DEFINING CONDUCTIVITY OF PANEL SURVEY IN THE CONTEXT OF DEVELOPING COUNTRIES

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abstract: Panel survey has been tried in analyzing socioeconomic changes and travel behavior over time. It is perceived that with the theoretical advantages of panel data, their use in developing countries becomes attractive. None thus far has been done on the conductivity of panel survey and accuracy of panel data. The paper concluded that panel survey is plausible at the household level than at the individual level. It was found that the performance and conduct of the survey are likely to affect the quality of panel data. Hence, feasible countermeasures on improving the conductivity of panel survey were proposed.

1. INTRODUCTION

1.1 Background

Transportation systems in urban areas in developing countries consist mainly of competing formal and informal public-vehicle systems. Further, affluence induced by economic development has consequently increased motorization in urban areas as in Singapore, Kuala Lumpur, Bangkok, Manila and Hong Kong. Singapore and Seoul have ventured on mass rapid transit while metropolitan areas like Metro Manila invested on light rail transit (LRT) systems. Similar modes of transport are being planned in Bangkok, Kuala Lumpur and Jakarta. These are the among the issues that confront transport planners in this part of the world. To address these issues in developing countries, a variety of urban-wide transport planning studies were conducted over the past three decades. Urban transport planning processed that had been applied in developed countries were adopted to developing countries using similar assumptions and concepts. However, inasmuch as the conditions in the developed countries were not similar to those in the developing countries, there were flaws in the adaptation of these planning processes. One significant difference is that urbanization

and development in developing countries as in Asia grow at a rapid rate surpassing those in developed countries during their period of urbanization. At present, urbanization in developing countries averages 3.5 to 6 percent annually compared to those in developed countries at an average of 1.5 percent. In this regard, the impact of such growth and swift pace of urbanization on people in the Third World is more than that in developed countries when they experienced urbanization. People's behavior and life styles changed rapidly and dynamically.

Current conventional cross-sectional planning methods have become inefficient in meeting the requirements of planning brought about by new developments in the developing countries. Analysis and forecast of travel demand given the complex composition of the transport system in developing countries could not be met by these conventional methods. Furthermore, they need analytical tools that can accommodate the impacts of changes (especially over time) in the policy variables that planners and policy-makers consider. Changes in formation (or pattern) of population, employment, residential relocation and mobility, and work places are among the points that need to be examined in transport policy making and assessment. Disaggregate analysis were tried in metropolitan areas such as in Metro Manila, Johore and in some parts of Latin America. However, these methods were again found to be ineffective in responding to the rapid changes in people's behavior over time. Villaroman (1988) stated that effects of time and the presence of a new mode need further analysis and improvements in modeling techniques. What is needed is an approach that can provide better understanding of the changes in people's travel behavior. Another feature of such an approach is its potential to analyze and examine the impacts of introducing new modes of transport such as the mass transit system and the effects of responsive transport measures such as the TDM and TSM schemes.

In this regard, a method that can analyze the effects of transport policies and measures on people's behavior given the rapid and continuous changes in the region is essential. A tool that may seem attractive in meeting these requirements is one that can handle data from the same samples obtained over time. With such an analytical method, urban transport planners in developing countries can meet the requirements of planning given the rapid changes in the region. An approach that fits these needs is panel analysis - an approach using information from the same samples over time. From the existing literature on this field, there are several theoretical merits that tend to justify the attractiveness of panel analysis. The ability of panel data to provide multiple observations on the impacts of changes over time conform to the essentials of urban transportation planning in growing metropolitan areas in developing countries. However, before panel analysis can be introduced in the developing countries it is essential that the potential of carrying out a panel survey be determined given the conditions in the region. Likewise, more importantly, since panel analysis is an advanced and complicated analytical tool that requires accurate data, the quality of the panel data has to be ascertained. These issues have to be taken before the practical viability of applying panel analysis can be examined. This paper would try to present a synopsis of a study done with regards to the potential of panel survey.

