillovers from other (presumably) rationed markets are not considered in the long run, assuming that all these effects are working through the permanent income effect.

$$C = C\ (Y^d\ ,\ IT) \qquad (2.39)$$

where Y^d stands for disposable income and IT for the inflation tax.

Spillovers, however, are allowed in the short run, and in particular we consider the possibility of changes in unemployment diminishing accumulated wealth by means of temporary disavings.

The investment function comes from (2.18), where we have taken an exogenously given desired capacity level. In such a case, (2.18) becomes an investment function where we have assumed that firms wish to satisfy expected total demand in the long run.

---

10 Actually, there exists some positive spillover from demand pressure to investment that should be used to correct (2.35):

$$\log\left(\frac{YD}{Y}\right) = \left(S_X\ \hat{\phi}_X + S_M\ \hat{\phi}_M - S_I\ \hat{\phi}_I\right) \log\left(\frac{DUK}{DUK_{min}}\right)$$

Nevertheless we disregard this extension.

$$\frac{E(YD_1)}{K} = (1-\tau)^{\sigma} e^{(1-\sigma)\beta_T} (\frac{CC}{P})^{\sigma} \tag{2.40}$$

Aggregating over firms we have

$$\frac{YD}{K} = (1-\tau)^{\sigma} \; e^{(1-\sigma)\beta_T} \; (\frac{CC}{P})^{\sigma} \tag{2.41}$$

Notice that in (2.40) an additional spillover effect appears running from excess demand to accelerated investment.

$$\frac{K}{Y} = (\frac{\beta^{\alpha}}{1-\tau}) \quad e^{(\sigma-1)\alpha T} \; (\frac{P}{CC})^{\sigma} (\frac{YD}{Y}) \tag{2.42}$$

Equation (2.41) is the basis of our empirical model, and can be reinterpreted as a proper investment function. Assuming that the rate of growth of the capital stock is small relative to the depreciation rate (δ) and not too volatile, we can show (see Bean (1981)):

$$\log (\frac{I}{Y}) \doteq \log (\frac{K}{Y}) + \text{constant} \tag{2.43}$$

The long run determinants of the I/Y ratio are those of K/Y. Then, using (2.38), the investment function can be written as

$$\frac{I}{Y} = \frac{I}{Y} (\text{Trend}, \frac{C}{P}, \frac{YD}{Y} (\text{DUK})) \tag{2.44}$$

3. THE EMPIRICAL FRAMEWORK

This Section presents a synopsis of the model estimated in Section 4. It consists of nine equations arranged in two blocks.

3.1. Wages and Prices block

The **wage equation** (see (2.11)) takes the following general form:

$$(w+t_1-p) = \beta_0 + \beta_1(w+t_1-p)_{-1} - \beta_2(\Lambda)U - \beta_3\,{}^{2}p + \beta_4(k-ls) + \beta_5 Z_1 \quad (3.1)$$

Where $\beta(\Lambda)$ is a lag polynomial, **w** is the gross monthly wage per employee, **p** is the value added deflator, t_1 is the employer's Social Security contribution rate, **U** is the unemployment rate, **(k-ls)** an index of trend productivity and Z_1 is a vector of wage push factors (it may include, among others, the tax wedge, the replacement ratio, an index of union pressure, an index of mismatch, the age structure of the labour force, etc.). Small letters denote logarithms but for the tax rates.

The "feasible" real wage is set by firms according to the **price equation** which takes the form of a mark up on average labour costs (see (2.10)):

$$(p-w-t1) = \alpha_0 + \alpha_1(p-w-t1)_{-1} + \alpha_2(\Lambda)w + \alpha_3 duk + \alpha_4(k-ls) + \alpha_5 Z_2 \quad (3.2)$$

where $\alpha(\Lambda)$ is a polynomial in Λ, and $\alpha(\Lambda)w$ allows for sluggish nominal adjustment, **duk** is the logarithm of the degree of utilization of capital, which stands for a proxy of demand pressure, and Z_2 is a vector of possible shift factors.

The unemployment rate is the only variable in (3.1) that has a negative effect on the "target" real wage. Solving for **U** in the long-run version of (3.1) and (3.2), setting to zero nominal surprises and fixing **duk** at its average level, we get the **NAIRU**. That is, the unemployment rate which matches "feasible" and "target" real wages. If equilibrium unemployment is not to be affected by trend productivity, then $\alpha_4/(1-\alpha_1) = \beta_4/(1-\beta_1)$.

3.2 Notional demand block

The exports equation, according to (2.36) and (2.37) has the form:

$$x + \phi_X (duk - duk_{min}) = \delta_0 + \delta_1\, wt + \delta_2 PRXI + \delta_3 Z_3 \qquad (3.3)$$

where **wt** stands for real world trade, **PRXI** for exports competitiveness, Z_3 a vector of nominal surprises (a nominal exchange rate variation, the inflation rate, etc.)

Similarly, notional imports are a function of its fundamental determinants.

$$m - \phi_M (duk - duk_{min}) = \theta_0 + \theta_1\, y + \theta_2(\Lambda) PRM \qquad (3.4)$$

where **PRM** is some import relative price index, **y** is real GDP.

The consumption function, according to (2.39) has an error correction specification

$$C = d_0 + d_1 \Delta y^d + d_2 \Delta IT - d_3 \Delta U - d_4 \Delta R + d_5 \left[C - d_6 y^d - d_7 IT\right]_{-1} \qquad (3.5)$$

Where y^d is disposable income, **IT** inflation tax, **R** the real interest rate.

The investment function has the error correction specification of (2.44):

$$I = e_0 + e_1 \Delta y + e_2 \Delta CC + e_3 \Delta \pi + e_4 \Big[I - e_5\, y - e_6\, CC - e_7\, duk - e_8\, \pi \Big]_{-1} \qquad (3.6)$$

where CC is user cost of capital.

3.3. Employment block

We use a capital-labour relationship similar to that in Bean and Gavosto (1987). As explained in Section 2, under a CES technology, cost minimization leads to a relationship between factor proportions and relative factor prices (see (2.17)):

$$k - lp = \sigma_0 + \sigma_1 \Gamma(\Lambda) \; wpi + \sigma_2 \; trend \qquad (3.7)$$

where **k** is the capital stock, **lp** is potential employment, **wpi** is the relative factor price variable, defined as **wpi** = $\log (W(1 + t_1)/CC)$, **CC** is the user cost of capital and $\Gamma(\Lambda)$ is a polynomial in Λ that allows for slow adjustment of the capital-labour ratio to changes in relative prices.

Following Bean and Gavosto (1987) we relate the (unobservable) potential employment l_p to actual unemployment l by means of our capacity underutilization variable **(duk_{max} - duk)**

$$l_p = l + \phi_3 \; (duk_{max} - duk) \qquad (3.8)$$

By substituting (3.8) into (3.7) we obtain:

$$k - l = \sigma_0 + \sigma_1 \Gamma(\Lambda) \; wpi + \phi_3 (duk_{max} - duk) + \sigma_2 \; trend \qquad (3.9)$$

Then, we can compute l_p as

$$l_p = -(\widehat{k - l}) + k \qquad (3.10)$$

where $(\widehat{k-l})$ is the fitted value of $(k-l)$ in (3.9) with **duk** = duk_{max}.

The potential output **YP** is computed by fitting

$$y-l-a = f_0 + f_1 \; (k-l-a) + f_2 \; (duk_{max} - duk) \qquad (3.11)$$

where a is an index of technical progress, and taking fitted values for $l = l_p$ and $duk = duk_{max}$.

