GROSS JOB FLOWS

AND

WAGE DETERMINATION IN THE U.K.:

EVIDENCE FROM FIRM LEVEL DATA

Thesis submitted for the degree of Ph.D. in economics,

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ABSTRACT

This thesis studies important evolutions in three areas in labour economics: the flow approach, the efficiency wage hypothesis and unions. In part one I discuss gross job flows in the U.K., while part II is concerned with wage determination and firm performance. I give an introduction in chapter I where I motivate the study of gross job flows and I highlight the importance of spillovers from the product market to the labour market and vice versa. In chapter II I analyze a pattern of gross job creation and destruction in the U.K. during the 70's and early 80's. At any point in time and even within narrowly defined sectors simultaneous creation and destruction of jobs is observed, the latter being more variable over the cycle. Gross job reallocation, defined as the sum of gross job creation and destruction, is counter cyclical. Chapter III explores the relationship between firm size and job creation and destruction. The largest firms create and destroy most jobs. However, in percentage terms the gross job creation rate is largest in small firms, while the gross job destruction rate is lowest. I further investigate the size distribution dynamics and find that in the long run firms converge towards their average size, while plants do not. The final chapter of part I compares gross job flows across countries and shows the difficulties involved in making a consistent comparison. In part II I analyze vertical spillovers from the labour market to the product market and vice versa. I show that there exists a positive relationship between the wage paid in the firm and its market share performance, only under the hypothesis of efficiency wages. The theory is supported by evidence from firm level panel data. I show that important new insights may be obtained if the product market is explicitly taken into account when analyzing labour problems. Finally, in chapter VI I investigate the impact of unions on employment growth in the

U.K. and find that unions have a negative effect on employment growth, but a positive effect on employment levels, although this effect is not robust with respect to time. Moreover, the union effect is weaker the more competitors the firm faces.

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CHAPTER I: INTRODUCTION AND OVERVIEW

In this thesis I study three areas in labour economics which received a lot of attention in the literature in the past couple of decades or so:

1. The *matching* or *flow approach* (e.g. Pissarides, 1985, 1986, 1990)
2. The *efficiency wage* hypothesis (e.g. Akerlof, 1984; Solow, 1979; Yellen, 1984)
3. The role of *unions* on economic performance (e.g. Clark, 1984; Lindbeck and Snower, 1986; Oswald, 1985).

These three approaches attempt to provide an economic rational, different than the typical competitive framework, for unemployment. This thesis makes a substantial contribution in each of these three broad fields in labour economics. Part I of the thesis can be situated in the *flow approach* and is concerned with the analysis of gross job creation and destruction in the U.K.. This is the first study on gross job flows in the U.K. which reveals a number of new and interesting facts and could therefore be used for further empirical and theoretical work in this area. In the second part of the thesis I investigate the wage determination process, in particular I develop a test which discriminates between the efficiency wage hypothesis and other forms of wage determination, like union bargaining.

In this introductory chapter I will motivate the current research and give a brief overview of the issues and the results reported in this volume. In section I.1. I start with explaining in a non-technical way what I mean with gross job flows and continue to motivate why it matters and it is interesting to study them. In section I.2 I discuss spillovers between the labour market and the product market. These two sections reflect part I and II respectively of the thesis. In section I.3 I give an overview of the thesis.

I.1. Gross Job Flows: What and Why?

Gross job creation and gross job destruction can be contrasted with net job creation and destruction. I mean with gross job creation the sum of all firms which expand their labour force in a particular year. With gross job destruction I mean the sum of all firms which contract their labour force in a particular year, expressed as a positive number. These figures can be expressed as rates in which case the amount of job creation and destruction in a particular year is divided by aggregate or sectoral employment. The difference between the gross job creation and gross job destruction rate gives the net employment growth rate. If it is positive there is net job creation, if this difference is negative there is net job destruction. The process of job turnover is described in figure I.1.

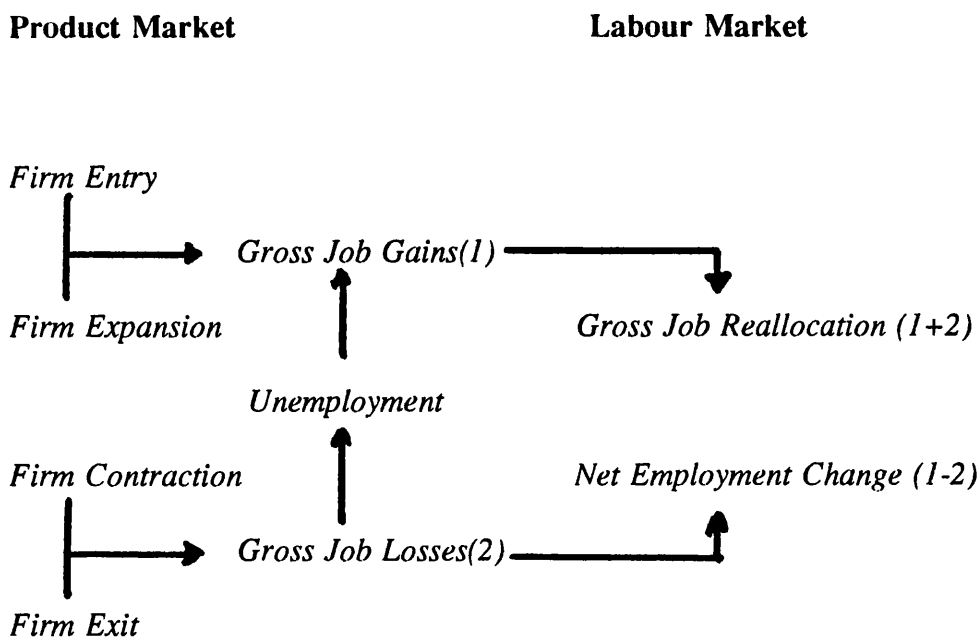


Figure I.1

As can be seen in figure I.1 the process of job creation and destruction reflects an interaction between the product market, via industry evolution, and the labour market, employment change and its effect on unemployment. These interactions between product markets and labour markets will be important and occasionally be made explicit throughout the thesis. Job destruction has a direct impact on unemployment, as well as job creation. Of course, the job loss rate does not reflect the inflow rate into unemployment since workers might quit their jobs voluntarily. Similarly, the outflow rate is not the same as gross job creation since a new job might be filled by an employed person or an inactive one.

It is with the emergence of large micro-level panel datasets, that the research on gross job flows received a major impulse. The analysis of gross job flows may be regarded as a more detailed way of analyzing labour demand. Labour demand for any aggregate, like sector, must then be viewed as the result of firms creating jobs in that sector on the one hand and destroying jobs on the other. The study of the process of gross job creation and gross job destruction is interesting and important for a number of reasons. A small net job creation rate might involve large gross job creation and large gross job destruction. In other words, underlying the net employment flows there exists a process which captures the sources of the shocks leading to different net employment flows. For instance, 2% net employment growth could be the result of 4% gross job creation and 2% gross job destruction, or of 30% gross job creation and 28% gross job destruction. Thus gross job flows provide information on the underlying turbulence leading to net employment growth and hence on the underlying dynamics, this is information which is not available if only net flows are taken into account. Moreover, the sources of the shocks leading to different net employment growth can be easier identified: the process of gross job creation and destruction reflects a process of firm expansion and contraction on the one hand and of firm entry and exit on the other. Thus the analysis of gross job flows is ultimately linked to the analysis of firm growth and hence is related to the evolution of the size distribution of firms. In this respect there is a general belief that small plants and firms are the major job creators and hence are the engine of the economy.

It has often been argued that the European unemployment problem is the result of too low job creation and many countries have implemented job creation schemes and policies. It is the gross job creation rate which reflects the real number of new jobs in an economy. The analyses of gross job creation and destruction leads to assessing the durability of a newly created job. By the micro-economic nature of the analysis it is possible to track a newly created job in one firm over a number of years and it is therefore possible to infer the length of a job opportunity in an economy. This could be important for policy reasons.

Finally, in labour economics there exists a substantial literature on worker flows and its relation to the Beveridge Curve (Pissarides,1990). Obviously, gross job flows will account for a substantial fraction of the amount of worker flows in an economy. As such the research on gross job flows can be viewed as complementary to the research on worker flows.

I.2. Spillovers between the Product Market and the Labour Market

The process of industry evolution, i.e. firm expansion and contraction, leads to job creation and destruction and thus to a pattern of labour demand. Factors like the intensity of price competition, technological innovation, efficiency differences, etc. most likely affect the evolution of industries and firm sizes, hence job turnover. Interactions between the product market and the labour market have recently received an impulse due to the development of theories in industrial organisation (Tirole, 1989; Sutton, 1991). The focus of the second part of the thesis will be on these spillovers and their importance in analyzing labour problems.

In the Keynesian literature product demand changes are transmitted to the labour market via the effect prices have on the real wage. If prices are more responsive than nominal wages to product demand changes , then a rise in demand reduces the real wage, hence raising employment. In contrast, if prices are sluggish, a change in product demand will have a direct effect on labour demand, without requiring a change in the real wage. Lindbeck and Snower (1994) analyze the long run effects of such product demand changes on the labour market. I focus on how the "toughness of price competition" affects these interactions between the labour market and the product market, in particular when wages are determined endogenously. I take up the literature on the efficiency wage hypothesis and on union bargaining in the framework of a general oligopoly model. Strategic interactions between firms influence the outcome of the wage paid in the firm. A number of new insights can be obtained by incorporating recent game theoretic models of competition in models of the labour market.

I.3. Overview

Part I of the thesis has three chapters, chapters II, III and IV. In **chapter II** I analyze a pattern of gross job creation and gross job destruction in the U.K. manufacturing sector during the 70's and 80's. To do this I make use of a panel of large manufacturing firms and of three occasional surveys with plant level data. At any point in time and even within narrowly defined sectors gross job creation and gross job destruction coexist. Job creation and destruction are inversely related and gross job reallocation, the sum of the two, is counter-cyclic. Gross job destruction is more variable than gross job creation over the cycle. The idiosyncratic component is substantial. However, it is predominantly aggregate and sectoral shocks which explain the main fraction of the total time variation of the gross job reallocation rate. I compare the reported findings with those of the U.S. manufacturing sector and conclude that although the *magnitude* of gross job flows is lower in the U.K., the *cyclical* properties are very similar. Finally, in the light of the reported results, I discuss a number of anomalies of existing theory and point out new theories explaining the observed pattern of job creation and job destruction.

In **chapter III** I investigate whether there exists a relationship between firm size and job creation. I start with decomposing *net job creation* into *gross job creation* and *gross job destruction*, by plant or firm size. I find that there exists a monotonic relationship between size and gross job creation, the smallest plants (firms) have the highest gross job creation rate. This relationship is reversed for the gross job destruction rate. In absolute terms, however, the largest firms and plants create and destroy most jobs. This is not surprising since they also provide most jobs in the economy. I go on with studying the dynamic evolution of the cross-section distribution of firm and plant size. To do this I compute Markov transition matrices and compute the ergodic or steady state distribution of firm and plant size. I find that in the long run plants do not converge, while firms do converge towards their mean employment in the sample.

In **chapter IV** I compare the U.K. results with those of other studies for different countries. I give an overview of the existing studies to date and show that there are international differences between gross job flows, with the U.S. having the highest gross job reallocation rate. I explore the hypothesis that the institutional arrangements, industrial policy and employment protection legislation cause differences in gross job flows and find preliminary evidence they do. Throughout chapter IV I highlight the difficulties at this stage with the limited availability of international data to make consistent comparisons.

Part II of the thesis consists of two chapters, chapter V and chapter VI. In **chapter V** I explore the *efficiency wage* hypothesis and develop a new approach to analyzing the problem. Efficiency wage theories have been put forward as attractive ways of explaining different aspects of the labour market. To find direct evidence of efficiency wage payments has proven to be quite difficult. I model various vertical spillovers from wage determination in an upstream labour market to market share performance in a downstream product market and *vice versa*. I do this within Sutton's (1991) general oligopoly model under alternative theories of the labour market. Rent sharing due to efficiency wages is shown to create only a *downstream* vertical spillover. While rent sharing due to wage bargaining creates a two way vertical spillover. The spillovers due to efficiency wage payments are shown to be the only downstream spillover that drives a positive relationship between a firm's wage growth and product market performance. Using U.K. firm level panel data I *constrain the data* with the theory to pinpoint the downstream spillover due to efficiency wage payments. The spillover turns out to be significant and this can be taken as the first direct and general empirical evidence for efficiency wage payments.

In the final chapter, **chapter VI**, I take up the literature on unions and firm performance. In particular, I investigate the effect trade unions have on employment behaviour in the U.K. during the 1980's. The approach I follow is empirical. I allow the union to have an effect on employment which is over and above the union-wage effect on employment. I find that unionised firms have lower net employment *growth* rates, although this effect is not robust over time and is weaker if firms face many competitors. Moreover, this effect is only present in the manufacturing sector, not in the non-manufacturing sector. I also find that firms which de-recognised unions have on average lower employment growth rates than firms which did not de-recognise unions. This suggests that unions affect employment *levels* positively.

All chapters in the thesis are self-containing in the sense that they can be read on their own. I highlighted and reported new facts and approaches in three areas in labour economics. I view the results reported in this thesis as a beginning of a longer research agenda. The literature on gross job flows is still very young and new. The facts reported in part I of the thesis should be compared with the results in different countries when more data become available. Also, the data quality in the U.K. is still poor. A search for new and better data should eventually lead to more detailed facts on gross job flows in the U.K., which might give correspondingly sharper insights. The empirical regularities on gross job flows should lead to a rethinking of a number of theories not only in labour economics, but also in industrial economics, the latter being concerned with the process of expansion and contraction of firms. The general approach I follow to analyze the efficiency wage hypothesis is an approach which could be applied to other problems in labour economics as well: It is concerned with integrating industrial economics into labour economics and vice versa. Spillovers from the labour market to the product market and vice versa do matter. This is the start of an evolution in labour economics (e.g. Dowrick, 1989, 1990, Lindbeck and Snower, 1994 among others). In the conclusion of the thesis I give a research agenda which is along these lines.

PART I

GROSS JOB FLOWS

CHAPTER II: GROSS JOB CREATION, DESTRUCTION AND REALLOCATION IN THE U.K. MANUFACTURING SECTOR

II.1. Introduction

The study of employment shocks and the flow of jobs received a new impulse from the recent empirical research of Davis and Haltiwanger (1990,1992), investigating the process of gross job creation and gross job destruction in the U.S. manufacturing sector using a detailed plant level panel dataset covering the period 1972-86. One of the advantages of using micro economic datasets is that this allows the researcher to decompose employment shocks into several components: employment shocks stemming from the birth or death of plants or firms (B and D) and employment shocks emerging from the expansion or contraction of establishments or firms (G and C). Hence the net change in employment for a given aggregate is defined as

(II.1) $\Delta E \equiv B + G - C - D$

It is the terms on the right hand side in (II.1) which represent gross employment flows. For the U.S. manufacturing sector, Davis and Haltiwanger (1990, 1992) find that on average plants created 9.2% new jobs and destroyed 11.3% existing ones during the 70's and early 80's. Similar results are found for other countries like Germany, Italy and other European countries (Boeri and Cramer, 1992, Contini and

Revelli, 1993). This chapter is concerned with gross job creation and gross destruction in the U.K. manufacturing sector in the 70's and early 80's. This is a particularly interesting period to analyze since there were two major recessions, the first and second oil shocks. Moreover, I analyze the same time period as in Davis and Haltiwanger (1992), so that I will be able to compare the U.S. findings with those of the U.K..

The results that emerge are striking and open a new dimension for research on job flows in the U.K.. Using a sample of large manufacturing firms I report an annual average gross job creation rate of 1.6% and an annual average gross job destruction rate of 5.6% over the sample period, 1972-86. Moreover, I also find that even within narrowly defined sectors there exists simultaneous creation and destruction of jobs indicating that firms behave in a very heterogeneous way regarding their employment decisions.

The methodology I pursue in this chapter is very similar to the one followed by Davis and Haltiwanger (1990, 1992) and Boeri and Cramer (1992). In the second section I introduce the working definitions and the data I work with. Section II.3 reports some basic facts on job creation and job destruction rates in the U.K. manufacturing sector over the period 1972-86. I will report the yearly gross job flow rates and discuss their cyclical properties. Gross job reallocation, the sum of gross job creation and destruction, turns out to be counter-cyclic. Fluctuations in the job destruction rate are far more pronounced than fluctuations in the job creation rate. I also report gross job flows within narrowly defined sectors and analyze the extent of shifts of jobs both within and between sectors. This is done in section II.4. I further look at inter-industry gross job flow differentials and discusses the importance of idiosyncratic shocks viz. aggregate and sectoral shocks in explaining the time variation in gross job creation and destruction. In section II.5, I test the robustness of the results by comparing them with gross job creation and destruction measured from the Workplace Industrial Relations Surveys, these cover three occasional surveys of plant level U.K. data in the 80's. Finally in section II.6 I highlight some anomalies of the traditional theory in labour economics due to the reported results on gross job flows. I give as an illustration a Cournot model which generates simultaneous job creation and destruction in one sector and continue to mention some new lines of theoretical research. Section II.7 summarises and concludes the chapter.

II.2. Definitions and Data

II.2.1. Defining Gross Job Flows

Let x_{it} denote the size of firm i at time t, which is measured as the average employment (n) in firm i at time t and t-1. The growth rate of firm i at time t, g_{it} is then defined as

(II.2) $$g_{it} = [n_{it} - n_{it-1}]/x_{it}$$

This measure is similar to that used by Davis and Haltiwanger (1990,1992). It is symmetric about zero and lies in the closed interval [-2,2] with deaths (births) corresponding to the left (right) endpoint. (II.2) Is monotonically related to the conventional growth rate measure and the two are approximately equal for small growth rates. Let the conventional growth rate measure be defined as

(II.3) $$g^{c}_{it} = [n_{it} - n_{it-1}]/n_{it-1},$$

then

(II.4) $$g^{c}_{it} = 2g_{it}/(2-g_{it})$$

An economic reason to use (II.2) rather than (II.3) is that size of the firm is defined over the interval of two years, as an average, rather than on one particular date a year before.

The gross job creation rate and destruction rate are related to the size weighted frequency distributions of firm growth rates in the following way. Let job creation in sector j at time t be defined as

$$\text{(II.5)} \qquad pos_{jt} = \Sigma_{i \in I} g_{it}(x_{it}/X_{jt}), \quad \text{for all } g_{it}>0$$

where X_{jt} stands for sector size j at time t and I stands for the set of all firms in sector j at time t. The gross job destruction rate in sector j at time t is then defined as

$$\text{(II.6)} \qquad neg_{jt} = \Sigma_{i \in I} |g_{it}|(x_{it}/X_{jt}), \quad \text{for all } g_{it}<0$$

Gross job reallocation in sector j at time t is then simply the sum of the gross job creation and gross job destruction rate or

$$\text{(II.7)} \qquad gross_{jt} = pos_{jt} + neg_{jt}$$

To compare gross job flows with net flows we define net employment growth in sector j at time t as the difference between the job creation and job destruction rate or

$$\text{(II.8)} \qquad net_{jt} = pos_{jt} - neg_{jt}$$

The creation and destruction of jobs will involve some worker reallocation. Gross job reallocation represents an upper bound on the worker reallocation rate required to accommodate job reallocation. A lower bound on the worker reallocation rate is given by (II.9),

(II.9) $$\max_{jt} = \max\{pos_{jt}, neg_{jt}\}.$$

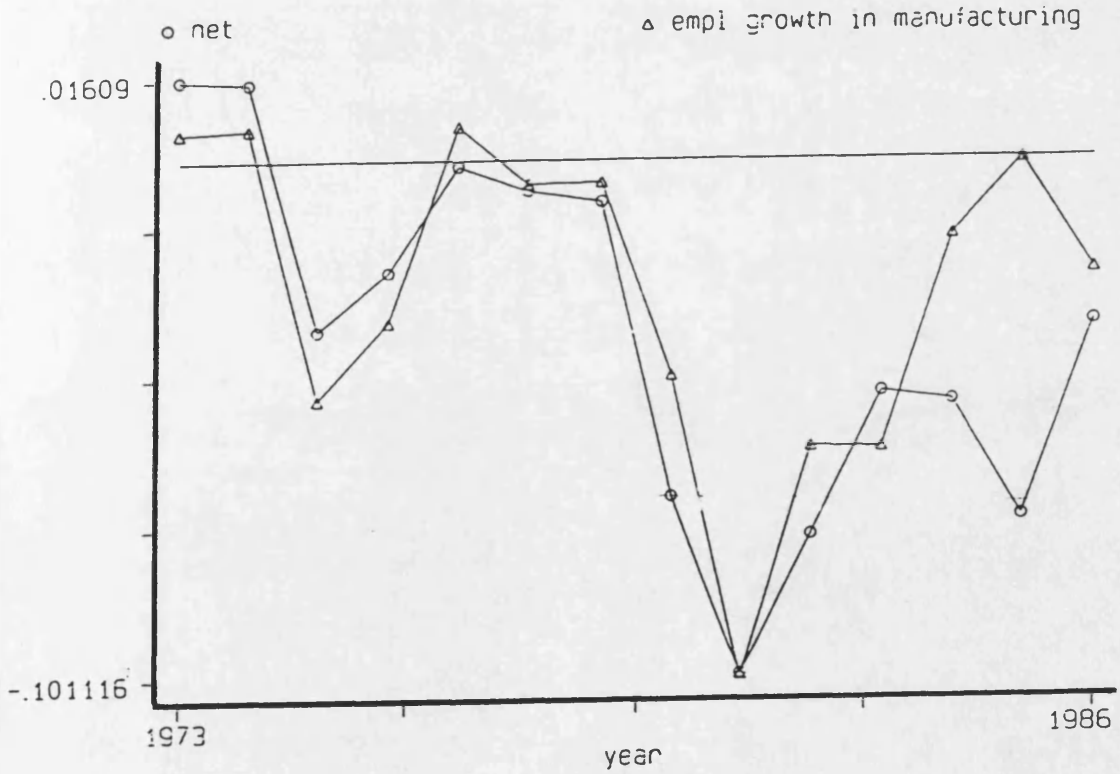
Of course worker reallocation will not be driven entirely by job reallocation. Other aspects will influence worker reallocation as well, like job satisfaction, employer satisfaction, etc.. It is however interesting to investigate how important job reallocation is in the process of worker reallocation. It would give an indication of 'involuntary' worker reallocation.

II.2.2. Data for the U.K.

The principle dataset I use consists of an unbalanced panel of 993 large U.K. manufacturing companies over the period 1972-86, drawn from the EXSTAT data tape and DATASTREAM on-line service. Average employment in the sample is 4530 in 1978 and the median is 1111 employees. In 1978, the total number of employees in the sample amounts to 4,231,552. This compares with 7,176,000 employees in the manufacturing population. Thus the sample covers about 60% of total manufacturing in 1978. While the sample contains the majority of manufacturing workers, it contains only a minority of firms in total manufacturing, namely only the large firms. The majority of these firms are multi-plant firms and the dataset undersamples small firms.

After 1982 the sample size drops significantly due to the Companies Act of 1982: firms were no longer required to report the number of domestic employees, although some continued to do so. I do not observe entry and exit, so our dataset consists of large continuing firms only. Figure II.1 shows the sample employment growth and the employment growth for the entire manufacturing population. It is clear that the correlation between sample employment growth and the one for the entire manufacturing population is very high until 1982 after which it drops significantly probably due to the Companies Act of 1982.

Figure II.1: Net employment growth of the sample vs. net employment growth in U.K. manufacturing population

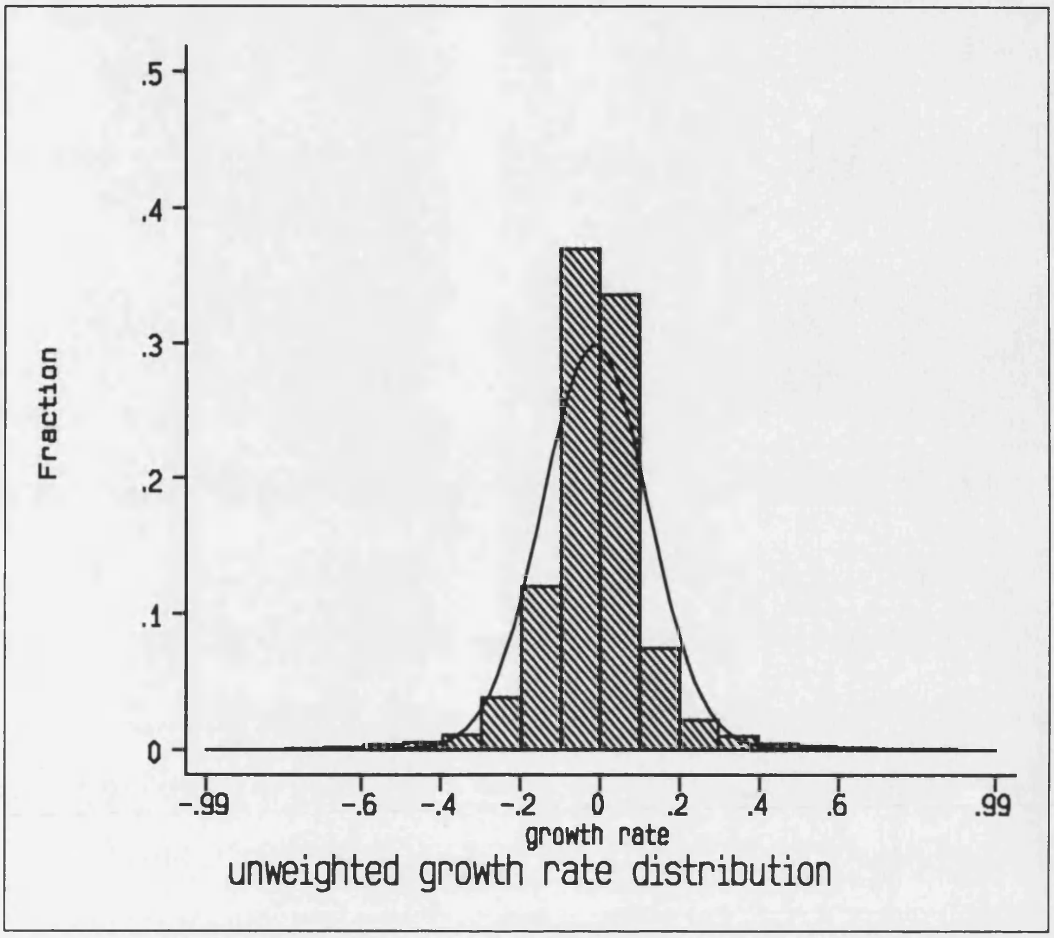


Each firm in the dataset is assigned to a particular industrial group, classified according to an EXSTAT classification scheme. In order to use external industry level data, this classification scheme is matched with the Standard Industrial Classification scheme, which is reported in table II.1. This matching scheme was kindly provided by S. Machin and J. Vanreenen.

Table II.1:INDUSTRIAL MATCHING

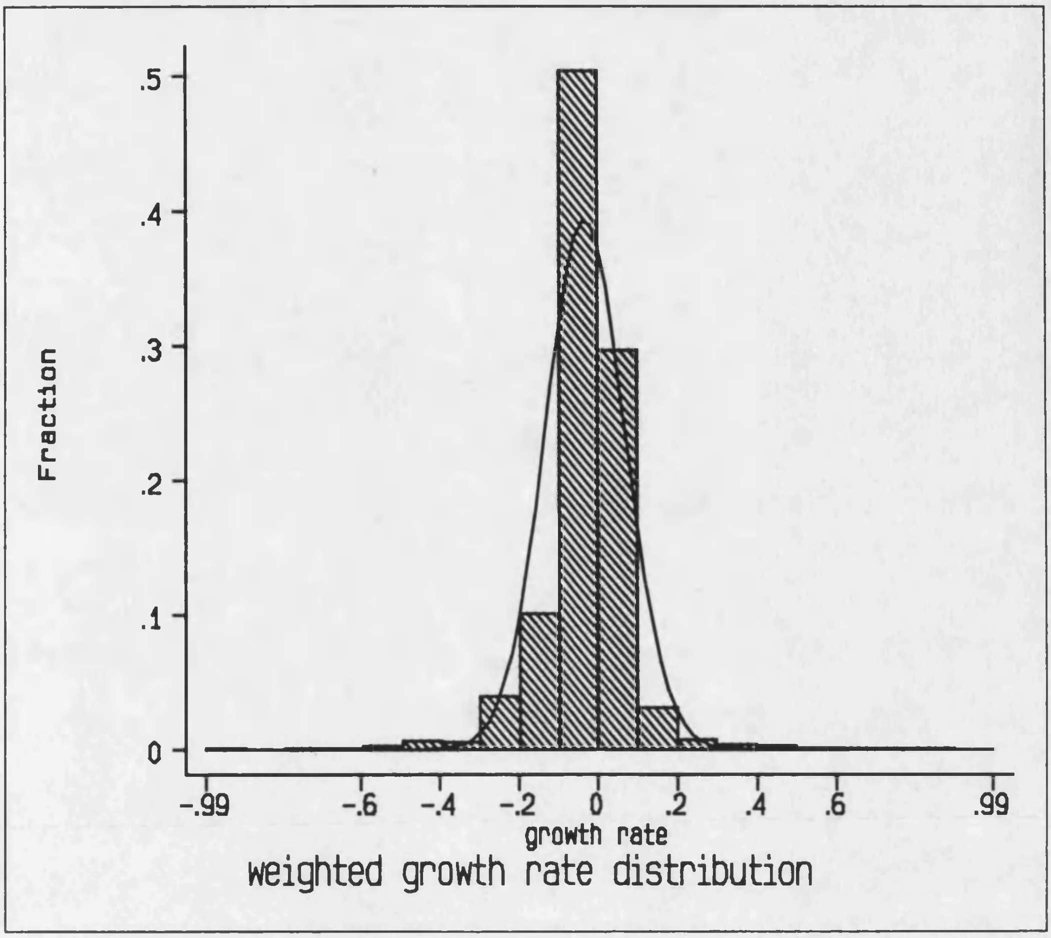
EXSTAT	DESCRIPTION	SIC (1980)
12	Brick and Roof tiles	241,245,248
14	Building Materials	243,244
15	Cement and Concrete	242,243
16	Paint	255
17	Timber	461,463
19	Electricals (Excluding radio and TV)	34
20	Cold formed fastening	316
21	Founders and Stampers	311,312
22	Industrial Plant	328
23	Mechanical Handling	325
24	Pumps and Valves	328
25	Steel and Chemical Plant	241,245,248
26	Wires and Rope	341
27	Misc.Mechanical Engin.	32
28	Machine Tools	322
29	Misc. engineering Contractors	328
30	Heating and Ventilation	346
31	Instruments	224
32	Metallurgy	224
33	Special Steels	221
34	Misc.Metal Forming	222,223
35	Electronics	34
36	Radio and T.V.	342,246
37	Floor Covering	438
38	Furniture and Bedding	467
39	Household Appliances	346
40	Cutlery	31
41	Motor Components	351-3
42	Motor Distributors	351-3
43	Motor Vehicles	351-3
44	Security and Alarm Serv.	34
45	Breweries	424,426-9
46	Wines and Spirits	424,426-9
49	General Food Mnfg.	411-23,428
50	Milling and Flour	416,419
52	Newspaper and Periodical	475
53	Publishing and Printing	475
54	Packaging and Paper	471-72
59	Clothing	453
60	Cotton and Synthetic	43
61	Wool	43
62	Miscellaneous Textiles	43
63	Tobacco	429
64	Footwear	451
65	Toys and Games	494
66	Plastics and Rubbers	483
67	Pharmaceuticals	257
68	General Chemicals	251,256
69	Office Equipment	330

Crucial in our analysis is the employment variable. In section II.2 I have defined the growth rate for firm i. Figure II.2a depicts this unweighted growth rate distribution for the 14 year sample. Figure II.2b depicts the size-weighted growth rate distribution. In both case a normal distribution is fitted over it. Both figures clearly show the asymmetric nature of the growth rates, with central peaks in the interval [-0.2,0]. This reflects the decline in the U.K. manufacturing sector during the 70's and the early 80's. As can be seen, the growth rate distribution does not lie in the interval [-2,2], this is because in the dataset I do not observe entry nor exit of firms.



.5
.4
.3
.2
.1
0
Fraction
-.99
-.6
-.4
-.2
0
.2
.4
.6
.99
growth rate
unweighted growth rate distribution

Figure II.2a



Fraction
.5
.4
.3
.2
.1
0
-.99
-.6
-.4
-.2
0
.2
.4
.6
.99
growth rate
weighted growth rate distribution

Figure II.2b

In the EXSTAT/DATASTREAM dataset I do not observe employment in individual plants belonging to the same firm. If I measure job creation and job destruction at the firm level, I do not take into account the reshuffling of jobs between plants within the same firm. Thus job creation and destruction rates computed from plant level data will most likely be higher. Furthermore, many studies use plant level instead of firm level data to compute gross job flows. To investigate how large the difference between the gross job flows computed from firm level data vs. plant level data is I use three alternative datasets, the Workplace Industrial Relations Surveys of 1980,1984 and 1990 (WIRS1,2,3 hereafter), in which there is plant level data on employment as well as detailed information on localisation, industry affiliation and other plant level variables[1]. To be included in the survey a plant had to employ at least 25 workers, large establishments were over-sampled and hence may be compared with "large" firms from the EXSTAT datatape. Since WIRS1,2,3 are occasional surveys I can only compute the job creation and destruction rates for the years 1980,1984 and 1990.

[1]More details on the sampling procedures and basic characteristics of this dataset can be found in Millward and Stevens (1986) and Millward et al. (1993).

A few critical remarks are appropriate at this stage. Whether establishments or firms should be the underlying units of observation depends on a number of factors, like the extent of intrafirm mobility of workers and the nature of investment (firm -or plant-specific). Thus far choices to use firms or establishments as unit of measurement have been constrained by the availability of data and the current study is no exception to this rule[2]. In both the datasets I do not observe entry nor exit of firms (establishments), so that the computed measures of job creation and job destruction are likely too low. However, Hamermesh (1991) estimates the relative importance of the various flows of jobs and concludes that the contribution to net employment change of continuing firms accounts for roughly two-thirds of the gross flows of jobs. In other words, the major source of net employment fluctuations in the aggregate can be explained by expansion and contraction of existing firms.

II.3. Gross Job Flows in the U.K. Manufacturing Sector

III.3.1. Basic Facts

Table II.2 reports gross and net flows of employment per year for the U.K. manufacturing sector. The average job creation rate is 1.6% with a standard deviation of 0.008, while the average job destruction rate is 5.6% and a corresponding standard deviation of 0.035. The average gross job reallocation rate is 7.2% (standard deviation =0.029), while the average lower bound on gross job reallocation is 5.8% (standard

[2]An overview of studies on gross job flows is given chapter IV.

deviation=0.032). Figure II.3 plots the gross job flows over time. What is immediately clear from figure II.3 is that gross job reallocation is counter-cyclic, driven almost entirely by the job destruction rate. On the given scale the job creation rate seems relatively constant over time. Table II.3 illustrates this further. It shows the correlation matrix of job creation, destruction, reallocation and net employment growth. Job creation and job destruction are negatively correlated and job reallocation is counter-cyclic. From figure II.3 and from comparing the standard deviation of the job creation rate, 0.008, with the standard deviation of the job destruction rate, 0.035, I conclude that there is a strong asymmetry between the gross job creation and gross job destruction rate, in which the latter is more variable than the job creation rate over the business cycle.

Note 1: Chapter II, p 39

The gross job reallocation rate reflects partly the net employment growth rate. I therefore construct the *excess job reallocation rate*, i.e. the difference between the gross job reallocation rate and the minimum necessary for observed employment growth or xs = gross -|net|, as in Blanchflower and Burgess (1993). Table II.2b shows the excess job reallocation rate in each year, as well as the ratio xs/gross. From the second column it is clear that the excess job reallocation rate is a substantial fraction of the actual gross job reallocation rate, except in the early 80's where the ratio drops to 12%, which might be caused by the drop in the sample after 1982. On average 50% of the gross job reallocation rate is due to movements in net employment growth. The correlation coefficient between the excess job reallocation rate and net employment growth is 0.61. This positive correlation remains if the sample is restricted up to 1982. This indicates that the excess job reallocation rate is pro-cyclical. Thus, controlling for the minimum necessary job reallocation to accommodate the observed net employment growth, the job reallocation rate looses its counter-cyclical property. This indicates that the counter-cyclicallity in the gross job reallocation rate is driven by the net employment growth rate. Table II.6b (compare with table II.6, p46) shows gross job flows within narrowly defined sectors. Also if the excess job reallocation measure is used there seem to be differences between the different industries. The fraction xs in gross varies substantially between industries. Both measures, xs and gross show heterogeneous firm behaviour even

Table II.2: Gross Job Flows, 1973-1986 (*)

year	pos	neg	net	gross	max
1973	0.031	0.015	0.015	0.047	0.031
1974	0.026	0.010	0.015	0.037	0.026
1975	0.010	0.044	-0.033	0.054	0.044
1976	0.013	0.035	-0.022	0.049	0.035
1977	0.025	0.026	-0.001	0.051	0.026
1978	0.021	0.026	-0.005	0.047	0.026
1979	0.022	0.030	-0.007	0.053	0.030
1980	0.009	0.078	-0.068	0.088	0.078
1981	0.009	0.121	-0.112	0.130	0.121
1982	0.007	0.113	-0.105	0.121	0.113
1983	0.004	0.073	-0.068	0.078	0.073
1984	0.011	0.060	-0.049	0.071	0.060
1985	0.011	0.086	-0.075	0.098	0.086
1986	0.021	0.060	-0.038	0.082	0.060
average	0.016	0.056	-0.039	0.072	0.058
std.	0.008	0.035	0.041	0.029	0.032

Table II.3: Correlation matrix

	pos	neg	net	gross
pos	1			
neg	-0.77	1		
net	0.85	-0.99	1	
gross	-0.65	0.98	-0.95	1

* See Note 1

within narrowly defined industries.

If one is interested in the reallocation of jobs in excess of the one necessary to accommodate net employment growth, then the XS measure is appropriate. However, if one views the literature on gross job flows as an alternative approach to studying employment dynamics than the "gross" measure is sufficient to use. This is the point of view of the current work.

