

PDF hosted at the Radboud Repository of the Radboud University Nijmegen

The following full text is a publisher's version.

For additional information about this publication click this link.

<http://hdl.handle.net/2066/74913>

Please be advised that this information was generated on 2018-03-22 and may be subject to change.

NiCE Working Paper 08-102

April 2008

**Operating Hours in the EU: the Role of Strategy,
Structure and Context**

Lei Delsen

Jeroen Smits

Nijmegen Center for Economics (NiCE)

Institute for Management Research

Radboud University Nijmegen

P.O. Box 9108, 6500 HK Nijmegen, The Netherlands

<http://www.ru.nl/nice/workingpapers>

Abstract

This paper explains differences in weekly operating hours between EU countries from differences in working time strategies, establishment characteristics and the economic and institutional context. The data used are from the 2003 representative European Union Company survey of Operating hours, Working times and Employment (EUCOWE) in France, Germany, the Netherlands, Portugal, Spain and the United Kingdom. The research results indicate that in Europe weekly operating hours are largely determined by the use of certain working time options, including shift work, staggered work, weekend work and overtime hours and by the contractual weekly working hours. The use of these options results from a compromise that reflects differences in preferences and the relative bargaining power positions of employers and the employees. This compromise again is influenced by economic conditions as well as by the institutional environment of the establishment. Although establishment size is an important determinant, internal characteristics of the establishment play a lesser role in explaining differences in weekly operating hours in the EU, while the economic and institutional context in which the establishment operates plays the smallest determining role.

Corresponding author: Lei Delsen, Department of Economics, Nijmegen School of Management, Radboud University Nijmegen, P.O. Box 9108, NL 6500 HK NIJMEGEN, The Netherlands.

E-mail: L.Delsen@fm.ru.nl

To be included in L. Delsen, F. Bauer, G. Clette and M. Smith (eds.) (2009) *Comparative Analyses of Operating Hours and Working Times in the European Union*, Physica Verlag, Heidelberg.

1. Introduction

Long and flexible operating hours, and opening and service hours are key indicators of economic performance. Extending operating times and a more flexible organisation of work are important policy instruments to improve competitiveness of a single enterprise, a sector or an economy (European Commission, 1995; Betancourt and Clague, 1981; Anxo *et al.*, 1995; Delsen *et al.*, 2007). A prolongation of operating times and opening hours may increase average capital productivity and ultimately increase profitability, reduce unit costs, and generate more jobs and/or higher wages. For these reasons, both governments and companies consider operating hours a strategic goal of macroeconomic policy (European Commission, 1995).

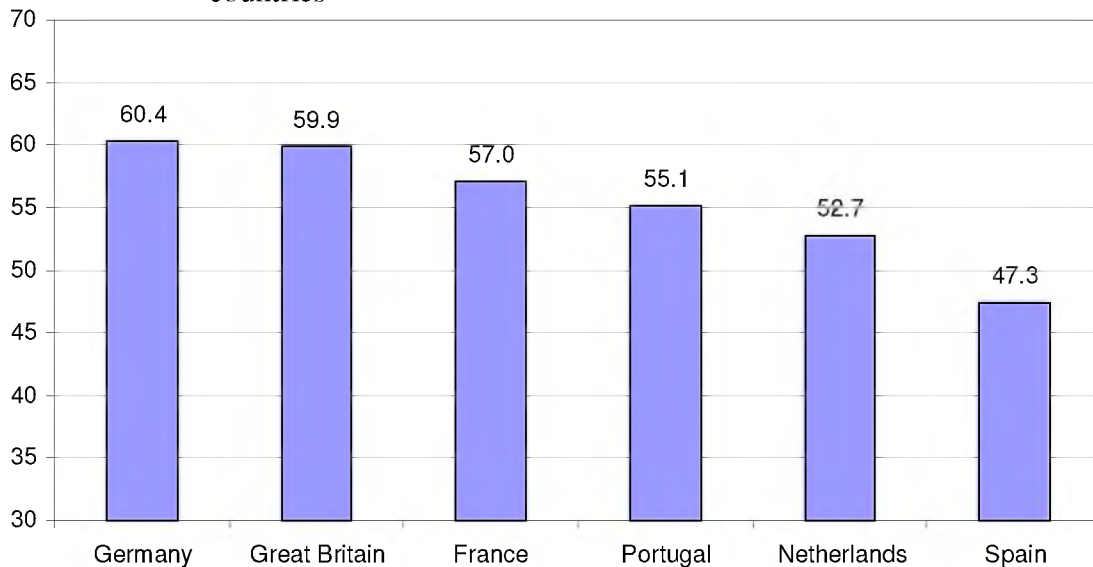
At the macro level, operating hours depend on the openness of the economy, its industry and branch structures, and the size of plants in a country. Also the business cycle situation is of importance. Figure 1 shows that among the six EU countries covered by the EUCOWE survey there are considerable differences in the weekly operating hours - defined as the weekly business hours, including preparation times and times for maintenance - ranging from 60.4 hours in Germany to 47.3 hours in Spain. These figures concern the *direct* measurement of operating hours of establishments. The direct measure is calculated from the answers given by the respondents to the question “How many hours did your establishment operate in a typical week in March or April 2003?”¹

According to the *endogenous capital utilisation* theory, in the short run the capital stock is fixed and capital utilisation is variable (Anxo *et al.*, 1995). In this theory, capital utilisation not only concerns the firms’ organisational choices that vary with market conditions, but also labour supply behaviour. Starting point of this paper is that weekly operating hours and the working-time arrangements used to realise these operating hours are the result of both demand and supply factors. There may be a trade-off between economic and social objectives, as the decoupling of operating hours and individual

¹ For more details see the EUCOWE questionnaire in Delsen *et al.* (2007). The *indirect* measure of weekly operating hours is constructed on the basis of the number of employees and the duration of the various working time patterns. Hence it measures the number of employees that experience the various operating hour regimes.

working times may require employees to work at less social hours, which interfere with social life and affect the so called work-life balance. The extent to which a trade-off takes place depends on the way in which these long and flexible operating hours are achieved. At the establishment level, it depends on the organisation of work. To match preferences of firms concerning weekly operating times, opening hours and service hours, and preferences of workers concerning hours and times of work some compromise has to be reached. This compromise reflects the relative bargaining power positions of the employer and the employee and is influenced by economic conditions as well as by the institutional environment of the establishment.

Figure 1. Directly measured weekly operating hours in the six EUCOWE countries



In this paper, we want to find out to what extent weekly operating hours are determined by working time strategies, by internal characteristics of the establishment, and by the economic and institutional context in which the establishment operates. The working time options concern the use of shift work, staggered working times, Saturday and Sunday work, overtime (including the premia paid for it), part-time work and on-call labour. Also the use of temporary workers (agency workers plus fixed-term employees) is included in our analysis. Characteristics of establishments used to explain the variation in weekly operating time include sector of activity, establishment's age, ownership (multinational),

sector and size class, capital intensity, and skill and gender composition of the workforce. The economic and institutional environment concern fluctuations in product demand, the business cycle situation, the degree to which the establishment experiences competition and the coverage by collective labour agreements.

The paper is organised as follows. In Section 2 the hypotheses concerning the determinant of operating hours are derived. These hypotheses are grouped according to internal and external dimensions. The internal dimension concerns the working time strategies and the establishment characteristics. The external dimension concerns the economic and institutional environment. In the result section first bivariate relationships are established between weekly operating hours and the working-time patterns (Section 3.1), between weekly operating hours and establishment characteristics (Section 3.2), and between weekly operating hours and the economic and institutional environment (Section 3.3). After that the results of a multivariate regression analysis are presented (Section 4), explaining the weekly operating hours in the six countries *ceteris paribus* from establishments' characteristics, the use of the various working-time options and the economic and institutional context. In Section 5 conclusions are drawn.