Keynesian employment (LK) is that level of employment that could satisfy total demand for domestic output. If demand for domestic output is large and this generates shortages, these shortages will be met by lower exports and larger imports. These spillovers of internal demand on exports and imports are the basis of divergence between Keynesian demand (YD) and actual demand (Y).

In order to compute the Keynesian labour demand lk we need a relationship that shows how l would adjust in the short-run to changes in Y. For this purpose we estimate the following relationship,

$$l-k-a = a_0 + a_1(l_{-1} - k-a) + a_2 (y - k) \qquad (3.12)$$

Then we can transform YD into the Keynesian demand for labour lk as follows,

$$lk = l + \frac{a_2}{1 - a_1} (\phi_1 S_X + \phi_2 S_M) (duk - duk_{min}) \qquad (3.12)$$

Finally, the **employment function** relates actual employment to keynesian and potential labour demand and to labour supply when we aggregate over micromarkets where some uncertainty labour demand, capacity or labour force availability prevails.

1) If labour force (LS) is considered <u>exogenous</u> the employment function is (see (2.30'):

$$L = (LK^{-\rho} + LP^{-\rho} + LS^{-\rho})^{-1/\rho} \qquad (3.14)$$

where is the inverse of the imputed mismatch variable that can be modeled as

$$\rho = b_0 + b_1 \text{ trend} + b_2 Z_4 \qquad (3.15)$$

where Z_4 is a vector of mismatch variables that may include structural change variables, industrial and global mismatch, etc.

It follows from (3.11) that the elasticities of employment with respect to LK, LP and LS are less than one and correspond to the proportion of firms or micromarkets in Keynesian, Classical and Repressed Inflation regimes. Denoting by PK, PC and PRI these proportions we have

$$\left.\begin{aligned} PK &= \frac{LK^{-\rho}}{LK^{-\rho} + LP^{-\rho} + LS^{-\rho}} \\ PC &= \frac{LP^{-\rho}}{LK^{-\rho} + LP^{-\rho} + LS^{-\rho}} \\ PRI &= \frac{LS^{-\rho}}{LK^{-\rho} + LP^{-\rho} + LS^{-\rho}} \end{aligned}\right] \qquad (3.16)$$

Also, if $LK = LP = LS = \bar{L}$, then $\bar{L} = 3^{-(1/\rho)}L$, implying an structural unemployment rate in equilibrium (SURE) equal to

$$(LS - L)/LS = 1 - 3^{-(1/\rho)} \qquad (3.17)$$

2) When we can differentiate between actual (LS) and <u>effective</u> labour force (LF), on the basis that only a subet of the former is actually searching for a job and exert a downward pressure on wages. Both the long-term unemployment (disenfranchisement effect) and

changes in the cost of being unemployed, measured by the replacement ratio, rr, (search intensity effect) can be the variables to explain the divergence between LF and LS:

$$LF = LS\ (\alpha_0 + \alpha_1 Z_5) \qquad (3.18)$$

where Z_5 includes replacement ratio, long term unemployment, mismatch, time trend, etc.

Therefore we estimate, in this case:

$$L^{-\rho} = LK^{-\rho} + LP^{-\rho} + (LF(\alpha_0 + \alpha_1 Z_5)^{-\rho} \qquad (3.19)$$

4. EMPIRICAL RESULTS

The model of Section 3 has been estimated using instrumental variables. The wage and price equations have been estimated jointly, and so have been the exports and imports equations.

4.1 Wage and price equations

Table 4.1 shows the preferred specifications of the wage and price equations.

The **wage equation** is estimated to be static since no lags of the dependent variable proved to be significant. Its explanatory variables try to capture: (i) the effect of trend productivity on the target wage, (ii) the effect of unemployment, (iii) shift factors and (iv) a nominal surprise effect.

(i) Trend productivity effect.

Trend productivity is proxied by the capital-labor supply ratio **(k-ls)**. Its positive coefficient is very robust to different specifications of the wage equation and has been restricted to yield neutrality with respect to the equilibrium unemployment rate obtained from the price and wage equations. Since in the long run, economic growth does not appear to have imparted any noticeable trend to unemployment in most industrial economies, the assumption seems quite sound and, as the low value of the chi-squared test indicates, it is easily accepted by the data. Similar considerations apply to the labour augmenting technical progress index **a**, which has a significant positive effect on wages, and turns out to be neutral with respect to equilibrium unemployment.

(ii) Unemployment effect.

Leaving aside price surprises, the unemployment rate is the only variable in the wage equation that can lower the target wage. This effect is very significant and also very robust to different specifications. We have tried several lags of U, its logarithm, first and second differences, long term unemployment, and male unemployment as different measures of labor market tightness. Neither of them improve the results shown in Table 4.1.

(iii) Wage pressure effects.

A variety of push factors have been tried, such as replacement ratios, union power proxies, mismatch indexes, taxes, benefit proxies, import price wedge and age structure of the labour force. The union power dummy variable appears with the correct sign and is relatively well determined. The mismatch index, defined as the imputed mismatch variable in the aggregate employment function, the replacement ratio and the import price wedge had the correct sign but were insignificant. Given that their correlations were larger than .8 and hence there were signs of joint collinearity, a synthetic index was formed with their unrestricted coefficients which turns out to be very significant. The other significant shift factors are the fiscal wedge variables. In the unrestricted version of the equation the coefficient of t_1 and t_2 were significant and very close to unity whereas the coefficient of t_2 was incorrectly signed and insignificant. In order to gain efficiency, the first two coefficeints were set equal to unity and the variable t_2 was eliminated, both restrictions being easily accepted.

(iv) **Nominal surprises**

Nominal surprises, as measured by the second difference of p, exert, as expected, a significant negative effect on real labour cost.

In the **price equation** we have not imposed unit elasticity of prices to labour costs. We have tested its validity in the short-run and in the long-run by including several lags of **w**. Unit elasticity is accepted in the long-run but not in the short-run. We have not found significant effects of nominal surprises, as measured either by $\Delta^2 w$ or using fitted values from subsidiary univariate models. One interpretation of this result is that in the determination of the wage target, based upon annual bargaining rounds, nominal surprises have a stronger effect than in the price equation, as firms set prices continuously. Another possibility is that given that Δw seems to follow a random walk, the variable $(w-w^e)$ is embedded in the error term, and the 3SLS estimation method allows to estimate consistently the remaining coefficient in the equation.

The cyclical demand variable, as proxied by DUK, has a negative influence on prices, favouring the hypothesis, advanced in Section 2, that the elasticity of demand moves strongly procyclically and the mark-up countercyclically. Therefore, its negative effect dominates the positive effect derived from increasing marginal costs. This result is very robust to alternative specifications of demand including public deficit, competitiveness and internal demand.

The trend productivity variable (k-ls) and the technical progress index **a** have the expected negative sign, with coefficients equal in absolute value to those in the wage equation, given that, as we said, neutrality is not rejected. Finally there is a significant short-run effect of the import price wedge.

