

DATA QUALITY AND COSTS IN MEASURING TIME-RELATED UNDEREMPLOYMENT IN KOREA

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Abstract

Time-related underemployment exists when a person's employment is insufficient in terms of the volume of work. Two alternative definitions can be considered based on a longer-term view or a shorter-term view and these were designed into a single questionnaire. We conducted a pilot sample survey with about 6,000 respondents in Korea. The estimates of underemployment using the two definitions show some differences given the ages, genders, industrial areas and main activities of the respondents. A larger number of people could be identified as underemployed when the longer-term view is used than when the shorter-term view is used, but there is a greater cost associated with the former. The cost-benefit of the interviewers' time was investigated by multiple visits to households. Biases and costs are also analyzed using the results of the comparison of the decrease in non-responses with the increase in the costs for the interviews.

Key words: labor force survey, time-related underemployment, non-response, duration of interview.

1. Introduction

Full employment policy has become the most important target for many national governments, mainly focusing on the reduction of unemployment. However, it has long been recognized that the measured unemployment cannot fully describe the shortcomings of the labor market in a country. Many workers may have experienced not only a total lack of employment opportunities but also a lack of adequate employment opportunities. Therefore, employed persons may be simultaneously in time-related underemployment (visible underemployment) or inadequate employment (invisible underemployment)²⁾ (International Labor Organization, 1998).

In this paper, we discuss several issues concerning data quality and costs in measuring the time-related underemployment. In Section 2, we establish a measurement model based on the two alternative definitions of underemployment, which are implemented in the pilot sample survey. In Section 3, we analyze the collected survey data such as the duration of interviews, the results of alternative definitions of underemployment and the non-response data at the first visit. Lastly, in Section 4, we discuss the comparison between the data of variables and cost-benefit in the pilot sample survey.

2. Measurement of time-related underemployment

The term underemployment is derived from the concepts of the labor force and thus issues for the measurement of underemployment should also be applicable to the current Labor Force Survey

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²⁾ Since the concepts to statistically describe invisible underemployment have not been sufficiently developed, the measurement of volume of underemployment is limited to time-related underemployment.

(LFS). According to the international standards developed by the International Labor Organization, the term *time-related underemployment* (hereafter *underemployment*) can be defined using three criteria, applied to employed persons: working less than the regular duration, doing so involuntarily and seeking or being available for additional work, during the reference period. To recognize a person as underemployed, all three criteria should be met at the same time.

Based on the three criteria above, we can define underemployment in two ways: in Definition I, underemployment is defined by a shorter-term view, such as the actual hours of work, the desire for more hours of work and availability for additional work, for each item during the reference week exclusively. On the other hand, in Definition II, underemployment is defined from a longer-term view than that of Definition I. This definition includes the combination of two measures, actual and usual hours of work, availability for additional work, not only during the reference week but also during a given period in the future.

A new questionnaire for the measurement of underemployment was designed to obtain sufficient information so that Definitions I and II could be applied to the same respondent at the same time.