1.2 Objectives and Organization of the Study

The study hoped to ascertain the potential of carrying out a panel survey and examine the quality of panel data in developing countries given the rapid changing environment in the region. As such, conductivity of panel survey is defined in this study as the potential of carrying out a panel survey in an area and the ability to obtain good quality panel data. For this end, the principal objective of the study was **to examine the conductivity of panel survey**. In particular, the conductivity of panel survey would be gauged by:

a) exploring further the rationale and need to integrate panel analysis in the urban transportation planning process in the context of developing countries;

b) examining the potential of carrying out a panel survey essential for panel analysis and identify the problems associated with the conduct of the survey;

c) determining and evaluating the quality of the panel data in developing countries;

and

d) proposing countermeasures on how to improve the potential of conducting panel survey and obtain good quality of panel data with the hope of enhancing the conductivity of panel survey.

The study on the conductivity of panel analysis was divided into four parts: a) Examining the Potential of Conducting the Panel Survey with Metro Manila as the Case Study (chapter 2); c) Analysis of the Quality of Panel Data (chapter 3; and d) Concluding Remarks (chapter 4).

2. EXAMINING THE POTENTIAL OF CONDUCTING PANEL SURVEY WITH METRO MANILA AS THE CASE STUDY

2.1 The Metro Manila Panel Survey

As referred to earlier, the study tried to ascertain the conductivity of panel survey in developing countries. Conductivity is defined here, as shown in Figure 1, as the potential to carry out a panel survey and obtain good quality of data in terms of accuracy and less bias due to attrition (the rate of samples dropping from the waves of the survey). This chapter would discussed the panel survey and examination of the potential of panel survey while the next chapter focused on the analysis of the quality of panel data.

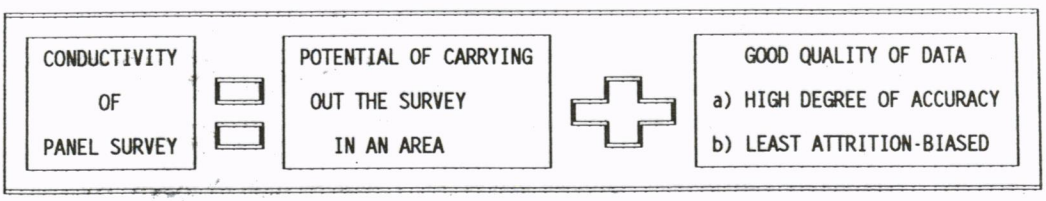

Figure 1 Definition of Conductivity of Panel Survey

2.1.1 Study Area and Survey Design and Conduct

A three-wave panel survey was conducted in Metro Manila, the capital region of the Philippines having an area of 636 sq. kms. with a population of 7.80 million as of the last census in 1990 (roughly 13.0% of the national population). The initial wave of the survey was conducted on the first quarter of 1987 along the present LRT line 1 corridor, while the second wave was in the second quarter of 1990 in the same corridor and augmented in the latter part of the year to include the proposed LRT line 2 corridor. The third wave was in the second quarter of 1992 covering both LRT corridors. The purposive-quota-proportional sampling (i.e., with respect to income distribution and density) was employed in the first wave so as to have proper representation of the population in the area as much as possible. A list of the 1987 wave samples was prepared together with their corresponding home addresses, name of household heads and members, sex and age of members for the 1990 wave along LRT line 1 corridor. The list prepared for the 1992 wave was from both LRT corridors of the 1990 wave. In the conduct of the latter surveys, those on the lists were given priority. In cases were those on the list were not available new members of an household were interviewed. New households interviewed as refreshments of those not covered were done using the same sampling method as in the first wave.

Basically, the sets of questionnaire for all the three waves were the same. The questionnaire sets for the first two waves contain three forms: household (HH) information, individual-interviewed information and trip information. Table 1 shows the differences in the design of the questionnaire sets of the three waves. In the 1992 survey, apart from the above forms, a fourth form was added where RP and SP questions on the proposed LRT line 2 were incorporated. The 1987 wave asked only to-work trips while the latter waves asked all trips of members interviewed. An urban planning consulting firm was tasked to hire the necessary personnel of the three waves of the panel survey. The survey was in the form of a personal interview (door-to-door) survey. The survey was from 15:00-21:00 on week-days and 8:00-17:00 during week-ends to cover as many working members as possible.

