

An Analysis of the Relationship between ICT Diffusion and Deemployment in Japan

Yuka SAKAMOTO, Wendy A. SPINKS

Tokyo University of Science (RIKADAI),

KW608 1-14-6, Kudankita, Chiyoda-ku, Tokyo, 102-0073, JAPAN

Tel & Fax: +81-3-5228-8344

Email: sakamoto@ms.kagu.tus.ac.jp, spinks@ms.kagu.tus.ac.jp

Abstract: This paper examines a deemployment hypothesis, which predicts that the diffusion of ICT and greater outsourcing trends in corporations will promote self-employment options for workers. The data set (N=6,783) is from the telework population survey conducted by the Japanese Ministry of Land, Infrastructure and Transport (MLIT) in November 2002. Logistic regression analysis for predicting self-employment (without employees) shows that there is a lower probability for workers who use/used ICT to become self-employed than those with no ICT experience. Workers in specialist/technical occupations are more likely to become self-employed than those in non-white collar occupations, but not to a statistically significant degree. Women with small children, highly educated women and not highly educated men show a stronger tendency to opt for self-employment. Workers who have difficulty in obtaining satisfactory jobs in salaried employ seem to have a propensity to become freelancers or self-employed workers without employees. The variables that could be used were limited, but our analysis shows that deemployment hypothesis was not supported at the time of the survey.

1. Research Background

1.1 ICT Diffusion and Self-employment Trends

Whereas the number of self-employed workers in the Japanese agricultural and retail sectors has fallen consistently since 1975, it has been noted that the increase in the number of specialist and/or technical self-employed workers during the same period is high [1]. This increase is frequently attributed to the emergence of a new group of technologically-savvy self-employed workers known as SOHOs (Small Office Home Office). In Japan information and communication

technologies spread rapidly in the latter half of the 1990s, the number of technologically-savvy self-employed workers as of 2005 reportedly being approximately 1.68 million or 16.5% of all self-employed workers in general [2].

In recent years, the number of non-primary industry self-employed workers in many European countries including Germany, Denmark, the Netherlands and the United Kingdom has shown a slight increase [3]. Elsewhere, while it is commonly mooted that the diffusion of ICT has led to an increase in the number of non-primary industry self-employed workers in Europe, the United States and Japan, an exact definition of what constitutes this type of new freelancer or self-employed worker created by the rise of ICT has yet to be established. As a result, it is extremely difficult to conduct an international comparison of the number of technologically-savvy self-employed workers using statistical data at present.

1.2 Deemployment hypothesis

Based on the above trends, this paper will propose and examine a deemployment hypothesis. The deemployment hypothesis predicts that the diffusion of ICT and greater outsourcing trends in corporations will promote self-employment options.

There are three main factors behind the increase in small-scale, specialist and/or technical self-employed workers accompanying the diffusion of ICT. The first is the relatively small amount of capital required to start ICT-based ventures. The vast majority of self-employed workers using ICT are involved in some form of information-related activity. In contrast to the large amount of capital required for plant investment in manufacturing, for example, information-related businesses can be boot-strapped, the amount of initial investment required being minimal especially with the growing progress in smaller, cheaper computers and peripherals since the 1990s. Furthermore, due to the widespread diffusion of ICT, information-based businesses are not as location-sensitive as services that require face-to-face interaction and, therefore, conveniently located customer premises. As a result, smaller initial costs are deemed to lower the hurdle for starting up businesses.

The second factor is the corporate trend to greater outsourcing and the accompanying drop in the number of employees on the payroll witnessed in the 1990s and common to Europe, the United States and Japan [4]. The two main causes of outsourcing are the increase in international competitiveness triggered by the global economy and the subdivision of manufacturing processes (*ibid.*). The adoption of ICT inside firms also led to a standardization of business processes, thereby opening the way for the outsourcing of in-house tasks. In other words, the need to accumulate specialist in-house human capital has been reduced [5].

