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No. 542

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DETERMINANTS OF FIRMS' OPERATING TIMES - SOME EVIDENCE FROM FIRM-LEVEL DATA***

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ABSTRACT: Most discussions of working times have been concerned with the operating times of workers, whereas the capital operating times have received considerably less attention. Previous work has mainly been theoretical, and the few empirical studies available are almost exclusively based on industry level data. This study uses data from a questionnaire on firms' actual and preferred operating times and relate these to production and demand characteristics of the firms. The results for the manufacturing firms are consistent with predictions from the theory of firms' choices of operating hours, whereas in the services industry we find only a very weak relationship between operating times and the economic variables.

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TIIVISTELMÄ: Työaikoja koskevissa keskusteluissa päähuomio on kiinnitetty työntekijöiden ajankäyttöön ja yritysten käyntiaikoja ei ole juuri huomioitu. Kuitenkin työaikojen lyhennysten työllisyysvaikutukset riippuvat oleellisesti siitä, miten käyntiaikoja samanaikaisesti sopeutetaan. Aikaisempi tutkimus on päävoittoisesti ollut teoreettista. Harvat empiiriset tutkimukset ovat perustuneet toimialatason aineistoihin. Tässä tutkimuksessa hyödynnetään yritystason tietoja ETLAn vuonna 1990 800 suomalaiselle yritykselle suunnatusta työaikajärjestelyjä koskevasta kyselytutkimuksesta. Tarkastelun kohteena ovat sovelletut ja halutut käyntiajat sekä niihin vaikuttavat taloudelliset tekijät. Teollisuusyritysten osalta tulokset osoittavat, että viikoittaisen käyntiajan pituuteen vaikuttavat mm. yrityksen koko, pääomavaltaisuus ja kysynnän hintajousto. Palvelusektorin yritysten kohdalla yhteys taloudellisiin tekijöihin on selvästi heikompi.

SUMMARY

Most discussions of working times have been concerned with workers' time use, whereas the capital operating times of firms have received considerably less attention. And yet, the effects of working time reductions on e.g. employment depend crucially on what happens to capital utilization.

Previous research on capital operating times have predominantly been of theoretical nature. The few empirical studies carried out have been based on industry or other types of aggregate level data. The data set used in this study contains information about firms' actual and preferred operating hours, production and demand characteristics. The data have been constructed from the answers to a questionnaire on working time issues carried out by ETLA, which was sent to 800 Finnish firms operating in the manufacturing and service sectors (400 in each sector) in spring 1990.

In this study we examine the determinants of both the operating times firms actually employ as well as the operating hours they would like to have. The purpose is to assess the importance of economic factors in the determination of firms' operating times. The results show that the weekly operating hours in manufacturing is affected by the size of the firm (plant), capital intensity of production and the price elasticity of the demand for the firm's products. The same factors, which according to theory are the central ones, also explain differences between firms with respect to the changes they would like to make in their current operating times. Thus, the results confirm some of the earlier findings from investigations which have relied on industry-level data. We also obtain similar results for the service sector firms. However, the role of the economic explanatory variables we use turned out to be much smaller in that sector.

YHTEENVETO

Työaikoja koskevissa keskusteluissa päähuomio on kiinnitetty työntekijöiden ajankäyttöön. Samanaikaisesti yritysten ja niiden reaalipääoman käyntiaikoihin ei ole juuri ollenkaan kiinnitetty huomiota. Kuitenkin työaikojen lyhennysten vaikutukset esim. työllisyyteen riippuvat oleellisesti siitä, mitä tapahtuu pääomakannan käyttöasteelle.

