Energy Policy 98 (2016) 557–564

Contents lists available at ScienceDirect

Energy Policy

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

Measuring energy poverty in Japan, 2004–2013

Shinichiro Okushima

Graduate School of Systems and Information Engineering, University of Tsukuba, 1-1-1, Ten-nodai, Tsukuba-Science-City, Ibaraki 305-8573, Japan

HIGHLIGHTS

- This study is the first evaluation of energy poverty in Japan by unique microdata.
- Focus on the period of the 2011 Great East Japan Earthquake and Fukushima accident.
- Shows the aggravation of energy poverty among lower-income and vulnerable households.
- Identifies factors accounting for the changes in energy poverty by decomposition.
- Major changes in the explanatory factors before and after the Fukushima accident.

ARTICLE INFO

Article history:
Received 19 March 2016
Received in revised form
3 September 2016
Accepted 3 September 2016

JEL:
D63
I32
Q49

Keywords:
Decomposition
Energy poverty
Fuel poverty
Great East Japan Earthquake
Measurement
Vulnerability

ABSTRACT

This paper first examines energy (or fuel) poverty in Japan from 2004 to 2013, especially around the time of the 2011 Great East Japan Earthquake (GEJE). To analyze the issue, the paper employs various poverty and vulnerability measures with the assistance of our unique dataset. The results indicate the aggravation of energy poverty among lower-income and vulnerable households during the past decade, resulting from both the escalation of energy prices and lowering of income. The analysis also employs a new decomposition technique and identifies the explanatory factors associated with the increase in energy poverty. These results suggest there were major changes in the forces driving the increase in energy poverty before and after the GEJE. After 2011, income alleviates energy poverty in Japan, with energy prices becoming the main driving factor.

1. Introduction

Japan faces an unprecedented situation concerning energy policy. After the Great East Japan Earthquake (GEJE) and consequent Fukushima nuclear power plant accident in March 2011, Japan's nuclear power plants have barely operated over several years, resulting in Japan becoming increasingly dependent on fossil fuel imports, especially liquid natural gas (LNG), for electricity generation, a development coinciding with the significant depreciation of the yen (see, e.g., METI, 2014b, 2015). The Japanese government has sought to promote renewable energy production after the incident at Fukushima, using measures such as a feed-in-tariff (FIT) scheme. Recently, this policy is starting to garner much attention regarding the possibility of a heavy burden on the shoulders of households in the near future (e.g., METI, 2016).[1]

Adding to this movement toward 'denuclearization', the government introduced a new tax on fossil fuels to address climate change, and raised Japan's consumption tax to better sustain the existing social security system. Combined, these developments have significantly increased energy costs in Japan, and, eventually, they will further increase the burden placed on households for energy use, despite recent falls in international energy prices.

Apart from these problems regarding energy costs, there is a compounding problem. The share of low-income households in

[1] The latest Strategic Energy Plan by the government, approved by the cabinet on April 2014, also expresses concern regarding the possible heavy burden on households in the future, mentioning, 'Renewable energy introduced based on the feed-in-tariff program is expected to increase and may become a cost-increasing factor for electricity users' (METI, 2014a).

E-mail address: okushima@sk.tsukuba.ac.jp

http://dx.doi.org/10.1016/j.enpol.2016.09.005
0301-4215/

Japan is steadily increasing because of population aging and its continuing sluggish economy (see, e.g., MHLW, 2012a, 2012b). Vulnerable households, e.g., single-parent-with-dependent-child(ren), elderly, and single-person households, are much more sensitive to rising living costs, including energy (Boardman, 2010; Hills, 2012). From this point of view, the problem of energy poverty – the theme of this study – could be a worrisome concern for Japan on a middle- to long-term basis. As discussed later, energy poverty means the condition of not being able to meet basic energy needs.

Against this background, this paper provides a historical analysis of the situation of energy poverty in Japan after the 2000s, especially around the time of the GEJE and the Fukushima nuclear power plant accident, and specifies the factors accounting for the increase in energy poverty in Japan in that period. Since there are few studies concerning the matter in Japan, this is the first to show empirically the certainty of energy poverty in Japan after the 2000s, using detailed microdata, particularly among lower-income and vulnerable households. To achieve that end, the paper employs vulnerability and poverty measures, and a new decomposition technique using our unique dataset.

The remainder of the paper is structured as follows. Section 2 discusses the concept of energy poverty. Section 3 explains the data used in the analysis. Section 4 discusses the results. The final section provides some concluding remarks.