The third factor does not concern socio-economic change, but rather the growing desire on the part of individual workers to engage in self-employment. For example, Pink (2001)[6], who pointed to the growing number of free agents in the United States, cites two reasons for the trend: 1) the risk inherent in working continuously for a single employer as individual longevity increases but corporate longevity decreases; and 2) the difficulty in meeting both work and family obligations as firms make increasing time demands on their workers as well as the difficulty for women achieving internal rewards with the so-called “glass ceiling” still firmly entrenched. Accordingly, he sees women as key players in the freelance and/or self-employed market.

In Japan, the number of female workers is increasing, but approximately 70% of women employed before having children are reported to leave their jobs following childbirth [7]. The trend to resign from work due to childbirth is especially pronounced among salaried workers, most self-employed workers staying in the workforce [8]. Higher levels of education and longer periods in the workforce before marrying means that an increasing number of women have accumulated considerable human capital prior to marriage. Should the barriers for becoming self-employed be lowered, women in salaried employment may not necessarily leave the workforce due to childbirth but opt for self-employment.

Elsewhere, it has been reported that while many firms stipulate sixty years as their retirement age, many individuals wish to remain in the workforce after sixty. The age of pension eligibility has been raised due to Japan’s relatively rapid demographic graying and the government is actively pursuing policies to keep older workers in the workforce. Should the barriers for becoming self-employed be lowered, seniors may also opt for self-employment.

2. Methodology

2.1 The Data Set

Our research uses data collected at the individual worker level and analyzes individual work status choices to ascertain the relationship between ICT and self-employment. The data itself consists of the individual survey sheets collected in the 2003 Comprehensive Policy Support Survey for Regional Activity Through the Promotion of Telework & SOHOs, conducted by the Urban Infrastructure Division of the Urban & Community Infrastructure Bureau of the Japanese Ministry of Land, Infrastructure & Transport (referred to hereafter as the “MLIT Telework Survey”). Table 1 provides an outline of the survey data, which is suitable for our research purpose given that it consists of a random national sample and provides detailed information on ICT usage and work status.

Table 1: Outline of the MLIT telework survey

Survey Type	Cross section survey
Survey Subjects	Nationwide, male & female workers 15 years and older
Sampling	Random Digital Dialing (RDD)
Survey Method	Phone interviews
Survey Period	October 25 - November 10, 2002
Sample size	
No. Surveyed	6,899
Valid responses	4,125
Response Rate	59.8%
	(revised sample size for within-household individual selection probability = 6,783)
No. used for analysis	5,346 excluding students and primary industry workers

The average age of the sample was 45.3 for males (range: 15-84) and 44.9 for females (range: 16-86). Compared to the 2002 Basic Survey on Workforce Composition (Japanese Bureau of Statistics), the sample's ratio of under-twenty year olds is low and the ratio of 40-50 year olds is somewhat high (MLIT 2003). For analysis a data set of 5,346 was used after removing students and primary industry workers. The average age of this subset was 44.8 for males (range: 15-84) and 44.5 for females (range: 18-86).

2.2 Variables

2.2.1 Self-employed workers

The dependent variable “self-employed workers” is 1 and “others” the 0 dummy variable. Of the items indicating employment status, those who corresponded to “freelance” “self-employed (no employees)” “family worker” and “piece worker” were treated as “self-employed worker”.

2.2.2 ICT Usage

This is to ascertain whether self-employment has increased due to ICT diffusion or not, and uses two variables: “ICT use in current job” and “ICT use before current job”. If e-mail and/or the Internet is used for business purposes “ICT use in current job” is 1; if not, 0 is the dummy variable. If length of e-mail use is longer than years in current job “ICT use before current job” is 1; if not, 0 is the dummy variable. The reason for using “ICT use before current job” is to identify a causal relationship, if any, between ICT use and self-employment. In order to identify whether ICT diffusion has led to self-employment, it is necessary to distinguish whether people using ICT previously become self-employed using their ICT skills or whether ICT is being used simply as a

means of communication after self-employment. If more people have been using ICT longer than their period of self-employment, we will judge it to be true that self-employment is on the increase due to ICT diffusion.