2. Hypotheses concerning determinants of operating hours

2.1 Working time strategies

An increase in the weekly operating hours means that the equipment will operate longer: earlier in the morning, later in the evening, at night, and/or at weekends. In the economic literature it is assumed that longer operating hours require longer working hours (Anxo *et al.*, 1995; Dupaigne, 2000; 2001; Betancourt and Clague, 1981). However, throughout Europe, in collective labour agreements longer operating hours have been exchanged for shorter but more flexible working hours. The UK, where industry-wide collective bargaining is absent, is the exception. Decoupling of operating time and working time allows reconciling workers' demands for shorter hours with industry needs for increased production (see *e.g.* Delsen, 1995; European Commission, 1995; Contensou and Vranceanu, 2000; Golden and Figart, 2000). Moreover, in the EU the share of part-time jobs has increased strongly over the past two decades (Delsen, 1995; Garibaldi and

Mauro, 2002; Buddelmeyer, Mourre and Ward, 2008). Hence, the relationship between weekly operating hours and average *contractual* weekly working time has become more ambiguous.

The organisation of work is a very important determinant of the capability of a firm to adjust production to fluctuation in demand. Evidence for Europe shows that the use of shift work is not only predetermined by technological requirements (continuous operation), but that economic conditions play an important role, too. Once shift work has been introduced in an establishment, it is used for a relative long period of time. Changes in shift work are related to a medium or long term adjustment of production or demand (see Anxo *et al.*, 1995; Jirjahn, 2008). Shift work is one of the most important factors determining the length of the operating times (European Commission, 1995; Anxo *et al.*, 1995; Dupaigne, 2000; 2001; Betancourt and Clague, 1981). Establishments that use shift work, therefore will have longer weekly operating hours relative to establishments that use no shifts.

Apart from shift work, also staggered, *i.e.* overlapping, working times, overtime work, and working on Saturdays and on Sundays are important alternative and interrelated work schedules to extend the period of daily and weekly productivity and service hours (see Delsen *et al.*, 2007). Staggered working hours may also be used to vary staffing levels within given opening and operating hours (Kümmerling and Lehndorff, 2007). Also supply factors play a role. Staggered working hours offer some flexibility in working hours to the employees and may contribute to improving work-life balances.

Like staggered working hours, also overtime hours may be used for other purposes than to extend operating hours. Overtime enables firms to effectively manage variable workloads without increasing staffing levels. Overtime allows matching the preference of firms to extend operating hours to evenings or weekends and preferences of workers concerning the *actual* weekly hours of work. Overtime may be used on a permanent basis or temporarily to cope with unpredicted short-term fluctuations or to replace absent workers. The association between overtime work and establishment size is ambiguous. For example, workers in larger German manufacturing establishments are more likely to work overtime: both the incidence and the hours of overtime per worker increase with establishment size. This is related to the higher absence rates. German manufacturing

establishments using shifts are less likely to use overtime (see Jirjahn, 2008). A higher proportion of temporary workers who are unfamiliar with the organisation and have to be settled in or have to be trained by senior employees may imply more overtime work by core employees (Delsen, 1995; Jirjahn, 2008). Böckerman (2002) found that in small Finnish establishments the share of overtime hours is relatively high, because such establishments are confronted with more volatility in demand and production. In West European countries the incidence of overtime increases with establishment size, while the number of overtime hours per employee decreases with establishment size (see Delsen *et al.*, 2007). We expect weekly operating hours to be longer in establishments that use staggered working times, overtime hours, working on Saturday and working on Sunday relative to establishments that do not use these working-time options.

Research shows that there is a trade-off between lower capital costs and higher labour costs related to the extension of capital utilisation. For the employer, extending weekly operating hours implies increasing labour costs as wage premia must be paid if longer or unusual hours (overtime, weekend and shift work) are worked (Betancourt and Clague, 1981; Anxo *et al.*, 1995; Kostiuk, 1990). Management weights extra costs of premia against the flexibility gain and the avoidance of costs of hiring additional labour. Extension of operating hours may also be accompanied by attempts to reduce the unsocial hours premia. These premia mirror employee preferences of leisure time. A reduction in leisure raises the wage rate for less social length or times of work. In this respect the overtime allowance, like extra time off in lieu, can be considered a bonus used to remunerate an employee for his/her willingness to work long hours or at less social times. It also serves as an incentive for an employee to work long hours. Empirical results indicate that the higher the overtime and shift-work premia, the lower the level of capital utilisation (see Bautista *et al.*, 1981; Dupaigne, 2000; 2001). Premia paid and extra time off in lieu for various working time patterns have a negative impact on the number of weekly operating hours.

Part-timers may be brought in at (predictable) peak times and to cover regular and anticipated variations in demand. They prevent underemployment of full-time staff during off-peak periods and overtime payments in busy periods. Part-timers may also enable establishments to remain open longer, *e.g.* on evenings or weekends. Apart from these

demand factors also supply factors play a role. Employees may prefer and choose to work part time for personal reasons, to improve their work-life balances (Delsen, 1995; Buddelmeyer, Mourre and Ward, 2008). We expect weekly operating hours to be longer in establishments with a higher part-time rate.

Fixed-term employment contracts may be used when fluctuations are predictable and overtime and agency work when fluctuations are unpredictable. In the case of irregular variations in demand, also on-call labour (hours not agreed) contracts are a solution. The incidence of these forms of work shows a procyclical movement. Flexible work arrangements have long been standard practice in order to match working time with variations in customer volume. These contracts are mainly associated with an extension of operating hours, which are mostly determined by social factors (consumers' demands) rather than economic ones (Delsen, 1995; Böckerman, 2002; Mitlacher, 2007). Agency workers may also be used to introduce additional but reversible shifts (Delsen and Smits, 2007). Also supply factors play a role. Relative to core workers, temporary workers may be more willing to work less social hours. We expect weekly operating hours to be longer in establishment with a higher proportion of agency workers, fixed-term employees, and employees without an agreed number of working hours.

2.2 Structural characteristics of establishments

Increasing returns to scale and indivisibilities in the production process influence the minimum efficient size of establishments. Savings in administrative and supervision costs due to indivisibilities in production imply that smaller firms will generally have a lower level of capital utilisation. Empirics confirm this: capital utilisation is more fully in large-scale plants than in small-scale plants (Bautista *et al.*, 1981; Eriksson and Fellman, 1995). Moreover, shift work is positively associated with establishment size (Cette, 1989). We therefore expect weekly operating hours to be longer the larger the size of the establishment. In the producing sector, technical reasons (high costs of starting up or stopping production) may explain continuous operation in certain branches of industry (see Anxo *et al.*, 1995; Delsen *et al.*, 2007). Apart from economic and technical grounds, long opening and operating hours may also be determined on social grounds. For instance, certain social services, like accident and emergency, police and fire brigade, and certain

personal services, like hotels, must be available for 24 hours. In construction and producer services, including financial intermediation, the proportion of employees working on non-standard times is small and weekly operating hours are relatively short (see Parent-Thirion *et al.*, 2007; Delsen *et al.*, 2007). Production and service processes increasingly look alike. On the one hand, the development of technology and the consequent changes in the production process produces great development of service functions at all phases of transformation processes. The pure production costs have continued to decrease. On the other hand, services have become more standardised and mechanised. Modern technology has forced the service sector to make radical changes to some of its functioning modes through the introduction of processes which are very close to the capital intensive processes in manufacturing (see Giarini and Stahel, 1993). Evening, night and/or weekend work may be used for enlarging operating and opening times or service hours, but also to perform branch specific tasks which cannot or need not to be done during normal day time, like cleaning, repairing machinery or introducing new soft- or hardware. From these empirical results we expect weekly operating hours to be relatively long in the social services and the personal services and relatively short in construction and producer services.