Table II.2b: Excess Job Reallocation

year	xs	xs/gross
1973	0.031	0.66
1974	0.021	0.58
1975	0.020	0.37
1976	0.027	0.55
1977	0.050	0.98
1978	0.042	0.88
1979	0.045	0.85
1980	0.019	0.22
1981	0.018	0.14
1982	0.015	0.12
1983	0.009	0.12
1984	0.022	0.30
1985	0.022	0.23
1986	0.043	0.53
average	0.027	0.47
std.	0.012	0.29

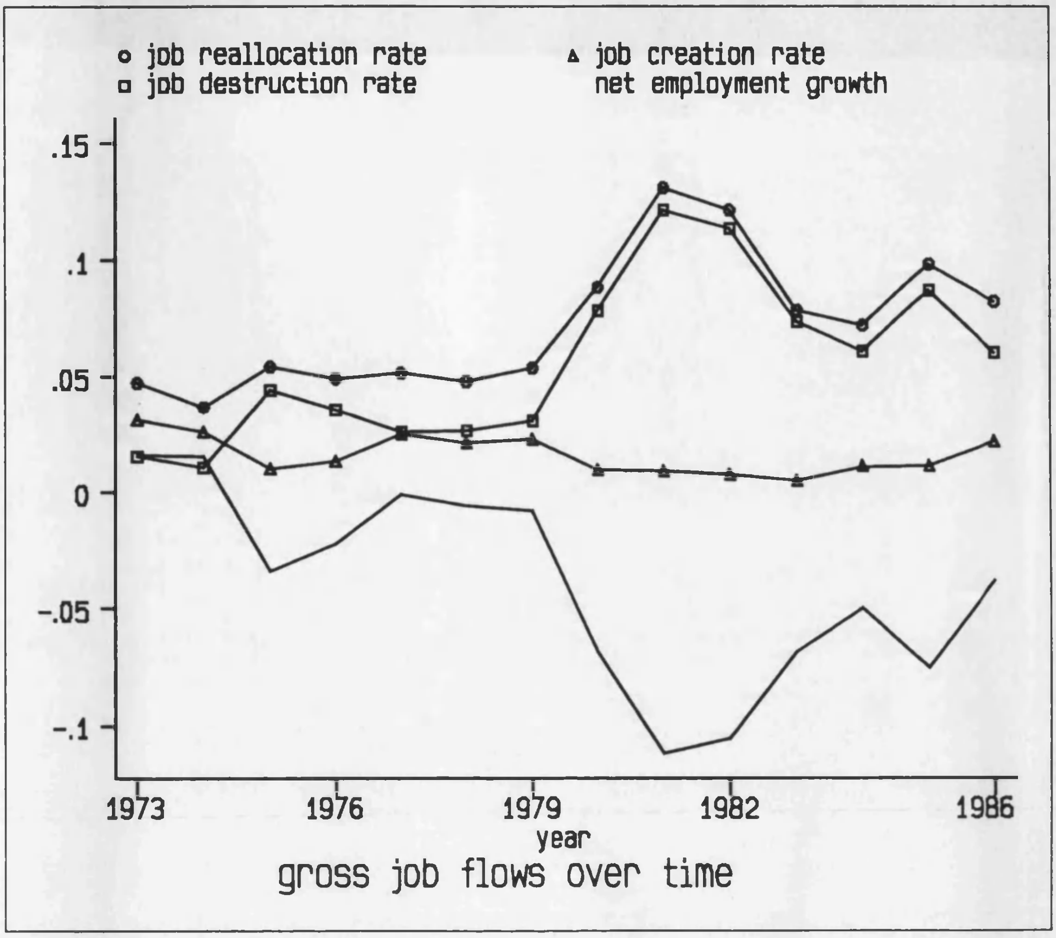


Figure II.3

The *cyclical* properties reported here are strikingly similar to those reported by Davis and Haltiwanger (1992) for the U.S. manufacturing sector. They also find that the gross job reallocation rate moves counter-cyclical and that it is the gross job destruction rate which is the more variable component. However, the *magnitude* of the gross job reallocation rates reported here is smaller than those for the U.S.. Most likely, this is due to the fact that the U.S. data consists of the population of plants, including entry and exit, while in the current U.K. dataset mainly contains large firms,

Table II.6b: Gross job flows for 2-digit industries

2-digit name	pos	neg	gross	xs
Brick and Rooftiles	0.024	0.039	0.064	0.010
Building Materials	0.021	0.041	0.063	0.028
Cement and Concrete	0.019	0.027	0.047	0.016
Paint	0.022	0.045	0.067	0.025
Electricals	0.013	0.038	0.051	0.021
Cold formed fastening	0.062	0.045	0.107	0.008
Founders & Stampers	0.022	0.051	0.073	0.021
Industrial Plant	0.025	0.039	0.065	0.038
Mechanical Handling	0.029	0.040	0.069	0.030
Pumps and Valves	0.019	0.043	0.062	0.022
Steel and Chemical Plant	0.043	0.046	0.089	0.034
Wires and Rope	0.011	0.063	0.074	0.014
Misc.Mechanical Engineering	0.016	0.054	0.070	0.026
Machine Tools	0.025	0.053	0.079	0.022
Misc.Engineering Contractors	0.027	0.067	0.095	0.014
Instruments	0.012	0.045	0.057	0.015
Metallurgy	0.028	0.041	0.070	0.027
Special Steels	0.003	0.080	0.083	0.006
Misc. Metal Forming	0.011	0.046	0.058	0.004
Radio and T.V.	0.044	0.027	0.071	0.022
Floor Covering	0.013	0.054	0.068	0.017
Furniture and Bedding	0.060	0.035	0.096	0.031
Household appliances	0.033	0.067	0.101	0.031
Cutlery	0.034	0.044	0.078	0.024
Motor Components	0.016	0.052	0.068	0.015
Motor Distributors	0.008	0.079	0.088	0.005
Breweries	0.028	0.014	0.043	0.019
Wines and Spirits	0.027	0.034	0.062	0.009
General Food Mnfg.	0.013	0.039	0.052	0.021
Milling and Flour	0.056	0.031	0.087	0.003
Newspapers & Periodicals	0.015	0.048	0.063	0.022
Publishing & Printing	0.020	0.050	0.070	0.024
Packaging and Paper	0.024	0.040	0.065	0.022
Clothing	0.036	.0420	0.078	0.041
Cotton and Synthetic	0.001	0.066	0.067	0.002
Wool	0.028	0.059	0.087	0.038
Misc. Textiles	0.011	0.071	0.083	0.018

excluding entry and exit. Restricting the comparison to U.S. plants with more than 1000 employees, Davis and Haltiwanger (1992) compute an annual average gross job creation rate of 6% and destruction rate of 7.8%, hence an annual average gross job reallocation rate of 13.8%.

Table II.4 shows the frequency of firms creating/destroying jobs per growth rate interval. The majority of firms creating/destroying jobs are those with modest growth rates; 43% of existing firms destroying jobs have a growth rate in the interval [-0.05,0], 49% of existing firms creating jobs have a growth rate in the interval [0,0.05]. Thus firms having modest growth rates account for a large proportion of job creation and job destruction.

Footwear	0.028	0.024	0.052	0.017
Toys and Games	0.065	0.088	0.150	0.022
Plastics and Rubbers	0.032	0.052	0.085	0.034
Pharmaceuticals	0.015	0.034	0.049	0.023
General Chemicals	0.010	0.053	0.063	0.018

Note: The figures refer to 14-year size weighted averages.

Table II.4: Frequency of firms creating/destroying jobs per growth rate interval

growth rate interval	frequency of firms
< -0.75	0.0006
-0.75 - -0.50	0.008
-0.50 - -0.25	0.056
-0.25 - -0.10	0.256
-0.10 - -0.05	0.244
-0.05 - 0.00	0.433
0.00 - 0.05	0.493
0.05 - 0.10	0.248
0.10 - 0.25	0.197
0.25 - 0.50	0.047
0.50 - 0.75	0.010
> 0.75	0.003

II.3.2. Persistence in job creation and destruction

Given substantial and frequent job creation and job destruction, it is important to investigate whether the new jobs persist or whether they are transitory in nature. This might be important for policy reasons. If economic policy focuses on encouraging firms to create jobs, it is important that these newly created jobs are not of short duration, but that the effect is long term. Table II.5 reports the one-year and two-year persistence rates of job creation (fpos1, fpos2) and job destruction (fneg1, fneg2). The one-year (two-year) persistence rate of job creation is simply the number of jobs created in year t, which still exist at time t+1 (t+2), expressed as a fraction of the number of jobs created at time t. The one-year (two-year) persistence rate of job destruction is computed in a similar way. It is important to view this persistence measure as indicators of the persistence of job *opportunities*, irrespective of who occupies it. A high persistency in job creation for instance does not necessarily imply low worker turnover. Imagine an expanding firm. In one year it hires 10 people, the next year it fires them all and hires 11 more. The following year it fires 11 and hires 12 more, and so on. The measure of persistence we use will indicate that the job *opportunities* are highly persistent in this firm, whereas the people occupying these jobs are highly transient. The average one-year persistence rate in job creation is 62%, while in job destruction this is 81%. This indicates that the majority of new jobs last for more than one year, but also the majority of destroyed jobs will not be re-created after one year. Thus the reallocation process is long-term in nature. It is also clear that the persistence in job destruction is higher than the persistence in job creation. This again indicates the asymmetric nature of gross job flows. These results are very similar to those reported by Davis and Haltiwanger (1992). They compute an annual average one-year persistence rate in job creation of 67% and in job destruction of 81%.

Table II.5: Persistence in job creation and job destruction

year	fpos1	fpos2	fneg1	fneg2
1974	0.87	-	0.78	-
1975	0.59	0.27	0.90	0.45
1976	0.63	0.19	0.86	0.83
1977	0.83	0.35	0.78	0.53
1978	0.80	0.50	0.79	0.45
1979	0.81	0.48	0.88	0.62
1980	0.63	0.49	0.92	0.54
1981	0.44	0.12	0.83	0.81
1982	0.24	0.16	0.50	0.46
1983	-	-	-	-
1984	0.57	-	0.87	-
1985	0.38	0.33	0.86	0.74
1986	0.63	0.20	0.71	0.63
average	0.62	0.31	0.81	0.61
std.	0.19	0.14	0.11	0.14

Note: The missing variables refer to the year 1983, in which there was a significant fall in the number of observations, due to the companies account act of 1982.

The above analysis suggests that firm level employment changes must be associated with long-term joblessness or worker reallocation across firms. The job destruction rate can give an indication of the length of a job opportunity. This does not mean that the same job is always engaged by the same worker. Several workers could have done the same job, but at different time periods. Assuming stationarity, the average duration of a job opportunity is the inverse of the destruction rate. Since the average job destruction rate of 5.6%, the average job duration is 18 years. This is consistent with other studies, using labour force surveys. Compared with the U.S., Davis and Haltiwanger (1992) find that the average job destruction rate for large plants (more than 1000 employees) is 7.8%. This implies an average job duration of 13 years. The average job destruction rate for their entire sample is 9.98 % which implies an average job duration of 10 years.

II.4. Inter Industry Gross Job Flow Differentials

The above analysis focuses on the entire manufacturing sector and demonstrates firm heterogeneity within the manufacturing sector. Table II.6 shows that this firm heterogeneity still holds within narrowly defined sectors, the gross job creation, destruction and reallocation rate refer to size weighted averages, based on annual values. The average gross job reallocation rate varies between 4.3% in 'Breweries' to 15% in 'Toys and Games'. Thus there is considerable cross-industry variation in the gross job reallocation rate. Even within narrowly defined sectors, there exists a substantial amount of job creation and job destruction, showing the heterogeneity of incumbent firms.

Table II.6: Gross job flows for 2-digit industries

2-digit name	pos.	neg	gross	max
Brick and Rooftiles	0.024	0.039	0.064	0.039
Building Materials	0.021	0.041	0.063	0.041
Cement and Concrete	0.019	0.027	0.047	0.027
Paint	0.022	0.045	0.067	0.045
Electricals	0.013	0.038	0.051	0.038
Cold formed fastening	0.062	0.045	0.107	0.062
Founders & Stampers	0.022	0.051	0.073	0.051
Industrial Plant	0.025	0.039	0.065	0.039
Mechanical Handling	0.029	0.040	0.069	0.040
Pumps and Valves	0.019	0.043	0.062	0.043
Steel and Chemical Plant	0.043	0.046	0.089	0.046
Wires and Rope	0.011	0.063	0.074	0.063
Misc.Mechanical Engineering	0.016	0.054	0.070	0.054
Machine Tools	0.025	0.053	0.079	0.053
Misc.Engineering Contractors	0.027	0.067	0.095	0.067
Instruments	0.012	0.045	0.057	0.045
Metallurgy	0.028	0.041	0.070	0.041
Special Steels	0.003	0.080	0.083	0.080
Misc. Metal Forming	0.011	0.046	0.058	0.046
Radio and T.V.	0.044	0.027	0.071	0.044
Floor Covering	0.013	0.054	0.068	0.054
Furniture and Bedding	0.060	0.035	0.096	0.060
Household appliances	0.033	0.067	0.101	0.067
Cutlery	0.034	0.044	0.078	0.044
Motor Components	0.016	0.052	0.068	0.052
Motor Distributors	0.008	0.079	0.088	0.079
Breweries	0.028	0.014	0.043	0.028
Wines and Spirits	0.027	0.034	0.062	0.034
General Food Mnfg.	0.013	0.039	0.052	0.039
Milling and Flour	0.056	0.031	0.087	0.056
Newspapers & Periodicals	0.015	0.048	0.063	0.048
Publishing & Printing	0.020	0.050	0.070	0.050
Packaging and Paper	0.024	0.040	0.065	0.040
Clothing	0.036	.0420	0.078	0.042

Table II.6 contd.

Cotton and Synthetic	0.001	0.066	0.067	0.066
Wool	0.028	0.059	0.087	0.059
Misc. Textiles	0.011	0.071	0.083	0.071
Tobacco	0.066	0.058	0.125	0.066
Footwear	0.028	0.024	0.052	0.028
Toys and Games	0.065	0.088	0.150	0.088
Plastics and Rubbers	0.032	0.052	0.085	0.052
Pharmaceuticals	0.015	0.034	0.049	0.034
General Chemicals	0.010	0.053	0.063	0.053

Note: The figures refer to 14-year size weighted averages.

This immediately begs the question whether this job reallocation process reflects shifts of jobs *across* different industries or job reallocations *within* any industry. I therefore construct the following index of intra-industry job reallocation in period t (cfr. Boeri, 1988),

(II.10) $$index_t = 1 - \Sigma_j|net_{jt}|/\Sigma_j gross_{jt}$$

If (II.10) equals 0, then job flows reflect shifts occurring entirely *across* sectors, while a value of 1 reflects shifts of jobs occurring entirely *within* sectors. Table II.7 reports the yearly values of this index. The 14-year average is 30%. Figure 4 shows how this index varies over the business cycle and demonstrates how the index moves pro-cyclically. The correlation coefficient between the index and net employment growth is 0.90. This suggests that in good times jobs are reallocated more within one sector, while in bad times jobs are reallocated more across sectors. In bad times firms within one sector are more homogeneous in their behaviour than in good times. In good times firms within the same sector both expand and contract. This is consistent with Wadsworth (1989) using Labour Force Survey data. He finds that inter-firm mobility of workers is procyclical. The increased job reallocation *within* sectors in good times suggests that it is during booms that restructuring of firms *within* the same sector occurs, possibly caused by an increase in the toughness of price competition: The potential gain in market share by undercutting the market price is larger than in bad times (cfr. Rotemberg and Saloner, 1986). The increased job reallocation *across* sectors during recessions indicates a restructuring of the economy as a whole, which suggests a shift of jobs from 'declining' sectors to 'growing' and 'new' sectors.

Table II.7: Index of intra-industry job turnover

year	index
1973	0.538
1974	0.424
1975	0.309
1976	0.404
1977	0.455
1978	0.549
1979	0.497
1980	0.214
1981	0.106
1982	0.071
1983	0.086
1984	0.099
1985	0.158
1986	0.347

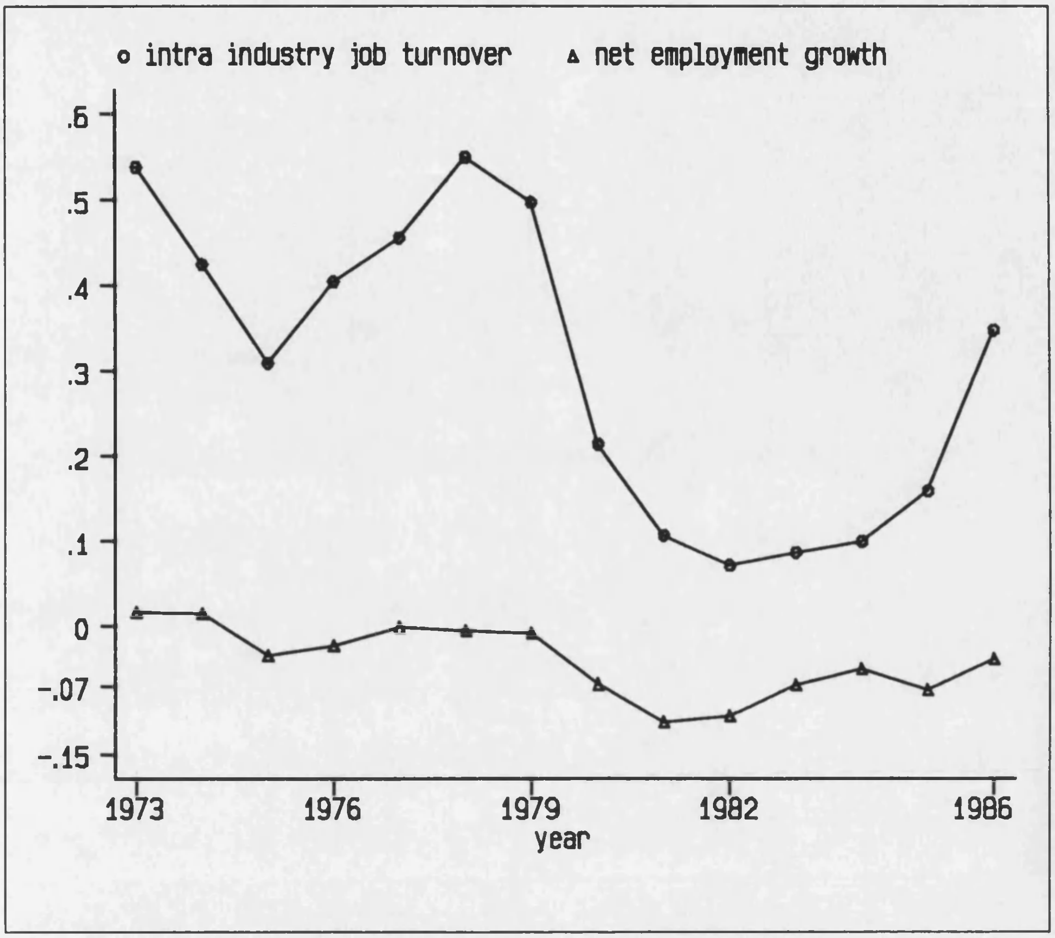


Figure II.4

The above analysis suggests that there are several sources of shocks at work leading to the process of gross job creation and job destruction. I therefore decompose the gross job flow measures into separate components which can be associated with different types of shocks. I shall distinguish the part of gross job creation, destruction and reallocation which is due to aggregate and sectoral shocks on the one hand and idiosyncratic or firm specific shocks on the other.

Let the idiosyncratic growth rate in firm i at time t, g_{it}^{dev} be defined as

(II.11) $$g_{it}^{dev} = g_{it} - g_{jt} - g_t,$$

where g_{jt} refers to growth rate in sector j at time t and g_t refers to aggregate growth rate. Equation (II.11) allows us to capture several existing views of the business cycle. For instance, the hypothesis that it is aggregate disturbances which are the driving forces of business cycle fluctuations. In this case, all the time variation in the gross job flow measures is driven by the time variation in the aggregate component. A less simplistic view of the business cycle would be one in which there are cross-sectoral differences in the responses to aggregate disturbances (see Abraham and Katz, 1986). In (II.11) I allow for completely unrestricted sectoral responses to aggregate disturbances. With our current set up we are able to go one step further. In particular, we will investigate the importance of idiosyncratic disturbances versus aggregate and sectoral disturbances in explaining the time variation in our gross job flow measures and thus in explaining business cycle fluctuations.

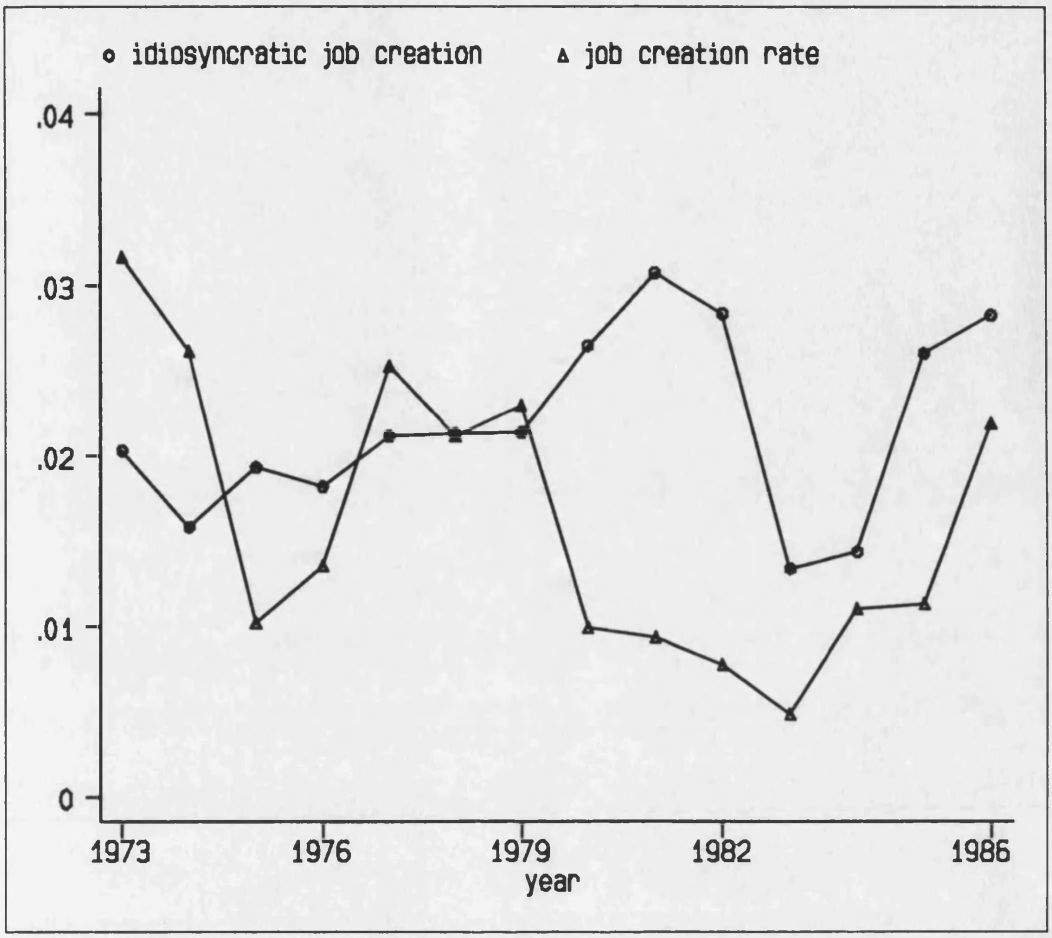
I define the idiosyncratic job creation, job destruction and job reallocation rate in a similar way as in section II.2.1 or

(II.12) $$pos_t^{dev} = \Sigma_{i\in I} g_{it}^{dev}(x_{it}/X_{jt}), \text{ for all } g_{it}^{dev}>0$$

(II.13) $$neg_t^{dev} = \Sigma_{i\in I} |g_{it}^{dev}|(x_{it}/X_{jt}), \text{ for all } g_{it}^{dev}<0$$

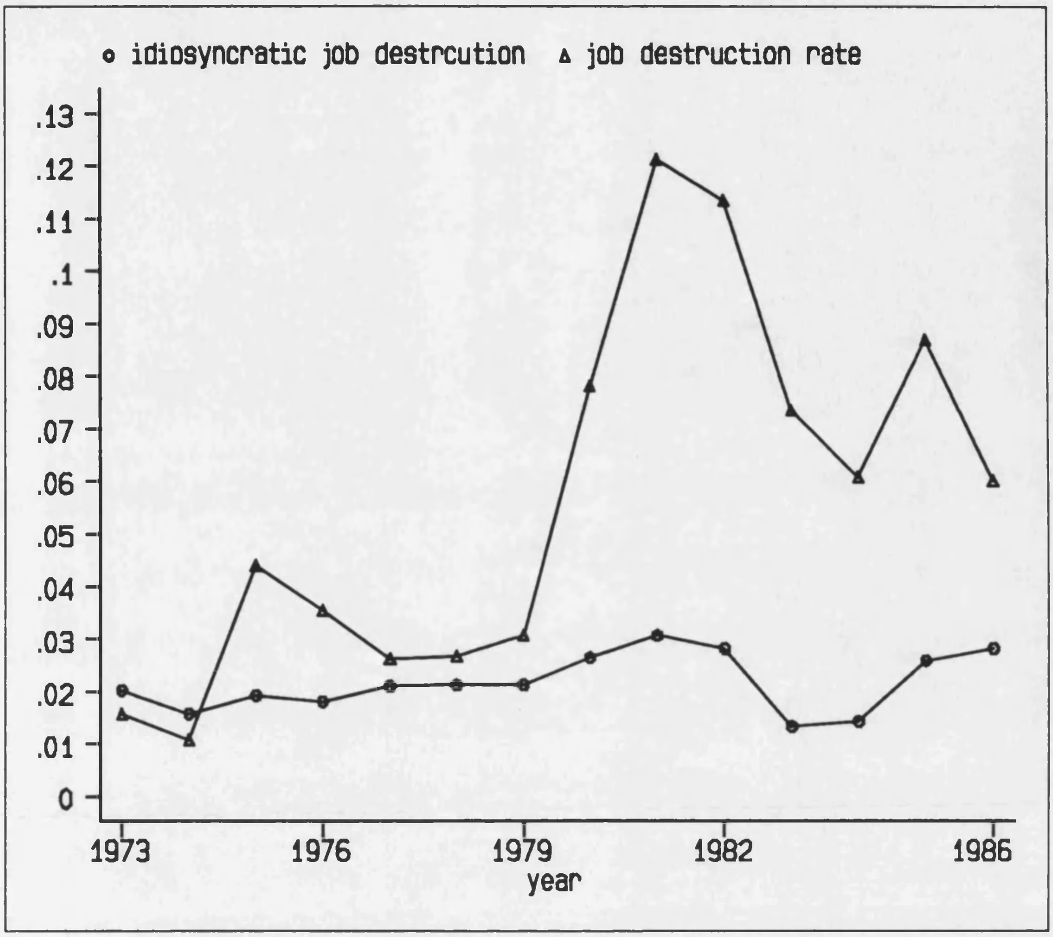
(II.14) $$gross_t^{dev} = \Sigma_{i\in I} |g_{it}^{dev}|(x_{it}/X_{jt})$$

Figures II.5 a,b and c plot the idiosyncratic job creation, destruction and reallocation rate viz. the overall job creation, destruction and reallocation rate over time. The idiosyncratic component is in all three cases substantial. The three figures also indicate a cyclicallity in the idiosyncratic component of the gross job flow measures.



o idiosyncratic job creation
Δ job creation rate
.04
.03
.02
.01
0
1973
1976
1979
1982
1986
year

Figure II.5a


o idiosyncratic job destrcution
▵ job destruction rate
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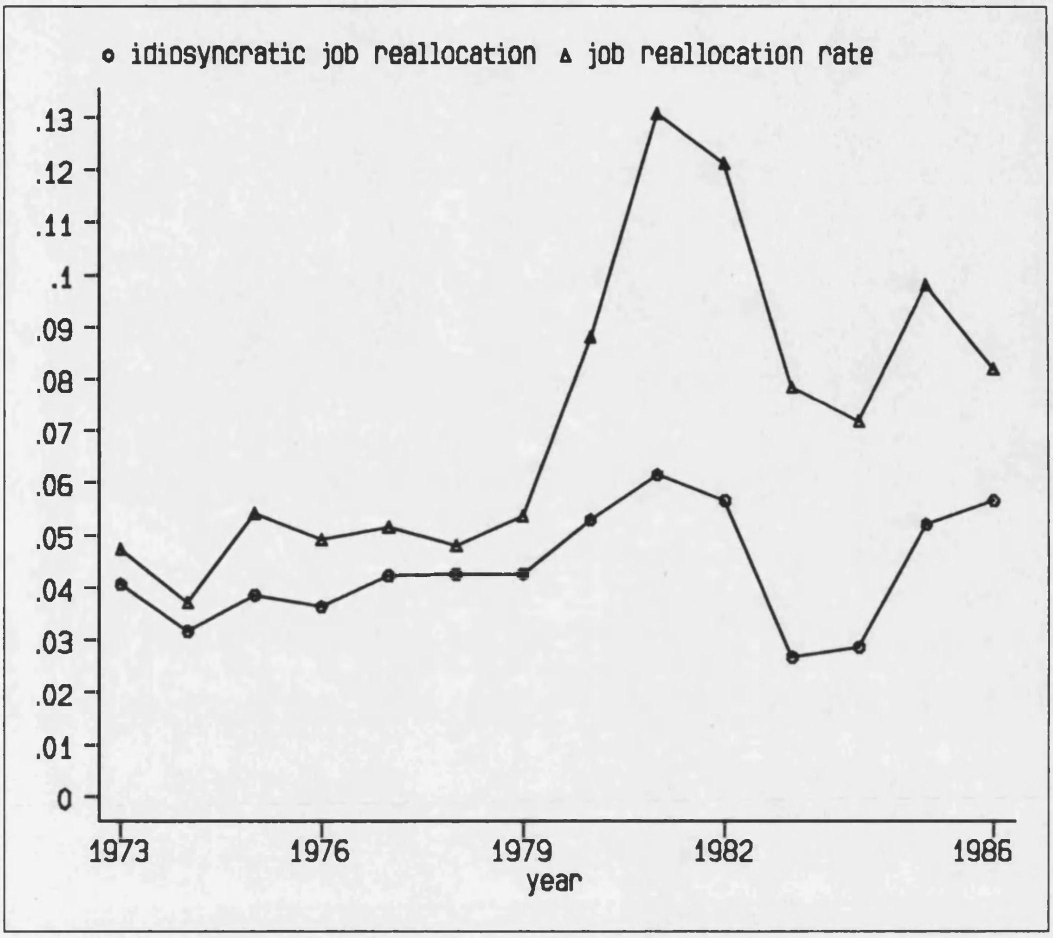
1973
1976
1979
1982
1986
year

Figure II.5b



o idiosyncratic job reallocation ▲ job reallocation rate
.13
.12
.11
.1
.09
.08
.07
.06
.05
.04
.03
.02
.01
0
1973
1976
1979
1982
1986
year

Figure II.5c

The fact that the idiosyncratic component is substantial does not mean that such idiosyncratic effects account for most of the *time variation* of the gross job flow rates. For instance, figure II.5b shows a relatively stable idiosyncratic component in the job destruction rate. I address this issue more rigorously by using a variance decomposition due to Davis and Haltiwanger (1992).

Consider the following identity,

(II.15) $y_t = y_t^{dev} + (y_t - y_t^{dev})$

Where y stands for pos,neg and gross respectively. Taking the variance of (II.15) yields

(II.16) $var(y_t) = var(y_t^{dev}) + var(y_t - y_t^{dev}) + 2cov(y_t^{dev}, y_t - y_t^{dev})$.

Dividing (II.16) by $var(y_t)$ left and right gives

(II.17) $1 = var(y_t^{dev})/var(y_t) + var(y_t - y_t^{dev})/var(y_t) + 2cov(y_t^{dev}, y_t - y_t^{dev})/var(y_t)$.

If the idiosyncratic component is time invariant, then $var(y_t^{dev})/var(y_t)$ collapses to zero and the time variation is y_t can be entirely explained by aggregate and sectoral shocks. The covariance term in (II.17) indicates whether the idiosyncratic effects reinforce or counteract the impact of aggregate and sectoral effects on y_t. A positive sign means a reinforcing of the aggregate and sectoral effects, while a negative sign indicates the opposite. The covariance term in (II.17) is the part of the variance of y_t which cannot be unambiguously explained by idiosyncratic effects or sectoral and aggregate effects.

Table II.8 shows this variance decomposition for gross job reallocation, creation and destruction. In all three cases the variance of aggregate and sectoral effects explains the majority of the total time variation in job reallocation, creation and destruction. The idiosyncratic effect in job creation counteracts the impact of aggregate and sectoral effects as indicated by the negative covariance term, while the idiosyncratic effect in job destruction reinforces weakly the aggregate and sectoral effects as indicated by the low positive covariance term. Thus while job creation falls and job destruction rises during recessions, idiosyncratic effects counteract the fall in gross job creation, while they reinforce the rise in gross job destruction. The latter observation is also true for the U.S., however, the covariance terms are much larger. Moreover, in the U.S. it is the variance in the idiosyncratic component of gross job reallocation which explains most of the total time variation, unlike the results here. This is what we could expect given our low values of the covariance terms. In sum, while the time variation of gross job reallocation in the U.K. is predominantly driven by aggregate and sectoral disturbances, in the U.S. this is predominantly driven by idiosyncratic shocks. This suggests that the sources of turbulence are different in the U.K. than in the U.S.. These results, however, might have been caused by the nature of our dataset, large firms who are 'big players' in each sector. In other words movements in these large firms reflect movements in their sector.

Table II.8: Variance decomposition

	gross	pos	neg
$var(y^{dev})/var(y)$	0.14	0.42	0.024
$var(y-y^{dev})/var(y)$	0.61	1.55	0.834
$2cov(y,y-y^{dev})/var(y)$	0.24	-1.0	0.070

Note: y refers resp. gross,pos, neg.

II.5. Comparison With An Alternative Establishment Based Dataset

The entire analysis so far has been based on the principal dataset of large U.K. manufacturing firms, the EXSTAT/DATASTREAM company accounts data. In this section I will use the Workplace Industrial Relations Surveys to compute gross job flow measures based on plant level rather than firm level data. This will allow me to infer how much gross job flow rates computed from firm level data are lower than the ones computed from plant level data. Moreover, by using the Workplace Industrial Relations Surveys it is possible to identify certain relationships between plant characteristics such as age, type of plant, etc. and the magnitude of gross job flows.

Note 2: Chapter II, p 58

The WIRS dataset is a random stratified sample, over-sampling large plants. To control for this weights have been provided. However, the main results refer to the non-weighted data. One reason is that the correlation coefficient between the weights and size is very low, in 1990 for instance this was 0.3. Moreover, the weights push the size distribution towards a more symmetric one, while in reality the size distribution of plants is highly skewed. In this note, I report the job creation and destruction rates computed from the weighted data for 1984 and 1990 since I did not have the weights of 1980 at my disposal. Blanchflower and Burgess (1993) make use of the weighted data throughout, so I refer to them for a complementary comparison. Table II.9b shows the results for the manufacturing sector, while table II.10b shows them for the non-manufacturing sector.

Table II.9b: Gross Job Flows from Weighted WIRS, Manufacturing Only

year	pos	neg	net	gross
1984	0.039	0.080	-0.04	0.119
1990	0.050	0.054	-0.004	0.104

Table II.10b: Gross Job Flows from Weighted WIRS, Non-Manufacturing Only

year	pos	neg	net	gross
1984	0.036	0.039	-0.003	0.075
1990	0.053	0.051	0.002	0.105

Comparing table II.9b with II.9 and table II.10b with II.10 the results are very similar. Thus weighting did not seem to matter a lot. Table II.11b reports the

II.5.1. Basic Facts on U.K. Gross Job Flows Using WIRS[3]

Table II.9 shows the gross job creation, destruction and reallocation rate computed from WIRS1,2,3 for 1980, 1984 and 1990. These refer to gross job flows in U.K. manufacturing plants, rather than firms. Based on three time observations, the average gross job reallocation is about 10%.

Since in the main data set observations are up to 1986, I can only compare the years 1980 and 1984, not 1990. The average gross job reallocation rate in the main sample is 8% for 1980 and 1984. This compares with 10% in the WIRS sample. In other words, the gross job reallocation rate based on *firm* level data rather than *plant* level data is, on average, about 25% (10/8 - 1) lower. Assuming that this difference is, on average, the same over the sample period, the corresponding gross job reallocation rate if plant level data were used, would be equal to 9%. This is still lower than the one reported for the U.S., 16%[4].

Table II.9: Gross job flows from WIRS, Manufacturing Only

year	pos	neg	net	gross	max
1980	0.022	0.074	-0.052	0.096	0.074
1984	0.022	0.081	-0.058	0.100	0.081
1990	0.048	0.049	-0.001	0.098	0.049

[3]See also Blanchflower and Burgess (1993).

[4]This corresponds to U.S. manufacturing plants, excluding entry and exit.

* Please see note 2

weighted counterpart of table II.11 and table II.12b for table II.12. From table II.11b it can be seen that by and large a similar relationship between plant age and gross job flows emerges. Looking at the extremes, the oldest plants have a lower gross job reallocation rate than the youngest. From table II.12b it seems that the weighting implies a disappearance of the fact that gross job turnover is higher in multi-plant firms.

Table II.11b: Gross Job Flows and Age, Weighted

1984	<3	3-5	5-10	10-25	>25
pos	0.099	0.059	0.050	0.044	0.030
neg	0.081	0.023	0.065	0.040	0.056
gross	0.18	0.083	0.116	0.085	0.086
1990	<5	5-10	10-15	15-20	>20
pos	0.078	0.077	0.064	0.042	0.042
neg	0.072	0.085	0.039	0.055	0.044
gross	0.15	0.16	0.103	0.098	0.086

Table II.12b: Gross Job Flows and Multi-Plant Firms, Weighted

	single independent	group
1984		
pos	0.042	0.036
neg	0.036	0.054
gross	0.079	0.091
1990		
pos	0.062	0.051
neg	0.045	0.054
gross	0.107	0.106

Table II.10 reports the gross job flow rates for the *non-manufacturing* sector. In 1980 and 1984 gross job turnover is lower in the non-manufacturing sector than in the manufacturing sector. This pattern reverses in 1990. Remarkable, though, is the apparent symmetry between job creation and job destruction in the non-manufacturing sector. This could indicate that the non-manufacturing sector was in equilibrium, i.e. job creation is equal to job destruction, whereas this was not the case with the manufacturing sector.

