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ORIGINAL RESEARCH

Impact of Income, Deprivation and Social Exclusion on Subjective Poverty: A Structural Equation Model of Multidimensional Poverty in Hong Kong

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Abstract
Multidimensional poverty in urban cities has become an increasing global concern. Income poverty, deprivation, social exclusion and subjective poverty have been commonly used as measurements for poverty. However, the path relationship among these various dimensions has been ignored. This study aims to fill this research gap by focusing on the impact on subjective poverty. A random sample survey of 1979 adult participants in Hong Kong was used for the analysis. Structural equation modelling was applied in studying the path relationship among the monetary, material, social and subjective dimensions of poverty. Subjective poverty was predicted through a mediated model, with deprivation and social exclusion as the mediators. The result of this structural equation modelling indicated that the impact of income on subjective poverty was partially mediated by the material and social dimensions of poverty. In an age group comparison analysis, deprivation showed a larger influence on the elderly group, whilst social exclusion had a larger mediating effect on the younger group. The implication of these results and limitations are discussed.

Keywords Subjective poverty · Deprivation · Social exclusion · Hong Kong · Multidimensional poverty · Structural equation model

1 Introduction

Poverty is a multidimensional concept that can be conceptualised and measured with monetary, material, social and subjective perspectives. Previous studies have shown that the various dimensions of poverty are interrelated (Bellani and D'Ambrosio 2011; Bradshaw and Finch 2003). However, the path relationship among them has been ignored. Using structural equation modelling (SEM) with a cross-sectional population dataset, this study attempts to test the framework of multidimensional poverty and compare the weights of the

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impact of other dimensions, including income, deprivation and social exclusion, on subjective poverty. Furthermore, this paper reveals that the impact of material deprivation and social exclusion on subjective poverty are different for various age groups.

This paper first examines the concepts of multidimension poverty, focusing on deprivation, social exclusion and additional emphasis on subjective poverty. It reviews the relationship among the various dimensions of poverty and highlights the research gaps. Next, it presents the dataset, hypothesis, methodology and result. Finally, it discusses the analytical results with policy suggestions, followed by the limitations of this research.

1.1 Multidimensional Nature of Poverty

The nature of poverty is multidimensional (Alkire and Seth 2015; Bourguignon and Chakravarty 2003; Dewilde 2008; Kakwani and Silber 2008; Kwadzo 2015). Among the dimensions of poverty, the monetary dimension is the most dominant and commonly used approach in policy design and academic research (Laderchi et al. 2003). However, in the past decades, numerous scholars have argued that the monetary approach has limitations in the conceptualisation and measurement of poverty, for example, it neglected how the families limit their expenditure and caused material deprivation, or it overlooked the social dimension of human being (Gordon 1998; Levitas 2006; Townsend 1987). Various approaches have been developed in studying the multidimensional nature of poverty to capture the suffering of humans (Wagle 2002). Apart from the monetary dimension, poverty has also been viewed and measured through the material, social and subjective dimensions (Bellani and D'Ambrosio 2011; Bradshaw and Finch 2003). The concepts of deprivation, social exclusion and subjective poverty are briefly reviewed and explained.

Townsend (1962) has criticised that the income approach only focuses on the monetary perspective, thus overlooking the heterogeneity of human nature, including dignity and subjective feelings. Instead, he proposed the concept of deprivation. Poverty has other important aspects of poverty, such as housing, education, medical services and material essentials. As Townsend proposes, 'Deprivation may be defined as a state of observable and demonstrable disadvantage relative to the local community or the wider society or nation to which an individual, family or group belongs' (Townsend 1987, p.125). Deprivation can mean 'a lack of socially perceived necessities' (Bradshaw and Finch 2003). The deprivation approach is widely used across countries (Gordon and Pantazis 1997; Townsend 1979). For the operationalisation of deprivation, Townsend (1979) has developed a set of indicators in measuring poverty in the UK in the 1970s. Afterwards, scholars have developed various indicators of deprivation using a consensual approach by asking the affordability of the essential items of families (Gordon and Pantazis 1997; Mack and Lansley 1985; Saunders et al. 2014). Material deprivation indicators are widely used in European countries in monitoring poverty (Guio et al. 2017).

Social exclusion has been widely used in Europe and by international agencies to measure non-income poverty situations. This concept was initially used to describe the limited social protection and job security in France in the 1970s and was later extended to measure the inadequate social participation and poor social network in communities (Levitas 2006; Townsend 2002). Scholars have developed various frameworks for understanding social exclusion. Some models have focused on moral and cultural exclusion, discrimination and inequality (Silver 1994), whilst others have emphasised resource distribution, labour market exclusion and moral deficiencies (Levitas 2006). Researchers have argued that there was no single universal definition of social exclusion

(Atkinson 1998; Gordon 1998; Laderchi et al. 2003). Nevertheless, social exclusion can be understood clearly from several perspectives, such as social networks, social support and social participation (Gordon et al. 2000; Levitas 2006; Vrooman and Hoff 2013; Wagle 2002). Various dimensions of social exclusion have also empirically demonstrated a high degree of correlation (Kwadzo 2015). Among the various definitions of social exclusion, social support and social network are commonly used for operationalised measurements. Given the availability of data, this study focuses on the dimensions of social exclusion, such as poor social network and lack of social support.