Capital intensity is another important establishment characteristic that is of influence on operating hours and on working-time management. For highly capital-intensive establishments, extension of operating hours may lead to a more efficient use of capital and reduced unit capital costs. Capital intensive processes tend to have higher levels of utilisation (Winston, 1974; Anxo *et al.*, 1995; Eriksson and Fellman, 1995). Weekly operating hours are longer in capital intensive establishments relative to labour intensive establishments.

Also gender is of importance for weekly operating hours. There may be legal constraints governing the times at which women can work. Also working time preferences (regarding both duration and times) may play a role. Empirics show that women are less likely to work evenings, and are less involved in shift work and in overtime hours (Anxo *et al.*, 1995; Böckerman, 2002). Here reverse causality may also play a role. Establishments with a high proportion of women face difficulty in using these work schedules, while establishments making use of overtime or shift work may be

reluctant to hire women (Jirjahn, 2008). These results concern manufacturing. Also in certain branches of the female dominated service sector, *e.g.* health care, round the clock service is provided. We expect operating hours and the proportion of females in the workforce to be ambiguous.

Also the proportion of skilled personnel may influence operating hours. In part the same reasoning as with capital intensity applies: in establishments where highly trained employees are the most important capital, extension of operating hours and working times might lead to a more efficient use of that human capital. However, in contrast with capital goods, the maximum working time of employees is legally restricted and hence the possibility to let them work longer is restricted. Extension of operating hours will, therefore, generally make it necessary to hire additional personnel, which in establishments with many skilled employees is relatively expensive. Investments in human capital of their employees, representing fixed costs per employee, may induce employers to demand for overtime. This leads to the expectation that the proportion of skilled workers and overtime incidence are positively associated (Jirjahn, 2008). In the EU the higher skilled and better qualified workers tend to work longer hours than the average employee; managers, professionals and technicians have more work autonomy (Parent-Thirion *et al.*, 2007). However, the opposite relationship between weekly operating hours and human capital may also apply. This is related to working time preferences. For manual employees, financial motives to work overtime prevail. For low wage earners overtime pay may be essential to earn a living by supplementing their earnings. Also the level of skill is important. Higher educated (non-manual) workers have been found to be less willing to work unsocial hours, overtime and shifts (see Anxo *et al.*, 1995: 30). Hence, it requires higher compensating differentials in order to accept overtime and shift work. This would imply that the costs of extending operating hours are higher for establishments with more skilled workers and thus that the proportion of skilled workers and overtime are negatively associated (Anxo *et al.*, 1995; Böckerman, 2002). The relationship between weekly operating hours and the proportion of skilled workers is thus ambiguous.

One may expect that newly established companies and young establishments in order to compete for and gain a share in the market are more likely to have longer weekly

operating hours than those establishments that are already settled in the market. Research in Finland indicates that young service sector firms have longer operating hours, while for manufacturing firms this relationship is not significant (Eriksson and Fellman, 1995). We expect establishment age and weekly operating hours to be inversely related.

Also ownership may influence weekly operating hours. One may expect that establishments that are part of multinational companies (MNCs) have longer operating hours than national organisations. This may be related to the size effect. Foreign-owned establishments tend to be larger than domestically owned establishments. Also the sector effect plays a role. Globalising pressure varies between sector; it may expect to be stronger in the producing sector. MNCs have greater propensity to use working time patterns likely to increase operating times, including shift.

2.3 The economic and institutional environment

In the short run, capital and labour are complementary production factors; increases in labour input and capital services coincide (Baxter and Farr, 2001). Hence, the weekly operating hours might be positively associated with the business cycle situation.

Building flexibility into a plant means sacrificing the lowest achievable unit costs. Uncertainty reduces optimal utilisation of capacity. Short-term fluctuations may be driving the move toward extended operating hours. Firms which experience cyclical increases in demand are more likely to increase the utilisation of their capital stock, by introducing new shifts, extending the working week (Eriksson and Fellman, 1995). We thus expect establishments that experience considerable fluctuations in business activity to have longer weekly operating hours than establishments that do not have to cope with fluctuations.

Competition between employers at national and international levels creates pressure to drive down unit labour costs and unit costs associated with utilisation of plant and equipment. Pressure to reduce labour costs and costs associated with the utilisation of the plant and equipment may also create pressure to extend operating hours. Competition may force firms to improve technical and productive efficiency, *i.e.* a more optimal use of available capital and labour in the production process. Technical efficiency refers to the physical relation between resources (capital and labour) and economic output. Productive

efficiency refers to the maximisation of outcome for a given cost, or the minimisation of cost for a given outcome. Longer operating times may be considered important in this respect to increase capital utilisation and hence economic performance.

Collective bargaining coverage implies that standards for weekly working time, premia, bonuses, extra time-off for overtime and less social working hours, and differences in working time patterns become institutionalised. Firms may compensate workers involved in these types of arrangements by providing them with a more stable and regulated job. As far as collective agreements increase premia for overtime hours, shift work and less social hours, this may have a negative impact on operating hours. Contractual working times may be shorter in the covered sector than in the uncovered establishments. If so, this may induce covered establishments to use overtime and shift work to prevent operating time from falling (Jirjahn, 2008). Throughout Europe, longer operating hours have in collective labour agreements been exchanged for shorter but more flexible working hours to avoid these premia. Flexible working patterns are more frequent when there is a collective labour agreement (Delsen, 1995; European Commission, 1995; Contensou and Vranceanu, 2000; Golden and Figart, 2000). Weekly operating hours therefore are expected to be longer in establishments that are covered by collective agreements.

3. Bivariate results

3.1 Operating hours and working time patterns

To gain insight into the factors that influence the operating hours of establishments in the six EUCOWE countries, Table 1 presents bivariate regression coefficients between the directly measured weekly operating hours and characteristics of the establishments, their working time patterns and of the environment in which they are operating.

The data largely confirm our expectations concerning the relationship between weekly operating hours and the various working-time patterns. The rather high significant positive regression coefficients in all countries between weekly operating hours and the use of shifts, staggered working times and Saturday and Sunday working can be rather straightforwardly interpreted as resulting from the fact that these all are major working

time options used to extend weekly operating hours. The data produce similar pictures for all six countries: shift work shows the highest coefficients, followed by working on Sunday and working on Saturday. The weakest effects are for staggered working times. The average overtime hours per employee have the expected positive relationship with weekly operating hours in all countries, except France. The added quadratic term is negatively associated with weekly operating hours, indicating a parabolic relation for the UK, the Netherlands and Portugal. In these countries, longer overtime hours per employee are associated with longer weekly operating hours, but the impact of overtime diminishes with its volume. Within the range covered by our data, the effect of overtime remains positive. Opposite to our hypothesis, the overtime premium is strongly positively associated with weekly operating hours in all six countries. The use of overtime premium and/or extra time off in lieu of overtime seems to serve mainly to induce employees to work long hours or at unsocial times.

We expected longer contractual working times of employees to increase operating time. This is confirmed for Germany and the UK, the countries with the longest weekly operating hours, as well as for the Netherlands and Spain, the countries with the shortest weekly operating hours (see Figure 1). However, the significant negative coefficients of the quadratic terms for Spain, UK and Netherlands indicate that in these countries the positive impact of contractual weekly working hours on weekly operating hours becomes weaker if the contractual working hours are longer, suggesting an inverted U-shaped relationship. In Germany the relationship is linearly positive. For France and Portugal, countries with intermediate weekly operating hours, the relationship is negative. In these last two countries longer weekly operating hours are accompanied by shorter average weekly working time, suggesting a trade-off between operating time and contractual working time. In France the relationship is nonlinear; the negative impact decreases with the length of the average contractual weekly working hours, pointing towards a U-shape relationship. In Portugal the negative relationship is linear. The trade-off between operating time and contractual working time may be explained from legislation and collective labour agreements that require special working time reductions for shift workers, for employees working at nights or during the weekend. Also specific strategic use of part-time contracts may play a role here. For instance, in Portugal part-time

employment is not used to extend operating hours, but to guarantee the operation of some type of business, and is associated with shorter operating hours (see Castro and Varejão, 2007: 164-165). These businesses are predominantly in the retail trade and leisure services and closely linked to week-end operations (a small number of establishments operated from Fridays to Sundays only). These inter-country differences may also be partly related to employee preferences. From this mixed picture, it may be concluded that longer weekly contractual working hours is not a condition *sine qua non* for extending weekly operating hours, as suggested in the economic literature.

