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Influence of law on shift schedule design: USA and Europe

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Introduction

The evening sessions of the previous Night- and Shiftwork symposia lent themselves to intense debates. Specifically, one dealt with "permanent night-shifts and length of a sequence of night-shifts"(XII Symp.), and the other evaluated "12h shifts" (XIII Symp.). To some extent these issues revealed a polarisation in thought between USA and European professionals. In addition, statistical data (BLS, 1997) shows that only 2,9 mill out of 16,8 mill shift-workers in US have rotating shifts. This polarisation and the statistical data led us to the question of the importance of environment in shift rota design and research. Out of a multitude of potentially relevant factors, we concentrated on particular elements of the legal environment.

Legislation has a great potential for influencing the design of shift rotas. Legal constraints may also act as unifying agents, placing all industrial and bargained working hours within a larger context. To determine the actual impact of legislation, we analysed central elements of national labour laws (e.g. limitations of maximum daily and weekly working hours, restrictions regarding work on weekends, and payment of overtime). Additionally, payment of overtime is of crucial importance when designing shift rotas for full-time employees. Though recognising the complexity and high variability of laws regarding working hours, the authors assert that meaningful international comparisons can be made by concentrating on structural elements. In this way the findings should hold true for a dominant section of the work-force.

The central hypotheses of this paper are as follows: First, there are substantial differences in legalisation regarding working hours between EU and the USA. Secondly, within the legal framework of the USA, their full-time employees work longer hours than Europeans, rarely less than 40h a week. Thirdly, permanent shifts, meaning that the employee works e.g. one night shift only, and extended shifts, where the employee stays at work longer, are more reasonable in US than in the EU.

Table 1: The arguments discussed in this order

LINE OF THOUGHT		
For substantial part of workforce ...	EU	US
(1) Daily and weekly working hours	Strong legal limits	Hardly any limits
(2) Overtime (OT) payment for work beyond 40 h	No OT if averaging out is	Often
(3) Payment	Monthly	Weekly (*)
(4) US full-time employees work longer hours		
(5) Averaging of hours more difficult in US; therefore full-timers have to be scheduled for 40 h a week.		
(6) Due to (4) and (5) in rota design, good results are more difficult for:		
a) Number and quality of days off (e.g. weekends, number of single days off, too many duties in a row without longer breaks)		
b) Bad series of duties (e.g. Night - off - Morning)		
(7) Due to (6), for full-timers	permanent shifts have advantages	
(8) Due to (6), for full-timers	extended shifts have advantages	
(9) Permanent shifts and extended shifts are more reasonable in US than in EU		

(*) important sub-set of blue-collar workers

The analysis leads us to the conclusion that European wages and labour laws allow for greater flexibility in work schedule design and, at the same time, allow for rotas that are much closer to meeting the BEST-Guidelines. The BEST-Guidelines define a set of criteria to enforce acceptable rotas, e.g. short sequences of consecutive nightshifts, forward rotation, no permanent nightshift, etc.

Differences in legal frameworks

The variations of (continental) European legislation and - even more distinct - the differences between (continental) European and Anglo-American laws could fill books. A detailed discussion is far beyond the scope of this paper.

(1) With respect to the EU background, the EU-directive regarding working hours (Union, 1993) is a reasonable starting point. It defines limits on maximum weekly working hours, rest hours, minimum vacation of 4 weeks, etc. Its instantiations within the national labour laws roughly follow the line drawn by this directive. While there are differences in several issues regarding the details of how limits are formulated, overall they are rather similar (e.g. German and Austrian labour law). Basically, these national labour laws define statutory limits on weekly and overtime hours. With respect to the US, the Fair Labour Standard ACT (FLSA) of 1938, as amended, seems to be a reasonable starting point. Labour law in the US creates few restrictions to maximum weekly working hours, as long as security and safety (e.g. in transportation) is not concerned. Transportation is the only industry that has statutory restrictions on weekly hours, such as trucking, but the limit is well above the FLSA maximum. It is possible for truckers to work up to 60 hours in a given 7-day period, as long as they have some minimum time off daily. As Golden (1999) states: Its "... sole reliance on the monetary deterrent [overtime differential] to long hours contrasts with most countries in Europe and in Canada..." (p.12).