The subjective poverty approach focuses on the personal feeling and judgement in defining poverty (Mahmood et al. 2019). It overcomes the limitations of solely using the objective approach in measuring poverty by overlooking social and cultural differences (Leu et al. 2016), social specificity and subjectivities of people (Pradhan and Ravallion 2000). The subjective approach highlights that subjective well-being is one of the most important aspects of humans, thus requiring additional attention (Kingdon and Knight 2006; Maggino 2015b). It emphasises well-being in relation to experience, which is essentially subjective. It also recognises the authority of people in accessing and interpreting their own well-being (Rojas 2008; vanPraag and Ferrer-i-carbonell 2006). Compared with measuring the snapshot of income and expenditure, subjective measurements can relatively capture a longer-term projection of well-being, with consideration of the past income and assets of the respondents (Posel and Rogan 2016). Subjective poverty is a crucial dimension in reflecting subjective well-being (Siposné Nándori 2014) with a similar measurement approach (García-Quero and Guardiola 2018). Therefore, the subjective approach has been increasingly applied for measuring the quality of life and evaluating social progress and the impact of social policy (Crettaz and Suter 2013; Maggino 2015a).

Subjective poverty is a growing concern in poverty studies; thus, scholars have developed various measurements for it (Colasanto et al. 1984; Goedhart et al. 1977; Mahmood et al. 2019). One relatively simple measurement is directly asking people whether they feel that they are living under poverty (Bradshaw and Finch 2003). Other commonly used approaches include the ladder approach (Mahmood et al. 2019), the self-evaluation of living standard (Siposné Nándori 2014), the subjective poverty line (SPL) and the Leyden poverty line (LPL). In terms of the ladder approach, Cantril (1965) has proposed using a ladder as a scale of happiness and asked people to place themselves on it. Scholars have used the step ladder scale from poorest to richest for measuring subjective poverty (Beegle et al. 2012). Setting the SPL is normally based on asking minimum income questions (Gustafsson and Sai 2019) on aspects such as the absolute minimum for making ends meet per month (Kapteyn et al. 1988) or the level of income for buying necessities per week (Bradshaw and Finch 2003). Meanwhile, the LPL is commonly set by asking an income evaluation question, which requires people to judge their circumstances by answering 'very good', 'good', 'sufficient', 'insufficient', 'bad' or 'very bad' (Kapteyn et al. 1988). The subjective approaches are applied in studies in several countries, including European countries, the United States, mainland China and developing countries (Alem et al. 2014; Angelillo 2014; Bishop et al. 2014; D'Agostino et al. 2019; Gustafsson et al. 2004). Scholars also use integrated methods for measuring subjective poverty with various dimensions (Azeem et al. 2017; Halleröd 1995; Spicker et al. 2007).Since the spreading use of subjective approach in poverty measurement and the growing concern in policymaking process in recent year, we choose to set subjective poverty as the major dependent variable of this research. Multidimensional approach or combined approach of subjective poverty was also used in previous studies (Mahmood et al. 2019; vanPraag and Ferrer-i-carbonell 2006). In this research,

the combined approach, including self-reported poverty and the ladder approach evaluation of living standards, will be applied in measuring subjective poverty.

1.2 Relationship Among Various Dimensions of Poverty

The relationship among various dimensions of poverty is complicated. Firstly, the association between income poverty and subjective poverty is ambiguous (Mysíková et al. 2019). Income level is normally found to be negatively associated with subjective poverty, in which a high income implied a feeling of being less poor. Studies have noted a positive relationship between objective income and subjective well-being, which encompassing subjective poverty but measured in opposite direction (Kingdon and Knight 2006), but the level of such correlation can vary (Frey and Stutzer 2002; Ibrahima 2013). Nevertheless, other studies have shown that the relationship between objective and subjective poverty is insignificant (Filandri et al. 2020), or households are dissatisfied even when they live above the objective poverty line (Siposné Nándori 2014).

Subjective poverty is not only affected by the income of individuals but also by the relative deprivation level when comparing their own situation with others (Luttmer 2005). Siposné Nándori (2011) has indicated two main streams of studies. One stream proposes that people are highly concerned about their relative position in society. Such preoccupation affects subjective assessment. Reducing relative poverty entails reducing subjective poverty. The other stream indicates that individuals focus on survival and subsistence. Minimising absolute material poverty indicates less subjective poverty.

Social factors are also important for subjective self-assessment, as people normally compare themselves with others around them. The assessment of poverty differ among social networks (Gustafsson et al. 2004). Exclusion from society and social inequality are the determinants of subjective poverty (Ibrahima 2013). A cross-country study on children has proposed that the impact of social exclusion on subjective well-being is much more salient than the income and material situation (Gross-Manos 2017). Nevertheless, few studies have shown that social interaction is insignificantly associated with subjective well-being (Salas and Vigorito 2019).

Few studies have investigated the relationship among income poverty, deprivation, social exclusion and subjective poverty in the same research. One study conducted by Bellani and D'Ambrosio (2011), which uses data from Europe, has shown that income and deprivation is correlated. In addition, deprivation demonstrates a stronger association with subjective well-being than that of income. Social exclusion is also found to be highly correlated with subjective well-being. Another study by Bradshaw and Finch (2003) has found little overlap in the definitions of income-poor, deprived and subjectively poor among individuals in England. This overlap indicates the dimensions of poverty that measure various aspects of well-being. In their research, income poverty, deprivation and subjective poverty are found to be statistically correlated with one another. Using logistic regression for subjective poverty, the odds of being income poor is relatively small after controlling the deprivation level. People under the intersection of income poverty, deprivation and subjective poverty are more at risk of social exclusion than those who are non-poor or poor in only one dimension (Bradshaw and Finch 2003). However, the two studies do not demonstrate the path relationship among the various dimensions of poverty.