Weekly operating hours increase with the part-time rate in all countries, except Germany where weekly operating hours decrease with the part-time rate.² Germany also is the only country where the (negative) relationship is linear. In the other five countries the positive relationship is nonlinear: the added quadratic term is negative in these countries, indicating an inverted U-shaped relation between the part-time rate and weekly operating hours. The expected strategic use of part-time employment as an instrument for permanently extending weekly operating and opening hours is confirmed. However, its impact on weekly operating hours diminishes the higher the part-time rate. Employee preferences and coverage of regular fluctuations in demand may play a role here. The latter may also partly explain the negative relation in Germany.

The percentage of agency workers and fixed-term employees has a significant positive effect on weekly operating hours in Germany, Spain, the Netherlands and Portugal. The significant negative coefficients of the quadratic term indicate that this positive impact on weekly operating hours is weaker in establishments with a high percentage of agency and fixed-term employees. The expected strategic use of agency workers and fixed-term employees as an instrument for extending weekly operating and opening hours is confirmed. In the UK this relationship is negative and linear and contradicts our hypothesis, suggesting that agency workers and fixed-term employees are mainly used to cope with unpredicted short-term fluctuations or to replace absent workers.

² Part-time employment refers to less than 35 contractual weekly working hours, and may therefore in certain economic sectors also include full-time contracts.

Table 1. Bivariate regression coefficients of selected establishment characteristics on weekly operating hours

	DE	ES	FR	UK	NL	PT
Working time patterns						
Shift work	44.518	46.791	67.894	67.275	36.070	65.904
Staggered working times	12.361	x	19.331	15.014	18.978	33.641
Saturday work	23.376	23.809	22.758	35.023	18.758	38.758
Sunday work	36.843	40.065	38.893	54.886	31.144	56.252
Percentage part-time (< 35 hours)	-0.059	0.264	0.259	0.545	0.290	0.904
Percentage part-time square	Ns	-0.003	-0.003	-0.005	-0.003	-0.009
Average overtime hours	1.127	8.360	<i>-0.174</i>	4.197	2.363	8.194
Average overtime hours square	ns	ns	ns	-0.125	-0.104	-0.660
Overtime premium	7.650	x	4.449	14.263	5.632	20.911
Percentage agency & fixed-term employees	0.372	0.257	<i>0.049</i>	-0.092	0.288	0.354
Percentage agency & ft square	-0.004	-0.003	ns	ns	-0.003	-0.004
Percentage contract hours not agreed	<i>0.049</i>	x	0.067	0.540	0.464	0.592
Percentage hours not agreed square	ns	x	ns	-0.005	-0.005	-0.007
Average contractual working time	0.219	1.461	-0.941	1.868	0.963	-0.471
Average contractual working time square	ns	-0.022	0.023	-0.031	-0.022	ns
Establishment characteristics						
1-19 employees	-45.175	-51.933	-48.017	-51.741	-41.364	-47.286
20-249 employees	-26.840	-33.912	-26.359	-25.505	-31.229	-33.351
250+ employees	ref.	ref.	ref.	ref.	ref.	ref.
Primary sector	5.044	<i>6.073</i>	<i>-1.156</i>	<i>0.281</i>	<i>3.355</i>	<i>-8.138</i>
Secondary sector	<i>0.052</i>	<i>-0.324</i>	<i>2.403</i>	<i>-1.875</i>	<i>-1.554</i>	<i>-4.580</i>
Construction	-9.217	-7.523	-13.491	2.532	-6.454	-15.244
Distributive services	2.381	<i>-0.968</i>	<i>-1.002</i>	<i>3.161</i>	<i>1.049</i>	<i>-1.867</i>
Producer services	-6.409	-5.727	-4.074	-6.040	-8.077	-12.704
Social services	<i>-1.023</i>	-3.839	<i>-0.956</i>	8.332	<i>1.296</i>	19.951
Personal services	9.172	12.308	18.278	-6.391	10.385	22.582
Establishment age < 10 years	4.562	<i>-0.782</i>	<i>1.940</i>	-11.255	5.013	<i>-1.106</i>
Percentage skilled employees	-0.070	x	<i>-0.030</i>	-0.996	-0.108	x
Percentage skilled employees square	ns	x	ns	0.006	ns	x
Percentage labour costs	-0.089	2.063	0.527	<i>-0.048</i>	-0.090	0.302
Percentage labour costs square	ns	-0.042	-0.005	ns	ns	-0.003
Labour costs increased since 1998	<i>1.411</i>	15.195	6.668	12.830	2.663	7.363
Percentage female employees	0.240	0.379	0.413	-0.437	0.317	0.481
Percentage female employees square	-0.002	-0.004	-0.004	0.004	-0.003	-0.003
Multinational	<i>4.297</i>	3.706	7.390	<i>1.410</i>	<i>3.616</i>	<i>-0.198</i>
Economic and institutional environment						
International competition	4.674	3.287	4.122	<i>0.245</i>	5.125	-3.677
Employment increased since 1998	8.717	6.022	<i>0.721</i>	<i>3.296</i>	5.862	<i>1.087</i>
Experiencing fluctuations	3.922	x	7.256	<i>2.466</i>	9.695	8.632
Collective labour agreement	<i>-1.260</i>	8.859	4.931	<i>2.203</i>	8.607	6.174

x = variable not available in country; ns = Quadratic term not significant
 Non-significant coefficients are printed in grey and italic.

The percentage of employees without an agreed number of hours (on-call contracts) has a positive impact on weekly operating hours in France, the UK, the Netherlands and Portugal. Like in the case of agency workers and fixed-term employees, the significant negative coefficients of the added quadratic term indicate that this positive impact on weekly operating hours is hump-shaped. For France the positive relationship is linear. The expected strategic use of on-call labour as an instrument for extending weekly operating and opening hours is confirmed, except for Germany where the relation is not significant.

3.2 Operating hours and establishment characteristics

Table 1 also presents the bivariate regression coefficients of characteristics of establishments on the directly measured weekly operating hours for the EUCOWE countries. In all six countries, weekly operating hours increase considerably with establishment size, *i.e.* the number of employees of establishments. Small establishments have the shortest and large establishments have the longest weekly operating hours. Our hypothesis is confirmed.

Concerning the weekly operating hours in the different branches of the economy the bivariate analysis shows a mixed picture that partly conflicts with our expectation. In most countries weekly operating hours in the primary sector, the secondary sector and in construction do not differ significantly from the average and hence do not contribute to explaining weekly operating hours at the national level. Producer services have the expected significant negative impact on average weekly operating hours in all six countries, and personal services have the expected significant positive impact on average weekly operating hours in all countries; the UK being the exception. The impact of social services weekly operating hours varies between countries: an expected positive impact in the UK and Portugal and in Spain it has a negative impact on weekly operating time.

Young establishments (aged less than 10 years) only have the expected significant longer operating hours in Germany and the Netherlands. In the UK the relation is reversed. The latter may be related to the fact that a considerable part of the new establishments concern are in the producer services.

