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The Healthy Workplace Index: The Canadian Automotive Industry

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THE HEALTHY WORKPLACE INDEX

AND

THE CANADIAN AUTOMOBILE INDUSTRY[1]

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SECTION ONE: INTRODUCTION

Has the quality of life at work improved in the last decade? Have workplaces become healthier places to work? The reality is we do not know. The purpose of this paper is to develop a Healthy Workplace Index which will permit us to answer these questions by measuring the quality of life at work. In what follows, an index will be proposed, its validity will be tested against a set of data drawn from a 1996 survey of workers employed by Chrysler, Ford, General Motors and CAMI in Canada, and finally the index will be used to rank the quality of life at work of companies employing different systems of work organization. The index is constructed using a methodology employed by the United Nations in their Human Development Index.[2]

The Human Development Index was first proposed by the United Nations in the 1990 Human Development Report. There was concern that existing measures of economic development such as GNP per capita were poorly correlated with improvements in the quality of life. The authors were looking for a broader index which would recognize that:

> People are the real wealth of a nation. The basic objective of development is to create an enabling environment for people to enjoy long, healthy and creative lives. This may appear to be a simple truth. But it is often forgotten in the immediate concern with the accumulation of commodities and financial wealth.[3]

While meant to inform the debate regarding the development of a broad social index, this statement could easily be altered to apply to indices of quality of life at work. Thanks to groups such as the International Competitiveness Forum and the researchers attached to MIT's International Motor Vehicle Project much attention has been paid in the last ten years to the productivity and competitiveness of workplaces.[4] There has been an implicit assumption that what is good for competitiveness is good for workers. Such has been the faith in the overall benefits of competitiveness that certain researchers have made stunning claims of how systems such as lean production will lead to empowered workers, claims now largely ridiculed by serious research. The fact of the matter is that little attention has been paid to how work reorganization is affecting workers, of its impact on their health at work, or their quality of life at work.

There are a growing number of attempts to collect data from workers about their work experience. Much of this work has been stimulated by the path breaking work of

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[2] United Nations, Human Development Report 1990, (New York, 1990), pp. 9-16.

[3] ibid. p. 9.

[4] James P.Womack, D James P.Womack, Daniel Jones and Daniel Roos, The Machine That Changed the World: The Story of Lean Production, (New York, 1990); Nick Oliver et al., Worldwide Manufacturing Competitiveness Study: The Second Lean Enterprise Report, (Anderson Consulting, 1994); Nick Oliver et.al., Inside the Chinese Automotive Industry; The Third Lean Enterprise Report, (Anderson Consulting, 1998.)

Karasek and Theorell which linked the organization of work and workers' health.[5] In Europe, a major research project has been launched by the European Foundation for the Improvement of Living and Working Standards. In their Second European Survey on Working Conditions conducted in 1996, they collected data from just under 16,000 European workers employed in the 15 member states of the European Union on various dimension of the quality of life at work. The summary results suggest that many European workers are working harder with little evidence of the empowerment discussed in much of the management literature.[6] In Canada, some data on working conditions has been collected as part of the Workplace and Employee Survey sponsored by Human Resources Development Canada, but the range of questions on working conditions is limited and is unlikely to yield a detailed picture of the quality of life at work. None of these studies has led to an index which would allow researches to economically and accurately measure the quality of life at work or the healthiness of different workplaces.

[5] Robert Karasek and Tores Theorell, Healthy Work: Stress, Productivity and the Reconstruction of Working Life, (New York: Basic Books, 1990).

[6] European Foundation for the Improvement of Living and Working Conditions, Second European Survey on Working Conditions, (Dublin, 1996).

3

The index being proposed in this paper is the next step in an ongoing research project which was initiated in the mid-1990s, by the Canadian Automobile Workers (CAW) who were becoming increasingly concerned that management sponsored surveys were giving an incomplete picture of the changes occurring at the workplace and their impact on workers. A partnership was formed with researchers at McMaster University to design a survey instrument which would focus specifically on the health of workers and how new models of work organization were affecting the quality of life at work.[7] The survey is comprised of 45 closed ended questions and examines topics such as workload, physical and emotional health, job control, relations with management, and relations between home and work. It was designed to be filled out by the workers themselves in their own time. Between 1995 and 1997, three rounds of surveys were conducted involving just under 10,000 workers and 75 different workplaces.[8] This paper will focus on a subset of this data, the 5,559 responses collected from workers at the 24 Canadian workplaces of Ford, Chrysler, General Motors and CAMI. This includes workers involved in the assembly of vehicles, the manufacturing of components such as engines and transmissions, parts depots, and office and skilled trades workers.

[7] See Appendix One for details on how the data was collected.

[8] For summaries of the results of these surveys see, Wayne Lewchuk & David Robertson, "Working Conditions Under Lean Production: A Worker-based Benchmarking Study", Asia Pacific Business Review, summer 1996, pp. 60-81; CAW/TCA, Working Conditions Study: Benchmarking Auto Assembly Plants, (CAW, March 1996, pp. 1-41; Wayne Lewchuk and David Robertson, "Production Without Empowerment: Work-Reorganization from the Perspective of Motor Vehicle Workers", Capital and Class, 1997, pp. 37-65; Human Centred Benchmarking: Work Reorganization and the Quality of Work Life in the Clothing, Textile, Primary Textile, Box, Paper, Aluminum, Electrical and Electronic Products Sectors, report submitted to the Manufacturing Research Corporation of Ontario, August 1997, pp. 1-65. Ongoing surveys include the General Motors plant in Ellesmere Port and the Mitsubishi plant in Bloomington-Normal Illinois. See, Wayne Lewchuk, Paul Stewart and Charlotte Yates, Global Firms Global Strategies an International Study of the Quality of Working Life in The Automobile Industry, (unpublished); Robert Bruno & Lisa Jordon, "From High Hopes to Disillusionment: The Evolution of Worker Attitudes at Mitsubishi Motors", (Work Employment and Society Conference, 1998).

4

SECTION TWO: THE HEALTHY WORKPLACE INDEX

At a minimum, a healthy workplace is one where workers are not physically overloaded, where stress and tension are at a minimum, where management treats workers with respect, and where workers have a degree of control over decisions that affect their lives at work. An index reflecting these conditions needs to aggregate a number of different indicators of quality of life at work measured in different metrics. The methodology used to construct the Human Development Index (HDI) proved ideal for constructing a Healthy Workplace Index. The Human Development Index was created to overcome the limitations of national income as a measure of development and the quality of life in a country. It was argued that Gross National Product (GNP) was a poor reflection of overall quality of life where income was unequally distributed or where GNP only partially captures activities which people value highly. This might include better nutrition and health services, greater access to knowledge, more secure livelihoods, better working conditions, or security against crime and physical violence to name a few.[9]

The HDI was constructed from three different indicators of development: expectation of life, adult literacy, and income.[10] Each of these indicators is measured in different units. To create a single index, minimum and maximum values were defined for each of the three indicators. The maximum can be interpreted as development targets. The original values for the three indicators were then translated onto a scale from 0 to 1, where 0 represented an indicator having the minimum value while 1 was assigned to an indicator with the maximum value. Values between 0 and 1 represent indicators above the minimum but below the maximum. The Human Development Index is the average of these three scale values.[11]

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[9]For instance, in the 1990 Human Development Report it was shown that Sri Lanka's GNP per capita was less than 1/5 of Brazil's, yet its life expectancy at birth was 71 years compared to 65 years in Brazil and its adult literacy rate was 87% compared with 78%. (p. 9)

[10] In the original Human Development Index proposed in 1990 the targets used to calculate development were a life expectation at birth of 78 years, 100% literacy, and a target income equal to the logarithm of the average poverty line of the richer countries. See Human Development Report, 1990, p. 14. The equation used to calculate the Index has been revised a number of times. See, Human Development Report, 1994 pp. 90-110.

[11] The HDI has become the focus of a number of research reports including a series of papers by Crafts. See, Crafts, N.F.R. (1997a), "Some dimensions of the 'quality of life' during the British industrial revolution", Economic History Review, 50, pp. 617-39; Crafts, N.F.R. (1997b), "The Human Development Index and changes in standards of living: Some historical comparisons", European Review of Economic History, 1, pp. 299-322.

