

New technology and the quality of working life in New Zealand

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Abstract

Since the 1980s there have been major changes in workplace organization resulting from the application of new information and communications technologies (ICTs). The present study uses a sample of the working population to estimate the extent to which new technology has affected the quality of working life in New Zealand.

Many econometric techniques are prone to bias because of systematic differences between workers who are involved with new technology and those who are not. The present study therefore uses propensity score matching (PSM) to ensure that workers who are using new technology are only compared to workers who have not experienced these developments, but who have otherwise similar characteristics. PSM is an increasingly popular technique for the comparison of a treatment group with a control group, as it provides robust estimates of the actual effect of a particular treatment such as the adoption of new technology in the workplace.

The study addresses a range of questions relating to workplace satisfaction, from gains in the autonomy of workers and job variety to the extent to which workers now feel more closely monitored. It also addresses the relationship of new workplace structures resulting from technology adoption to more flexible working arrangements such as telecommuting.

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1. Introduction

Since the 1930s economic thinking has been strongly dominated by growth theory and the idea that economics is primarily about maximizing production. However the last 20 years have seen a growing belief that production, while important, is by no means the only issue, and other dimensions of the economy also deserve attention. In particular it is now widely accepted that workers do not simply give up their time in order to acquire cash incomes, but rather that work is an important part of their lives and the quality of their working life has real significance for them. Thus, if productivity and cash incomes rise but at the expense of less happiness in the workplace, there could be a tradeoff in which the gains from greater earnings are partially or even totally offset by rising personal costs.

Since the 1970s the cost of computers has shown a spectacular decline, which coupled with the integration of computing with telecommunications has facilitated far-reaching changes in the way work can be organized. Not only have workplaces themselves been reorganized to take advantage of the new technologies, but increasingly work is being outsourced, sometimes, as with call centres, to distant countries where labour is relatively cheap. There is also something of a trend to move work to the workers' homes - so-called telecommuting - with the potential to save the employer the costs of office space and to spare the worker wasteful commuting time.

A postal questionnaire was used to investigate the extent to which workers in New Zealand felt that new ICT had affected their working lives, and how far they felt the quality of working life had improved or declined. In particular, because of the well-established relationship between the adoption of new technology and workplace reorganisation, a number of questions were included to probe workers' reactions to changes in organizational structures and workplace relationships.

Workers who choose to work in industries with high technology are likely to differ significantly in terms of their aptitudes and preferences from those who do not, and regression analysis is therefore prone to giving biased results. Propensity score matching (PSM) allows the comparison of outcomes for workers using the new technologies against the outcomes for workers of similar propensities who are not using those technologies. PSM was therefore used

to examine differences in wages as well as different outcomes over a variety of workplace satisfaction measures.

2. Review of the literature

Work is not only important as a source of income, it is also an end in itself (Saunders, 2002). It is demoralizing if those who would like to work are unable to find anything suitable, and failure to find work is associated with health problems (Martin, 1994). Work gives people a sense of belonging (Phelps, 1997), a sense of identity (Barrett and Spoonley, 2001) and a sense of self-worth in addition to the financial rewards (Lane, 1991; Freeman and Soete, 1994). People need to be needed (Layard, 2006).

Since work matters to people it is not surprising that the quality of their working life (QWL) matters (Birch and Paul, 2003). “QWL is found to significantly reduce absenteeism, minor accidents, grievances, and quits” (Havlovic, 1991), and several life-satisfaction studies have found that non-financial aspects of workplace satisfaction, especially the climate of workplace trust, can have substantial income-equivalent effects (Firth et alia, 2004; Helliwell, 2005; James, 1992).

New ICT is a feature of the last 30 years, and from its earliest days it has been associated with speculation about its likely effects on the workforce. Numerous studies from around the more advanced economies have established that new technology is associated with generally higher wages, with rising wage dispersion (Black and Lynch, 2001; Galor and Moav, 2000), and with an increasing skills premium (Caselli, 1999; Freeman, 2002), and in New Zealand these patterns are similar to other English-speaking countries (Borland, 2000; Hyslop and Maré, 2005).