In our model we use the percentage of labour costs in total costs of the establishment as a proxy for capital intensity. Table 1 shows a mixed picture. The expected linear negative relationship with operating hours is confirmed for Germany and the Netherlands. In the Southern European countries Spain, France and Portugal this relationship is positive. Here labour intensive establishments have significant longer operating hours and its impact is nonlinear. These inter-country differences may relate to differences in the way the management of the establishments weights the increasing labour costs resulting from extra wage premia and the costs of hiring additional labour and the gains from extending operating hours. Our bivariate analysis supports the trade-off between lower capital costs and higher labour costs of more intensive utilisation of capital. The growth in the share of labour costs in total costs between 1998 and 2003 is positively associated with weekly operating hours in all countries, except Germany. Hence, in establishment with long weekly operating hours in 2003 this was accompanied by an increasing proportion of labour costs in the preceding five year period.

The regression coefficient of the proportion of skilled employees - in the EUCOWE survey measured by the percentage of managerial, professional and higher technical staff - on weekly operating hours is negative in Germany, the Netherlands and the UK. The significant quadratic term implies that in the UK this relationship is nonlinear: the negative impact of skilled employees on weekly operating hours decreases the higher the proportion of skilled employees in the workforce. These results seem to indicate the importance of working time preferences of skilled employees, *i.e.* their lower willingness to work less social hours, to work overtime and to work shifts.

Unlike our expectation, the regression coefficients of the female rate on the operating hours are nonlinear and positive in all countries, except in the UK, where it is nonlinear and negative. Hence, in most countries a high proportion of women in the workforce is favourable for the extension of operating hours. In part this may be related to differences between male and female employees in the sectoral distribution. Women are overrepresented in personnel services with above average weekly operating hours and underrepresented in producer services, with below average weekly operating hours. As already pointed out, the negative relationship in the UK does not concern a causal relationship.

The regression coefficient of MNCs on weekly operating hours has the expected positive sign in Spain and France. In these countries foreign owned establishments have longer weekly operating hours, suggesting that foreign capital ownership is a more important determinant of weekly operating hours than the “local environment”. For the other countries no significant influence was found.

3.3 Operating hours and the economic and institutional environment

The coefficients of the economic and institutional context variables presented in Table 1 are lower than those for working time options, indicating a relative low economic significance of these economic and institutional context variables. We see that in line with our expectations, in Germany, Spain, France and the Netherlands the establishments that mainly compete on international markets have significant longer weekly operating hours. These results suggest that longer operating hours are used as a measure to improve productive and technical efficiency to address international competition. For Portugal the relationship is negative. This finding is difficult to explain. However, it disappears in the multivariate analysis and hence is the result of other organisational characteristics that are related to the operating hours and experiencing international competition.

Weekly operating hours may also be influenced by the business cycle. We used employment growth since 1998 as a proxy for the business cycle situation. Past employment growth (1998-2003), *i.e.* a boom, has the expected significant positive association with the length of weekly operating time in Germany, Spain and the Netherlands. In the other countries the business cycle has no impact on the usual weekly operating hours.

In Germany, the Netherlands, France and Portugal, establishments that experienced considerable fluctuations in business activity in 2002 recorded significant longer weekly operating hours in 2003 than establishments that did not experience those fluctuations. This is in line with our expectations. These longer operating hours to cope with fluctuations may be inefficient, *i.e.* increase unit costs, and reduce competitiveness. In the UK no significant impact of fluctuations is found.

Table 2. Multivariate regression coefficients of selected establishment characteristics on weekly operating hours

	DE	ES	FR	UK	NL	PT
Intercept	55.289	60.630	46.726	23.264	48.171	73.099
Working time patterns						
Shift work	31.613	33.125	46.299	40.477	20.831	37.724
Staggered working times	5.180	x	7.694	6.745	8.492	13.078
Saturday work	10.117	2.905	9.180	8.565	7.477	12.168
Sunday work	22.356	21.736	25.046	29.278	21.991	28.970
Percentage part-time (< 35 hours)	0.246	-0.068	0.102	0.438	<i>0.008</i>	-0.069
Percentage part-time square	-0.002	Ns	-0.002	-0.003	ns	ns
Average overtime hours	<i>0.261</i>	3.510	<i>-0.266</i>	0.892	2.318	-1.866
Average overtime hours square	ns	Ns	ns	ns	-0.135	ns
Overtime premium	3.399	X	2.503	3.265	<i>-0.776</i>	8.657
Percentage agency & fixed-term employees	<i>-0.018</i>	<i>-0.002</i>	<i>-0.027</i>	-0.096	<i>-0.045</i>	<i>0.000</i>
Percentage agency & ft square	ns	ns	ns	ns	ns	ns
Percentage contract hours not agreed	-0.185	x	<i>0.001</i>	<i>0.025</i>	0.376	<i>-0.044</i>
Percentage not agreed square	0.002	x	ns	ns	-0.005	ns
Average working time	0.248	<i>0.044</i>	0.184	0.747	0.713	-1.004
Average working time square	ns	ns	ns	ns	-0.013	0.015
Establishment characteristics						
1-19 employees	-19.204	-23.628	-16.374	<i>-6.012</i>	-18.670	-15.992
20-249 employees	-12.947	-16.612	<i>-8.297</i>	<i>-0.038</i>	-15.039	<i>-11.950</i>
250+ employees	ref.	ref.	ref.	ref.	ref.	ref.
Primary sector	<i>-0.527</i>	<i>1.109</i>	<i>-0.659</i>	<i>0.615</i>	<i>1.190</i>	<i>-0.432</i>
Secondary sector	<i>-0.938</i>	<i>-0.032</i>	<i>-0.165</i>	<i>-0.662</i>	<i>-1.931</i>	<i>-0.528</i>
Construction	<i>-0.555</i>	<i>-2.243</i>	<i>-0.123</i>	2.827	<i>-1.869</i>	<i>-1.884</i>
Distributive services	<i>1.367</i>	<i>0.419</i>	<i>-3.910</i>	<i>-0.213</i>	<i>0.665</i>	<i>-2.639</i>
Producer services	<i>0.302</i>	<i>-0.912</i>	<i>0.636</i>	<i>-5.531</i>	<i>-3.515</i>	<i>-4.104</i>
Social services	<i>-1.350</i>	<i>-1.642</i>	<i>1.916</i>	<i>0.386</i>	3.486	10.350
Personal services	<i>1.702</i>	3.300	2.306	<i>2.578</i>	<i>1.976</i>	<i>-0.762</i>
Establishment age < 10 years	3.416	<i>-0.373</i>	<i>1.512</i>	-3.904	3.309	-1.457
Percentage skilled employees	0.184	x	<i>-0.025</i>	-0.323	-0.082	x
Percentage skilled employees square	-0.003	x	ns	0.002	ns	x
Percentage labour costs	<i>-0.028</i>	0.351	0.088	<i>0.046</i>	<i>0.007</i>	0.038
Percentage labour costs square	ns	-0.008	ns	ns	ns	ns
Labour costs increased since 1998	-1.539	2.810	2.505	6.422	<i>1.180</i>	<i>1.155</i>
Percentage female employees	-0.031	0.034	<i>-0.009</i>	<i>-0.012</i>	<i>-0.025</i>	<i>0.020</i>
Percentage female employees square	ns	ns	ns	ns	ns	ns
Multinational	-6.270	<i>-2.324</i>	<i>4.479</i>	<i>1.209</i>	<i>-0.664</i>	<i>1.695</i>
Economic and institutional environment						
International competition	<i>0.654</i>	<i>0.725</i>	2.946	2.399	3.238	<i>-0.330</i>
Employment increased since 1998	4.051	<i>0.656</i>	<i>-0.449</i>	<i>2.014</i>	<i>1.969</i>	<i>0.449</i>
Experiencing fluctuations	<i>0.825</i>	x	<i>1.538</i>	<i>-2.043</i>	3.020	<i>-2.885</i>
Collective labour agreement	<i>-0.203</i>	<i>1.627</i>	<i>-0.332</i>	<i>-2.838</i>	2.899	<i>0.218</i>
Number of cases	2,946	5,934	2,227	1,412	1,826	2,810
R ² adjusted	0.489	0.486	0.621	0.642	0.434	0.687
R ² adjusted without working time options*	0.171	0.207	0.225	0.269	0.203	0.252

x = variable not available in country; ns = Quadratic term not significant.

