Working with Computers in Canada: An Empirical Analysis of Incidence, Frequency and Purpose

Final Report

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Abstract

Information and communication technologies (ICTs), especially computers, have been widely used in the Canadian workplace and have wide-ranging and far-reaching effects and implications. As one in a series of studies on workplace computer usage and related issues, this paper uses the 14th cycle of the General Social Survey by Statistics Canada to empirically investigate the incidence, frequency and purpose of computer use among Canadian workers.

How widely are computers used in the workplace? The data on hand show that nearly six out of ten workers used a computer to perform various tasks in 2000. Logistic regression results demonstrate that the incidence of computer use at work significantly varies by gender, age, educational attainment, country of birth, province, work schedule (full- vs part-time), employment type (regular employees, the self-employed who hires paid help, the own-account self-employed), industry, and occupation.

How often are computers used at work? Among those who used computers in the workplace, 85% did so on a daily basis, another 10% several times a week, and the remaining 5% several times a month. Ordered-logistic regression results show that once a worker uses a computer, gender, educational attainment, country of birth and province make no difference in how frequently he/she does so. However, there appear to be huge variations in the frequency of computer use across age groups, work schedules, employment types, industries, and occupations.

What are computers used for at work? Overall, the Internet, word processing and email are the most frequently reported functions of computer use at work, and programming is the least commonly stated purpose. While this general pattern regarding the relative popularity of functions largely holds true when each characteristic is considered in isolation (e.g., male or female is examined alone), there appear to be marked differentials in the proportion of workers using computers for each purpose across worker attributes such as gender, age, educational attainment, and country of birth; across geographic areas; and across work characteristics such as full- or part-time work schedule, employee or self-employed (with or without paid help) employment type, industry, and occupation.

Other papers in the series examine workplace computer technology and skills upgrading, computer effects, and computer skills acquisition.

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1. Introduction

Information and communication technologies (ICTs), especially computers, have dramatically changed the way we work and live. According to the 2000 General Social Survey (GSS) by Statistics Canada, nearly six out of ten Canadian workers used a computer (personal computer, mainframe or word processor) at work, with the majority (78%) using it to perform various tasks on a daily basis (Marshall 2001). This usage rate is up from one in two in 1994 (Morissette and Drolet 1998) and from 39% in 1989 (Lowe 1997).

The implications of ICTs can be wide-ranging and far-reaching. As the engine of these technologies, computers and the information highway (or the Internet) have penetrated into every corner of our daily lives. On productivity and job quality, Rubery and Grimshaw (2001) argue that there are three main areas on which ICTs have effects: 1) employment relations and protection (e.g., employment opportunities, employment relations, career opportunities, job protection and collective bargaining, and pay); 2) time and work autonomy (e.g., work intensity, power and autonomy, work/life balance, and work relations); and 3) skills and careers (e.g., skills and job prospects).

Extremely polarized views on the effects of ICTs can be found in the literature. For example, the pessimistic argues that ICTs destroy employment opportunities through automation and rationalization, and reduce pay by downgrading skills and weakening workers' collective bargaining power. To the opposite, the optimistic hypothesizes that ICTs create jobs through developing new markets and human capital, and increase pay by augmenting skills (see Rubery and Grimshaw 2001, Table 1) for detailed discussions on effects of ICTs from these opposite views).

Work by others (e.g., Baldwin, Diverty and Sabourin 1995; Baldwin and Lin 2002) has shown that the adoption of computers and other new technologies is a key element in firms' success because these technologies are correlated with market share increase, productivity gains, product and delivery quality improvement, increased flexibility, production costs reduction, and so on.

Computers and the Internet also have great impacts on labour market operations. For example, the Monster network now lists over one million employment opportunities in 17 countries. Job seekers can also post their CVs there to be viewed by employers from all over the world. Using a special supplement to the December 1998 Current Population Survey (CPS), Kuhn and Skuterud (2000) show that 15% of unemployed job seekers in the United States used the Internet to search for jobs in 1998, so did half of all job seekers with online access from home. They further demonstrate that Internet job search rates exceeded those of traditional job search methods such as services provided by private employment agencies, contacting friends and relatives, or using trade unions/professional associations.

There are many issues surrounding the adoption of computer technology in the workplace. For instance, to what extent are Canadians exposed to new computer technology at work? Does workplace introduction of new computer technology require workers to upgrade their skills? To what extent does the adoption of computer technology affect the work environment and job content in terms of causing excess stress, making work more or less interesting, making job more or less stable? How do Canadians acquire computer skills? It is indeed important to answer these questions if we are going to better understand the computer revolution.

But before we do that, some basic knowledge is required regarding computer use in the workplace. For instance, how widespread is computer use among the workforce? How often do workers use computers to perform their work requirements? For what purposes are computers used at work? While subsequent research will deal with issues regarding computer technology and skills upgrading, effects of computer technology on workers as well computer skills acquisition, the objective of the present paper is to address questions concerning the incidence, frequency and purpose of computer use in the workplace.