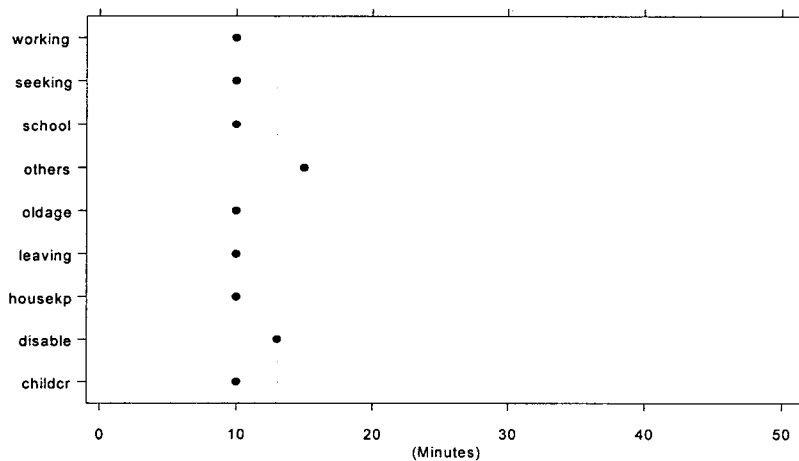
The primary purpose of the pilot sample survey was to be able to design a further questionnaire to measure underemployment. In this pilot task, we collected the information on employment status of the respondents, such as multiple job holding, the length of working hours, underemployment and additional jobs desired. We also measured the quality of the data and the costs in the survey. During the interview week, the interviewers were required to contact all the sample households in order to obtain underemployment information about all the persons aged fifteen or over residing at the addresses. The interviewers should have visited the sample households at least three times until they completed the interviews, by contacting the respondents, conducting the interviews with them, and filling out the questionnaire. The interviewers administered the interview using the face-to-face method by asking the questions as written on the questionnaire. The interviews in the pilot sample survey were taken during the week from 29 June to the 5 July 1999 (the interview week). The reference week for the pilot survey was the week between the 20th (Sunday) June and the 26th (Saturday).

3. Analysis of the results

Duration of interview

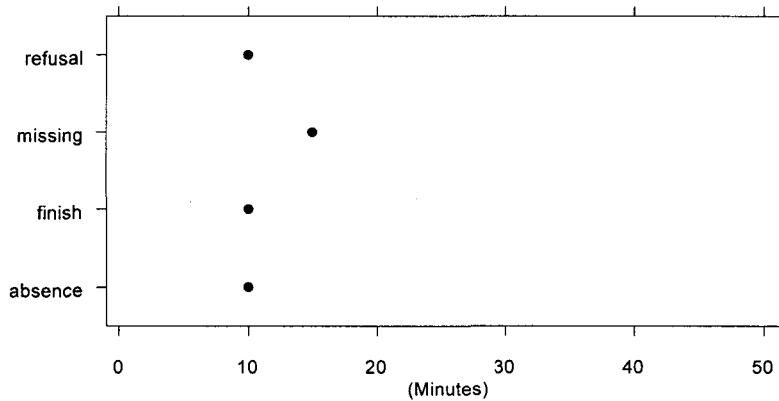
Among the variables analyzed in relation to duration of the interview, it is clear that the gender of the respondents does not affect the length of the interviews. However, duration of the interviews shows some differences amongst main activity groups of the respondents. In Figure 1, we give box-plots for the respondents categorized by main activity.

Figure 1 Duration of Interview by main activity



In Figure 2, we give box-plots for duration of the interviews by the status of the first visit. The status of the first visit is classified into three categories as follows: The category *finish* means that the interviewers completed the interview when they visited the sample household; the *absence* category that the respondents were not present at the sample households when the interviewers visited them; and the category *refusal* that the interviewers could not conduct the interview because the respondents refused the interview request.

Figure 2 Duration of Interview by status of first visits



From above, it is clear that, when the interview was finished at the first visit, it took time less than the interviews at the second or third visit. Furthermore, it can be inferred that the interviewers completed the interview quickly when they contacted the respondents and made good rapport. Therefore, when modeling survey cost in relation to duration of the interview, some statistical tests are necessary to estimate the effects of several influential variables such as main activity, age and results of the visits.

Results of two definitions

Figure 3 gives the ratio proportion of respondents classified as underemployed by the longer-term view as compared with the shorter-term view of underemployment by the relationship to the head of the sample households. Amongst the persons classified as underemployed, the frequencies of four groups such as *brother or sister*, *father or mother*, *other relatives* and *de facto* were very small, these groups were grouped as a single group *others*.