2. Measuring energy poverty

Energy (or fuel) poverty, which is the main subject of this analysis, can be defined conceptually as the condition of lacking the resources necessary to meet basic energy needs, following the definition of food poverty given by Greer and Thorbecke (1986).[2] Bouzarovski et al. (2012) provide a similar definition in which energy poverty describes a condition wherein a household cannot access energy services at the home up to a socially and materially necessitated level. The ways of thinking about energy poverty can be split usually into one of two types. The first is 'availability', concerning the lack of access to modern types of energy (e.g., electricity), which is generally the focal point in a developing country context (e.g., IEA, 2010). The second is 'affordability', comprising various issues that prevent people from satisfying their basic energy needs. This is the typical focus of the energy poverty problem in developed countries like Japan. As for income poverty, the issue of energy poverty in developed countries has a 'relative' nature while that in developing countries has an 'absolute' nature (see, e.g., Kakwani and Silber, 2007). Even in developed countries, the problem of energy poverty can be a major social issue that potentially affects millions of households and individuals, and may account for significant hardships, negative health impacts, and additional carbon emissions (Hills, 2011, 2012).

To date, there has been rather less attention given to the energy poverty problem in developed countries than in developing countries (Boardman, 2010; Bouzarovski et al., 2012; Brunner et al., 2012). However, since Boardman's (1991) seminal work, the UK context has become the exception. Besides regular annual reports, there have been several reports on the issue of energy poverty by the UK government, among others. Of special note, the Hills fuel poverty review suggested a new approach to evaluating energy poverty (Hills, 2011, 2012). Subsequently, there is a recently growing literature on energy poverty in the UK, such as Boardman (2010), Chawla and Pollitt (2013), Moore (2012), and Waddams Price et al. (2012), on other European Union (EU) countries such as Austria (Brunner et al., 2012), Germany (Heindl and Schuessler, 2015; Schuessler, 2014), and Spain (Phimister et al., 2015), and as a comparative study across the EU (Bouzarovski et al., 2012; Thomson and Snell, 2013).

On poverty measurement, evaluating poverty comprises these two steps (Sen, 1976, 1979). The first step is 'identification' – that is, who are the poor? – and the second step is 'aggregation' – how are the poverty characteristics of different people to be combined into an aggregate measure? Identification involves the practical definition of certain given standards – the poverty line – that might separate 'the poor' from 'those that are not poor'.

Setting the poverty line is a troublesome but necessary task. In terms of energy poverty, energy budget shares often serve as standards (see, e.g., Pachauri et al., 2004). Boardman (1991) – the de facto founder of energy poverty measurement – suggested the first quantified definition of energy poverty for the UK: households are in energy poverty when they are unable 'to have adequate energy services for 10% of income'. The UK government officially uses this approach; one of their poverty measures – the so-called '10% indicator' – defines a household in fuel poverty as one that needs to spend more than 10% of its income on fuel costs (DECC, 2010).[3] The fuel costs include energy consumption for space heating, water heating, lights and appliances, and cooking, but exclude the energy for driving cars.

In terms of 'aggregation', this 10% indicator is a kind of headcount ratio, which identifies the extent of poverty in a society using the proportion of the 'poor' in the total population. The headcount ratio is popular and widely used as an income poverty measure.[4] We employ a variant of this measure in our analysis for generality and simplicity, as discussed later in detail.

Energy poverty and general income poverty are closely related; hence, researchers have often not treated energy poverty as an independent problem. However, there is good reason to do so. In the field of poverty measurement, there is a broad consensus that deprivation is multidimensional and therefore looking only at income poverty is insufficient (Atkinson, 2003; Bourguignon and Chakravarty, 2003). The concept of energy poverty perceives poverty not just as the lowness of income, but also as the inability to meet some elementary and essential needs (Sen, 1997).[5] Maintaining an adequate level of warmth at home is a clear example of such basic needs. Many studies empirically show that energy poverty is a distinct problem not subsumed into general income poverty (see, e.g., Pachauri et al., 2004; Hills, 2011, 2012; Phimister et al., 2015). For this reason, Boardman (2010, p. 21) appropriately declares that currently, 'fuel poverty is politically accepted as a real problem'.

3. Data

We measure energy poverty in Japan using the unique microdata on household income, expenditure, and characteristics in a sample of about 50,000 households covering all of Japan. The

[2] For simplicity, we regard 'energy poverty' as synonymous with 'fuel poverty', although other researchers, e.g., Li et al. (2014), consider that the former has a broader meaning than the latter, and so require a strict distinction between the two terms. In our view, the term 'energy poverty' is more suitable for the context of Japan, as well as Germany, because the problem in both countries is largely affected by higher expenses for electricity (Schuessler, 2014).

[3] Along with this definition, the UK government uses an alternative definition being the Low Income High Cost (LIHC) indicator. See, e.g., Hills (2012) for details. The LIHC indicator is nevertheless being criticized by some researchers. For example, Heindl and Schuessler (2015) prove that the LIHC indicator has counter-intuitive dynamic properties, which may cause false policy implications.

[4] That said, the headcount ratio has some well-known problems. One is that it pays no attention to the 'depth' of poverty and thus evaluates the marginally poor the same as the miserably poor. These drawbacks also generally apply to the 10% indicator. For more general information on poverty measures, see Sen (1997) and Haughton and Khandker (2009).

[5] In the context of 'specific egalitarianism' by Tobin (1970), we need to consider the distribution of 'certain specific scarce commodities' including basic necessities like food, energy, housing, etc., as well as the distribution of income.