The data used in this analysis are extracted from the 14th cycle of the General Social Survey (GSS 2000) by Statistics Canada, entitled "Access to and Use of Information Communication Technology". The presentation of materials proceeds in the following fashion. Section 2 briefly describes the data used for the analysis, discusses our model specifications, sample restrictions, and estimation. Section 3 presents and discusses our results: 3.1 for findings on the incidence of computer use in the workplace; 3.2 on the frequency of computer use; and 3.3 on the purpose of computer use. Finally, Section 4 concludes with a summary of main findings and a short discussion of future work.

2. Data, Model, Sample, and Estimation

Empirical analysis in the study uses data extracted from the public use microdata file of the 14th cycle of the General Social Survey by Statistics Canada (GSS 2000), conducted from January through December 2000. The target population for this survey is all Canadians 15 years of age and older, who are not residents of the three territories (Yukon, Northwest and Nunavut), or full-time residents of institutions (e.g., the armed forces, correctional facilities, health-care institutions).

GSS 2000 is a household-based survey and has 25,090 respondents, representing approximately 24.6 million Canadians. It contains a wealth of information on access to and use of ICTs in Canada, especially computers and the Internet, in the 12 months prior to the survey date. It also contains a wealth of information on respondents' personal and socio-economic characteristics.[1] All research questions addressed in the paper are derived from the GSS direct questioning of respondents (see Appendix 1 for details).

The first issue we address is how widespread is computer use in the Canadian workplace and how this incidence is correlated to observable demographic attributes, geographic locations, and work characteristics? The dependent variable takes on the value of 1 if a worker uses a computer at work and 0 otherwise. Given that the dependent variable is dichotomous, logit or probit regression is the appropriate estimation technique.

The second issue we examine is that given that workers use computers at work, how often do they use them and whether this frequency varies with observable demographic attributes, geographic locations, and work characteristics? The dependent variable takes on the value of 1 should a worker use a computer at work every day; the value of 2 if he/she uses a computer several times a week; and the value of 3 should he/she use a computer several times a month. Since the dependent variable has more than two discrete and ordinal values, ordered logit or probit regression is the appropriate estimation technique.

Explanatory variables for both models are workers' demographic attributes, geographic areas, and work characteristics. Within the context of our data, demographic attributes include gender, age, educational attainment, and country of birth. These demographic attributes are entered as regressors for computer use is commonly found to vary along these lines (see Lowe 1997).

Canada is a large country composed of economically diverse regions. As the industrial and occupational structure, and hence technology, differ from one area to another, computer use is also expected to vary. Hence, geographic locations, indicated by province and urban/rural area of residence, are entered into the models as additional regressors.

[1] See Statistics Canada (2001) for details on the survey's sample design, collection method, processing and weighting process, contents, and so on.

Furthermore, computer use is expected to vary along a set of work characteristics. Within the context of our data, these work characteristics include full-time or part-time work schedule, employee or self-employed (with or without paid help) employment type, industry, and occupation.

The final empirical samples used to estimate these equations include respondents aged 15 to 64 who were employed and not full-time students at the time of the survey. The sample for the incidence equation consists of 13,325 observations, representing about 13.6 million workers. The frequency equation is modelled with a sample of 6,758 observations, representing about 6.8 million workers who used computers at work in the month prior to the survey date. Both equations are estimated with weighted data using the survey sample weight.

Appendix 2 itemizes variable definitions and relevant sample statistics. Finally, we are interested in the purpose of computer use in the workplace. The GSS lists 10 functions computers are used for. Because of the large number of purposes being surveyed, we report the results based on our descriptive analysis here.

For the purpose of our analysis, the GSS offers a number of advantages. First of all, it is the first nationally representative survey focusing on ICTs. Along with the wealth of information on respondents' personal and work characteristics, the data permit for the first time an in-depth analysis of computer use.[2] Secondly, its large sample size ensures the statistical reliability of findings and also makes sub-national analysis possible. Of course, it also suffers from numerous limitations. Most noticeably, the lack of information on employer characteristics (e.g., firm size by the number of employees or assets/revenue, Canadian vs foreign ownership) prevents us from examining if computer use varies with workers working for different types of employers.[3] Also, a sizeable portion of the sample has missing information on annual income, which undesirably reduces the useful empirical samples if this variable is used.[4]

[2] Other surveys also have questions on the use of computers and other advanced technologies (e.g., GSS 1989 and GSS 1994 of Statistics Canada, the longitudinal Workplace and Employee Survey of Statistics Canada, the 1999 survey of Information and Communications Technologies and Electronic Commerce of Statistics Canada, the 1997-98 survey on Information Highway and the Canadian Communications Household of Ekos Research Associates Inc.). But their focus is not on computers and as a result, they lack the detailed questioning allow an in-depth analysis as conducted here.

[3] This is nonetheless a limitation all household-based surveys face.

[4] Non-respondents ("Don't know" or "Refused") to this variable amount to about one-third of the sample. Our final specification excludes income as an explanatory variable to gain sample size but we did try to include it as an additional regressor at the expense of reduced samples in our earlier runs and the results did not make any meaningful difference.

