Social Science & Medicine 113 (2014) 59–67

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Does poverty reduce mental health? An instrumental variable analysis

Wulung Hanandita*, Gindo Tampubolon

Institute for Social Change, University of Manchester, Humanities Bridgeford Street Building 2F, Oxford Road, Manchester M13 9PL, United Kingdom

ARTICLE INFO

Article history:
Received 1 February 2014
Received in revised form
15 April 2014
Accepted 4 May 2014
Available online 6 May 2014

Keywords:
Poverty
Mental health
Indonesia
Weather
Precipitation anomaly
Instrumental variable
gmm
Control function

ABSTRACT

That poverty and mental health are negatively associated in developing countries is well known among epidemiologists. Whether the relationship is causal or associational, however, remains an open question. This paper aims to estimate the causal effect of poverty on mental health by exploiting a natural experiment induced by weather variability across 440 districts in Indonesia ($N = 577{,}548$). Precipitation anomaly in two climatological seasons is used as an instrument for poverty status, which is measured using per capita household consumption expenditure. Results of an instrumental variable estimation suggest that poverty causes poor mental health: halving one's consumption expenditure raises the probability of suffering mental illness by 0.06 point; in terms of elasticity, a 1% decrease in consumption brings about 0.62% more symptoms of common mental disorders. This poverty effect is approximately five times stronger than that obtained prior to instrumenting and is robust to alternative distributional assumption, model specification, sample stratification and estimation technique. An individual's mental health is also negatively correlated with district income inequality, suggesting that income distribution may have a significant influence upon mental health over and above the effect of poverty. The findings imply that mental health can be improved not only by influencing individuals' health knowledge and behaviour but also by implementing a more equitable economic policy.

1. Introduction

The negative association between poverty and mental health in developing countries has been increasingly documented. Research from various parts of the world generally shows that low levels of income, education, and assets as well as low social class are correlated with a higher probability of having common mental disorders (Lund et al., 2010). However, empirical evidence regarding the causal effect of the association remains scarce. Few studies have investigated the strength or the direction of causality between poverty and mental health in developing countries, although such study clearly benefits the formulation of public policy aimed at improving the health of the population. In encouraging study of this topic in the United States, Stowasser et al. (2011, p.2) note that ' … if causal links between wealth and health were confirmed, society would likely benefit from more universal access to health care and redistributive economic policy. Yet, if such causal links were rebutted, resources would be better spent on influencing health knowledge, preferences, and ultimately the behavior of individuals.' Considering both the growing burden of disease attributed to mental illness (IHME, 2013) and tightly constrained health budgets (Patel, 2007), it is important to understand whether poverty reduces mental health in developing countries.

The fact that poverty is negatively associated with mental health in low- and middle-income countries is hardly surprising, but to reach a convincing estimate of its causal effect is certainly not an easy task. Two-way or simultaneous causation may come into play (Smith, 1999), inflating the estimated effect and making it impossible for researchers looking at observational data to separate the effect of wealth on mental health (social causation hypothesis) from that of the reverse (social selection hypothesis). Secondly, the observed wealth–health relationship may be confounded by unobserved common causes that accidentally induce a spurious correlation. Genetic frailty, early childhood environment, family background and preference or taste for lifestyle may impact both an individual's ability to work (and hence accumulate wealth) and his or her susceptibility to mental illness (Stowasser et al., 2011). The study on the mental health effect of poverty may also suffer from what is generally known as the attenuation bias. More often than not, wealth is measured with error, as a noisy, low signal-to-noise ratio variable which could trivially result in a downward-biased parameter estimate (Cameron and Trivedi, 2005). Because these endogeneity problems might be working at the same time, it is

* Corresponding author. Institute for Social Change, University of Manchester, HBS Room 2.12A, Oxford Road, Manchester M13 9PL, United Kingdom.
E-mail address: wulung.hanandita@postgrad.manchester.ac.uk (W. Hanandita).

http://dx.doi.org/10.1016/j.socscimed.2014.05.005
0277-9536/

difficult to predict the magnitude and direction of the potential bias resulting from their presence *a priori*. In addition, the small number of population data available in developing countries remains a major obstacle for public health research.

The aim of this paper is therefore to address these issues. We apply instrumental variable and control function estimators to a large (N = 987,205), nationally representative dataset from Indonesia, namely the *Riset Kesehatan Dasar* (Riskesdas) 2007. We use seasonal precipitation anomaly, defined as the average deviation of monthly precipitation from its half-century (1951–2000) normals in all 440 *kabupaten* (districts) in Indonesia, as an instrument for poverty status. The identifying assumptions are that precipitation anomaly strongly predicts per capita household expenditure in a largely agricultural economy (relevance condition), is randomly assigned hence unrelated to any potential unobserved confounders (validity condition), and is exerting its influence upon mental health only through its effect on consumption expenditure (exclusion restriction). Conditional on these partially testable assumptions, the instrumental variable approach allows the analyst to isolate the exogenous variation of poverty, thus allowing for the derivation of a consistent estimate of the mental health effect of poverty in the presence of endogeneity. This study is one of the few population-based studies that attempts to look beyond the simple correlation between poverty and mental health in the context of low- and middle-income countries.