Pääoman käyntiaikoja käsittelevä tutkimus on päävoittoisesti ollut teoreettista. Harvat empiiriset tutkimukset ovat perustuneet toimiala- tai muihin aggregaattitason aineistoihin. Tutkimuksen hyödyntämässä aineistossa on tietoja yritysten soveltamista ja halutuista käyntiajoista sekä samojen yritysten tuotantoa ja markkinoita kuvaavia tietoja. Aineisto on peräisin ETLAn vuonna 1990 suorittamasta 800 suomalaiselle (400 silloisen STK:n ja 400 LTK:n jäsenyritykselle) suunnatusta työaikajärjestelyjä koskevasta kyselytutkimuksesta.

Tutkimuksessa tarkastellaan sekä yritysten soveltamiin että niiden haluttuihin käyntiaikoihin vaikuttavia tekijöitä. Tavoitteena on selvittää taloudellisten tekijöiden osuutta käyntiaikojen määräytymisessä. Tulokset osoittavat teollisuusyritysten osalta, että yrityksen (ja/tai toimipaikan) koko, tuotannon pääomavaltaisuus ja yrityksen valmistelemien tuotteiden kysyntäjousto vaikuttavat viikoittaisen käyntiajan pituuteen. Samat, teorian mukaan keskeiset, muuttujat selittävät myös yritysten välisiä eroja koskien käyntiaikoihin haluttuja muutoksia. Siten tutkimus vahvistaa joitakin aikaisemmin toimialatason aineistoja hyödyntävistä tutkimuksista saatuja tuloksia. Tulokset palveluyritysten osalta ovat samansuuntaisia jos kohta käyttämämme taloudellisten muuttujien rooli osoittautui selkeästi pienemmäksi.

1. Introduction

The great majority of discussions concering working times are about the operating times of workers, whereas the capital operating times have received considerably less attention. This holds also for the research carried out in this field. There are two strands in the literature. The first looks at the relationship between economic growth and productivity on one hand, and the utilization capital on the other (*Foss*, 1984). A related issue is whether procyclical variation in productivity and real wages can be attributed to cyclical variation in capital operating times (for some recent studies on these matters; see *Shapiro* (1993) and *Mayshar* and *Solon* (1993)).

The second reason for being interested in the operating time of capital has to do with the employment effects of working time reductions. If a shorter working day or work-week implies a lower utilization of the capital stock, this will of course increase capital costs. Thus, it will have similar effects as a decline in the capital stock, that is, a decrease in output and consequently also in the number of jobs. A number of simulations with macroeconomic models show that the employment of shorter working time depend critically on what happens to capital utilization (see *Taddei* (1995) for a recent summary of this research).

Earlier analyses of operating times have predominantly been of theoretical nature. Empirical studies have been thin on the ground, mainly because appropiate data have not been available.[1] The purpose of this paper is to throw some light on these issues. In contrast to most of the earlier studies of the determinants of shiftworking and operating hours which are based on industry level data[2], we make use of a data set which contains information about time use at the *firm* level. Our point of departure is the notion that it may not be very satisfactory to treat the operating time of capital as exogenous (as is done in the simulations or analyses of contributions to growth mentioned above). The question

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[1] *Betancourt* and *Clague* (1978, 1981), *Bosworth, Dawkins* and *Westaway* (1981) and *Bosworth* and *Dawkins* (1981) are some notable exceptions.

[2] *Betancourt* and *Clague* (1981) use a data set on firms from a survey conducted by the UNIDO and specially designed for the study of capital utilisation.

we will try to shed some light on is: are firms' choices of operating times exclusively technologically (or institutionally) determined, or are there also economic factors influencing these decisions? Our analysis will be carried out separately for manufacturing and service sector firms.

The next section briefly reviews the key results from theoretical analyses of the determinants of operating times. Section 3 describes the data set we use in the study, section 4 contains the results of our empirical analyses and the fifth section offers some concluding remarks.

2. Analytical background

Most of the theoretical insights concerning the determinants of capital utilisation and shift work are from the seventies and early eighties; a comprehensive survey is given in *Bosworth* and *Heathfield* (1995). There are three different approaches to the study of capital utilisation which are relevant here. The first is models of firms' choices of shift systems, developed by e.g. *Winston* (1974) and *Betancourt* and *Clague* (1978), which focus on the discrete choices between different numbers of shifts assumed to be of the same length. The results of these models are concerned with the increase in labour costs *cum* savings in capital costs and the effects of some production characteristics.