3. Empirical Results

While Appendix 3 reports the logit/ordered logit regression results, Table 1 shows the estimated incidence and frequency of computer use computed from these results.[5] These probabilities are evaluated at the sample mean (details are found at the end of Table 1).

Table 1
Estimated Probability of Incidence and Frequency of Computer Use at Work

	Use %	Frequency of use		
		Daily %	Several times per week %	Several times per month %
Male	58.2	86.3	9.4	4.3
Female	55.0	86.3	9.4	4.3
Age1524	53.1	79.3	13.7	6.9
Age2534	59.3	85.4	9.9	4.6
Age3544	61.6	86.1	9.5	4.4
Age4554	53.1	88.6	7.9	3.5
Age5564	47.4	87.9	8.3	3.8
Edulhs	23.7	86.3	9.4	4.3
Eduhs	47.6	86.3	9.4	4.3
Edups	60.6	86.3	9.4	4.3
Eduuni	75.0	86.3	9.4	4.3
Can	58.7	86.3	9.4	4.3
Notcan	47.8	86.3	9.4	4.3
ONT	58.8	86.4	9.3	4.3
NFL	40.0	86.4	9.3	4.3
PEI	50.5	86.4	9.3	4.3
NS	50.9	82.0	12.1	5.9
NB	58.8	86.4	9.3	4.3
QC	51.7	86.4	9.3	4.3
MAN	58.8	86.4	9.3	4.3
SAS	58.8	86.4	9.3	4.3
AL	62.7	86.4	9.3	4.3
BC	58.8	86.4	9.3	4.3
Rural	56.8	84.3	10.7	5.1
Urban	56.8	86.7	9.1	4.2
Full	58.9	87.2	8.8	4.0
Part	38.8	67.7	20.3	12.0
Emp	57.9	87.5	8.6	3.9
See	57.9	81.5	12.4	6.1
Sene	46.7	73.4	17.2	9.4

(continued)

[5] Probit/ordered probit models are also estimated. They show very similar qualitative results and are hence not reported here.

Table 1 (concluded) Estimated Probability of Incidence and Frequency of Computer Use at Work				
		Frequency of use		
	Use %	Daily %	Several times per week %	Several times per month %
Manu	60.6	90.0	6.9	3.1
Agri	60.6	71.3	18.4	10.3
Forest	60.6	90.0	6.9	3.1
Util	77.9	90.0	6.9	3.1
Cons	34.2	82.3	11.9	5.8
Trade	60.6	90.0	6.9	3.1
Trans	42.4	84.2	10.7	5.1
Finance	81.1	90.0	6.9	3.1
Profes	76.2	90.0	6.9	3.1
Manage	60.6	84.0	10.8	5.1
Educ	52.4	62.0	23.1	14.9
Health	36.4	70.3	18.9	10.7
Info	60.6	90.0	6.9	3.1
Accom	44.6	90.0	6.9	3.1
Others	42.2	82.9	11.5	5.6
Public	74.4	90.0	6.9	3.1
Mana	74.4	89.0	7.6	3.4
Prof	74.4	89.0	7.6	3.4
Tech	67.0	83.5	11.2	5.4
Clerical	82.3	92.1	5.5	2.4
Sales	45.0	77.1	15.1	7.8
Trades	32.6	65.4	21.5	13.1
Primary	20.8	73.2	17.4	9.5
Process	22.5	78.9	14.0	7.1

Note: Coefficients of explanatory variables that are not significantly different from zero at the 10% level are set to zero. The estimated probability is evaluated at the mean. For dummy variables, this is done by using the sum of the unweighted coefficients of the variable and weighted coefficients of other groups of dummy variables, where the weight is the corresponding variable's share of the sample.

3.1 Incidence of Computer Use

In the country as a whole, nearly six in ten workers used a computer at work. After controlling for other variables, men are found to be more likely to use a computer at work than their female counterparts (58% compared to 55%). Computer use was the highest among those aged 35 to 44 and lowest for the oldest group of workers (55-64). The incidence of computer use is estimated at 53% for the youngest group of workers (15-24), rising to 59% among the 25-34 group and further to 62% for those aged 35 to 44, then declining to 53% for the 45-54 group and further to 47% for the oldest group.

Educational attainment makes a big difference in computer use in the workplace — there exists a strong positive correlation. The average usage rate is estimated at 24% for those with less than a high school education, dramatically rising and reaching a level three times as high among those who have obtained at least a university degree.

Native-born workers were over 20% more likely to use a computer at work than those born outside of the country (59% compared to 48%). While whether a worker lives in an urban or rural area does not make any difference in computer use, the province in which he/she resides does reveal a significant difference. The lowest estimated usage rate is found for Newfoundland where only 40% of workers used a computer. Prince Edward Island, Nova Scotia and Quebec are also observed with a lower incidence of computer use at work (around 50%). Alberta had the highest likelihood of workplace computer use at nearly 63%.