2.1.2 Results of the Survey and the Panel Data Sets

The results of the three waves of the survey are given in Table 2. Then the covered household and member samples were initially matched so as to institute the panel samples. Since the first wave was along LRT 1 while the latter waves were along LRT 1 and 2 the 1987 samples were matched to the 1990 March samples and all samples in 1990 and 1992 were matched. The matching keys were: a) household level - address, family names and length of residence at given address, and b) individual level - exact names of respondents, sex and age. Table 3 summarizes the outcome of the initial matching and implied that the two matching sets have almost the same degrees of matching in both household and member levels. However the '87-'90 set has slightly higher matching. The matched member samples were further matched according to the consistency in their civil status, changes in occupation, employment and work place and the final panel members as given in Table 4. The consistency of the further matching took into consideration the logical changes that could had occured given the time difference between waves. The classification of the matched sample members as indicated in the table implied that those categorized as panel members were those with the most logical and appropriate matching as specified in Table 4. From Table 5,

the number of matched members have declined in both sets. Percentage-wise, the '87-'90 set has more accurate matched (or panel) members than the '90-92 set.

Table 1 Differences in the Design of the 1987, 1990 and 1992 Questionnaire Sets

ITEMS	1987	1990	1992
No. of Forms	2	3	4
Household Information Form	Form 1	Form 1	Form 1
Household Income Bracket Telephone Number/s Length of Residence	not asked not asked	modified was asked was asked	as in 1990 was asked was asked
Household Member Form	Form 2	Form 2	Form 2
Target Member Samples Member Income Length of Stay at Given Work Place or Address	Working not asked	All members modified was asked	All Members as in 1990 was asked
Trip Information Form	in Form 2	Form 3	Form 3
To Work Trip To School Trip Other Trips	included not asked not asked	in Form 3 in Form 3 in Form 3	Form 3.A Form 3.B no form
RP-SP Questionnaire Form	none	none	Form 4
SP Questionnaire SP Experiments	- -	- -	Form 4.A Form 4.B

Table 2 Results of the Survey

WAVE	NO. OF HOUSEHOLDS COVERED	NO. OF MEMBERS INTERVIEWED
1987	899	1437
1990	1261	4126
1992	1167	4029

a) Only working household members in 1987 wave while all members in the other waves

b)

1990 March:	872 HHs	3039 members (LRT 1)
1990 Aug. :	295 HHs	1087 members (LRT 2)
1990 Wave :	1261 HHs	4126 members

Table 3 Results of Matching

A. H'hold Level	'87-'90	'90-'92
No. of Households	892 (100.0%)	1261 (100.0%)
HHs Matched Unmatched HHs	447 (50.1%) 445 (49.9%)	631 (50.0%) 630 (50.0%)
B. Member Level	'87-'90	'90-'92
No. of HH Members	1437 (100%)	4029 (100.0%)
Members Matched Unmatched Members	514 (35.8%) 923 (64.2%)	1308 (31.7%) 2818 (68.3%)

The next section discusses the examination of the potential of the panel survey in Metro Manila.

2.2 A Look at the Potential of Panel Survey in Metro Manila

On the outset, the results of the survey showed that the potential of conducting the panel survey in Metro Manila is likely. However, there was a low turn-out at the individual level than at the household level. Nonetheless, comparing the household acceptance rates at second wave of the Metro Manila panel to some panels in the developed countries as shown

in Table 6, it could be observed that the the acceptance rates are parallel to those in the developed countries. This comparison showed that panel survey is plausible in the developing countries. Despite the low individual matching rate as just mentioned, it could therefore be surmised that at the household level, the panel survey could be carried out. The constraints or difficulties met during the 1990 March wave are summarized in Table 7. These difficulties were likewise observed in the 1992 wave.