5

The Healthy Workplace Index is constructed in a similar fashion. Eighteen different indicators of quality of life at work were selected from the CAW/McMaster survey ranging from the pace of work, to concern over losing one's job, to days working in pain. Maximums and minimums were defined for each of these 18 indicators. The indicators, and the maximums and minimums used in the Healthy Workplace Index are listed in Table One where they have been grouped into four categories: Physical Health, Emotional Health, Workload, and Job Control.

6

TABLE ONE: COMPONENTS OF THE HEALTHY WORKPLACE INDEX[12]
(Numerical value of minimums and maximums in brackets)

	MINIMUM	MAXIMUM
PHYSICAL HEALTH INDEX		
1) Days working in physical pain last month.	Every day (1)	Never (5)
2) Part of each day working in an awkward position.	All the time (1)	Not at all (5)
3) Days exhausted after shift in the last month.	Every day (1)	Never (5)
EMOTIONAL HEALTH INDEX		
1) How tense and wound up at work last month?	Very tense (1)	Not tense at all (4)
2) How concerned over losing your job in the next 3 years?	Very concerned (1)	Not concerned (3)
3) Days in last month felt distaste at the prospect of going to work.	Every day (1)	Never (5)
4) Enough energy after work for family in the last month.	Never (5)	Every day (1)
5) How easy was it to get time off to attend personal needs (doctor, ill child)?	Very difficult (4)	Very easy (1)
6) Could you keep current work pace until age 60?	No (4)	(Yes) 1
7) Are management policies fair?	Very unfair (5)	Very fair (1)
WORKLOAD INDEX		
1) Are there enough people in your area to do work assigned?	Far too few (5)	About right (3)*
2) Is the current physical work load?	Much too heavy (1)	About right (3)*
3) How much time to do the work currently assigned?	Far too little (5)	About right (3)*

[12] The actual questions can be found in the Appendix.

7

4) Is the current work speed?	Much too fast (1)	About right (3)*
5) What part of each day do you work as fast as you can so you do not fall behind?	All day (1)	Never (5)

JOB CONTROL INDEX

1) During a working day, how much can you vary your pace of work?	Not at all (5)	A great deal (1)
2) Is there adequate relief staff so you can easily leave the line to attend to personal matters? (washroom)	Far too few (5)	About right (3)*
3) How easy is it to change things you do not like about your job?	Very difficult (5)	Very easy (1)

One of the difficulties faced in defining indices such as the Human Development Index or the Healthy Workplace Index is that there is a degree of subjectivity in defining the maximums and minimums which define the end points of the scale.[13] For the Healthy Workplace Index we relied on the minimums and maximums as defined in the survey and our own sense of a reasonable standard. For the six indicators with a time base such as days working in pain, or time working in an awkward position, the minimums and maximums were straightforward. Working in pain every day would be a minimum and never working in pain would be a maximum, a workplace reorganization goal. A second group of seven indicators such as 'how easy was it getting time off for personal matters', or 'the perceived fairness of management policies' had non-numerical answer choices of the variety from"very unfair" to "very fair" or from "very difficult" to "very easy". We relied on the end points of our survey questions for the minimums and maximums, assigning a value of 1 to minimums and increasing the value of each succeeding response by one unit with the maximum taking the value of the number of answer choices, in most cases 5. A third group of five indicators including questions relating to workpace or physical workload were more problematic. On the survey, respondents had the choice of reporting their workpace was 'much too fast', 'too fast', 'about right', 'too slow', or 'much too slow'. It seemed unreasonable to use 'much too slow' as an objective given it is not clear if having a workpace which is 'much too slow' is necessarily an improvement over having a workpace which is 'about right' . It was

[13] After a number of revisions, the Human Development Index sets minimums at the lowest value any country in the sample reported over the previous thirty years. The maximums are set at the level which the United Nations predicts the leading country will achieve within the next 30 years. See, Human Development Report, 1994, p.92.

8

decided to use 'about right' as the maximum for this series of questions. This raises the difficult issue, not addressed in this paper, of how workpace norms are defined between industries and across time and the meaning which should be attached to the response 'about right'.

To construct the index, the raw values from each of the 18 survey questions, usually ranging from 1 to 5, were converted to a scale from 0 and 1. A simple linear formula was used to calculate this value.[14] A value of 0 would represent someone with working conditions defined by the minimum for this indicator while a value of 1 would represent someone with working conditions defined by the maximum for this indicator. A value of .5 would represent someone half way between the minimum and the maximum. To see how the index was calculated it might be useful to look at an actual example. For the indicator days working in physical pain the minimum was working in physical pain every day (value 1) and the maximum was never working in physical pain (value 5). For a worker reporting working in physical pain most days (value 2) the indicator would take the value (Individual response-minimum)/(Maximum-minimum)=(2-1)/(5-1)=.25.

The 18 life at work indicators were grouped into the four categories listed in Table One. The rationale for doing this was it allowed us to decompose the index into four constituent parts and facilitated having an unequal number of questions in each component. The index for each category was simply the average of the scale value of the indicators in that category. The final Healthy Workplace Index was simply the average of the four category indices. A value of 0 on the Healthy Workplace Index would represent a workplace where working conditions were at the minimum on all 18 indicators. A value of 1 would represent a workplace where working conditions were at the maximum on all 18 indicators.

[14] Where the numerical value of the maximum was greater than the minimum the index formula was (Individual response-minimum)/(Maximum-minimum). Where the numerical value of the maximum was less than the minimum the formula was (Minimum-individual response)/(Minimum-maximum). In either case the formula returns a value of 0 where the individual reports working conditions equivalent to the minimum and 1 where conditions are equivalent to the maximum.

9

SECTION THREE: THE QUALITY OF LIFE AT WORK IN CANADIAN AUTOMOBILE PLANTS

This section will examine two questions. First, does the Healthy Workplace Index (HWI) reflect general assumptions regarding the quality of life at work in different sectors? We would be concerned if for instance it suggested that skilled workers had less control than assembly line workers, or office work was physically more demanding than working on a moving assembly line. Second, what does the Healthy Workplace Index tell us about the quality of life at work in the Canadian automobile industry?

Diagram One reports the mean values of the Healthy Workplace Index for 3,962 direct and indirect workers employed assembling vehicles, manufacturing components and in parts depots. The horizontal line in each of the diagrams is the unweighed sample mean. The vertical lines report means disaggregated by sector, sex, type of job and age. In Diagram One, the sample mean for the Healthy Workplace Index is .54. This should be interpreted as the average worker reporting working conditions about half way between the minimums and the maximums defined in Table One. Diagram One also reveals significant differences between the responses of workers employed in different sectors. The assembly plants had a lower HWI (.48) than those working in parts depots (.64) with those in component plants in between. The other characteristics for which disaggregated results are provided appear to be less significant. Males reported virtually the same HWI as females. Direct workers (eg. assembly line and machine operators) had somewhat lower HWI than indirect workers (eg. inspectors and material handlers). Workers 50 and over reported higher HWI but there was no obvious pattern for those below 50.

The results reported in Diagram One suggest that the HWI does reflect generally held assumptions regarding the quality of work enjoyed by workers in different sectors and with different characteristics. Most would predict that of the three types of workplaces for which we have data, working in an assembly plant organized around a moving assembly line would be the least attractive while working in a parts depot where workers have greater freedom to pace themselves would be the most attractive. Most would also expect that direct production workers, many of whom are mechanically paced on short cycle jobs, would report poorer quality of life at work than indirect workers many of whom work at non-machine paced tasks with longer job cycles. Assumptions regarding the impact of sex and age on the quality of life at work are less obvious. Given that jobs are allocated in these plants on the basis of seniority one would expect that male workers and older workers, both of whom have more seniority on average, would be working at better jobs than female workers and younger workers. For older workers this advantage may be negated if they are finding it increasingly difficult to sustain the expected workpace. Diagram One suggests that the advantage reported by males is marginal, while it would appear that older workers have been able to bid into more attractive jobs. The HWIs reported in Diagram One are broadly consistent with expectations of the quality of life at work in different contexts. This suggests it is a valid measure of the quality of life at work and can be used to rank