A marked correlation has also been found between new technology and workplace reorganization (Wolff, 2002). Organizational changes and IT adoption appear to go hand in hand (Lindbeck and Snower, 2000), and many authors have suggested that the potential benefits of automation cannot be fully realized in the absence of reorganization (Askenazy, 2000; Hitt and Snir, 1999; Pilat, 2002). These changes typically include the decentralization of authority, delayering of managerial functions and greater delegation of decision making, and increased multitasking (McConnell, 1996; Caroli and van Reenen, 2001).

Ever since the 1970s, when computerization began to spread widely through offices and workplaces, there has been speculation about its potential effects on the quality of working life (Schouteten, 2004), with opinions ranging from the enthusiastic to the seriously concerned (Zetka, 1991). The enthusiasts imagine a world in which the computers take over the routine tasks, giving workers greater autonomy and enhanced job satisfaction (DiMaggio et alia, 2004), while the pessimists note the power of computers to monitor their own operators, and dread an Orwellian world with work ever more time-bound and productivity-driven (Burris, 1998).

The actual effects that have been reported in the literature tend to find a mixture of benefits and costs, rather than either extreme. Freeman (2002) reports that people who work more with computers work longer hours but for higher pay, confirming Ducatel's earlier (1994) finding of a shift from manual to mental work involving an intensification of the pace of work. Simultaneously, the takeover of routine tasks by computers has changed the proportions of workers of different types in the more automated workplace, permitting some reduction of management layers and increasing use of self-managing teams (Black and Lynch, 2003). Overall, while there are widespread findings of higher earnings in more-technologized workplaces (Doms, Dunne and Troske, 1997; Haskell, 1999; Katz, 2000), there is little consensus in the international literature as to the long term effects on workplace pressure and other indicators of the quality of working life.

3. Data and methods

A questionnaire was distributed by mail to 1800 people randomly selected from the electoral rolls. This gave good geographic coverage of the adult population, but is almost certainly skewed toward older and more established workers because of the tendency for people to move more often when younger. 599 questionnaires were returned, but 221 were unusable or declined to take part, usually because the respondent was long retired. The 378 usable responses represent 20.9 percent of the total mailout.

Names were selected by choosing 18 representative electorates (16 General electorates and 2 Maori electorates) out of a total of 69 for the whole country. 100 names were then chosen at

random from each of those 18 rolls. The number of usable responses averaged 21 per electorate, but varied from 29 for the Rangitikei electorate down to 11 for Waiariki.

Content of the questionnaire

The questionnaire¹ asked 62 questions, arranged in five sections:

- A. 14 on job satisfaction
- B. 12 on workplace organization
- C. 5 on the extent of recent ICT-adoption
- D. 10 on perceived effects of ICT-adoption
- E. 21 on demographics, such as age, sex, marital status, local government region of residence, etc.

The questions in section A invited responses on a 7-point Likert scale from 1 = very dissatisfied to 7 = very satisfied. The workplace organization questions in section B were phrased as statements (eg. B.1 “There are now fewer layers in the management structure”) and responses were invited on a 7-point Likert scale from 1 = strongly disagree to 7 = strongly agree.

The first question in Section C asked whether the respondent’s workplace had experienced the adoption of significant new automation in the previous five years. 264 of the 378 usable responses (69.8%) replied “yes” to this question. All respondents were asked to complete the first two sections and the demographic section, so that general workplace satisfaction could be judged irrespective of whether there they had experienced any technological change. Only those who replied “yes” to question C.1 were asked to complete the rest of Sections C and D.