TABLE 4.1

Wage equation

$$(w+t_1-p)_t = -1.21 + .83^*(k-ls)_t - 1.06U_t + 1^*t_1 + 1^*t_3 + .025PS_t - .27\,\Delta^2 p_t + .016a_t$$

(20.5) (9.8) (2.4) (2.0) (3.1)

$$+.80\,(mm_{t-1} + .30\,rr_{t-1} + .15\,prel_{t-1})$$

(3.8)

(k-l) : $X^2(1)$ = 0.9	SEE = .010	
t_1,t_3: $X^2(2)$ = 2.5	D.W. = 2.0	LM(4) = 3.2

Price equation

$$p_t - 1^*(w + t_1)_t = .56 + .39(p_{t-1} - (w+t_1)_t) - .83^*(k-ls)_t - .27duk_t - .16^*a_t + .47prel_t$$

(26.0) (12.8) (3.9) (2.7)

$(w+t_1)$: $X^2(1)$ = 1.1	SEE = .008
a : $X^2(1)$ = 1.3	D.W. = 2.0
(k-ls) : $X^2(1)$ = 1.7	LM(4) = 3.6

PS: Dummy taking value 1 for 1973-77, 0 elsewhere

All variables in logs except t1,t3,U, PS

* Denotes restricted coefficient

Method of estimation: Three Stage Least Squares

Sample period 1965-1986

The **NAIRU** is computed by solving for U in the long-run solutions of the wage and price equations, setting nominal surprises to zero and **DUK** to its average level in the baseline sample period. For 1966-72 we set the NAIRU equal to the average level of observed unemployment. As shown in Figure 2.9, the **NAIRU** was above the path of actual unemployment until the beginning of the 80's. After that date, its rate of growth was lower than the rate of growth of **U**. In 1985, the NAIRU was 3.6 points lower than actual unemployment.

4.2 Notional demand block

4.2.1 Exports and imports

Exports

In Table 4.2 we present estimates of the exports equation. The dependent variable includes exports of goods and services as measured in the National Accounts and does not include the net revenue from tourism which represents almost a 20% of the total exports. Alternative specifications aggregating tourism and exports of goods and services were tried . However, we did not found a significant negative effect of the cyclical variable, **DUK.** Since Tourism proved to be positively correlated with the cyclical variable, we chose the disaggregated approach and left tourism revenues as exogenous.

The dependent variable, x, is divided by the implicit exports deflator. The independent variables try to capture: (i) World income effects, (ii) competitiveness and (iii) the spill-over effect of domestic demand over sales abroad (iv) nominal surprises.

TABLE 4.2

Exports equation

$$x_t = 6.07 + 1.86\, wt_t - 1.01\, PRXI_t - .76\, duk_t - .56\, \pi_t$$
$$(5.93) \quad (58.87) \quad (5.23) \quad (2.99) \quad (2.80)$$

R^2 = .997   SEE = .038

$\bar{R}^2$ = .996   D.W. = 2.01

Period of estimation: 1965-85

Notes:

t ratios in parenthesis

Estimation method: Three stage least squares (jointly with imports)

All variables except π in logs.

INF : Inflation rate (GDP deflator)

(i) World income effect.

To estimate this effect, we have used a measure of real world trade (WT), which plays the role of the scale variable in the exports equation. We have also tried alternative specifications which included two separated variables (world GDP, to catch the income effect, and the ratio world trade/world GDP to catch the effect of world integration). In all cases, the best specification was the one with only the world trade variable.

(ii) Competitiveness.

If we assume that tradable and non-tradables markets are perfectly integrated, only one relative price should be included. Other specifications for Spanish exports (see Bonilla (1978) or Mauleón (1986)) have found two relevant competitive indexes: one for the price of Spanish exports relative to World (or industrial countries) imports, and another for the price of Spanish value added (GDP deflator) to World (or industrial countries) imports. In this work, only the former is included. The index of competitiveness is built dividing the price of Spanish exports by the price of international imports times the appropriate exchange rate. We tried two different export competitiveness indexes. One, used in our related work, Molinas, Sebastian, and Zabalza (1987), has the price of world imports as the alternative relevant price. The other is referred to the price of industrial countries imports, where more than 70% of the total Spanish exports actually go. The profiles of both indexes are very different. Considering the World as the relevant market, (PRX), Spanish exports have gained in competitiveness over the last years. On the other hand, considering only industrial countries, (PRXI), such a gain has not taken place. When including the latter, there is a substantial improvement in the fit, standard error and significance of the coefficients. We later comment on other significance of the coefficients. We later comment on other differences found when using these two indexes.

(iii) Spill-over effect.

Observed and demanded exports differ. An excess demand for domestic goods, represented by high value of capacity utilization relative to a fixed reference benchmark (DUK), has a negative effect on actual exports. Other measures for internal demand were tried and also found suitable. However, we kept the variable DUK for reasons of consistency with the rest of the model.

(iv) Nominal surprises.

Lagged values of the competitiveness index where found not significant. However nominal surprises as price changes that are later followed by exchange rate depreciation enter significantly. These may not change competitiveness in the long-run but exert a downward pressure in the short run. The variable π_t tries to pick up this effect, as well as a possible switch of some producers from attending foreign costumers to domestic ones.

The exports equation is static. The world trade elasticity is closed to 1.9. This result is similar to the long-run values of previous estimates of the Spanish exports equation. Bonilla (1978) obtained 1.7, Mauleòn (1985) obtained 1.3, Molinas, Sebastiàn and Zabalza (1987) obtained 1.3 and Fernández and Sebastián (1988) obtained 2.0.

The estimated price elasticity is -1.01. This compares with the long-run elasticity of -0.9 in Bonilla (1976), -0.5 in Mauleòn (1985) and -1.0 in Molinas, Sebastián and Zabalza.

These elasticities, as Table 4.2 shows, are obtained using PRXI as the relevant price variable. Should the variable used be PRX, the estimated elasticities would tend to be lower. We opted for this specification, because when using **PRXI**, the cyclical demand proxy takes the correct sign and becomes very significant, suggesting the presence of important spill-over effects via exports. In addition, when using **PRXI**, the statistical properties of the equation improve substantially with respect to the specification using **PRX**.

__Imports__

The poor fit and unstability of the imports equation that had been detected forced us in previous work to disaggregate imports into its oil and non-oil components. However, in this paper we try a different competitiveness index that remarkably improves the estimation of our aggregate imports equation. We present the aggregate as well as its separate componentes in Table 4.3. We still find that the disaggregated results contain useful information that helps us to explain the aggregate results.

The dependent variable, **m**, is divided by the implicit import deflator. When disaggregating into oil imports, **mo**, and non-oil imports **mno**, each component is divided by it own deflator.

The independent variables try to measure (i) income effects, (ii) price competitiveness and (iii) spill-over effects.

(i) __Income effect.__
We used real GDP as the scale variable, denoted by **y** in the equation. Other variables, such as total final demand including imports, were tried but eventually disregarded as results were better with GDP, both for the estimation of this effect and for the statistical properties of the equation.

TABLE 4.3

Imports equations

TOTAL IMPORTS

$$m_t = -\ 5.31 + 1.43\ y_t + .085\ PRME_t - .29\ PRMC_t + 1.15\ duk_t$$
(10.45) (23.87) (2.87) (2.40) (3.35)

R^2 = .993 SEE = .035
$\bar{R}^2$ = .991 D.W. = 2.04

OIL IMPORTS:

$$mo_t = -\ 8.26 + .31\ mo_{t-1} + 1.34\ y_t - .27\ PRME_{t-1} - 1.48\ duk_t$$
(4.68) (2.40) (4.84) (5.72) (2.90)

R^2 = .980 SEE = .057
$\bar{R}^2$ = .975 D.W. = 2.08

NON-OIL IMPORTS

$$mno_t = -\ 3.80 + 1.22\ y_t + .20\ PRME_t - .44\ PRMC_t + 1.79\ duk_t$$
(6.36) (16.09) (5.31) (3.14) (4.43)

R^2 = .991 SEE = .040
$\bar{R}^2$ = .989 D.W. = 2.04

Number of observations: 21
Degrees of freedom: 16
Estimation method: Three Stage Least Squares

(ii) Price competitiveness.