The aim of the second class of models is an integrated analysis of factor demand and work patterns. This literature, starting with *Bosworth* and *Dawkins* (1981), studies the choice of the optimal work patterns for given utilisation levels. This is a more general analysis in that it allows a larger variety of choices (for instance, overtime) open to firms. A third approach focuses on rhythmically varying factor costs (wages, including night and weekend premia, and electricity prices) as determinants of the timing of productive activities (*Winston* and *McCoy* (1974), *Heathfield* (1972)). In this type of models, capital intensity is instrumental to the optimal timing of the use of factors of production.

Most of the empirical studies in this field takes an "eclectic" view with respect to theory. This paper is no exception and we use existing theory as a guide in choosing our explanatory variables. These can be grouped under two headings: production characteristics and demand characteristics.

Production characteristics. In looking at determinants of capital utilisation, the natural approach is to start off from the structure of production costs. The potential for economising on factor costs is affected by the production technology. The more capital intensive the production processes, the greater are the potential savings from an increased utilisation of capital. In manufacturing, certain processes for technical reasons involve high costs of starting or stopping production. Clearly, the higher these costs, the longer are the operating times preferred by firms. Another production characteristic discussed in the literature is the rate of technical obsolescence of the capital stock. The higher this is, the shorter the pay-back period and hence, the more intensively the firm wishes to utilise its capital. Finally, operating times are predicted to be a positive function of plant size, the main reason being the savings in administrative and supervision costs due to indivisibilities in production.

Demand characteristics. This category consists of factors associated with the properties of the product like storability and the costs of holding inventories and factors associated with the properties of the market demand like trend, variance and price elasticity of demand. For obvious reasons, firms prefer longer operating hours the more storable the product is and/or the less expensive it is to keep in stock. Firms which experience a trendwise or cyclical increase in demand are more likely to increase the utilisation of their capital stock (by introducing new shifts, extending the workweek). Capital utilisation is also affected by the price elasticity of demand as this has an effect on the extent to which demand changes can be met by price changes.

It is clear from our short description of the factors focused on in the models of choice of operating times, that they are more likely to be relevant for the behaviour of manufacturing firms. It is also evident that empirical validation of them makes very strong and unusual data demands which are virtually impossible to satisfy. We have no measures for

starting and stopping costs, technical obsolescence and the costs of holding inventories. Furthermore, three of our explanatory variables - price elasticity of demand, capital intensity and seasonal variability in demand - had to be constructed from other data sources and are therefore only available at the industry level. We have included industry dummies which may be picking up some of the influences of these missing variables. Following *Bosworth, Dawkins* and *Westaway* (1981), we also use a measure for the proportion of manual workers as they are associated with different types of capital than non-manual workers. In addition, we have two dummy variables to account for whether the firm is new (that is, less than 4 years of age) and if the firm has recently changed its operating time, respectively. As will be explained below, we make use of two different measures of operating hours. Our estimating equations are of the following type:

$$\textit{Actual/Preferred operating time} = (\textit{demand: trend, variance, price elasticity;}\ \overset{+}{\textit{capital intensity, plant size;}}\ \overset{+}{\textit{manual workers,}}\ \overset{+}{\textit{age of firm,}}\ \overset{-}{\textit{recent change in COT,}}\ \overset{+}{\textit{industry dummies}}),$$

with the expected signs below the explanatory variables. The definition and the measurement of the independent variables are explained in the *Data Appendix*. The corresponding information for the dependent variables is provided in the next section.