2. Poverty and mental health: association and causality

The two-way causation between poverty and mental health has been recognised for quite some time. The consensus among epidemiologists seems to suggest that the social causation hypothesis (wealth → health) is more plausible for explaining high-prevalence mental disorders such as depression and anxiety disorders, whilst the social selection hypothesis (health → wealth) is probably more relevant for low-prevalence mental disorders like schizophrenia (Goldberg and Morrison, 1963; Muntaner et al., 2004; Saraceno et al., 2005). Despite the intuitive logic behind this consensus (Adler and Ostrove, 1999; Dohrenwend et al., 1992), it is important to note that there have been only sparse empirical attempts to separate the competing causal directions (Muntaner et al., 2004).

Amid the paucity of population data equipped with reliable income and mental health measures, research in low- and middle-income countries have so far been able to investigate only the associational nature between wealth and mental health. Researchers often have to rely on small community or facility samples which are not only prone to the self-selection bias but also limit the application of multivariate statistical tools. The majority of community and facility studies conducted throughout the developing world suggests that poverty is positively associated with mental illness (Lund et al., 2010). Population-based studies (Dzator, 2012; Hamad et al., 2008; Myer et al., 2008) also support this finding, although they have not yet addressed the endogeneity issues; in the Indonesian setting in particular, Tampubolon and Hanandita (2014) recently confirmed the association using data from the Indonesia Family Life Survey 2007.

In contrast to the associational nature of studies conducted in developing countries, investigations of the causal effect of wealth on mental health began to appear as early as the mid-1990s in developed countries. Acknowledging the dual relationship between health and economic status (Smith, 1999) as well as the potential error in measuring income and the possibility of confounding due to unmeasured variables, Ettner (1996) took a set of variables (work experience, state-wide unemployment rate, parental education, spousal and spouse's parents' education, and spousal work experience) as instruments for individual income in the United States (N = 8000). She applied a two-stage instrumental variable estimator and found that reduced income leads to worse mental health (as indicated by higher Center for Epidemiologic Studies Depression Scale (CES-D) scores). The effect was four times stronger after instrumenting for income, although Meer et al. (2003) and Frijters et al. (2005) later cast doubt on the validity of her instrument set. Using the same identification strategy but with a different instrument set (age, inheritance, time in current job, mother's education, fraction of household income earned by the respondent, hours watching TV and rural-urban residence), Zimmerman and Katon (2005) did not detect any statistically significant effect of financial status (debt-to-asset ratio) on mental health (CES-D score). They admitted that the non-significance might be due to the poorly performing instrument set, although one could argue that the application of an instrumental variable estimator to a small sample (N = 2000) might well account for the finding.

Three points in the existing literature are worth noting. First, the negative association between poverty and mental health is generally found in both developed and developing countries, but there is a marked difference with respect to the weight of the evidence. Among the studies conducted in low- and middle-income countries, there has been a lack of the investigation into the causal relationship that has been performed in high-income countries. Perhaps the only study that has sought to do so is the one conducted by Chin (2010), which did not find a statistically significant income effect on mental health in Malawi (F = 10.34; N = 2400). Second, although the small-sample bias as well as the inefficiency properties of instrumental variable estimator have been well studied (Bound et al., 1995; Cameron and Trivedi, 2005), previous applications were mostly limited to small datasets; sometimes, in addition, they were carried out with a rather weak instrument set. Finally, instrumental variable analysis offers a way to address endogeneity problems, but due to the limited availability of data collected in developing countries, it is likely that researchers would not have the privilege of exploring instrument sets like those used in the two US studies reviewed above. This does *not* mean, however, that there is no way for researchers working with data from developing countries to implement the technique.

3. Weather variability as a source of exogenous variation

One promising instrument for individual income to be used in developing countries is the variability of rainfall over time and across places. It is not difficult to see that, in predominantly agriculture-dependent economies, the amount of precipitation in a given locality should be positively correlated with crop production, hence strongly determining individual income or consumption expenditure. Levine and Yang (2006, p.5) showed that 'higher local rainfall leads to higher rice output in Indonesian districts' which 'occurs contemporaneously (in the same calendar year), rather than with a lag', although the effect seems to be statistically significant only 'in districts that are not major cities'. This is also supported by Kishore et al. (2000), who looked at the impact of rainfall anomalies during the 1997–1998 El Niño event in Indonesia. In Africa, analysis conducted using Ugandan data has also resulted in similar findings: higher rainfall is correlated with higher production of coffee, bananas and peas as well as higher GDP (Björkman-Nyqvist, 2013). In fact, Miguel et al. (2004) found that positive rainfall shock is generally associated with positive GDP growth in 41 African countries. At the individual level, the positive correlation between rainfall shock and individual income has been confirmed in the Philippines (Yang and Choi, 2007), Malawi (Chin, 2010), Tanzania (Savage and Fichera, 2013) and Thailand (Paxson, 1992) as well. Studies consistently show that positive rainfall shock can be