We use two indices for price competitiveness, both based on a ratio between import and domestic prices (GDP deflator).
The first, **PRMC**, is defined as the price of consumption imports relative to the GDP deflator. In previous attempts we used the total imports deflator, but it was not significant and the statstical properties of the equation were rather poor. Apparently the main channel through which price sensitivity is exerted corresponds to a subset of importable commodities (mainly consumption goods), and the aggregate relative price variable did not manage to take this fact into account. We also include as a separate explanatory variable the relative price of energy imports, **PRME**, which is strongly significant in all specifications. This variable is later used as a proxy to explain mismatch functions. In the disaggregated equations, it exhibits a positive sign in the non-oil imports, that we interpret as a "substitution effect", and a negative sign in the oil specifications. It also appears in the aggregate specification with a positive sign, which implies that the crossed substitution effect with respect to non-oil imports dominates the pure substitution effect over oil imports (this is consistent with the fact of 90% of total imports are non-energy).

(iii) Spill-over effect.

It tries to measure the positive effects on imports of excess of domestic demand measured by DUK. In the disaggregate approach it has a negative sign in the energy equation (-1.48) and a positive sign in the non-energy equation (1.79). The negative sige is not very intuitive. However it could embody partly the marginal cost referred above, partly the contemporaneous correlation of DUK with PRME. Moreover, if we weight each coefficient by the share of each component in total imports we obtain practically the same coefficient as that estimated in the aggregate equation.

The income elasticity of imports is 1.4, close to other studies and also quite close to other countries' estimates. (e.g. Bonilla (1978), obtained 1.2; Mauléon (1985), 1.0 though using a different scale variable).

The elasticity of imports to the relative price of consumption importables is -0.29. This is just slightly lower than other countries' estimates but, contrary to other findings that (see Mauleón (1985)) suggested that Spanish imports were not sensitive to relative prices changes, we have indentified a significant negative elasticity. The elasticity of imports to the relative price of energy is positive for the reasons mentioned above. However, in the disaggregate approach, oil imports are almost as sensitive to energy prices (-.27) as non-oil imports to consumption importables prices (-.44).

4.2.2 Consumption

Table 4.4 shows the estimated consumption function. The equation is reparameterised as an error correction model (see Hendry et al (1984)). Disposable income (Y^d) and the inflation tax (IT) (defined as inflation times real M_1 holdings), proxying the inflation erosion of real balances, appear as the long-run determinats of consumption. The short run dynamics are captured by changes in those variables and changes in the real interest (R) and unemployment rates, (U), the latter capturing transitory effects due to liquidity constraints. For details see a related work in Andrés, Molinas and Taguas (1987).

The empirical results are quite satisfactory. All regressors are significant and have the correct sign. The equation shows no signs of misspecification neither in sample nor in post sampling predictive failure (the appropiate misspecifications tests are not reported for brevity, but are available on request).

The long-run elasticity of income is unity which is consistent with a permanent income interpretation in absence of wealth effects. The inflation tax has an small but significant effect, as one would expect having in mind the persistence of a high inflation period in recent years. Turning to the short-run, on top of the correct effect of the changes in consumption, income, and the inflation tax (which is more important than in the long-run) we found both a real interest and an unemployment effect. The real interest effect approximates the impact on investment in consumer durables that will also be found in the investment function.

Interestingly enough, the change in the unemployment rate shows up very strongly in the short-run. Actually data easily accept the null of the acceleration of the unemployment rate having an strong negative impact on consumption . The unambiguous negative impact is noteworthy as compared as with other results (Sneessens y Drèze (1986)) and given the presence of the inflation tax it can not be interpreted as a bad proxy for inflation (as argued in Urgern-Sternberg (1981). The acceleration in unemployment may arise as a spillover from a rationed labour market and may be working either worsening future income expectations, or the actual income distribution, or even signalling short-run liquidity constraints for unemployed workers. These effects do not appear explicitly in the long-run because all of them should be working through changes in the aggregate permanent income.

TABLE 4.4

Consumption function

$$C_t = \underset{(12.4)}{.647}\,\Delta y^d_t \;\underset{(3.1)}{-.01}\,\Delta IT_t \;\underset{(2.0)}{-.09}\,\Delta R_t \;\underset{(3.9)}{-.02}\,\Delta^2 u_t \; -$$

$$\underset{(7.7)}{-.51}\left[C_{t-1} - \underset{(273.4)}{1.0}\, y^d_{t-1} + \underset{(2.2)}{0.1}\, IT_{t-1} \right]$$

$R^2 = .980$ SEE = .0043 D.W. = 1.92

Period of Estimation 1965-86

All variables in logs. except. R_t

Estimation method: Instrumental variables

TABLE 4.5

Investment Function

$$I_t = \underset{(4.4)}{1.39}\,\Delta duk_t + \underset{(2.5)}{0.99}\,(\Delta y_t + \Delta y_{t-1}) - \underset{(2.7)}{0.54}\,\Delta^2 CC_t - \underset{(3.4)}{1.18}\,\Delta \pi_t \; -$$

$$-\underset{(8.0)}{0.95}\left[(I-Y)_{t-1} + \underset{(5.4)}{1.03} + \underset{(7.6)}{2.62} CC_{t-1} \underset{(3.9)}{-2.52}\, duk_{t-1} + \underset{(3.3)}{1.13}\, \pi_{t-1} \right] + \hat{e}_t$$

$R^2 = 0.95$ DW = 1.91 SEE = 0.026

Period of estimation: 1965-85

Estimation method: OLS

4.2.3 Investment

It is important to capture the determinants of investment not only as a major component of aggregate demand, but as the variable that pins down to the evolution of the capital stock (and hence potential employment). In Table 4.5 we summarize the preferred specification for the investment function, along the lines of the theoretical model sketched in Section 2.

As in the case of consumption an error correction mechanism has been adopted so that we can properly isolate the long-run relationship. Similarly, long and short-run parameters are jointly estimated. Four main determinants of investment are obtained: excess demand (or capacity utilization), user cost of capital, GDP and inflation. The null hypothesis of a long-run unit coefficient of GDP is easily accepted so that the variable to explain is the ratio I-Y. All the regressors are significant and correctly signed. The theoretical role for inflation seems quite well founded, either as a proxy for the impact of uncertainty on investment decisions, or as a proxy for some non-neutralities in the fiscal treatment of investment (Feldstein (1982)). In any case one should expect a negative coefficient.

On top of the long-run, the short-run parameters are correctly signed as well. The error correction parameter is very close to one, which suggests a full adjustment in one period, or rather a static model with current investment planned one year ahead and deviations from planned investment being purely transitory.

The equation shows a remarkable good fit and no sign of structural break, having an acceptable performance in post sample prediction. These statistical properties are quite noticeably given the sharp changes in the investment figures in Spain (almost ten years of negative rates) which were reflected as serious stability problems in other approaches.

It is interesting to comment briefly that the prediction performance worsens somewhat in 1986, the first post-sample observation. This was not totally unexpected given that the rate of growth of investment reached a 13,6 per cent after several years of persistent negative rates. Nevertheless, our prediction and fit do much better than any reasonable **ARIMA** representation of the investment series, some of them including up to two different trends.

4.3 Employment block

4.3.1. Capital-labour ratio

We have estimated equation (3.9) assuming that the cost of capital equals the price of investment goods as several attempts with interest rates have been unsuccessful. In order to estimate the polynomial $\Gamma(\Lambda)$ we assume, following Sneesens and Drèze (1986), that it has a geometric distributed lag structure:

$$\Gamma(\Lambda) = \frac{1 - \Gamma}{1 - \Gamma\Lambda}$$

Γ is estimated jointly with the other parameters of (3.9) by a suitable search procedure. We obtained $\hat{\Gamma}$ = .78. The results of the estimation are summarized in Table 4.6.