3. The data on operating times

The data set has been constructed from the answers to a questionnaire sent to 800 firms operating in the manufacturing and service sectors (400 in each sector) in Finland in spring 1990.[3] The response rate was 33.4 giving us 267 observations of which 23 were incomplete with respect to the issues focussed on in this paper and hence had to be discarded. Thus, the two samples in our study consist of 141 manufacturing firms and 103

[3] Actually in order avoid problems with mergers or big multi-product firms the unit is not firms but plants.

service sector firms, respectively. The population from which they are drawn are firms belonging to either The Employers Federation (the manufacturing firms) or The Employers Confederation of the Service Industry. Small firms are less likely than big and medium-sized firms to be members of these confederations and as larger companies are also more prone to answer questionnaires and have better access to the type of data requested, they are (especially for the service sector) over-represented in the data set.

The main purpose of the questionnaire, carried out at the Research Institute by the Finnish Economy (ETLA), was (i) to study how firms had reacted and adjusted to a working time reduction during the 1986-89 period, which in all, corresponded to 80 hours per worker and year, and (ii) to ask firms about their needs concerning alter-native forms of working time arrangements. In addition to questions about changes in the number of employees, working hours, shift-working and so on, the firms were also asked about the operating time of their capital. Hence, the data do not only provide information about actual time use arrangements and recent changes therein, but also on the firms' preferences with regard to capital operating times (and the working times of their work forces).[4]

We measure capital operating times from the information provided by the firms concerning their daily and weekly operating times at the time of questionnaire (spring, 1990). Weekly operating time is recorded as either 5, 6 or 7 seven days and the daily operating time is either 8, 16 or 24 hours. Combining these pieces of information gives us nine different operating times, some of which are very rare (for example, in manufacturing: 7 times 8 hours, 6 times 16 hours, and 6 times 24 hours). In the empirical analysis these measures will be scaled by the maximum number of hours per week (168 hours). Hence our operating time measure will be a *weekly utilisation rate* which is a proportion between 0.238 and 1. It should be noted that this way of measuring operating times is better suited for describing arrangements within the manufacturing sector.[5] In the service

[4] A detailed presentation and discussion of the results of the questionnaire is given in *Eriksson* and *Fellman* (1991).

[5] Measuring operating time is difficult as there in many cases is no such thing as *the* operating time of a firm, but different machines and departments having different operating times. Although we do not want to downplay this problem, we think it is less severe when the

sector firms, an operating time exceeding 8 hours does not necessarily imply that there are several shifts. Moreover, there may be some measurement error due to difficulties in distinguishing between operating and opening times as for instance in the case of shops.

Table 1 provides a rough picture of the operating times and the working time arrangements in the firms in our sample. There is nothing surprising here. Also the differences between the two sectors accord to our priors. We can see that operating times are considerably longer, shift-working is much more common and that periodic work arrangements as well as part-time work are less frequent in manufacturing firms than in firms in the service sector.

The firms were also asked whether, and if so why, they had changed their operating times during the preceding four year-period. As can be seen from *Table 2*, one of out of four manufacturing firms had lengthened their operating times. In the services industry, 15 per cent of the firms had lengthened and 10 per cent shortened their operating times. The main reason for increasing operating times in manufacturing was changes in output whereas shorter working times and adoption of new technologies were equally important in the service firms (*Eriksson* and *Fellman*, 1991).

The questionnaire inquired about firms' interest in longer operating hours. As shown in *Table 2*, almost every second manufacturing firm and more than one third of the service firms wished to have longer operating hours. These high figures are in part explained by the fact that at time of answering the questionnaire the firms were influenced by the experience of a period of three to four years of rapid growth and most of them did not yet see any signs of the deep recession which was a fact only one year later. When asked about the factors perceived by firms as the main obstacles to introducing longer operating hours (see *Eriksson* and *Fellman, 1991),* the answers indicate an interesting difference between the two sectors. The increase in production costs is considered by service firms as a major reason for not adopting longer operating times. This is less a problem in

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observation unit, as in our case, is the plant.

manufacturing where resistance of employees and lack of skilled labour are considered more important obstacle, probably because longer operating hours in this sector more often imply an increase in the number of shifts or a lengthening of the workweek.