Table II.10: Gross job flows from WIRS, Non-Manufacturing Only

year	pos	neg	net	gross	max
1980	0.039	0.045	-0.005	0.085	0.045
1984	0.031	0.033	-0.002	0.064	0.033
1990	0.061	0.060	0.006	0.122	0.061

II.5.2. Gross Job Flows and Establishment Characteristics using WIRS

In this section I look at plant level characteristics and gross job flows. In particular, I look at the relationship between gross job flows on the one hand and age of the plant and the multi-plant character of the firm on the other hand. This type of analysis was not possible with the EXSTAT/DATASTREAM dataset since I did not have access to such information. In the next chapter I shall explore in detail the relationship between plant *size* and gross job creation and destruction, so here I focus on other plant characteristics like age and multi-plant firms.

In table II.11, gross job flow rates for different age categories are reported. The youngest plants have the highest gross job reallocation rate, while the oldest have the lowest, especially since the youngest have the highest gross job creation rate, 16% in 1980, 4.1% in 1984 and 24% in 1990 compared to the oldest resp., 2.6%, 2.5% and 3.3%, however the youngest seem to have the lowest job destruction rate, except in 1984, 1.6% in 1980, 19% in 1984 and 4.4% in 1990 while the oldest have a job destruction rate of resp. 6.1%, 5.4% and 5.9%. It should be noted here that I do not observe entry nor exit in the dataset. A well-known fact is that young plants are more likely to fail than old ones and therefore if I observe plants in the youngest age category with the highest growth rates this could simply mean that it is exactly the most efficient ones who remain, while the least efficient ones already have left the market. This also points in the direction of recent theories of passive learning (Jovanovic, 1982): Plants are endowed with a certain efficiency level which is a random draw of a known distribution. By Baysian updating plants find out about their underlying efficiency level. Since the least efficient ones are more likely to drop out in the early phases of their existence a negative correlation between plant age and growth is to be expected.

Table II.11: Gross Job Flows and Age of the Plant

	<3	3 - 5	5 - 10	10 - 25	>25
1980					
pos	0.16	0.062	0.041	0.037	0.026
neg	0.016	0.062	0.049	0.056	0.061
gross	0.18	0.12	0.091	0.093	0.088
1984					
pos	0.041	0.061	0.039	0.029	0.025
neg	0.19	0.023	0.096	0.042	0.054
gross	0.24	0.084	0.13	0.071	0.080
1990	<5	5 - 10	10 - 15	15 - 20	>20
pos	0.24	0.058	0.10	0.052	0.033
neg	0.044	0.034	0.028	0.069	0.059
gross	0.28	0.093	0.13	0.12	0.093

A final hypothesis I shall investigate is whether multi-plant firms have higher gross job reallocation than single plant firms. Intuitively, one might expect higher gross job flows in plants belonging to a group, than in independent plants. The reason for this is that in multi-plant firms there can occur more reshuffling of jobs between several plants of the same firm. Table II.12 reports the results and confirms that plants which are part of a group have higher gross job flows than independent plants. In single independent plants is the gross job reallocation rate 8.8% in 1980, 6.3% in 1984 and 9.9% in 1990, while plants belonging to a multi-plant firm have resp. job reallocation rates of 10.9%, 8.4% and 11.3%.

Table II.12: Gross Job Flows and Multi-Plant Firms

	single independent	group
1980		
pos	0.030	0.046
neg	0.058	0.063
gross	0.088	0.109
1984		
pos	0.021	0.027
neg	0.041	0.056
gross	0.063	0.084
1990		
pos	0.068	0.054
neg	0.031	0.058
gross	0.099	0.113

II.6. Gross Job Flows and Existing Theory

II.6.1. Some anomalies of existing theory

In this paragraph I briefly look at some of the existing theories and its problems in the light of the reported material in this chapter. The observed pattern of job creation and job destruction cannot be predicted by conventional theory in labour or macro economics. Of course, since the facts on gross job flows are new, traditional theory could not take these into account and it is therefore easy to criticize the theory. Nevertheless it is worth mentioning a few theories which should be reviewed in the light of the new evidence on gross job flows.

Firstly, a large class of models assumes homogeneous behaviour of firms within the same sector. Lilien (1982) for instance describes a model in which sectoral disturbances drive aggregate fluctuations. Table II.6 shows that even within narrowly defined sectors, there exists a substantial amount of job creation and job destruction, so assuming homogeneous firm behaviour within one sector seems to be unreasonable. Furthermore, it is clear from figures II.5a,b and c and table II.8 that idiosyncratic shocks cannot be neglected, albeit they are not the most important factor in explaining the time variation in gross job reallocation. Thus models treating the idiosyncratic component of firm-level employment behaviour as orthogonal to the business cycle are clearly incorrect.

Traditional studies on labour demand assume a "representative firm" and estimate corresponding labour demand elasticities. However, the firm's response to exogenous wage shocks might be different depending on whether the shock is an adverse or a favourable one, as suggested by the asymmetry between job creation and job destruction. This asymmetric nature of gross job flows suggests that firms might have different adjustment costs when expanding viz. contracting. The majority of the literature, however, assumes symmetric adjustment costs. Over the past decade a number of new theories have been proposed to explain persistent unemployment in Europe. Perhaps one of the most influencing is the 'insider-outsider' theory proposed by Lindbeck and Snower (1989). The incumbent workers (insiders), represented by trade unions face a trade off between choosing for higher real wages and more jobs. The insider approach assumes that the union is only concerned with the employment of their members. Given the employment level in the firm the union chooses the maximum wage possible. The firm will not replace the insiders by cheaper outsiders because of the insider power predominantly stemming from high hiring/firing costs. The insider-outsider model can easily explain asymmetric behaviour between job creation and job destruction. A negative shock leads to a number of insiders losing their jobs and hence their insider power. When the economy picks up again the remaining insiders will simply bargain for higher wages, without hiring new workers. However, the theory cannot explain the simultaneous job creation and destruction at all phases of the business cycle and within narrowly defined sectors. This is because the model assumes homogeneous firm behaviour and therefore does not incorporate idiosyncratic risk. Furthermore, one should not observe substantial job creation in the framework of the Insider-Outsider theory, especially not in recessions. The evidence reported here poses a serious problem to the theory.

It should be clear that it is easy to go on with the list and criticize existing theories in the light of the reported evidence on gross job flows. Such an exercise is in itself uninteresting since it avoids to explain the observed phenomena. I go on with giving some tentative explanations and discussing some of the promising new theories.

II.6.2. Some Explanations

Abstracting from the cyclical properties of gross job creation and destruction any interpretation must first answer *why* there is both job creation and destruction even within narrowly defined sectors. Varying efficiencies over time and across firms are the obvious source of turnover. I will give a simple example which illustrates that the introduction of imperfect competition and strategic interactions between firms in modelling employment can easily generate simultaneous job creation and destruction in one sector. Consider for simplicity a duopoly where both firms produce the same homogeneous product with one factor of production, labour (L) at constant unit cost w for firm 1 and w^* for firm 2[5]. Firm 1 produces X and earns a payoff π, while firm 2 produces Y and earns a payoff π^*. Both firms have the same technology, with diminishing marginal productivity of labour and face a conventional inverse demand function for their product. I write the payoff functions for firm 1 and 2 respectively as the following:

(II.18) $$\pi = P(X,Y)X - wL$$

(II.19) $$\pi^* = P(X,Y)Y - w^*L^*$$

[5]This modelling strategy will be pursued in detail in chapter V.

Both firms move simultaneously and unilaterally. Firm 1 chooses L to maximise π, given w, holding L^* constant. Firm 2 chooses L^* to maximise π^*, given w^*, holding L constant. I first analyse employment setting in firm 1 by writing down its first order conditions for profit maximisation.

(II.20) $$\pi_L = P(1 + 1/\eta)F' - w = 0$$
$$\Rightarrow L = R(L^*)$$

where η stands for the price elasticity of demand, R(.) stands for the optimal response function of firm 1 and F is firm 1's production function.

Similarly for firm 2,

(II.21) $$\pi^*_L = P(1 + 1/\eta^*)F^{*\prime} - w^* = 0$$
$$\Rightarrow L^* = R^*(L)$$

Thus in both firms employment is set where the marginal revenue product of labour, which is conditional on employment in the other firm, is equal to the per unit wage. The conditions are expressed as optimal response functions, R and R^*, in equation (II.20) and (II.21). The following implies uniqueness and stability of the Nash equilibrium in employment setting.

(II.22) $$D \equiv \pi_{LL}.\pi^*_{L*L*} - \pi_{LL*}.\pi^*_{L*L} > 0$$

Where $\pi_{LL*} = \pi^*_{L*L} < 0$.

Solving (II.20) and (II.21) simultaneously I obtain the optimal employment in firm 1 and firm 2 as a function of the exogenous variables, W and W^*, or

$$\text{(II.23)} \qquad L^0 = \rho(W,W^*)$$

$$\text{(II.24)} \qquad L^{*0} = \rho^*(W,W^*)$$

Note that employment demand not only depends on the firms' own wage, but also on the wage paid in the other firm. This is a very common result for an industrial economist, not for a labour economist. Taking a total differential of (II.20) and (II.21) and by applying Cramer's rule I obtain the comparative static effects of a change in resp. w and w^* on the optimal employment levels in firm 1 and 2, yielding the expected signs, or

$$\rho_1 = \pi^*_{L^*L^*}/\, D < 0,$$

$$\rho_2 = \pi^*_{L^*L}/\, D > 0,$$

$$\rho^*_1 = \pi_{LL^*}/\, D > 0,$$

$$\rho^*_2 = \pi_{LL}/\, D < 0.$$

These comparative statics effects may be interpreted as shocks to the wage. An exogenous increase in the wage in firm 1, holding the wage in firm 2 constant and is therefore specific to firm 1, leads to a decrease of employment in firm 1 (job destruction) and to a lesser extent an increase of employment in firm 2 (job creation). Figure II.6 illustrates the effect of a shock to the wage in firm 1. I start from a symmetric equilibrium, where $w_0 = w^*_0$, implying $L_0 = L^*_0$. Employment is set where the *conditional* marginal revenue product of labour is equal to the firm's wage level. I call this the *conditional* marginal revenue product, since it depends on a *given* employment level in the other firm. A shock in firm 1, pushing up the wage in firm 1 from w_0 to w_1 leads to a fall of employment in firm 1 (job destruction) and to a lesser extent to an increase of employment in firm 2 (job creation). Note in figure II.6 that the *conditional* demand for labour of firm 2 shifts out in response to a fall in employment in firm 1. This results in a shift in the conditional demand function of firm 1 further in.The reason for this is because employment demand in one firm is *conditional* on employment in the other firm and hence employment in the other firm becomes a shift factor.

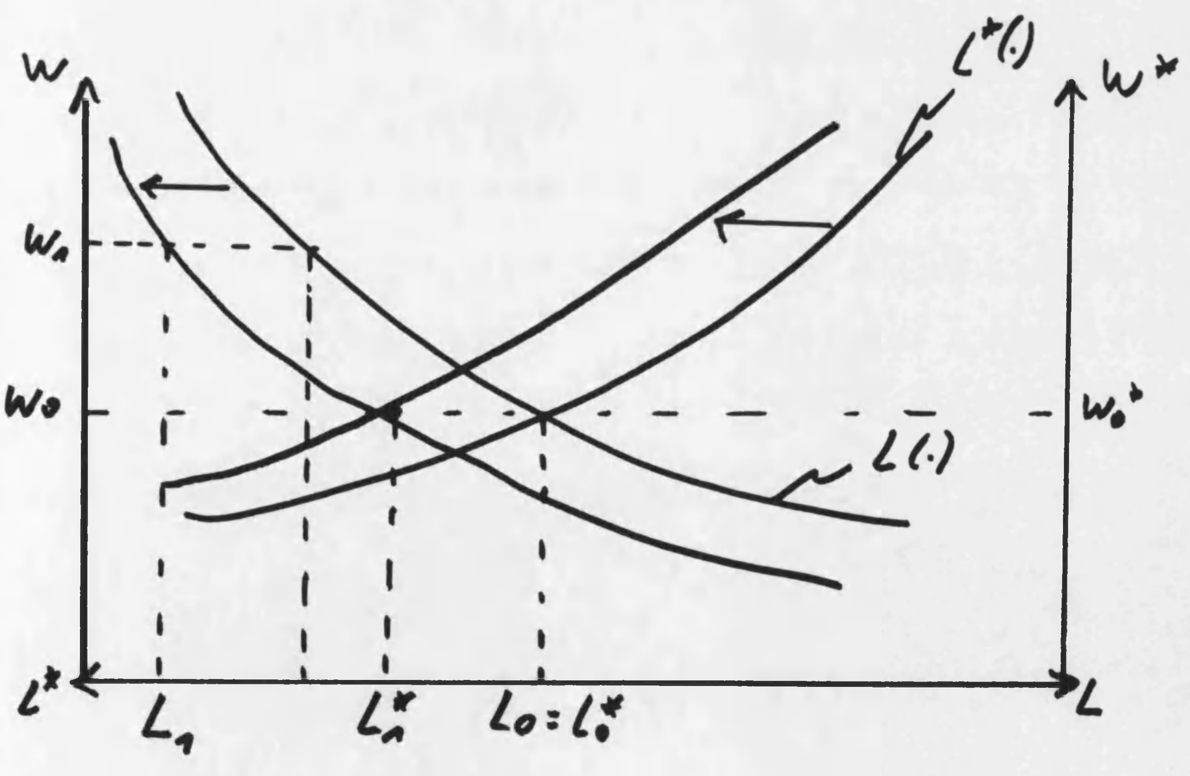


Figure II.6

This simple duopoly example illustrates nicely the effect of introducing imperfect competition in the analysis of employment demand. *Under oligopoly, even with homogeneous products, there is simultaneous creation and destruction of jobs within one sector in response to wage shocks (i.e. differences in efficiency). Moreover, under oligopoly, the labour demand curve in firm i will shift in response to (i) a change in the wage in firm i, (ii) a change in the wage in firm j.* Thus one source of simultaneous job creation and destruction is strategic interactions between firms and efficiency differences. I believe this line of thinking might be fruitful in explaining observed inter-industry differences in gross job reallocation rates. Blanchflower and Burgess (1993) made a start by investigating differences in gross job turnover between "monopoly" plants and "oligopoly" plants using the WIRS data. They find that in the former gross job turnover is lower than in the latter.

Another source of turnover is technological progress which suggests one possible explanation for the asymmetry between job creation and destruction. Imagine that the growth process involves the replacement of old production techniques by new, more productive ones. Then, new jobs that produce at low marginal cost are largely immune to variations in demand, while old high marginal cost jobs are not and fluctuations in demand primarily affect job destruction. Firms have the choice when to introduce new technologies and close down the obsolete and old ones. Thus, the timing of job destruction is endogenous and could be concentrated in recessions. It is this intuition which underlies the model of Davis and Haltiwanger (1990). They suggest that aggregate fluctuations are the result of transitory productivity shocks. If reallocating labour takes time, it is efficient to do so in recessions which are periods of transitory low productivity and hence the opportunity cost of closing down a job is lower.

The matching approach or 'flow approach' in labour economics is an alternative approach to explain the facts of job creation and job destruction (Pissarides, 1990). Firms and unemployed job seekers are matched according to a constant returns to scale matching technology. In equilibrium, the flow into unemployment equals the flow out of unemployment. Persistent unemployment in this framework is explained by structural shocks affecting the outflow rate of unemployment, leading to an outward shift in the Beveridge curve or 'unemployment-vacancy' curve. The matching approach provides a particularly useful framework to analyze the behaviour of job creation and job destruction, since it consists of a specification of demand in terms of job creation and destruction, a matching process between workers and firms and a wage determination process. A simple specification of job creation and destruction is as follows,

(II.25) $pos = pos(w,Z^1),\ pos_w \leq 0$

(II.26) $neg = neg(w,Z^2),\ neg_w \geq 0$

where Z reflects a vector of shift parameters and w the wage, shifting job creation and job destruction. They can reflect factors like aggregate demand, foreign competition, changes in technology, etc.. Blanchard and Diamond (1992) use this type of specification to describe the "flow approach" to labour markets and discuss its implications.

Mortensen and Pissarides (1993a,b) develop a model of endogenous job destruction in response to persistent idiosyncratic shocks and incorporate the model into the matching approach to equilibrium job creation and wage determination. They start by specifying the matching process which takes place between individual job seekers and jobs. The rate at which jobs and workers are matched into productive matches is given by the matching function,

(II.27) $m=m(u,v)$

with u the unemployed, v the number of vacancies and m is assumed to be constant returns to scale. There exists a continuum of jobs which are either vacant or filled. The value of a filled job in the usual matching model (Pissarides, 1990) is p, common to all jobs and represents an aggregate product price. Mortensen and Pissarides (1993a,b) change this assumption and allow idiosyncratic shocks. The value of a filled job becomes $p + \sigma\varepsilon_u$, with p and σ common to all jobs, but ε is a job specific productivity shock and is a drawing from a common distribution F(x) with upper support ε_u and σ measures dispersion of these shocks. Jobs are being created at the highest possible productivity or $p + \sigma\varepsilon_u$. After the job is created productivity follows a stochastic process and shocks arrive at rate λ leading to a new realization of ε, drawn from F(x). While in the traditional matching model job destruction is exogenous, at rate s, here job destruction is modelled endogenously. It is assumed that the cost of closing down a job is zero and hence filled jobs die whenever an idiosyncratic shock reduces the value of the job below 0. Let ε_d denote the reservation productivity that determines job destruction. The assumption made here is that low values of ε imply a negative job value, while a high value implies a positive value. Therefore, there exists a unique reservation productivity ε_d which values the job at 0 in the absence of firing costs. By evaluating the return of a vacancy and of a filled job and by deriving the Beveridge curve, Mortensen and Pissarides show the optimal job destruction and job creation policy. A key characteristic of their model is that in good times firms are willing to hire low productivity workers since demand is high and labour is scarce, whereas in bad times, demand is low and thus firms lay off low productivity workers. In other words, recessions are times of 'cleaning up' obsolete or unproductive production techniques because the opportunity cost of closing down a job is much lower than in good times, so the pace for reallocation increases. Mortensen and Pissarides (1993b) simulates this model and proves to generate the observed cyclical pattern of job creation and job destruction. Models in the same spirit include Caballero and Hammour (1990) and Davis and Haltiwanger (1990).

II.7. Summary and Conclusion

The main purpose of this chapter was to analyze gross job flows in the U.K. manufacturing sector for the period 1973-1986. As such, I reported intriguing new facts, which lead to some new questions to the existing theory. The analyses of gross job flows can be viewed as an alternative approach to the demand for labour, a view sympathised by Hamermesh (1993) and others.

The *cyclical* properties of gross job flows reported in this chapter are strikingly similar to those reported for the U.S. manufacturing sector, although the *magnitude* of gross job flows is smaller in the U.K.. At all phases of the business cycle and even within narrowly defined sectors there is simultaneous job creation and job destruction. Gross job destruction is more variable than gross job creation over the cycle and they are negatively correlated. Gross job reallocation, the sum of the two, is counter-cyclic. The idiosyncratic component of gross job flows is substantial. The variance of idiosyncratic gross job creation and destruction explains the main proportion in the total time variation of gross job creation and destruction. However, sectoral and aggregate shocks seem to be the main driving force behind the time variation in gross job reallocation. While the idiosyncratic effects in job creation counteract the procyclical movement in job creation, they reinforce the countercyclical movement, albeit very weakly, in job destruction.

Theories explaining the observed pattern of job creation and job destruction so far have concentrated on explaining this process in relation to the business cycle. Little attention has been paid to explaining inter-industry gross job flow differentials. It should, however, be clear that underlying the process of job creation and job destruction, there is a process of expansion and contraction of firms within the same sectors. This topic is at the core of the research in Industrial Organisation. Labour economics should take more into account the theory of Industrial Organisation, in which strategic interactions between firms are explicitly modelled. The extent of gross job reallocation in a particular sector could then be related to the degree of strategic interaction between firms, i.e. the degree of price competition firms face. Alternatively, the process of gross job creation and destruction is ultimately linked to the process of firm growth and its implications for the size distribution of firms. I shall take up this issue in the next chapter.

CHAPTER III: FIRM SIZE AND GROSS JOB FLOWS

III.1. Introduction

The process of job creation and destruction is the result of forces in the product market leading to firm expansion and contraction. Factors like the intensity of price competition (Sutton, 1991), technological innovation, underlying efficiency differences (Jovanovic, 1982), etc. most likely affect the evolution of industries and firm sizes, hence job turnover. The key to understanding job turnover is therefore to understand the dynamic behaviour of firm size[1].

This chapter focuses on the dynamic evolution of the cross-section distribution of plants and firms in the U.K. and its implications for gross job creation and destruction. I abstract from possible forces influencing the cross-section distribution of firm sizes, like efficiency differences between firms, learning effects, differences in sunk costs, etc.. Job creation and destruction is a reflection of the dynamic behaviour of firm size. I will analyze on the one hand the intra-distribution mobility of firms, which reflects where job creation and destruction is concentrated and on the other hand I want to infer whether firms in the long run converge towards a common size or not.

[1]In the Industrial Organisation's literature early contributions in this area and the implications for business concentration include Hart and Prais (1956) and Simon and Bonini (1958). Recently, Evans (1987a,b) and Dunne, Roberts and Samuelson (1989) took up the issue.

The data I use are both the Workplace Industrial Relations Surveys (WIRS) of 1980, 84 and 90 of plant level data, including plants with 25 employees are more, and the EXSTAT/DATASTREAM firm level data of "large" companies used in the last chapter. While the WIRS data are three occasional surveys, the EXSTAT/DATASTREAM data is a panel. Because retrospective questions on employment were asked in the WIRS data it is possible to analyze job creation and destruction rates. Entry and exit is not observed and therefore the samples are restricted to continuing and surviving plants and firms only.

In the second section I start with defining size and in the third section I provide descriptive statistics showing a relationship between gross job creation, destruction and firm size. In this section job creation and destruction occurs *within* size classes. In the fourth section I investigate the dynamic evolution of the cross-section distribution of size by computing Markov transition matrices. In other words the focus is then on job creation and destruction *between* size classes. In section five I summarize and conclude this chapter.

III.2. Defining Size

In the 'small business' literature a small firm is usually defined as one employing less than 500 workers (Pratten, 1991). This is completely arbitrary and often dictated by the law. I follow a different approach, by defining five different size classes *relative* to the average employment in the sample. Using a relative definition for a small firm has several advantages. Firstly, small in this case is defined relative to the average, thus as the average declines over time (e.g. a shrinking manufacturing sector as it was in the U.K.) also the cut-off employment level for a small firm declines. Thus a relative definition takes into account dynamic movements. Secondly, as is the case for the EXSTAT/DATASTREAM dataset, if a small firm is defined as one employing less than 500 employees, then given the dataset I observe hardly any small firm. An absolute definition of a small firm might capture only 1% of the firms, meaning there are no small firms.

The five size classes in each period t are defined as firms with less than or equal 1/4. between 1/4 and 1/2, between 1/2 and 1, between 1 and 2, and more than 2 times the average employment in the sample at time t. A small firm is then one located in the first size class[2]. Table III.1 gives an overview of the cut-off (upper end) employment levels in each size class for the EXSTAT/DATASTREAM firm level data in each year. In this dataset, a small firm employs between maximum 1505 workers in 1973 and minimum 1022 in 1981. Table III.2 gives the cut-offs for the WIRS dataset and it shows that the employment levels are much lower in this dataset.

[2]An alternative approach would be to define a set of quantiles, each size class would in this case have an equal number of observations.

Table III.1
Overview size classes EXSTAT/DATASTREAM

year	1	2	3	4
1972	1476	2950	5889	11498
1973	1505	3010	5942	12012
1974	1489	3013	6029	11903
1975	1419	2807	5668	11238
1976	1136	2251	4515	9074
1977	1142	2276	4520	8923
1978	1129	2254	4522	9014
1979	1134	2250	4492	8998
1980	1073	2147	4245	8632
1981	1022	2042	4081	8174
1982	1257	2450	5062	9766
1983	1319	2677	5046	10519
1984	1261	2530	4844	9430
1985	1234	2409	4592	9915
1986	1088	2186	4389	8612

Note: The fifth size class is not indicated since it includes firms employing more than the employment level in the fourth size class.

Table III.2
Overview size classes WIRS data

	1	2	3	4
WIRS80	52	104	208	416
WIRS84	118	236	470	941
WIRS90	133	269	538	1076

Note: as in table III.1

III.3. Gross Job Flows and Size

In this section I give cross tabulations and describe a relationship between gross job creation, destruction and firm or plant size. In other words, I report job creation and destruction rates *within* size classes, while the next section looks at job creation and destruction *between* size classes. I first discuss the results from the EXSTAT/DATASTREAM firm level panel data and second I do a similar exercise for the WIRS plant level data.

III.3.1. Results from Firm Level Data

Table III.3 shows annual average results for the EXSTAT/DATASTREAM data. There is a clear monotonic relationship between the gross job creation rate and size. The smallest firms have on average the highest gross job creation rate, 5.1%, and this declines as size increases, the largest firms have on average a gross job creation rate of only 0.8%. There seems to be a positive correlation between size and the gross job destruction rate, although this relationship is less pronounced. The three smallest size classes have on average about the same gross job destruction rate, around 4.5%, while the largest firms have on average a gross job destruction rate of 5.8%. Finally, there is a negative relationship between size and the gross job reallocation rate. The smallest firms have a gross job reallocation rate of 9.6%, while the largest one of 6.7%. This correlation is predominantly driven by the negative correlation between size and the gross job creation rate.

Table III.3
Annual average gross job flows from firm level data,1973-86

size category	job creation	job destruction	job reallocation
1	0.051	0.044	0.096
2	0.036	0.043	0.079
3	0.031	0.046	0.077
4	0.026	0.051	0.078
5	0.008	0.058	0.066

The fact that the gross job destruction rate is highest in the largest firms suggest that the least stable jobs are provided in the largest firms. An alternative approach is to compute the survival probability of a newly created job. Table III.4 reports the annual average one year persistence rate of new jobs and of destroyed jobs, computed in the same way as in chapter II. It represents the fraction of newly created jobs which still exist a year later. Similarly for job destruction it represents the fraction of destroyed jobs which are still destroyed a year later.

Table III.4
Annual average one-year persistence rates, 1974-86

size	persistence in job creation	persistence in job destruction
1	0.67	0.69
2	0.66	0.74
3	0.62	0.74
4	0.75	0.78
5	0.60	0.87

There is no clear pattern for the annual average persistence rate in gross job creation. It first declines for the three smallest size classes, increases to 75% for the fourth size class after which it declines again to 60%. On average, the survival probability of a newly created job is highest in the smallest firms and in the second but largest. In contrast, the average one year persistence rate in job destruction increases monotonically with size. This means that on average a job which was destroyed in year t has a higher probability of still being destroyed a year later in larger firms.

In figures III.1 a,b,c,d and e I plot the various gross job flows over time for the five size classes. For all five size categories, the countercyclicallity in the gross job reallocation rate discussed in last chapter is present. However, the asymmetry between gross job creation and destruction increases with firm size. This becomes clear from comparing figure III.1e with figure III.2a. Figure III.2e is very similar to figure II.3. It seems that the time profile of the gross job flows, discussed in chapter II, is mirrored by the largest size category.

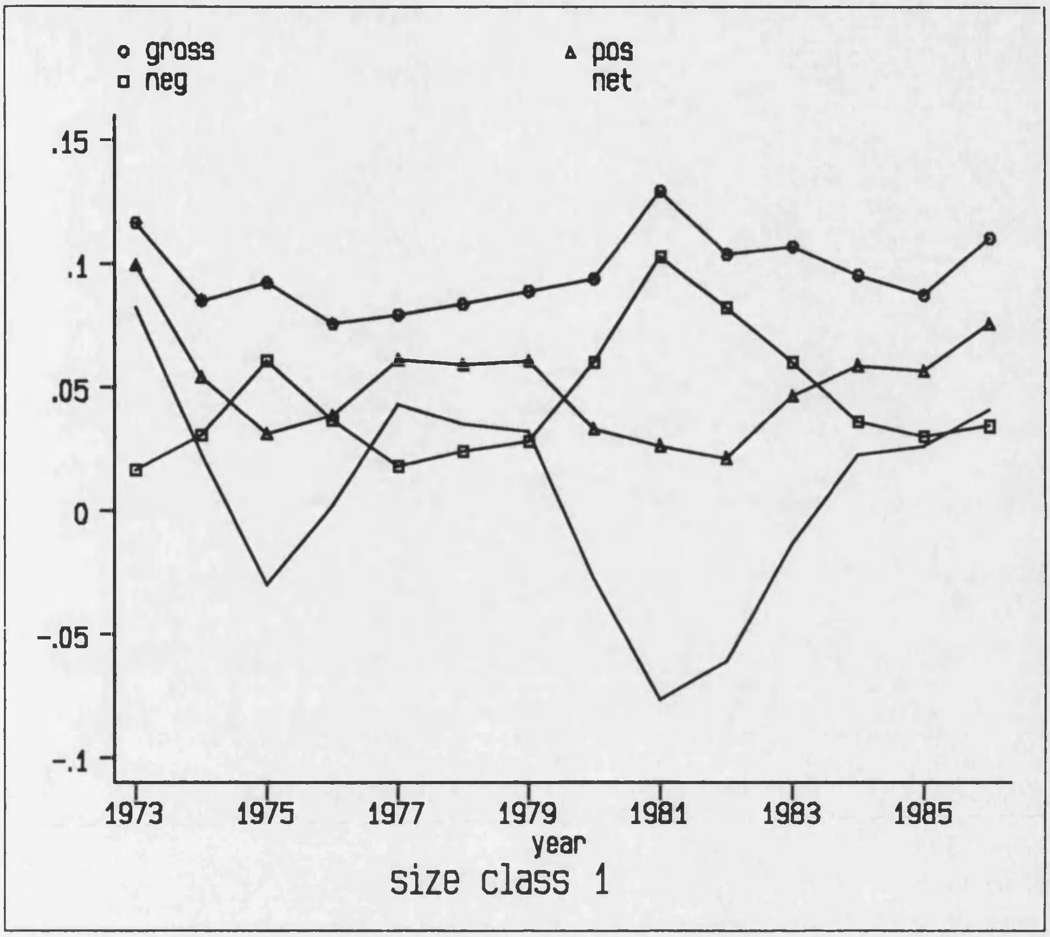


Figure III.1a

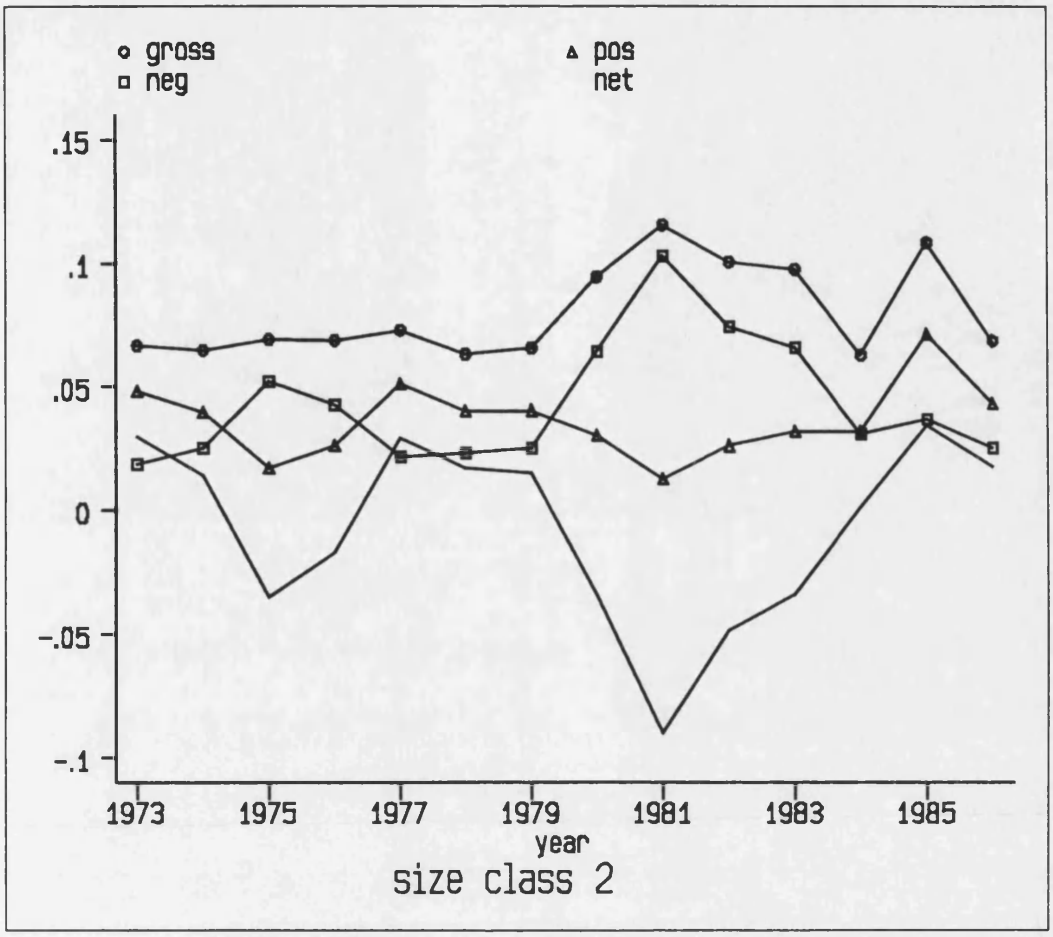


Figure III.1b

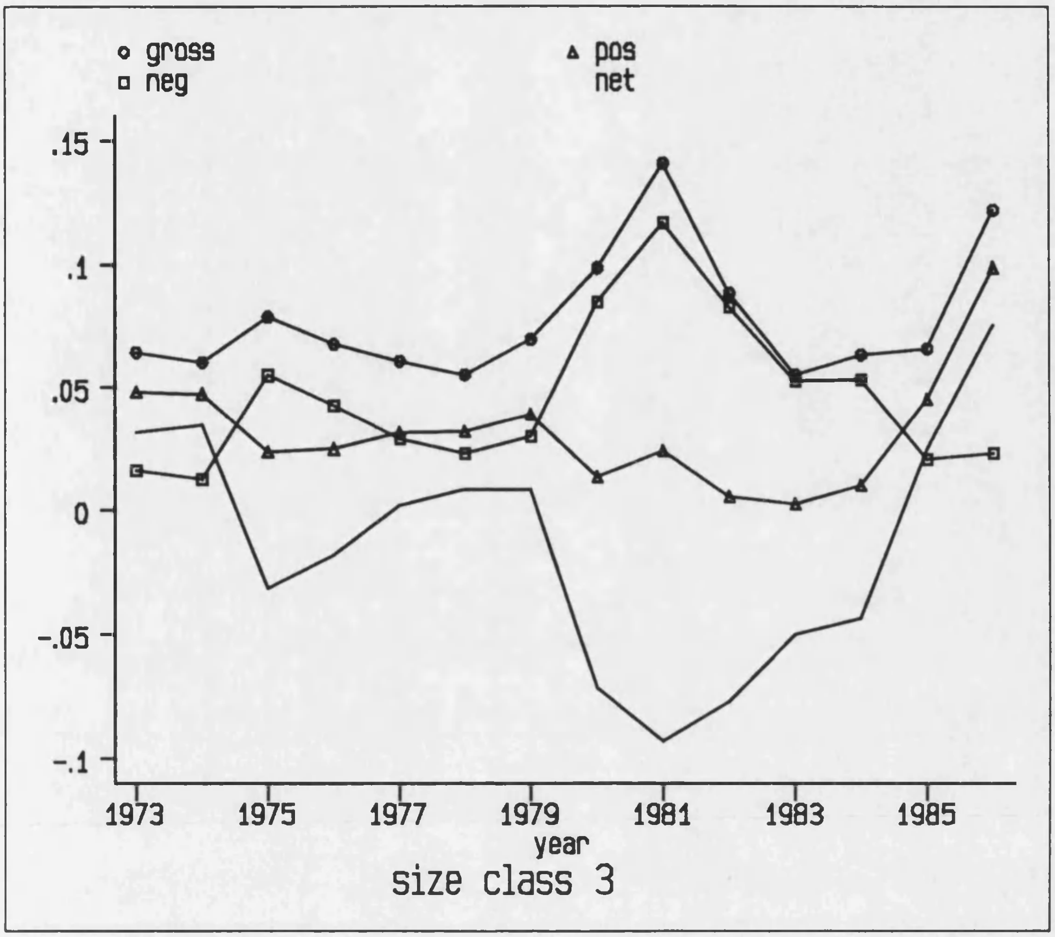


Figure III.1c

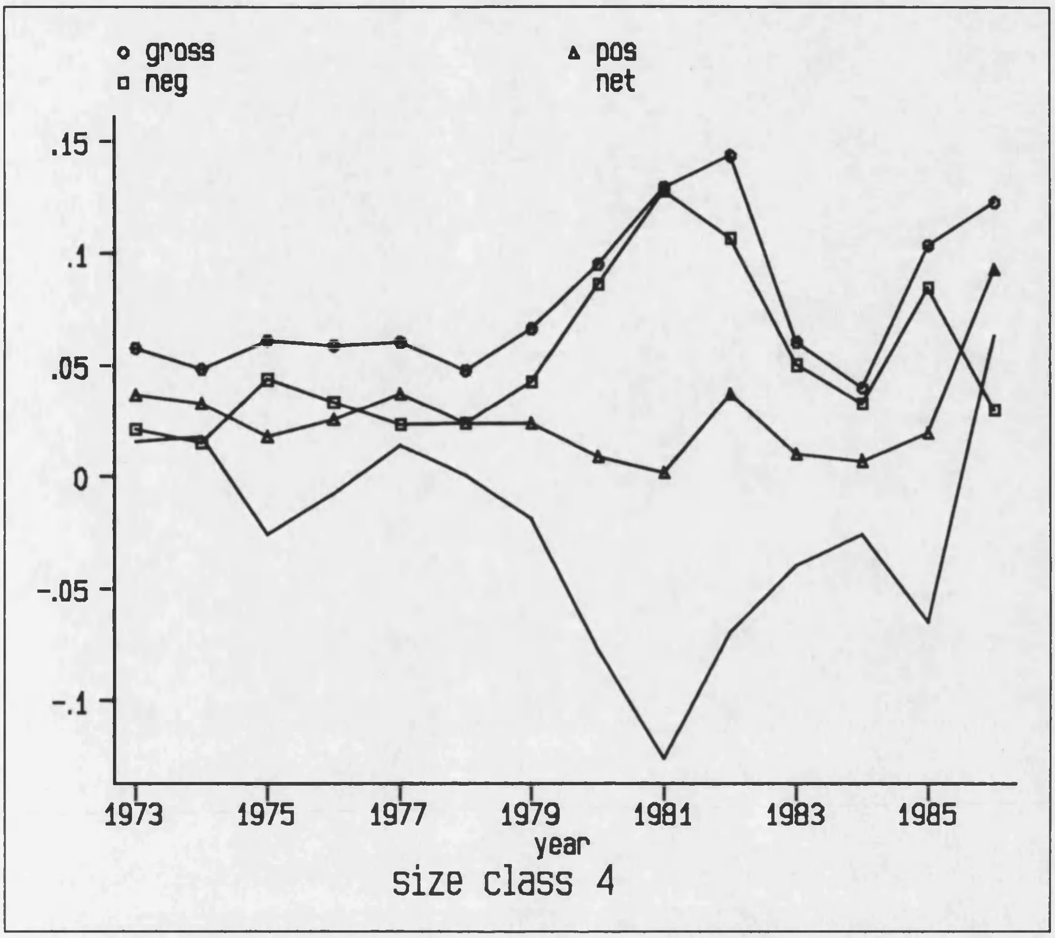


Figure III.1d

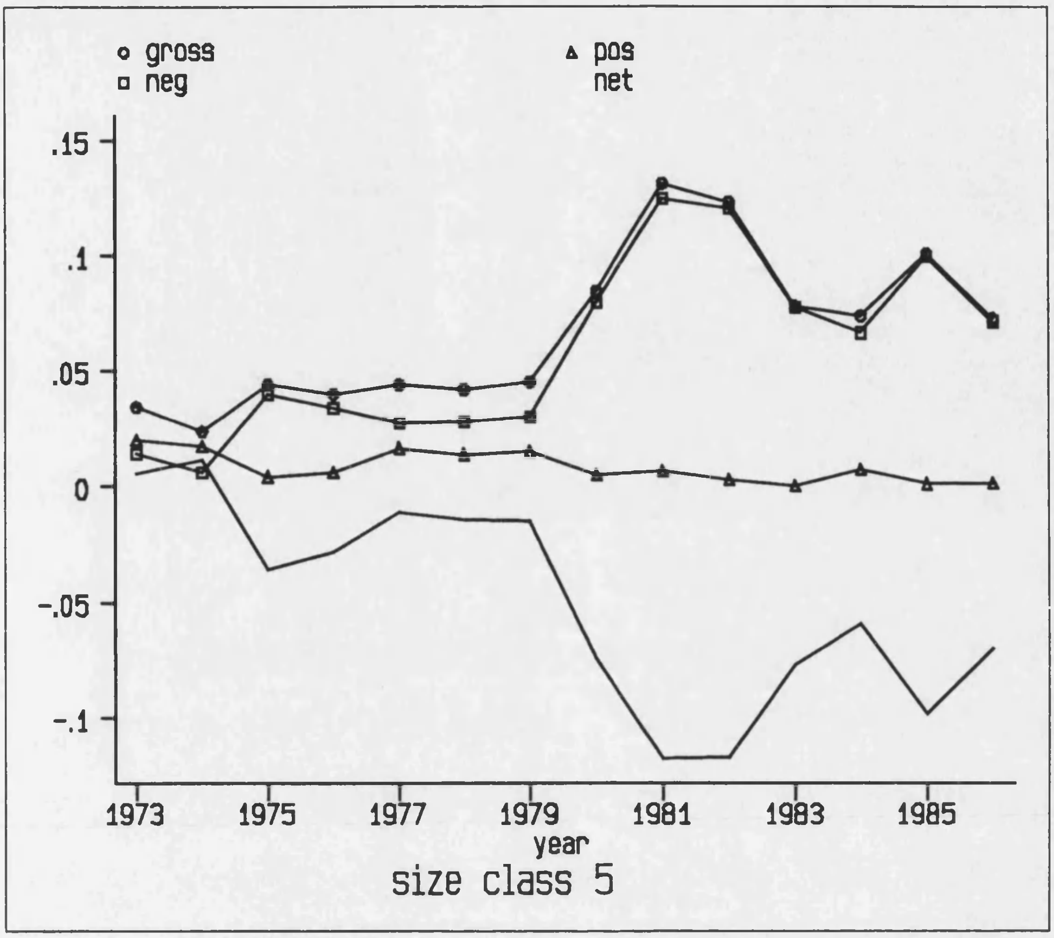


Figure III.1e

The fact that the gross job creation *rate* is highest in small firms and the gross job destruction *rate* lowest, does not necessarily imply that small firms create most jobs in absolute terms. If a small firm creates 100 extra jobs and a large firm also creates 100 extra jobs, they both create equally most jobs, but in percentage terms it is the small firm which creates most jobs. I therefore computed the job creation share of small firms in total, as well as their share of job destruction in total. Table III.5 reports the annual average results.