Figure 3 Ratio of longer term view to shorter term view by relationship to head



For the group of *spouse*, the number of underemployed persons by the longer-term view is almost double that by the shorter-term view, meaning that those respondents are strongly influenced by the different definitions of underemployment. Since most persons with the relationship of spouse to the head are female rather than male, the two groups have a similar pattern to the female group in the gender groups. There are differences in the ratio proportion of the underemployed persons according to the longer-term view to that according to the shorter-term view, amongst the groups of persons by relationship to the head. The frequencies according to both definitions are highly statistically significant, $\chi^2 = 83$ and $df = 3$ for the shorter-term view and $\chi^2 = 162$ and $df = 3$ for the longer-term view.

Costs of non-response at the first visits

As explained in Section 2, the interviewers in the survey were required to visit the sample households at least three times until they finished the interviews. At the first visit for the interviews in the pilot survey, 2,851 persons or 46.62% of the respondents were contacted and interviewed. Since the rest of the respondents were not interviewed due to their absence from the sample household or refusal of the interview request, the interviewers visited them again to contact and interview them one or two more times. About 33% of the remaining respondents gave no complete answer to the questionnaire due to the respondents' absence or refusal.

In order to examine the benefit of efforts to reduce the non-response errors and the impact of the non-respondents on the estimates, we make comparisons between estimates based on successful responses at the first visit with responses from subsequent visits. In addition, we discuss the relationships between the benefits and the costs for the reduction of the non-response at the first visit, based on the costs of the field tasks in the next section.

4. Discussion

Comparison between the data of main activity, labor status and underemployment

The results of the comparisons between the data of main activity, labor status and underemployment showed that most variables have little impact on the sample estimates, except for main activity which shows some effect. Although the nature of main activity is related to that of labor and the underemployed status, the pattern of statistics for the main activity shows some contrasts for these two variables. Among the data of the main activity levels, the response rates vary in the three categories³⁾ including *work*, *taking leave* and *seeking work*, showing 56% versus 44%, 68% versus 32%, and 61% versus 39% respectively. However, the rates in the data of the persons in the labor force and not in the labor force are similar, at 58% versus 42% and 56% versus 44% respectively. The data of the underemployed status also show a similar pattern of the rates between the respondents and non-respondents at the first visits, at 58% versus 43% for not-underemployed and 54% versus 46% for underemployed respectively. Table 1 shows that the estimates of underemployment would become biased if the data responded later were ignored, since the underemployment rates vary across the main activity levels.

³⁾ The three categories of people may have the possibility of working during the reference week or usually working, thus, these are related to the underemployment.

Table 1 Underemployment by main activities between respondents and non-respondents at the first visit (proportions in parenthesis)

Main activities	Respondents at the first visit			Respondents later			Total
	Not underemployed	Underemployed	Total	Not underemployed	Underemployed	Total	
Work	1,107 (0.8807)	150 (0.1193)	1,257	868 (0.8671)	133 (0.1329)	1,001	2,258
On leave	61 (0.9531)	3 (0.0469)	64	28 (0.9333)	2 (0.0667)	30	94
Job seeking	130 (0.8966)	15 (0.1034)	145	87 (0.9560)	4 (0.0440)	91	236
Caring for child/children	106 (1.0000)	0 (0.0000)	106	76 (0.9870)	1 (0.0130)	77	183
Attending School	608 (0.9935)	4 (0.0065)	612	406 (0.9878)	5 (0.0122)	411	1023
Too old	413 (0.9764)	10 (0.0236)	423	378 (0.9793)	8 (0.0207)	386	809
Disability	178 (1.0000)	0 (0.0000)	178	75 (1.0000)	0 (0.0000)	75	253
Others	21 (1.0000)	0 (0.0000)	21	28 (1.0000)	0 (0.0000)	28	49
No answer	45 (1.0000)	0 (0.0000)	45	29 (0.9355)	2 (0.0645)	31	76
Total	2,669 (0.936)	182 (0.064)	2851	1,975 (0.927)	155 (0.073)	2130	4,981

Now, we test whether the number or proportion of underemployment is different in two groups of the respondents, *the respondents at the first visits* and *the respondents later*. We note that, for the respondents at the first visit, the proportion of underemployed varies from 0.00% to 11.9% ($\chi^2 = 138$, $df=8$), which is highly significant statistically speaking. For the respondents later groups, the underemployment rate varies from 0.00% to 13.3% ($\chi^2 = 105$, $df=8$), which is highly statistically significant. Using the data on Table 1, we examine how the relationships between the respondents at the first visit and the respondents later vary within main activities. Table 2 presents the results of the test for equality of underemployment rate of all factors within each category. For the test within each category, two factors are used, including the respondents at the first visit or later and underemployed and non-underemployed. For the two categories, *disability* and *others*, we do not give the statistics since no respondents in these categories are underemployed.