4. Empirical analysis

We now consider some of the results of our empirical analysis. We begin with the determinants of firms' actual operating times. The results for the manufacturing and the service sector firms are set out in *Tables 3* and *4*, respectively. The dependent variable in these equations is (the log of) operating times which is scaled by the total number of hours per week and can therefore only take on values between 0.238 and 1. In order to account for this feature we have also estimated the equations on logistic form, but as they did not differ from those obtained from the simpler log-linear speci-fication, we only report the latter because of their of ease of interpretation. It should also be noted that the dependent variables is not evenly distributed in the 0.238 - 1 interval. For instance, in manufacturing almost 80 per cent of the firms were either in operation for five 8-hour-days, five 16-hour-days or seven 24-hour-days. Similarly, half of the service sector firms were operating five or six 8-hour-days and a third six or seven 16-hour-days[6].

Naturally, our analysis is limited by the variables available in our data set. As this has not been specifically constructed for an investigation of the determinants of firms' time use, there are certain potentially important explanatory variables missing, notably variables describing differences in firms' production technologies. Differences in variables such as: use of continuous processes, costs of lightning up/shutting down, costs of holding inventories are, however, likely to a large extent to be industry-specific and will, therefore, be captured by the industry dummies. One factor on which we cannot obtain any information from our data is the magnitude of the induced extra costs from the introduction of more shifts or longer work weeks. However, as the compensation for

[6] Thus, at least for the manufacturing sector, we could instead have looked at firms' choices between one, two or three shifts, using a trichotomous dependent variable.

working at evenings, nights or weekends are basically the same in all industries, it is not very likely that the differences between firms in this respect are large.

In the first column of *Table 3*, we find the estimates for manufacturing firms for a specification without industry dummies. The explanatory power of this specification is over 20 per cent and most of the coefficients are consistent with received theory. Some of them change, but not dramatically, when the industry indicators are included; see columns 2 and 3. So, the differences between firms' operating hours are not solely or predominantly due to inter-industry differences.[7]

As for the individual coefficients we may note that two of the three demand characteristics variables turned out significant. The measure for timing of demand attached a positive coefficient suggesting that firms facing a larger variance of demand have longer operating hours. This was somewhat surprising to us as we had originally expected this variable to be of more importance in services. As expected, firms' demand for shifts or longer operating time is decreasing in the price elasticity of their output.

It should, of course, be noted that both these variables do not refer to the individual firms but pertain to the industry level. Note, however, that in constructing the price elasticity variable we have used a finer division into industries than when setting up the industry dummies (and constructing the seasonal variability measure) which are for rather broad categories. The only demand variable which was totally insignificant was a dummy for trend in demand. This is highly correlated with the dummy for "recent change in operating times" and so, the positive coefficient of the latter variable may also reflect influences of a positive or negative trend in demand for the firm's products.

As far as the production and firm characteristics are concerned, only plant size enters with a clearly significant coefficient. The effect of plant size is usually interpreted as reflecting cost savings due to indivisibilities in capital and management. As plant size here is equal to the number of employees, it is perhaps not very surprising to find a positive relation-

[7] A specification with only industry dummies yields an R^2 equal to 0.13.

ship.[8] Inspired by *Cette* (1995), we also checked whether plant size has an independent role when capital intensity is controlled for. This could arise from an increase in capital utilisation leading to greater savings, the more capital intensive the production process. The coefficient of the average capital intensity in the firm's industry was not far from significant and its inclusion or exclusion did not affect the estimates for plant size. Two variables which never were significant in any of the estimations were the proportion of blue collar workers and a dummy for the firm/plant being less than four years of age.