Table 4 Criteria for Defining Category

CATEGORY	AGE DIFFERENCE		CHANGE IN CIVIL STATUS	CHANGE IN OCCUPATION	CHANGE IN EMPLOYMENT	CHANGE IN WORK PLACE	REMARKS
	87-90	90-92					
1	3 or 4	2 or 3	consis-tent	no change or change is less than 3 years for 1987-90 or 2 years for 1990-92			PANEL MEMBERS
2	-1 to 2 5 to 8	-2 to 1 4 to 7	consis-tent	--- same as above ---			LIKELY PANEL
3	< -1 > 8	< -2 > 7	consis-tent	--- same as above ---			LESS LIKELY
4	< -1 > 8	< -2 > 7	consis-tent	changes had occurred and more than 3 years for 1987-90 2 years for 1990-92			NOT PANEL
			not				

Table 5 Panel Members

	Category	'87-'90	'90-92
1	Panel	245 (48.3%)	410 (36.2%)
2	Likely Panel	157 (31.0%)	370 (32.7%)
3	Less Likely	37 (7.3%)	166 (14.7%)
4	Not Panel	68 (13.4%)	186 (16.4%)
	TOTAL	507 (100%)	1132 (100%)

It could be surmised that some of the constraints listed on the table are similar to those panel surveys in developed countries. For instance, household samples that could not be located, samples refusing the survey and certain strata of the society (i.e., lower or higher income group, older people, etc.) were found to be among the problems of panel surveys in developed countries. Kitamura and Bovy (1987) examined the relationship of certain characteristics of the people to the attrition rate and the above constraints were mentioned. The implications of these findings indicate that the difficulties can be associated to the timing and duration of the waves of the survey, and more importantly to the supervision and performance of the personnel involved in the survey (especially the interviewers). Inasmuch as some of these difficulties or factors are similar to those in developed countries, it showed that these can be considered as the common problems associated with panel survey. In this regard, proper and feasible countermeasures have to be instituted to increase the potential of conducting the panel survey. These countermeasures have to address the means on how to attain more panel samples notably at the individual so as to boost the matching rate not only at the household level but at the individual level.

Table 6 Comparison of Household Acceptance at Wave 2

SURVEYS	INTERVAL	ACCEPTANCE RATE
Dutch Panel	.5-year	58.45%
Cardiff Panel	.5-year	48.91%
Puget Sound Panel	1.0-year	56.30%
Metro Manila 1987-90 Panel	3.0-year	50.11%
Metro Manila 1990-92 Panel	2.0-year	49.96%

2.3 Proposed Countermeasures to Improve the Potential of Panel Survey in Metro Manila

Based on the results of the panel survey in Metro Manila and from existing panel surveys in developed countries, appropriate countermeasures to improve the performance of the panel survey in developing countries can be instituted. These propositions (Table 8), if properly implemented, can boost the factors affecting the potential of panel survey in developing countries. The counter-measures could be grouped as follows: a) measures on how to improve design of the survey, b) measures in making the conduct of the survey effective and simple, and c) those pertaining to proper supervision and training of survey personnel. Based on the results of the 1990 March and 1992 Surveys, the measures on how to enhance the performance of the panel survey data can be done through ameliorating the design of the questionnaire, proper sampling, appropriate survey manual, having a good coding and encoding system and experienced survey personnel. Likewise, the timing and duration of the waves of the survey must also be considered. Another way to have an efficient survey organization is to tapped a company experienced in survey activities in handling the survey. Panel surveys in developed countries showed the advantages of employing experienced organizations for the panel survey.

2.4 Chapter Summary

This chapter described briefly the design and conduct of the panel survey in Metro Manila and the examination of the potential of carrying out the panel survey in the context of developing countries. The results of the survey and the examination of the potential of the panel survey implied that it is possible to carry out such a survey in Metro Manila. This is particularly true at the household level. However, at the individual level, the the panel survey was not so satisfactory. The household acceptance rate at second wave of the Metro Manila panel is comparable with those in the developed countries. Likewise, the difficulties met were among those considered in the other panel surveys. Thus, to further improve the survey and enhance its potential, appropriate countermeasures were suggested. It is hoped that these measures could be instrumental in alleviating the problems of the panel survey and boost ints potential notably at the individual level. The succeeding chapter discusses the second aspect of the conductivity of panel survey - analyzing the quality of the panel data.