Table III.5
Share of job creation and destruction in total, firm level data

size	pos share (1)	neg share (2)	employment share (3)	(1)/(3) ratio 1	(2)/(3) ratio 2
1	0.21	0.057	0.060	3.5	0.94
2	0.15	0.062	0.066	2.51	0.89
3	0.15	0.075	0.084	1.8	0.85
4	0.15	0.091	0.093	1.63	0.93
5	0.32	0.712	0.694	0.47	1.01

The smallest firms have a job creation share of 21% and a job destruction share of 5.7%. Clearly in absolute numbers the smallest firms create least jobs, but they also destroy least jobs. This is not surprising since their employment share is only 6%. Thus proportionally, they contribute more to job creation and less to job destruction. Of course, table III.5 reflects an average over a 14-year sample period. Whether there have been shifts in this pattern over time is shown in figure III.2a through e. It shows the ratio of the job creation share over the employment share (ratio 1) and the ratio of the job destruction share over the employment share (ratio 2) for each size class.

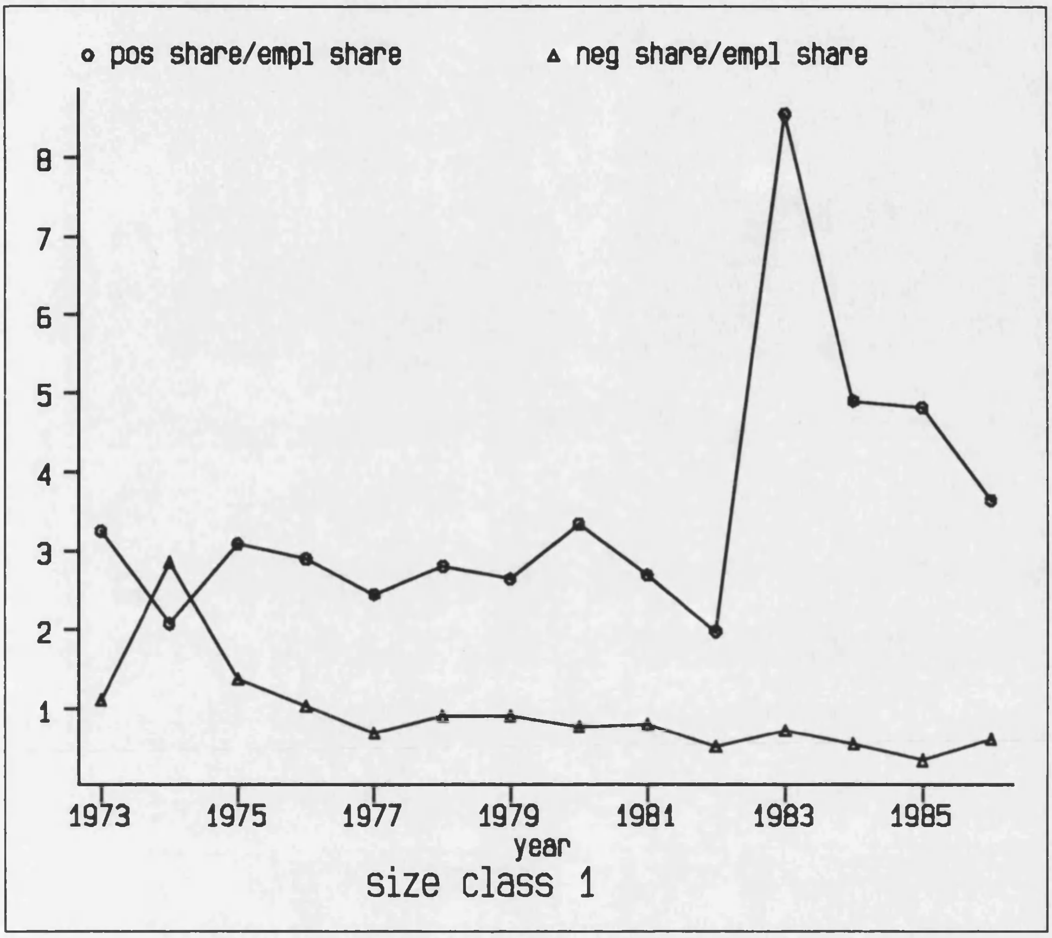


Figure III.2a

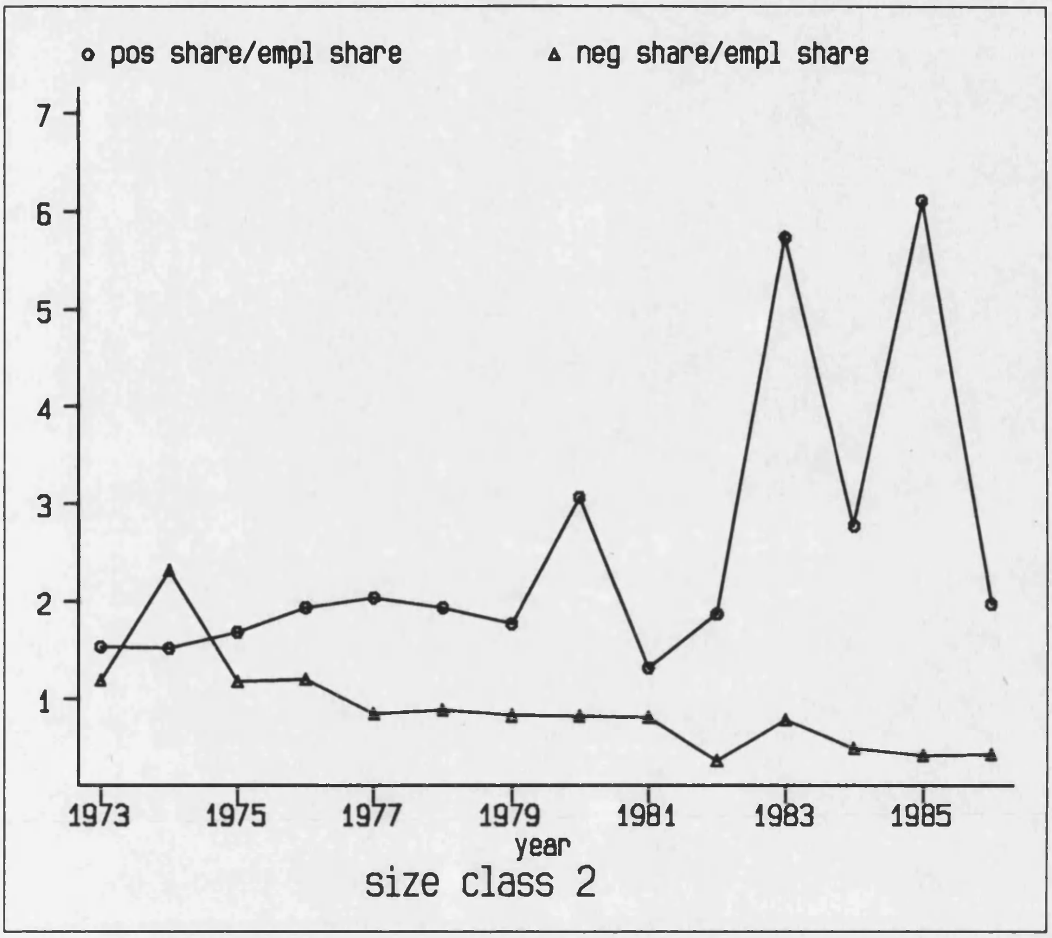


Figure III.2b

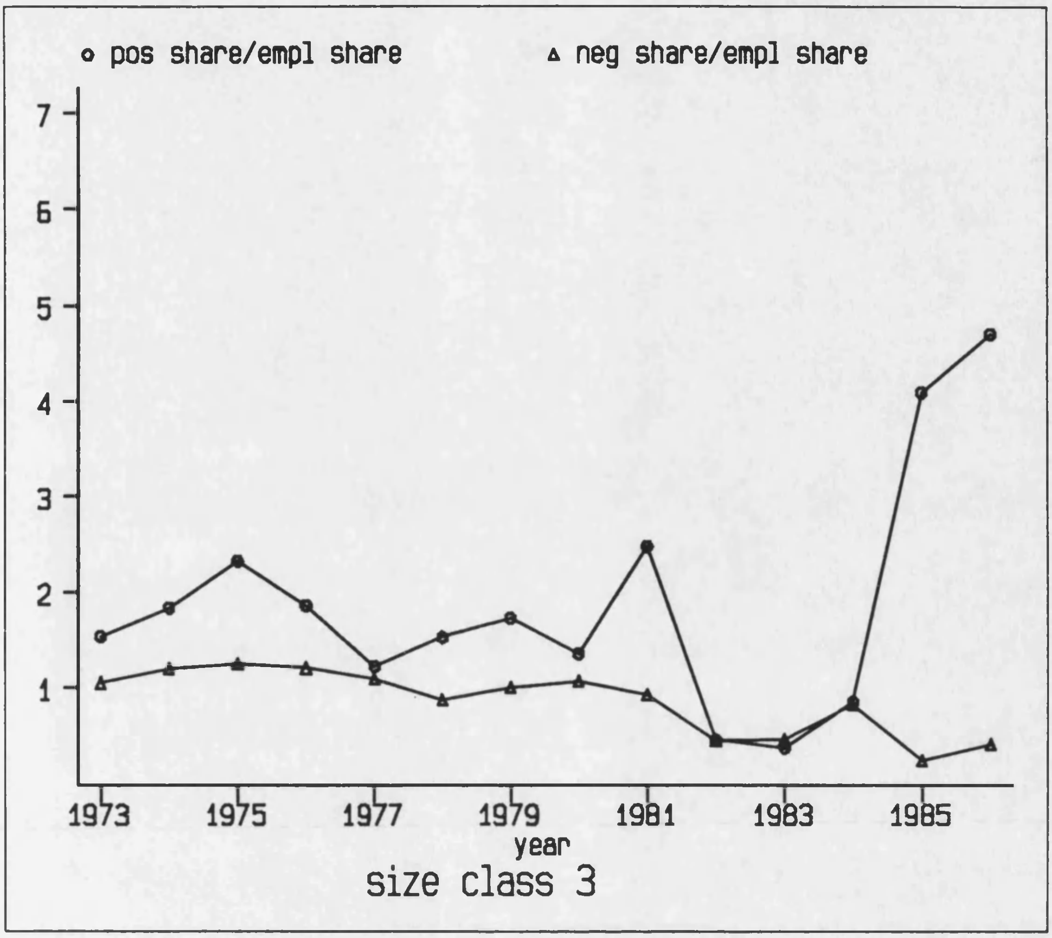


Figure III.2c

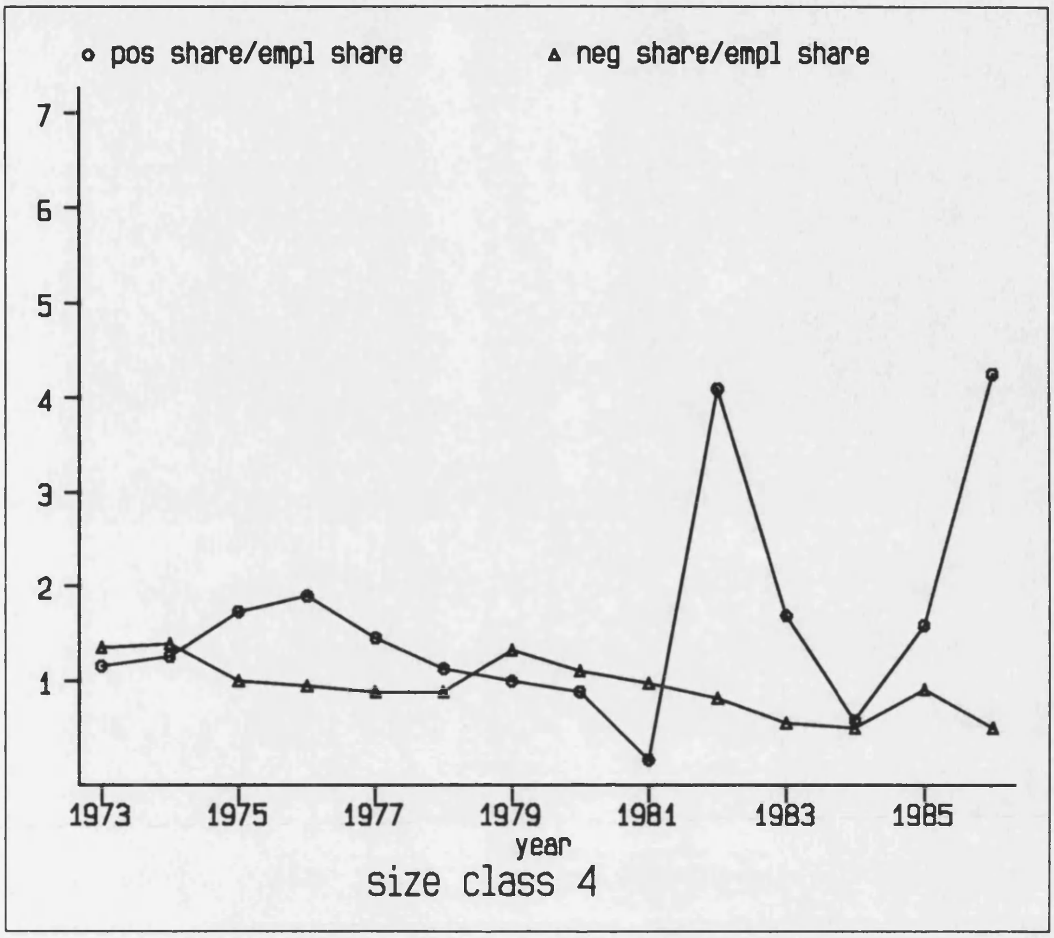


Figure III.2d

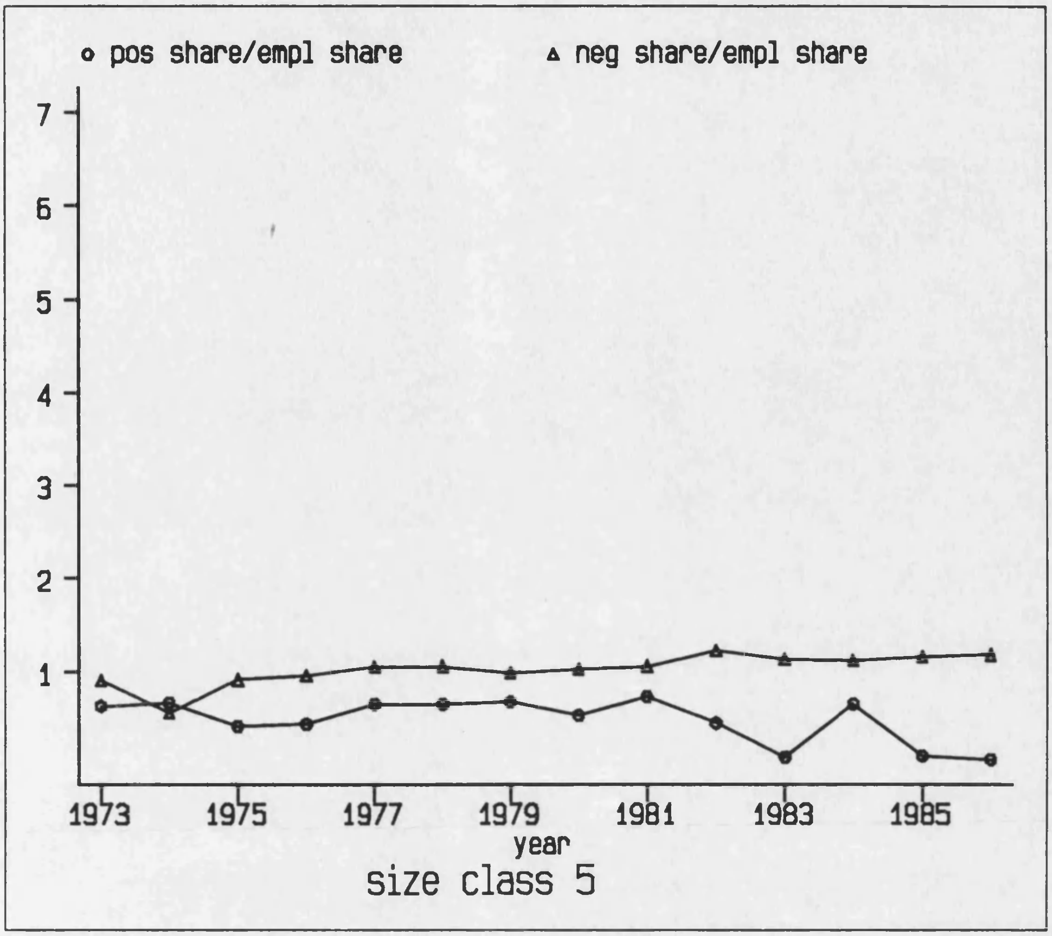


Figure III.2e

From these graphs it seems that the job destruction share, relative to the employment share and the job creation share, relative to the employment share, remained relatively constant for the largest firms. For the other size classes the job destruction share, relative to the employment share, remained relatively constant over time for all size classes, except for the period 73-74, the ratio increased for the two smallest size classes. The job creation share, relative to employment share, fluctuates much more,in particular from the late 70's, early 80's onwards. There seems to have occurred a lot of structural change for the four smallest size classes during the early 80's. There is no clear pattern emerging, all what can be said is that the job creation share has been fluctuating a lot in the early 80's, except for the largest firms[3].

III.3.2. Gross Job Flows and Size: Plant Level Data

In this sub-section I repeat the description of section III.3.1, but now I use the Workplace Industrial Relations Surveys of 1980, 1984 and 1990. Since these are three occasional surveys and not panel data, I am not able to compute the persistence rates in job creation and destruction, nor am I able to infer any cyclical properties. The main results remain by and large the same.

In table III.6, I show the annual average gross job creation, destruction and reallocation rate for the five size categories. Again there exists a monotonic relationship between plant size and the gross job creation rate. Small plants create on

[3]The increased variation in the job creation share after 1982 could be the result of a fall in the number of observations in the sample, though.

average most of the new jobs in *percentage* terms, 7.4% compared to 2.4% for the top size category. For gross job destruction, this relationship is reversed. The largest plants destroy on average 6.4% existing jobs, while the smallest destroy on average 3.6% existing jobs. Table III.7 summarizes the annual averages of the job creation, destruction and employment shares, as well as their ratios.

Table III.6
Average gross job flows from plant level data

size category	job creation	job destruction	job reallocation
1	0.074	0.036	0.111
2	0.049	0.040	0.089
3	0.047	0.050	0.098
4	0.030	0.051	0.082
5	0.024	0.064	0.089

Table III.7
Share of job creation and destruction in total, plant level data

size	pos share (1)	neg share (2)	employment share (3)	(1)/(3)	(2)/(3)
1	0.109	0.030	0.046	2.4	0.66
2	0.11	0.050	0.074	1.57	0.72
3	0.16	0.101	0.11	1.46	0.89
4	0.178	0.173	0.191	0.93	0.90
5	0.43	0.64	0.57	0.74	1.11

Again a very similar pattern as described in last section emerges. The smallest plants account only for 10.9% of total job creation and 3% of total job destruction, but proportionally they contribute much more to job creation and much less to job destruction as can be seen from the last two columns.

In table III.8, the evolution of the job creation, destruction and employment shares over time is summarized. In 1980 the smallest plants accounted for 9.5% of total job creation, this increased in 1984 to 12.3% and dropped in 1990 to 10.8%. The largest plants provided 35% of the new jobs in 1980 and this increased to 51% in 1990. Whether proportionally they became more or less important can be seen from the last two columns. The ratio of the job creation share to the employment share of the smallest plants dropped from 2.74 in 1980 to 2.42 in 1984 and to 2.06 in 1990, in contrast, this ratio increased for the largest plants from 0.7 in 1980 to 0.8 in 1990. Whether this reflects a general trend cannot be said on the basis of only three observations. Irrespective of the evolution small plants keep a ratio larger than 1, while large plants smaller than 1.

Table III.8
The evolution of the job creation, destruction and employment share

year	size	job creation share	job destruction share	employment share	(1)/(3) ratio 1	(2)/(3) ratio 2
80	1	0.095	0.022	0.034	2.74	0.64
84	1	0.123	0.29	0.051	2.42	0.57
90	1	0.108	0.04	0.052	2.06	0.77
80	2	0.154	0.051	0.105	1.46	0.48
84	2	0.12	0.052	0.062	1.93	0.84
90	2	0.073	0.046	0.055	1.32	0.83
80	3	0.226	0.159	0.16	1.39	0.98
84	3	0.121	0.082	0.085	1.42	0.97
90	3	0.133	0.062	0.084	1.57	0.73
80	4	0.17	0.18	0.19	0.86	0.91
84	4	0.19	0.17	0.20	0.96	0.89
90	4	0.17	0.16	0.17	1.00	0.94
80	5	0.35	0.58	0.50	0.70	1.16
84	5	0.44	0.65	0.60	0.73	1.09
90	5	0.51	0.68	0.63	0.81	1.09

To a certain extent the results reported here are similar to those found by Davis, Haltiwanger and Shuh (1993) in the U.S.. They also report that the job creation share and the job destruction share is highest in the largest firms. This contrasts with Birch (1979) in the U.S. and Gallagher et al. (1990) in the U.K. reporting that most jobs are created in small firms. Davis, Haltiwanger and Shuh (1993) also find a negative monotonic relationship between the gross job creation rate and size, however, they find a negative relationship between the gross job destruction rate and size, while the results here show a positive relationship between the gross job destruction rate and size.

From the results reported in this section some regularities seem to emerge. Irrespective of using plant level or firm level data, on average, there is a negative relationship between size and the gross job creation rate and a positive correlation between size and the gross job destruction rate. In absolute terms, however, it is the largest firms or plants which create most jobs, but also destroy most. This is not surprising since they also have the largest employment share. Relative to their employment share, though, it is the small firms or plants which create most jobs and destroy least. Finally, the job destruction share remained relatively stable over time, while the job creation share fluctuated a lot in the early 80's. From these cross-tabulations it is, however, difficult to tell whether firms will converge and if there is convergence to which size will they tend. Moreover, these cross-tabulations do not give any information on the mobility of firms *between* size classes, they just reflect job creation and destruction *within* size classes. This theme will be analyzed in detail in the next section.

III.4. Cross-Section Dynamics of Firm Size

In this section I study the process of job creation and destruction in relation to the evolution of the cross-section distribution of firm sizes. The literature has mainly focused on the relationship between firm level net growth rates and initial size (Evans, 1987a,b; Dunne, Roberts and Samuelson,1989), by regression analysis, giving a significant negative coefficient on initial size. This could be interpreted as convergence and hence a collapsing cross-section distribution of firm size, although a negative coefficient on initial size could be a result of Galton's fallacy (Quah, 1993a,b; Leonard, 1986). If the dependent variable is the growth rate measured as the difference between current size and initial size and if the regressor is initial size (all in natural logarithms), then firms that have a transitory low initial size, due to measurement error, will on average seem to grow faster than those with transitory a high size. The cross-section distribution dynamics involves changes in the shape of the distribution and intra-distribution mobility, which can only be captured imperfectly by a summary statistic, like a regression coefficient. Moreover, the traditional regression analysis concentrates on *net employment growth,* while the focus here is on gross job creation and gross job destruction. It is therefore useful to turn to an alternative econometric strategy. I will consider the dynamic behaviour and the cross-section variation of the entire size distribution of firms and plants.

A convenient way of summarizing gross job turnover between different size classes is to structure the data in Markov transition matrices, which describes movements of firms across states, i.e. size classes. Let $S_i(t)$ denote the number of firms in size class or state i at time t and let S(t) stand for the vector summarizing all possible states. Then the evolution of S(t) is described by a law of motion:

(III.1) $$S(t+1) = M\,S(t),$$

where M maps one distribution into another and is called a Markov transition matrix and contains information on intra-distribution movements of firms. If there are n states then there are n^2 entries in an nXn transition matrix M indicating the probability of transition of state i to state j. Of course, there is no a priori reason why S(t) should be first order or why the relation should be time invariant, nevertheless it is a first step in analyzing the dynamics in the size distribution (Quah, 1993a). Iteration of (III.1) gives a predictor for future cross-section distributions or

(III.2) $$S(t+s) = M^s S(t),$$

If s goes to infinity, the long-run or ergodic distribution of firm sizes may be characterized. This ergodic distribution can give an indication of convergence or divergence. Divergence might occur if {S(t+s)} tends to a bimodal distribution, while convergence if it the sequence tends towards a point mass.

To compute M, I defined a discrete space of five size classes as in section III.2 and normalized employment by average employment. This normalization controls for a declining or growing market, in other words for aggregate movements. For instance, in a declining market it is to be expected that firms become smaller over time and thus converge towards a smaller size. The entries in the M matrix are simply the relative frequencies or

(III.3) $$m_{ij}(t,t+1) = n_{ij}(t)/n_i(t),$$

where $n_{ij}(t)$ stands for the number or plants or firms moving from state i to state j, while $n_i(t)$ stands for the number of plants or firms in state i at time t. The coefficient $m_{ij}(t,t+1)$ is the probability of moving from state i to state j over a one-year period and can be interpreted as unrestricted maximum likelihood estimators of transition probabilities. These transition probabilities reflect job creation and destruction *between* different size classes, while in last section job creation and destruction *within* size classes was reported.

Table III.9 gives the one-year transition matrices for the WIRS data in 1980, 1984 and 1990, as well as the one-year average transition matrix taken over all three samples. The first column gives the total number of transitions which lie in each size class and the first row shows the upper end of the grid, 1/4 the average, etc.. For instance, in the 1980 survey, 374 plants had employment less than or equal to 1/4 the average employment in the sample, of which 90.64 remained in that size class the next year, while 9% moved one size class up. Each of these transition matrices shows persistence, indicated by the high diagonal elements, with more persistence in the smallest and in the largest size class. On average, 95% of the small plants remained small the next year, while only 5% moved to a higher size class, indicating low job creation, i.e. migration of small plants to larger ones is limited. Most job creation and destruction between size classes occurs in the middle, in particular the third category. Only 80% of plants employing between a half the average and the average employment in the sample stayed in that size class over a one year period. The same pattern holds if transitions over a longer period are computed. Table III.10 shows the 6-year, 4-year and 5-year transition for the WIRS samples of 1990, 1984 and 1980 respectively[4]. Again there is higher persistence in the extremes. Most job creation from one size class to another does not occur in the smallest plants, but rather in the middle size categories. For instance in 1990, more than 20% of plants employing between 1/4 the average employment and 1/2 the average have moved one size class up and 12% moved one size class down. From these transition matrices it is clear that simultaneous job creation and destruction not only occurs *within* size classes, but also *between* size classes. In other words there is substantial *intra-distribution* mobility. Table III.11 shows the one-year average transition matrix for the firm level data over the period 1972-86. A very similar pattern emerges as with the plant level data. Most turbulence is in the middle size classes, while there is higher persistence in the extreme size classes.

The bottom row in table III.9 panel D shows the ergodic or steady state distribution of the average one-year transition matrix of the plant level data. It is found by computing the eigenvector associated with an eigenvalue of 1 from this matrix. Of course, this is just an indication since I only have three points in time and in principle the ergodic distribution should be computed over a much longer time period. From the

[4]The choice of the step of the transition was imposed by the nature of the census in each survey year.

ergodic distribution it can be seen that 50% of the plants eventually end up in the smallest size class (which corresponds to plants with less than 101 employees). This indicates that the long run size distribution of plants is skewed. It cannot be said that there is convergence, because if there was convergence then all plants should end up at the mean, 1. This becomes clear from looking at the ergodic distributions in table III.10. There is a bimodal distribution in each sample. Many plants end up in the larger size classes, but also many end up in the smaller. Of course these are one-step transitions over a limited number of years and the length is different for each sample. Thus comparisons are hard to make. Moreover, most likely a lot of idiosyncrasies affect the probabilities since they are not averaged out. The ergodic distributions are indicative though. The ergodic distribution from firm level data looks very different. There is convergence towards the mean, indicated by the probability mass at the third size class. Thus in the long run, job creation comes from the smaller size classes, moving towards the average, while job destruction comes from the larger ones. The ergodic distribution computed from the firm level data makes more sense since it is computed over a sufficiently long time period. Whether this is the reason why there is a difference in the ergodic distribution of plants versus firms cannot be inferred. Alternatively, plants do behave inherently different.

To test the above results on their robustness I experimented with an alternative specification of the initial grid and extended the original five state specification to a ten state specification. Moreover, the ten states were chosen such that initially each firm or plant had the same probability of being in a given size class, in other words each state had approximately the same number of observations initially. The results

Note 3: Chapter III, p 102

The question of existence of the ergodic distribution is straightforward in the case shown here. For finite Markov processes the ergodic distribution always exists. A finite Markov process is the case where the state space $S=\{s_1,\ldots,s_n\}$ consists of a finite number of elements. Such a Markov process is called a Markov chain, as is the case here. However, uniqueness is not necessarily guaranteed. The ergodic distribution will be unique if and only if for every $i \in \{1,\ldots,n\}$, there exists $s \geq 1$ such that $m_{ij}^{s} > 0$ (Stokey and Lucas, "Recursive Methods in Economic Dynamics", Theorem 11.1 and 11.2). This latter condition is clearly not satisfied and hence the ergodic distributions found need not be unique.

are given in tables III.12 and III.13. As expected, there is a lot of job turnover between the different size classes especially. On average, 80% of the plants initially in the smallest size class (0.16 the average) were still there the next year, while for the firm level data, 87% stayed in the smallest size class the next year (0.08 the average). The ergodic distribution* for the plant level data shows no convergence. There are several "peaks", one at the fourth size class, one at the sixth and one at the eighth, thus confirming the result found earlier. For the firm level data there is a clear tendency that firms move towards the right hand side of the size distribution. Given the grid here, the mean is located between the 8th and the 9th size class. Firms have a probability of 18% to arrive in the 8th size class, 23% in the 9th and 29% in the last size class. Convergence here is not well pronounced, but this might be due to the fact that the mean is located so far to the right. In any case, there is a probability piling up in the area of the mean, which is consistent with the ergodic distribution from the five-state specification.

Table III.9
One-year Markov transition matrices, plant level data

A/1980

	1/4	1/2	1	2	6.81
374	0.906	0.0909	0.002	0.00	0.00
506	0.025	0.926	0.047	0.00	0.00
449	0.004	0.222	0.723	0.046	0.002
263	0.000	0.003	0.068	0.897	0.030
294	0.003	0.000	0.003	0.064	0.928

* Please see Note 3

B/1984

	1/4	1/2	1	2	33.3
745	0.977	0.021	0.001	0.000	0.000
323	0.089	0.860	0.049	0.000	0.000
222	0.009	0.099	0.855	0.036	0.000
255	0.003	0.000	0.066	0.917	0.011
269	0.003	0.000	0.007	0.059	0.929

C/1990

	1/4	1/2	1	2	22.9
509	0.974	0.025	0.000	0.000	0.000
161	0.099	0.857	0.043	0.000	0.000
129	0.007	0.093	0.845	0.046	0.007
134	0.000	0.022	0.067	0.880	0.029
184	0.000	0.005	0.005	0.054	0.934

D/Average one-year transition matrix

	1/4	1/2	1	2	21
1628	0.952	0.046	0.000	0.000	0.000
990	0.071	0.881	0.046	0.000	0.000
800	0.007	0.138	0.808	0.043	0.003
652	0.001	0.008	0.067	0.898	0.024
747	0.002	0.001	0.005	0.059	0.930
ergodic	*0.50*	*0.31*	*0.099*	0.056	*0.024*

Table III.10

A/1980: One step 5-year transition

	1/4	1/2	1	2	10.8
353	0.747	0.229	0.017	0.002	0.002
427	0.053	0.782	0.154	0.009	0.000
347	0.000	0.259	0.579	0.158	0.002
211	0.004	0.023	0.099	0.729	0.142
239	0.004	0.000	0.012	0.092	0.891
ergodic	*0.069*	*0.294*	*0.165*	*0.200*	*0.27*

B/1984: One step 4-year transition

	1/4	1/2	1	2	17.5
705	0.903	0.090	0.005	0.000	0.000
249	0.120	0.702	0.176	0.000	0.000
208	0.014	0.139	0.653	0.187	0.004
204	0.000	0.009	0.088	0.818	0.083
255	0.003	0.003	0.007	0.145	0.839
ergodic	*0.239*	*0.161*	*0.151*	*0.28*	*0.158*

C/1990: One step 6-year transition

	1/4	1/2	1	2	19.7
509	0.886	0.102	0.009	0.003	0.000
157	0.121	0.656	0.203	0.012	0.006
110	0.009	0.109	0.600	0.263	0.018
138	0.000	0.000	0.152	0.587	0.260
165	0.000	0.024	0.012	0.121	0.842
ergodic	*0.13*	*0.11*	*0.15*	*0.21*	*0.37*

Table III.11
Average one-year Markov transition matrix for firm level data, 1972-86

	1/4	1/2	1	2	45.9
4195	0.958	0.041	0.000	0.000	0.000
1596	0.062	0.869	0.068	0.000	0.000
1050	0.000	0.070	0.870	0.059	0.000
591	0.000	0.000	0.086	0.859	0.054
827	0.000	0.000	0.001	0.035	0.963
ergodic	*0.21*	*0.20*	*0.29*	*0.14*	*0.14*

Table III.12
Average one-year Markov transition matrix, plant level
10-state specification

	0.16	0.25	0.35	0.47	0.52	0.66	0.97	1.55	2.74	33.3
471	0.80	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.0	0.00
476	0.11	0.78	0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.00
463	0.00	0.09	0.77	0.13	0.00	0.00	0.00	0.00	0.00	0.00
487	0.00	0.00	0.09	0.66	0.22	0.01	0.00	0.00	0.00	0.00
475	0.00	0.00	0.00	0.08	0.81	0.10	0.00	0.00	0.00	0.00
471	0.00	0.00	0.00	0.02	0.16	0.68	0.12	0.00	0.00	0.00
472	0.00	0.00	0.00	0.00	0.00	0.09	0.80	0.08	0.00	0.00
486	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.88	0.05	0.00
490	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.84	0.06
483	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.90
ergodic	*0.049*	*0.084*	*0.093*	*0.11*	*0.022*	*0.11*	*0.10*	*0.12*	*0.06*	*0.03*

Note: The first row gives the upper end of the grid

Table III.13
Average one-year Markov transition matrix, firm level 1972-86
10-state specification

	0.08	0.11	0.14	0.16	0.28	0.38	0.54	0.9	2.4	45
852	0.87	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
848	0.10	0.69	0.18	0.02	0.00	0.00	0.00	0.00	0.00	0.00
824	0.00	0.14	0.63	0.20	0.01	0.00	0.00	0.00	0.00	0.00
828	0.00	0.01	0.10	0.65	0.22	0.01	0.00	0.00	0.00	0.00
829	0.00	0.00	0.01	0.12	0.66	0.19	0.00	0.00	0.00	0.00
813	0.00	0.00	0.00	0.00	0.11	0.69	0.18	0.00	0.00	0.00
828	0.00	0.00	0.00	0.00	0.00	0.12	0.72	0.14	0.00	0.00
821	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.81	0.10	0.00
835	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.87	0.05
863	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.96
ergodic	*0.012*	*0.014*	*0.017*	*0.029*	*0.046*	*0.072*	*0.11*	*0.18*	*0.23*	*0.29*

Note: The first row gives the upper end of the grid

From the above transition matrices a number of interesting lessons can be learned. The first is that there exists substantial *intra-distribution* mobility of firms and plants in all size classes. This intra-distribution mobility cannot be observed in a traditional regression analysis. Moreover, from the ergodic distribution it can be inferred whether firms and plants converge in size or not and to which size, in the traditional regression a negative coefficient on initial size was subject to Galton's fallacy. This is not the case here since the dynamic evolution of the entire size distribution is taken into account. From the ergodic distribution it seems there is no convergence of plant sizes, while firms seem to converge towards the average

The above results should be checked using data over longer time horizons, but at this stage the data used here are the best available. If such data are available extensions are possible. For instance, one could argue that the size distribution in narrowly defined sectors might be different from sector to sector. Several sectors have different levels of sunk costs, different levels of minimum efficient scale and different degrees of price competition. These factors could influence the evolution of the size distribution of firms. Again, a substantial amount of data at a detailed level of disaggregation is needed to explore these issues.