Turning next to the estimations for the service sector firms, presented in *Table* 4, one might expect these to differ from the results regarding manufacturing firms since the operating times in the latter are more "technology-driven". The results do indeed differ, albeit perhaps not in the manner one would expect. To put it briefly, we have drawn a number of blanks with respect to the economic variables. Thus, the variables trend in demand and plant size (and capital intensity) both turned out completely unrelated to inter-firm differences in operating times. Apart from the industry dummies and the borderline significant young firm-dummy, with a hard-to-explain positive coefficient, the only explanatory variable which carries some weight is the measure for seasonal fluctuations in demand.

As the service sector can be considered to be more heterogeneous than manufacturing, we also estimated the same equation (excluding, of course, the industry dummies and the industry level variables) for the smaller but more homogeneous group of 45 wholesale and retail trade industry firms in our data set. This exercise ended up with equally dismal results. No relationships betwen operating times and plant size, trend in demand, age of firm and recent change in capital operating times were detected.

It should be noted, however, that the analysis for the service sector may be affected by data problems. Although in constructing the questionnaire, efforts were made to point out

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[8] The loglinear relationship is superior to a linear specification. We have also experimented with quadratic terms but these did not contribute anything to the estimations.

to the respondents the difference between operating hours on one hand, and service or opening hours on the other, there may still be some measurement error in our dependent variable. Our measure of operating times is rather crude as the data only allow for either 8, 16 or 24 operating hours per day (which is standard in manufacturing) whereas there may be much more variation in hours per day and from day to day in the services sector. But also some of the independent variables, especially plant size, may be contaminated by measurement errors since the distinction between plant and firm is less clear in many service firms than in manufacturing.

One way of interpreting our results is also that they lend some support for the hypothesis that the use of capital is a less important factor in the service sector and what may be crucial here is factors like the rhythmically varying demand for non-storable products.

Looking exclusively at capital operating times from the firms' perspective, ignores the fact that there is both a demand for and *supply* of shift-work and other working-time arrangements (see *Bosworth* and *Dawkins* (1981) and the essays in *Anxo et al.* (1995) for some analyses of the supply side). Firms' *preferred* capital operating hours are unlikely to match the hours of work preferred by workers (for an analysis of families' choices of instantaneous time use; see *Hamermesh* (1995)) and thus, some compromise has to be reached. Consequently, the observed operating times are not necessarily those preferred by firms. As mentioned earlier, almost every second firm in the study reported being interested in longer operating times.

We used this information as an admittedly crude measure of firms' preferences and estimated logit models with preference for longer operating hours as the dependent variable[9] and basically the same explanatory variables as before (and again, separately for the manufacturing and the service sector). The results are set out in *Table 5*. The first thing to note is that several variables carry significant coefficients with the same sign as in

[9] The dependent variable equals one if the firm wishes to have longer operating times, zero otherwise. Thus, we have lumped the alternatives: no change, shorter operating times and "do not know" into one category. This is done after some experimentation with multinominal logit models.

the estimations for current operating times. Trend, variability and price elasticity of demand, plant size and the firm being a new one, all have similar effects as on operating times. The number of shifts[10] was included as a control for current operating time and, as expected, it entered with a negative coefficient for the manufacturing firms. Two additional controls, the share of manual workers and a dummy for recent change in capital operating times also turned out significant. Manufacturing firms which recently changed their operating times would like to have further changes, whereas firms with a high share of blue collar workers are less interested. The latter result is perhaps what one would expect (if anything). One possible interpretation is that the share of blue collar workers acts as a proxy for capital intensity. (This variable is already included, but only in form of industry averages.)

Again, the fit is poorer for the service sector sample, but now the coefficients for trend in demand and plant size are relatively large although not precisely estimated. New service firms would prefer longer operating hours. Thus, the results of the logit analysis show that some of the variables suggested in the literature as potential influences on the length of operating times also appear to have a considerable influence on firms' preferences regarding changes in their current operating hours.