(2) While the discussion regarding flexibility gained momentum in the last decades, in shiftwork in the EU there has been variability in hours worked per week for many decades. Basically one was and is allowed to work many hours in one week and fewer hours in other weeks if s/he meets the average working hours agreed upon for a specified period of time (typically called the plan-cycle or length of plan). Such averaging periods may be rather long, e.g. several months. The limits for maximum working hours per week vary, but for most employees they are equal or exceed 50h in a single week. Working hours agreed are much lower (40h, 38,5h, 35h). The ability to work for ≥ 50 h a week and the ability to average working hours allows for a high degree of freedom in rota design.

Such averaging periods not only make a rota legal, there is an additional important consequence. Within this averaging period it is typical that no money supplements have to be paid as long as hours average out in the end and as long as there are no short-term changes of the rota. For an employee working 40h per week in average, a rota with the following working hours in the consecutive weeks of e.g. 32h 32h 40h 48h 40h 48h would be fine. Typically, such a rota would not cause overtime-payment. Additional costs may only arise with short-term changes or if average working hours are not met. While in metal and comparable industries the averaging of hours follows the line of building up a weekly average, other industries concentrate towards a monthly averaging process. In hospitals for instance, the monthly hours dominate and should be met by e.g. +/- 10 hours.

This averaging out within a medium term plan (several weeks) is not to be mixed up with flexibility of operating hours. In classical planning it just means that one group may work less in one week if (and only if) another group works more (e.g. 4 groups with 40h on average: one group may work 24h, another one 40h, two groups with 48h). This reflects the fact that in shift-work, especially if the weekends are involved, working hours per week are a somehow arbitrary measure. (E.g. say D has 8h, then the following sequence – starting with Monday, x as symbol for off – xxDDDDD DDDDDxx - would lead to 10 days of work in a row but only 40h per week!)

US strongly differ in the averaging mechanisms. The central issue is defined in FLSA Sec. 7 (a) (1) "... no employer shall employ ... for a workweek longer than forty hours unless ... employee receives compensation ... specified at a rate not less than one and one-half times the regular rate...". Further on FLSA draws a distinction between persons for whom this paragraph applies (non-exempted) and for those where it does not. Golden (1999) analysis that about 40% of workers are "exempt" from overtime pay (typical persons that are exempted are white-collar workers with "privileged" positions), only slightly up from 38% in 1990. This 40% are evenly distributed over industries. Some groups have a slightly less restrictive system, e.g. nurses. Hospitals are allowed to schedule work on a 9/80 two-week-schedule legally. They receive overtime payment if they work for more than 80 hours in a two-week period (e.g. "9/80 option").

What may also irritate Europeans is that the definition of workweek does not necessarily go hand in hand with Monday to Sunday but can be defined as part of the work contract. Employees working side by side may have different workweeks in US.

(3) Averaging of hours is further eased in EU as it is very unusual to pay on a weekly basis, but rather on a monthly basis. In addition, there are many reasons for companies to change from wages to salaries. One of the reasons is the increase in flexibility. It is well known (e.g. Kutscher et al. 1996) that it is necessary to steady the flow of income in order to be able to build more flexible working hours systems. In US, weekly payment of wages builds up further pressure not to go below 40h as changes immediately effect the financial status of employees and a fall below the working hours agreed typically would then cause problems with regular payments for flat etc.¹.

¹ More anecdotal: Maybe even the banking system may be added to this difference. In Germany and Austria it usually is possible to overdraw ones checking account for the height of several monthly incomes. This makes averaging easier than with a short-term credit system that is more strongly based on credit cards.

Additional issues not covered in this article

There are several issues that may influence the subject but can not be dealt with properly under limits of this article. Two important issues are costs of overtime and part-time issues.

Comparing costs if overtime is to be paid is difficult. National labour laws know different levels of money supplements. For example, overtime costs in Austrian collective agreements may differ from 50% to 100% or even up to 200-300% (in rather special cases). In Germany over-time supplements “Start at 25%”. In America the overtime pay premium is weakening as a deterrent over time, as fixed costs of hiring new employees continue to rise as employee benefit costs (such as premiums for private health insurance plans) and training costs escalate.

In spite of these differences the actual costs do not really matter here, as we concentrate on rota design with minimum or no overtime payment. As overtime is not a big issue there is also little incentive to hire part-timers to save over-time-supplements.