2.2.3 Family Responsibilities

“Life stage” and “dual income dummy” are used as variables to ascertain the family responsibilities of individual worker. Family responsibilities are deemed to increase for workers with small children and a working spouse. For life stage, three categories for the various stages of child-raising are given, namely “youngest child 0-2 years of age” “youngest child 3 yrs – preschool” “youngest child at primary school”. An additional category for all others (single, no children in residence, junior high school and above) is also used. A value of 1 is used in the case of a working spouse; if not, 0. The 0 value also includes respondents with unemployed spouses and single respondents.

2.2.4 Age (Age Group)

This variable is used to ascertain whether older workers become self-employed or not. Moreover, since there is a large age bias in ICT users, age also acts as an important control variable for examining the effect of ICT itself on self-employment. Actual age is used and categorized into five groups: 15-29, 30-39, 40-49, 50-59, and 60 and over.

Human Capital

The education and occupational variables are used here. The occupation variable is used to ascertain whether self-employment is increasing in jobs that mainly use information. Additionally, since there is a strong tendency for higher educated, white-collar workers to use ICT, age and education act as important control variables to specify the effect of ICT use. For the education variable, “senior high school graduate” is used as the benchmark, four additional categories being “junior high school graduate” “college graduate” “university graduate” and “graduate school graduate”. The MLIT Telework Survey includes an item on years in current job, but since it does not ask the total number of years in the workforce, age is used as a proxy for work experience. For occupation five categories are used, four white-collar categories from the Japanese Industrial Standard (JIS) classification (“clerical” “managerial” “sales” “specialist/technical”) and “non-white collar” for all other occupations.

3. Results

Firstly, descriptive results of the share of freelance/self-employed workers by gender, life stage and ICT usage are discussed. This is followed by the logistic regression analysis with self-employment as the dependent variable, to identify factors behind becoming self-employed.

Because of the large gender gap that exists regarding the share of ICT users and work status choices, the analysis is conducted by male and the female sample.

3.1 Cross-Variable Relationships

Table 2 provides a summary of the descriptive results for the share of self-employed workers, the proportion being 7.3% for non-primary industry workers. Cross-variable analysis and χ^2 testing show that “ICT Usage” “Gender” “Age group” “Education” “Occupation” and “Life Stage” are statistically significant at 1% level.

Table 2: Share of self-employed workers (%)

	N	Self-employed workers		TOTAL
		yes	no	
Total	5,347	7.3	92.7	100.0
ICT Usage**				
Use in current job**	1,618	3.8	96.2	100.0
Of whom, use before current job**	658	4.0	96.0	100.0
Don't use**	3,072	10.0	90.0	100.0
Gender**				
Male**	2,953	8.2	91.8	100.0
Female**	2,394	6.3	93.7	100.0
Age Group**				
15-29**	684	1.7	98.3	100.0
30-39**	1,179	3.4	96.6	100.0
40-49	1,356	6.9	93.1	100.0
50-59	1,418	7.8	92.2	100.0
60 and over**	711	19.1	80.9	100.0
Education**				
Junior High School**	655	14.0	86.0	100.0
Senior High School	2,742	7.3	92.7	100.0
College	474	5.3	94.7	100.0
University**	1,365	5.1	94.9	100.0
Graduate School	111	6.3	93.7	100.0
Occupation**				
Clerical**	1,147	1.9	98.1	100.0
Managerial**	276	2.9	97.1	100.0
Sales**	837	11.8	88.2	100.0
Specialist/Technical	1,118	7.4	92.6	100.0
Non-white collar**	1,969	9.2	90.8	100.0
Life stage**				
Youngest child 0-2 yrs**	356	3.9	96.1	100.0
Youngest child 3yrs-preschool	371	6.5	93.5	100.0
Youngest child primary school	656	5.8	94.2	100.0
Single/Youngest child high school or above/ No children in residence**	3,964	8.0	92.0	100.0
Dual income+				
Yes	2,710	8.0	92.0	100.0
No	2,637	6.7	93.3	100.0