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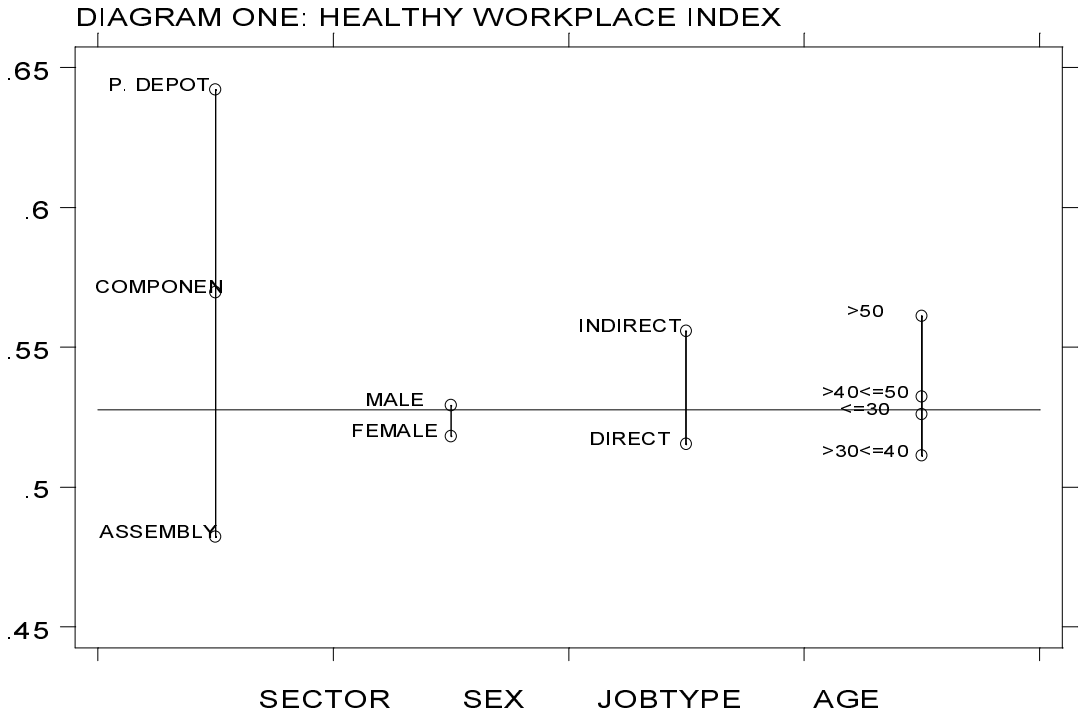
conditions at different companies using different models of work organization.

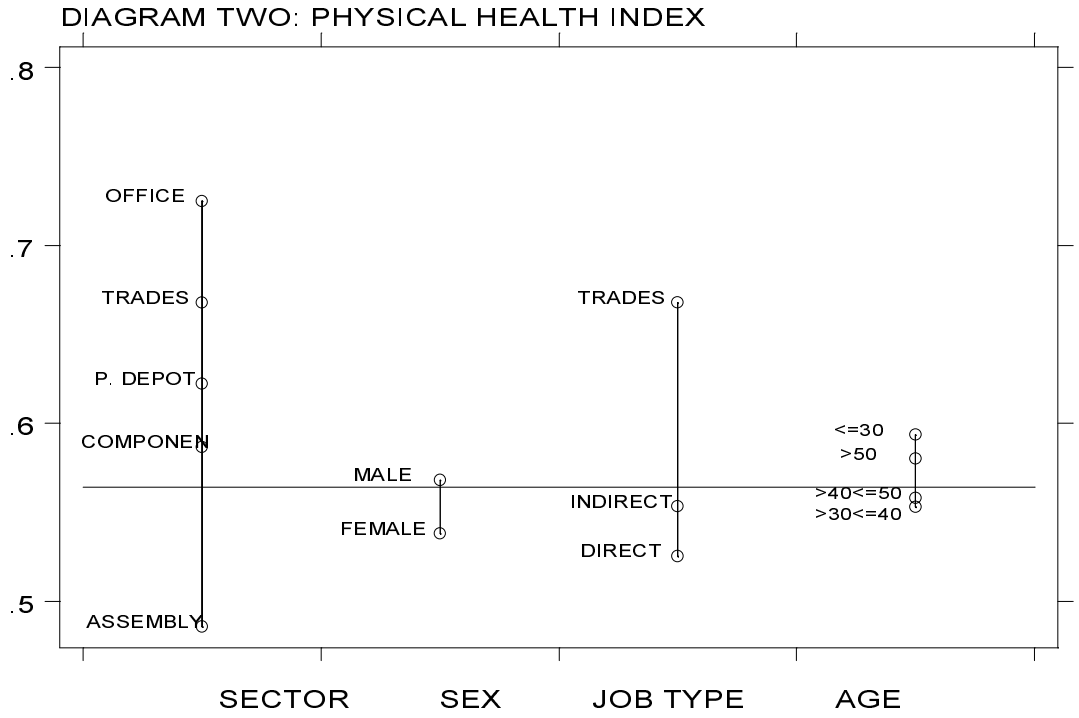


The Healthy Workplace Index provides a single measure which can be used as an indicator of the overall quality of life at work at different workplaces. Further insights can be drawn by examining the four components of the Index which are reported in Diagrams Two to Five. The Workload Index and the Job Control Index employ the same sample as the Healthy Workplace Index. The two health components, the Physical Health Index and the Emotional Health Index include as well just over 1,000 office workers and skilled trades workers employed at the 24 workplaces in the study.

The results from the Physical Health Index (PHI), which includes indicators of working in pain, working in an awkward position, and exhaustion after work are reported in Diagram Two. The PHI mirrors the overall Healthy Workplace Index with a few exceptions. Not surprisingly, disaggregating by sector reveals that office and skilled trades workers enjoy significantly better physical conditions than those employed in assembly plants. The Index for office workers was 49% higher than that reported by those in assembly plants. Women reported marginally poorer physical conditions than men. Age had only a minor impact on the PHI. The latter suggests that the ability of older workers to bid onto better jobs is more or less negated by the decline in their

11

ability to sustain the pace and physical load expected in this sector. Skilled trades workers reported better conditions than either indirect or direct workers.



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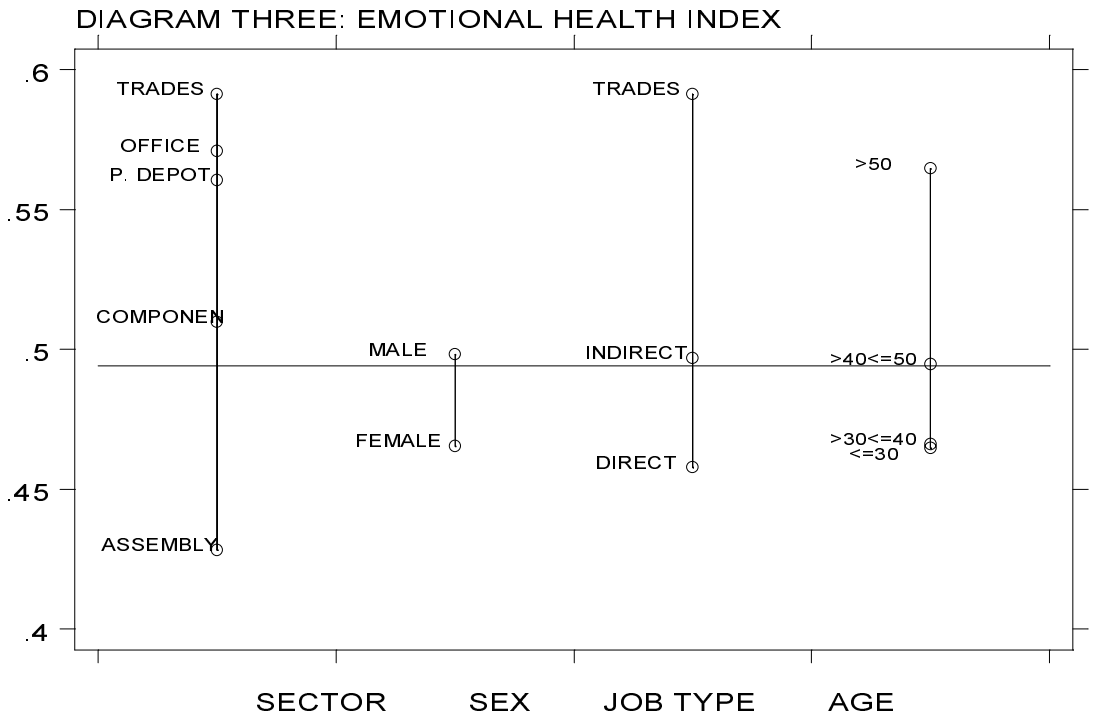
The results from the Emotional Health Index (EHI) which includes questions on tension, job security, and relations with family are reported in Diagram Three. There are some interesting differences between the Emotional and Physical Health Indices. The mean value of the EHI (.49) was 14% lower than the mean value of PHI which may suggest that more attention needs to be directed towards stress and tension related health concerns. Disaggregating by sector revealed that the highest EHI was reported by skilled trades workers. Office workers, who reported the highest score on the PSI, do not score nearly as well relative to other sectors on the EHI. The EHI for office workers was only marginally higher than those working in parts depots and only 32% higher than those working in assembly plants compared with 49% higher on the PHI. The difference between male and female workers was somewhat larger, although still small relative to the differences reported between sectors. Age also appears to be a more important determinant of scores on the EMI. There was a clear correlation between age and the values of EMI with workers over age 50 reporting EHI 22% higher than those 30 or younger.