III.5. Summary and Conclusions

This chapter has looked at a relationship between gross job flows and firm size. I started with producing cross-tabulations of gross job flows for five different size classes, defined relative to average employment in the sample. Irrespective of using firm or plant level data the smaller ones have the highest gross job creation rate and the lowest gross job destruction rate. This implies that the least stable jobs are located in the largest firms. This latter fact is different than the results for the U.S.. In the U.S. the smallest plants have both the highest job creation rate and the highest job destruction rate. There is no clear relationship between the persistence of newly created jobs and size, while the largest firms have the highest persistence rate in job destruction. The largest firms account for the largest share in total job creation as well as for the largest share in total job destruction. This is not surprising since they also have the largest employment share. Proportionally, small plants and firms seem to be more important, although that the bulk of the job creation and destruction happens in the larger plants and firms.

The process of job creation and destruction is ultimately linked to the process of expansion and decline of firms. This has been studied in firm growth models. I studied firm size dynamics to take into account the dynamic evolution and the intra-distribution mobility of the entire size distribution. To do this I computed Markov transition matrices and reported evidence indicating convergence in firm sizes towards the average, but no convergence in plant sizes. Knowledge of the evolution of the size distribution of firms and factors determining this evolutionary process will most likely help to understand the implied process of job creation and destruction.

CHAPTER IV: AN INTERNATIONAL COMPARISON OF GROSS JOB FLOWS

IV.1. Introduction

In this chapter I give an overview of the existing studies on gross job flows and make an attempt to compare the gross job flow rates across different countries. As such the results of chapter II for the U.K. are placed in a broader international context. I will discuss the difficulties arising when comparing gross job flows across countries. The labour markets of Europe and the U.S. have been contrasted by the difference in low net job creation and persistently high unemployment in Europe. The difference in performance across countries has been attributed to predominantly social policies and institutional arrangements (Jackman et al.,1990). In particular, the role of wage-bargaining arrangements (Calmfors and Driffill, 1988) and of unemployment benefits (Burda, 1988) have been argued to account for differential unemployment rates across countries. Most likely, also these factors contribute to explaining differences in gross job creation and destruction rates between countries. However, as discussed in chapter II, the idiosyncratic component of gross job creation and destruction is substantial, suggesting that firm specific characteristics and shocks are also important to explain differences in gross job creation and destruction rates.

There are only two studies investigating differences in gross job reallocation rates across countries, both focus on differences in economic policy. Leonard and Schettkat (1991) compare job stability between Germany and the U.S.. They regress job reallocation, creation and destruction rates on six industry groups in Germany and the U.S. from 1978-81. Conditional on industry and year they find that the job reallocation rate is 3.9 percentage points higher in the U.S. than in Germany and contribute this difference to the difference in institutions and regulations in both countries. Moreover, they also report differences in gross job flows across different sectors which are similar in both countries. If technology matters in explaining different job reallocation rates across industries, then these differences should persist across countries. However, even after controlling for technology via industry dummies they still found a difference in job reallocation rates. They take this as indirect evidence for the impact of different institutions and regulations on gross job creation and destruction rates. More direct evidence that policy matters is given in Leonard and Van Audenrode (1993) comparing the U.S. with Belgium. They show that differences in job creation and destruction rates can be contributed to differences in industrial policy. Subsidization of failing companies has imposed a tax on growing firms which contributed to lower job creation in Belgium. Both firm level and industry level data on subsidization have been used to prove their hypothesis. These two studies, however, are only based on comparing two countries so that these results should be seen as suggestive rather than conclusive.

In section IV.2 I give an overview of the existing studies on gross job flows and report gross job reallocation rates across different countries. I then argue why it is so hard to compare gross job reallocation rates on a consistent basis across different countries. Despite the reported caveats I go on with an attempt to compare a few countries. This is done in section IV.3. It should be noted that it is not clear a priori that a high gross job reallocation rate is good or bad. If a high gross job reallocation rate is driven by a high gross job destruction rate, then higher unemployment will result. If on the other hand a high gross job reallocation rate is driven by a high gross job creation rate, unemployment will reduce. If jobs involve a lot of on-the-job training and human capital then lower job and worker turnover is desirable. Furthermore, high gross job turnover implies high transaction costs. In contrast, if there is a lot of structural change then a flexible labour market is desirable, implying flexible job policies in firms. In section IV.4 I discuss briefly cyclical similarities in gross job flow rates between the U.S. and the U.K. and in section IV.5 I summarize and conclude this chapter.

IV.2. Gross Job Flows across Countries: Overview and Problems

It is only recently that labour economists have started to use detailed firm and plant level panel data. It is then not surprising that the number of studies on gross job flows is limited and that the nature of each study is often quite different. Table IV.1 gives an overview of these studies for nine countries. The gross job creation and destruction rates refer to annual averages computed over the relevant sample period. These figures are computed from different data sources, they refer to different industry affiliation and sample periods, moreover some of them are calculated on the basis of firm level panel data, like the Belgian and the U.K. study, while the others on the basis of establishment level panel data.

There are a number of caveats when one wants to compare these results. Firstly, some of the studies are based on *firm level* data while others are based on *plant level* data. Which measure the most appropriate one is, is open to debate. Usually, the choice is dictated by the availability of the data. Plants within the same firm can expand or contract, die or be born, implying job flows, while at the same time there may be no measured change in the numbers of jobs at the level of the firm. Thus the reshuffling of jobs between plants is not observed at the firm level. This is not necessarily bad since what matters are the net job opportunities provided by each firm and the number of plants is a mere reflection of the organisation of the firm. Hamermesh (1993) argues that it depends on where the specificity of investment lies and on the possibility of intrafirm mobility of workers. To the extent that investment is plant- but not firm specific, or that workers do not move among plants within the same firm, the plant is the more appropriate unit of observation.

The *industrial coverage* of the data is a second problem when one wants to compare gross job flow rates between different countries. A large number of papers focus only on the manufacturing sector. Economy wide judgements inferred from these studies are in fact very specific to the manufacturing sector. It is of course interesting to compare job flows in the manufacturing sector versus those in the non-manufacturing sector, however, when international comparisons are made only similar sectors should be compared, because they most likely reflect the same underlying technology and competition, potentially causing the gross job flows within one sector. Even restricting attention to the manufacturing sector, it could well be the case that some sectors in country A are in full expansion and are still relatively young, converging towards a "steady state", while in country B these sectors reached already their "steady state" and in country C these sectors are in decline. This is in fact the reason why it is exceptional in the Industrial Organisation's literature to find cross-country comparisons.

A similar argument can be used for the *sample period* covered in the different studies. As shown in chapter II, the gross job reallocation rate for the U.K. is counter-cyclical, the gross job creation rate is pro-cyclical, while the gross job destruction rate is counter-cyclical. Also for the U.S. manufacturing sector this is the case as shown in Davis and Haltiwanger (1990, 1992). This cyclicallity in gross job flows implies that it matters to compare job flows which refer to a similar phase in the business cycle. The evidence of chapter II suggests that the gross job reallocation rate in a boom will be different than the one in a recession. Furthermore, it is not always the case that the timing of the business cycle is the same in different countries.

Finally, as can be seen from table IV.1, some studies only include *continuing firms or establishments*, while others also include job flows emerging from *entry and exit of firms or establishments*. It is clear that one should only compare figures referring to either both entry and exit and expansion and contraction of firms or alternatively one should only focus on gross job flows computed from continuing firms, excluding entry and exit.

All the above remarks are applicable to the results reported in table 1. Ideally, one should have comparable firm or plant level data, referring to the same sample period for say all the OECD countries. In this case, consistent gross job creation and destruction series may be computed and a pooled cross-section time series study may be performed, taking into account the above criticisms. At this stage such rich information is not yet available. Moreover, a lot of these criticisms, albeit to a lesser extent, are also true for other cross-country studies. For instance the comparability of unemployment rates across countries is often questionable. Each country has often their specific way of collecting macro data without following a general code. Bearing these facts in mind, I will make some statements by "comparing" gross job reallocation rates across countries. These statements should therefore be viewed as suggestions, rather than real "truths".

Table IV.1

Overview Studies on Gross Job Flows

country	source	period	pos[1]	neg[1]	gross[1]	pos	neg	gross
Germany	Cramer & Koller (1988)	1978-84	5.6	6.1	11.7	8.3	8.2	16.5
	Cramer & Koller (1988)*	1978-84	4.1	5.6	9.7	5.7	7.0	12.7
Germany	Boeri & Cramer (1992)	1977-89	6.2	5.8	12	8.5	7.5	16
United States	Davis and Haltiwanger(1990)*	1973-86	7.3	8.5	15.8	9.2	11.3	20.5
United Kingdom	chapter II*, firms chapter II*, plants	1973-86 1980,84,90	1.6 3.5	5.6 6.5	7.2 10	N.A.	N.A.	N.A.
Belgium	Mulhay & Van Audenrode (1993)*	1979-84	2.3	3.4	5.7	N.A.	N.A.	N.A.
	Mulhay & Van Audenrode (1993)	1985-89	3.8	5.1	8.9			
Italy	Contini & Revelli (1992)	1978-83	10.3	10.7	21	11.9	12.2	24.1

France	OECD (1987)	1978-84	5.7	6.2	11.9	11.4	12.0	23.4
	OECD (1987)*	1978-84	3.9	5.7	9.6	8.1	9.0	17.1
Canada	OECD (1987)	1979-84	8.8	7.5	16.3	11.1	9.6	20.7
	OECD (1987)*	1979-84	7.5	7.5	15	8.9	9.1	18
Japan	OECD (1987)	1982-84	4.1	3.6	7.7	N.A.	N.A.	N.A.
Sweden	OECD (1987)	1982-84	8.8	8.7	17.5	11.4	12.1	23.5
	OECD (1987)*	1982-84	6.3	7.2	13.5	7.8	9.5	17.3

Notes: (1) indicates that the gross job flows are computed excluding the contribution of entry and exit of businesses.
(*) indicates that the figures refer to the manufacturing sector only

IV.3. An Attempt to Compare Gross Job Flows across Countries

There are a number of interesting facts emerging from table IV.1. First, in all countries there is simultaneous creation and destruction of jobs, second the gross job reallocation rate seems to differ across countries, ranging from 21% in Italy to 7.7% in Japan (excluding the contribution of entry and exit to the gross job creation and destruction process). Third, comparing the gross job creation and destruction rate when entry and exit of businesses is excluded with the ones when they are included in the calculation it turns out that on average about 30% of total job creation and destruction is accounted for by entry and exit of establishments, with the outliers being France and Italy. It is therefore possible to estimate the corresponding figures for the U.K. under the assumption that also in the U.K. the contribution of entry and exit to the job generation process is on average 30%. This would yield an average gross job reallocation rate of 10.3% if the firm level data are used and of 14.3% if the plant level data are used. These results suggest that there are shocks which affect both expansion and contraction of existing firms or plants, as well as the entry and exit process of firms or plants. The major source of job turnover within an aggregate however is the expansion and contraction of existing firms or plants. There is only one study which investigates the role of entry and exit in the job creation and destruction process in more detail. Boeri and Cramer (1992) find for the German economy that over the period 1977-89 cyclical employment fluctuations are mainly associated with contractions and expansions of continuing plants, while the entry of establishments is the driving force of trend employment growth. They find no evidence of significant adjustment costs of labour and suggest that the role of entry in employment growth has to do with differences in product specialisation of new firms and incumbents.

I next attempt to compare the gross job creation, destruction and reallocation rates for a number of countries, based on the results of table IV.1. I will restrict the comparison to the manufacturing sector and to data obtained from existing and continuing business units only. Furthermore, the sample period to which the rates refer will be restricted to 1978-84 since most studies have this period in common[1]. This period is also characterised by a supply shock which has affected all countries in some way or another, the second oil shock. In table IV.2 I give the annual average gross job creation, destruction and reallocation rate for the selected countries. I have transformed the gross job flow rates based on firm level data for the U.K. and Belgium into plant level data based on the (rough) approximation discussed in chapter II that rates computed from firm level data are on average about 25% lower than those computed on the basis of plant level data. This transformation is necessary to make a "consistent" comparison.

[1]I have also included Belgium and Canada, although the sample starts only in 1979.

Table IV.2

country	job creation	job destruction	job reallocation
Germany	0.041	0.056	0.097
United States	0.067	0.085	0.152
United Kingdom[1]	0.011 *0.014*	0.071 *0.088*	0.082 *0.102*
Belgium[1]	0.023 *0.029*	0.034 *0.042*	0.057 *0.071*
France	0.039	0.057	0.096
Canada	0.075	0.075	0.15

Note: (1) The firm level data for the U.K. have been transformed to plant level data on the basis of the approximation (in italic) made in chapter II that the difference in gross job flow rates is on average about 25%.

From table IV.2 it is immediately clear that in all countries firms on average were shedding labour in the manufacturing sector, implying negative net employment growth over the period 1978-84. However, there was still some gross job creation going on, with the highest rates in the U.S. and Canada, 8.5% and 7.5%, and the lowest in Belgium and the U.K., 2.9% and 1.4%. In contrast, the average gross job destruction rate is highest in the U.S. and the U.K., 11.3% and 8.8%, and lowest in Belgium and Germany, 4.2% and 5.6%. Finally, the average gross job reallocation rate is highest in the U.S. and Canada, 19.9% and 15%, while in the European countries the average gross job reallocation rate is always around 10%. It has often been argued that the European unemployment problem is due to the lack of job creation in Europe. To a certain extent, this might be true for the U.K. and Belgium where job creation is very low. Also, job creation is in general lower in Europe than in North America, nevertheless, there is still substantial gross job creation in Germany and France. Taking into account that in general the gross job destruction rate is also lower in Europe, the Eurosclerosis problem is not necessarily linked to the fact of too low job creation. What is clear from table IV.2 is that especially job destruction is a very important component of the net job generation problem, especially in the U.K., where the difference between gross job creation and destruction is largest.

There are most likely two main causes leading to different gross job creation and destruction rates. One is linked to the way in which firms operate and markets are organised. Firm specific investment, technology and competition between firms will have effects on the expansion and contraction of firms and hence on job creation and destruction. The other cause is related to economic policy and institutional arrangements. Since the late 70's there has been a marked upswing in world labour market policies aimed at reducing unemployment (see Jackman et al. 1990). These policies may be classified in two broad categories: one is concerned with increasing the outflow rate from unemployment, the other with giving incentives to firms to hoard on labour and to hire new workers. It is the latter which potentially influences gross job creation and destruction. I will focus on three possible sources affecting gross job flows across countries: the employment protection legislation (EPL), the degree of centralisation and finally the amount of subsidies firms get. Table IV.3 gives an overview of each of these indicators for the selected countries.

Table IV.3
Overview Policy Indicators

country	EPL	Centralization	subsidies
U.S.	1	3	0
Canada	2	1	N.A.
U.K.	3	5	0.038
Germany	4	2	0.030
France	5	6	0.049
Belgium	6	4	0.064

Notes: EPL is taken from Bertola (1990), the adjusted degree of centralization is taken from Calmfors and Driffill (1988), adjusted to test for hump-shape and subsidies are subsidies to the manufacturing sector as a percentage of value added and is taken from Leonard and Van Audenrode (1993).

I start by looking at the *employment protection legislation* across countries. Emerson (1988) documents the importance of employment protection laws for Europe and it has been claimed that these laws are the cause of the poor employment performance in Europe. Blanchard et al. (1986) among others have argued that especially in unstable environments employment protection legislation makes labour unattractive to firms as a factor of production and therefore firms will substitute to more capital intensive production techniques. Furthermore, as argued by Lindbeck and Snower (1989) firing restrictions lead incumbent workers to bargain for higher wages, disregarding unemployment among outsiders. Recently, Burgess (1992) finds that the employment protection legislation affects negatively the capability of an economy to reallocate labour to more productive ones. Theoretically, the role of employment protection legislation has been illustrated by Millard (1993) in a matching model with endogenous job separations due to Mortensen and Pissarides (1993a,b). Employment protection legislation lowers both job creation and destruction because on the one hand an employer becomes more reluctant to open up a new job, given the increased cost of closing it down when a negative shock arrives, on the other hand an employer will only close down a job when the expected return of a filled job falls below the cost of job destruction, instead of zero. Thus even if the job yields a negative return the employer will not destroy it as long as the cost of job destruction is higher. Millard (1993) calibrates his model for the U.S. and the U.K. and finds that the higher employment protection legislation in the U.K. can only explain about 4% in the difference in job creation and destruction between the U.K. and the U.S.. I use Bertola's (1990) ordinal ranking of countries according to their restrictiveness in the employment protection legislation[2]. This ranking is based on a wide range of factors, discussed in detail in Emerson (1988) and is also used by others investigating the effect of employment protection legislation, like Burgess (1992). Figure IV.1 shows the relationship between the average gross job reallocation rate for the countries listed in table IV.2 and the employment protection legislation ranking in these countries. Not surprisingly, there is a clear negative correlation between employment protection legislation and gross job reallocation.

Figure IV.2 plots the average gross job reallocation rate against the degree of centralisation. Calmfors and Driffil (1988) show that there is an inverted U-shaped relationship between unemployment and the degree of centralisation of bargaining: unemployment will be lowest when bargaining is either completely decentralised or completely centralised. The index used here is adjusted to test for such an inverted U-

[2]Bertola (1990) does not include Canada in his ranking, but it is reasonable to assume that it is located close to the U.S..

shape by ranking first the most de-centralised and most centralised country, followed by the second most de-centralised and most centralised country and so on. Thus deviations from a linear relationship indicate deviations from the inverted U-shape. Figure IV.2 shows a weak linear relationship between gross job reallocation and the index. Thus it seems that the institutional arrangements do matter for gross job reallocation.

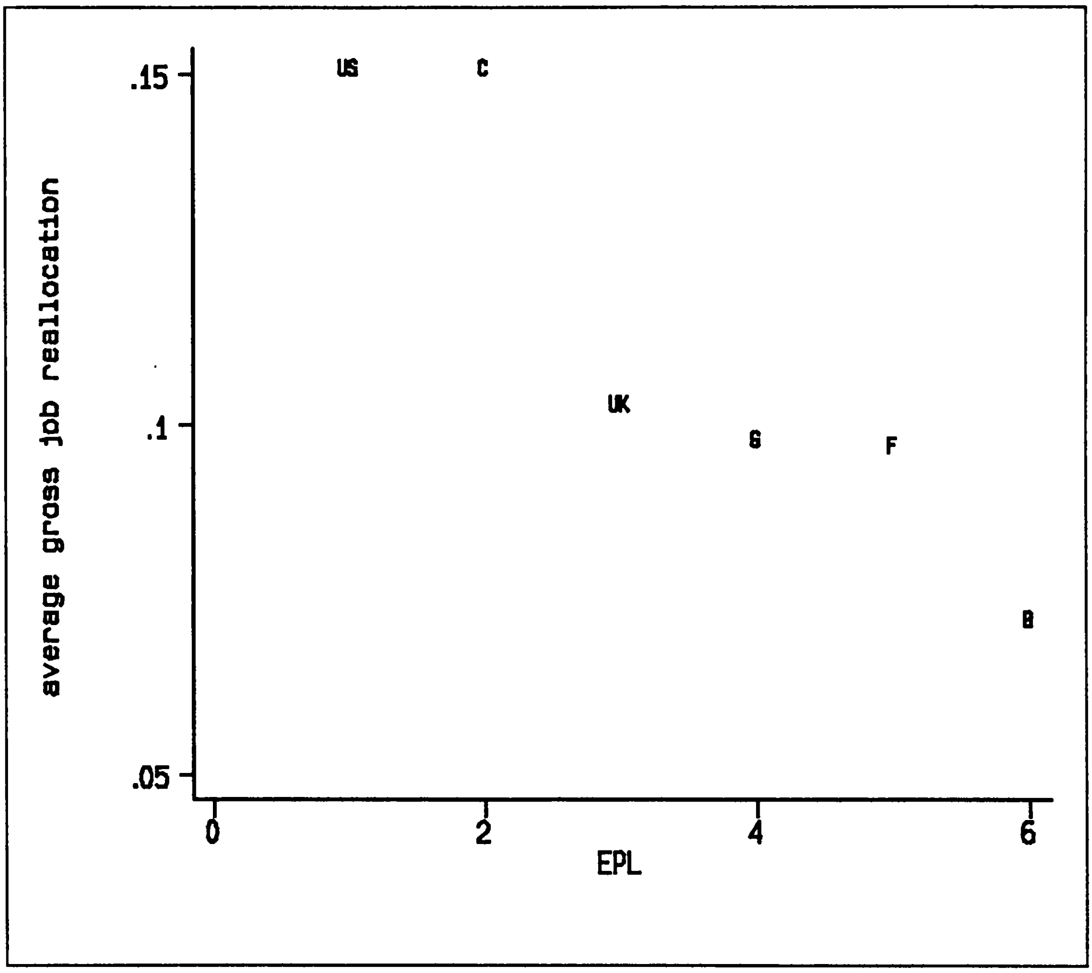


Figure IV.1

Gross Job Reallocation vs. Employment Protection Legislation

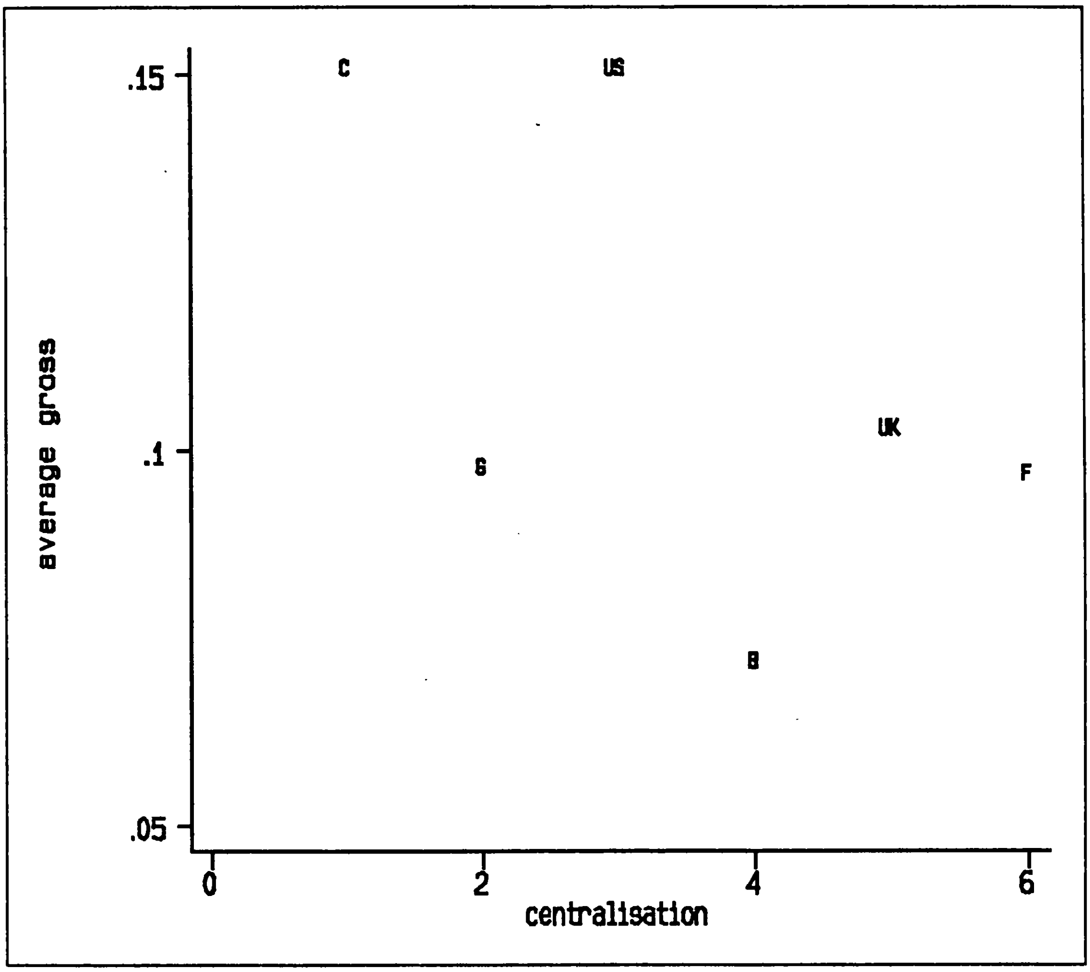


Figure IV.2

Gross Job Reallocation vs. Degree of Centralisation, adjusted to test for hump-shape

Finally, Leonard and Van Audenrode (1993) argue that the difference in employment performance is due to governments subsidizing failing companies, which would act as a tax on growing companies, thereby reducing both job creation and destruction. Data were only available for a few countries, nevertheless, figure IV.3 seems to support their hypothesis.

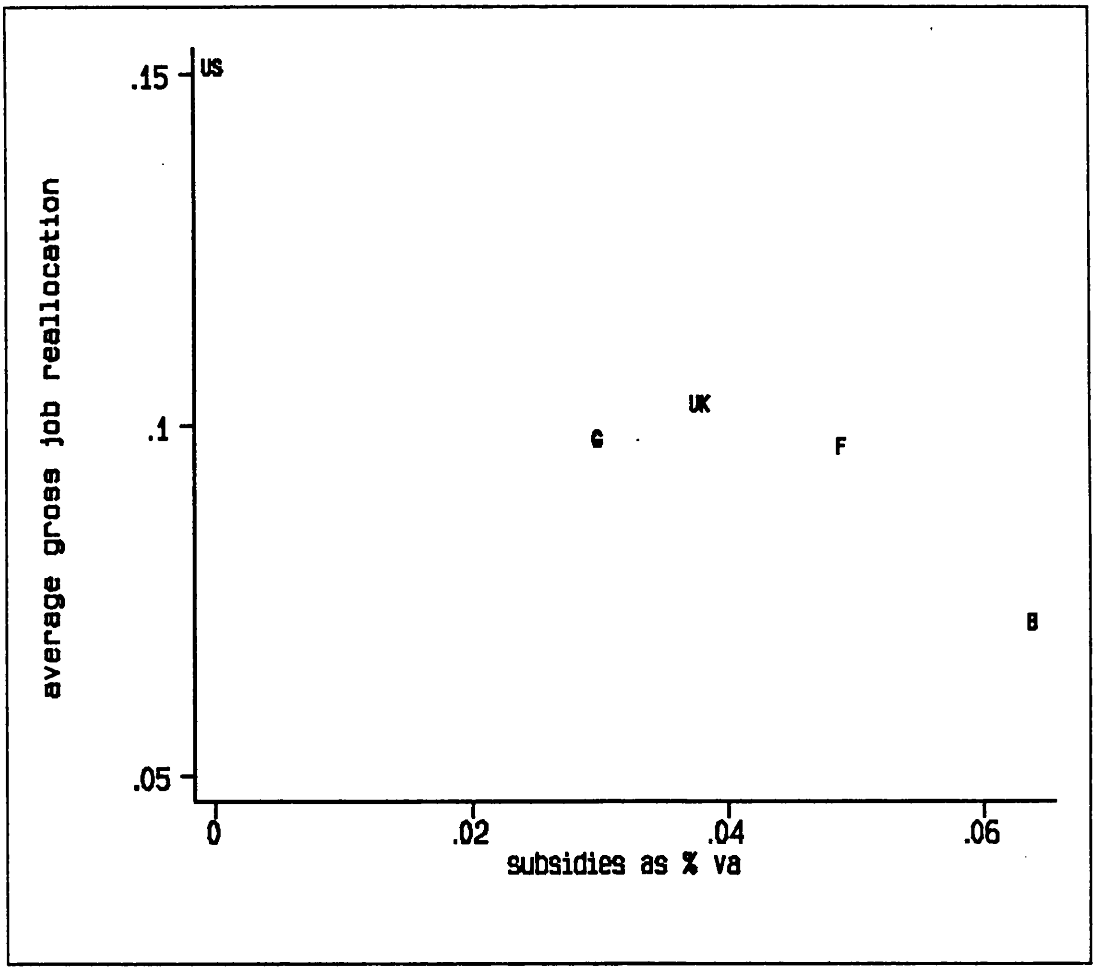


Figure IV.3

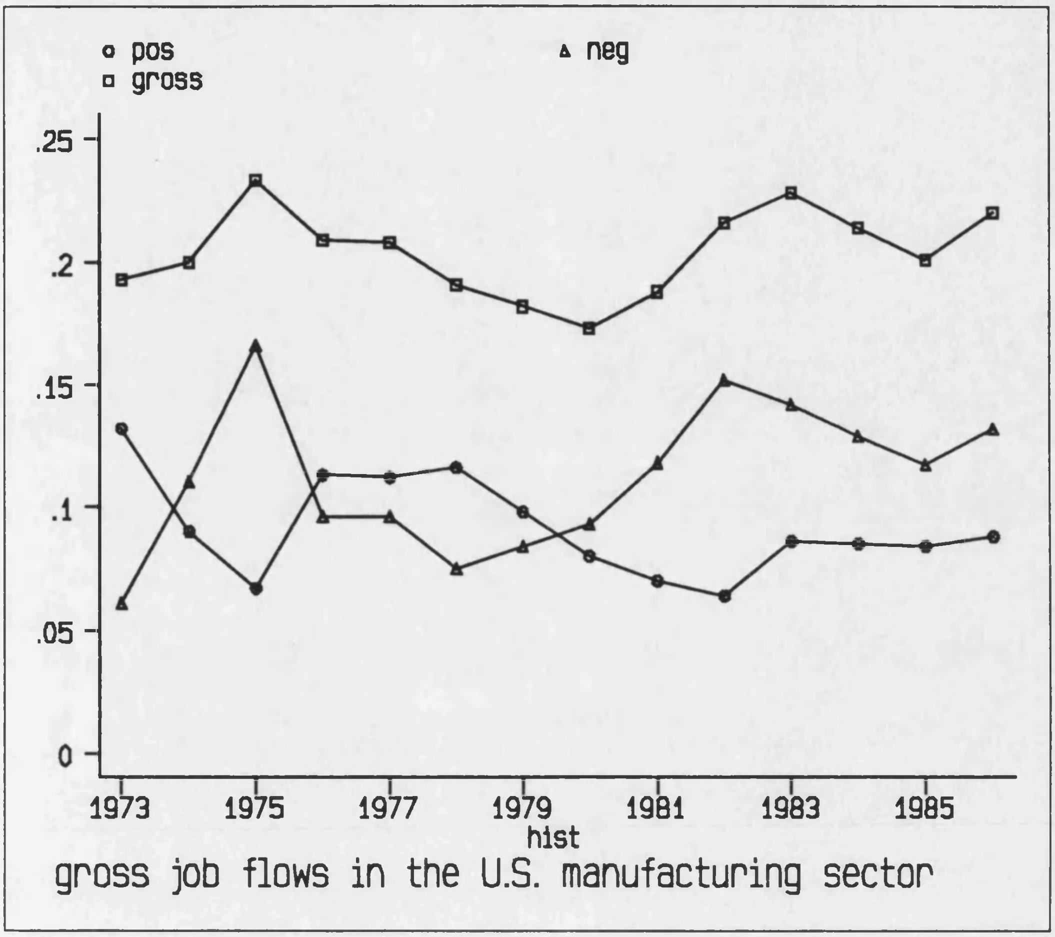
Gross Job Reallocation vs. Subsidies to Manufacturing

The results of this section seem to suggest that differences in gross job reallocation rates across countries are related to differences in the institutional settings and industrial policy. Of course, nothing conclusive should be inferred at this stage since the observations cover only six countries. Nevertheless, I believe it is a first step in the right direction to go about explaining differences across countries. It is clear that it is crucial to collect comparable data in order to make consistent international comparisons, this will be possible as data are collected on a systematic basis over a long enough period.

IV.4. Cyclical Properties: A Comparison between the U.S. and the U.K..

So far, the focus was on differences in *magnitudes* of gross job flows. Another dimension is the similarity in the cyclical properties of gross job creation, destruction and reallocation. What matters then is the access to a long time span to infer some cyclical properties. There are only three countries which cover a relatively long sample period the U.K., the U.S. and Germany. The U.S. and the U.K. both cover the period 1973-86 for the manufacturing sector, while Germany refers to 1977-89 and covers both the manufacturing and non-manufacturing sector. The comparison will therefore refer to the U.K. and the U.S. only. The main points have already been raised in chapter II, so this section stresses the most important ones.

In figure IV.4a I show the gross job creation, destruction and reallocation rate for the U.S. manufacturing sector, while in figure IV.4b the corresponding U.K. rates are plotted.



pos
gross
neg
.25
.2
.15
.1
.05
0
1973
1975
1977
1979
1981
1983
1985
hist
gross job flows in the U.S. manufacturing sector

Figure IV.4a

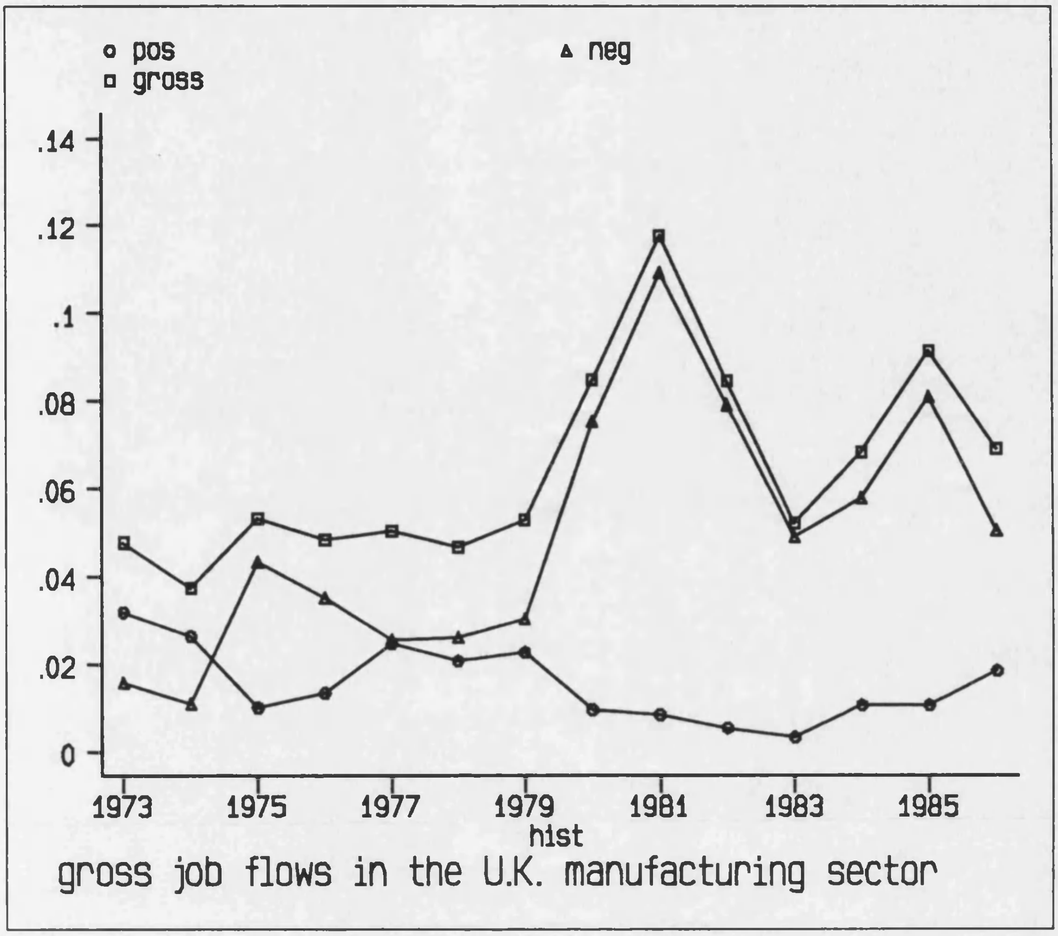


Figure IV.4b

In both the U.S. and the U.K. there is an asymmetry between the job creation and destruction rate, with the job destruction rate being the more variable component over the cycle. The job destruction rates show large spikes in recessions. This asymmetry is, however, more pronounced in the U.K. than in the U.S., especially with the second oil shock. In the U.K. there was an appreciation of the pound which could have contributed to increased job destruction. It is especially after the second oil shock that manufacturing suffered more in the U.K. than in the U.S. and that job shedding was relative to job creation much higher in the U.K.. It was also in this period that manufacturing production was discouraged by the Thatcher Government.