In the review, we have found that age is a common and crucial factor in determining multidimensional poverty. A population with various age groups reveal various effects of age on poverty (Adetola 2014; Kingdon and Knight 2006; Ningaye and Mom Njong 2014).

The effects are significantly salient in the Asian context. For example, a recent study in Taiwan has stated that elderly people aged 60 or above have shown higher levels of multiple deprivation than the younger groups (Chen et al. 2019). Another research in South Korea has stated that multidimensional poverty has shown various patterns based on the age of householders. Old people may have experienced more multidimensional poverty than younger ones (Hwang and Nam 2020). To summarize, the literature review highlighted the multidimensional nature of poverty and relationships among various types of poverty. However, the path relationship and interaction among different dimensions of poverty was not clear. Moreover, age was a core element in multidimensional poverty research, but how age affect the path relationship was unknown. The age group difference will be examined in the analysis.

1.3 Hong Kong Context and Previous Studies

Hong Kong, a typical example of a world city, faces escalating poverty problems under globalisation and financialisation (Lee et al. 2007; Milanovic 2016). The city has a high GDP per capita but a high Gini coefficient, which shows a large income inequality (Saunders and Tang 2019). Poverty has been a growing concern in previous years, not only for the public but also for the Hong Kong government (Goodstadt 2013). The alleviation of poverty is one of the core policy agendas of the Hong Kong government. The Commission on Poverty (CoP) was established, and the official poverty line was set in 2013 using 50% of the median housing income as the threshold (Lau et al. 2015b; Wong and Chan 2019). The CoP publishes a poverty report each year to monitor the poverty situation and evaluate the impact of policy intervention. In 2018, 1.41 million people identified as income poor, comprising 20.4% of the poverty rate (HKSAR government 2019). Moreover, poverty has been worsening among the elderly group, along with the ageing trend in the past years (Chou and Lee 2018). However, the analysis of poverty is limited by the income approach. Other dimensions of poverty are ignored in the poverty alleviation agenda. Nevertheless, scholars and NGOs have conducted other studies on the other dimensions of poverty in Hong Kong.

In terms of poverty research in Hong Kong, studies on deprivation in Hong Kong have been conducted. With the consensus from respondents, those who lack two or more out of 14 essential items are classified as deprived (HKCSS 2011; Saunders et al. 2014). An estimated 14.5% of people in Hong Kong were living under deprivation in 2014 (HKCSS 2014). A recent research by Cheung et al. (2019) have shown that deprivation is significantly associated with the income level but with relatively moderate overlapping. This finding indicates that the deprivation measure is a crucial complement to income measure. Consequently, disadvantaged groups without income poverty can be identified. For social exclusions, Lau et al. (2015a) have adopted the framework of the social exclusion research in the UK to Hong Kong and examined the understanding of social exclusion by various households using focus groups. Eight key issues are identified as multidimensional experiences of social exclusion, such as ‘social and family life’, ‘social support’ and ‘discrimination’. Another research conducted by Cheung (2013) has linked the income gap and the opportunity of leaving poverty with social exclusion. The research determines the elderly as the most vulnerable group to social exclusion. Although studies have proposed the measurement of multidimensional poverty, none of them have examined the relationship among the different dimensions.

In terms of the relationship among the dimensions of poverty, longitudinal studies have found that young people with economic disadvantages (i.e. received welfare from the government) have lower subjective life satisfaction than the less economic disadvantaged group (Shek 2008; Shek and Liu 2014). Another research has shown that deprivation explains the variation in life satisfaction more than it explains income poverty (Lau and Bradshaw 2018). However, the sample of the research is only limited to children and the adolescents. A study on the elderly population has shown that income, material deprivation and social and neighbourhood support are significantly associated with the subjective view of life satisfaction (Cheung and Chou 2019). However, this result cannot extend to the overall population. A recent study by Saunders and Tang (2019) has attempted to reveal the overlapping of income poverty, deprivation and subjective poverty in Hong Kong. However, the relationship among them has been ignored.

1.4 Research Gaps, Aims of Study and Hypothesis

The literature review has revealed that the interaction among the dimensions of poverty have been ignored despite the rising concern of multidimensional poverty across countries. Moreover, the multidimensional poverty framework is rarely applied in global cities in the Chinese or Asian context for poverty analysis. This lack of application provides the research gaps for investigation.

This study aims to investigate the relationship between income and non-income dimensions of poverty in Hong Kong, an example of a global city. It also tests whether the material and social dimensions of poverty mediate the impact of income poverty on subjective poverty. This research is potentially the first study to investigate the relationship among income poverty, deprivation, social exclusion and subjective poverty in a global city within the Asian context. The study uses SEM to examine the path impacts and mediating effects of poverty indexes.

This study focuses on subjective poverty. We hypothesised that all income, material and social dimensions of poverty have shown significant association with subjective poverty. Income is usually found as the most influential factor of subjective poverty. It is highly correlated with deprivation and social exclusion, which may also affect subjective poverty. We assume that the impact of income on subjective poverty is mediated by deprivation and social exclusion. For comparison, we suppose that the pattern of the relationship among the dimensions of poverty is different among age groups.

2 Methods

2.1 Data and Sample

The data used in this study were collected from the project 'Trends and Implications of Poverty and Social Disadvantages in Hong Kong: A Multi-Disciplinary and Longitudinal Study'. The project was a cross-sectional random sampling study. A total of 25,000 addresses were obtained from the Census and Statistics Department of Hong Kong. The samples were stratified by the living location and housing types of families. The interviewees were adults living in Hong Kong aged 18 and above. Face-to-face interviews were conducted by professionally trained interviewers.