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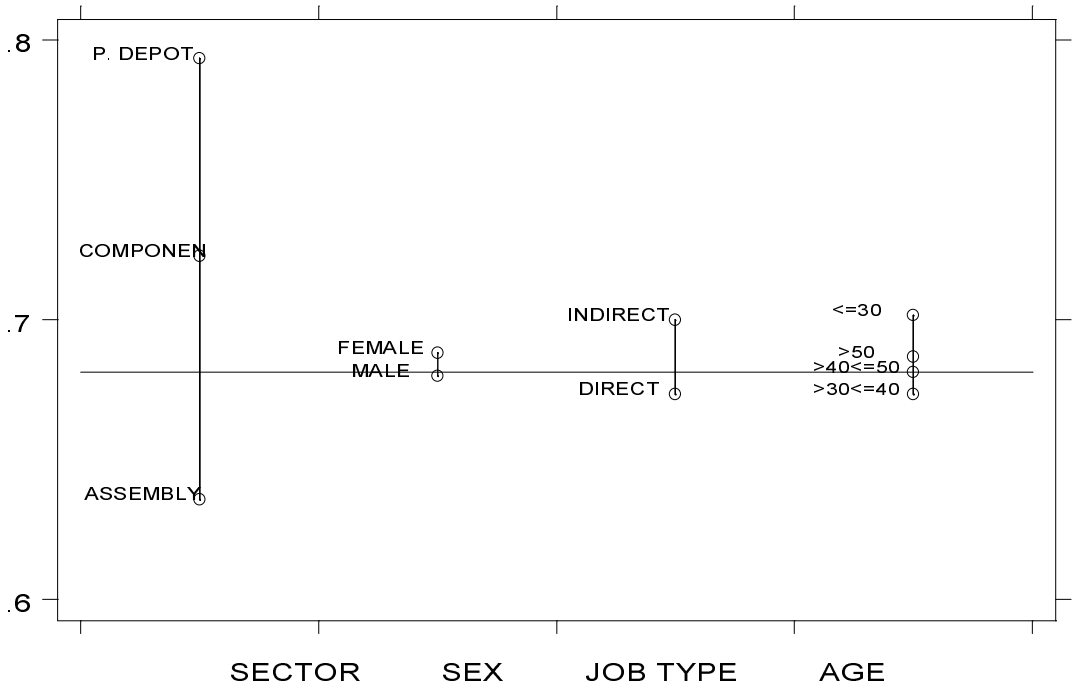
Results for the Workload Index(WLI), which includes questions on the speed of work, the physical load, the amount of time allocated, the number of people and the pace needed so one does not fall behind are reported in Table Four. Of all the indices calculated, the Workload Index has the highest mean value at .68. In interpreting this figure it is important to keep in mind that the survey included a range of questions about physical workload and the pace of work. It is unlikely that all of these questions would apply to all types of work. For instance, people working in a parts depot may be concerned that they have too little time to do their work and that there are not enough people assigned, but they are unlikely to report their work is too fast. Those on an assembly line may report their work is too fast and too heavy, but are unlikely to report there are too few people assigned as most line operations must have their full quota of workers to operate. This is confirmed by looking at the correlation matrix for the five questions in this index. All were less than .6 and most were between .25 and .45 suggesting a moderate degree of correlation. This is also confirmed by looking at how many workers reported at least one aspects of their workload was excessive compared to those who report their workload was excessive on all aspects. In the entire sample, 69% reported that their work was either too fast, too heavy, had too little time allotted, or had too few people assigned but only 14% reported it was all of these things.

In designing this component of the HWI, it was necessary to make a choice between attempting to correct for this possible upward bias versus making the index construction as simple as possible and transparent to the reader. In previous work by the authors, this problem was resolved by measuring overloaded jobs as those where workers reported their load was excessive on three out of four or five indicators. We have opted not to take this approach here as we felt it would make the index less transparent to the reader and raise questions regarding the value of the WLI compared to the other indices calculated. Instead we have opted simply to warn the reader that in interpreting this index one needs to be sensitive to the likely upward bias created by the construction of the index.

Returning to the WLI itself, while the mean score on this index is higher than any other index the variance between workers in different sectors or with different characteristics was relatively small. Those working in parts deports reported a WLI which was only 23% higher than the WLI for those employed in assembly plants. Personal characteristics appear to have almost no impact on the WLI. As was the case with the PHI, the advantage older workers might have in bidding onto preferred jobs appears to be counterbalanced by the difficulty older workers have sustaining the workload expected in this sector.

14

DIAGRAM FOUR: WORKLOAD INDEX



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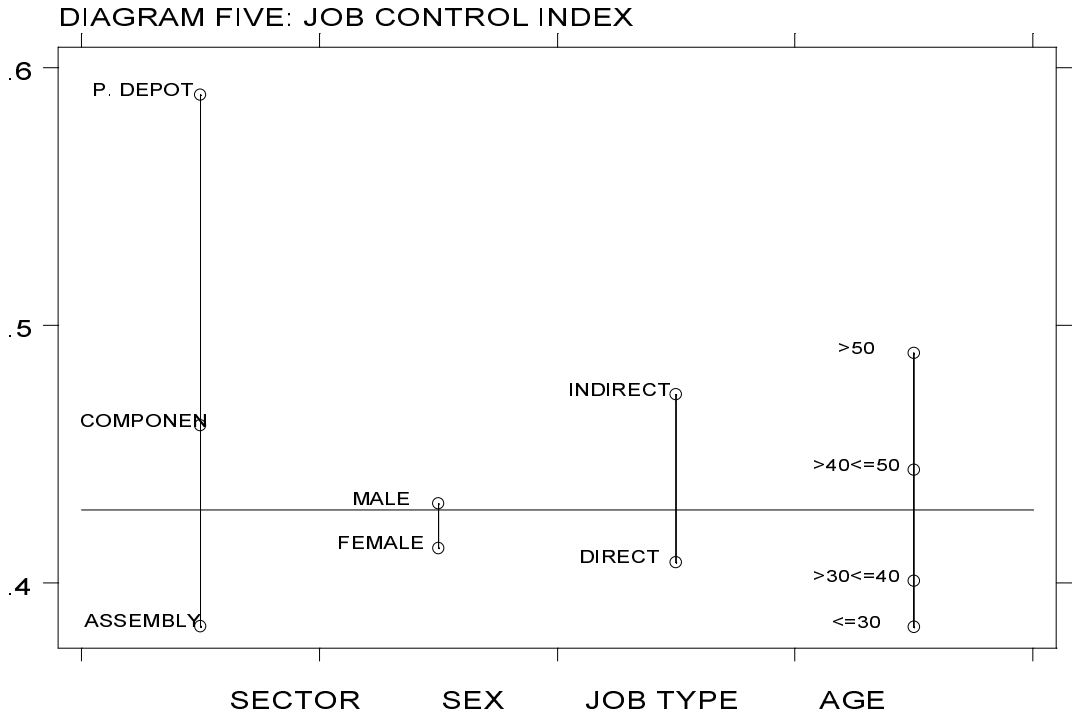
Results for the Job Control Index (JCI), which includes questions on the ability to vary workpace, find relief to attend to personal matters at work, or change things you do not like about your job are reported in Diagram Five. The sample mean score of .43 was the lowest of all the indices calculated. This raises doubts about the extent to which changes in work organization in the automobile industry have empowered workers. Disaggregating by sector revealed that parts depot workers had a JCI 55% higher than than those working in assembly plants. Sex appears to have had little impact on reported scores. Indirect workers generally reported higher scores than direct workers and older workers reported higher scores than younger workers.