Work schedule and employment type make big differences too. Full-time workers were 50% more likely to use a computer at work than those working on a part-time basis (59% vs 39%). And regular wage and salary workers as well as the self-employed who hire others were substantially more likely to use a computer in the workplace than the own-account self-employed (those working for their own without hiring any paid help).

Computer use at work differs substantially across industries and occupations. The average estimated usage rate ranges from highs of 81% for financial services and 78% in utilities to lows of 36% in health and social services and 34% for construction. By occupation, it reaches as high as 82% for clerical professions and as low as 21% for primary occupations.

3.2 Frequency of Computer Use

Among those who used a computer at work in the month prior to the survey (around 50% of all workers), 85% did so on a daily basis, another 10% several times a week, and the remaining 5% several times a month.

Once a worker used a computer, gender made no difference in how frequently he/she did so. The average user, male or female, has a probability of 86% using a computer at work every day, 9.4% doing so several times a week, and 4.3% doing so several times a month.

The youngest group of workers were not only less likely to use computers at work but also less likely to use them as frequently when they did as compared to older workers. Under 80% of those aged 15-24 used them every day compared to over 85% for those aged 25 and above. It is worthy noting that while workers aged 45 and above were substantially less likely to use computers at work than those aged 25-34, they were slightly more likely to use them more frequently (every day) among those who did so.

There does not appear to be any difference in the frequency of computer use in the workplace with respect to educational attainment, country of birth, and province of residence except for Nova Scotia where workers reported to use computers at work mildly less frequently. Rural workers were slightly more likely to use computers to perform tasks more frequently than those residing in urban areas.

There are marked variations in the frequency of computer use in the workplace across work characteristics. Full-time workers were substantially more likely to use computers at work than their comparable counterparts working less than 30 hours a week (87% compared with 68% did so every day). Regular employees were more likely

to use computers at work than the self-employed who hired paid help, who in turn were more likely to use computers at work than the own-account self-employed (88%, 82% and 73% did so every day, respectively).

The frequency of computer use at work varies considerably across industries. The estimated likelihood of daily use ranges from lows of 62% in education, 70% in health and 71% in agriculture to highs of 90% in public administration, information services, professional services, financial services, manufacturing and so on. The frequency of computer use at work also varies significantly across occupations. It is estimated that daily users amounted to 92% of all users for the clerical and 89% for the managerial and professional. In comparison, they only represented 65% of all users in trades and 73% in the primary occupations.

3.3 Purpose of Computer Use

Table 2 shows the proportion of workplace computer users who reported that they used computers for each of the 10 stated purposes in the 12 months prior to the survey date. Overall, the Internet, word processing and email were the most frequently reported functions of computer use respectively — nearly 83%, 82% and 78% of users connected to the Net, did word processing and sent/received messages through email with their computers at work. Programming was the least commonly stated purpose of workplace computer use — under 15% of users reported doing so.

Although this overall pattern held true for both men and women, gender differences were quite obvious. Except for word processing,[6] the proportion of female users who reported using computers for every other purpose was lower than that of their male counterparts, quite substantially in some cases. In particular, the percentage of women using computers for programming was under half of that for men (9.5% compared to 19.2%).

The general pattern observed above held true with respect to each of the age groups too. Yet, age differences also existed. Proportionally, more younger users did word processing, programming and surfed the Net but fewer of them kept records with their computers at work than their older counterparts. This is especially obvious when the youngest group is compared to the oldest.

Again, the overall pattern generally applied to all education groups. But the differences among different education groups were striking, particularly when the lowest-educated group is compared to those with the highest education. For example, only half of those with an education below high school did word processing, compared to nearly every one of those who had obtained at least a university degree. This marked difference was also observed between the two groups with respect to the use of computers at work for the Internet, email, programming, data analysis, desktop publishing, and spreadsheet use.

[6] This is not surprising given that a much higher proportion of women were employed in the clerical professions where word processing is almost universally required.