In the project, 3791 valid cases were obtained out of 4947 addresses. The response rate was 60.2%, and 2282 adults were successfully interviewed. Among them, 1979 cases answered the questions related to deprivation, social exclusion and subjective poverty. Those respondents were chosen as the sample in this study.

2.2 Measures

As for income, considering the differences in the household size and composition of families, the *equivalised household income (EHI)* was used to measure the income level. The EHI was calculated by dividing the household income before tax by the square root of the number of household members. To compare with other variables with smaller values, the EHI took a natural logarithm for calculation.

In terms of *deprivation*, consensual approach was used to formulate the deprivation index. This seeks to find a public consensus on what are the necessities of life (Guio et al. 2017; Mack and Lansley 1985). In the survey, 301 interviewees were asked whether they had the proposed 21 daily necessities, including 'diet and clothing', 'medical, dental and optical care', 'household facilities' and 'social and family life'. The 21 items were indicated as necessities by more than 50% of respondents in a previous research on deprivation in Hong Kong (Saunders et al. 2014). The items included 'three meals a day', 'fresh fruit or vegetables every day', 'able to consult a private doctor when you are sick', 'have a washing machine' (see "Appendix"). A two-point scale was used for measurement (0 = yes and 1 = no). A score of 21 items were summed up as the *deprivation index* (*DI*), from 0 to 21, with a higher score showing a higher level of deprivation. The Cronbach's alpha for these items was 0.834.

For *social exclusion* (*SE*), the respondents were asked six questions about their social networks and social support. These questions included how frequently the respondents communicated (SE1) and met (SE2) with their friends or family; how much support they received if they were sick (SE3), needed practical help around their home (SE4) or needed someone to provide advice about an important decision (SE5) and how often they felt respected and understood by other people (SE6). These questions provided a range of answers. For example, questions on social support garnered responses from 'a lot', 'some', 'not much' to 'None at all'. Questions on the frequency of meeting friends ranged from 'less than once a month' to 'every day'. After the conversion of the direction of the answer scale, the high scores in each question indicated a high level of social exclusion. These scores were used to construct the measurement of social exclusion. The Cronbach's alpha of these questions was 0.728.

As for *subjective poverty (SP)*, the respondents answered the four questions related to subjective poverty. The four questions were 'How far above or below the income level should you be at to keep your household out of poverty?' (SP1), 'Do you think you are poor now?' (SP2), 'Looking back in your life, how many times have you thought you have lived in poverty according to the standards of that time?' (SP3) and 'How would you rate your current standard of living?' (SP4). The Cronbach's alpha of these four items was 0.614, which obtained a moderate reliability for measuring subjective poverty. These items were used to construct the measurement of subjective poverty.

For age, the respondents were asked to provide their age. The ages of the respondents were sorted into three groups, ranging from 18 to 40 (young adult), 41 to 59 (adult) and 60 or above (elderly).

2.3 Analytic Strategy

Structural equation modelling (SEM) is a statistical methodology for investigating the plausibility of theoretical models that attempt to explain relationships among variables (Hu and Bentler 1999). SEM can analyze independent variables, dependent variables, and error terms within a theoretical framework. It allows operationalization of the constructs, which cannot directly be observed, with different observed variables. Moreover, SEM takes measurement error into account in the analysis. It can also address the mediating and moderating effect by estimation of model with variables with interconnections (Hoyle 2012). In addition, it has been found that a minimum sample size of 100 or 200 in total is acceptable for SEM analysis (Kline 2011; Loehlin 1992). Other scholars suggested that 5 or 10 cases per measured variables were required for SEM analysis (Bentler and Chou 1987; Kline 2011). As this research focus on studying the path relationship among different types of poverty and the sample used fit the minimum requirement of sample size. SEM was appropriate statistical method for analysis.

In this study, the associations among the various dimensions of poverty were tested using SEM with assistance of AMOS. Firstly, a confirmatory factor analysis was conducted for the latent variables, social exclusion and subjective poverty, to eliminate the factors with low weight loading. This elimination ensured that the constructs in the models were well-explained by the observed variables. Secondly, the SEM was formed with the variables of income, deprivation, social exclusion and subjective poverty and tested with a full dataset. Thirdly, the SEM was conducted using a cross-group age comparison to determine whether the mediating effects and the strength of paths were different among age groups.

For each SEM, the regression weight among variables, the direct effect and indirect effect on the dependent variable and the goodness of fit of model were discussed. Specifically, the SEM had various goodness-of-fit indicators. The Chi square was normally used to examine the size of discrepancies between the original and implied model, with a large Chi square showing significant discrepancies. However, for a dataset with a large sample size, such as that in this study, the Chi square was inappropriate for evaluating the model fit (Byrne 2001). Instead, other goodness-of-fit indices developed by researchers were used for evaluation. These included the root mean square error of approximation (RMSEA) (Steiger 1990), comparative fit index (CFI) (Bentler 1990), Tucker-Lewis index (TLI, also known as NNFI) (Bentler and Bonett 1980; Tucker and Lewis 1973) and incremental fit index (IFI) (Bollen 1989). The RMSEA is considered as a good fit for a value below 0.08 (Hu and Bentler 1999). The CFI, TLI and IFI are satisfied if the value is higher than 0.90 (Bentler 1990) or with a superior fit if it is above 0.95 (Hu and Bentler 1999). The goodness-of-fit index (GFI) and adjusted goodness-of-fit index (AGFI) are also reported and considered acceptable if it is larger than 0.90 (Hu and Bentler 1999).