***p<.001 **p<.01 +p<.10

Looking at the statistically different characteristics of self-employed workers (those with a absolute value of adjusted residual above 1.96), the number of self-employed workers who chose ICT “use in current job” and “use before current job” were significantly low. The proportion of male self-employed worker is significantly higher. Looking at age, the number of self-employed workers in the 15-29 and 30-39 years of age group was significantly low, but 60 and over was significantly high.

In terms of occupation, the proportion of self-employed in “specialist/technical” occupations was not markedly high as suggested by existing literature, the statistically significantly high category being “sales”. The significantly high results for “managerial” occupations may be a function of the considerably large number of self-employed workers employing staff. The share of self-employed workers also differs according to life stage, those with “youngest child 0-2 years” being significantly low and those with “Single/Youngest child high school or above/No children in residence” high.

Based on these cross-variable results alone, there does not indeed seem to be a tendency for people using ICT before their current jobs to become self-employed. This result will be confirmed by a multivariate analysis.

3.2 Logistic regression analysis (Self-employment)

Tables 3 and 4 overleaf give the results for the male sample and the female sample in that order. The χ^2 testing dismissed the null hypothesis and indicated a good fitting for all models for both samples.

3.2.1 Age & Family Responsibilities

Model 1 incorporates age and the variables concerning family responsibilities. While the cross-variable analysis indicated there were significantly few self-employed workers with “youngest child 0 - 2 years”, controlling for age resulted in non-significant relationships between life stage (age of children) and choice of self-employment for the male sample. In contrast, the probability of choosing self-employment was significantly high in the female samples for respondents with small children. The probability of females with children “0-2 years” and “3-preschool” opting for self-employment was more than four times that of respondents without small children. “Dual income” had non-significant effect in the male sample.

3.2.2 Effect of ICT

Model 2 incorporates the ICT usage variables and examines the effect of ICT use on becoming self-employed after controlling for age and the “family responsibilities” variables. It was confirmed that ICT “use in current job” was significantly low in the male sample but was not

significant in the female sample. ICT “use before current job” was significantly low for both samples. The probability of respondents who used ICT of becoming self-employed was lower than non-ICT users.

3.2.3 Impact of Human Capital

After ascertaining the impact of age, “family responsibilities,” and “ICT usage”, Model 3 incorporates the “human capital” variables given their strong relationship between the “ICT usage” and the “human capital” variables. Of the occupational variables, “clerical” was significantly low for both samples. “Sales” loaded significantly highly and “specialist/technical” loaded highly but not significantly so as compared to non-white collar occupations for both samples.

Education showed the opposite effect for the male and female samples. Whereas it was negatively aligned in the male sample, it was positively aligned in the female sample. The probability of male workers becoming self-employed was significantly higher in “junior high” as compared to “senior high”, but significantly low in “university” and “graduate school”. In contrast, in the female sample, “graduate school” was significantly high and “university” was high but not significantly so.

Table3: Summary of logistic regression analysis for predicting self-employment (male sample: N= n=1,984)