Table 2 Chi-square tests within *main activities* for two groups of respondents (at the first visit and later)

Main activities	Pearson's chi-squared	Degree of freedom	p-value
Work	0.931282	1	0.3345299
On leave	0.158867	1	0.6902018
Job seeking	2.673182	1	0.1020518
Caring for children	1.384187	1	0.2393892
Attending school	0.893570	1	0.3445118
Too old	0.078847	1	0.7788659
Disability	-	-	-
Others	-	-	-
No answer	2.981691	1	0.08421123

In conclusion, we have found that the underemployment rate varies across the main activity groups, but within these groups, there is no statistically significant difference between the respondents at the first visit and later. More detailed investigation of the cost-benefits of following up the non-respondents at the first visits follows below.

Cost-benefit analysis in the pilot sample survey

As for the non-respondents at the first visit, the interviewers in the actual field survey visited the sample households again, contacted the appropriate respondents, and conducted the interviews with them. Obviously, the interviews cost more than when they are finished after visits subsequent to the first visit. We examine the costs for the second or third visits and seek alternative ways to increase the survey data quality.

Errors in most surveys may have significant impacts on the survey estimates but it can be questioned how much should be spent to obtain more reliable data (Cochran, 1977). In the pilot sample survey, more than 30% of the respondents could not be contacted at the first visit by the interviewers. Therefore, it should be considered whether it would be worthwhile to allocate extra resources to cover the non-respondents. However, the survey costs include several elements: survey printing, sampling, interviewers training, the interviewer's salary, the supervisor's salary, the field director's salary and data entry. Table 3 shows the costs incurred for the pilot sample survey.

Table 3 Costs for the pilot sample survey

Contents	Costs (A\$)	Costs per person (A\$)	Proportion (%)
1) Questionnaire printing	375.0	0.06	1.97
2) Sampling	687.5	0.11	3.61
3) Interviewers training	500.0	0.08	2.62
4) Interviewer's salary	14687.5	2.40	77.05
5) Supervisor's salary	312.5	0.05	1.64
6) Field director's salary	1875.0	0.31	9.84
7) Data entry	625.0	0.10	3.28
Total costs	19062.5	3.12	100.00

For three visits to a household, we introduce the concept of the cost weight. We assume that the cost weight of the successful interview at the first visit is 1.0, that is, when the interviewers visit, contact and conduct the interview with the respondent. Under this assumption, when the interviewers visit but cannot contact the respondent because the respondent is absent, the cost weight is 0.2, by calculating the proportion of *Absence* to that of *Finish*, $7 / 35 = 0.2$. In certain cases, although the interviewers contact the respondents, the interview request can be refused. In this situation, the cost weight can be slightly higher than the situation of absence above because the interviewers have to persuade the respondents to be interviewed, giving weight 0.3, by calculating the proportion of *Refusal* to that of *Finish*, $10.5 / 35 = 0.3$. The interviews were designated as being classified in various ways and Table 4 shows several distinctive ways to finish the interviews and a detailed weighting process for each case.