3 Results

3.1 Descriptive Statistics

The median of EHI is 12,021 HKD (SD = 9051) or 1541 USD (SD = 1160). The means, standard deviations (SDs) and correlations among the log of income, deprivation index and observed variables used in the construct of social exclusion and subjective poverty are

listed in Table 1. Pearson's correlation is used to analyse the correlation among variables. All observed variables are with significant correlations with $p < 0.01$.

3.2 Measurement Model

The measurement model of latent variables, social exclusion and subjective poverty must be verified before being merged into a structural model. Confirmatory factor analysis (CFA) is used to examine whether the observed data represent the meanings of constructs (Hoyle 2012). Six items (SE1 to SE6) are placed into the CFA to measure social exclusion. This measurement model shows good fit. The values are: RMSEA = 0.058, which is less than the critical value 0.8, CFI = 0.989, TLI = 0.976 and AGFI = 0.973, which are all larger than the critical standard of adaptation of 0.9. The measurement model is satisfactory. The factor loadings range from 0.33 to 0.84 (Table 2), higher than the minimum acceptable loading of 0.30 (Hair et al. 2014; Tabachnick and Fidell 2019). All factor loadings are significant ($p < 0.001$) in the model.

Four items (SP1–SP4) are placed into the CFA to measure subjective poverty. All four observed variables are significant ($p < 0.001$), with relative high loading from 0.53 to 0.75 (Table 2), which is higher than the acceptable level. They also show good fit, with RMSEA = 0.064, CFI = 0.988, TLI = 0.963 and AGFI = 0.977. This result indicates that the observed variables have effectively reflected the meanings of the latent variables. The constructed social exclusion and subjective poverty dimensions are used for further analysis in the following SEM models.

3.3 Overall Model

The overall model is first tested with a total sample, which provides good fit, with χ^2 (48, N = 1979) = 493.909, $p < 0.001$, RMSEA = 0.069, CFI = 0.941, IFI = 0.941, TLI = 0.919, AGFI = 0.933. Given the relatively large sample size (> 200), the checking of the Chi square and p value can be overlooked (Bollen and Long 1993; Maruyama 1998). All indexes are a good standard for adoption, thus indicating that the model is good. The standardised results of the structural model are shown in Fig. 1. For simplicity, the figure only shows the associated paths among the explanatory variable, mediating variables and dependent variable. The path diagram of the measurement models is omitted.

In the model, the other exogenous variables explain approximately 57% of the variance of subjective poverty. All paths of EHI, deprivation and social exclusion on subjective poverty are significant ($p < 0.001$). The EHI has the largest direct impact ($\beta = -0.42$, $p < 0.001$) on subjective poverty in the model. The direct impact of deprivation and social exclusion on subjective poverty are 0.38 and 0.17, respectively. The EHI shows a significant and indirect effect on subjective poverty ($\beta = -0.18$, $p < 0.001$) through the mediating effect of deprivation and social exclusion. The direct effect of deprivation on social exclusion ($\beta = -0.41$, $p < 0.001$) is significant and larger than that of income on social exclusion ($\beta = -0.20$, $p < 0.001$) (Table 3).

The statistical results indicate that the income level is the most influential factor of subjective poverty compared with the impact of deprivation and social exclusion. A low-income level indicates a high level of subjective poverty. Moreover, the result also reveals that the impact of income on subjective poverty is mediated by deprivation and social exclusion with a significantly large regression weight. The total mediating effect (−0.18) is comparable with the direct effect (−0.42) (Table 4). The result shows that the respondents

Table 1 Means, SD and correlation among observed variables

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Log of equivalized income	9.30	0.62	1.00											
2. Deprivation Index	0.87	1.97	−0.32*	1.00										
3. SE1: communicate with family or friends	1.85	1.33	−0.24*	0.36*	1.00									
4. SE2: meet with family or friends	2.93	1.79	−0.13*	0.26*	0.44*	1.00								
5. SE3: get support if being sick	2.28	0.89	−0.25*	0.31*	0.28*	0.26*	1.00							
6. SE4: get support if needed practical help	2.29	0.87	−0.28*	0.33*	0.30*	0.27*	0.78*	1.00						
7. SE5: get support if needed advice for decision	2.09	0.82	−0.23*	0.34*	0.35*	0.24*	0.62*	0.64*	1.00					
8. SE6: feel respected or understood by others	1.28	0.64	−0.16*	0.38*	0.27*	0.24*	0.3*2	0.34*	0.37*	1.00				
9. SP1: adequacy of income out of poverty	3.09	1.07	−0.48*	0.30*	0.16*	0.12*	0.20*	0.21*	0.19*	0.12*	1.00			
10. SP2: think yourself as poor	1.76	0.43	0.36*	−0.44*	−0.22*	−0.16*	−0.24*	−0.23*	−0.24*	−0.27*	−0.45*	1.00		
11. SP3: frequency of thinking as poor when looking back	2.82	1.15	−0.29*	0.30*	0.22*	0.13*	0.24*	0.22*	0.19*	0.14*	0.28*	−0.42*	1.00	
12. SP4: rating of current living standard	3.02	0.58	−0.32*	0.41*	0.23*	0.14*	0.23*	0.23*	0.26*	0.27*	0.37*	−0.38*	0.29*	1.00