	Model1			Model2			Model3		
	B	SE B	Odss	B	SE B	Odss	B	SE B	Odss
【Control Variabes】									
Age	.057 ***	.007	1.058	.048 ***	.006	1.049	.052 ***	.007	1.053
【Family Responsibilities】									
Life Stage(RG:No young children in residence)									
Youngest child 0-2 yrs	-.125	.361	.883	.004	.362	1.004	.000	.365	1.000
Youngest child 3yrs-preschool	.278	.304	1.321	.418	.306	1.519	.412	.310	1.509
Youngest child primary school	-.087	.266	.917	.066	.269	1.068	.102	.272	1.108
Dual income	.084	.140	1.087	.091	.142	1.095	.055	.146	1.056
【ICT Usage RG:Don't use】									
Use in current job				-.553 *	.256	.575	-.113	.273	.893
Of whom, use before current job				-1.135 ***	.183	.321	-.722 ***	.201	.486
【Human Capital】									
Education(RG:Senior High School)									
Junior High School							.348 +	.185	1.416
College							.230	.391	1.259
University							-.425 *	.203	.654
Graduate School							-1.497 +	.853	.224
Occupation(RG:Non-white collar)									
Clerical							-1.748 ***	.454	.174
Managerial							-1.692 **	.490	.184
Specialist/Technical							.250	.219	1.284
Sales							.545 **	.184	1.725
Constant	-5.332			-4.622			-4.888		
χ^2		107.398***			152.402***			237.331***	
df		6			8			16	

+p<.10 *p<.05 **p<.01 ***p<.001

Table 4: Summary of logistic regression analysis for predicting self-employment (Female sample: N=1,323)

	Model1			Model2			Model3		
	B	SE B	Odss	B	SE B	Odss	B	SE B	Odss
【Control Variabes】									
Age	.093 ***	.010	1.097	.088 ***	.010	1.092	.088 ***	.011	1.092
【Family Responsibilities】									
Life Stage(RG:No young children in residence)									
Youngest child 0-2 yrs	1.567 **	.575	4.791	1.599 **	.576	4.950	1.504 *	.584	4.498
Youngest child 3yrs-preschool	1.534 ***	.395	4.635	1.517 ***	.397	4.560	1.402 **	.405	4.064
Youngest child primary school	1.009 **	.300	2.742	.970 **	.302	2.638	.867 **	.305	2.380
【ICT Usage RG:Don't use】									
Use in current job				-.586	.437	.556	-.875 +	.485	.417
Of whom, use before current job				-.478 +	.277	.620	-.611 *	.308	.543
【Human Capital】									
Education(RG:Senior High School)									
Junior High School							-.250	.256	.778
College							-.082	.307	.921
University							.316	.302	1.372
Graduate School							1.591 *	.616	4.910
Occupation(RG:Non-white collar)									
Clerical							-.790 *	.305	.454
Managerial							.736	.624	2.087
Specialist/Technical							.290	.255	1.336
Sales							.476 +	.246	1.609
Constant	-7.674			-7.348			-7.306		
χ^2		110.989***			115.724***			147.459***	
df		5			7			15	

+p<.10 *p<.05 **p<.01 ***p<.001

4. Summary and Discussion

Using data from a nationwide telework survey, this paper has explored whether the perceived impact of ICT diffusion on lowering of barriers for becoming self-employed actually affects workers' choices for becoming self-employed or not. The major findings can be summed up as follows.

The probability for becoming self-employed for workers who uses/used ICT was significantly low. Existing research [9] shows that the larger the place of employ, the greater the share of ICT users. This issue of scale may explain the low level of ICT usage by those becoming self-employed. although Sakamoto and Spinks (2007)[10] found a tendency for workers who used ICT to start up new businesses, and showed that ICT diffusion has led to a small increase in the number of a new kind of technologically savvy self-employed worker, this tend only applied to self-employed worker with employees, but not the lone self-employed. These results indicate that the deemployment hypothesis was not supported.

Whereas highly educated women showed a stronger tendency to opt for self-employment, highly educated men showed a tendency to not opt for self-employment. This result means that workers who have difficulty in obtaining satisfactory salaried employ tend to become self-employed. In Japan, the higher the level of education, the higher the salary of employed workers. In other words, the salaries of employed male workers who are not highly educated are relatively low. On the other hand, employment opportunities for highly educated women who leaved their jobs following childbirth are limited. Arguably, these factors have a stronger impact on employment choices than ICT usage.