For part-timers a comparison of EU and US is difficult. Due to averaging of working hours in EU, part-timers are not so much cheaper than in US. However this is compensated to an unknown degree with fixed costs for insurance, etc., compared to proportional costs in EU. Therefore further analysis is needed to work out whether a higher percentage of part-timers are employed in shiftwork in US. If this is the case, we can expect a high tendency towards permanent shifts in general. Literature names different reasons for part-time work (Ley 1993). The most important one is family (I). Besides people work part-time due to further education (II), other social activities (III), health (IV), etc. With exception of reason IV, all reasons bring up complex synchronisation tasks. In addition, if one has to take several part-time jobs (e.g. “working poor”) this synchronisation gets even more important. While fixed shifts have their shortcomings, they definitely make scheduling easier. In addition to permanent shifts we may expect – up to some degree – a tendency towards extended shifts. Extended shifts cause less duties (if working hours do not increase) and therefore simplify synchronisation.

Focusing in

(4) Full-timers in US work longer hours in shift-work than they do in EU. This is caused by several reasons. First, the legal limits regarding maximal working hours mentioned above. Second, collective agreements in several EU countries define regular working hours well below 40 hours. Third, Golden (1999, p. 8) also notes that “Overtime hours becomes one of the few available paths for households to maintain real absolute and relative income growth.” This goes fine with statistics of the Bureau of Labour Statistics (1999), which show 4,5h of overtime in average for manufacturing.

A additional reason for longer work hours for US full-timers is flexibility. Flexible rotas for full-time employees in the US are worse for both, employers and employees, than in the EU as long as they are cost-optimal and there is no hiring and firing, given that 40h define a minimum level of work for US full timers. Additional work can only come with additional hours. As there are little restrictions for such additional hours of work, US-employees will work long hours – as long as no additional employees are hired, whereas in Europe working hours per week can be reduced well below 40h. With similar operating hours, rotas with less working hours per employee and week are better. So EU rotas are better for employers and employees, as long as there is no hiring and firing. On the other hand, under similar conditions US hiring might start earlier and therefore lead to better rotas. However, as the European upper limit of ≥ 50 h in single weeks with 48h as maximum for average hours is close to the US minimum limit of 40h, this should not be the case very often (i.e. it is only one or two duties difference).

(5) Several reasons cause US-full-timers to be scheduled with 40h in every single week. First, there are some collective agreements that guarantee 40h each week. Therefore it would be very expensive to go below these 40h. This is facilitated by the FLSA. The FLSA provides the opportunity for some flexibilisation, given that a number of hours is guaranteed by collective agreements. So the FLSA does not discourage flexible or varying lengths for daily shifts (except for a small number of states, such as California, which require a daily overtime pay premium after 8 hours for a certain number of industries and occupations). Secondly, the dominant form of payment is payment on a weekly basis. Reductions in hours immediately hurt. From a European view astounding, even income statistics of the Bureau of Labour Statistics are made on a weekly basis. Furthermore it seems reasonable to assume that even some of the “exemptions” get overtime payment if they work more than 40h a week, even though it is not caused by a law.

Comparing rotas for full-timers

Regarding the average number of operating hours of shift-rotas we distinguish discontinuous, partial continuous, close to full continuous and full continuous rotas. Discontinuous and partial continuous rotas are not of interest. There are only few alternatives in design of discontinuous, partial continuous rotas for full-time employees (Jansen 99). Therefore we concentrate on close to full continuous and full continuous rotas.

Next we have to define the criteria on which rotas are compared. In BEST (1991) several criteria are listed. We concentrate on a subset of these criteria and analyse how the fulfilling of these depends on the question whether there are permanent shifts receptively whether there are extended shifts. Several criteria were not analysed, as they were directly influenced by the question of permanent shifts (e.g. no permanent night work) or are difficult to assess in general (e.g. workload).

Therefore we basically concentrate on a) number and quality of days off (e.g. free weekends, not too many single days off, not too many duties in a row without at least two days off); b) series of duties that should be avoided (like Night Evening, or Night off Morning).