*$p < 0.01$

Table 2 Standardized factor loadings of observed variables on constructs

Latent construct	Observed variable	Factor loading
Social exclusion	SE1: communicate with family or friends	0.42
	SE2: meet with family or friends	0.33
	SE3: get support if being sick	0.73
	SE4: get support if needed practical help	0.77
	SE5: get support if needed advice for decision	0.84
	SE6: feel respected or understood by others	0.46
Subjective poverty	SP1: adequacy of income out of poverty	0.61
	SP2: think yourself as poor	0.75
	SP3: frequency of thinking as poor when looking back	0.53
	SP4: rating of current living standard	0.54

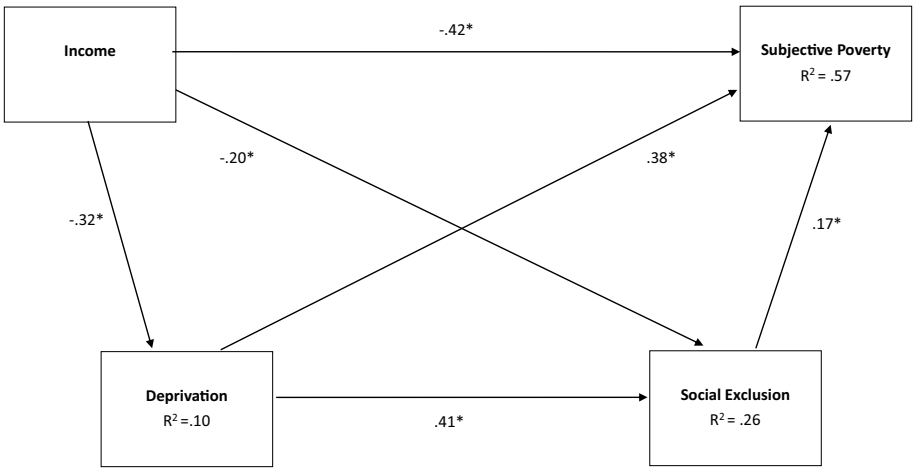

Fig. 1 Overall model. *$p < 0.01$. *Source:* Table 3

Table 3 Path coefficients, SE, and critical ratios of the overall model

			b	β	SE	C.R.
Deprivation	←	EHI	−0.998	−0.316*	0.067	−14.817
Social exclusion	←	EHI	−0.191	−0.199*	0.024	−7.849
Social exclusion	←	Deprivation	0.126	0.415*	0.009	13.435
Subjective poverty	←	Social exclusion	0.197	0.175*	0.033	5.938
Subjective poverty	←	EHI	−0.452	−0.417*	0.027	−16.460
Subjective poverty	←	Deprivation	0.132	0.384*	0.009	14.258

b Unstandardized coefficients, *β* standardized coefficients, *SE* standard error, *C.R.* critical ratio
*$p < 0.01$

Table 4 Standardized indirect effect of overall model

	Income	Deprivation	Social exclusion	Subjective poverty
Deprivation	0.000	0.000	0.000	0.000
Social exclusion	−0.131*	0.000	0.000	0.000
Subjective poverty	−0.179*	0.072*	0.000	0.000

*$p < 0.01$

feel that they are living in poverty not only because of their low-income level but also because of other consequences of low income, such as deprivation and social exclusion.

Deprivation plays a significant and direct role in subjective poverty. The weight loading is comparable with the effect of income. Moreover, the direct effect of deprivation on social exclusion is critically large, which indicates a high level of deprivation. Not only does it have a significant impact on the perception of respondents about being poor, but it also leads people to social exclusion. These results emphasise the important role of deprivation in poverty analysis.

3.4 Age Comparison Model

In the comparison model (Fig. 2), the paths, factors loadings and covariances are constrained to be equal in various models. Thus, the covariance matrices of three age groups can be fit simultaneously into the same model. The result provides a good model fit, with χ^2 (N: aged 18–40 = 562; N: aged 41–59 = 719; N: aged 60 or above = 698) = 702.70, $p < 0.001$; RMSEA = 0.040, CFI = 0.925, IFI = 0.925, TLI = 0.914, AGFI = 0.918. The data from all age subgroups fit in the same theoretical model well. The model is further tested by releasing the constraints of the paths among income, deprivation, social exclusion and subjective poverty. The result provides a better fit to the model ($\chi^2 = 697.62$, $p < 0.001$;

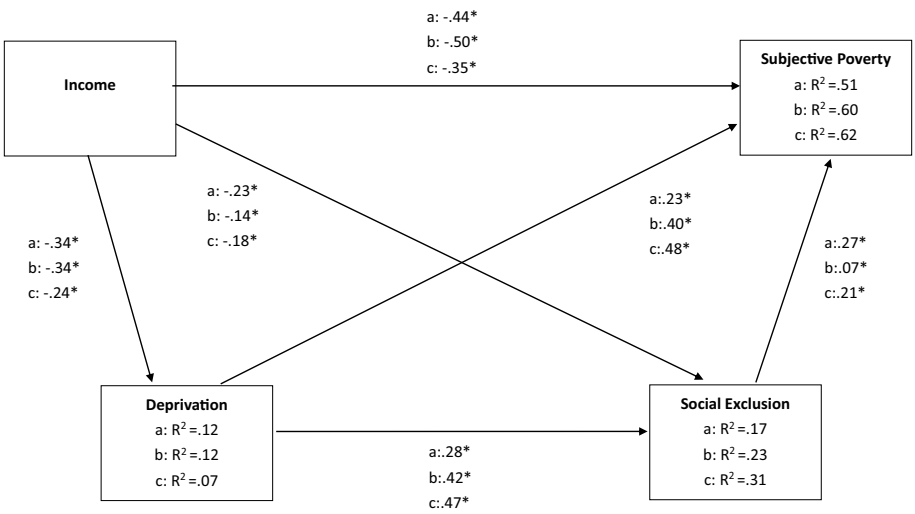

Fig. 2 Age comparison model. *$p < 0.01$. **a** aged 18–40; **b** aged 41–59; **c** aged 60 or above. *Source:* Table 5

RMSEA = 0.041, CFI = 0.928, IFI = 0.928, TLI = 0.912, AGFI = 0.917) and remains goodness of fit in the theoretical model.