3. ANALYSIS OF THE QUALITY OF PANEL DATA

3.1 Foreword

Most of the recent panel studies have been concentrated on the usefulness of panel survey and analysis of the bias of panel data due to attrition rate (the rate of samples dropping from the panel). However, not much has been done on assessing the quality of panel data especially in the developing countries since this is the first attempt to initiate such an endeavor. The approach in assessing the quality of panel data is shown in Figure 2. As given in Figure 2, the quality of panel data is analyzed by examining the accuracy of panel data and attrition. The two panel data sets would be used in this analysis. As in the previous chapter, suitable countermeasures on how to improve the quality of panel data would be the ends of this chapter.

Table 7 Constraints During the 1990 March and 1992 Survey

A. During the 1990 March Survey Dry-Run	
CONSTRAINTS	ACTIONS TAKEN
Many households refused the survey	New households were interviewed
Many households transferred residence	-- same --
Households could not be located	-- same --
Original household members not at home at the time of interview	Interviewers made appointments if possible or interview other members of the same household
Difficulty of classifying occupation and employment sector	Wrote actual occupation or employment sector
Many Chinese households rejected the interviews	New households were interviewed in the same zone or area
B. During the Actual Surveys	
Could not locate households on the list since some households share one house or address	
Many households at squatter areas (of the survey area) were relocated	
Difficulty in locating addresses of households because street names were changed in some zones or areas	
Interviews not finished due to: a) respondents in a hurry b) short interview time c) respondents not cooperative	

3.2 Analysis of the Accuracy of Panel Data

3.2.1 Analytical Approach

The accuracy of panel data would be analyzed by looking at the factors that affect the accuracy of data. This was done by examining all the socioeconomic attributes of the panel sample members and compare the signficance of the accuracy of the data. The comparative analysis of the data sets from the two panels was done by looking at the following: a) which among the data sets yielded highest proportion of samples with high level of accuracy; b) which data set revealed the significance of accuracy; and c) interpretation of the influences of the changes in socioeconomic attributes on the accuracy of data. The significance of the cumulative proportion of samples based on the degree of accuracy of the data sets were compared using t-test analysis of significance of the categories defined for the accuracy of

data. The t-test analysis of two samples is employed here because it can explain the significance of the ratio of accuracy between the two data sets. The values of the respective t-values were computed using the formula as given in equation 1.

Table 8 Proposed Countermeasures to Improve the Potential of Panel Survey in Developing Countries

PURPOSE	SUGGESTED COUNTERMEASURES
To improve the design of survey	* Incorporation of the above suggestions on the design of the survey * Careful planning and consideration of the characteristics of the area * Putting emphasis on the conduct of dry-runs prior to the survey and consider consider improvements on the design * Inclusion of a language or dialect to which samples are familiar * Establish an efficient coding, encoding and checking system
To make the conduct and performance of the survey more effective and simple	* Carrying out of pre-surveys and dry-runs to eliminate any possible problems in actual survey * Establish an efficient survey organization * Proper and appropriate training of survey staff from supervisors, enumerators to coders and encoders * People concerned shall be well aware of the survey and its objectives * The timing and interval of the waves of the panel should be at the same period of the year * The duration of the respective waves should correspond to the time needed to cover the desired samples and tasks for the survey

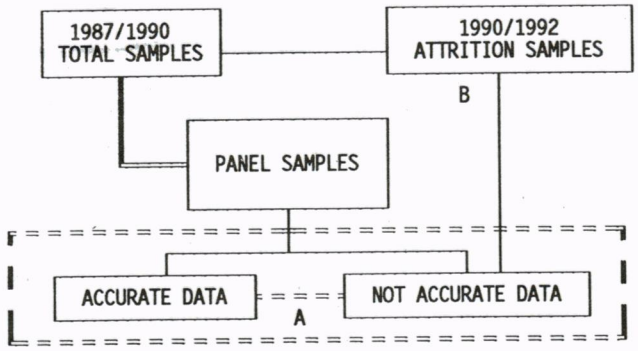

Figure 2 Scheme of Analysis of Quality of Panel Data

Looking first at the influence of the time interval between the two sets of waves, from Table 5.4, it could be observed that despite the three-year interval of the 1987-1990 panel compared to the two-year interval of the 1990-1992 panel, the degree of data accuracy of the former time period is greater than the latter at the first two cumulative categories. However, at the last cumulative category, the two time periods share the same level of accuracy. These