Diagrams One to Five suggest that the Healthy Workplace Index can be a valid measure of the quality of life at work. It suggests that the sector one works in has a significant impact on reported Index values. It also suggests that personal characteristics such as sex, age and job type are generally less important. The detailed study of the four components which make up the Index suggest that in areas such as Physical Health and Workload, any advantages an older worker might have by being able to bid onto a preferred job are balanced by the reality that as one ages it becomes more difficult to sustain the workload expected in this sector.

16

SECTION FOUR: RANKING THE QUALITY OF LIFE AT WORK AT DIFFERENT COMPANIES AND WORKPLACES

In the previous section of the paper, we argued that the Health Workplace Index was a valid instrument for measuring the quality of life at work. It was shown that the reported values of the Index varied significantly by sector and to a lesser degree by personal characteristics such as sex, job type and age. In this section of the paper we will look at a single sector, motor vehicle assembly, and how the quality of life at work varies across the four companies and nine workplaces for which we have data. There are two reasons for doing this. The first reason is a desire to determine if the quality of life at work within a sector is determined largely by factors beyond the control of individual companies and workplaces. If this were the case we would expect to find little variance in the HWI. If the HWI varies between companies or between workplaces this suggests that choices are being made regarding how to implement technology which can have either a positive or negative impact on the quality of life at work. The second reason for focussing only on the assembly sector is that the work emerging from the International Motor Vehicle Project at MIT has created a great deal of confusion in policy and academic circles by suggesting that the quality of life at work is improving as a result of the shift to Lean Production. The HWI can be used to test this hypothesis.

In previous work, we argued that at the time of the survey each of the four companies assembling vehicles in Canada was at a different point in the transition to Lean Production.[15] We argued that GM had gone the furthest down the road towards lean production practicing a top-down teamless variant of the system. Workplace standards had been tightened, jobs were redesigned to reduce the ability of employees to vary from a pre-defined work sequence, JIT was in place, continuous improvement was being promoted, and overall labour hours per vehicle had fallen dramatically. When it opened, CAMI, a joint project of Suzuki and GM had gone some way towards implementing a team based system of lean production borrowing heavily from the work organization practices of Suzuki. Since the opening, many of these early practices have either been abandoned or become less important in the overall organization of the plant.[16] Teams now play a minor role in day to day decisions and the task of continuous improvement has increasingly become a management task. Chrysler and Ford had made the least progress in adopting a workplace set of institutions consistent with lean production. Chrysler had emphasised new product design over the last decade and its ability to sell as many mini-vans as it produces made regularity of output a higher priority than minimizing the cost of production. The Ford assembly plant in the

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[15] See, Wayne Lewchuk and David Robertson, "Production Without Empowerment: Work-Reorganization from the Perspective of Motor Vehicle Workers", Capital and Class, vol. 63, 1997, pp. 37-65.

[16] See, James Rinehart, Christopher Huxley and David Robertson, Just Another Car Factory, (ILR Press, 1997).

17

sample produces an older model and has made limited efforts to move towards the practices associated with lean production.

Diagram Six reports HWI for the assembly sector only by company, workplace, sex, job type and age. A total of 2,424 observations from 9 different assembly plants are included. The first observation is that company seems to matter. Ford's score on the HWI was 31% higher than that of GM. This is comparable to the difference between assembly plants and parts depots in Diagram One. Workplace has less of an influence. Individual GM and the Chrysler workplaces are tightly bunched around the GM and Chrysler means. The HWI at the best workplace is 46% higher than at the worst workplace while the best Chrysler workplace is 10% better than the worst Chrysler workplace and the best GM workplace is 15% better than the worst GM workplace. The remaining three personal characteristics are relatively less important.

The observation that the HWI varies across companies suggests that the quality of life at work is not simply technically determined. Even within a relatively technologically homogeneous sector, factors such as work organization, management policies and involvement of the union appear to influence the quality of life at work of workers. However, this effect appears to be influenced mainly by company policies. At the local level there was much less variance between workplaces belonging to the same company.

Diagram Six raises serious concerns regarding the hypothesis that the shift to Lean Production will enhance the quality of life at work. In Diagram Six, the ranking of the different companies on the HWI is inversely related to the extent to which each company has moved towards lean practices. GM, which has made the most effort to become lean, is at the bottom of the scale while Ford, which has made the least effort to change, is at the top. This should not be interpreted as suggesting that the old Fordist model of work organization is attractive to workers. A score of .55 on the HWI at Ford suggests quite the opposite. Our results do suggest that progress in implementing lean and becoming more productive and competitive does not appear to be associated with a climb up the HWI league tables for workers.

18

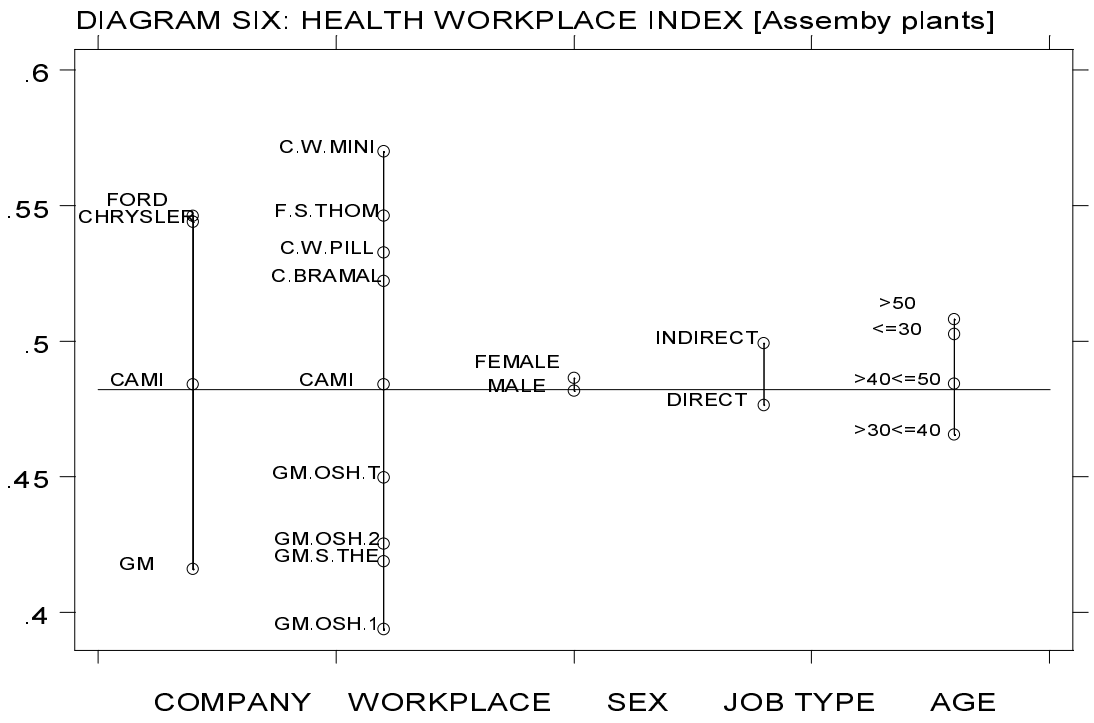
DIAGRAM SIX: HEALTH WORKPLACE INDEX [Assemby plants]
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.55
.5
.45
.4
FORD
CHRYSLER
GM
CAMI
C.W.MINI
F.S.THOM
C.W.PILL
C.BRAMAL
CAMI
GM.OSH.T
GM.OSH.2
GM.S.THE
GM.OSH.1
FEMALE
MALE
INDIRECT
DIRECT
>50
<=30
>40<=50
>30<=40
COMPANY
WORKPLACE
SEX
JOB TYPE
AGE

19

Diagrams Seven to Ten report results for the four components of the HWI. The results can be summarized briefly. A quick scan of the Diagrams makes it clear that Ford and Chrsyler workplaces reported the the highest quality of life at work. In general, GM workers reported the lowest index scores except on the EHI where CAMI had the lowest scores. CAMI scored closer to Ford and Chrysler on the PHI and the WLI. The percentage difference between the lowest and the highest company scores on the four indices was, PHI 37%, EHI 47%, WLI 42% and JCI 11%. This suggests that there were significant company differences in the quality of life at work on at least three components of the index, but that scores on the JCI were tightly bunched around the mean. This last finding contradicts the argument that the shift to lean production would enhance the quality of life at work by empowering workers and giving them greater control over decisions affecting them. Given the workers in our sample report limited ability to vary their workpace, almost no capacity to changes things they do not like about their job, and problems getting time off the job to go to the washroom, it is hard to envision describing these workers as empowered or in control in any meaningful way. Workplace appears to have less influence on the quality of life at work than company. On three of the four indicators the GM and the Chrysler workplaces were tightly bunched around the GM and Chrysler company means. The only Index where this was not the case was the Job Control Index which also exhibited the least variance between company means.