The paths among various dimensions of poverty are different in the three age groups (Table 5). The impact of income on subjective poverty demonstrates the largest weight among all the paths in the model for the young adult group ($\beta = -0.44$, $p < 0.001$) and the adult group ($\beta = -0.50$, $p < 0.001$) but not the elderly group ($\beta = -0.35$, $p < 0.001$). The path strength from deprivation to subjective poverty is the strongest for the elderly group ($\beta = 0.48$, $p < 0.001$), much higher than those of the adult group ($\beta = 0.40$, $p < 0.001$) and the young adult group ($\beta = 0.23$, $p < 0.001$). The impact of social exclusion on subjective is the largest for the young adult group ($\beta = -0.27$, $p < 0.001$), compared with that of the adult group ($\beta = -0.07$, $p < 0.001$) and elderly group ($\beta = -0.21$, $p < 0.001$).

The models have explained 62% of the variance on subjective poverty for the elderly group, 60% for the adult group and 51% for the young adult group. In all three age groups, similar with the overall model, the impact of income on subjective poverty was mediated by deprivation and social exclusion, along with relatively large loadings. The indirect effects of income on subjective poverty are significant among three groups, loading from −.16 to −.18. For the elderly group, the direct effect ($\beta = -0.48$, $p < 0.001$) and total effect ($\beta = -0.57$, $p < 0.001$) of the impact of deprivation on subjective poverty is larger than the impact of income on subjective poverty (direct: $\beta = -0.35$, $p < 0.001$; total: $\beta = -0.53$, $p < 0.001$). This result demonstrates the crucial role of deprivation in the model analysis.

4 Discussion and Conclusion

This study examines the relationships among various dimensions of poverty, with the focus on their impact on subjective poverty. The proposed model is tested by a large-scale random sample in Hong Kong. Although many studies studied the multidimensionality of poverty (Bellani and D'Ambrosio 2011; Kwadzo 2015) and overlaps of dimensions of poverty (Bradshaw and Finch 2003), this study contributed in examining the path relationship among different types of poverty, which was insufficiently studied. Moreover, age group comparison of the SEM analysis of multidimensional poverty is another key contribution compared with the previous literature (Adetola 2014; Kingdon and Knight 2006; Ningaye and Mom Njong 2014). The result indicates that income is directly associated with subjective poverty and mediated through deprivation and social exclusion. The age comparison model shows that the paths within the model are different among three age groups.

In the overall model, the result with good indices of the model fit indicates the theoretical model of how income, deprivation, social exclusion and subjective poverty are supported in Hong Kong. The variables can explain the variance of subjective poverty. In addition, all regression paths and the variances of the various dimensions of poverty are significant, thus being consistent with the outcomes of previous studies (Bellani and D'Ambrosio 2011). The result highlights that income is the most influential factor and is negatively associated with subjective poverty. This finding echoes those in previous studies, in which income poverty is associated with subjective poverty (Frey and Stutzer 2002; Ibrahima 2013). Moreover, deprivation and social exclusion also demonstrate a positive relationship with subjective poverty. This observation extends the research of Lau and Bradshaw (2018) on children to the general population, which emphasises the impact of deprivation on subjective well-being. It differs from the research of Salas and Vigorito (2019), in which the role of social interaction is not salient.

Table 5 Path coefficients, SE, and critical ratios of the comparison model

			18–40			41–59			60+		
			β	SE	C.R.	β	SE	C.R.	β	SE	C.R.
Deprivation	←	EHI	−0.342*	0.097	−8.61	−0.345*	0.107	−9.84	−0.243*	0.143	−6.60
Social exclusion	←	EHI	−0.225*	0.037	−4.51	−0.136*	0.034	−3.30	−0.176*	0.034	−4.56
Social exclusion	←	Deprivation	0.281*	0.015	5.53	0.418*	0.013	8.88	0.466*	0.010	10.09
Subjective poverty	←	Social Exclusion	0.273*	0.089	5.14	0.072*	0.064	1.64	0.210*	0.060	4.27
Subjective poverty	←	EHI	−0.436*	0.054	−9.89	−0.497*	0.045	−13.10	−0.354*	0.040	−9.26
Subjective poverty	←	Deprivation	0.235*	0.022	5.38	0.402*	0.016	9.80	0.476*	0.012	10.79

β Standardized coefficients, *SE* standard error, *C.R.* critical ratio

*$p < 0.01$

Previous studies have mostly focused on the overlap over various dimensions of poverty (Bradshaw and Finch 2003; Cheung et al. 2019; Posel and Rogan 2016). This study reveals the path relationships among them. In the model, deprivation acts as a critical factor in the mediation between income and subjective poverty with a relatively large regression weight. The model indicates the households feel that they are living poorly not only because of their income but also because of the material deprivation caused by their income level. Social exclusion also shows a similar effect on deprivation but with less weight. This effect reveals that the perception of poverty among the people in Hong Kong is affected by material adequacy instead of social network and support. As shown in Table 4, the indirect effect of income on subjective poverty is nearly half in magnitude of the direct effect. This shows the important role of material and social dimension of poverty in mediating income and subjective poverty. This result extends the study of Bradshaw (Bradshaw and Finch 2003), which focus on overlapping of income, deprivation and subjective poverty, to path relationship among various dimensions of poverty.