Non-significant coefficients are printed in grey and italic.

* Without the shift, staggered, Saturday and Sunday work variables.

Establishments covered by a collective labour agreement on working time or operating hours were found to operate significantly more hours per week in Spain, France, the Netherlands and Portugal. In these countries our expectation is confirmed. Collective agreements may be accompanied by cost increases or conditions that hamper the extension or reduce the length of operating and opening hours. Our results indicate that, on balance, coverage by collective agreements facilitates and promotes the extension of operating and opening hours by employers. In Germany and the UK the impact of collective labour agreements is not statistically significant. For Germany also Bauer *et al.* (2002) found similar operating hours for establishments covered and not covered by sectoral collective agreements.

4. Multivariate results

In Table 2 the results of a multivariate regression analysis are presented to establish, *ceteris paribus*, the impact of establishment's characteristics, the working-time patterns used by establishments and the institutional and economic environment on the number of weekly operating hours in a typical week in March or April 2003. The proportion of explained variance of the models is high, ranging from 43% in the Netherlands to 69% in Portugal. However, these percentages are high due to the presence of the working time patterns in the model. Shift work, staggered working times, Saturday and Sunday work are, among others, used as strategies to extend operating hours. Hence the fact that they have strong positive effects on operating hours and explain a substantial part of its variance comes as no surprise. Still it is important to have them in the multivariate models, because we know that the use of these working time patterns varies among sectors and among establishments with different characteristics. Hence if we leave them out, we do not know whether the effects of the other variables in the model are real effects of those variables, or compositional effects due to the fact that establishment with different characteristics make different use of these working time patterns.

To get an idea of the proportion of the variance in weekly operating hours explained by the other variables in the model, at the bottom of Table 2 also the percentages of explained variance are presented for models without the shift, staggered,

Saturday and Sunday work variables. These percentages range from 17% in Germany to 27% in the UK. In this section, where relevant, the multivariate results are compared with the bivariate results in Table 1 to point out similarities and differences.

4.1 Working time strategies

The multivariate analysis to a large extent confirms the results from our bivariate analysis concerning working time strategies. In all six countries, controlled for all the other characteristics, shift work is the most important determinant and Sunday working the second most important determinant of weekly operating hours. Also staggered working times and Saturday working are economically and statistically significant working time schedules to lengthen operating hours. The effect of the latter two varies between countries. In Germany, France and the UK Saturday work is a stronger determinant of weekly operating hours than staggered working times, while in Portugal and the Netherlands staggered working times is stronger than working on Saturdays.

In Germany, the UK and the Netherlands again a positive relationship between weekly operating hours and average contractual weekly working time is found. Now also France shows the expected positive relationship. For Portugal, again, the relationship is negative, suggesting a trade-off between operating hours and contractual working time hours. This may be related to specific strategic use of part-time contracts. In Portugal part-time employment is not used to extend operating hours, but allows establishments to operate only during week-ends, *e.g.* in leisure and retail trade. Also from the multivariate results it can be concluded that longer weekly contractual working hours is not a necessary condition for long weekly operating hours, as suggested in the economic literature. Decoupling of weekly operating hours and individual working time does not necessarily mean shorter operating hours.

The impact of the proportion of part-time employees on weekly operating hours shows again a mixed picture. In three of the countries, Germany, France and the UK, the effect is nonlinear, with an initial increase followed by a decrease of operating hours. These results point towards the expected strategic use of part-time employment as an instrument for extending weekly operating and opening hours in these countries. However, its impact on weekly operating hours decreases the higher the part-time rate,

pointing towards an inverted U-shape relationship. Unlike the bivariate results, in Spain and Portugal the impact is significant negative and linear. Hence, higher proportions of part-time employment in these countries are accompanied by shorter weekly operating hours. These results can be explained from the fact that in these countries the majority of establishments do not use part-time work. In Spain this is the case with 62% of the establishments. Moreover, the part-time using establishments are small and mainly located in retail trade and social services (see Fernández Macías and Muñoz de Bustillo Llorente, 2007). This also applies to Portugal where 86% of establishments do not use part-time work (Castro and Varejão, 2007). It is important to note that in the Netherlands, where 70% of the establishments use part-time employment contracts³, no significant impact was found. This finding is in line with the fact that the high proportion of part-time work in the Netherlands is mainly the results of the preferences of employees and much less the result of strategic use as an instrument for extending weekly operating hours (see Delsen and Smits, 2007).

Average overtime hours per employee again have the expected positive relationship with weekly operating hours in the Netherlands, Spain and the UK. As the EUCOWE data on operating hours concern a usual week, this points towards strategic use of structural (permanent) overtime to extend operating times, opening hours or service hours. In Spain only 3% of the establishments use overtime (Fernández Macías and Muñoz de Bustillo Llorente, 2007: 189). Table 2 shows that in these establishments overtime hours have a strong positive impact on weekly operating hours. Interesting in this respect is also the case of the Netherlands, the only country where the relation is not linear. Hence, in the Netherlands longer overtime hours per employee are associated with longer weekly operating hours, but the impact of overtime diminishes with its volume. In contrast with the bivariate results, in Germany overtime hours are not statistically significant any more and in Portugal the negative effect points towards a trade-off between operating hours and overtime. In Portugal only 5.5% of the establishments use overtime hours (Castro and Varejão, 2007: 156 and 166). The results suggest that in this

³ To compare: in the UK 71% of the establishments use part-time work, in Germany 60% of the establishments and in France 52% of the establishments (see Smith, Bosworth and Carroll, 2007; Bauer *et al.*, 2007; Cette, Kocoglu and Sylvain, 2007).

country overtime hours, like part-time employment, are not used to extend operating hours, but to guarantee the operation of some type of business with shorter operating hours.

Like in the bivariate analysis and opposite to our hypothesis, the overtime premium again is positively associated with weekly operating hours in Germany, France, the UK and Portugal. In these countries overtime premium and/or extra time off in lieu of overtime seems to serve to induce employees to work longer hours or to work at unsocial times. Unlike the bivariate results, in the Netherlands the relationship is not statistically significant any more.

The positive relationship between weekly operating hours and the percentage of agency workers and fixed-term employees found in the bivariate analysis is completely absent in the multivariate analysis. Opposite to our expectation, the percentage of agency workers and fixed-term employees again has a significant linear negative effect on operating hours in the UK and is in the other countries not significant. This seems to indicate that these contracts and employees are mainly used as strategies for coping with fluctuations and not for extending operating hours permanently.

The multivariate results concerning the on-call contracts (hours not agreed) differ considerably from the bivariate results too. The percentage of on-call contracts now has a nonlinear negative effect on weekly operating hours in Germany and a nonlinear positive effect in the Netherlands. In France, Portugal and the UK the positive relationship found in the bivariate analysis is absent in the multivariate results; suggesting that, like agency workers and fixed-term employees, also employees with on-call employment contracts are mainly used as strategies for coping with fluctuations and not for extending operating hours permanently. Hence, the Netherlands seems to be the only country where on-call labour is used to extend weekly operating hours.