Table 4 Weighting process for each case of the result of the visits

Cases	Weighting	Weight
Finish	{Planing (2) + Review (5)} + {Travelling (3) + Contacting (2) + Interviewing (20) + Travelling (3)}	1.0
Absence-Finish	{Planing (2) + Review (5)} + {Travelling (3) + Checking (1) + Travelling (3)} + {Travelling (3) + Contacting (2) + Interviewing (20) + Travelling (3)}	1.0 + 0.2 = 1.2
Absence-Absence-Finish	{Planing (2) + Review (5)} + {Travelling (3) + Checking (1) + Travelling (3)} + {Travelling (3) + Checking (1) + Travelling (3)} + {Travelling (3) + Contacting (2) + Interviewing (20) + Travelling (3)}	1.0 + 0.2 + 0.2 = 1.4
Absence-Refusal-Finish	{Planing (2) + Review (5)} + {Travelling (3) + Checking (1) + Travelling (3)} + {Travelling (3) + Contacting (2) + Persuading (2.5) + Travelling (3)} + {Travelling (3) + Contacting (2) + Interviewing (20) + Travelling (3)}	1.0 + 0.2 + 0.3 = 1.5

Refusal-Refusal-Finish	{Planing (2) + Review (5)} + {Travelling (3) + Contacting (2) + Persuading (2.5) + Travelling (3)} + {Travelling (3) + Contacting (2) + Persuading (2.5) + Travelling (3)} + {Travelling (3) + Contacting (2) + Interviewing (20) + Travelling (3)}	1.0 + 0.3 + 0.3 = 1.6
No answer	Unknown	1.3 ⁴⁾

Using the cost weight for each case, the cost of the interviewer's salary, A\$ 14,687.5, can be redistributed into each case using the weight proportions. Table 5 shows the cost calculation based on the cost weights for each case.

We can consider again how much money should be spent to reduce the non-response errors in the pilot sample survey. That is, when planning a household sample survey base on face-to-face interviewing, the maximum number of visits can be decided. Otherwise, the decision can be made by choosing one of two alternatives: for fixed costs, T, 1) the 36.24 % of the interviewers salary still be used to reduce the non-response or 2) that amount of money be used to increase the quality in other variables. For example, for the alternative 2), the size of the sample can be increased instead of revisiting the sample households. In other words, to make the number of the respondents about 6,000 persons, the sample size should be over 12,870 persons. In this case, the interviewer's salary could decrease to A\$12,579, which can be calculated by multiplying the number of the expected sample persons by the cost per unit.

Table 5 Cost calculation according to the cost weight

Results of visits	Persons	Proportion	Cost weight	Persons * weight	Proportion	Variable cost (A\$)
Finish	2,851	0.4662	1.0	2,851.00	0.4070	5,977.48
Absence-Finish	1,483	0.2425	1.2	1,779.60	0.2540	3,731.16
Absence-Absence-Finish	511	0.0836	1.4	715.40	0.1021	1,499.93
Absence-Refusal-Finish	17	0.0028	1.5	25.50	0.0036	53.46
Refusal-Refusal-Finish	12	0.0020	1.6	19.20	0.0027	40.26
No Answer	1,242	0.2031	1.3	1,614.60	0.2305	3,385.21
Total	6,116	1.0000		7,005.30	1.0000	14,687.50

5. Conclusion

The results of the survey based on the two different definitions of underemployment show that the underemployment status of more workers could be identified when the longer-term view for the definition is used than when the shorter-term view is used. However, there is still a greater cost associated with the latter because the more relaxed measurement by the longer-term view needs a greater number of questions than that by the shorter-term view.

The total length of time that the interviewers spend on all the interviews in a survey is related to the total costs of the survey. According to the results of the survey, certain variables show significant influences on the duration of interviews, such as the main activity, age and the final status of the visits. When the interview was completed at the first visit, this was less time than the interviews at the second or third visits.

Meanwhile, the efforts to reduce non-responses in the field survey can also be a source of the increase in the survey costs. Using the data of non-responses at the first visit in the pilot survey, the benefits of reduction of non-response errors were examined. For the measures derived from the survey data such as underemployment, they can be estimated by checking the individual answers to the related questions and ignoring the non-responses in the survey with little bias.

⁴⁾ Due to unknown results, the weight for these data is considered as the average of absent case and refused case, so 1.3.

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