The age comparison model shows that the theoretical model is applicable for all age groups. It demonstrates that the impact of income on the subjective poverty of the three age groups are mediated by deprivation and social exclusion. Nevertheless, the paths of the impact vary among the groups. Notably, deprivation shows much more impact on subjective poverty than income for the elderly group. The case is different in the young adult group and adult group. These differences in the results indicate that material deprivation demonstrates a critical role in the subjective perception of the elderly for feeling poor. Social exclusion shows a critical role in the model for the young adult group, thus implying that young adults are more concerned with the adequacy of social support and social network than the older group when thinking of themselves as poor or not. This outcome echoes the research of Bellani and D'Ambrosio (2011), in which the subjective perception of well-being is more affected by social exclusion than material constraint. It is also consistent with previous findings, in which age is an important factor in the analysis of multidimensional poverty (Chen et al. 2019). Furthermore, the income level has the largest impact on subjective poverty for the adult group, implying that this age group is more concerned about income than other groups in deciding the position of subjective poverty. The differences among the age groups in analysing the path relationship among the dimensions of poverty are rarely revealed in previous research.

This study highlights the multidimensional natures of poverty and how the policy response to poverty should be different according to which measure is applied. In Hong Kong, the poverty analysis and anti-poverty measures proposed by the HKSAR government are dominated by the income approach. Despite an increase in welfare expenses in the recent years, the issue on poverty remains unsolved. The subjective perception of well-being is crucial for the policymaking process, which goes beyond economic consideration (Maggino 2015b). Policymakers and the public sometimes ask why the people feel poor even after income enhancement through policy intervention. The result of this study demonstrates the crucial roles of deprivation and social exclusion, which not only has a direct effect but also imposes a mediating effect on subjective poverty. To cope with subjective poverty, additional effort besides income enhancement should be exerted to improve material deprivation and social exclusion. Policy examples include material support on poor households and providing social support to the socially excluded population.

The result in the age comparison model also contributes important findings for policy design and implementation. With the ageing population in cities all over the world, including Hong Kong (Chou and Lee 2018), the various paths among the various dimensions of poverty have proposed to focus in setting anti-poverty measures. Although much of the

previous research has suggested that poverty alleviation should not only focus on income (Bradshaw and Finch 2003; Siposné Nándori 2011), few of them have made suggestions based on age difference. The result suggests that material support is important for the elderly to alleviate subjective poverty, whilst social support and network are crucial for young adults. Targeted anti-poverty measures with consideration of age are essential for alleviating subjective poverty, especially under the ageing population in Hong Kong.

An operationalised analysis is required to measure the various dimensions of poverty. Although measurements of deprivation, social exclusion and subjective poverty have been suggested by different scholars in Hong Kong (Cheung et al. 2019; Chou and Lee 2018; Fong and Wong 2015; Saunders 2015), they are not yet acknowledged by the government. The anti-poverty policy should not be limited to providing money or financial support, but it also needs to include the material, social and subjective perspectives of poverty.

Several limitations exist in this study. Firstly, the research data are cross-sectional and have limited power for explaining the causality among variables. Longitudinal or qualitative research is required to study the casual mechanism among income, deprivation, social exclusion and subjective poverty. Secondly, some of the questions are self-reported, such as the measurement of social exclusion and subjective poverty. A validated scale of measurement can confirm the theoretical model. Thirdly, the survey has been conducted in Hong Kong. The generalisation of the results to other cities or countries must consider the cultural differences among societies.

Authors' Contribution Siu Ming Chan was responsible for literature search, data analysis, data interpretation and writing of this paper. Hung Wong was responsible for the overall research design, data collection of the data set. All authors read and approved the final manuscript.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval This study was approved by the Survey and Behavioral Research Ethics Committee of The Chinese University of Hong Kong in Jun 2012.

Appendix: 21 Items of Daily Necessities for Measuring Deprivation

1. Three meals a day.
2. Fresh fruit or vegetables every day.
3. Eat fresh/frozen poultry for special occasions (e.g. Chinese New Year).
4. One or two pieces of new clothes in a year.
5. Enough warm clothes for cold weather.
6. One set of decent clothes (e.g. for job interview/Chinese New Year celebration).
7. Able to consult private doctor when you are sick.
8. Able to consult Chinese medicine practitioner when you are sick and purchase prescribed medicines.
9. Can pay for spectacles if needed.

10. Have toilet inside a self-contained apartment, with no need to share with other residents.
11. A mobile phone or telephone landline.
12. A washing machine.
13. An air-conditioner.
14. A computer device with internet connection at home.
15. Able to replace worn out furniture.
16. Able to replace/repair broken electrical goods (e.g. refrigerator or washing machine).
17. Some amount of money to spend each week on yourself, not on your family.
18. Celebrations on special occasions (e.g. Chinese New Year).
19. A meal out with friends or family at least once a month.
20. Can offer a gift of money on occasion of wedding.
21. Give red pocket money (laisee) during Chinese New Year.

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