4.2 Establishment characteristics

The multivariate regression results in Table 2 confirm the statistic and economic significance of establishment size in explaining operating hours. In all countries, except the UK, weekly operating hours increase with establishment size. Like in the bivariate analysis, in Germany, Spain, and the Netherlands weekly operating hours are significant

lower in small (1-19 employees) establishments than in medium sized (20-249 employees) establishments, and in these medium sized establishments weekly operating hours again are significant lower than in large (250+ employees) establishments. In France and Portugal the differences between the medium-sized establishments and the largest establishments are smaller than in the other countries (except the UK) and not significant.

Concerning the weekly operating hours in the different branches of the economy, the multivariate analysis shows that in most sectors of industry operating hours do not differ significantly from the national average. This holds for the primary and secondary sectors in all six countries. In the UK, weekly operating hours in construction are higher than average. Operating hours in the different branches of the service sector show a mixed picture that moreover varies between countries. In the producer services, operating hours are significantly lower than average in the UK, the Netherlands and Portugal and in the social services, operating hours are significantly higher than average in the Netherlands and Portugal. In the personal services, operating hours are higher than average in Spain and France and in the distributive services they are lower than average in France and Portugal. The higher than average operating hours in the personal and social services and the lower than average operating hours in the producer and distributive services are in line with our expectations.

Young establishments (aged less than 10 years) have the expected longer operating hours in Germany and the Netherlands. In the UK and Portugal the relation is the reverse of what was expected: young establishments there have shorter weekly operating hours. The latter may be related to the fact that a considerable part of the new establishments are in the producer services.

Unlike the bivariate analysis, the multivariate analysis confirms the ambiguous relationship between weekly operating hours and the proportion of skilled workers (managerial, professional and higher technical staff). In the UK and the Netherlands establishments with higher percentages of skilled staff have significantly shorter weekly operating hours. In these two countries the negative impact of employee preferences and the costs of extending operating hours seem to be more important than the benefits of the extension of operating hours and the demand for overtime of the employer induced by the

investments in human capital of their employees. Unlike the bivariate results, in Germany the percentage of skilled employees has a significant positive impact on weekly operating hours. Here managerial, professional and higher technical staff seems to be considered as fixed costs. Extending operating hours allows reducing unit fixed costs. In Germany and the UK the relationships are nonlinear. In the Netherlands the relationship is linear.

The multivariate results concerning the impact of capital intensity on weekly operating hours differ from the mixed bivariate results. The percentage of labour costs in total costs of the establishment is used as a proxy for capital intensity.⁴ The negative linear relationship in Germany and the Netherlands turns statistically insignificant. For the UK, the relationship remains insignificant. Opposite to our expectation, in Spain, France and Portugal the proportion of labour costs again is positively associated with weekly operating hours. Here labour intensive establishments have longer weekly operating hours than capital intensive establishments. Like the bivariate results, only for Spain this relationship is nonlinear. The coefficients indicate that the economic significance is low. The trade-off between lower capital costs and higher labour costs of more intensive utilisation of capital is confirmed again in Spain, France and the UK. In these countries, establishments that experienced a growth in the share of labour costs between 1998 and 2003 had longer than average operating hours. In Germany, however, the effect is negative, indicating that in this country long weekly operating hours in 2003 were preceded by capital-deepening investments in the preceding five year period.

The proportion of females in total employment of the establishment has an (unexpected) positive relationship with weekly operating hours in Spain and an (expected) negative relationship with weekly operating hours in Germany. In the other four countries no significant impact was found.

Foreign ownership (multinational) has a significant negative impact on weekly operating hours in Germany. This effect was not expected. In the other countries no impact was found. This suggests that the “local environment” is a more important determinant of weekly operating hours than foreign ownership.

⁴ There have been indication that capital intensity may be highly correlated with shift work (Cette, 1989), causing multicollinearity problems. However, in our data the relationship between the proportion of labour costs in total costs and shift work is not statistically significant.

4.3 Economic and institutional environment

In the multivariate analysis, not much significant effects of the economic and institutional environment on weekly operating hours are found. Regarding the effect of international competition, only for France and the Netherlands a significant relationship is identified; establishments that experience international competition in these countries have longer operating hours. Hence, for the other countries, unlike our expectations and opposite to the bivariate findings, international competitive pressure does not force establishments to increase operating hours.

With regard to the effect of the business cycle, in the bivariate analyses positive effects of employment growth in the period 1998-2003 were found for Germany, Spain and the Netherlands. However, in the multivariate analysis, this effect is only significantly present for Germany. Hence in the other five countries no clear effects of the business cycle situation on the average number of weekly operating hours seems to exist.

The bivariate analysis showed that most countries that experienced considerable fluctuations in business activity in 2002 had significantly longer weekly operating hours in 2003 than other establishments. In the multivariate analysis, this only is the case in the Netherlands. Here longer operating hours to cope with fluctuations may be inefficient, for building flexibility into a plant may imply sacrifice the lowest achievable unit costs. Moreover, contrary to the bivariate results, for Portugal the relationship is negative.

In the Netherlands, establishments covered by a collective labour agreement on working time or operating hours also tend to operate longer hours per week. In this country, collective labour agreements facilitate and promote the extension of operating and opening hours by employers. Most Dutch firms and employees are covered by legally extended sectoral labour agreements that limit the power of the insiders, *i.e.* incumbent personnel within establishments. In the UK the opposite applies. Here establishments covered by collective agreements have lower weekly operating hours, probably because of accompanying cost increases or conditions that hamper the extension of or reduce operating and opening hours. This hampering impact may be related to insider power of employees resulting from decentralised collective bargaining.

5. Conclusions

Our results indicate that in West European countries shift work and Sunday working are the most important working-time options used to extend weekly operating and opening hours, followed by staggered working times and Saturday working. Another economic and statistically significant determinant of weekly operating hours in West Europe is establishment size; operating hours are generally longer in larger establishments. Structural overtime hours also contribute significantly to the length of weekly operating hours in most countries, France and Portugal being the exception. Inter-country differences may partly relate to differences in employee preferences for working overtime. Opposite to earlier research we found that overtime premia are positively related to weekly operating hours.

The contribution of part-time employment to operating hours shows a mixed picture: in Spain and Portugal it is linear and negative, while in Germany, France and the UK it is non-linear and positive. In the Netherlands it is insignificant. Employee preferences most likely play a role here too. Concerning the use of temporary workers, the bivariate results differ from the multivariate results. Bivariate results show positive and nonlinear effect on weekly operating hours. Multivariate results show insignificant or negative effects, the Netherlands being the exception. Hence, agency workers, fixed-term employees and employees with on-call (hours not agreed) contracts seem to be mainly used for coping with unpredicted short-term fluctuations or to replace absent workers, and not for extending operating hours permanently. Our results also show that, unlike what has been suggested in the economic literature, longer weekly contractual working hours is not a condition *sine qua non* for extending weekly operating hours.

Other establishment characteristics co-determine weekly operating hours. Operating hours in the service sector vary between branches: producer services and distributive services have lower than average operating hours, while social services and personal services have higher than average operating hours. In none of the countries, operating hours in the primary and secondary sectors differ significantly from the country's average. The effect of the proportion of skilled workers (managerial, professional and higher technical staff) on operating hours was for two of the four countries for which this information is available (UK and Netherlands) negative and for

Germany nonlinearly positive. Hence the expected ambiguous (mixed) relationship between weekly operating hours and the proportion of skilled workers was confirmed in our data. The multivariate results concerning the impact of capital intensity on weekly operating hours confirm the trade-off between lower capital costs and higher labour costs of more intensive utilisation of capital is confirmed. Only for Spain, France and Portugal, a positive effect on operating hours was found.

The impact of the age of the establishments on weekly operating hours shows a mixed picture; in some countries (Germany, Netherlands) operating hours are significantly longer in younger establishments, while in other countries (UK and Portugal) they are significant shorter in younger establishments. In most countries the proportion of female employees and being part of a multinational does not have an impact on weekly operating hours. The latter suggests that the “local environment” is a more important determinant of weekly operating hours than foreign ownership.