Method of analysis

Workers who choose to work in industries with high technology are likely to differ significantly in terms of their aptitudes and preferences from those who do not, and regression analysis such as an ordered logit is therefore prone to giving biased results (Caliendo and Kopeinig, 2008). Propensity score matching (PSM) is a method which allows the comparison of outcomes for workers using the new technologies against the outcomes for workers of similar propensities who are not using those technologies, and is therefore less prone to sample bias (Dehejia and Wahba, 2002).

PSM was therefore used in this study to compare both wage differences and other workplace satisfaction measures between workers using new ICT and workers of similar propensities in firms not using the new technology, the control variables being age and age squared, sex, highest level of education attained, and whether or not the worker lived in one of the three main centres. Figure 1 shows the propensity scores for each group of workers. These propensity scores range from 0.4 to 0.95, but the workers using new technology rise to a mode at about 0.85 while the workers not using new technology are bunched further to the left, with a mode below 0.6 and a substantially lower mean.

Once the propensity scores have been calculated there are various matching techniques available. The present study uses kernel matching, whereby each “treated” observation (i.e. each observation of a worker using new technology) is matched against the whole set of control observations, but weighted by distance from the same propensity score.

Results

1. ICT and wages

An extensive literature going back to the early 1990s has found that workers in industries using new technology are likely to receive higher wages (Doms, Dunne and Troske, 1997; Katz, 2000), and also that within industries the firms which make more use of new technology are likely to pay higher wages (Acemoglu and Shimer, 2000). Strong confirmation of this pattern was found in the present study. For workers in firms using new technology the estimated coefficient on log-wage was 0.231 ($t = 3.37$) which represents a difference in hourly wage of 26 percent.

2. ICT and job satisfaction

Table 1 gives the estimated coefficients for all the 14 questions in section A of the questionnaire, but only the following five questions produced responses with statistically significant differences between the two groups of workers:

- A.1 How satisfied are you with the variety of tasks in your job?
- A.4 How satisfied are you with the financial rewards in your job?
- A.10 How satisfied are you with your job security?
- A.12 How satisfied are you with the growth and development opportunities in your job?
- A.14 Overall, how satisfied are you with your job?

For all these five questions worker satisfaction was higher for the workers in newly technologized workplaces. Questions A.10 and A.12 both showed an increase of fully half a point on the Likert scale of worker satisfaction, and question A.1 gained nearly half a point. Workers in enterprises with new ICT are happier with the variety in their work, and with the growth and development opportunities, as well as being more optimistic about job security. Unsurprisingly, in view of the wage premium revealed in point 1 above, their satisfaction with financial rewards is up by 0.815, almost a whole step higher on a 7-point scale. Workers in firms using new technology are better off and they appreciate it, and overall they are more satisfied in their work.

However there was no significant finding in the questions relating to challenge (A.2), autonomy (A.3), the meaningfulness of the tasks (A.11) or work-life balance (A.13). Nor was there any significant difference in the levels of satisfaction with the organization of the workplace, as revealed by the questions on quality of supervision (A.6), communication (A.7) or co-worker relations (A8). Apart from greater satisfaction with the variety of tasks, these findings provide no support for the enthusiasts who anticipated gains for workers in terms of increased independence or more congenial workplace organization.

The fact that some questions showed strong ICT correlations while others did not is revealing in terms of the nature of the ICT effect. Most of the responses which were correlated with new technology were in the areas of pay and future prospects. This finding strongly suggests that the underlying causality is likely to be rooted in the nature of the firm, rather than anything specifically technological. It seems plausible that these are the workplaces with the more expansive outlook, the ones which are simultaneously introducing new automation and encouraging their workers to look at new ways of working and new directions for the firm.

3. ICT and workplace organization

Section B of the questionnaire offered 12 statements in the general area of workplace organization, and asked respondents how strongly they agreed or disagreed with each. Table 2 provides the full set of findings.