In chapter II, section II.4, I have performed a variance decomposition which allowed me to infer the importance of aggregate and sectoral shocks on the one hand and idiosyncratic shocks on the other in explaining the time variation in the gross job flow rates. Here I compare this variance decomposition for the U.S. with the U.K.. Equation (II.17) of chapter II is reproduced in table IV.4.

Table IV.4

	U.S. pos	U.S. neg	U.S. gross	U.K. pos	U.K. neg	U.K. gross
$var(y-y^{dev})/var(y)$	1.44	0.63	0.03	1.55	0.83	0.61
$var(y^{dev})/var(y)$	0.16	0.079	1.026	0.42	0.024	0.14
$2cov(y,y-y^{dev})/var(y)$	-0.60	0.287	-0.056	-1.0	0.07	0.24

Source: Davis and Haltiwanger (1992), chapter II

The first row shows the contribution of aggregate and sectoral effects in explaining the total time variation in gross job flows, while the second row shows the idiosyncratic effects. The covariance term in the final row indicates whether the idiosyncratic shocks counteract or reinforce the aggregate and sectoral effects. A positive sign indicates a reinforcement, while a negative sign indicates a counteraction. For both the U.S. and the U.K. the aggregate and sectoral effects explain most of the time variation in job creation and job destruction. The idiosyncratic effect strongly counteracts the procyclical movements in job creation, while it reinforces the countercyclical movement in job destruction, although the latter is very weak for the U.K.. It is exactly this weak effect which causes the difference between the U.S. and the U.K. in explaining the time variation in the gross job reallocation rate. In the U.S. it is predominantly the idiosyncratic effects which explain most of the time variation, while in the U.K. it is the aggregate and sectoral effects. The reason is that in the U.K. the reinforcement of the countercyclical movement in job destruction is weak, as indicated by the low covariance term in the second column, while this is not so in the U.S..

Whether the cyclical properties reported here are stylized facts has to be investigated when more comparable data over long time spans become available. Perhaps, the asymmetry between job creation and destruction observed in both the U.S. and the U.K. are very typical for that time period, including two oil shocks. Perhaps, they are typical for the manufacturing sector.

IV.5. Summary and Conclusion

In this chapter I gave an overview of the existing empirical literature on gross job flows. Consistent cross-country comparisons of gross job creation, destruction and reallocation rates are difficult for a number of reasons, including differences in sample periods, industrial coverage, the nature of the data, etc.. Despite the shortages of the available data, I attempted to make a comparison of manufacturing gross job flow rates across nine countries. There are clear differences between countries, in particular between the U.S. and European countries, the latter look more similar.

There could be several reasons why there exist differences in gross job flow rates across countries. I reported preliminary evidence that the institutional arrangements on bargaining, industrial policy and employment protection legislation affect gross job reallocation rates. I concluded this chapter with stressing the cyclical similarities between the U.S. and the U.K.. A consistent comparison across many countries such that statistical inferences are possible is the obvious next step on the research agenda. However, this will only be possible if better and more plant or firm level data become available.

PART II

WAGE DETERMINATION AND FIRM PERFORMANCE

In the second part of the thesis I address the more traditional problems in labour economics. In part I, the emphasis was on the flows of jobs and thus the analysis can be classified under the *flow approach* in labour economics. Over the past couple of decades or so, there have been two other approaches in the literature in labour economics which received substantial attention,in particular the *efficiency wage literature* and the *union* literature. The remainder of the thesis will be devoted to these two approaches.

In chapter V I analyze the process of wage determination under the assumption of efficiency wage determination on the one hand and union wage bargaining on the other. The approach I pursue is very alternative. I explicitly model spillovers from the product market to the labour market and vice versa, which allows me to obtain a number of unique predictions and as such I am able to develop a *direct* test of the efficiency wage hypothesis. In chapter VI I focus exclusively on unions and in particular I investigate how unions affect employment growth at the firm level, over and above the union-wage effect on growth.

CHAPTER V: ENDOGENOUS WAGE DETERMINATION AND PERFORMANCE[1]

V.1. Introduction

In this chapter I consider a duopoly in which wages are determined endogenously. I consider two widely discussed forms of wage determination, the efficiency wage hypothesis on the one hand and union wage bargaining on the other. Efficiency wage theories in recent years have been put forward as attractive ways of explaining involuntary unemployment and other aspects of the labour market. To find direct evidence of efficiency wage payments has proven to be quite difficult. Studies in the U.S. have documented large and persistent inter-industry and firm wage differentials (Krueger and Summers, 1988; Blackburn and Neumark, 1988; Katz and Summers, 1989; Groshen, 1991 and Gibbons and Katz, 1992). These studies used wage equations to examine and reject the hypothesis that competitive and bargaining theories can explain a hundred percent of the wage differentials that exist in U.S. industry. Indirectly they see this proof by contradiction as evidence for the existence of efficiency wage payments. There is no general proxy in empirical work for the presence of efficiency wage payments. A union dummy is usually considered to be a

[1]This chapter is joint work with Paul Walsh and is published in The Economic Journal, Vol. 104, pp. 542-555.

good proxy for the effect bargaining has on wage determination, but the best general evidence for efficiency wage payments is seen to be the above proof by contradiction approach. This is very indirect evidence. Different control variables and estimation techniques can reduce the size of the unexplained wage differentials. This certainly casts a doubt on whether the unexplained differentials are really only due to efficiency wage payments. It also leaves it open to debate whether efficiency wage payments can really explain any of the estimated unexplained wage differentials.

Yellen's (1984) efficiency wage model captures the essence of the efficiency wage argument which is present in all models of efficiency wage payments. Its results can be generalised to be true of all efficiency wage models[1]. The key feature of all these models is that the wage has a dual function. One is to hire labour and the other is to create incentives that reduce efficiency costs. Our key insight is to note that the wage premium is only a fraction of the product market rent it creates. This is quite a different type of rent sharing to that under wage bargaining. This is a share in additional rent created by the wage premium itself rather than a share in the absolute rent created by the firm. The argument pursued here is simple. Wage growth due to efficiency wage payments induces better product market performance. The firm will only commit to paying wage premium incentives *if and only if* there is some net gain in product market performance from doing so or else the firm would not undertake the efficiency wage payment.

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[1] There are five important efficiency wage models that explain why firms find it *profitable* to pay wages above the opportunity cost of labour. The Shirking Model (Shapiro and Stiglitz, 1984), The Labour Turnover Model (Salop, 1979), The Adverse Selection Model (Weiss, 1980), The Sociological Models (Akerlof, 1984) and The Union Threat Model (Dickens, 1986).

The theory I develop tracks vertical spillovers from an *upstream* labour market to a *downstream* product market and vice versa. Specifically, I track vertical spillovers within Sutton's (1991) general oligopoly framework under three alternative theories of wage determination. Figure V.1 shows three vertical spillovers that flow downstream into the product market.

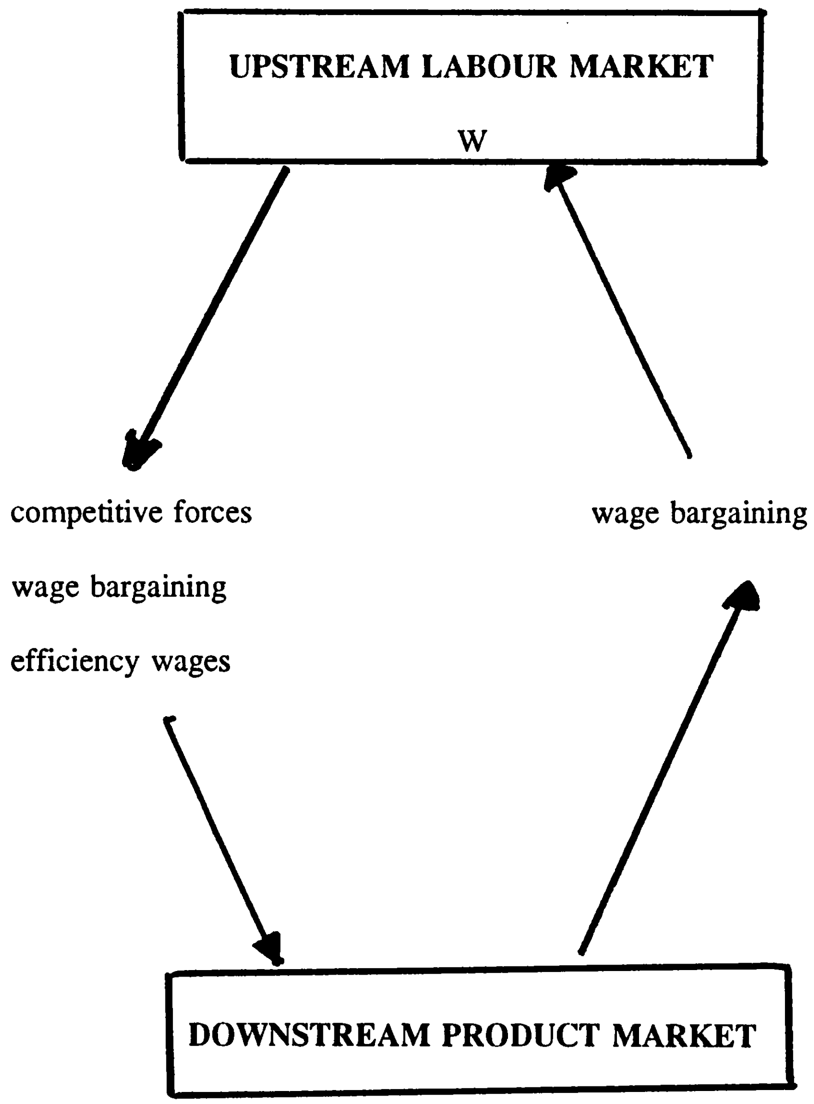


Figure V.1

One is due to variations in the opportunity cost of labour. This is a proxy in a partial equilibrium model for all competitive explanations of wage growth. Another is due to variations in efficiency wage payments. This is shown to be only a downstream vertical spillover. There is no upstream spillover in the presence of efficiency wage payments. The presence of wage bargaining drives a two way vertical spillover. I show that an upstream vertical spillover can only exist under rent sharing due to wage bargaining. I conclude from the theory that a positive relationship between a firm's market share performance and wage growth in the downstream market can only be explained by a downstream spillover created by efficiency wage payments.

To find evidence of efficiency wage payments in firms I take a very different road to the one taken by the proof by contradiction approach. Using U.K. panel data, I set out to pinpoint the downstream spillover due to efficiency wage payments by *constraining the data* with the theory. I wish to show that this spillover drives a positive relationship between the firm's wage and performance in the product market and can be taken as direct evidence of efficiency wage payments. The approach is in the same spirit of the more direct tests of efficiency wage theories which test the prediction of a well know efficiency wage model. Most efficiency wage theories predict a positive relationship between wage premium incentives and performance. Up to now performance was measured in a very specific way which related to a particular model of efficiency wage theory[2]. In Figure V.2 I demonstrate the more general

[2] Performance has been measured in terms of self-reported effort, worker and pay satisfaction, training costs, absences, turnover, job queues and productivity (Levine, 1986 & 1992, Bielby and Bielby, 1988, Akerlof et al., 1988, Holzer et al. 1988, Allen, 1984, Holzer, 1990, Wadhwani and Wall, 1991 and Machin and Manning, 1992).

approach followed here. Wage premiums are paid to create incentives that are cost reducing or productivity enhancing. This can be done in many ways as put forward by the existing theories of efficiency wages. The feature that is common to all theories is that the wage premium incentives will lead to better product market performance or else the firm would not undertake the efficiency wage payment. Exactly how the wage premium incentive reduces efficiency costs I treat as a *black box* but the net outcome will always result in better product market performance. The problem of this approach is clear. If the door is open to alternative theories this approach still can only be seen as indirect evidence for efficiency wage payments. *The finger print of a thief has to match exactly your suspect if you wish to use it as evidence for a conviction.*

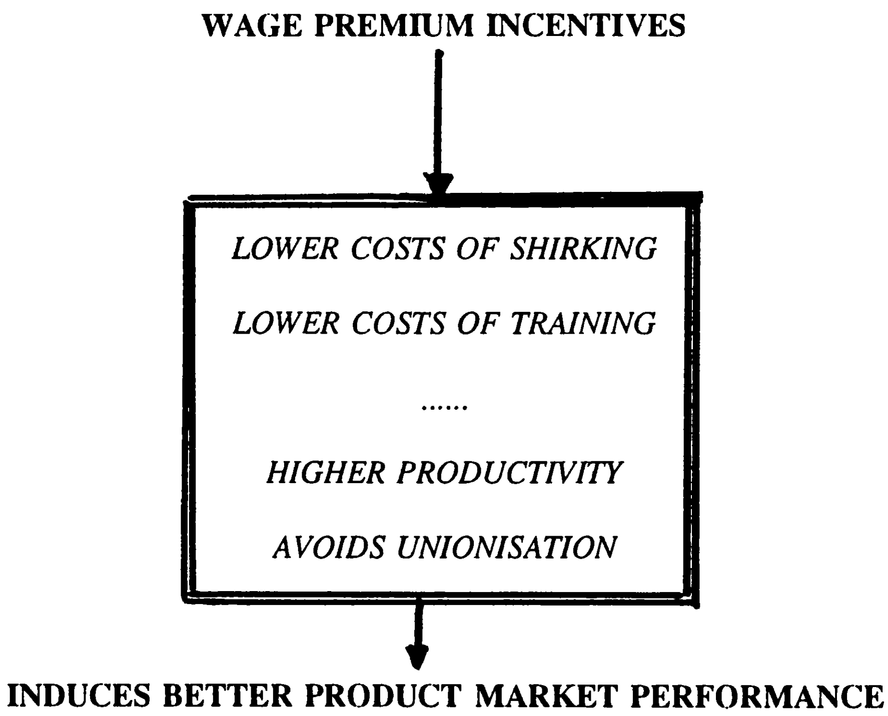


Figure V.2

Section V.2 develops the generalised efficiency wage oligopoly model. In this section I examine the downstream vertical spillovers due to variations in efficiency wage payments and in the outside option available to workers. Section V.3 develops the generalised wage bargaining oligopoly model. In this section I examine the *two way* vertical spillovers due to the presence of wage bargaining. Section V.4 generalises what I wish to carry from the theory on vertical spillovers to the empirical work. In section V.5 I *constrain the data* with my theory to pinpoint the vertical spillover due to efficiency wage payments and I conclude with the empirical evidence.

V.2. The Generalised Efficiency Wage Oligopoly Model

In this section I will determine the relationship between the wage paid in a firm and market share performance within a generalised efficiency wage oligopoly model. I work with two vertical spillovers. One is induced by changes in the outside option of labour and the other by changes in efficiency wage payments. I model the *product market* within a general oligopoly model. The generalised oligopoly model originates from Sutton (1991). Under oligopoly, the equilibrium price a firm faces can be modelled to vary from the monopoly price to the competitive price level, as summarised by the function P(N) in Figure V.3. Where N stands for the number of firms and P is price. This function summarises the different equilibrium price outcomes I can model under oligopoly for a given historically determined level of concentration. By changing the type of strategic competition and the degree of product differentiation in the model, it is possible to generate any price which lies in between the two extremes[3]. I will model price competition to be either very weak or extremely strong which will lead me to state the general oligopoly result. I work with homogeneous Cournot competition as a *building block* to model weak price competition and homogeneous Bertrand competition as a *building block* to model the limit of strong price competition. I obtain the general oligopoly result by assuming that if a relationship between two variables holds at the two extremes, it will also hold for any intensity of price competition that you wish to model in between these two extremes. Furthermore, if there are changes as I move from the one extreme to the other, I make the assumption that these changes will occur gradually and continuously as I strengthen the *toughness of price competition* in the general oligopoly model.

[3] You will always get a unique equilibrium price outcome if you impose product differentiation exogenously on the demand conditions you work with.

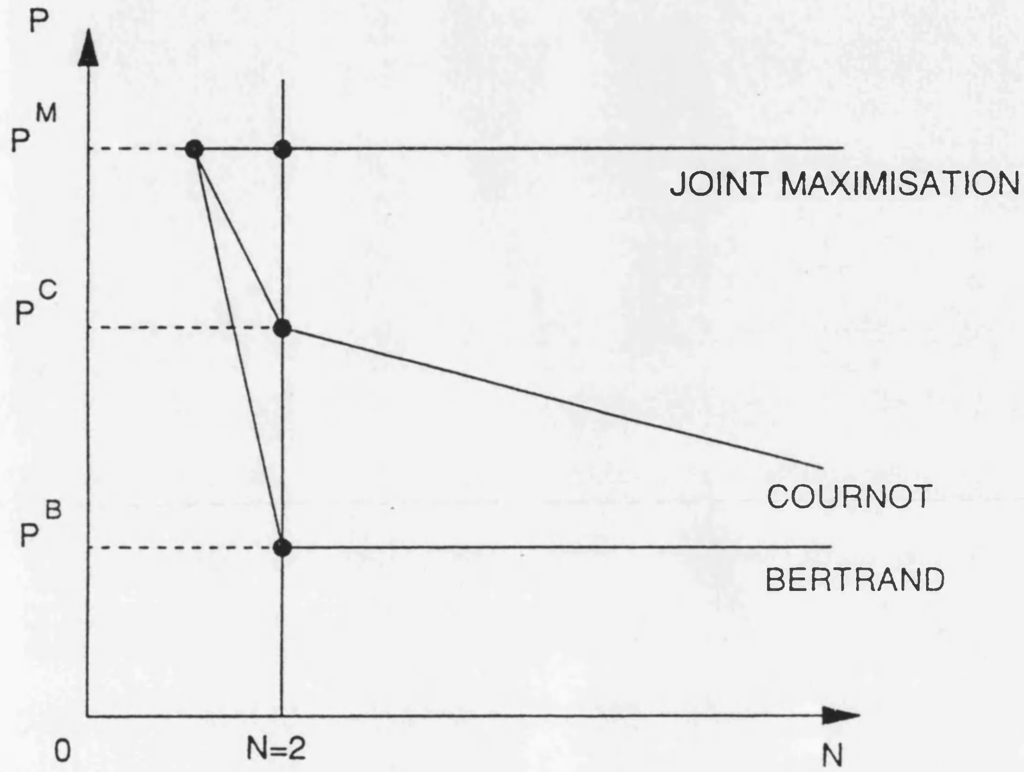


Figure V.3

Note 4: *Chapter V, p 143*

In the production function (V.2) effort enters multiplicative with employment. This is a quite common modelling procedure in the efficiency wage literature (see Layard, Nickell and Jackman, 1991). However, it is possible to think of a more general form of the production function (V.2). An alternative would be specified as the following: (V.2') $X = F(e,L)$, $F_e > 0$, $F_{ee} < 0$ and $F_L > 0$, $F_{LL} < 0$.

In this case the *separation principle* (discussed on p 145) will no longer hold. In the current framework this would imply that next to the downward spillover from the product market to the labour market there will also be an upstream spillover from the product market to the labour market. For instance, if conditions in the product market are such that there is an exogenous increase in the marginal product of labour, there will be a positive upstream spillover (a positive wage effect). The way to control for this possibility in the empirical implementation is the same as in the case of bargaining. By instrumenting the wage appropriately, it is possible to exclude the upstream spillover, i.e. the causality from the downstream product market to the upstream labour market. By instrumenting the wage, it is only the downstream spillover from the labour market to the product market which is picked up. In this case, there will still be a positive relationship between the wage paid and market share performance, only under the hypothesis of efficiency wage payments, as long as the increase in effort is bigger, than the increase in the wage, thereby reducing efficiency wage costs. If however, the increase in effort is smaller than the increase in wages, there will also be a negative relationship between the wage paid and market share performance.

I model the *labour market* by embedding an efficiency wage model into the general oligopoly model. I can see this as a version of Yellen's (1984) general efficiency wage model. As I outlined in the introduction, Yellen used this model to capture the essence of the efficiency wage argument. The results can be generalised to be true of all efficiency wage models. Two firms produce a homogeneous product with one factor of production, labour. Firm 1 produces X and earns a payoff π, while firm 2 produces Y and earns a payoff π^*. The inverse demand curve is written as the following:

(V.1) $$P = P(X + Y) : \quad P'(\cdot) < 0 \quad P''(\cdot) = 0$$

Where P is the industry price. The firms have access to the following technologies. I write the technology to firm 1 as the following:

(V.2) $$X = F(e.L) \quad : e(W - A) = 1 + \delta(W - A)^{\alpha} , \delta \geq 0, 0<\alpha<1$$

Output in firm 1 is a function of efficiency units of labour. L is employment and e are units of worker effort in firm 1.* I assume the production function exhibits diminishing marginal productivity in efficiency units of labour ($F'(\cdot) > 0 \quad F''(\cdot) < 0$). A is the outside option for workers in firm 1 and is a proxy in partial equilibrium for all competitive explanations of wage growth. δ is a parameter that proxies for exogenous conditions in firm 1 that facilitate efficiency wage payments. When δ is equal to zero e is equal to one and firm 1 will go back to having a conventional production function. The effort function also exhibits diminishing marginal effort by workers in

Please see Note 4

response to wages above the opportunity cost of labour ($e'(\cdot) > 0 \quad e''(\cdot) < 0$). I write the technology to firm 2 as the following:

(V.3) $$Y = F^{*}(e^{*}.L^{*})$$

I assume firm 2 works with a conventional production function and I set $e^{*} = 1$. In other words, wages are considered to be set exogenously. This is done for expositional simplicity. Where L^{*} is employment in firm 2. I also assume the production function exhibits diminishing marginal productivity of labour ($F^{*\prime}(\cdot) > 0 \quad F^{*\prime\prime}(\cdot) < 0$). Finally, I write the payoff functions for firm 1 and 2 respectively as the following:

(V.4) $$\pi = P(X + Y).X - W.L$$

(V.5) $$\pi^{*} = P(X + Y).Y - W^{*}.L^{*}$$

Where W is the per unit wage cost of workers in firm 1 and W^{*} is the per unit cost of workers in firm 2.

The Vertical Spillovers Under Weak Price Competition: Both firms move simultaneously and unilaterally. Firm 1 chooses L and W to maximise π holding L^{*} constant. Firm 2 chooses L^{*} to maximise π^{*}, given W^{*}, holding L constant. I first analyze employment and wage setting in firm 1 by writing down its first order conditions for profit maximisation.

(V.6) $\pi_L = P(1+1/\eta).F' - W/e = 0$

(V.7) $\pi_W = P(1+1/\eta).F' - 1/e' = 0$

The employment and the wage level are set to equate the marginal revenue product of labour (η = price elasticity of industry demand) , which is conditional on L^*, to the respective per unit cost. The second order conditions $D_0 = \pi_{LL} < 0$ and $D_1 = \pi_{LL}.\pi_{WW} - \pi_{LW}.\pi_{WL} > 0$ must be satisfied for a maximisation.

The efficiency wage that is set in firm 1 turns out to be independent of how I model the product market. To see this I look at the first order conditions for firm 1 and see what they imply for wage setting. Using (V.6) and (V.7), the wage in firm 1 is set where the percentage change in effort due to a percentage change in the wage is unity. This is a well known Solow Condition.

(V.8) $W/e = 1/e' \Rightarrow \varepsilon = (de/dW).(W/e) = 1$

The optimal wage and hence effort level is set where $\varepsilon = 1$. This is an important *separation principle* that held under perfect competition in Yellen (1984), but also holds under imperfect competition in the product market. Using (V.8) and (V.2) I can express the optimal efficiency wage and its partial derivatives with respect to δ and A as the following:

(V.9) $(W/e)^0(A, \delta, \alpha) : (W/e)^0_\delta < 0 , (W/e)^0_A > 0$

The optimal efficiency wage is increasing in A holding δ and α constant and decreasing in δ holding A and α constant. Both an increase in the opportunity cost of labour and an improvement in the conditions that facilitate efficiency wages will cause a rise in the equilibrium wage level but the latter leads to a fall in efficiency wage costs and the former leads to an increase. Wage growth due to efficiency wage payments reduces efficiency costs and acts like a subsidy and will be shown to lead to better product market performance. Wage growth due to external conditions that drive up the opportunity cost of labour will increase efficiency costs and act like a tax on product market performance. Note that from (V.9) the optimal efficiency wage is set independent of product market factors and hence there are no upstream vertical spillovers from the product market to wage determination in the labour market. I can re-express (V.6) as the following, assuming that the efficiency wage level set by firm 1, satisfies the Solow Condition. This will give the condition for optimal employment setting in firm 1.

(V.10) $$\pi_L = P(1+1/\eta).F' - (W/e)^0 = 0$$

$$\Rightarrow \quad L = R(L^*)$$

Employment in firm 1 is set at a level where the marginal revenue product of labour is equal to the per unit efficiency wage cost. This is conditional on L^* and $(W/e)^0$. It is also expressed as the optimal response function of firm 1. Optimal employment setting in firm 2 is based on the following first order condition.

$$\text{(V.11)} \qquad \pi^*_{L*} = P(1+1/\eta^*).F^{*\prime} - W^* = 0$$

$$\Rightarrow L^* = R^*(L)$$

Employment is set at a level where the marginal revenue product of labour, which is conditional on L, is equal to the per unit wage. The wage is exogenously given. The second order condition $D^*_0 = \pi^*_{L*L*} < 0$ must be satisfied. I can also express (V.11) as the optimal response function of firm 2. The following implies uniqueness and stability of the Nash equilibrium in employment setting.

$$\text{(V.12)} \qquad D \equiv \pi_{LL}.\pi^*_{L*L*} - \pi_{LL*}.\pi^*_{L*L} \quad > 0$$

Where $\pi_{LL*} = \pi^*_{L*L} < 0$. The solution functions for the employment levels can be solved from the first order conditions (V.10) and (V.11). Taking a total differential of (V.10) and (V.11) while holding W^* constant, then by applying Cramer's rule I find the comparative static effects of changes in $(W/e)^0$ on the employment levels. I express them as the following:

$$\text{(V.13)} \qquad L^0 = \phi_1(W^*, (W/e)^0) : dL/d(W/e)^0 = \pi^*_{L*L*}/D < 0$$

$$L^{*0} = \phi_2(W^*, (W/e)^0) : dL^*/d(W/e)^0 = -\pi^*_{L*L}/D > 0$$

A fall in the optimal efficiency wage (a rise δ) will increase the employment level in firm 1. To a lesser extent it will lead to a fall in employment in firm 2. A rise in the optimal efficiency wage (a rise in A) has the opposite effect on the employment levels. Using (V.2),(V.3) and (V.13) I solve for the solution function for market share (Φ) and I can get the partial derivatives of the function with respect to $(W/e)^0$ as the following:

$$\text{(V.14)} \qquad \Phi = \Phi(\, W^*, (W/e)^0 \,) \; : \Phi_{(W/e)^0} < 0, \; \Phi_{(W/e)^0 (W/e)^0} > 0$$

Market share is negative and increasing in the optimal efficiency wage that is set. In particular, market share increases as δ rises ($(W/e)^0$ decreases), at an increasing rate and decreases with increases in A ($(W/e)^0$ increases) at an increasing rate. I have two downstream vertical spillovers in this model. When conditions external to the firm change the opportunity cost of its workers, this drives a negative and increasing relationship between a firm's wage and its market share performance. When conditions change that increase the responsiveness of workers to wage premium incentives this drives a positive and increasing relationship between a firm's wage and its market share performance.

In Figures V.4a,b and V.5 I give a diagrammatic illustration of the effect of a change in the wage driven by efficiency wage payments and its result on market share performance. I start from a symmetric equilibrium where $X_0=Y_0$. Figure V.4a illustrates the technologies for the two firms and the equilibrium output levels as a function of the efficiency units of labour hired. Figure V.4b shows us the conditions for optimal employment setting. Employment in both firms is set where the conditional marginal revenue product of labour is equal to a firm's efficiency wage level. The efficiency wage in firm 2 is set exogenously by assuming that $e^*=1$. The efficiency wage in firm 1 is set where the Solow Condition is satisfied. This is shown in Figure V.5 where $\varepsilon=1$ at W_0 and e_0. In the symmetric equilibrium $(W/e)^0 = W^*$ and employment is also set at the same level $L_0=L^*_0$.

I wish to demonstrate the effect a change in δ has on the market share and the wage set by firm 1, holding A and W^* constant. A rise in δ from δ_0 to δ_1 leads to a rise in W_0 to W_1 and to a greater extent a rise in e_0 to e_1 as shown in Figure 5 where again $\varepsilon=1$. This leads to a fall in the optimal efficiency wage level to $(W/e)_1$. This causes a rise in employment (output) in firm 1 and to a lesser extent a fall in employment (output) in firm 2 as summarised in Figure V.4. In firm 1 the workers get some share of the extra rent they create from being more productive. The firm uses the wage for a dual function. One is to hire labour, the other is to improve worker productivity. The efficiency wage is lower and the firm becomes more cost competitive in efficiency terms relative to its rival. The firm 1 gains market share even though it seems to have a higher unit wage cost. One might expect market share to decline at a diminishing rate as δ rises as I have assumed diminishing marginal productivity in both firm's production functions. One should note from Figure 4b that the conditional demand for labour under Cournot competition shifts up in response to δ as employment in firm 2 falls. To a greater extent the conditional demand for labour for firm 2 shifts down under Cournot competition in response to a rise in δ. This process leads to market share to rise at an increasing rate for firm 1. The comparative static effects of a change in A can be shown to have the opposite effects of a change in δ starting from the symmetric equilibrium in Figures V.4 and V.5.

Figure V.4a

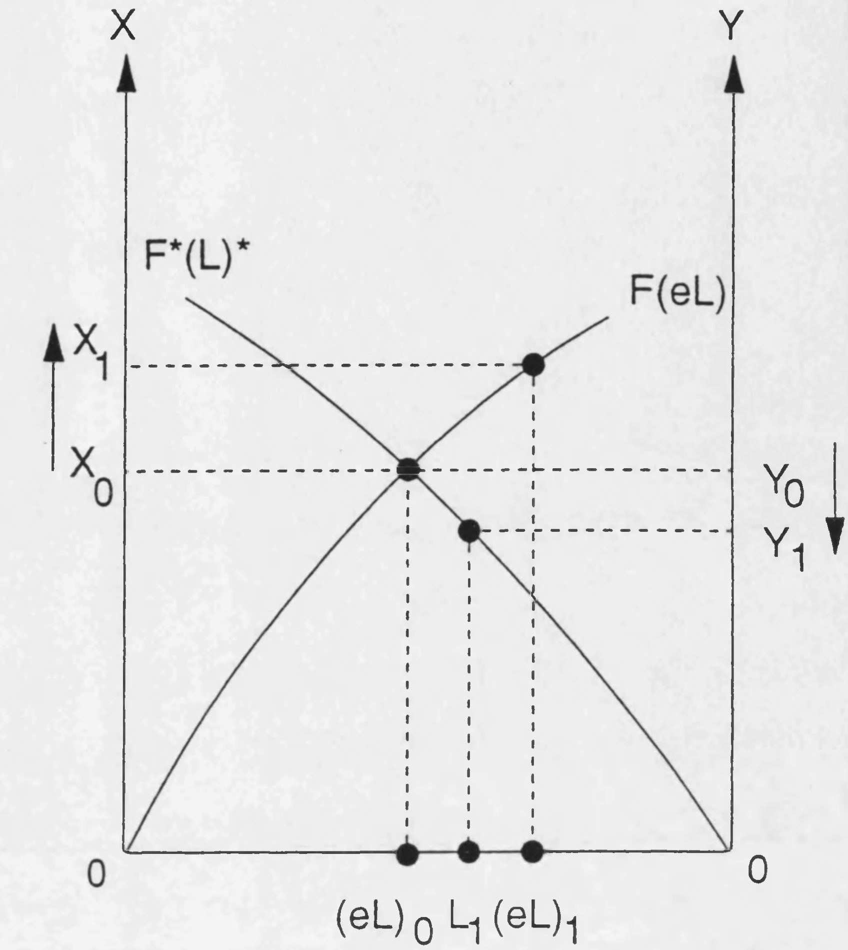
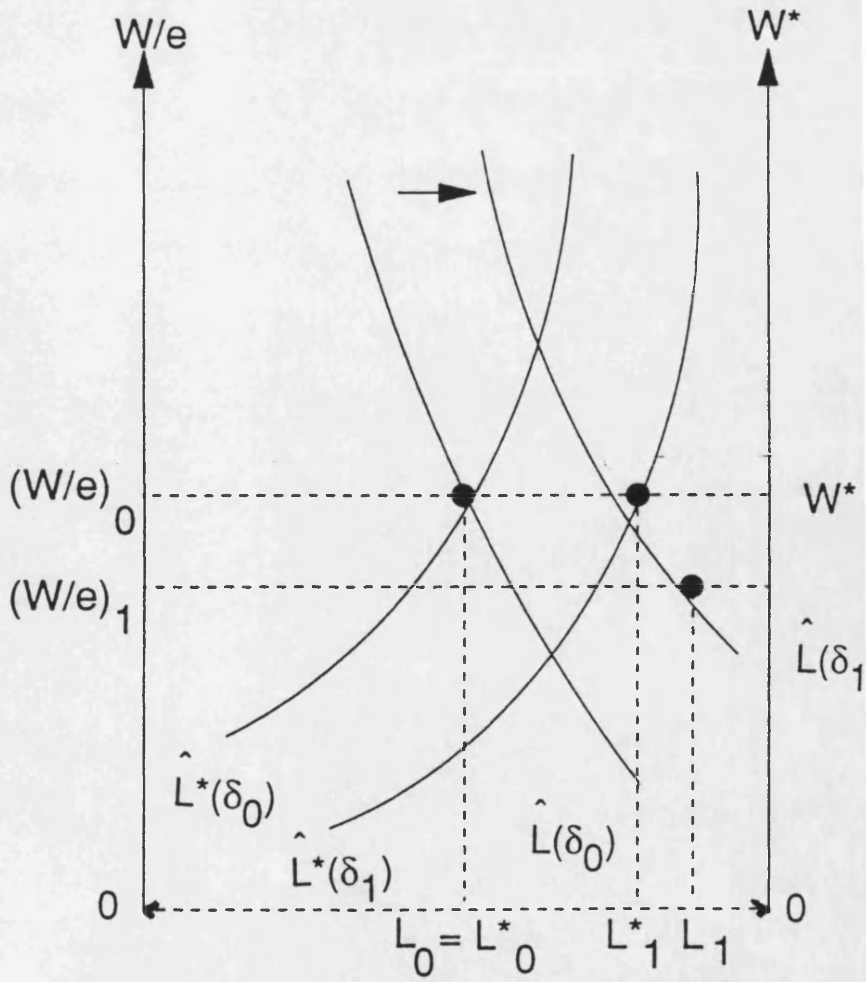


Figure V.4b



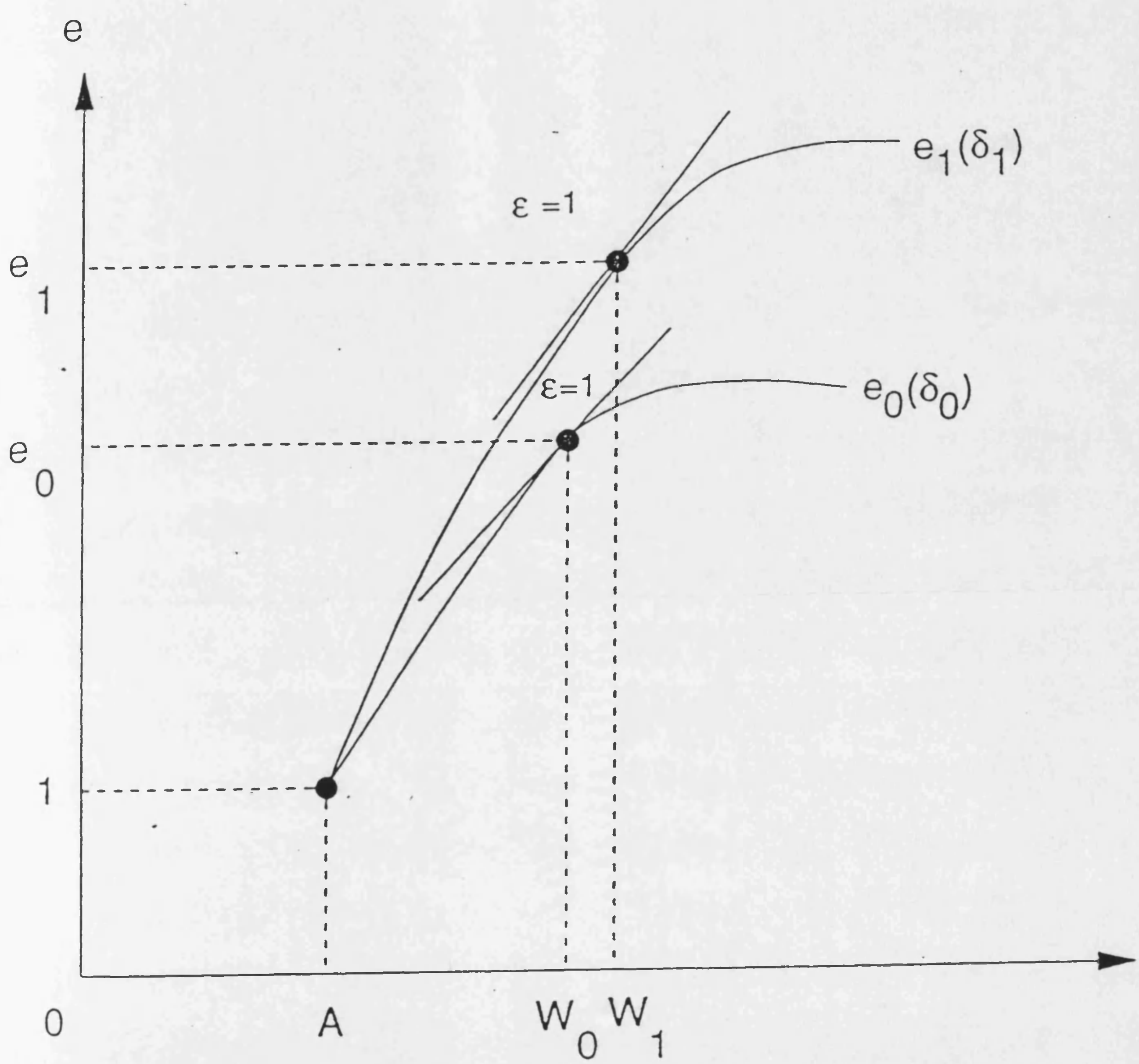


Figure V.5

The Vertical Spillovers Under Strong Price Competition: I now examine whether the downstream vertical spillovers drive the same relationship under the limit of strong price competition. The firms produce a homogenous product. Firm 1 is assumed to set the optimal efficiency wage level $(W/e)^0$, where the Solow condition is satisfied ($\varepsilon = 1$). Firm 2 takes its wage as given or alternatively where e^* is fixed at one. They unilaterally and simultaneously set their respective price levels under the common strategy used. Firm 1 chooses P to maximise π, given $(W/e)^0$, holding P^* constant. Firm 2 chooses P^* to maximise π^*, given W^*, holding P constant. In the case of symmetric efficiency wage costs, it is easy to show, with a proof by contradiction, that the price that induces a Nash equilibrium is a price $P^e = (W/e)^0 = W^*$. This implies that both earn a zero economic profit and share the market. This is the symmetric equilibrium of the game.