The economic and institutional context also explains part of the weekly operating hours. Bivariate results differ from multivariate results. In the multivariate analysis, the positive impact of the business cycle on weekly operating hours is found in fewer countries. In most countries, international competitive pressure does not force establishments to increase operating hours. The impact of fluctuations in business activity on weekly operating hours is ambiguous. Bivariate analysis shows that in most EU countries, except Germany and the UK, establishment covered by collective labour agreements have longer operating hours. The multivariate analysis reveals a complete different picture: only in the Netherlands the relationship is positive, while in the UK it is negative.

Concerning the central question of this chapter, our research results indicate that weekly operating hours in Europe are largely determined by working time strategies. Internal characteristics of the establishment play a lesser determining role, and the economic and institutional context in which the establishment operates is least important.

References

- Anxo, D., G. Bosch, D. Bosworth, G. Cette, T. Sterner and D. Taddei (1995) *Work patterns and capital utilisation - an international comparative study*, Dordrecht: Kluwer Academic Publishers.
- Bauer, F., H. Groß, E. Munz and S. Sayin (2002) *Arbeits- und Betriebszeiten 2001. Neue Formen des betrieblichen Arbeits- und Betriebszeitmanagements. Ergebnisse einer repräsentativen Betriebsbefragung*, Berichte des ISO 67, Köln: Institut zur Erforschung sozialer Chancen.
- Bauer, F., H. Groß, S. Lehndorff, S. Schief and G. Sieglén (2007) Operating hours, working times and employment in Germany, in: L. Delsen, D. Bosworth, H. Groß, R. Muñoz de Bustillo y Llorente (eds.) *Operating Hours and Working Times. A Survey of Capacity Utilisation and Employment in the European Union*, Heidelberg: Physica-Verlag, 95-120.
- Bauer, F., H. Groß, R. Muñoz de Bustillo y Llorente, E. Fernández Macias and G. Sieglén (2007) Cross-country Comparison of Operating Hours, Capacity Utilisation, Working Times and Employment, in: L. Delsen, D. Bosworth, H. Groß, R. Muñoz de Bustillo y Llorente (eds.) *Operating Hours and Working Times. A Survey of Capacity Utilisation and Employment in the European Union*, Heidelberg: Physica-Verlag, 41-72.
- Bautista, R. M., H. Hughes, D. Lim, D. Morawetz and F. Thoumi (1981) *Capital Utilization in Manufacturing: Colombia, Israel, Malaysia and the Philippines*, New York: Oxford University Press.
- Baxter, M. and D. D. Farr (2001) The Effects of Variable Capital Utilization on the Measurement and Properties of Sectoral Productivity: Some International Evidence, *NBER Working Papers 8475*, Cambridge: National Bureau of Economic Research.
- Betancourt, R. R. and C. K. Clague (1981) *Capital Utilization: A Theoretical and Empirical Analysis*, Cambridge: Cambridge University Press.
- Böckerman, P. (2002) Overtime in Finland, *Finnish Economic Papers*, 15 (1): 36-54.
- Buddelmeyer, H., G. Mourre and M. Ward (2008) Why do Europeans work part-time? A cross-country panel analysis, *ECB Working Papers Series 872*, Frankfurt am Main: European Central Bank.
- Burns, R. N. and M. W. Carter (1985) Work force size and single shift schedules with variable demands, *Management Science*, 31, May: 599-607.
- Castro, A. and J. Varejão (2007) Operating hours, working times and employment in Portugal, in: L. Delsen, D. Bosworth, H. Groß and R. Muñoz de Bustillo y Llorente (eds.), *Operating Hours and Working Times. A survey of Capacity Utilisation and Employment in the European Union*, Heidelberg: Physica-Verlag, 147-167.
- Cette, G. (1989) Recours au travail posté et caractéristiques des entreprises, *Economie et Prévision*, 87: 43-48.
- Contensou, F. and R. Vranceanu (2000) *Working time. Theory and policy implications*, Cheltenham: Edward Elgar.
- Delsen, L. (1995) *Atypical Employment: An International Perspective. Causes, Consequences and Policy*, Groningen: Wolters Noordhoff.

- Delsen, L., D. Bosworth, H. Groß and R. Muñoz de Bustillo y Llorente (eds.) (2007) *Operating Hours and Working Times. A Survey of Capacity Utilisation and Employment in the European Union*, Heidelberg: Physica-Verlag.
- Delsen, L. and J. Smits (2007) Operating hours, working times and employment in the Netherlands, in: L. Delsen, D. Bosworth, H. Groß and R. Muñoz de Bustillo y Llorente (eds.), *Operating Hours and Working Times. A survey of Capacity Utilisation and Employment in the European Union*, Heidelberg: Physica-Verlag, 121-146.
- Dupaigne, M. (2000) *Capital utilization and the willingness to rest: A general equilibrium analysis*, Econometric Society World Congress 2000 Contributed Papers 0391, Econometric Society, August 11-16, Seattle.
- Dupaigne, M. (2001) Capital utilization and work schedules: the welfare costs of shiftworking, *Economics Letters*, 73: 195-200.
- Eriksson, T. and S. Fellman (1995) Determinants of firms' operating times – Some evidence from firm level data, *Discussion Paper 542*, Helsinki: ETLA, the Research Institute of the Finnish Economy.
- EC (1995) Performance of the European Union labour market. Results of an ad hoc labour market survey covering employers and employees. *European Economy, Reports and Studies No. 3*, Brussels/Luxembourg: European Commission, Directorate-General for Economic and Financial Affairs.
- Garibaldi, P. and P. Mauro (2002) Anatomy of employment growth, *Economic policy*, 17 (34): 67-114.
- Giarini, O. and W. M. Stahel (1993) *The Limits to certainty. Facing risks in the new service economy*, Dordrecht: Kluwer Academic Publishers.
- Golden, L. and D. M. Figart (eds.) (2000) *Working time. International trends, theory and policy perspectives*, London: Routledge.
- Jirjahn, U. (2008) On the determinants of shift work and overtime work: evidence from German establishment data, *British Journal of Industrial Relations*, 46 (3): 133-168.
- Kostiuk, P. (1990) Compensating differentials for shift work, *Journal of Political Economy*, 98 (5): 1054-1075.
- Kümmerling, A. and S. Lehndorff (2007) *Extended and unusual working hours in European companies*, Dublin: European Foundation for Improvement of the Living and Working Conditions.
- Mitlacher, L. W. (2007) The role of temporary agency work in different industrial Relations Systems - A comparison between Germany and the USA, *British Journal of Industrial Relations*, 45 (3): 581-606.
- Muñoz de Bustillo y Llorente, R. and E. Fernández Macías (2007) Operating hours, working times and employment in Spain, in: L. Delsen, D. Bosworth, H. Groß and R. Muñoz de Bustillo y Llorente (eds.) (2007) *Operating Hours and Working Times. A Survey of Capacity Utilisation and Employment in the European Union*, Heidelberg: Physica-Verlag, 169-195.
- Parent-Thirion, A., E. Fernández Macías, J. Hurley and G. Vermeulen (2007) *Fourth European Working Conditions Survey*, Dublin: European Foundation for the Improvement of Living and Working Conditions.
- Smith, M., D. Bosworth and M. Carroll, (2007) Operating hours, working times and employment in the UK, in: L. Delsen, D. Bosworth, H. Groß and R. Muñoz de

- Bustillo y Llorente (eds.) (2007) *Operating Hours and Working Times. A Survey of Capacity Utilisation and Employment in the European Union*, Heidelberg: Physica-Verlag, 197-223.
- Winston G. C. (1974) The theory of capital utilization and idleness, *Journal of Economic Literature*, 12 (4): 1301-1320.