Table 2
Purpose of Computer Use at Work

	Word Processing %	Data Entry %	Record Keeping %	Data Analysis %	Programming %	Graphics / Desktop Publishing %	Spreadsheet %	Encyclopedia /Education %	Internet %	E-mail %
All	82.0	72.2	69.5	45.8	14.5	46.5	62.1	50.2	82.7	77.9
Male	80.4	72.7	72.0	52.4	19.2	52.4	66.3	53.0	85.5	79.0
Female	83.7	71.6	66.8	38.6	9.5	40.2	57.7	47.1	79.7	76.8
Age15-24	83.2	68.9	55.4	36.3	17.6	46.9	58.8	48.5	86.6	74.8
Age25-34	84.7	72.0	68.1	47.8	16.4	50.4	65.5	47.4	86.5	80.7
Age34-44	82.0	73.6	72.9	48.1	15.3	49.2	64.9	57.4	83.5	78.9
Age45-54	80.7	72.5	71.6	46.2	11.2	42.5	59.2	48.0	79.0	76.3
Age55-64	75.4	69.1	68.5	37.9	11.8	34.7	51.8	37.8	73.3	73.0
Less than HS	50.6	58.8	59.9	29.5	10.9	28.0	37.9	38.8	58.3	49.1
High School	66.7	64.0	58.5	33.3	7.1	31.5	49.0	40.9	71.5	65.3
Post-Secondary	81.1	73.3	70.2	42.9	13.5	44.7	60.9	49.0	80.8	76.1
University	93.8	76.0	74.8	57.1	19.6	58.1	72.7	57.4	93.1	89.5
Canadian-born	81.2	72.4	69.2	44.9	13.2	46.2	61.7	49.3	82.2	76.7
Foreign-born	85.5	71.0	71.1	49.7	20.2	48.1	64.4	54.4	84.8	83.7
Newfoundland	81.7	69.7	73.4	41.8	9.3	44.4	55.8	56.5	85.0	78.7
Prince Edward Island	81.6	70.1	64.3	42.6	8.2	41.0	52.4	43.2	81.3	79.0
Nova Scotia	80.6	70.6	69.6	41.1	11.5	50.2	57.8	56.0	83.0	77.7
New Brunswick	77.0	69.6	68.2	37.9	12.0	41.4	57.8	49.3	75.1	71.6
Quebec	76.1	74.2	66.7	48.4	16.2	45.1	61.1	42.7	76.3	68.8
Ontario	83.4	70.9	70.6	45.1	14.4	47.1	62.7	52.1	83.5	80.0
Manitoba	84.4	74.0	72.3	46.4	11.8	47.8	65.3	57.1	78.7	75.9
Saskatchewan	80.9	75.0	67.8	43.7	11.5	46.8	61.2	49.9	85.7	77.6
Alberta	85.5	73.6	72.8	46.9	14.0	47.9	65.5	51.9	87.3	82.7
British Colombia	86.6	70.9	68.5	45.0	15.0	46.2	61.8	53.5	89.8	86.4
Urban area	76.0	72.3	70.6	41.9	11.2	42.3	57.6	49.9	77.0	71.6
Rural area	83.3	72.2	69.3	46.6	15.2	47.5	63.1	50.2	83.9	79.3
Full-time	82.0	72.9	70.3	47.3	14.8	47.4	63.6	50.0	83.3	78.6
Part-time	81.7	64.3	61.2	28.6	10.8	36.5	46.1	51.7	76.1	70.1
Employee	81.5	71.1	67.6	44.5	14.4	45.7	61.9	49.0	81.8	77.4
Self Employed										
(SE - With Employees)	81.6	78.9	80.8	56.2	13.2	46.2	63.0	53.8	86.4	78.2
(SE - Without Employees)	86.5	76.9	78.8	49.5	16.4	54.4	64.0	58.5	88.1	82.5

(continued)

Table 2 (concluded)
Purpose of Computer Use at Work

	Word Processing %	Data Entry %	Record Keeping %	Data Analysis %	Programming %	Graphics / Desktop Publishing %	Spreadsheet %	Encyclopedia /Education %	Internet %	E-mail %
Industry										
Agriculture	68.8	71.5	79.1	46.5	7.3	39.4	57.7	50.5	82.0	70.2
Forestry	72.6	68.9	68.7	53.4	12.2	45.9	66.6	54.1	83.1	74.7
Utilities	88.6	82.8	74.6	55.1	15.6	64.1	79.3	57.2	92.1	87.2
Construction	76.8	73.4	73.4	40.2	13.3	33.2	64.6	44.5	75.5	64.1
Manufacturing	74.4	71.4	68.8	49.9	14.2	46.0	65.0	46.3	78.1	73.3
Trade	71.7	70.2	64.5	44.0	13.3	39.0	55.0	45.7	74.9	66.6
Transportation	67.8	63.3	63.6	36.8	7.2	37.8	59.0	49.9	76.5	72.1
Finance	85.4	74.7	72.9	54.4	11.9	42.5	64.1	44.5	84.8	83.3
Professional Services	93.7	78.5	78.0	59.8	30.1	60.8	76.0	53.2	92.7	89.4
Management	83.9	75.0	66.3	44.3	10.1	41.4	60.6	47.2	80.6	75.2
Education	93.7	72.5	69.9	41.5	13.3	57.8	62.2	65.5	91.5	85.9
Health Sciences	78.2	64.4	60.8	31.7	8.9	34.3	44.1	48.0	76.4	70.4
Information Creation	90.7	75.4	68.6	44.8	18.2	57.7	67.9	49.6	92.6	90.5
Accommodation	78.2	62.8	67.5	33.1	12.4	44.5	54.8	44.5	78.0	70.0
Other Services	82.7	75.7	74.8	37.3	10.3	53.2	59.8	52.2	77.8	74.0
Public Administration	87.8	75.3	73.8	46.8	14.1	47.0	67.7	53.7	85.6	86.7
Occupation										
Management	86.6	79.0	79.9	60.1	15.5	54.5	74.6	52.9	87.2	83.4
Professional	92.1	74.1	72.6	54.8	23.7	56.7	69.9	57.8	91.5	87.9
Technical	84.7	68.4	68.8	42.2	13.6	55.9	60.8	51.8	88.4	84.2
Clerical	85.7	81.2	73.7	43.7	9.8	39.6	65.0	45.3	79.5	78.7
Sales	74.4	64.7	58.7	32.9	8.8	37.9	47.6	44.9	76.0	68.6
Trades	56.7	55.8	59.1	32.0	10.9	35.5	47.6	48.5	69.8	60.3
Primary	60.5	69.5	73.8	46.7	9.5	38.2	56.2	47.9	76.8	67.6
Processing	60.7	56.3	56.5	38.0	11.6	33.1	47.6	41.2	70.2	52.6
N (Raw)	**7,764**	**7,763**	**7,763**	**7,762**	**7,764**	**7,764**	**7,764**	**7,764**	**7,766**	**7,767**
N (Weighted)	**7,905,060**	**7,904,298**	**7,903,971**	**7,904,044**	**7,905,060**	**7,905,060**	**7,905,060**	**7,905,060**	**7,907,060**	**7,907,493**