In all the rotas below we work with: D... Morning shift, A...Afternoon shift, N...Night Shift, “-“ as symbol for the day off. All shifts have 8h and no unpaid breaks. ** indicates sleep after Night-shift. Work hours are counted and linked to the day the shift starts (e.g. 8h for the night shift that starts on Sunday is considered to be Sunday hours). Weeks are defined as Monday to Sunday (simplification). This simplification is needed to allow for easier checking by readers. In reality things are more complex (e.g. Austria calculates mostly from Monday 0:00, US employees may have several starts of weeks – probably causing hours clerks sleepless nights in checking the 40h per workweek limit).

Rotas are written down in the classical representation (Gärtner and Wahl 1998). The following example of a classical rota can be read as a 4-week in which the first week of each group is shown. The following week group A has the rota of the first week group B, etc.

	1 Mo	1 Tu	1 We	1 Th	1 Fr	1 Sa	1 Su
A	D	D	A	A	N	N	N
B			D	D	A	A	A
C	N	N			D	D	D
D	A	A	N	N			

Fig. 1: Classic 4 group solution - EU

(6) A “classic solution” in EU that provides optimal weekends for a 4-group solution is not feasible in US as long as 40h a week have to be guaranteed. – The fourth week would result in a payment of less than 40h.

	1 Mo	1 Tu	1 We	1 Th	1 Fr	1 Sa	1 Su	2 Mo	2 Tu	2 We	2 Th	2 Fr	2 Sa	2 Su
A	D	D	A	A	N	N		D	D	A	A	N	N	
B	A	A	N	N			D	D	A	A	N	N		
C	N	N			D	D	A	A	N	N			D	D
D			D	D	A	A	N	N			D	D	A	A

Fig. 2: 4 groups – 42h – US

	1 Mo	1 Tu	1 We	1 Th	1 Fr	1 Sa	1 Su
A	D	D	A	A	N	N	
B	D	A	A	N	N		
C	A	A	N	N			
D	A	N	N				D
E	N	N				D	D
F	N			D	D	D	A
G				D	D	A	A
H			D	D	A	A	N
J		D	D	A	A	N	N

Fig. 3: Similar approach EU – 37.6h a week

	1 Mo	1 Tu	1 We	1 Th	1 Fr	1 Sa	1 Su	2 Mo	2 Tu	2 We	2 Th	2 Fr	2 Sa	2 Su
A	D	D	A	A	N	N					D	D	A	A
B	A	A	N	N				D	D	A	A	N	N	
C	N	N					D	D	A	A	N	N		
D					D	D	A	A	N	N				
E			D	D	A	A	N	N					D	D

Fig. 4: Similar approach EU – 33.6h a week

If no single days off should be scheduled,

- the only feasible distribution in US of days off and on duty
- is 6 days of work
- followed by 2 days off.

(Other rotas are possible, if single days are allowed.)

Theoretical optimum is 1 weekend off in 8 weeks – US

Fast forward rotation further reduces off time to a consecutive 48h. Fast forward rotation means a plan where the employee works only a short period in every shift type, e.g. DDAANN.

The restrictions caused by the 40h minimum constraint are severe. The solutions 1,3,4 are not feasible in US (for most employees). The feasible fast forward rotating solution in US is rather bad with respect to the weekends. If we go below 6 days in a row, there are only solutions with single days off! Even with single days off one has to accept very fast rotation (e.g. single Evening shifts) or series of duties to be avoided to get feasible rotas.

Both, the high average working hours and the 40h minimum restriction, make it more rewarding to drop fast forward rotation and even to drop all rotation in order not to further harm the spare-time (7).

For employees with more than 40h a week there is an additional incentive towards extended shifts. Given the difficult situation of rota design and the small number of days off under optimal 40h conditions (with 40h and 8h duties less than or equal to 2 days!), night shifts further degrade this situation.

Summary and Conclusion

We analysed the constraints on rota design and designed a series of rotas to address this and other scheduling problems, from both an American and a European standpoint. We tried to avoid all overtime work. It was possible to develop rotas that met the BEST requirements within the European legislative environment and working hours below 40h a week more closely than rotas developed under American legislation with working hours above 40h a week. The high working hours in US hinder the use of reasonable fast forward rotating sys-

tems. With respect to spare-time, permanent shifts and extended shifts are much more attractive when working 40h a week or more than when working less than 40h a week.

In general, European wages and labour laws allow for greater flexibility in work schedule design and, at the same time, allow for rotas that meet the BEST-Guidelines far better.

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