I next look at the comparative static effect of a change in δ, holding W^* and A constant. Starting from a symmetric equilibrium, a rise in δ by the smallest amount in firm 1 will ensure firm 1 enjoys all the market, while firm 2 will choose not to enter. In particular, a rise in δ implies a lower optimal efficiency unit wage cost in firm 1, so that the equilibrium price P^e if both firms entered the market would be $(W/e)^0 \leq P^e < W^*$, leading firm 2 not to enter the market. Note however that $W > W^*$. So although firm 1 is paying a higher wage, in efficiency cost terms firm 1 is the low cost producer. Market share under weak price competition is positive and increasing in δ, holding W^* and A constant. This relationship still holds under the limit of strong price competition. Market share increases with a rise in δ but at the fastest rate possible. It causes market share to rise to one.

I next look at the comparative static effect of a change in A, holding W^* and δ constant. Starting from a symmetric equilibrium, a rise in A by the smallest amount in firm 1 will ensure firm 2 enjoys all the market, while firm 1 will choose not to enter. In particular, a rise in A implies a higher optimal efficiency unit wage cost in firm 1, so that if firm 1 was to enter the market the equilibrium price would be set $W^* \leq P^e < (W/e)^0$, leading firm 1 not to enter the market. Market share under weak price competition is negative and increasing in A, holding W^* and δ constant. This relationship still holds under the limit of strong price competition. Market share decreases with a rise in A but at the fastest rate possible. It causes market share to fall to zero.

Vertical Spillovers Within The General Oligopoly Model: I looked at the downstream vertical spillovers under the assumption of either extremely strong or weak price competition. I could model the different intensities of price competition in between these two extremes as summarised by the P(N) function in Figure V.3. As I outlined, if a result holds at the two extremes, I assume it will hold for any degree of intensity of price competition I could model in between these extremes. The predictions regarding the above vertical spillovers hold at the two extremes of the P(N) function and Proposition 1 summarizes the general result I take from the efficiency wage oligopoly model.

Note 5: *Chapter V, p 154*

Rewording of the Propositions

Proposition 1: p 154

(i) The downstream vertical spillover due to efficiency wage payments (changes in δ) leads to a positive relationship between a firm's market share performance and the wage paid in the firm, independently of how the toughness of price competition in the product market is modelled.

(ii) The downstream vertical spillover due to changes in the outside option (A) for workers leads to a negative relationship between a firm's market share performance and the wage paid in the firm, independently of how the toughness of price competition in the product market is modelled.

Proposition 5: p 165

To find a positive relationship between a firm's market share performance and the wage paid in the firm in a market share equation, when controlling for rent sharing due to wage bargaining, can be seen as evidence for the presence of efficiency wage payments.

*

Proposition 1: *(i) The downstream vertical spillover due to efficiency wage payments drives a positive and increasing relationship between a firm's market share performance and its unit wage cost, independently of how the toughness of price competition in the product market is modelled.*

(ii) The downstream vertical spillover due changes in the outside option for workers drives a negative and increasing relationship between a firm's market share performance and its wage paid, independently of how the toughness of price competition in the product market is modelled.

There is another general result that emerges from looking at the two extremes of price competition in the general oligopoly model. I stated that I would assume that if any change occurred by moving from weak to the limit of strong price competition that this change is assumed to be gradual and continuous for the different degrees of the toughness of price competition I could model in between. The downstream spillovers in the limit of strong price competition causes market share to change at the fastest rate possible. The general result I take from this is summarised in Proposition 2.

Proposition 2: *The downstream spillovers from wage determination into the product market due to efficiency wage payments and changes in the outside option that workers face, have stronger effects on market share determination, the more intensive price competition is modelled in the product market.*

* Please see notes

V.3.The Generalised Wage Bargaining Oligopoly Model

In this section I look for predictions about the relationship between wage growth and market share performance in the presence of wage bargaining. I focus only on the *two way* vertical spillovers generated by the presence of wage bargaining. The analysis of the downstream spillover due to A is the same as outlined in Section I and will not be repeated. There is empirical evidence to suggest that price cost mark-ups in product markets are very much influenced by the presence of unions. This is a result of a downstream spillover in the presence of wage bargaining.[4] There is also empirical evidence on the influence a price cost mark-up has on the wage mark-up created by union activity. This is a result of an upstream spillover in the presence of wage bargaining.[5] As in Dowrick (1989) I want an analysis that allows us to look at the interaction of the labour and product market to determine the division of the absolute product market rent. I set out to demonstrate the downstream and upstream spillovers that operate in the presence of wage bargaining. I model the product market as in Section V.2 and the labour market within a generalised bargaining framework. I model wage bargaining in the presence of a union. Obviously wage bargaining and the two way spillovers that result can take place in the absence of union

[4] Freeman (1983), Voos and Mishel (1986) and Domowitz et al. (1988) all report that unionisation in US manufacturing reduced price over marginal cost mark-ups for all industry groups. Evidence from the UK by Karier (1985) and Dowrick (1990) also show that unions reduce price cost margins in oligopolistic industries.

[5] Stewart (1990) in the U.K. finds that unions establish bigger mark-ups in firms with greater market power and market share. There is also evidence from Belgian Manufacturing Sectors (Bughin, 1991a,b) that unions are able to extract a significant amount of rent from the highest market share firms.

representation. The set-up for firms in this section is exactly the same as in Section V.2 when I set e=1. I work with equations (V.1) to (V.5) when e=1. I introduce a union into firm 1 only. The union is risk neutral and maximises the following function in which the union only gets utility from a wage above the outside option for its workers.

(V.15) $$U(W) = (W - A)$$

The Vertical Spillovers Under Weak Price Competition: Firm 1 bargains with the union over the wage level, while holding L and L^* constant. Bargaining is over the wage only and firm 1 maintains the *Right To Manage.* Given (V.15), efficient contracts will lie on the labour demand curve[6]. The wage level of firm 2 is set exogenously for expositional simplicity. Simultaneously to the wage bargain, firm 1 (firm 2) unilaterally chooses L (L^*) to maximise $\pi(\pi^*)$, holding W (W^*) and L^* (L) constant.

To model *wage setting* in firm 1 I use the (generalised) asymmetric Nash bargaining solution for (two player) non-cooperative bargaining environments which approximates the unique perfect equilibrium outcome of a strategic time preference

[6] There exists no consensus over the empirical "truth" of alternative union bargaining models. Evidence is found in both the US and UK for the assumption made in (V.15), Farber (1986), Oswald (1987), Clark and Oswald (1989) and Layard et al. (1991). If employment does enter into the utility function of the union U(W,L), the employment that is set on the labour demand curve will not be an efficient outcome for the firm or the union. Both can do better by moving off the demand curve and setting wages and employment on the contract curve. This efficiency argument is made by MacDonald and Solow (1981).

model[7]. The Nash bargaining solution is obtained by maximising the Nash product of the payoff functions for the two parties net of opportunity costs (threat points). I express the generalised Nash product as the following:

(V.16) $$\Omega = (U - U^{*})^{\beta}.(\pi - \pi^{*})^{1-\beta}$$

Where U^{*} is the opportunity cost of the union and π^{*} is the opportunity cost of the domestic firm. The threat points in this model are $(0,0) = (U^{*},\pi^{*})$[8]. β is the relative bargaining power of the union, which goes up as β approaches one [9]. I rewrite (V.16) using the above and (V.15) as the following.

(V.17) $$\Omega = (W - A)^{\beta}.\ \pi^{1-\beta}$$

To get the Nash bargaining solution I maximise (V.17) with respect to W holding L and L^{*} constant, and I express the first order condition as the following:

---

[7] As the delay between offers approaches zero, the limit of the subgame perfect equilibria of the bargaining game can be calculated using the asymmetric Nash Solution (Binmore et al., 1986 and Osborne and Rubinstein, 1990).

[8] The disagreement or threat points are (0,0). A treat point cannot correspond to an outside option (see Sutton, 1986). The inclusion of the outside option affects the equilibrium outcome of the strategic models only if one of the parties prefers the outside option point to one of the agreement points. Otherwise the threat to leave the bargain is not credible.

[9] The asymmetry cannot be due to asymmetries in preferences or disagreement points in the strategic model that the Nash solution is approximating (as they disappear in the limiting equilibrium outcomes) but rather it is in the bargaining procedure or in parties beliefs about some determinants of the bargaining environment (see Osborne and Rubinstein, 1990).

(V.18) $\Omega_W = d\text{Log}\,\Omega/dW = \beta/(W-A) + [(1-\beta)/\pi]d\pi/dW = 0$

$\Rightarrow (W - A).L = \beta\,.\,\pi/(1-\pi) \quad > 0$

$\Rightarrow W = R^{*}(L,L^{*})$

The wage that is set in the efficient bargain ensures the workers get a share in the product market rent. The share depends on the relative bargaining strength of the two players. This condition is re-expressed as an optimal response function. The wage that is set is conditional on L and L^{*}. The second order condition $\Omega_{WW} < 0$ must be satisfied.

Employment setting in firm 1 is modelled as in Section 2 under weak price competition. The first order condition is the same as equation (V.6) in Section I setting e=1. This leads us to write down the following optimal response function for employment setting in firm 1:

(V.19) $L = R(W, L^{*})$

I do not model *wage setting* in firm 2. The wage is set exogenously. I model *employment setting* as under weak price competition in Section 2. The first order condition is the same equation as (V.11). The second order condition is expressed as $D_2 = \pi^{*}_{L^{*}L^{*}} < 0$. This gives firm 2's optimal response function in employment setting:

(V.20) $L^{*} = R(L)$

The following implies uniqueness and stability of the Nash equilibrium. The principle minors of the following determinant must alternate in sign, starting negative,

$$\text{(V.21)}\quad D = \begin{vmatrix} \Omega_{WW} & \Omega_{WL} & \Omega_{WL*} \\ \pi_{LW} & \pi_{LL} & \pi_{LL*} \\ \pi^{*}_{L*W} & \pi^{*}_{L*L} & \pi^{*}_{L*L*} \end{vmatrix} < 0.$$

The solution functions for the endogenous variables can be solved from the optimal response functions (V.18),(V.19) and (V.20). Taking a total differential of (V.18), (V.6) and (V.11) I apply Cramer's rule to find the comparative static effects of changes in β holding A and W^* constant and changes in W^*, holding A and β constant.

$$W^0 = \Upsilon_1(A, \beta, W^*): \quad W_\beta = -\Omega_{w\beta}.D_1/D > 0, \quad W_{W*} = -D_2/D > 0$$

$$\text{(V.23)}\quad L^0 = \Upsilon_2(A, \beta, W^*): \quad L_\beta = -\Omega_{w\beta}\pi^*_{L*L*}/D < 0, \quad L_{W*} = -D_3/D > 0$$

$$L^{*O} = \Upsilon_3(A, \beta, W^*): \quad L^*_\beta = \Omega_{w\beta}.\pi^*_{L*L}/D > 0, \quad L^*_{W*} = D_4/D < 0$$

Where $D_1 > 0$ and is the same as expression (V.12), and $D_2 = \Omega_{WL*}.\pi_{LL} - \Omega_{WL}.\pi_{LL*} > 0$, $D_3 = \Omega_{WW}\pi_{LL*} - \Omega_{WL*}\pi_{LW} > 0$, $D_4 = \Omega_{WW}\pi_{LL} - \Omega_{WL}\pi_{LW} > 0$. A rise in β in our model is a rise in union bargaining power. In general it represents a downstream vertical spillover in the presence of wage bargaining. A rise in union bargaining power decreases employment and to a lesser extent causes a rise in employment in firm 2. It also causes the wage in firm 1 to rise. In general a rise in W^* represents an upstream vertical spillover in the presence of wage bargaining. It is an exogenous change that improves the market share of firm 1. A rise in W^* increases employment and the wage level in firm 1 and to a greater extent decreases employment in firm 2. A rise in W^* improves the market share of firm 1 and some of the benefits of this gain will be shared in the form of higher wages.

Using (V.23) I can express the solution function for the market share of firm 1 and I can get the partial derivatives of this function with respect to β and W^*.

(V.24) $$\Phi = \Phi(A, \beta, W^*) : \quad \Phi_\beta < 0, \quad \Phi_{W^*} > 0$$

Market share is negative in β and positive in W^*. A change in β represents a downstream vertical spillover due to wage bargaining. A rise in β drives wage growth that disimproves market share performance in firm 1. A change in W^* is an upstream vertical spillover due to the presence of wage bargaining. This represents an exogenous change in the product market that is in favour of firm 1. It leads to a rise in wages induced by better market share performance. In contrast to rent sharing under efficiency wages, rent sharing as a result of wage bargaining creates two way vertical spillovers.

In Figure V.6 I give a diagrammatic illustration of the effect a rise in β has on the endogenous variables, holding A and W^* constant, in firm 1. This is a downstream spillover in the presence of wage bargaining. Figure V.6 shows the efficient bargaining solution, where firm 1's isoprofit and its union's indifference curve are tangent on the conditional demand for labour curve. The optimal condition for employment setting is also satisfied. A rise in the bargaining power of the union leads to a fall in the employment and output of firm 1 and to a lesser extent a rise in the employment and output of firm 2. This shifts out the conditional demand for labour in firm 2 and to a lesser extent shifts in the conditional demand for labour in firm 1. The wage level rises in the revised bargain in firm 1. The union gets a bigger share of a smaller rent. The analysis of the upstream spillover due to wage bargaining is similar to the above. It will lead to a rise in the wage level set in the revised bargain in firm 1. In this case the union gets the same share of a bigger rent. It has the opposite effect on the conditional labour demand curves and market shares for the two firms.

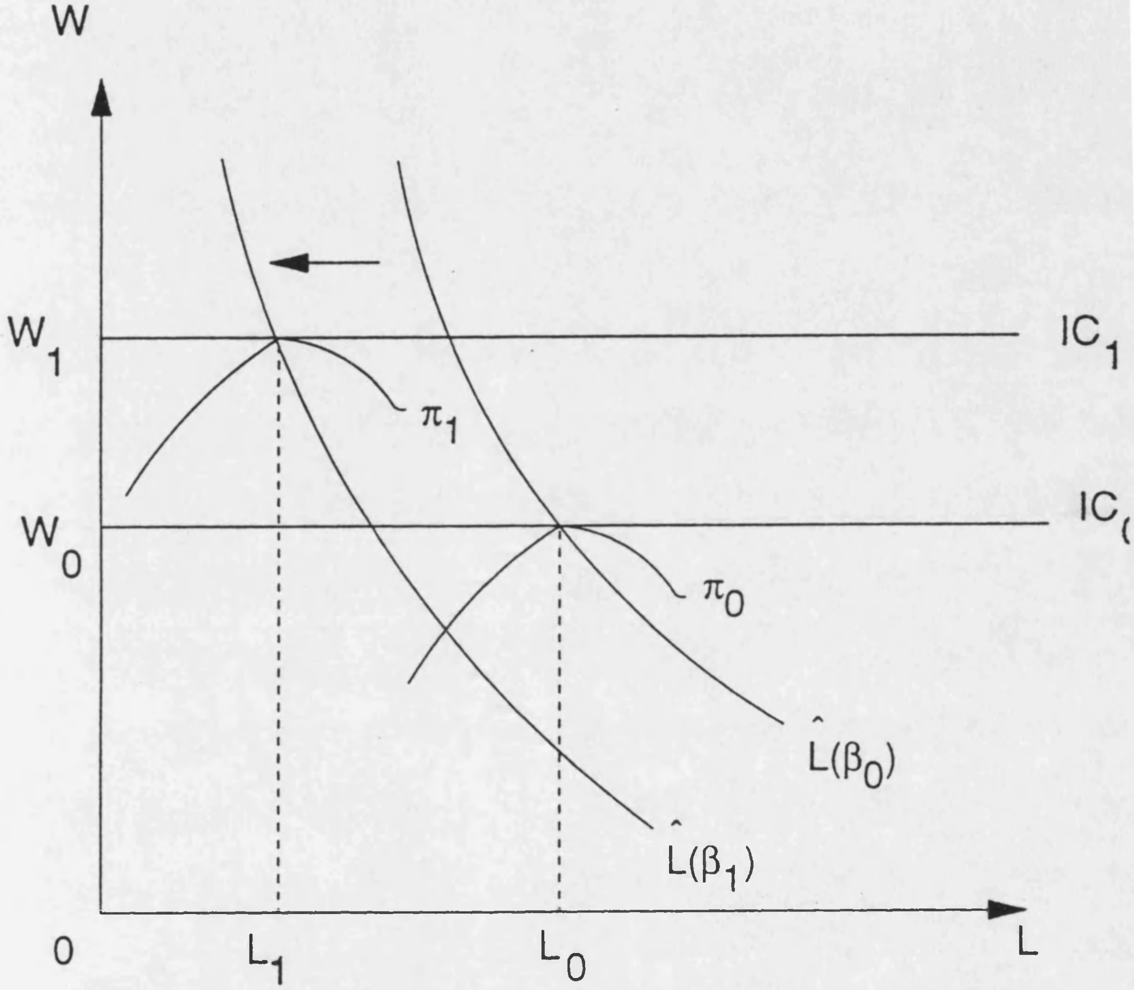


Figure V.6: Effect of a rise in β in firm 1.

The Vertical Spillover Under Strong Price Competition: I examine the two way spillovers under the limit of strong price competition. The firms produce a homogenous product. Firm 1 bargains with the union over the wage level while holding P and P^* constant. The wage level of firm 2 is set exogenously for expositional simplicity. Simultaneous to the wage bargain, firm 1 (firm 2) unilaterally chooses P (P^*) to maximise $\pi(\pi^*)$, holding W (W^*) and P^* (P) constant. In the case where the outside option of firm 1 equals unit wage cost of firm 2 ($A = W^*$), it is easy to show, with a proof by contradiction, that the P^e that induces a Nash equilibrium is $P^e = A = W^*$. This implies that in the short run all players earn a zero economic profit and the firms share the market. This is the symmetric equilibrium of the game.

I next look at the comparative static effect of a change in β, holding W^* and A constant. This is downstream spillover in the presence of wage bargaining. Rents in this model are driven to zero by the degree of price competition. A change in β has no effect on market share or the wage level set. Downstream spillovers in the presence of wage bargaining are zero under the limit of strong price competition. I next look at the comparative static effect of a change in W^* holding β and A constant. This is an upstream spillover in the presence of wage bargaining. The only Nash equilibrium for this game is for firm 2 not to enter the market to leave firm 1 as the monopoly firm and its workers to share the monopoly rent. If firm 2 was to enter the market, firm 1 could set a price $A < W \leq P^e < W^*$ that would ensure losses for firm 2 and gains for firm 1 that would be shared with workers. Any exogenous change in the product market in favour of firm 1 will lead market share to rise to one. Upstream spillovers are strongest under the limit strong price competition.

Vertical Spillovers Within the General Oligopoly Model: In the above two sub sections there are general results emerging within the general oligopoly model. I looked at the two way vertical spillovers in the presence of wage bargaining under the assumption of either extremely strong or weak price competition. I formulate the general results as outlined in Section 2. The general result I take from the analysis on the downstream and upstream vertical spillovers due to wage bargaining are summarised in the following proposition.

<u>*Proposition 3:*</u> *(i) The downstream vertical spillover, due to wage bargaining, drives a negative relationship between the wage and market share performance and becomes weaker by increasing the toughness of price competition in the product market.*

(ii) The upstream vertical spillover, due to wage bargaining, leads to a positive relationship between the wage and market share performance and becomes stronger by increasing the toughness of price competition in the product market.

V.4. The Generalised Predictions

Before I proceed into the empirical analysis I will generalise some of the key results from the theoretical analysis. The key insight is to note that wage growth driven by efficiency wage payments is the only downstream vertical spillover that improves market share performance in the downstream market. The door must be shut tight to other theories of wage determination that predict this outcome. Otherwise I will again end up with indirect evidence of efficiency wage payments in firms. The vertical spillovers that flow downstream due to efficiency wage payments and changes in the outside option get stronger, as I increase the toughness of price competition in the product market. The vertical spillover that flows downstream due to wage bargaining is an exception to this rule.

Wage bargaining is the only theory of wage determination that creates a vertical spillover that flows upstream into the labour market. This upstream spillover becomes stronger as I increase the toughness of price competition in the product market. This again drives a positive relationship between wage growth and market share performance but the causation is in the *opposite direction* and it gives rise to the endogeneity problem I control for in our empirical section[10]. Based on the theoretical analysis I put forward the following proposition which is a testable prediction and may lead to the first general direct evidence of efficiency wage payments in firms.

Proposition 5: * *To find a positive relationship between a firm's market share performance and its unit wage cost in a market share equation, when controlling for rent sharing due to wage bargaining, can be seen as direct evidence for the presence of efficiency wage payments.*

[10] Vainiomaki and Wadhwani (1991) and Nickell et al (1992) working with firm level panel data, look for and find a positive relationship between wage growth and market share growth in a wage equation. Both papers suggest that this relationship could be consistent with rent sharing due efficiency wage payments and bargaining. From our theory, spillovers into wage determination from the upstream market can only be due to the presence of explicit or implicit wage bargaining. We take these papers as direct evidence for the presence of rent sharing due to wage bargaining.

* Please see note 5

V.5. The Empirical Evidence

By explicitly modelling the vertical spillovers that result from imperfections in both an upstream labour market and downstream product I have a clearcut empirical agenda that discriminates between alternative theories of wage determination. I set out to find evidence for the presence of the downstream vertical spillover due to efficiency wage payments and wage bargaining[11]. To this end, I use the theory to constrain the data. The basic data source is the same data as those used in the previous chapters, the EXSTAT/DATASTREAM company accounts.

The theory relates to industries where goods do not have a 'vertical attribute' in the sense of models of vertical product differentiation. For this reason I excluded R&D intensive industries and focus on relatively homogenous goods industries. As in Sutton (1991), I expect market share to be mainly determined by a competitive escalation in R&D expenditures. To discriminate between the downstream vertical spillover due to efficiency wages and wage bargaining I split the data into a high unionised and a low unionised sample. The criterion I apply is the median union density in 1979. Industries with lower than median density are grouped into what I call the low unionised sample, whereas the rest are grouped into the high unionised

[11] Vainiomaki and Wadhwani (1991) and Nickell et al (1991), look for and find a positive relationship between unit wage cost and (instrumented) market share performance in a wage equation. Both papers suggest that this relationship is consistent with efficiency wage and bargaining theories of wage determination. From our theory, spillovers into wage determination from the upstream market can only be due to the presence of explicit or implicit wage bargaining. We take these papers as direct evidence of upstream vertical spillovers from market share determination in the presence of wage bargaining.

subsample. This is an attempt to constrain the data so that empirically I can pick up the downstream vertical spillover due to union activity in the high unionised sample and efficiency wage payments in the low unionised sample. Yet, wage bargaining can still take place in the low unionised sample. The upstream spillover due to wage bargaining leaves us with an endogeneity problem in the market share equation which I control for in the estimation. The downstream spillover due to wage bargaining should be weakened by looking at low unionised firms in relatively homogenous goods industries.

This is how I constrain the data. I am left with two samples: the low unionised sample with 280 companies and the high unionised sample with 290 firms. The regressions I performed up to 1982, the reason being that after 1982 there is a significant fall in the number of observations due to a change in British legislation regarding the reporting of domestic employees. Table V.1 gives an overview of the number of observations available in each year for each sample.

Table V.1

Number of Observations

year	low unionised sample	high unionised sample
1973	197	193
1974	201	195
1975	219	213
1976	274	279
1977	280	290
1978	280	290
1979	275	284
1980	269	280
1981	245	255
1982	137	135

The average wage of the low unionised firms over the period 1973-1982 was very much in line with the high unionised sample. However, wage dispersion is much greater in the low unionised sample and grows over the period analyzed. The variance of the wage in the low unionised sample is 0.057 in 1973 and 0.078 in 1982. This compares for the high unionised subsample with 0.025 in 1973 and 0.04 in 1982. Over the period 1973-1982, I hypothesize that in the low unionised sample, if a firm *voluntarily* paid out higher wages, relative to other firms in the industry, for efficiency wage reasons, this would induce a better market share performance. I also hypothesize that in the high unionised sample, if a firm *involuntarily* paid out higher wages relative to other firms in the industry, due to union activity, this would have a determental effect on its market share performance. These are testable propositions.

Note 6: *Chapter V, p 169*

The relationship between equation (V.25), the empirical specification, and the theory can best be seen as follows. From (V.14) and (V.24) it can be stated that the market share in firm i depends on the wage paid in all other firms, firm specific factors, like $W/e(\alpha,\delta,A)$ the efficiency wage, bargaining parameters, A, β and unobservable fixed effects. These factors are in general unobservable, but they determine the wage paid in the firm. From the theory it was also clear that these effects may be stronger/weaker depending on the toughness of price competition in product markets. This in turn is affected by demand and supply shocks, product differentiation, R&D, sunk costs, etc.. An empirical specification needs to take into account these factors. Thus, market share in firm i at time t may be specified as follows:

$$MS_{it} = MS_{it}[W_{it}(X^P,X^L),X^P],$$

where X^L stands for a vector including labour market characteristics like A, β, δ, W^* while X^P stands for a vector including product market characteristics. Thus in this specification I allow the wage paid in the firm W_{it} to depend on product market characteristics, like market share. This will be the case under bargaining, capturing an upstream spillover from the product market to the labour market. For this reason it is important to instrument the wage appropriately. A testable form of the above is given in equation (V.25), where industry sales and the wedge between retail and wholesale price are controls for exogenous demand and supply shocks to the product market. Table V.2 and V.3 provide the main results. However, it is interesting to consider a number of robustness checks.

The basic market share equation that I seek to estimate, is written down in the following log-linear form.

$$(V.25)\ MS_{it}^{j} = FIX_{i}^{j} + \alpha_1 W_{it}^{j} + \alpha_2 SALES_{t}^{j} + \alpha_3 WEDGE_{t}^{j} + TIME_t + u_{it}^{j}$$

Where superscript j refers to the industry in which firm i belongs. MS_{it}^{j} is the market share of firm i in industry j in period t. FIX_{i}^{j} represents an unobservable firm fixed effect. W_{it}^{j} is the average wage in firm i belonging to industry j in period t. The vector of product market variables include, $SALES_{t}^{j}$ which are industry j's total sales in period t. $WEDGE_{t}^{j}$ is the wedge between the retail and wholesale price in industry j in period t. Industry sales and the industry wedge control for demand and supply shocks at the industry level. $TIME_t$ is an aggregate time effect which controls for aggregate shocks. u_{it}^{j} is a white noise error term. *

A common feature of micro data is the presence of unobservable fixed effects (FIX_{i}^{j}), which are potentially correlated with the other explanatory variables. Ignoring them would yield inconsistent estimates. Using panel data allows us to difference these fixed effects out and to estimate the coefficient on the wage consistently. By first differencing the equation (V.25), the fixed effect FIX_{i}^{j} drops out. Obviously, this generates first order serial correlation in the error term. What matters is that the errors in the level equation are serially uncorrelated. This implies that second order serial correlation must be absent in the first difference form[12].

[12] We shall use a test for serial correlation proposed by Arellano and Bond (1991), which is asymptotically N(0,1) distributed.

* Please see note 6

What matters is that the wage effects are robust. In table V.2b I have included the average industry wage, which could be considered as a proxy for the outside option. Under the efficiency wage hypothesis an increase in the outside option should lead to a negative effect on market share, while under the bargaining hypothesis this should lead to a positive effect. The results confirm the predictions. In the low unionised sample the average industry wage enters significantly at the 10% critical level and is negative, while in the high unionised sample the average industry wage has a positive effect and is significant at the 5% critical level. I further experimented with excluding industry sales. The results are shown in the second and fourth column of table V.2b. One could argue that industry sales should not be included in a market share equation since this is part of the definition of a market share. This might be true if the total population of firms is used in the analysis, however, the current study only covers a sample of large manufacturing firms. The fact that industry sales enters significantly simply means that as the market grows (demand shocks) certain firms, here the larger ones, benefit more than others in terms of their market share. In other words, it seems that it is the largest firms which gain most from changes in the market size, proxied by industry sales. If industry sales is excluded, the basic wage effect still holds and has the same order of magnitude. Also the effect of the industry wage is unaffected by excluding industry sales. The conclusion from this is that the results reported in tables V.2 and V.3 are quite robust.

The method of estimation is the generalised method of moments technique (GMM), proposed by Arellano and Bond (1991), where I shall use instrumental variables because the wage is going to be endogenous, resulting from the presence of wage bargaining. The advantage of GMM over other commonly used panel data estimation techniques, such as those proposed by Anderson and Hsiao (1981,1982), lies in the more efficient use of the available instruments. Arellano and Bond (1991) show that in a first difference model, valid instruments for endogenous variables are the levels of the endogenous variables dated t-2 and before. In other words, as the panel progresses, more instruments can be used. I wish to pick up the market share performance *induced* by unit wage cost i.e. the downstream spillovers from wage determination. It is therefore highly important to find valid instruments, thus a Sargan test of over-identifying restrictions is computed.

Table V.2 reports the results for the low unionised sample. For the two samples I report regressions for the period 1976-1982[13]. All specifications include time dummies to control for aggregate shocks. I started with estimating (V.25), a static equation. Specification (1) shows the results for the low unionised sample. I instrumented the wage using its lagged levels from t-3 backwards. I also included the lagged levels of the market share dated t-3 and before as additional instruments. However, the diagnostics indicate that the equation is misspecified, there is significant second order serial correlation and the Sargan test of instrument validity rejects. To rectify this problem, I include a lagged dependent variable. Economically, this lag

[13] Since we used instruments dated t-3 and before, the regression starts in 1976 instead of 1973.

Table V.2b

Independent variables	Low Union Sample	Low Union Sample	High Union Sample	High Union Sample
MS_{it-1}	0.77 (24.0)	0.77 (28)	_	_
W_{it}	0.57 (2.9)	0.60 (3.13)	-0.53 (-5.53)	-0.52 (-5.72)
$SALES_t$	0.22 (4.87)	_	0.32 (2.28)	_
$WEDGE_t$	0.05 (0.74)	0.010 (0.13)	0.18 (0.45)	0.33 (0.80)
Average Industry $Wage_t$	-0.27 (-1.62)	-0.30 (-1.82)	0.42 (4.04)	0.47 (4.66)
Number of Firms	280	280	290	290
Time Periods	7	7	7	7
Sargan Test	79.5 (df=61)	85.7 (df=61)	74.3 (df=62)	74.5 (df=62)
2nd-Order Serial Correlation Test	-0.849	-0.905	-0.392	-0.369

Notes: As in table V.3.

captures a partial adjustment mechanism. Of course, since the model is estimated in first differences, the lagged dependent variable becomes endogenous and thus must be instrumented. Specification (2) gives the results. I include the same instrument set as in specification (1) and they serve as instruments for the lagged dependent variable as well as for the wage. Column (2) shows a strong positive and significant effect of unit wage cost on market share performance. Both the second order serial correlation test and the Sargan test pass at conventional critical levels. This implies I am testing a clear causation between unit wage cost and market share performance. I take the positive wage effect as direct evidence that, over the period 1973-1982, in the low unionised sample, a subset of firms used high wages to *induce* a better market share performance.

In the high unionised sample, I set out to test whether a firm's market share performance deteriorates as a result of having relatively high wage costs due to union activity. Table V.3 reports the results for the high unionised sample. Again I started with estimating a static equation. I instrumented the wage using all available moment restrictions on the lagged wage and lagged market share. In this case, the static equation fits very well. The diagnostics show that there is no second order serial correlation and the Sargan test indicates that the instrument set used is a valid one. The effect of unit wage cost on market share is negative and significant at conventional levels. Over the period 1973-1982, in the high unionised sample, the negative relationship between unit wage cost and market share performance implies that a subset of firms involuntary paid out high wages, due to union activity, and this induced a deterioration in the market share performance of these firms. I see this as direct evidence for the presence union activity in this sample.

Table V.2

Firm Level Market Share Equations, 1976-1982
Low Unionised Sample

Dependent variable: market share

independent variables	(1)	(2)
MS_{it-1}	-	0.77 (25.3)
W_{it}	0.84 (8.96)	0.54 (3.34)
$SALES_t$	0.08 (2.23)	0.22 (4.94)
$WEDGE_t$	0.32 (3.45)	0.06 (0.88)
Number of Firms	280	280
Time periods	7	7
Sargan test	91.51 (df=62)	79.72 (df=61)
2nd-order serial correlation test N(0,1)	2.24 (280)	-0.970 (280)

Notes

(i) heteroscedastic robust t ratios in parentheses.

(ii) the equation is estimated using instrumental variables in first differences. All variables are in natural logarithm. In other words, all variables represent growth rates. The instruments used are valid moment restrictions on market share and on wages from t-3 backwards. Time dummies are included.

(iii) The test of 2nd-order serial correlation refers to the differenced equation. This checks that there is no correlation between the differenced errors and their second lag. This is a necessary condition for the undifferenced errors to be white noise.

Table V.3

Firm Level Market Share Equation, 1976-1982
High unionised sample

Dependent variable: market share

Independent Variables	static equation
W_{it}	-0.61 (-6.34)
$SALES_t$	-0.077 (-1.27)
$WEDGE_t$	-0.40 (-3.02)
Number of Firms	290
Time periods	7
Sargan test	71.82 (df=62)
2nd-order serial correlation test N(0,1)	-0.240 (290)

Notes: As in table 1, except that the instruments used are all available moment restrictions on market share from t-2 backwards and on wages from t-3 backwards.

V.5. Summary and Conclusions

In this chapter I considered alternative forms of wage determination and integrated it in the theory of oligopoly. The focus here was on the new and rich predictions one obtains if such an approach is followed. The main aim of this chapter was to develop in detail a theory which tracked the vertical spillovers from wage determination to market share determination in a downstream product market. The theory predicted that efficiency wage payments can only lead to a downstream spillover and this is the only downstream spillover from wage determination that drives a positive relationship between unit wage cost and performance in the product market. The presence of wage bargaining was shown to drive a two-way vertical spillover. The downstream spillover due to the presence of wage bargaining leads to a negative relationship between unit wage cost and market share performance. However, wage bargaining can also drive a positive relationship, however it is a spillover that flows in the opposite direction to that created by efficiency wages.

I set out to discriminate between the two downstream vertical spillovers. To this end, I use theory to constrain the data. I split the data into a high unionised and a low unionised sample of large firms in relatively homogenous good industries. Over the period 1973-1982, exploiting the pooled cross sectional and time series dimension of the data set, I find evidence, in the low unionised sample, that firms voluntarily paid high wages to induce better market share performance. I take this as direct evidence that the high wage firms in this sample paid efficiency wages. I also find evidence, in the high unionised sample, that firms involuntarily paid high wages, as a result of union activity, which had a determental effect on their market share performance.

APPENDIX

The data were obtained by combining the EXSTAT data tape with the DATASTREAM on-line service.

Data(1):Firm Specific Variables: Market Share: Firm's sales divided by industry sales (EXSTAT measure, for details see Vainiomaki and Wadhwani, 1991).

Wages: Domestic wage (EXSTAT itemc16) divided by domestic employees (EXSTAT item c15) (for details see Vainiomaki and Wadhwani, 1991).

Data(2):Industry Specific Variables: Industry Sales: Census of Production. This data was provided by S. Machin and J. Van Reenen.

Wholesale Prices: Producer indices matched with Exstat industry groups. See Ph.D. thesis London School of Economics, Martin Wall. Sources: Trade and Industry until 1979, thereafter British Business. Wedge=log(Retail Price) - log(Wholesale Price).

Union Density: Industry specific union density. This data was provided by S. Machin and J. Van Reenen.

List(1):Highly Unionised Industries Sample: Industrial Plant, Steel and Chemical Plant, Wires and Rope, Misc. Mechanical Engineering, Machine Tools, Instruments, Metallurgy, Special Steels, Misc. Metal Forming, Household Appliances, Cutlery, Newspaper and Periodical, Publishing and Printing and Packaging and Paper.

List(2): List of Industries In The Lowly Unionised Subsample: Brick and Roof Tiles, Building Materials, Cement and Concrete, Floor Covering, Furniture and Bedding, Breweries, Wines and Spirits, General Food Manufacturing, Milling and Flour, Clothing, Cotton and Synthetic, Wool, Misc. Textiles, and Footwear.

CHAPTER VI: THE EFFECT OF UNIONS ON EMPLOYMENT BEHAVIOUR IN THE U.K.

VI.1. Introduction

Over the past decade or so there have been considerable changes in trade union organisation and trade union recognition in the U.K.. The purpose of this chapter is to investigate empirically how unions affect employment behaviour and in particular how union de-recognition affected employment in U.K. firms.

Trade union activity clearly plays a major role in economic decisions firms make. Labour Economics has been marked by an increasing literature on the effect trade unions have on various aspects of company performance, such as firm profitability and productivity (e.g. Freeman and Medoff 1984, Clark 1984, Voos and Mishel 1986, Nickel et al. 1992, Gregg et al. 1993). There are however only a few papers investigating the effect of unions on firm-level employment behaviour[1]. The literature mainly uses cross-sectional data and focuses predominantly on the manufacturing sector. In contrast, this chapter uses a unique *panel* data set of large U.K. manufacturing *and* non-manufacturing firms to analyse the effect trade unions

[1]In the U.K. there are only two, Blanchflower, Millward and Oswald (1991) and Machin and Wadhwani (1991). In the U.S., Leonard (1992) and recently Bronars and Deere (1993) and in Canada a recent paper by Long (1993) investigates the issue.

have on both employment *growth* and employment *levels* at the firm. The data are again, as in previous chapters, drawn from the EXSTAT datatape. However, this time they refer to a different time period and are complemented with a postal survey. The use of panel data in investigating the effect trade unions have is important since a common criticism to cross-sectional analysis of economic problems is the potential bias emerging in cross-section regressions due to unobservable fixed effects which are correlated with one of the regressors. Since I use panel data I am able to control for these unobservable fixed effects. Moreover, it is exactly in the late 80's that there has occurred substantial changes in union organisation and recognition.