The differences between male and female workers was very small on all four indicators. On three of the four indicators women reported better conditions than men. Indirect workers reported higher indices than direct workers, but again the differences were small. Age was the one personal characteristic that seemed to affect index scores. Younger workers, less than age 30, had a PHI 15% higher than workers 30-40 and 13% higher than workers 30-50. On EHI it was older workers over the age of 50 who reported the highest index, 17% higher than those age 30-40. The different impact of age on the two health indices is of some interest. It suggests that younger workers are the most resilient in the face of physical demands, that older workers are the most resilient in the face of emotional demands, and that on both indices it is middle age workers, age 30-40, who report the lowest quality of life at work as measured by PHI and EHI. The other component of the index where age was relatively important was the JCI. While there was very little difference between workplaces on this component of the HWI, within each workplace it appears that younger workers perceive themselves to have the least control while older workers have the most. But even for workers over age 50, their JCI was still only .44 suggesting a minimal degree of control at work.

20

DIAGRAM SEVEN: PHYSICAL HEALTH INDEX [Assembly plants]

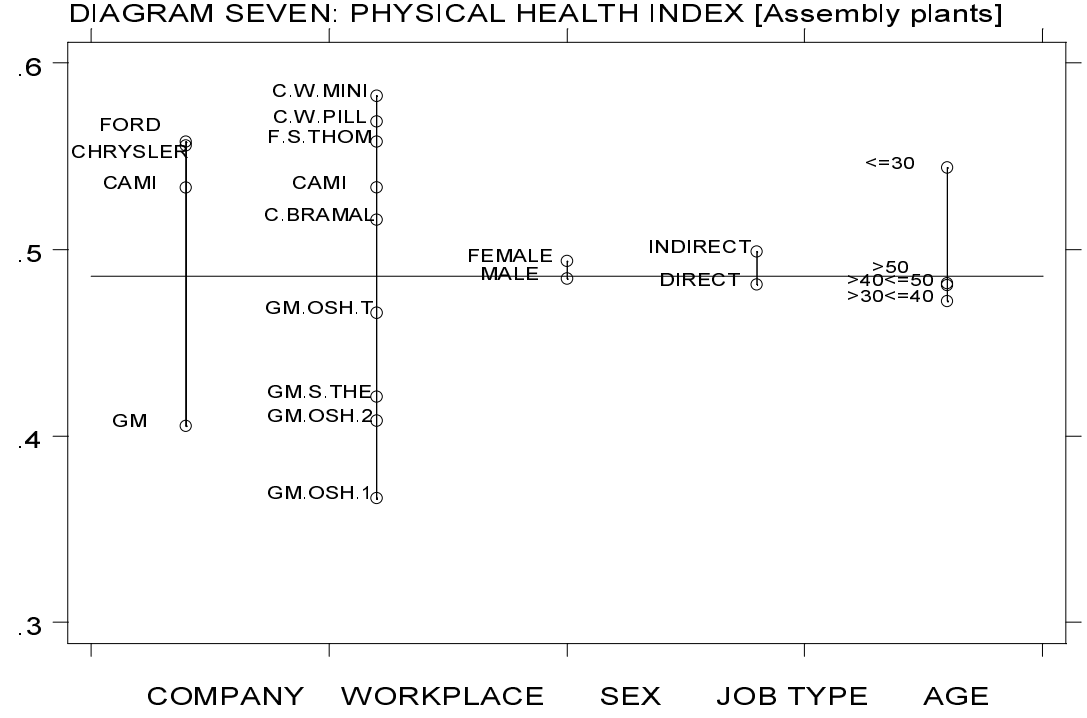
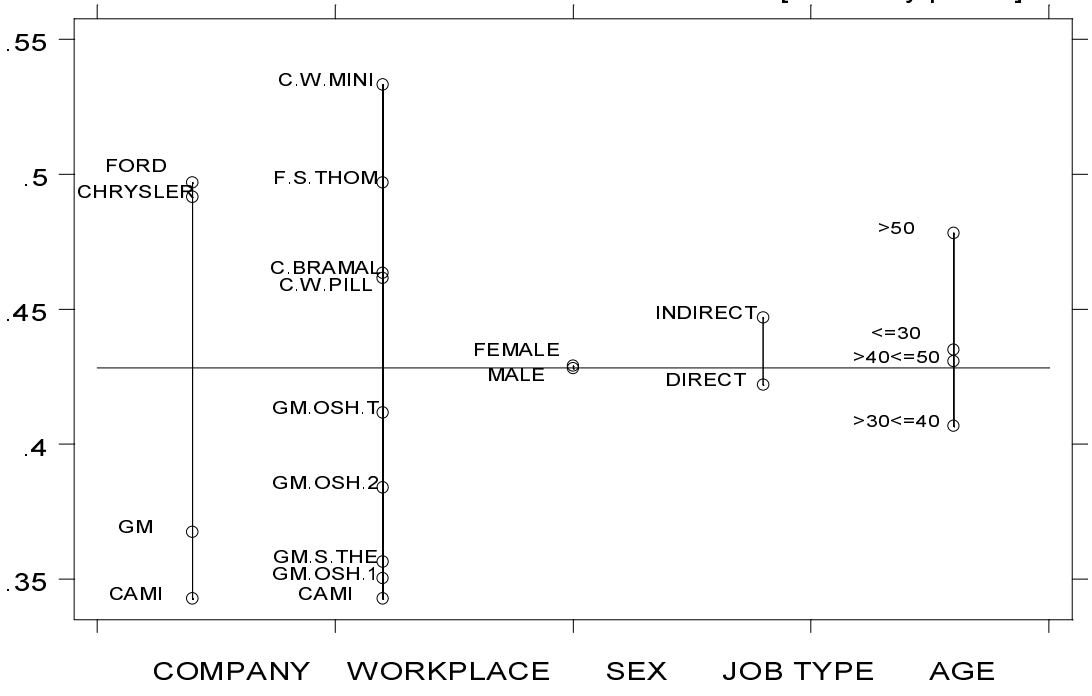


DIAGRAM EIGHT: EMOTIONAL HEALTH INDEX [Assemby plants]



21

DIAGRAM NINE: WORKLOAD INDEX [Assemby plants]