A value of $\hat{\Gamma}$ of .78 means that only 22 per cent of the optimal change in the capital-labour ratio induced by relative prices takes place within a year. We find a unit elasticity of the capital-labour ratio with respect to the distributed lag of relative prices. The coefficient of duk is very significant and lies within the plausible range.

Potential exmployment is estimated along the lines set-up in Section 3.

TABLE 4.6

Capital-labour ratio

$$(k-l)_t = -3.9 + 1.00\ (.22/\ 1-.78)\ wpi_t - .35\ duk_t + .02\ D_t$$

(103.1) (68.8) (4.1) (10.6)

R^2 = .999 DW = 1.72 SEE = .010

Number of observations = 19
Degrees of freedom = 15
Estimation method : Max. likelihood.

$$D = \begin{cases} 0 & \text{for } 1964\text{-}77 \\ t-14 & \text{for } 1978\text{-}85 \end{cases}$$

Production function

$$(y-l-a)_t = -1.1 + .51\ (k-l-a)_t + .33\ duk_t + .02\ DUM_t$$

(15.4) (14.7) (4.6) (2.69)

R^2 = .955 DW = 1.68 SEE = .008

Number of observations = 20
Degees of freedom = 16
Estimation method : Instrumental variable

$$DUM \begin{cases} 1 & \text{for } 79\text{-}80 \\ 0 & \text{elsewhere} \end{cases}$$

4.3.2 Keynesian labour demand

From the exports and imports equations we obtain the spill-over effects: $\phi_X = .76$ and $\phi_M = 1.15$.

The estimation of the labour-output relationship is presented in Table 4.7. All variables take the expected sign and are statistically significant. We obtain a long-run elasticity of employment with respect to output of 1.8 which seems reasonable as it implies a share of labour income of 0.55, close to what we find in reality. Both constant returns to scale and labour augmenting technical progress are not rejected by the data.

The estimation of (3.12) yields as values of a_1 and a_2, 0.61 and 0.73, respectively. Therefore, Keynesian labour demand is obtained as follows:

$$lk = l + \frac{.73}{1 - .61} (.76\, S_X + 1.15\, S_M)\ (DUK-DUK_{min})$$

where, as mentioned, S_X, S_M are the shares of exports and imports over GDP.

Our estimates of potential employment (LP), Keynesian labour demand (LK), plus the series of labor force (LS) and employment (L) are shown in Table 4.8 and Figure 1.10 (in Section 1).

4.3.3. Employment function

1) When LS is exogenous.

The results of estimating equation (3.14) are given in Table 4.7, and the corresponding regimes are shown in Table 4.9. These regimes are graphed in Figure 1.11, in Section 1. The adjustment parameter of the employment equation is a function of time and of some friction measures embodied in the relative price of energy imports and the proportion of labour force in agriculture.

The implied rate of frictional unemployment is lower than expected but similar to the ones obtained in other countries using the same model. Both the regime proportions and the frictional unemployment rate seem to be very robust to alternative specifications.

2) <u>An estimate of LF</u>.

Following Section 3 we reestimated the employment function (3.19) when some correction of the actual labour force LS is introduced to account for disenfranchisement effects or changes in search intensity. We tried several specifications which included long term unemployment. The best specification, however, was simply based on a constant plus the replacement ratio, **rr**. An intersectorial mismatch variable, **mm**, and a frictional variable, (bankrupticies (**brk**)) as a posible proxy for intrasectorial mismatch, were introduced in the employment fuction.

The results are presented in Annex 2 at the end, together with a graph of both actual (LS) and effective (LF) labour supply (see Figure A-2). We also examine the hypothesis that the disenfranchised unemployed workers do not exent downwards wage pressure, which would support a hysteresis effect. We find weak evidence in favour of such a hypothesis.

TABLE 4.7

Labour-output relationship

$$(l-k+a)_t = \underset{(6.4)}{.93} + \underset{(9.4)}{.61}\,(l_{t-1}-k+a) + \underset{(7.4)}{.73}(y-k)_t - \underset{(6.6)}{.03}\,DUM$$

R^2 = .993 DW = 2.28 SEE = 0.006

DUM is a dummy taking value 1 for 79-80.

Employment equation

$$l_t = \underset{(2.2)}{-94.5} + \underset{(2.4)}{3.46T} - \underset{(1.6)}{15.47PRME_t} + \underset{(3.4)}{3.98}\,NAN_t$$

R^2 = .997 DW = 2.25 SEE = 0.005

NAN is the proportion of labour force in agriculture. PRME is the relative price of energy imports.

TABLE 4.8

Values of LT, LK, LP and LS
(in thousands)

	L	LS	LP	LK
1965	12156.8	12340.8	12459.4	12424.6
1966	12291.1	12397.1	12597.1	12577.9
1967	12367.0	12492.0	12868.4	12478.3
1968	12426.0	12552.1	12764.2	12603.7
1969	12504.2	12622.7	12813.0	12882.4
1970	12501.3	12633.8	12948.6	12897.9
1971	12599.0	12791.0	12916.0	12865.8
1972	12825.0	13103.3	12910.3	13496.2
1973	13053.5	13357.0	13053.5	13943.7
1974	13222.1	13575.1	13329.5	13730.3
1975	13000.3	13514.8	13417.6	13171.1
1976	12761.5	13412.6	13279.6	13115.4
1977	12755.8	13504.3	13092.1	13184.0
1978	12604.6	13595.6	12842.1	12779.2
1979	11896.0	13101.3	12359.3	12083.3
1980	11367.0	12858.1	12017.9	11458.7
1981	11172.0	13045.0	11785.8	11255.2
1982	11061.0	13206.0	11575.2	11237.2
1983	10984.0	13353.4	11358.3	11073.7
1984	10668.0	13437.0	11134.0	10755.5
1985	10571.0	13542.0	10979.4	10586.8

TABLE 4.9

Frictional unemployment and regime proportions

	PK	PC	PRI	RHO	SURE
1965	0.296	0.247	0.458	64.658	0.017
1966	0.219	0.198	0.582	67.393	0.016
1967	0.486	0.062	0.452	66.707	0.016
1968	0.364	0.154	0.482	68.162	0.016
1969	0.161	0.229	0.610	65.340	0.017
1970	0.184	0.144	0.671	62.475	0.017
1971	0.312	0.247	0.442	59.809	0.018
1972	0.055	0.658	0.287	55.948	0.019
1973	0.021	0.760	0.219	54.172	0.020
1974	0.132	0.629	0.240	52.770	0.020
1975	0.530	0.266	0.203	37.208	0.029
1976	0.476	0.307	0.216	35.189	0.031
1977	0.368	0.455	0.177	30.447	0.035
1978	0.504	0.429	0.067	32.510	0.033
1979	0.661	0.300	0.039	35.027	0.031
1980	0.833	0.153	0.014	35.493	0.030
1981	0.797	0.195	0.009	30.597	0.035
1982	0.703	0.291	0.006	29.734	0.036
1983	0.702	0.296	0.001	33.994	0.032
1984	0.776	0.224	0.000	35.925	0.030
1985	0.807	0.193	0.000	39.242	0.028

ANNEX 1

In this Annex we report an estimate of a **Marshallian labour demand equation**, corresponding to an oligopolistic representative firm which faces an isoelastic demand function for its product (see Layard and Nickell (1985)). In this framework, the specification of the labour demand function is as follows:

$$L = L\ (K,\ W(1+T_1)/P,\ duk,\ A)$$

where constant returns to scale and labour augmenting technological progress imply the following restrictions on the elasticities, denoted by ϵ, respectively:

$$\epsilon_{LK} = 1$$
$$\epsilon_{LA} = |\epsilon_{LW}| - 1$$

Both restrictions are easily accepted by the data.