The Internet, word processing and email were also the most common functions of workplace computer use and programming the least regardless of whether the user was born in or outside of Canada. However, a substantially higher proportion of foreign-born users did programming than those born in the country (20.2% compared to 13.2%). To a lesser degree, this was also true with respect to word processing and email.

The general pattern also prevailed across the provinces despite significant variations. For instance, the proportion of using computers at work for email was the highest in British Columbia at 86% compared to the lowest at 72% for New Brunswick. For programming, Quebec had the highest percentage at 16.2% compared to the lowest in Prince Edward Island at 8.2% and Newfoundland at 9.3%.

Again, the Internet, word processing and email were the most frequently reported purposes of computer use at work and programming the least whether the worker worked full-time or part-time. Apparent differences between the two groups were found mainly in data analysis, spreadsheet use and programming, for which a substantially higher proportion of full-time workers used computers at work than of those working less than 30 hours a week.

The general pattern also held true when workers were categorized by their class of employment. The main differences were observed in record keeping and programming. A noticeably higher proportion of the self-employed (regardless of whether they hired paid help) used computers at work to keep records than that of wage and salary workers. For programming, the own-account self-employed were the most likely to do so, followed by regular employees and then by the self-employed who hired others.

The overall pattern was also observed across all industrial sectors. Yet major differences prevailed. For example, information and professional services consistently showed a markedly higher proportion of people using computers at work for word processing, the Internet and email than transportation and agriculture. The most striking industrial difference was found in the use of computers at work for programming. Three in ten users in professional services were engaged in programming compared to one in fourteen for transportation and agriculture.

By occupation, the Internet, word processing and email were again the most frequently reported purposes of computer use at work and programming the least. The standout was professional occupations which were consistently observed with the highest proportion of people using computers at work for nearly every single purpose. This was particularly striking with respect to programming — nearly a quarter of users in professional occupations used computers at work to program compared to under 9% in sales and 9.5% in primary occupations.

4. Summary and Future Work

Using the 14th cycle of the General Social Survey by Statistics Canada, this study has empirically investigated the incidence, frequency and purpose of computer use in the Canadian workplace. The following highlights our main findings.

How widespread is computer use in the Canadian workplace? The data on hand show that nearly six out of ten workers used a computer at work in 2000. The regression results reveal that the incidence of computer use at work is higher among men than among women; the highest among those aged 35 to 44 and lowest for the oldest group of workers (55+); significantly increases with educational attainment; higher among native-born workers than for those born outside of the country; the lowest for Newfoundland and highest for Alberta; markedly higher for full-time workers compared to those working on a part-time basis; substantially higher for regular employees as well as the self-employed who hires paid help than for the own-account self-employed; the highest in financial services and utilities and lowest in health and construction; the highest for clerical professions and lowest for primary occupations. These findings appear, for the most part, to be in line with work by others (e.g., ILO 2001, Marshall 2001, OECD 2001, and Lowe 1997).

How often are computers used at work? Among those who used computers in the workplace, 85% did so on a daily basis, another 10% several times a week, and the remaining 5% several times a month. The regression results show that once a worker uses a computer, gender, educational attainment, country of birth, and province of residence make no difference in how frequently he/she does so. However, there appear to be huge variations in the frequency of computer use across age groups, work schedules, and employment types. The youngest group of workers are less likely to use computers at work every day as compared to older workers. Full-time workers are substantially more likely to do so than their comparable counterparts working less than 30 hours a week. So do regular employees as compared to the self-employed who hire paid help, who in turn are more likely to use computers at work daily than the own-account self-employed. There also appear to be large industrial and occupational variations in the frequency of computer use at work. Given that a computer is used at work, the lowest daily use rate is observed in education, health, and agriculture and the highest in public administration, information services, professional services, financial services, and manufacturing. By occupation, the highest daily use rate is found in the clerical, managerial and professional occupations and the lowest in trades and primary professions.