were reflected by the t-values of the respective cumulative categories. Hence, at the outset the 1987-1990 possessed pronounced higher accuracy of data than the 1990-1992 time period. Among the five household attributes identified, two were found to have significant effects on the accuracy of the panel data. These are residential district and household vehicle ownership attributes. The other three attributes seemed to show indifference on the accuracy of data. With respect to the residential districts of the samples only the 1990-1992 data set was compared and examined for in the 1987-1990 data all the household samples reside in district along LRT line 1 corridor.

$$\left| \text{T-value} \right| = \frac{P_A - P_B}{\sqrt{P^*(1 - P^*)(1/N_A + 1/N_B)}} \tag{1}$$

$$\text{where : } P_A = \frac{n_A}{N_A} \qquad P_B = \frac{n_B}{N_B}$$

$$P^* = \frac{n_A + n_B}{N_A + N_B}$$

n_A = sample size of proportion to be compared at data set A
n_B = sample size of proportion to be compared at data set B
N_A = sample size for data set A
N_B = sample size for data set B

3.2.2 Results of the Analysis of Accuracy

Looking first at the influence of the time interval between the two sets of waves, from Table 9, it could be observed that despite the three-year interval of the 1987-1990 panel compared to the two-year interval of the 1990-1992 panel, the degree of data accuracy of the former time period is greater than the latter at the first two cumulative categories. These were reflected by the t-values of the respective cumulative categories. Hence, at the outset the 1987-1990 possessed pronounced higher accuracy of data than the 1990-1992 time period. Among the attributes identified, four attributes were found to have significant effects on the accuracy of the panel data. These are residential district, household vehicle ownership attributes, occupation and individual member income. From the Table 10, it can be seen that those households residing in districts along the present LRT line 1 corridor produced definite accuracy of data compared to those households residing along the proposed LRT line 2 corridor. One possible reason that could cause this difference in the accuracy of data are that the level of supervision and performance of the interviewers assigned in both LRT corridors is not the same. This implies that those along LRT line 1 may have proper supervision and performance than along LRT line 2. The second attribute that showed differences in the accuracy of data, as mentioned, is the household vehicle ownership. Table 10 also insinuates that those households without vehicles are likely to produce good quality of data than those having vehicles.

Table 10 indicates that working members are more likely to give higher degree of data accuracy than nonworking members. As for the individual monthly income, those household member samples with income below 4000 pesos showed more accurate data than those having 4000 pesos and above. This is shown by the number of samples in category 1 and t-test values. Albeit these findings, looking further at the t-test values of the respective attributes, the household attributes showed more significant difference in the accuracy of data than at the individual level. From the examination of the influence of attributes on the accuracy of data, it could be stated that socioeconomic attributes can be considered as factors in examining the accuracy of panel data. Likewise, between the two panel data sets, the 1987-90 panel has more accurate data than the 1990-1992 panel.

Table 9 Accuracy of Data - Effect of Time Period

Time Period	Categories (Cumulative %)			
	1 (1)	2 (1+2)	3 (1+2+3)	TOTAL
1987-1990	48.3	79.3	86.6	100.0
1990-1992	36.1	68.8	83.5	100.0
T-Value	4.66	4.36	1.60	

Table 10 Accuracy of Data - Pooled 1987-1990 & 1990-1992 Data Set

Factors Influencing Accuracy	Level of Comparison	Categories (Cumulative %)			
		1 (1)	2 (1+2)	3 (1+2+3)	TOTAL
Residential District (1990-1992 data only)	Along LRT 1	44.4	75.3	87.0	100.0
	Along LRT 2	16.9	54.0	75.7	100.0
	T-Value	8.70	7.07	4.72	
Household Vehicle Ownership	None	34.8	62.2	94.4	100.0
	One or More	15.5	86.8	95.4	100.0
	T-Value	7.25	-9.10	-0.74	
Occupation	Working	43.7	73.1	84.2	100.0
	Not Working	37.6	71.5	84.7	100.0
	T-Value	2.46	0.73	-0.28	
Individual Monthly	Below P 4000	46.5	76.8	85.8	100.0
	P 4000 & up	38.7	65.3	80.4	100.0
	T-Value	1.84	3.06	1.75	