The estimated equation is:

$$l_t - l_{t-1} = \underset{(2.4)}{-.04} - \underset{(11.7)}{.15 l_{t-1}} + .15^* k_t - \underset{(3.2)}{.18(w + t_1 - p)_t} + \underset{(3.4)}{.34\ duk_t} +$$

$$+ \underset{(3.0)}{.15\ duk_{t-1}} + .20^* a_t$$

SEE .011 DW = 1.8 LM(4) = 4.2

t – ratios in parenthesis
* denotes restricted coefficient.
k : $X^2(1) = 1.0$
a : $X^2(1) = 2.1$

ANNEX 2

Employment function with "effective" labour supply

$$\rho'_t = \underset{(7.3)}{91.7} - \underset{(2.3)}{16.5}\, PRME_t - \underset{(3.1)}{4.9}\, mm_t - \underset{(2.2)}{.71}\, brk_t$$

$$LF = \underset{(37.8)}{1.36}\, LS - \underset{(10.3)}{.60}\, rr$$

R^2 = .999 DW = 2.15 SEE = 0.003

Estimation period: 1965-85

Estimation method: Non Linear Least Squares

Using the previous estimate of LF, we can decompose the unemploment rate **U** which appears in the wage equation (see Table 4.1) into two components: an effective unemployment rate, **Us** (= 1- L/LF) and a disenfranchised unemployment rate, **Uf**(= U-Us). The interesting null hypothesis to test is whether **Uf** is significant. The estimated equation is similar to the previous one with the following coefficient estimates (t-ratios) for the unemployment rates, -.88(6.7) for **Uf** and -1.33(4.8) for **Us**. An F-test to test the equality of both coefficients gives a value of 1.0 which is non-significant at 5% significance level. Therefore, we can reject both the hypothesis that the disenfranchised unemployed workers do not exert downwards wage pressure, and that their pressure is smaller than that of the other unemployed. However the point estimates show that the effect of **Uf** is 40% smaller than that of **Us**, as we would expect from a partial interpretation of the hysteresis effect. Further work on this issue is in the research agenda.

FIGURE A–2

ACTUAL AND EFFECTIVE LABOUR SUPPLY

APPENDIX (ANUAL FIGURES FOR LAYERS 1 TO 4)

LAYER 1

	ΔL/L	Δ(LP/YP)/(LP/YP)	ΔY/Y	RESIDUAL
1966	.110473E-01	-.480908E-01	.706975E-01	-.115595E-01
1967	.617520E-02	-.416665E-01	.430882E-01	.475350E-02
1968	.477885E-02	-.656462E-01	.677193E-01	.270567E-02
1969	.628516E-02	-.621009E-01	.894366E-01	-.210506E-01
1970	-.231922E-03	-.488290E-01	.408048E-01	.779227E-02
1971	.781519E-02	-.481389E-01	.495303E-01	.642376E-02
1972	.179617E-01	-.523806E-01	.814039E-01	-.110616E-01
1973	.177930E-01	-.523196E-01	.785595E-01	-.844688E-02
1974	.129161E-01	-.416635E-01	.571728E-01	-.259314E-02
1975	-.167749E-01	-.392284E-01	.109781E-01	.114753E-01
1976	-.183688E-01	-.392897E-01	.301142E-01	-.919335E-02
1977	-.446656E-03	-.412929E-01	.329781E-01	.786814E-02
1978	-.118534E-01	-.314753E-01	.179562E-01	.166563E-02
1979	-.562176E-01	-.436718E-01	.186255E-02	-.144083E-01
1980	-.444687E-01	-.401654E-01	.154469E-01	-.197502E-01
1981	-.171549E-01	-.445224E-01	.444241E-02	.229250E-01
1982	-.993555E-02	-.321401E-01	.879192E-02	.134126E-01
1983	-.696140E-02	-.353291E-01	.210177E-01	.735002E-02
1984	-.287691E-01	-.313790E-01	.204549E-01	-.178451E-01
1985	-.909261E-02	-.364624E-01	.199939E-01	.737586E-02

LAYER 2

	ΔY/Y	PIK(ΔYD/YD)	PIC(ΔYP/YP)	PIC(ΔYS/YS)	RESIDUAL
1966	.706975E-01	.156768E-01	.123085E-01	.322149E-01	-.104973E-01
1967	.430882E-01	.171217E-01	.411188E-02	.232447E-01	.139007E-02
1968	.677193E-01	.257632E-01	.947299E-02	.363384E-01	.385522E-02
1969	.894366E-01	.158872E-01	.161158E-01	.440178E-01	-.134158E-01
197C	.408048E-01	.767050E-02	.901205E-02	.350844E-01	.109622E-01
1971	.495303E-01	.136355E-01	.118329E-01	.281042E-01	.404234E-02
1972	.814039E-01	.543742E-02	.360749E-01	.232538E-01	-.166378E-01
1973	.785595E-01	.185958E-02	.485681E-01	.165484E-01	-.115833E-01
1974	.571728E-01	.543489E-02	.430792E-01	.145140E-01	.585528E-02
1975	.109781E-01	-.121862E-02	.126942E-01	.736479E-02	.786225E-02
1976	.301142E-01	.181154E-01	.927980E-02	.714784E-02	.442883E-02
1977	.329781E-01	.132847E-01	.128986E-01	.889029E-02	.209545E-02
1978	.179562E-01	.377830E-02	.548639E-02	.265469E-02	-.603685E-02
1979	.186255E-02	.189420E-02	.190488E-02	.297506E-03	.223403E-02
1980	.154469E-01	.942929E-02	.200581E-02	.313659E-03	-.369811E-02
1981	.444241E-02	.327783E-02	.513422E-02	.538809E-03	.450845E-02
1982	.879192E-02	.937185E-02	.429544E-02	.265788E-03	.514116E-02
1983	.210177E-01	.118206E-01	.509760E-02	.583204E-04	-.404113E-02
1984	.204549E-01	.158844E-01	.268814E-02	.101453E-04	-.187217E-02
1985	.199939E-01	.131917E-01	.452774E-02	.236199E-05	-.227204E-02

LAYER 3.1

	$S_C(\Delta C/C)$	$S_I(\Delta I/I)$	$S_G(\Delta G/G)$	Δ(XD-MD)/YD
1966	.469068E-01	.292750E-01	.166739E-02	-.641734E-02
1967	.404804E-01	.482914E-03	.215602E-02	-.788967E-02
1968	.413229E-01	.163697E-01	.170588E-02	.113207E-01
1969	.477646E-01	.406228E-01	.366152E-02	.653381E-02
1970	.279424E-01	-.318111E-02	.435842E-02	.124864E-01
1971	.330662E-01	-.458045E-02	.391331E-02	.113694E-01
1972	.558835E-01	.362060E-01	.458539E-02	.227263E-02
1973	.541482E-01	.299514E-01	.539939E-02	-.224189E-02
1974	.332918E-01	.263229E-01	.653441E-02	-.248653E-01
1975	.160031E-01	-.940611E-02	.430371E-02	-.131979E-01
1976	.317732E-01	-.353558E-02	.460109E-02	.520071E-02
1977	.173952E-01	-.965014E-02	.364517E-02	.247286E-01
1978	.916376E-02	-.142445E-01	.486095E-02	.772375E-02
1979	.809670E-02	-.244723E-02	.392402E-02	-.670902E-02
1980	.892995E-02	.813366E-02	.419870E-02	-.993757E-02
1981	-.612829E-02	-.101870E-01	.143943E-02	.189904E-01
1982	.452639E-02	-.667466E-02	.655943E-02	.891981E-02
1983	.495608E-02	-.632325E-02	.489967E-02	.132962E-01
1984	-.775724E-02	-.647765E-02	.221950E-02	.324896E-01
1985	.100125E-01	.787113E-02	.386927E-02	-.539991E-02