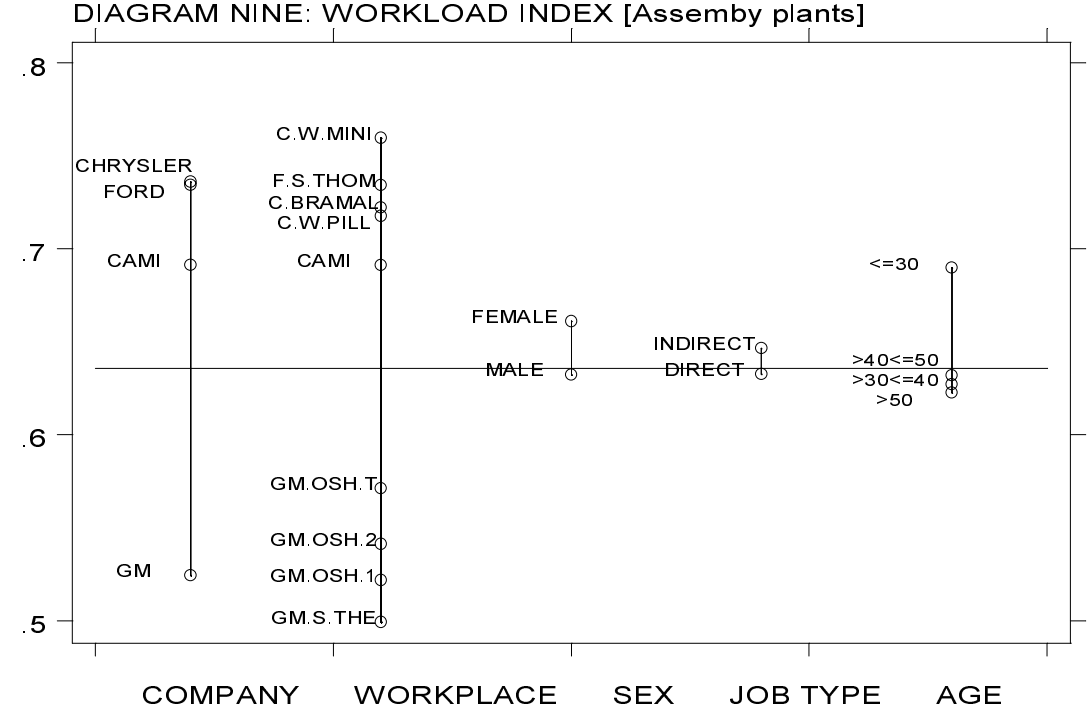
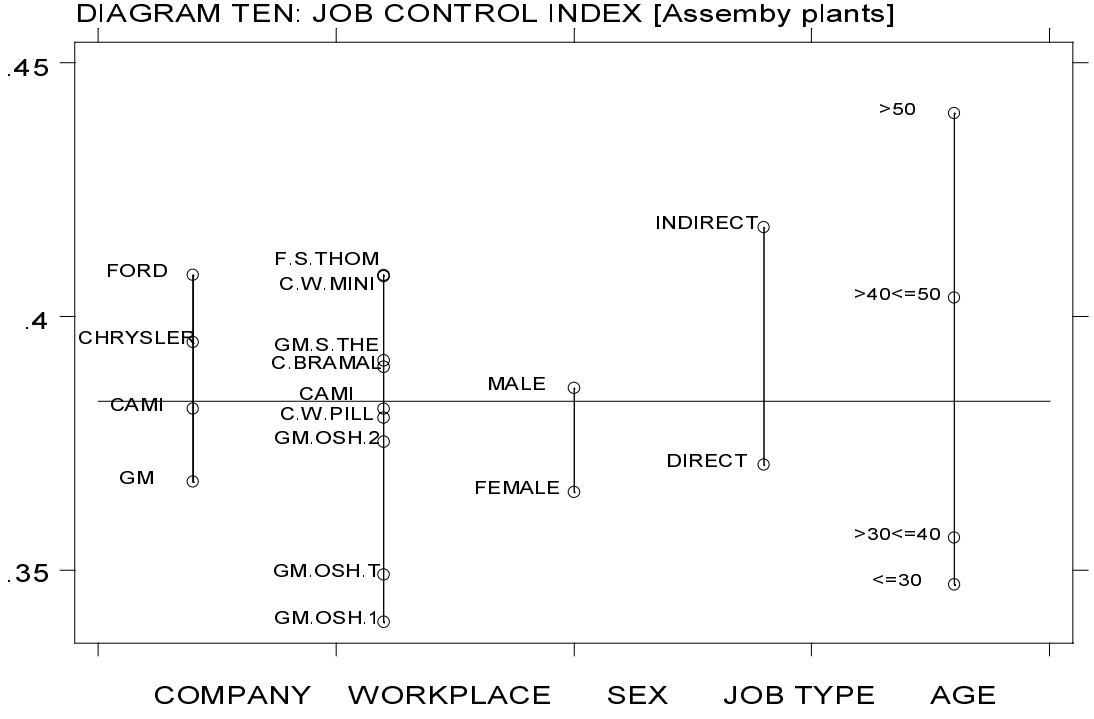


DIAGRAM TEN: JOB CONTROL INDEX [Assemby plants]



22

A detailed examination of the HWI for the vehicle assembly sector suggests that there are important differences across companies in the quality of life at work. It suggests that Ford and Chrysler have found a less alienating way to produce vehicles than GM. CAMI oscillates between looking like Ford and Chrysler on a number of indicators and like GM on others. There was much less variance between workplaces from the same company suggesting that local actors have limited independence and are constrained by decisions taken at a higher level. These results suggest that the quality of life at work is a function of both the technological imperatives associated with particular sectors, but also choices under each company's control regarding how this technology is implemented. Men and women face very similar quality of life at work across this sector while indirect workers report marginally better conditions than direct workers. Age appears to have a complex effect on the quality of life at work. There is some evidence that as workers grow older they find the physical demands of the job more onerous, but the emotional demands less so. There is also evidence that as workers grow older they find ways to enhance their control of their work environment.

23

SECTION FIVE: A MULTIPLE REGRESSION ANALYSIS OF THE HEALTHY WORKPLACE INDEX

Sections Three and Four of this paper explored the validity of the Health Workplace Index and how it could be used to shed light on a single manufacturing sector. Each relied on a simple presentation which ignored potential problems from sectors or companies having different compositions of workers in terms of age, sex or job type. In this section we will use the HWI as the dependent variable in a multiple regression analysis. This will allow us to control for differences in the composition of the workforce across sectors and companies.

Table Two present simple OLS regressions which use HWI and its four components as the dependent variable. The indices are regressed against company dummies, sex, job type dummies and age, where age is normalized around the age of 30. The omitted categories, and hence reference point for interpreting the coefficients, are direct, male workers, age 30, working at GM, in assembly plants. The coefficients in Table Two indicate the difference between the reference worker and a worker with this alternative characteristic. For instance under HWI a worker at Chrysler had an index value 10.7 percentage points higher than the reference worker.

Table Two broadly confirms the conclusions based on the evidence presented in Diagrams One to Ten. The fast majority of independent variables were highly significant. Only in a small number of cases were coefficients not significant at the .01 level. While most were significant, the size of the coefficients varied considerably. Workers at all three companies reported higher HWI than workers at GM, from 17% higher at CAMI to 26% higher at Chrysler. Correcting for compositional differences leads to slightly lower scores for Ford relative to Chrysler than was the case in the diagrams above. Sector remains an important factor in determining the indices. As was the case above, the other two sectors for which we have full information, components and parts depots, report higher indices than assembly. Personal characteristics including sex, job type and age are the most likely to be statistically insignificant and have the smallest coefficients.

24

TABLE TWO: EFFECT OF COMPANY, SECTOR AND PERSONAL CHARACTERISTICS ON THE HEALTHY WORKER INDEX AND ITS COMPONENTS.
(Comparison worker works at GM, in assembly, is male, direct and age 30.)

DEPENDENT VARIABLE	HEALTHY WORKPLACE INDEX	PHYSICAL HEALTH INDEX	EMOTIONAL HEALTH INDEX	WORKLOAD INDEX	JOB CONTROL INDEX
FORD	7.2	7.7	8.6	9.4	1.5**
CHRYSLER	10.7	10.1	9.1	15.4	4.4
CAMI	6.7	10.2	1.7***	13.6	4.5*
PARTS DEPOTS	16.9	15.9	13.4	17.4	19.8
COMPONENT	9.4	10.9	7.5	10.4	8.4
OFFICE	-	20.8	7.9	-	-
SKILLED TRADES	-	19.4	15.9	-	-
FEMALE	-2.0*	-2.9	-1.4**	-1.0***	-2.2*
INDIRECT WORKER	2.1	2.1*	1.9	1.0***	4.0
AGE	0.02	-0.01**	0.31	0.01***	0.35
CONSTANT	41.0	43.9	34.7	55.4	31.8

Unless otherwise indicated, all coefficients statistically significant at the .01 level.
* Statistically significant at the .05 level; ** at the .10 level; *** greater than .10

CONCLUSIONS

This paper set out to construct a Healthy Workplace Index using the United Nations Human Development Index as a model. This new Index was tested and found to offer measures which were consistent with generally held perceptions of quality of life at work in different sectors. It was then used to examine the quality of life at work in the Canadian automobile industry. The results suggest that there is significant room for improvement in this sector. Equally important, the results suggest that as important as sector was in shaping the work experience of people in the sample, that within a sector such as assembly there were surprising differences between companies, although not between workplaces from the same company. It was argued that the low scores of GM, and to some extent CAMI, suggest that new lean models of work organization are having a negative effect on the quality of life of workers. While Fordist style plants were revealed to have their own quality of work life problems, lean workplaces appear to offer even less healthy working conditions.