I will report evidence that unionised firms have lower growth rates than non-unionised firms over the sample period. However, this union effect is not robust with respect to the time period, a finding already suggested by Machin and Wadhwani (1991). The effect unions have are strongest when firms face only a few rivals, suggesting that spillovers from the product market to the labour market and vice versa might be important, as in last chapter. Finally, I find that unionised firms have lower employment growth only within the manufacturing sector. Within the non-manufacturing sector, I find no evidence that *unionised* firms have significantly different growth rates than non-unionised firms. I also find that firms which de-recognised unions have on average lower growth rates than firms which did not de-recognise unions. This suggests that unions have a positive effect on employment *levels*.

The plan of the chapter is as follows. In the first section I give a theoretical and empirical background of the problem under investigation. The third section describes the dataset used. I do this because I have not discussed the special features of this dataset in chapter II. In the fourth section I discuss the results.

VI. 2. Theoretical and Empirical Background

The two main classes of models of union behaviour are the *right to manage* model vs. the *efficient contract* model. The former assumes that management retains the right to set employment levels, given the wage which is either the result of bargaining or is set unilaterally by the 'monopoly' union. In this kind of models employment-wage combinations will be located on the labour demand curve. Given that the wage will be higher than in a competitive labour market, employment will be reduced. Since the union-wage effect makes employees more costly for union firms than for nonunion firms, union firms will substitute labour for capital and hence have less employment growth. In the latter class of models, the alternative wage or outside option of union members is taken into account while bargaining and the outcome will lie, in general, off the labour demand curve. In this case, bargaining is over both employment and wages and employment-wage combinations will lie on a contract curve, reflecting Pareto efficient outcomes (McDonald and Solow, 1981). In the efficient contract models, unions increase employment, provided unions put more weighing on employment than on wages. Wage-Employment combinations will then lie on an upward sloping contract curve. However, Layard and Nickell (1990) show that employment will be the same as in the case where there is bargaining over wages

Note 7: Chapter VI, p181

There are also other arguments why unions might affect employment growth. Since the union pushes up wages employees are more costly for union firms than for nonunion firms and hence union employers will substitute capital for labour thereby reducing employment growth in union firms. Another argument is related to the union protection of the labour force through job security provisions, severance payment agreements, etc.. In this case, job creation will be lower because of the uncertainty of the productivity of the new match. Moreover, the higher union wage makes it costly to hire new workers. These factors are absent in nonunion firms. A third argument for different employment growth in union than in nonunion firms has to do with the union capturing of economic rent of intangible capital. In this case, firms would have an incentive to switch to more labour intensive production, which would imply higher employment growth in union than in nonunion firms. However, the argument could easily be reversed. Because union firms invest less in new capital output growth will be hindered and hence in the long run also employment growth.

only, given a Cobb-Douglas production technology. Moreover, they show that compared to the competitive labour market, employment falls. Similarly, if union's indifference curves are flat in wage-employment space, efficient contracts will lie on the labour demand curve as shown by Oswald (1987). Thus there is no clear-cut prediction as to unions increase or decrease employment levels and growth. *

Empirically, there is not much of a consensus either. Blanchflower, Millward and Oswald (1991), using a large cross-section of U.K. establishments, find that employment grows around three percentage points slower in the typical British union establishment. Machin and Wadhwani (1991) dispute this, using the same dataset, and argue that unionism exerts a negative effect on employment growth only in plants which reformed working practices. In other words, those plants which underwent organisational change had lower employment growth, but it were also the ones which were unionised. A recent paper by Long (1993) finds for Canada, that unionised firms grew 3.7% slower than non-unionised firms within the manufacturing sector, while within the non-manufacturing sector this was 3.9%. Bronars and Deere (1993) analyse the effect of union elections on employment growth in the U.S.. They find that in the manufacturing sector firms with a "union win" have lower employment growth than firms without a "union win", looking at the raw correlations only. For the non-manufacturing sector there is no difference in average growth rates. When, however, a proper vector autoregressive analysis is performed this effect turns out to be statistically insignificant in both the manufacturing and non-manufacturing sector.

In order to analyse the issue empirically I need to have a testable model of

* Please see Note 7

Note 8: Chapter VI, p 182

The empirical specification (VI.1) and (VI.2) needs clarification. In this note, I show an alternative approach. The employment equation which will be estimated should include some measure of unionisation in order to test the effect unions have on employment. The simplest way to proceed is by adding a union term or

$$l_{it} = fix_i + \alpha_0 q_{it} + \alpha_1 w_{it} + \alpha_2 union_{it} + \eta_{it}, \qquad (1)$$

where $union_{it}$ stands for union density of firm i at time t, q stands for output, w is the wage, fix is an unobservable fixed effect, l stands for employment and η is a white noise error term. A more sophisticated employment equation would take into account that unions could have long lasting effects on employment. One way to model this is by allowing a distributed lag on the union term or

$$l_{it} = fix_i + \alpha_0 q_{it} + \alpha_1 w_{it} + \Sigma_k \beta_k union_{it-k} + \eta_{it}, \; k=0,..,\infty. \qquad (2)$$

The impact or short term effect in this case is β_0, while the long run effect is $\Sigma_k \beta_k$, $k=0,..\infty$.

The main problem with the current study is that union density is not available at the firm level for each individual time observation. The only two proxies are two dummies. One dummy (union recognition) refers to the fact whether firms recognise unions or not over the entire sample period. The other dummy variable (union derecognition) takes the value 1 if the firm de-recognised unions over the last four years. To control for the unobservable fixed effect in (1) or (2), the model needs to employment behaviour. The literature on unions and productivity recognises that unions may have effects on both the *level* and the *growth* of productivity. These effects need not be the same (see Addison and Hirsch, 1989). I will specify an employment equation which also allows these two effects to come through or

$$(\text{VI.1}) \quad l_{it} = fix_i + \alpha_0 q_{it} + \alpha_1 w_{it} + \alpha_2 UNION_{it} + \alpha_3 UNION_i \times TIME + \eta_{it}, \quad *$$

where l_{it} denotes the log of employment in firm i at time t, fix_i represents unobserved firm-specific fixed effects (or firm heterogeneity), w_{it} denotes the log of the real wage paid in firm i at time t, $UNION_{it}$ is a dummy equal to 1 if there is at least one union recognised in the firm at time t, $UNION_i$ takes the value 1 if the firm is unionised, TIME is a time trend and η_{it} is a white noise error term. By modelling the union effect in this way, I am able to investigate the difference between unionised firms versus non-unionised firms, which can be thought of as predetermined or a long term issue. This is captured by the time invariant union dummy, $UNION_i$. By also modelling a time varying union term, $UNION_{it}$, I am able to investigate the short term "impact" effects of changes in union recognition. This term reflects the effect of unionised firms which experience some change in unionisation, in our data which experience some union de-recognition. An economic intuition for modelling the union effects in this way is that if unions affect the *level* of employment in the firm, the firm moves away from its optimal employment level in the absence of unions. If a firm is no longer at its most efficient employment level, this could affect future *growth.* Note also that by modelling the union effect as in (VI.1), I investigate the effect of unions over and above the effect of the union-wage effect. Thus I allow the union to have a

* Please see note 9

be estimated in first difference form. First differencing (1) yields

$$\Delta l_{it} = \alpha_0 \Delta q_{it} + \alpha_1 \Delta w_{it} + \alpha_2 \Delta union_{it} + \Delta \eta_{it}, \qquad (1')$$

Thus in the empirical implementation $\Delta union_{it}$ is proxied by the dummy 'union derecognition'. One way to proceed is to estimate (1'). However, since all firms which de-recognised unions still recognised some unions after the derecognition the estimated coefficient could reflect the fact that unionised firms have lower employment growth than non-unionised firms as is suggested in the literature cited in the introduction of the chapter. To control for this it is advisable to include the other union dummy, union recognition, as well. This also fits in nicely with the existing literature on union-nonunion employment growth differentials. This approach is parallel to Machin et al. (1993) investigating the effect unions have on productivity in the U.K.. They specify a productivity equation with a union variable which varies over time and one which does not, but is interacted with a time trend.

separate effect on firm performance which does not come through the wage.

The fixed effect in (VI.1) is unobservable and potentially correlated with the other explanatory variables. I therefore estimate (VI.1) in first difference form, which cancels the fixed effect or

$$\text{(VI.1')} \qquad \Delta l_{it} = \alpha_0 \Delta q_{it} + \alpha_1 \Delta w_{it} + \alpha_2 \Delta UNION_{it} + \alpha_3 UNION_i + \Delta \eta_{it}$$

In (VI.1'), α_2 gives an indication of how unions affect the *level* of employment, while α_3 reflects the effect of unions on employment *growth.* Alternatively, the former reflects the impact or short term effects, while the latter reflects the long term effects.

VI.3. Data Description

The basic data source is the EXSTAT company accounts dataset of which I discussed the nature in detail in chapter II. The new feature, however, is that the dataset is complemented with a postal survey on union presence and changes in unionism which was carried out in the summer of 1990 by Paul Gregg(for more details of this survey see Gregg and Yates (1991), Gregg and Machin (1992), Gregg et. al. (1993)). In terms of employment, sales and industry affiliation the respondents formed a representative sub-sample of the EXSTAT population. The survey drew usable responses from 558 companies across all industrial sectors. A number of firms did not have company accounts reported in EXSTAT for each year or there were missing observations on variables of interest in particular years. I therefore required that companies had at least 4 continuous data observations between the years 1982 and 1989. Hence I are left with an unbalanced panel of 361 companies. I did not include companies, prior to 1982, since in 1982 there was a definitial change in the reporting of employees (due to the Companies Act in 1982). In order to have a consistent employment series I therefore started in 1982. Table VI.1 gives an overview of the structure of the panel. It gives the number of companies which have respectively 4,5,6,7 and 8 continuous time observations available.

Table VI.1: Structure of the EXSTAT Panel

number of continuous years	number of firms
4	32
5	28
6	53
7	146
8	102

The two main variables of interest are union recognition and changes in union status. The survey asked managers whether their company recognises trade unions for the purposes of bargaining over wages and conditions in any of the establishments[2]. Over the sample period around 42% of firms did not recognise unions while around

[2]The questions asked were formulated as follows: 'Does your company recognize trade unions for the purposes of bargaining over wages and conditions in any of your establishments?' Over the years 1980-4(1985-9), was there a net change in the number of your company's establishments that recognized trade unions for the purposes of bargaining over wages and conditions other than as a result of the opening and closure of establishments?(more details can be found in Gregg and Yates (1991) and Gregg and Machin (1991).

58% did recognise trade unions in one or more of their establishments. The change in unionism is captured by a trade union de-recognition variable. This is a dummy equal to 1 if there are less unions recognised or if there was a net decrease in closed shop arrangements over the period 1980-84 and 1985-89. However, the estimation technique used, implies that the sample over which estimation takes place is from 1985 onwards (see below), hence the union de-recognition variable refers to the period 1985-9. Moreover, it was only in the period 1985-89 that there were 'substantial' changes in unionism. Ideally, one would like to have information on year to year changes in unionism. So the 'union change' variable is merely a rough proxy for changed unionism. Table VI.2 gives an overview by year of firms which de-recognised unions. Around 15% of firms which recognised unions did also de-recognise unions in one or more of their establishments during the sample period.

Table VI.2: Number of unionised firms which de-recognised unions

year	union de-reconition	no union de-recognition
1984	7	178
1985	26	173
1986	26	181
1987	26	181
1988	24	174
1989	17	116

VI.4. Results

Table VI.3 gives the average and median one year employment growth rates for the period 1982-89. It shows that unionised firms grew less than non-unionised firms in both the manufacturing and non-manufacturing sector. Of course, these are just raw correlations and could reflect for instance the fact that large firms tend to grow slower and that exactly large firms are the ones which are unionised.

Table VI.3: Summary statistics on 1-year growth rates

union	summary statistic	manufacturing	non-manufacturing
yes	median	0.010	0.019
yes	mean	0.012	0.027
yes	standard deviation	0.20	0.21
no	median	0.063	0.073
no	mean	0.097	0.099
no	standard deviation	0.23	0.27

Table VI.4 gives the average and median growth rates (1985-89) for the sub-sample of firms which de-recognised unions versus did not de-recognise and for those firms de-recognising unions versus not de-recognising conditional on positive growth. The latter is done to account for the potential endogeneity of union de-recognition and (negative) firm growth. I computed the 4-year growth rate in 1989, thus the growth rate reflects the difference in employment between 1985 and 1989. The reason for this is that the union de-recognition variable refers to this time period. Table VI.4 shows that firms which de-recognised unions have on average lower growth rates, 0.035, than those which did not de-recognise, 0.18. This remains the case when I compare median growth rates, 0.084 vs. 0.099. When I compare growth rates, conditional on positive growth, firms which de-recognised unions have still lower growth rates on average than those which did not de-recognise (0.19 vs. 0.37). Figure VI.1a plots the growth rate distribution for firms which de-recognised unions, while figure VI.1b shows the growth rate distribution for firms which did not de-recognise. Interestingly, figure VI.1a shows that the majority of firms which de-recognised unions had *positive* growth rates. Thus de-recognition did not occur at shrinking firms only, which then would explain the de-recognition. All this suggests that because union de-recognition is correlated with lower growth rates unions have a positive effect on employment *levels*. Of course I need to test this hypothesis more rigorously in the regression analysis.

Table VI.4: employment growth rates,1985-89

type of action	mean	median	standard deviation
derecognition	0.035	0.084	0.30
no derecognition	0.18	0.099	0.41
derecognition and positive growth	0.19	0.23	0.11
no derecognition and positive growth	0.37	0.28	0.34

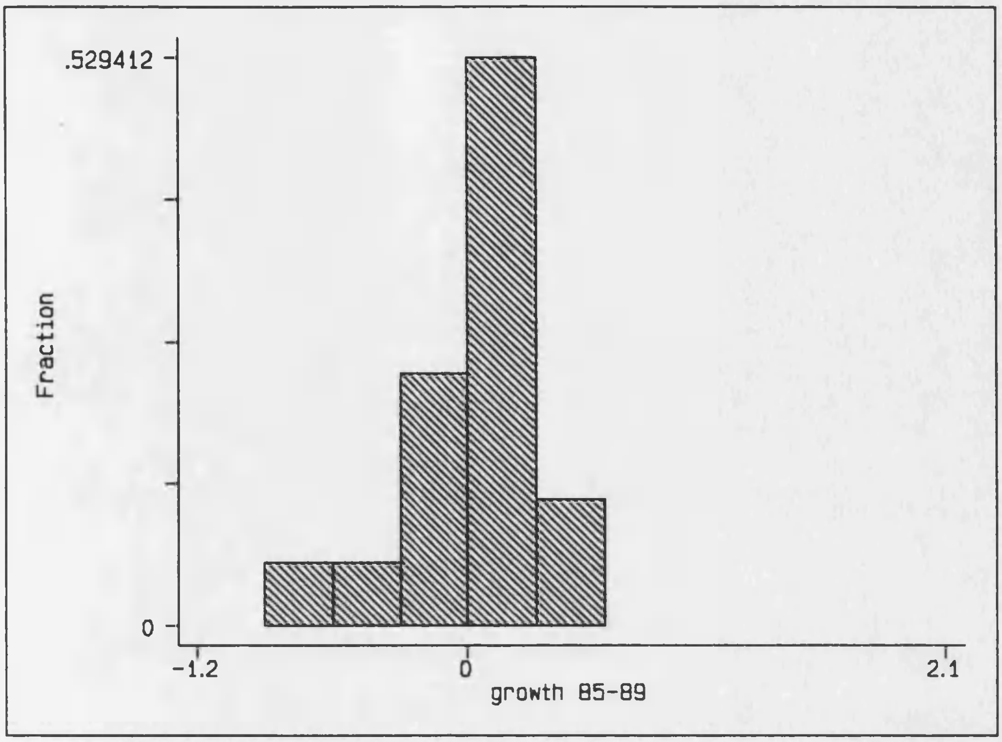


Figure VI.1a

Growth rate distribution for firms which did de-recognise unions

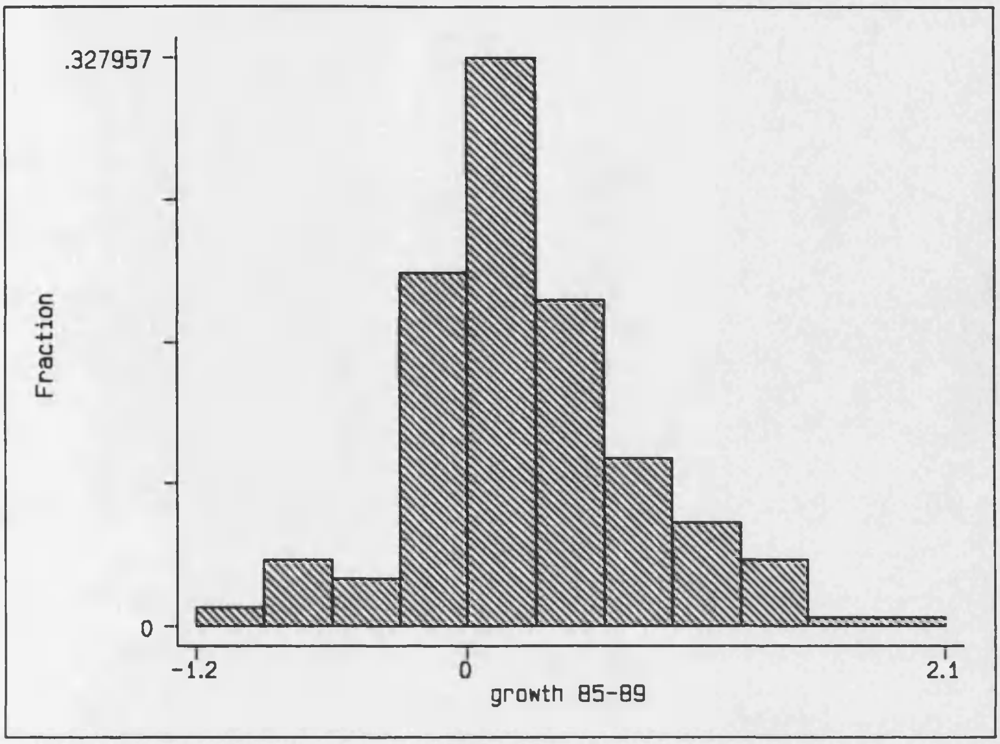


Figure VI.1b

Growth rate distribution for firms which did not de-recognise unions

I next turn to estimating the employment equation. Estimating (VI.1') by OLS would lead to inconsistent estimators because w and q are endogenous. Thus I need to instrument w and q. In panel data, valid instruments are the levels of the endogenous variables dated t-2 and before, as shown by Aralleno and Bond (1991). Thus the estimation will take place from 1984 instead of from 1982. I shall use, like in the last chapter, the General Methods of Moments estimator and use the Dynamic Panel Data package developed by Aralleno and Bond (1988). I briefly repeat the main advantages of it here. The advantage of using the GMM estimator over other commonly used estimation techniques in panel data exists in its optimal use of instruments. As the panel progresses more instruments become available. For instance, in 1984 instruments dated 1982 can be used, in 1985, instruments dated 1982 and 1983 can be used, etc.. In order to test the validity of the instruments, a Sargan test of over-identifying restrictions is produced and is asymptotically χ^2 distributed. First differencing equation (VI.1) generates first order serial correlation, but second order serial correlation should be absent if the error term in the levels is white noise. Therefore, a test of second-order serial correlation is computed and is asymptotically N(0,1).

When estimating (VI.1') I shall also control for possible industry effects on employment growth, via the industry wage[3]. I will further include time dummies to control for common aggregate shocks.

[3]The industry wage can also be thought of an outside option variable. A significant effect would support the efficient contract model.

Table VI.5 reports the results of estimating equation (VI.1') using the EXSTAT panel of company accounts. The wage, output and industry wage refer to real variables. The first column simply regresses employment growth on the union variables, without adding any extra controls, except time dummies. Unionised firms have a 6.4% lower *growth* rate than non-unionised firms. The union de-recognition variable has a negative effect of -4.4% and is significant at the 10% critical level. This means that unions have positive effects on employment *levels*. A possible interpretation for this is that the impact effect of unions on employment is positive. In other words, as a firm becomes unionised (de-unionised), increased (reduced) employment will result. But because the firm moves away from its optimal level of employment (or scale), it will subsequently grow less.

Note 9: *Chapter VI, p 192*

In this note I report some further robustness checks of the results in table VI.5. In particular, since the industry wage never enters significantly I drop it and instead include industry dummies. Table VI.5b shows the results. First, the wage elasticity is slightly higher, between -0.75 and -0.82. Secondly, from column 1, the union effects are weaker, but still significant and have still the same sign. In column 2, however, the union effects are no longer significant at conventional critical levels, although the sign of the union effects are still the same as in the case where there are no industry controls. The results of column 3 are consistent with those in table VI.5. It is in booms that unions have larger effects on employment growth. Finally, in column 4 the results are comparable to those from table VI.5. Again, the union effect is stronger the weaker the competition is firms face. The union derecognition effect is -0.039 if firms face a few rivals. This indicates that unions affect employment levels positively in the sub-sample of firms facing weak competition. In sum, the results from table VI.5 are robust to the inclusion of industry dummies.

Table VI.5: Unions and Employment Growth ✱
Dependent Variable: Δemployment

independent variables	(1)	(2)	(3)	(4)
Δwage	-	-0.57* (0.29)	-0.56* (0.29)	-0.59* (0.29)
Δoutput	-	0.77* (0.12)	0.77* (0.12)	0.78* (0.12)
Δindustry wage	-	0.31 (0.47)	0.27 (0.48)	0.32 (0.48)
union derecognition	-0.044** (0.026)	-0.006 (0.014)	-	-
union recognition	-0.064* (0.014)	-0.019* (0.011)	-	-
union derecognition$_{1984-87}$	-	-	-0.01 (0.02)	-
union recognition$_{1984-87}$	-	-	-0.015 (0.015)	-
union derecognition$_{1988-89}$	-	-	-0.005 (0.03)	-
union recognition$_{1988-89}$	-	-	-0.034* (0.012)	-
union recognition×comp	-	-	-	-0.041** (0.028)
union recognition×(1-comp)	-	-	-	-0.019** (0.011)
union derecognition×comp	-	-	-	-0.021** (0.014)
union derecognition×(1-comp)	-	-	-	-0.005 (0.019)
comp	-	-	-	0.018 (0.028)
time dummies	yes	yes	yes	yes
Sargan test	-	44.43 (df=33)	41.69 (df=33)	44.11 (df=33)
Second order serial correlation test N(0,1)	0.978	-0.257	-0.230	-0.185
Number of firms	361	361	361	361

Notes:(i)Instruments used are all available moment restrictions on wage from t-2 back and on output from t-3 back. (ii) one step robust standard errors in parentheses, except with Sargan test and Wald test, they refer to degrees of freedom.(iii) (*)/(**) denotes significant at 5%/10% Employment, wage, output and industry wage are in logarithms.

✱ Please see note 8)

Table VI.5b

independent variables	(1)	(2)	(3)	(4)
Δwage	_	-0.77* (0.3)	-0.75* (0.3)	-0.82* (0.3)
Δoutput	_	0.80* (0.11)	0.80* (0.11)	0.82* 0.11)
union derecognition	-0.037** (0.02)	-0.015 (0.01)	_	_
union recognition	-0.039* (0.01)	-0.013 (0.01)	_	_
union $derecognition_{84-87}$	_	_	-0.015 (0.02)	_
union $derecognition_{88-89}$	_	_	-0.015 (0.03)	_
union $recognition_{84-87}$	_	_	-0.004* (0.015)	_
union $recognition_{88-89}$	_	_	-0.025* (0.013)	_
recognition × comp	_	_	_	-0.039* (0.013)
recognition × (1-comp)	_	_	_	-0.008 (0.006)
derecognition × comp	_	_	_	-0.039* (0.02)
derecognition × (1-comp)	_	_	_	-0.009 (0.009)
Sargan test	_	42.5 (df=33)	40.0 (df=33)	42.1 (df=33)
2nd Order Serial Correlation	-0.318	-0.843	-0.817	-0.849

Notes: as in table VI.5
All specifications include **industry and year dummies**

The de-recognition effect becomes insignificant when the full model is estimated in column 2, although the point estimate is still negative. Of course, the union de-recognition variable does not capture perfectly the year to year changes in unionism, it is merely a dummy indicating whether there was de-recognition or abolishment of closed shop arrangements in the period 1984-89. I therefore experimented with regressing the difference between employment in 1989 and 1985 on the union de-recognition variable, referring to union de-recognition between 1985 and 1989. This would capture in a more exact way the union de-recognition effect. I only did a similar regression as in column 1, using OLS with heteroscedastic consistent standard errors. The union de-recognition effect is estimated to be -14% and significant at the 10% critical level, while the union recognition effect is estimated to be equal to -17% and is also significant at the 5% critical level[4]. When the sample is restricted to firms which experienced only positive growth the union de-recognition effect is -17% and is significant at the 5% critical level, the union recognition effect is -19%. Thus, although I cannot find statistically significant evidence of a union de-recognition effect in column 2 of table VI.5, I clearly cannot reject the hypothesis of no union de-recognition effect on employment growth. If any, there is likely going to be a negative union de-recognition effect, indicating a positive impact effect of unions on employment levels.

[4]It should be noted that the union recognition effect should be divided by 4 to obtain the one-year effect of union recognition.

Column 2 of table VI.5 also shows that unionised firms grow by 2.3% less than non-unionised firms. Related studies have found similar results. For the U.S., Leonard (1991) concludes that employment in unionised plants grows 2 to 4% lower than in non-unionised plants. For the U.K., Blanchflower et.al.(1991) have estimated a union growth differential of 2.5 to 4%.

I shall investigate the robustness of the estimated union effects by testing several hypothesis. First, the union effect could be correlated with the business cycle as suggested by Second, the effect of unions might be different when firms face a lot of competitors viz. a few competitors. Third, the union effect might be different in the manufacturing sector than in the non-manufacturing sector. I shall test these hypothesis in turn.

a. business cycle effect

Column 3 investigates whether unions have different effects in 'slump' years than in 'boom' years. Of course, the time dimension I work with is relatively small, so that the conclusions I draw from this are rather suggestive. Both the union recognition variable and the union de-recognition variable are interacted with a dummy for the period is between 1984-87, the 'slump' years and a dummy for the period between 1988-89, the 'boom' years. These time periods are generally viewed as slump viz. boom years in the U.K. (see Layard, Nickell and Jackman, 1990, p9). It is only in the 'boom' years that unionised firms have significant lower growth rates than non-unionised firms. In the 'slump' years the union effect is not statistically significant and the point estimate is also lower. Of course, this could also reflect changes in managerial behaviour during these years, rather than a reflection of the business cycle, given that I only observe one 'slump' and one 'boom'. The key finding of this is that the union effect on employment is not the same over time. This finding is consistent with Machin and Wadhwani (1991) and Gregg, Machin and Metcalf (1993). The latter paper investigates the effect of unions on productivity growth. Using the same dataset, they find a positive union effect on productivity growth for the boom years. They argue "if unionised companies were able to respond more quickly to any aggregate stimulus without taking on extra labour, then they could have experienced a boost to productivity (viz. non-union companies)." This thus implies that unionised firms have less employment growth in the boom years.

This business cycle effect is also consistent with an 'insider-outsider' interpretation (Lindbeck and Snower, 1989). When an adverse shock hits the firm some of the incumbent workers will loose their insider status because they are laid off. New employment is now at a lower level. If the economy picks up again, then the remaining insiders will bargain for higher wages, without taking into account the outsiders. Thus employment will stay at the lower level. Assuming two different types of firms, unionised viz. non-unionized, the unionised firm will have lower growth in booms than the non-unionised firm, because the non-unionised firm will simply hire extra workers if the economy picks up again.

b. competition effects

Stewart (1990) investigates the effect of product markets on union wage differentials and finds evidence that there exists only a union wage differential in establishments with some degree of product market power, as measured by the number of rivals a firm faces. The economic intuition for this is that union wage differentials are created by the capturing of rents. In a perfectly competitive market, there are no rents to capture, hence there will exist no union wage differential. This is consistent with the model of last chapter in which the union had no effect in the extreme case of tough price competition. Here, I use the number of competitors a firm faces to test whether unions have different effects in firms facing tough competition versus weak.

I test this hypothesis in column 4 of table VI.5. I have interacted the union variables with a dummy (comp) equal to 1 if the firm faces less than or equal to 5 competitors[5]. I also interacted the union variables with (1-comp) to capture those firms facing many rivals. Obviously I need to include comp separately to control for spurious correlation in the interaction terms. As expected, I find a stronger union effect when firms face only a few rivals. Unionised firms grow 4.1% slower in 'non-competitive' markets, while only 1.9% in 'competitive' markets. Moreover, the union de-recognition effect becomes now significant at the 10% critical level for those firms facing a few competitors and is -2.1%. It is -0.5% and insignificant for those firms facing many competitors. Thus when firms have some market power, as measured by

[5]The managers were asked whether they were the dominant firm in the market, whether they faced less than or equal to 5 competitors or whether they faced more than 5 competitors.

the number of rivals they face, unions do have stronger effects: Unions decrease employment *growth* more and increase employment *levels.*

c. manufacturing viz. non-manufacturing

The above results refer to both the manufacturing and non-manufacturing sector. Some authors suggest however that there could well be different union effects in the manufacturing sector than in the non-manufacturing sector. Bronars and Deere (1993) report an average employment growth rate for firms with a successful union election of 0.81% and of 2.21% for firms without a union win in the manufacturing sector, in the non-manufacturing sector, however, the employment growth rate is approximately the same for both type of firms, 3.42% viz. 3.04%.

I therefore split up the sample and estimate (VI.1') on the subsample including only manufacturing firms and on the subsample including only non-manufacturing firms. This is another way to test for the robustness of the negative union effect on employment growth as found in column 2 of table VI.5. Table VI.6 reports the results. Column (1) shows that unionised manufacturing firms grow 3.3% slower than non-unionised manufacturing firms. Column (2) reports the same regression for the non-manufacturing sector. There is no significant difference in growth rates between unionised and non-unionised firms. Note further that in the non-manufacturing subsample the only significant explanatory variable is the output of the firm. The wage does not attract a significant coefficient. This suggests that in the non-manufacturing sector labour market variables are not that important in employment determination.

Table VI.6: Unions and Employment Growth, Manufacturing viz. Non-Manufacturing
Dependent Variable: Δemployment

independent variables	manufacturing	non-manufacturing
Δwage	-0.76* (0.31)	-0.19 (0.31)
Δoutput	0.79* (0.10)	0.73* (0.14)
Δindustry wage	-0.28 (0.42)	0.29 (0.64)
union derecognition	-0.003 (0.019)	-0.01 (0.027)
union recognition	-0.033* (0.011)	-0.004 (0.018)
time dummies	yes	yes
Sargan test	37.4 (df=38)	47.8 (df=38)
Second order serial correlation N(0,1)	1.8	1.8
Number of firms	187	174

Notes: As in table VI.5

VI.5. Summary and Conclusions

In this chapter I addressed the question of what unions do to employment behaviour. Do unions affect the *level* of employment and do unions affect the *growth* of employment? I have used a unique panel data set of large U.K. manufacturing and non-manufacturing firms to investigate this question. This is important to control for unobservable fixed effects. Moreover it allows to exploit both the cross-section and time-series dimension and hence to test the robustness of the estimated union effects on employment behaviour at the firm level.

As to the question that unions affect the *growth* of employment, I found no *robust* evidence that unionised firms have lower growth rates than non-unionised firms. The evidence I report indicates that there exists a negative effect of unions on employment growth, but this is not systematic over time. Moreover, the effect is weaker as firms face more competitors. Finally, I found a significant negative union effect only in the manufacturing sector, but not in the non-manufacturing sector.
As to the question whether unions affect the *level* of employment, I conclude with a quotation of a recent article in the Financial Times (May 27,1993), 'Shell is to derecognise unions at refinery...and intends to cut the Haven workforce by 100 posts to 350 by the end of 1994'. The evidence presented here is in line with this quotation. It suggests that unions have a positive impact effect on employment levels. I found that there is a significant effect of union de-recognition on employment growth when firms face only a few competitors. The reason why in the other specifications the union de-recognition effect comes through only weakly and not significant at

conventional levels is most likely due to the construction of the union de-recognition variable and the limited number of observations on this variable.

GENERAL CONCLUSION

This thesis documented a number of important new facts and approaches in labour economics. In particular, the *flow approach*, the *efficiency wage hypothesis* and the *role of trade unions in the employment behaviour of firms* have been analyzed in depth. I believe that the results reported here are not final, but merit further investigation and thus this thesis is a starting point of a larger research agenda. I first summarize the main findings of the thesis and then conclude with suggestions and directions for future research.

A. The Main Findings and Some Lessons

In part I of the thesis I focused on the flow approach in labour economics. Central to the flow approach is the matching function, which summarizes how jobs and job seekers are matched together. Crucial to the analysis is the opening up of vacancies or *job creations* on the one hand and the dying of unproductive matches or *job destructions* on the other hand. I investigated empirically this process of job creation and destruction based on U.K. firm and plant level data.

In chapter II I report that on average U.K. manufacturing firms created 1.6% new jobs and destroyed 5.6% existing ones between 1973-86. Even within narrowly defined sectors there is simultaneous creation and destruction of jobs at all phases of the business cycle. Job creation is procyclical and job destruction countercyclical and they are inversely related with the latter being more variable over the cycle. The sum of the two, gross job reallocation, is therefore countercyclical. The idiosyncratic component of job creation, destruction and reallocation is substantial. Idiosyncratic shocks explain most of the time variation in the overall job creation and destruction rate, while aggregate and sectoral shocks explain most of the time variation in the gross job reallocation rate. The idiosyncratic shocks counteract the procyclical movement in job creation, while they only weakly reinforce the countercyclical movements in job destruction. It is in booms that jobs move between firms within the same sector, while in recessions jobs move between firms in different sectors. Both job creation and destruction are highly persistent: on average 62% of the new jobs still exist after one year, while 81% of the destroyed jobs are still destroyed after one year.

There has been an increasing interest in the role of small firms in the job generation process. In chapter III I investigated a relationship between gross job flows and the size of businesses using both U.K. firm and plant level data. I found that there is a positive relationship between the gross job creation rate and firm or plant size, this relationship reverses for the job destruction rate. In contrast, the smallest firms and plants have the lowest job destruction rate while the largest firms and plants the highest, indicating that the least stable jobs are concentrated in the largest firms. However, when I focus on the absolute amount of job creation and destruction, then the majority of jobs are created and destroyed in the largest firms, however, their employment share is also largest. The job destruction share is relatively stable over time, while the job creation share varied a lot from the late 70's onwards. I investigated the evolution of the cross-section size distribution of plants and firms by computing Markov transition matrices. There is substantial intra-distribution mobility, with higher persistency in the smallest and in the largest size classes. Most movements occur in the middle size classes. Firms converge in the long run towards the mean employment in the sample, while plants do not converge.

In chapter IV I compared the U.K. results with those of other studies and argued why at this stage it is difficult to make consistent cross-country comparisons of gross job flows. I attempted to make a consistent comparison of manufacturing gross job flows across nine countries. There are remarkable differences in gross job reallocation rates across countries, with the U.S. having the highest gross job reallocation rate. There could be several reasons why there exist differences in gross job flow rates. I focused on the role of employment protection legislation, the degree of centralisation in bargaining and industrial policy as factors influencing differences in gross job flows across countries and I found preliminary evidence they do. I further pointed out the similarities and the differences in the cyclical properties of job creation and destruction for the U.S. and the U.K..

In part II of the thesis I introduced explicitly *spillovers from the product market to the labour market* and vice versa to develop a test of the efficiency wage hypothesis. While it has been very hard to provide direct evidence of the efficiency wage hypothesis, I develop an alternative approach by building a general efficiency wage oligopoly model yielding an exact prediction. The intuition is very simple: Firms only have an incentive to pay efficiency wages if and only if it induces better product market performance. This leads to a positive relationship between the wage paid by the firm and its market share performance. It is only under the hypothesis of efficiency wage payments that this positive relationship between the wage and market share is possible. I tested the propositions using U.K. firm level panel data and constrain the data by the theory to a sample of low unionised firms on the one hand and one of high unionised firms on the other. In the former I found a positive effect of the firm's unit wage cost on its market share performance, while in the latter I find a negative effect, confirming the theoretical predictions.

In chapter VI I analyzed the effect unions have on employment behaviour in U.K. firms. While there exists a vast literature on the effect of trade unions on wages, only a few papers exist on the subject treated in chapter VI. Using a unique panel dataset of large U.K. firms, including firm level data on unionisation and union de-recognition, I found that there exists a negative relationship between unionised firms and their employment *growth* and a positive effect of unions on employment *levels*. However, this negative union-growth effect is not robust with respect to the business cycle, it is only in booms that unionised firms have significant lower growth rates than non-unionised firms. Moreover, there is a stronger union effect (both on the growth rate and the employment levels) when firms face only a few rivals.
Again the product market seems to matter.

B. A Research Agenda

The results of this thesis lead to both a theoretical and an empirical research agenda. At the *theoretical level* there are several possible routes one could follow. A model of job creation and destruction can either be developed from the matching approach with endogenous job separations as in Mortensen and Pissarides (1993a,b) or from the industrial organisation's literature on firm evolution as in Jovanovic (1982). It would be interesting to see what the theoretical implications are from innovation and technological progress on the process of job creation and destruction and firm entry and exit. Empirically, further research is needed to investigate the impact of entry and exit on the size distribution of firms and hence on the process of job creation and job destruction. It would be interesting to determine the evolution of the size distribution in narrowly defined sectors and to investigate whether there is convergence towards a common size or not in those sectors. Factors influencing the size distribution of firms are most likely the same as those influencing the process of job creation and destruction. From chapter IV it is clear that more and better international comparisons on gross job flows should highlight a number of stylized facts. I suggested three possible (policy) sources which could lead to differences in gross job flows across countries. The robustness of these results should of course be tested when there are more data on more countries available.

The approach I followed in chapter V could be applied to test the efficiency wage hypothesis in other countries. The product market approach could also be applied to other labour problems, like the research in the cyclicallity of real wages, the inflow and outflow analysis, etc.. Modelling spillovers from the labour market to the product market and vice versa can lead to a number of interesting new implications for certain beliefs in labour economics. For instance, it would be interesting to investigate correlations between the degree of competition and unionization, as well as to what extent do unions cause firm entry and exit.

I only gave a few areas of new and further research which list high on my research agenda. Surely, the list could go on much further. I believe by tackling the issues mentioned here, a better picture might be obtained of how labour markets work and of how unemployment comes about.

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