LAYER 3.2

	ΔYP/YP	Δ K/K	Δ(YP/K)/(YP/K)	RESIDUAL
1966	.621257E-01	.348281E-01	.263789E-01	.918728E-03
1967	.659544E-01	.314592E-01	.334431E-01	.105209E-02
1968	.615914E-01	.333064E-01	.273733E-01	.911705E-03
1969	.702946E-01	.501872E-01	.191465E-01	.960909E-03
1970	.624541E-01	.526547E-01	.930924E-02	.490175E-03
1971	.479283E-01	.414934E-01	.617849E-02	.256367E-03
1972	.548160E-01	.592299E-01	-.416706E-02	-.246815E-03
1973	.639134E-01	.727162E-01	-.820608E-02	-.596715E-03
1974	.685423E-01	.734336E-01	-.455675E-02	-.334618E-03
1975	.477044E-01	.568529E-01	-.865628E-02	-.492134E-03
1976	.301942E-01	.450757E-01	-.142396E-01	-.641860E-03
1977	.283419E-01	.390903E-01	-.103441E-01	-.404352E-03
1978	.127813E-01	.320342E-01	-.186553E-01	-.597609E-03
1979	.635321E-02	.232113E-01	-.164756E-01	-.382420E-03
1980	.130730E-01	.229947E-01	-.969871E-02	-.223019E-03
1981	.263778E-01	.227931E-01	.350478E-02	.798851E-04
1982	.147507E-01	.163191E-01	-.154330E-02	-.251854E-04
1983	.171995E-01	.871537E-02	.841082E-02	.733034E-04
1984	.120053E-01	.442285E-02	.754909E-02	.333885E-04
1985	.234279E-01	.110876E-01	.122050E-01	.135324E-03

LAYER 3.3

	ΔYS/YS	ΔLS/LS	Δ(YP/LP)/(YP/LP)	RESIDUAL
1966	.553129E-01	.456210E-02	.505203E-01	.230479E-03
1967	.514660E-01	.765502E-02	.434781E-01	.332826E-03
1968	.754075E-01	.481108E-02	.702584E-01	.338019E-03
1969	.722098E-01	.562456E-02	.662128E-01	.372418E-03
1970	.522601E-01	.879368E-03	.513356E-01	.451429E-04
1971	.636455E-01	.124428E-01	.505734E-01	.629276E-03
1972	.810412E-01	.244156E-01	.552760E-01	.134960E-02
1973	.756385E-01	.193615E-01	.552081E-01	.106891E-02
1974	.605133E-01	.163285E-01	.434749E-01	.709880E-03
1975	.362067E-01	-.444196E-02	.408301E-01	-.181365E-03
1976	.330252E-01	-.756208E-02	.408965E-01	-.309263E-03
1977	.502028E-01	.683685E-02	.430714E-01	.294473E-03
1978	.394787E-01	.676081E-02	.324982E-01	.219714E-03
1979	.764847E-02	-.363574E-01	.456661E-01	-.166030E-02
1980	.224984E-01	-.185707E-01	.418462E-01	-.777112E-03
1981	.618181E-01	.145435E-01	.465970E-01	.677682E-03
1982	.459591E-01	.123419E-01	.332074E-01	.409842E-03
1983	.481933E-01	.111616E-01	.366229E-01	.408770E-03
1984	.388589E-01	.626058E-02	.323955E-01	.202815E-03
1985	.459521E-01	.781424E-02	.378422E-01	.295708E-03

LAYER 4.1

	Δ(LP/YP)/(LP/YP)	TECH.PROGRESS	RELATIVE PRICE	RESIDUAL
1966	-.480908E-01	-.414311E-01	-.214523E-01	.147927E-01
1967	-.416665E-01	-.435488E-01	-.237113E-01	.255936E-01
1968	-.656462E-01	-.432348E-01	-.203447E-01	-.206662E-02
1969	-.621009E-01	-.411304E-01	-.225080E-01	.153756E-02
1970	-.488290E-01	-.378093E-01	-.202942E-01	.927447E-02
1971	-.481389E-01	-.337773E-01	-.215050E-01	.714343E-02
1972	-.523806E-01	-.294729E-01	-.290921E-01	.618441E-02
1973	-.523196E-01	-.252667E-01	-.311612E-01	.410825E-02
1974	-.416635E-01	-.214616E-01	-.235166E-01	.331469E-02
1975	-.392284E-01	-.182930E-01	-.243291E-01	.339380E-02
1976	-.392897E-01	-.159286E-01	-.272599E-01	.389880E-02
1977	-.412929E-01	-.144684E-01	-.263059E-01	-.518572E-03
1978	-.314753E-01	-.139448E-01	-.254052E-01	.787469E-02
1979	-.436718E-01	-.223224E-01	-.222396E-01	.890139E-03
1980	-.401654E-01	-.234982E-01	-.169044E-01	.237164E-03
1981	-.445224E-01	-.253016E-01	-.125386E-01	-.668215E-02
1982	-.321401E-01	-.274945E-01	-.863751E-02	.399191E-02
1983	-.353291E-01	-.297707E-01	-.536526E-02	-.193100E-03
1984	-.313790E-01	-.317567E-01	-.377473E-02	.415243E-02
1985	-.364624E-01	-.330114E-01	-.409578E-02	.644852E-03

LAYER 4.2

	Δ(X-M)	WT	Y	RELATIVE PRICES	DUK	RESIDUAL	NOMINAL SURPRISE
1966	-.351243E-01	.185673	-.175186	-.453357E-01	.000000	-.275173E-03	.000000
1967	-.135928E-01	.102924	-.107972	-.506917E-01	.535276E-01	-.264050E-02	-.874000E-02
1968	.907733E-01	.236152	-.166339	.568068E-01	-.180625E-01	.285766E-01	-.463600E-01
1969	-.109080E-02	.221324	-.220441	.502280E-01	-.528785E-01	-.532836E-01	.539600E-01
1970	.932044E-01	.196163	-.102235	.206121E-01	.000000	-.236157E-01	.228000E-02
1971	.114756	.114579	-.123680	.378579E-02	.350378E-01	.835140E-01	.152000E-02
1972	-.104549	.171988	-.201988	-.401056E-01	-.860605E-01	.238774E-01	.277400E-01
1973	-.661900E-01	.244086	-.189908	-.356719E-01	-.330469E-01	-.649496E-01	.133000E-01
1974	-.667616E-01	.773298E-01	-.145571	-.586759E-02	.840697E-01	-.375827E-01	-.391400E-01
1975	-.222470E-02	-.976143E-01	-.268047E-01	.208179E-02	.709410E-01	.514516E-01	-.228000E-02
1976	-.158700E-03	.241554	-.761046E-01	.111533E-01	-.359032E-01	-.713179E-01	-.695400E-01
1977	.130454	.106846	-.837960E-01	-.106808E-01	-.176244E-01	.117089	.186200E-01
1978	.107733	.122261	-.455644E-01	-.457482E-01	.535276E-01	-.219628E-01	.452200E-01
1979	-.451121E-01	.109113	-.452211E-02	-.171123	.000000	-.325403E-01	.539600E-01
1980	-.324125E-01	.114760E-01	-.396434E-01	.693297E-01	.182894E-01	-.154843E-01	-.763800E-01
1981	.102032	.755171E-02	-.108454E-01	.134712	.000000	.298936E-01	-.592800E-01
1982	.183034E-01	-.249941E-01	-.225670E-01	.329014E-01	-.182894E-01	.128726E-01	.383800E-01
1983	.827717E-01	.364070E-01	-.534121E-01	.128077	.182894E-01	-.359494E-01	-.106400E-01
1984	.138543	.176060	-.517186E-01	-.587080E-01	.000000	.364292E-01	.364800E-01
1985	-.175240E-01	.830309E-01	-.493768E-01	-.230483E-01	.185227E-01	-.580525E-01	.114000E-01

LIST OF VARIABLES AND DATA SOURCES

Variables:

A: Labour augmenting technical progress (own estimates).