As with the workplace satisfaction section, most of the workplace organization questions showed little or no relationship to the use of ICT, though the following four questions revealed statistically significant responses:

- B.3 Self-managing teams are used more in my workplace
- B.4 Pressure on staff has increase
- B.8 Flexible working hours have increased
- B.12 I feel more valued

Of all the questions which related to workplace organization, the only ones revealing a significant change in administrative systems were the self-managing teams and the flexible working hours. There was no significant change in closeness of supervision or flattening of hierarchies, in working from home or the use of casual or part-time staff. Evidently the optimistic hopes that workplaces with new technology would accommodate a greater variety of employment arrangements are largely forlorn. Confirming the similar questions in section A, there is little change in levels of monotony and no greater sense of independence.

The one truly organizational aspect of the workplaces with new technologies is the change in pressure on workers, which rose by nearly a whole point on the Likert scale, and was significant at the 1% level. The final question in this section to show a significant difference is the question about feeling valued, which was about half a point higher on the Likert scale. This finding accords with intuition, given that workers in more technologized workplaces are better paid. We would expect that workers who know they are well paid would feel better valued, since the converse of feeling underpaid is very likely to engender a sense of being undervalued.

In terms of the workplace changes accompanying increased use of ICT the findings therefore tend to support the more pessimistic view. The benefits in autonomy and more interesting

work that were hoped for in some quarters do not seem to have been realized, while pressure on staff is higher and workers feel themselves to be every bit as closely supervised.

5. Conclusions

The findings of this survey largely disabuse the extremists, with no finding that overall workplace satisfaction is significantly higher or lower as a result of new ICT. Those who hoped that new technology would give workers greatly enhanced autonomy, and make work more challenging, fulfilling and meaningful will find little support here. Neither is there any evidence of significant telecommuting, though flexibility in working hours does appear to have increased. Self-managing teams may have replaced line supervisors to some extent. But teams have their own dynamics and impose very real expectations on their members, so there is no incompatibility here with the apparent sense that pressure is higher in the more-technologized workplaces.

On the other hand, a number of the indicators show generally positive outcomes in workplaces adopting new ICT, and few of the fears associated with ICT are being realized. Workers in the more-technologized workplaces are generally more satisfied with their pay, their job security, and with the opportunities for growth and development. They feel more valued and they are significantly more likely to say they are satisfied with their job overall. These findings suggest that even though pressure on workers has risen, the benefits are tending to outweigh the costs and the overall quality of working life is probably improving rather than declining with the introduction of new technology.

The positive response to the question on variety in the workplace may have particular significance, since it strongly suggests that technology has not turned out to be deskilling as was feared in some quarters. This impressionistic response also accords well with the quantitative findings in the New Zealand and international literature, which generally find that returns to skills are higher in more-technologized industries, and that low-skill tasks are the ones most often replaced by computers in the automated office.

Footnote

¹The questionnaire is available on request from the contact author.