25

APPENDIX ONE: THE CAW/McMASTER SURVEY

The study had two components, a survey distributed to workers at their workplaces and a site visit by one or more members of the research team. The site visit allowed us to inspect the production process and to interview members of the union executive. All workplaces assembling vehicles or components in Canada, owned by Ford, Chrysler, General Motors and CAMI, and organized by the CAW were originally included in the study. The Ford Oakville assembly complex had to be dropped due to a combination of funding problems and awkward timing. The survey was distributed to approximately one out of every six production workers. Surveys were randomly distributed by local union members. Each person was asked to distribute 25 surveys in his or her area to ensure an even distribution throughout the plant. Surveys targeted at different areas of the workplace and different shifts were pre-bundled by the research team based on rough estimates of the proportion of people in each area of the plant. Surveys were filled out by workers on their own time and were returned to their local union representative, or the union office, in unmarked sealed envelopes. Respondents were asked not to identify themselves on the survey. The surveys were returned to the national office of the CAW and then sent to McMaster University for coding and data analysis.

Measures of the quality of life at work are notoriously difficult.[17] Simple questions such as, "Are you satisfied with your job?" often give contradictory results. It is impossible to completely eliminate the impact of a person's earlier experiences and expectations from responses to questions about current working conditions. The impact of this problem was minimized in a number of ways. Answer choices were either arranged along an objective time scale eg. from "All day" to "Never" or with relatively easily understood end points such as from "Very difficult" to "Very easy". Care was taken to make the survey worker friendly, using language used on the shop floor, and limiting the survey to four pages of questions, about 45 in total. The success of the survey instrument can be measured in part by the high overall response rate of 60% and that most surveys were filled out completely.

[17] See Christian Berggren, Alternatives to Lean Production: Work Organization in the Swedish Auto Industry, (Ithaca, 1992), pp. 184-193.

26

TABLE THREE: RESPONSE RATE

	POPULATION	SURVEYS DISTRIBUTED	SURVEYS RETURNED	RESPONSE RATE
CHRYSLER				
Bramalea Assembly	2,600	450	305	68
Pillette Rd Assembly	1,700	270	206	76
Windsor Mini Van Plant	5,600	750	357	48
Etobicoke Casting	248	200	70	35
Ajax Trim	655	125	72	58
Mississauga Parts Depot	215	183	84	46
Skilled Trades	1,176	345	211	61
Office	267	162	119	73
GENERAL MOTORS				
Oshawa Car Assembly Plant #1	2,841	450	335	74
Oshawa Car Assembly Plant #2	3,172	450	301	67
Oshawa Truck Assembly	3,600	450	107	24
St. Therese Assembly	2,841	450	382	85
Windsor Transmission	1,358	225	155	69
ST.Catherines Engine	1,450	250	159	64
St.Catherines Components	2,288	400	246	62
Windsor Trim	1,200	175	147	84
Woodstock Parts Depot	575	250	202	81
Skilled Trades	2,851	625	430	69
FORD				
St. Thomas Assembly	2,600	450	325	72
Windsor Engine Plant 1	730	200	113	57
Windsor Truck Engine	611	150	102	68
Essex Engine	1,244	250	217	87
Windsor Casting	984	200	150	75
Windsor Aluminum	425	150	121	81
Essex Casting	523	150	65	43
Bramalea Parts Depot	275	275	78	28
Skilled Trades	992	425	276	65
Office	136	111	83	75
CAMI				
CAMI Car and Truck Assembly	2,500	550	106	19
Skilled Trades	139	125	36	29
TOTAL ASSEMBLY	27,454	4,270	2,424	57
TOTAL COMPONENTS	11,716	2,485	1,617	65
TOTAL OFFICE	403	273	202	74
TOTAL PARTS DEPOTS	1,065	708	364	51
TOTAL SKILLED TRADES	5,159	1,520	953	63
TOTAL	45,797	9,256	5,560	60

27

APPENDIX TWO: INDEX VALUES

TABLE FOUR: INDEX VALUES (Entire sample)

	HEALTHY WORKPLACE INDEX	PHYSICAL HEALTH INDEX	EMOTIONAL HEALTH INDEX	WORKLOAD INDEX	JOB CONTROL INDEX
Sample mean	.53	.56	.49	.68	.43
Assembly	.48	.49	.43	.64	.38
Components	.57	.59	.51	.72	.46
Parts Depots	.64	.62	.56	.79	.59
Office	-	.73	.57	-	-
Skilled trades	-	.67	.59	-	-
Male	.53	.57	.50	.68	.43
Female	.52	.54	.47	.69	.41
Indirect	.56	.55	.50	.70	.47
Direct	.52	.53	.46	.67	.41
AGE					
>50	.56	.58	.56	.69	.49
>40<=50	.53	.57	.49	.68	.44
>30<=40	.51	.57	.47	.67	.40
<=30	.53	.59	.46	.70	.38

28

TABLE FIVE: INDEX VALUES (Assembly plants only)

	HEALTHY WORKPLACE INDEX	PHYSCIAL HEALTH INDEX	EMOTIONAL HEALTH INDEX	WORKLOAD INDEX	JOB CONTROL INDEX
Sample mean	.48	.49	.43	.64	.38
Ford	.55	.56	.50	.73	.41
Chrysler	.54	.56	.49	.74	.39
CAMI	.48	.53	.34	.69	.38
GM	.42	.41	.37	.52	.37
CHRYSLER					
Bramalea	.52	.52	.46	.72	.39
Pillette Road	.53	.57	.46	.72	.38
Mini Van	.57	.58	.53	.76	.41
FORD					
St.Thomas	.55	.56	.50	.73	.41
GM					
Oshawa #1	.39	.37	.35	.52	.34
Oshawa #2	.43	.41	.38	.54	.38
Oshawa Truck	.45	.47	.41	.57	.35
St. Therese	.42	.42	.36	.50	.39
CAMI					
Car & Truck	.48	.53	.34	.69	.38
Male	.48	.48	.43	.63	.39
Female	.49	.49	.43	.66	.37
Indirect	.50	.50	.45	.65	.42
Direct	.48	.48	.42	.63	.37
AGE					
=>50	.51	.54	.48	.62	.44
>40<=50	.48	.48	.43	.63	.40
>30<=40	.47	.47	.41	.63	.36
<=30	.50	.48	.43	.69	.35

29

APPENDIX THREE: SURVEY QUESTIONS

PHYSICAL HEALTH INDEX

1. In the last month at work, how many days have you worked with physical pain or discomfort?
every day most days half the time a few days never

2. What part of each day do you work in physically awkward positions?
all the time three quarters half one quarter not at all

3. In the last month, how often have you felt exhausted after your shift?
every day most days half the time a few days never

EMOTIONAL HEALTH INDEX

1. In the last month at work, how tense and wound up were you?
very tense somewhat tense not very tense not tense at all

2. How concerned are you about losing your job in the next three years?
very concerned concerned not concerned

3. In the last month, how many days have you felt distaste at the prospect of going to work?
every day most days half the time a few days never

4. In the last month, how often have you had enough energy after work for your family?
every day most days half the time a few days never

5. Over the last two years, was it easy for you to get time off to attend to personal needs such as a doctor`s appointment, an ill child or a wedding?
very easy easy difficult very difficult

6. Could you work at the pace of your current job until age 60?
yes likely not likely no

7. Are management policies reasonable and fair at this workplace?
very fair fair neither unfair very unfair

WORKLOAD INDEX

1. Are there enough people in your area to do the work assigned?
far too many too many about right too few far too few

2. Is your current physical work load(positioning and fastening parts, moving and lifting sub-assemblies, air tool torque):
much too heavy too heavy about right too light much too light

3. How much time do you have to do the work currently assigned to you?
far too much too much about right too little far too little

4. Is your current work speed or work pace:
much too fast too fast about right too slow much too slow

5. For what part of each day do you work as fast as you can so you don`t fall behind?
all day 75% of the time 50% of the time 25% of the time never

JOB CONTROL INDEX

1. Over the course of a working day, how much can you vary your pace of work?
a great deal a lot some a little not at all

2. Is there adequate relief staff in your work area so that you can easily leave the line to attend to personal matters(eg. going to the washroom, etc.)?
far too many too many about right too few far too few

3. How easy is it for you to change the things you do not like about your job?
very easy easy neither difficult very difficult