DUK: Capacity utilization in industry (Survey of Entrepreneur's Opinions, BE).

D: A truncated trend taking 0 value for 1964-77, T-14 for 1978-85.

DUM: A dummy variable taking 1 value for 1979-80, 0 elsewhere.

KLS: Capital/labour supply ratio. Capital series (see Baiges et al. (1986)) estimates) divided by labour supply (thousands) (INE,EPA).

L : Number of employed (in thousands) (EPA).

M: Real imports (in thousands of 1970 pts.) Exports including tourism expenditures (INE,CN).

MO : Real oil imports (in Thousand 1970 pts.). Oil imports (BE) divided by the oil imports unit value (MECO).

MNO: Real non-oil imports (in thousands 1970 pts.). Non-oil imports (BE) divided by the implicit non-oil imports deflator obtained from the imports deflator and the oil imports deflator.

MM : An index of mismatch. Sum of absolute changes in the proportion of total employees in each sector relative to total employees (GTE and EPA).

NAN : Proportion of agricultural labor force (GTE and EPA).

PIP: Relative price of investment. Gross fixed investment deflator divided by GDP deflator.

PREL: Ratio of CPI (INE) to GDP deflator (market prices) minus indirect taxes (INE,CN).

PRME: Relative price of oil imports. Oil imports deflator divided by GDP deflator.

PRMC: Relative price of consumption imports goods. Consumption importables unit value divided by GDP deflator.

PRX: Relative price of exports (relative to wold) . Spanish exports unit value (MECO) divided by world exports unit value (IFS) times the appropiate exchange rate.

PRXI: Relative price of exports (relative to industrial countries.). Spanish exports unit value (MECO) divided by industrial countries' unit value (IFS) times de appropriate exchange rate.

t2 : Income taxes. Total income tax colection (IGAE) over GDP (INE, CN).

t3: Indirect tax rate. Total excise collections divided by nominal private consumption (IGAE and INE).

U: Unemployment rate (INE-EPA).

$W(1+t_1)$: Total real labour cost (monthly). **W:** Real wage (obtained from total monthly labour share on GDP divided by employment (INECN). **$(1+t_1)$:** Total effective rate of employer's contributions to the Social Security (own estimates).

WPI: $W(1+t_1)$ divided by PIP

WT: Real world trade. World imports in $ (IFS) divided by world imports unit prices in $ (IFS).

X: Real exports (in thousands of 1970 pts.) Exports excluding tourism expenditures (INE,CN).

Y: Real GDP (in thousands 1970 pts.). (INE,CN). (In technological equations we use at factor costs. In national accounts identities we convert it into market prices).

Abreviations for sources

BE	Boletín Estadístico (Bank of Spain)
CN	Contabilidad Nacional
EPA	Encuesta de Población Activa
GTE	Grupo de Trabajo del Ministerio de Economía y Hacienda
IFS	International Financial Statistics (IMF)
MECO	Ministerio de Comercio
IGAE	Intervención General de la Administración del Estado
INE	Instituto Nacional de Industria

REFERENCES

ANDRES, J. MOLINAS, C. Y TAGUAS, D. (1987): "Una función de Consumo Privado para la Economía Española". D.G. de Planificación. Mº de Economía y Hacienda.

BAIGES, J. MOLINAS, C. Y SEBASTIAN, M. (1987): "La Economía española 1964-85. Datos, fuentes y análisis". Instituto de Estudios Fiscales.

BEAN, Ch. (1981): "An Econometric Model of Manufacturing Investment in the U.K.". Economic Journal vol. 91. 106-121.

BEAN, C. and GAVOSTO, A.(1987): "A discussion of British Unemployment combining traditional concepts and disequilibrium economics: a preliminary report", CLE Working Paper No.976.

ILS, M. (1985): "Emperical Structure Evidence on Wages, Prices and employment in the U.S.". Journal of Political Economy

BONILLA, J.M. (1978): "Funciones de Importación y Exportación para la economía española", Estudios Económicos, No. 14,, Banco de España.

DOLADO, J.J.; MALO DE MOLINA, J.L. and ZABALZA, A.(1986): "Spanish Industrial Unemployment: Some Explanatory Factors", Economica Vol.53, No. 210.

ENGLE, R.F. y GRANGER, C.W.J. (1987): "Co-integration and error correction: representation, estimation, and testing". Econometrica, 55, nº 2, pg. 251-276.

FELDSTEIN, M. (1982): "Inflation, Tax Rules and Investment: Some Econometric Evidence". Econometrica Vol. 50, nº 4 pg 825-862.

FERNANDEZ, J.I. and **SEBASTIAN, M.** (1988): Funciones de Importación y Exportación para la Economía Española. Mimeo.

GAGEY, F., LAMBERT, J. and **OTTENWAELTER, B** (1987): A Disequilibrium Estimation of the French Labour Market. A Preliminary Report. Mimeo.

HENCHY, D., PAGAN, A. and **SARGAN, J.D.** (1984): "Dynamic Specification" en Griliches, A, and M. Intrilligator eds., Handbook of Ecomometrics. North Holland

LAMBERT, P. (1987): "Disequilibrium Macro Models", Cambridge University Press. Cambridge.

LAYARD, R. and **NICKELL, s.** (1985): "Unemployment in Britain". Economica vol. 53 pg.

MAULEON, I. (1985): "Análisis econométrico de las importaciones españolas". Documento Interno Servicio de Estudios. Banco de España.

MAULEON, I. (1986): "Una función de exportación para la economía española", Investigaciones Económicas, vol. X, No. 2, pág. 357-378.

MOLINAS, C.; SEBASTIAN, M. and **ZABALZA, A.** (1987): "European Unemployment Program: preliminary results on Spanish Unemployment". Mimeo.

NICKELL, S. (1986): "The Supply Side and Macroeconomic Modelling". Mimeo.

ROTEMBERG, J. and **SALONER, G.** (1986): "A Supergame - Theoretical Model of Price Wars during booms". American Economic Review

SNEESENS, H. (1987): "Investment and the Inflation Unemployment Trade-off in a macroeconomic Rationing Model with Monopolistic Competition". European Economic Review, pg 781-808.

SNEESSENS, H.R. and **DREZE,** J.H. (1986): "A Discussion of Belgian Unemployment Combining Traditional Concepts and Disequilibrium Economics", Economica, Vol. 53, No. 210.

SNEESSENS, H.R. and **DREZE,** J.H. (1987): "Report on the Project on European Unemployment", CORE, manuscript.

UNGERN-STERNBERG, T. (1981): "Inflation and Savings: International Evidence on inflation-induced income losses". Economic Journal. Vol.91, pg. 961-976.