The higher probability of workers with small children to become self-employed was seen only in the female sample. For males, there was no relationship between family responsibilities and becoming self-employed. Women with small children, however, may merely be refusing to engage in jobs with a low level of discretion over work-hours, or are forced to opt for self-employment by being shut out of salaried employ due to age barriers. Accordingly, the spread of so-called decent jobs with a high degree of work-hour discretion and job stability in the labour market may be a greater determinant of whether workers opt for self-employment or not.

5. Concluding Remarks

There are two main areas where future research would be valuable. The first concerns occupational classifications. In this paper, we used four categories for white-collar work, but in order to accurately ascertain the relationship between ICT and self-employment, more detailed categorization such as the degree of work ICT dependence proposed by Sakamoto et al (2003) [11] would seem advisable¹.

A second issue concerns the need to obtain more long-term data on self-employed workers' careers prior to and after becoming self-employed. Existing research has highlighted SOHO operators' tendency for a lack of interest in growing their businesses, but we were unable this time to analyze whether women with small children remain self-employed through various life-stages or whether they seek out places of employ that match their required conditions of work. This area could be clarified by conducting an event history analysis after obtaining sufficient information on self-employed workers' job experience.

References

- [1] Yahata Shigemi (1998). The Shift from Employee to Self-Employment. *Japan Institute for Labour and Policy Training Magazine*, 452: 2-14 (in Japanese)
- [2] Japanese Ministry of Land, Infrastructure & Transport, (2006). Results of the 2005 Telework Population Survey. http://www.mlit.go.jp/kisha/kisha06/04/040614_.html. Accessed 23/9/2006. (in Japanese)

- [3] Hoffman, Edeltraud & Walwei, Ulrich (2003). Changing Workstyles in Germany and Denmark. Ohsawa Machiko & Houseman, Susan (eds.) *The Future of Work: A Comparison of Alternative Workstyles in Europe, the U.S. & Japan*, Japan Institute of Labor. (in Japanese)
- [4] Ohsawa & Hausman (eds.) (2003). *The Future of Work: A Comparison of Alternative Workstyles in Europe, the U.S. & Japan*, Japan Institute of Labor. (in Japanese)
- [5] Abe Masahiro (2001). What is the impact of ICT on employment? *Japan Institute for Labour and Policy Training Magazine*, No.498. (in Japanese)
- [6] Pink, D.H. (2001). *Free Agent Nation: The future of working for yourself*, Warner Business Books.
- [7] Japanese Ministry of Health, Welfare & Labor (2002). The First Cross-sectional Survey on Children Born in the 21st Century. (in Japanese)
- [8] Nagase Nobuko (1997). Female work choices: home-based production and labour supply. Chuma Hiroyuki, Suruga Terukazu (eds.) *Changes in Employment Practices & Female Labour*, University of Tokyo. 279-312. (in Japanese)
- [9] Fujioka I.(2004). Determinants of ICT Usage. Naoi Y., Taromaru H.(eds.), *A progress report National Survey about Information Society*, Osaka University.(in Japanese)
- [10] Sakamoto Y., Spinks, W.A. (2007) An Analysis of the Relationship between ICT Diffusion and Business Start-Ups in Japan, Proceedings of the 10th International Conference on Global Business and Economic Development, 1759-1768.
- [11] Sakamoto Y., Spinks, W.A., Shozugawa Y. (2003) An Analysis of the MLIT Survey 2002: The Japanese telework Population. The 8th International Telework Workshop, Electronic proceedings
<http://www/telework-academy.org>

End Notes

1. 1) Jobs predicated on the diffusion and use of ICT (jobs directly involved with ICT, e.g. website design, programming, etc.); 2) jobs where the diffusion of ICT has changed a major part of how that job is performed (formerly paper-based jobs, e.g. design, finance, etc.); 3) jobs where the diffusion of ICT has changed a minor part of how that job is performed (jobs directly handling physical goods or dealing directly with clients, e.g. agriculture, transportation, retail sales, etc.).