What are computers used for at work? Overall, the Internet, word processing and email are the most frequently reported functions of computer use at work, and programming is the least commonly stated purpose. While this general pattern regarding the relative popularity of functions largely holds true when each characteristic is considered in isolation (e.g., male or female is examined alone), there appear to be substantial differentials in the proportion of workers using computers for each purpose across worker attributes such as gender, age, educational attainment, and country of birth; across geographic areas; and across work characteristics such as full-time or part-time work schedule, employee or self-employed (with or without paid help) employment type, industry, and occupation. For instance, the proportion of female users who reported using computers for every other purpose except word processing was lower than that of their male counterparts, quite substantially in some cases. In particular, the percentage of women using computers for programming was under half of that for men.

Does the adoption and upgrading of computer technology in the workplace require workers to upgrade their skills? Does the application of computer technology at work affect the work environment and job content in terms of causing excess stress, making jobs more or less interesting, more or less stable? Do Canadian workers acquire their computer skills by taking formal training through educational institutions, with hands-on experience (i.e., learning on the job), or by way of self-learning such as studying user manuals, watching videos, learning through the Internet, or getting help from family members/friends? Which is the more popular/effective way of learning computer skills: formal training, on-the-job training, or self-learning? Despite being important, questions such as these are out of the scope of the present study and will be addressed in future work.

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Appendix 1

GSS questions on incidence, frequency and purpose of computer use

C1 In the past 12 months did you use a computer in your main job? Yes/No

D13 In the last month how often did you use the computer at work for work-related reasons? Was it……

Every day?

Several times a week?

A few times a month?

Not in the last month?

A5 In the past 12 months, did you use the Internet? Yes/No

A9 In the past 12 months, did you use E-mail? Yes/No

A14 In the last 12 months, have you done the following on a computer (word processing, data entry, record keeping, data analysis, writing computer programs, using a graphics or desktop publishing, using a spreadsheet program, using a CD-ROM encyclopaedia)? Yes/No

Appendix 2

Variable Definition and Sample Means		
	All workers	**Workers who used a computer in the last month**
Dependent Variables		
Use = 1 if used a computer in the last 12 months	0.5833	-
Frequent use = 1 if used a computer every day	-	0.8520
Medium use = 1 if used a computer several times a week	-	0.0955
Rare use = 1 if used a computer several times a month	-	0.0525
Independent Variables		
Male = 1 if gender is male	0.5454	0.5321
Female = 1 if gender is female	0.4546	0.4679
Age1524 = 1 if aged 15 to 24 years	0.1079	0.0761
Age2534 = 1 if aged 25 to 34 years	0.2448	0.2608
Age3544 = 1 if aged 35 to 44 years	0.3078	0.3400
Age4554 = 1 if aged 45 to 54 years	0.2424	0.2492
Age5564 = 1 if aged 55 to 64 years	0.0970	0.0739
Edulh = 1 if has less than a high school education	0.1320	0.0378
Eduhs = 1 if has a high school diploma	0.2013	0.1570
Edups = 1 if has some post secondary education	0.4305	0.4534
Eduuni = 1 if has a university diploma	0.2363	0.3517
Can = 1 if born in Canada	0.8165	0.8236
Notcan = 1 if born outside of Canada	0.1835	0.1764
ONT = 1 if residing in Ontario	0.3680	0.3955
NFL = 1 if residing in Newfoundland	0.0177	0.0135
PEI = 1 if residing in Prince Edward Island	0.0049	0.0042
NS = 1 if residing in Nova Scotia	0.0321	0.0283
NB = 1 if residing in New Brunswick	0.0254	0.0221
QC = 1 if residing in Quebec	0.2584	0.2462
MAN = 1 if residing in Manitoba	0.0372	0.0346
SAS = 1 if residing in Saskatchewan	0.0317	0.0284
AL = 1 if residing in Alberta	0.1018	0.1056
BC = 1 if residing in British Colombia	0.1228	0.1216
Rural = 1 if residing in a rural area	0.2152	0.1755
Urban = 1 if residing in an urban area	0.7848	0.8245
Full = 1 if working 30 hours a week or more	0.8911	0.9321
Part = 1 if working less than 30 hours a week	0.1089	0.0679
Emp = 1 if person is an employee	0.8296	0.8552
See = 1 if person is self-employed with employees	0.0650	0.0685
Sene = 1 if person is self-employed with no employees	0.1054	0.0764
Manu = 1 if Industry is manufacturing	0.1566	0.1336
Agri = 1 if Industry is agriculture	0.0224	0.0090
Forest = 1 if Industry is forestry, fishing, mining, oil and gas	0.0248	0.0170
Util = 1 if Industry is utilities	0.0075	0.0111
Cons = 1 if Industry is construction	0.0597	0.0260
Trade = 1 if Industry is trade	0.1425	0.1431

(Continued)