5. Concluding remarks

In the introduction we asked whether economic factors play any role in the determination of firms' operating times. In the main, our results for the manufacturing sector are consistent with the predictions of theory. The estimations suggest that production characteristics like plant size (and with less certainty: capital intensity) and demand characteristics like the price elasticity of demand do affect the length of firms' weekly operating hours. Thus, our inter-firm analysis confirms some of the results which earlier have almost exclusively been obtained in studies based on industry-level data. Some additional support for the economic theorising on the choice of operating hours is also

[10] Number of operating days was also tried, but was not never significant. The weekly utilisation rate gave similar results as the number of shifts.

have almost exclusively been obtained in studies based on industry-level data. Some additional support for the economic theorising on the choice of operating hours is also provided by our logit analysis of firms' preferences regarding the length of their operating times as these are also affected by largely the same economic factors.

However, our attempt to explain service sector firms' operating times with the same set of economic factors was an almost complete failure. Although this to some extent may be due to data problems, we feel the problem is not so much in how the questions were interpreted, but that the crucial questions were not asked. Clearly what is lacking here are variables accounting for the non-storability of the products and/or services produced and the very short-run variations in demand. The determinants of operating and working time arrangements in the service sector is clearly an area in which the hackneyed phrase: a lot still remains to be done, is wholly appropiate.

Table 1. Incidence of operating times and working time arrangements (% of firms)

	Manufacturing	Services
Weekly operating times:		
Monday-Friday	52.1	42.5
Monday-Saturday	7.0	34.7
Monday-Sunday	40.9	22.8
Daily operating times:		
06 - 18	30.3	54.6
06 - 22	28.2	36.6
06 - 06	41.5	8.9
Forms of working time[a]:		
Regular daytime	98.7	94.5
Regular evening work	17.7	35.8
Regular night work	7.5	11.9
Regular morning work	8.8	14.7
Discontinuous 2-shift	61.6	11.9
Continuous 2-shift	22.6	12.8
Discontinuous 3-shift	35.8	6.4
Continuous 3-shift	38.4	8.2
Other	5.7	5.5
During week[b]:		
Periodic work	15.7	37.2
Part-time work	31.4	65.5
Weekend work	12.6	26.4
Flexible working time	58.9	36.7

a. Regular evening, night and morning working times are such that part of the work is carried out between 18-21, 21-06 and before 06, but mainly thereafter, respectively. Discontinuous 2- and 3-shifts are usually worked Monday to Friday.
b. Periodic work: weekly working time varies, but are harmonised in 2 or 3 weeks periods. Part-time work: less than 30 hours per week.

Table 2. Changes in operating times, actual and preferred (% of firms)

	Manufacturing	Services
Changes in operating times in the 1986-89 period:		
No changes	65.4	74.6
Longer	27.1	15.4
Shorter	7.5	10.0
Interested in longer operating hours:		
Yes	48.4	37.3
No	35.8	43.6
Do not know	15.8	19.1

Table 3. Determinants of manufacturing firms' operating times

	(1)	(2)	(3)
Constant	-1.394	-1.188	-0.966
	(6.13)	(5.36)	(3.52)
Recent change in COT (D)	0.174	0.119	0.087
	(1.80)	(1.27)	(0.85)
Seasonal variability of	0.187	0.097	0.096
demand*	(2.42)	(2.12)	(2.00)
Price elasticity of	-0.434	-0.920	-0.991
output*	(2.08)	(3.97)	(3.07)
Log plant size	0.149	0.151	0.139
	(4.55)	(4.82)	(4.16)
Capital intensity*	0.081	0.101	0.121
	(1.26)	(1.48)	(1.54)
Young firm (D)	0.171	0.175	
	(0.94)	(1.01)	
Share of blue collar	0.045	0.042	
workers	(0.67)	(0.66)	
Industry (D)	no	yes[a]	yes[a]
R^2 (adj.)	0.229	0.324	0.336
see	0.514	0.468	0.444

Starred variables are industry level variables. D marks a dummy.

a. Of the industry dummies, only those for textiles, leather and footwear, and chemical products were statistically significant from zero.