3.3 Examination of the Factors Causing Attrition

Another consideration that needs attention concerns bias of the data due to attrition. Attrition is the general term for household samples that leave the panel at the succeeding waves of the survey. Usually the problem of attrition is associated with either of the following: a) possible

increase in respondents not answering or returning the questionnaire because they are required to join in more than one wave of the survey; b) difficulty of locating the households (or respondents) in numerous waves of the survey due to residential relocation or mobility; c) problem brought about by dissolution of households; and d) potential drop in reporting accuracy because of "panel fatigue" - due to participation in multiple waves of the survey. The factors that tend to cause the attrition in the Metro Manila panel could be examined through looking at the breakdown of the households from the first wave that were not interviewed in the second wave. These factors could be summarized as: a) households no longer in the survey area, b)samples from the first wave refusing the survey, c) households could not be located, and d) households not in given address. Table 11 below summarizes the breakdown of households not interviewed. The factors that tend to influence the attrition rate in the Metro Manila panel were comparable to those observed in the panel surveys in the developed countries, particularly the Dutch panel. This is specifically evident for the first two factors cited earlier. The last two factors - households could not be located and/or not in given address - seem to be characteristics found in Metro Manila and in the developing countries in general.

Finally, examining the household attributes that showed differences with those that tend to be in the panel and those not in the panel or potential to cause attrition, Table 12 could provide a glimpse for the 1990-1992 panel. This panel was examined for attrition since it showed lower number of panel samples than the 1987-1990 panel. The table showed that the among the attributes examined, five were found to differentiate the samples as likely panel and attrition samples. To see whether the effects of the differences on the composition of the panel and attrition samples are significant, chi-square test of the attributes was made. The results of the chi-squares of the five household attributes are presented in Table 13. The summary of the findings and chi-square tests showed that the attributes of those households which have the tendency to be panel households would seem to be: a) large household size, b) middle-income, c) permanently residing in the area, or d) at least with two private vehicles. The characteristics of those households which would likely be in the attrition household samples are: a) small household size, b) lower income or higher income, or c) not permanent residents of the area.

As for the attrition samples, so far a) the number of employed members in the household, and b) the inclusion of squatter households on initial waves are contributing elements. These observations thereby tend to support the earlier findings that for the 1990-92 waves, a) the unemployed members are likely to produce good data since they normally are in their houses at the time of the survey especially housewives and students; b) affluent households (notably Chinese households) have the tendency not to join the panel survey; c) since squatter households are considered as not having permanent residence and most have low income levels, they are more likely to be in the attrition household samples; and d) the rate of attrition affects the quality of data indirectly because of the bias on the composition of the household samples.

Table 11 Breakdown of Households Not Interviewed

Causes	1987-1990
Transferred Residence	154 (34.61%)
Refusing the Survey	124 (27.86%)
Could not be Located	116 (26.07%)
not in Given Address	51 (11.46%)
TOTAL	445 (100.00%)

Table 13 Results of Chi-Square Tests

Attribute	Chi-Square	D.F.
Household Size	13.35	9
No. of Employed Members	52.89*	10
Length of Residence	4.12	5
Household Income	2.17	6
Vehicle Ownership (A)	50.32*	4
Vehicle Ownership (B)	4.81	3

(0.05 significance level)

Table 12 Household Attributes Examined for Attrition

Attribute	Showed Distinction Between Panel and Attrition Samples
Household Size	o
No. of Males	
No. of Employed Members	o
No. of Unemployed Members	
No. of Members w/Driving License	
Household Income	o
Length of Residence	o
Vehicle Ownership	o