Variable Definition and Sample Means (concluded)		
	All workers	**Workers who used a computer in the last month**
Trans = 1 if Industry is transportation and warehousing	0.0515	0.0374
Finance = 1 if Industry is finance, insurance, real estate and	0.0620	0.0991
Profes = 1 if Industry is professional, scientific and technical	0.0671	0.1069
Manage = 1 if Industry is management, administrative and	0.0336	0.0300
Educ = 1 if Industry is educational services	0.0723	0.0894
Health = 1 if Industry is health care and social assistance	0.0971	0.0911
Info = 1 if Industry is information, culture and recreation	0.0445	0.0561
Accom = 1 if Industry is accommodation and food services	0.0537	0.0265
Others = 1 if Industry is other services	0.0435	0.0293
Public = 1 if Industry is public administration	0.0612	0.0944
Mana = 1 if Occupation is management	0.0976	0.1356
Prof = 1 if Occupation is professional	0.1775	0.2670
Tech = 1 if Occupation is technologists, technicians and	0.0665	0.0828
Clerical = 1 if Occupation is clerical occupations	0.1553	0.2264
Sales = 1 if Occupation is sales and services occupations	0.2351	0.1641
Trades = 1 if Occupation is trades, transport and equipment	0.1451	0.0707
Primary = 1 if Occupation is unique to primary occupations	0.0392	0.0143
Process = 1 if Occupation is unique to processing,	0.0839	0.0390
N (raw)	**13,325**	**6,758**
N (weighted)	**13,556,803**	**6,859,493**

Appendix 3

Logit and Ordered Logit Regression Results on Use and Frequency of Use of Computers at Work				
	Use		**Frequency of Use**	
	Coefficient	**T-ratio**	**Coefficient**	**T-ratio**
Intercept	0.1911	1.00	-	-
Female	-0.1275**	-1.99	0.0447	0.47
Age2534	0.2535***	2.52	0.4246***	2.51
Age3544	0.3485***	3.50	0.4743***	2.87
Age4554	0.1002	0.95	0.7037***	3.99
Age5564	-0.2303*	-1.87	0.6401***	3.06
Eduhs	1.0698***	10.22	0.1463	0.58
Edups	1.5997***	16.62	0.3671	1.53
Eduuni	2.2647***	19.21	0.3989	1.57
Notcan	-0.4425***	-5.80	0.1754	1.34
NFL	-0.7601***	-7.11	-0.0246	-0.13
PEI	-0.3346**	-2.03	0.1366	0.44
NS	-0.3180***	-2.67	-0.3368*	-1.69
NB	-0.1484	-1.16	-0.1723	-0.88
QC	-0.2871***	-3.91	-0.1849	-1.57
MAN	-0.0835	-0.74	-0.1389	-0.78
SAS	-0.1962	-1.60	0.0631	0.33
AL	0.1661*	1.76	-0.0935	-0.61
BC	0.0803	0.87	-0.1267	-0.91
Urban	0.0687	1.02	0.1982*	1.92
Part	-0.8141***	-9.36	-1.1805***	-8.67
See	0.0276	0.21	-0.4604***	-2.59
Sene	-0.4516***	-4.83	-0.9260***	-6.68
Agri	0.2277	0.86	-1.2870***	-2.61
Forest	-0.3285	-1.60	-0.5666	-1.28
Util	0.8311***	2.83	0.1405	0.31
Cons	-1.0834***	-7.63	-0.6575**	-2.13
Trade	-0.1562	-1.29	-0.1640	-0.79
Trans	-0.7361***	-4.79	-0.5260**	-2.07
Finance	1.0278***	5.64	-0.0344	-0.14
Profes	0.7323***	3.93	0.2018	0.87
Manage	-0.1239	-0.72	-0.5362*	-1.94
Educ	-0.3364***	-2.35	-1.7094***	-8.66
Health	-0.9909***	-7.87	-1.3338***	-6.48
Info	-0.0328	-0.21	-0.1323	-0.51
Accom	-1.1468***	-7.39	-0.2306	-0.75
Others	-0.7436***	-5.00	-0.6198**	-2.13
Public	0.6363***	4.32	-0.2953	-1.28
Prof	0.1003	0.81	-0.1902	-1.19
Tech	-0.3599***	-2.56	-0.4668**	-2.24
Clerical	0.4708***	3.63	0.3692*	1.93
Sales	-1.2702***	-11.86	-0.8696***	-5.24

(continued)

Logit and Ordered Logit Regression Results on Use and Frequency of Use of Computers at Work (concluded)				
	Use		Frequency of Use	
	Coefficient	T-ratio	Coefficient	T-ratio
Trades	-1.7940***	-14.24	-1.4473***	-6.79
Primary	-2.4054***	-10.75	-1.0825***	-2.40
Process	-2.3056***	-14.67	-0.7673***	-2.59
Cut1	-	-	-3.2304***	-8.73
Cut2	-	-	-1.9765***	-5.40
N	13,325		6,758	
n (Dep Var=1)	7,772 (58.3%)		-	
n_1 (Dep Var=0)	-		355 (5.3%)	
n_2 (Dep Var=1)	-		645 (9.6%)	
n_3 (Dep Var=2)	-		5,758 (85.2%)	
Chi-Square	2,469.80		511.13	

Note: * significant at 10%; ** significant at 5%; and *** significant at 1%.