Table 4. Determinants of service sector firms' operating hours

	(1)	(2)	(3)
Constant	-0.898	-0.827	-0.926
	(5.29)	(4.48)	(16.9)
Recent change in COT (D)	0.032	0.026	
	(0.22)	(0.19)	
Trend in demand (D)	0.045	0.015	
	(0.64)	(0.22)	
Seasonal variability of demand*	0.243	0.122	0.141
	(2.42)	(2.54)	(2.63)
Capital intensity*	0.021	0.017	
	(0.63)	(0.89)	
Log plant size	-0.015	-0.015	
	(0.46)	(0.48)	
Young firm (D)	0.293	0.248	0.243
	(1.84)	(1.61)	(1.63)
Industry (D)	no	yes[a]	yes[a]
R^2 (adj.)	0.081	0.262	0.256
see	0.457	0.428	0.417

Starred variables are industry level variables. D marks a dummy.

a. Of the industry dummies, those for hotels and restaurants, real estate and business services, education services, and other services obtained coefficients which differ statistically from zero.

Table 5. Logit estimates of demand for longer operating hours

	Manufacturing		Services	
	(1)	(2)	(3)	(4)
Constant	1.568	0.852	0.404	0.504
	(1.74)	(2.28)	(1.75)	(1.96)
Recent change in COT (D)	1.140	1.244	-0.112	
	(3.34)	(3.52)	(0.34)	
Trend in demand (D)			0.288	0.268
			(1.29)	(1.45)
Seasonal variability of demand*	0.009	0.101	0.454	0.437
	(2.12)	(2.27)	(3.88)	(4.00)
Capital intensity*	0.008	0.007		
	(0.89)	(0.67)		
Log plant size	0.296	0.292	0.140	0.180
	(2.49)	(2.43)	(1.14)	(1.45)
Price elasticity of output*	-1.656	-0.480		
	(1.99)	(0.89)		
Young firm (D)			0.798	1.020
			(1.60)	(1.83)
Number of shifts	-0.580	-0.644	-0.301	-0.332
	(3.38)	(3.54)	(0.98)	(1.11)
Share of blue collar workers	-0.368	-0.388		
	(1.55)	(1.62)		
Industry (D)	no	yes	yes	no
Log likelihood	-78.2	-63.7	-38.1	-45.9

Starred variables are industry level variables. D marks a dummy variable. Of the industry dummies only those for manufactures of food, beverage and tobacco, wood and wood products, paper and pulp, furniture and electrical machinery in the manufacturing sector and manufacture of food products, hotels and restaurants, real estate and business services, and water and air transports in the service sector.

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Data Appendix

The data set consists of variables from the survey which is described in the text and a number variables constructed from other sources. The dependent variables are described in section 3, so only the independent variables are presented below.

From the survey:

Plant size: number of employees in 1989

Share of blue collar workers: number of manual workers divided by total number of employees in 1989

Trend in demand: a dummy variable constructed from answers to question: has demand for your products been stable (0) or increased (1) or decreased (-1) in a trendwise fashion, with values taken by the dummy in brackets

Recent change in COT: a dummy equal to 1 if the firm answered affirmatively to the question: has the operating time been changed during the 1986-89 period; 0 otherwise

Young firm: dummy equal to 1 if the firm is less than four years old; 0 otherwise

From other sources:

Capital intensity: average industry level capital-output ratio calculated from the Industrial Statistics

Seasonal variability of demand: average coefficient of variation of output (sales) calculated from quarterly series for the period 1986-89. Same industrial classification as for the industry dummies

Price elasticity of output: estimates from *Backström* and *Wahlroos* (1980), who estimated demand functions for manufacturing goods at the four digit level for the period 1959-77. The measures are constructed by weighting the elasticity estimates by employment shares of the industries. Corresponding elasticity estimates for services are not available.

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