Hence, from these observations, it is imperative that to minimize, if not eliminate the influence of attrition on the panel data, careful considerations have to be done on the design, planning and conduct of the panel survey in Metro Manila. This way, not only can the conductivity of panel survey be enhanced but the influence of attrition could possibly be gauged. The examination of the quality of data showed that the conductivity of panel survey in Metro Manila is indeed possible. The good performance of the 1987-1990 data sets supported this result of the analysis. However, the short-comings of the data sets and the surveys, especially for the 1990-1992 waves, necessitate further improvements of the surveys and quality of the data. Hence, there is indeed a need to overhaul the design and conduct of the surveys. In this regard, the following section will cover what possible countermeasures on how to further enhance the conductivity of panel survey in Metro Manila (and in developing countries in general).

3.4 Countermeasures to Improve the Quality of Panel Data in Developing Countries

Thus far, from the findings on the accuracy of data and the factors and composition of the attrition, it could be stipulated that the conductivity of panel survey in Metro Manila is possible. As already mentioned elsewhere to further improve the conductivity of panel survey it is essential that: a) the quality of panel data be enhanced, and b) the influence of attrition on the quality of data be minimized. In this regard, to achieve this, it is important that improvements have to be done on the survey itself - from the design, planning and conduct of the survey. In order that the accuracy of panel data be improved and bias due to attrition be minimized, the socio-economic attributes of the samples should be incorporated in the design and conduct of the survey. The countermeasures are be based on the results of the analyses just presented and from existing studies of panel surveys in the developed countries. Table 5.14 summarizes the general features of the countermeasures and their

intentions; and it can be seen that, as in the potential of carrying out the panel survey, the suggested countermeasures could be grouped as follows: a) measures on how to improve design of the survey, b) measures in making the conduct of the survey effective and simple, and c) those pertaining to proper supervision and training of survey personnel.

Table 14 Proposed Countermeasures to be Considered

PURPOSE	SUGGESTED COUNTERMEASURES
To achieve accurate data	* Purposive-quota-proportional sampling * Standardized questionnaire set * Waves of the survey shall be on the same season or time of the year * Well established and prepared survey manual and instructions * Experienced and properly trained enumerators and supervisors * Establishment of an efficient coding and encoding system
To lower attrition rate	* Increase samples on groups where attrition rate is higher * Proper conduct of the survey * Tapping enumerators familiar with certain socioeconomic groups * Establish rapport with samples * Promotion of an incentive scheme to attract and maintain panel samples

3.5 Chapter Conclusion

This chapter attempted to render an approach on how to examine the quality of data and strengthen the conductivity of panel survey in Metro Manila and in general for growing metropolis in developing countries. It was found that by setting a definition for matching the samples is one means in describing the quality of data and hence the conductivity of panel survey especially in the context of developing countries (in Southeast Asian region). Factors influencing the quality of data (accuracy and attrition) were also examined. These factors ranges from socioeconomic attributes of the households to the characteristics of the individuals in explaining the accuracy of data and attrition. If the data set has poor level of accuracy of data and the effects of attrition were imminent then a high proportion of match samples would be meaningless. Hence, the potential of carrying out a panel survey is likewise influenced by the quality of data. Therefore, to further enhance conductivity of panel survey, appropriate countermeasures be instituted to improve the quality of data by correcting the accuracy and minimize the influence of attrition bias.

4. CONCLUDING REMARKS

This paper presented an attempt of examining the conductivity of panel survey in developing countries with Metro Manila as the case study. As such, study rendered an approach in analyzing both the potential of conducting a panel survey and quality of panel data in the context of developing countries. By doing so, it tried to provide a definition of the conductivity of panel survey in developing countries - conductivity of panel survey, in developing countries, is described as the potential to carry out such a survey that can produce better quality of data that are accurate and maintain less bias due to attrition. Although the

results of the Metro Manila Panel Survey showed some degree of potential in carrying out such a survey in developing countries (especially at the household level, the panel data generated necessitated the need to evaluate the quality of the data. This insinuated that with respect to the examination of the quality of panel data, not only the performance of the survey and attrition be assessed but also the potential of carrying out the panel survey and the accuracy of the panel data. This is essential especially in developing countries.

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