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Figure 1

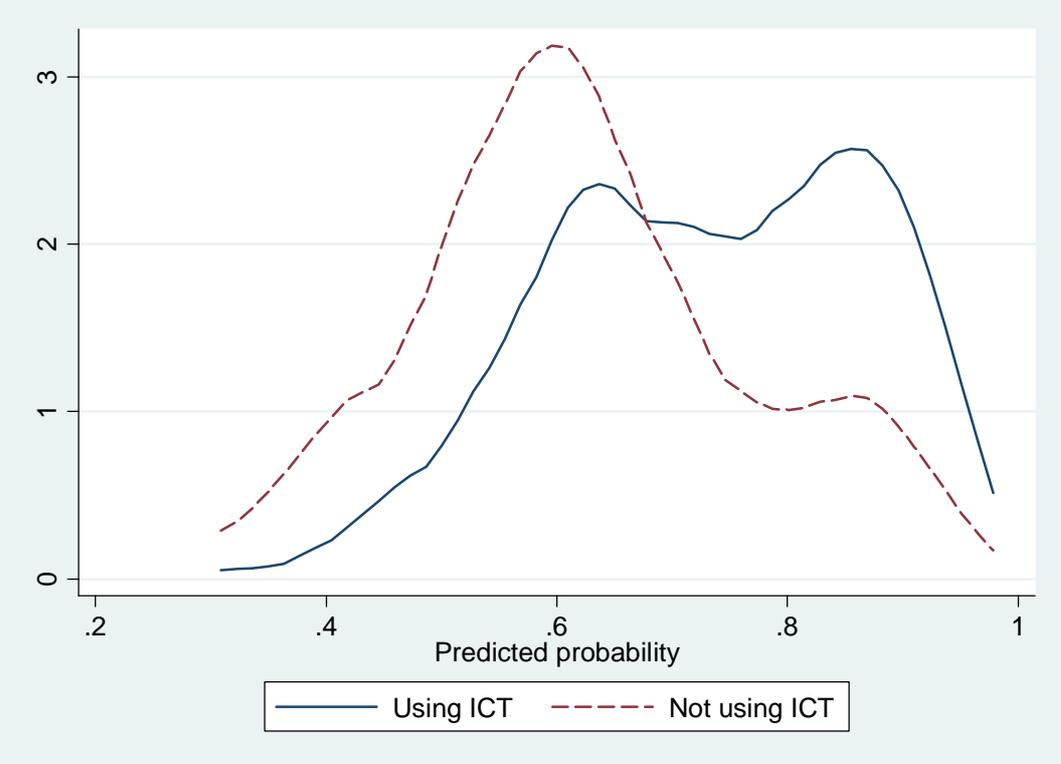


	Table 1: Relationship of ICT to job satisfaction	Coefficients (t-statistics)
A.1	How satisfied with variety of tasks?	0.434 (2.13)*
A.2	How satisfied with the amount of challenge in the job?	0.316 (1.57)
A.3	How satisfied with your autonomy?	0.110 (0.55)
A.4	How satisfied with your financial rewards?	0.815 (3.39)**
A.5	How satisfied with promotion or advancement opportunities?	0.379 (1.63)
A.6.	How satisfied with the quality of supervision?	0.197 (1.13)
A.7	How satisfied are you with communication?	0.004 (0.02)
A.8	How satisfied with co-worker relations?	0.085 (0.46)
A.9	How satisfied are you with the workload in your job?	0.029 (0.14)
A.10	How satisfied are you with your job security?	0.578 (2.65)*
A.11	How satisfied with the meaningfulness of the tasks?	0.350 (1.77)
A.12	How satisfied with the growth and development opportunities?	0.524 (2.51)*
A.13	How satisfied are you with your work/life balance?	0.306 (1.28)
A.14	Overall, how satisfied are you with your job?	0.397 (2.02)*
	*Significant at the 5% level **Significant at the 1% level	
	<i>Note – Some questions have been slightly abbreviated. For precise wording see original questionnaire</i>	

	Table 2: Relationship of ICT to workplace structures	Coefficients (t-statistics)
B.1	Now fewer layers in the management structure.	-0.171 (0.78)
B.2	My work is now more interesting.	0.291 (1.51)
B.3	Self-managing teams are used more in my workplace.	0.538 (2.47)*
B.4	Pressure on staff has increased.	0.886 (4.95)**
B.5	I have been given more independence.	0.259 (1.09)
B.6	The monotony in my work has increased.	-0.210 (1.28)
B.7	Workers are more closely supervised.	0.176 (0.96)
B.8	Flexible working hours have increased.	0.452 (1.98)*
B.9	I work from home more frequently.	0.092 (0.35)
B.10	Others in my workplace work from home more frequently.	0.271 (0.99)
B.11	The organisation is making more use of casual or part-time staff.	-0.314 (1.39)
B.12	I feel more valued.	0.502 (2.23)*
	*Significant at 5% level ** Significant at 1% level	

