



Measuring regional resilience towards fossil fuel supply constraints. Adaptability and vulnerability in socio-ecological Transformations-the case of Austria



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H I G H L I G H T S

- Mean resilience of Austrian municipalities towards peak oil is moderate.
- The difference between resilience values of municipalities is small.
- Significant differences in resilience between spatial types exist.
- Higher resilience is displayed by less urbanized types.
- Policies should target resilience components with the lowest values first.

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Resilience has become a prominent concept to understand system vulnerabilities and flexible ways of adapting to crises. Recently, it gained importance in discussions about the possible peak in oil production (peak oil) and its consequences, which might affect economic performance, social well-being and political stability, and thus also the energy transition to a low-carbon economy. The paper presents a new way of measuring resilience as absolute resilience related to a best practice-model of a resilient society. The resilience model is grounded in explicit theoretical assumptions. All indicators are justified by theoretical and empirical arguments. We present a case study of Austrian municipalities and broader-scale spatial types, which were defined according to their degree of urbanization. The mean resilience of Austrian municipalities is moderate, the difference between resilience values of municipalities is small. Significant differences between spatial types exist. Higher resilience is displayed by less urbanized types due to a higher share of agricultural activities and a more favorable level of GDP per capita. Austria has considerable latitude to improve resilience. Corresponding policies should target resilience components

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with the lowest values first. A sole focus on regionalization is not recommended. These conclusions are applicable to OECD countries in general.

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1. Introduction

Resilience has become a major concept in policy and scientific debates. In the context relevant to this paper, resilience, in general terms, denotes the ability of social systems to survive and cope with stress, disturbance or adversity by means of adaptation (e. g. Norris et al., 2008; Wilson, 2012). The increasing importance of the resilience concept is indicated by its growing use in the literature. From 1995 to 2011, the number of articles that mention resilience as a keyword had a tenfold increase, while within the same period scientific articles per year only doubled (Matzenberger, 2013). The resilience discourse seems to mark a significant shift in societal debates, as its upswing coincides with a range of intertwined dynamics that are now often discussed as multiple economic, political, ecological and social crises (Exner et al., 2013).

Indeed, fears of further destabilization of climate, energy security, politics, economy or food supply are voiced regularly, as illustrated by the latest Global Risks Report (World Economic Forum/WEF, 2013). The report mentions “resilience” 28 times, references excluded, while sustainability appears only 10 times in the text. This is just anecdotal, though notable evidence of a shift in discourse from sustainability to resilience. While sustainability is a concept that focused on win-win-situations and a positive vision of increasing living standards, resilience is a paradigm that instead puts at the center the notion of survival and the threat of multiple catastrophes (Exner, 2013a). Thus, resilience as a discourse displays ambivalent characteristics. This explains that, beyond the usually unquestioned use in policy papers, the scientific assessment of the resilience discourse ranges between a very critical stance to appreciation. The critical position interprets resilience mainly as a tool for social control by way of leading certain agents to adapt to socially created crises, instead of pushing for remedies by reforming political and economic structures (Cooper and Walker, 2011, cf. special issue of Planning, Practice & Research, O'Hare and White, 2013). In a more positive view, resilience is seen as an interesting extension of social science approaches. It thus might improve the understanding of development challenges that communities have faced in the past and will do so in the future (Norris et al., 2008; Wilson, 2012). The most prominent strand of debate that has considerably shaped the notion of resilience is promoted by organizations such as the Resilience Alliance. Resilience here is seen as the core concept of a socio-ecological systems perspective. Accordingly, “resilience thinking” (Walker and Salt, 2006; see also Gunderson and Holling, 2001) is promoted, which is understood as a new scientific and political paradigm.

We will take up the issue of conceptualizing resilience in the next chapter, and will draw conclusions relating to our operationalization and measurement of resilience in the last chapter. First we want to focus our investigation on a particular type of challenge that is one of the most often cited in relation to resilience thinking, i. e., the impeding scarcity of fossil fuels, especially of oil. Though our study does not depend on the credibility of any specific view on the availability and price of oil, we take the peak oil theory as the starting point for a set of scenarios to investigate which factors might indicate resilience on a regional level, when such a challenge is assumed (see special issue of Philosophical Transactions of the Royal Society A, 2014, No. 372 for an update on this debate).

This approach, however, is not merely a thought experiment of

theoretical value, but is linked to broadening policy debates on resilience in the face of threats to energy supply, which are often attributed to political constraints rather than only objective geological facts. Yet, while the specific kind of shock or stressor is often not explicit in official political resilience papers such as in the UK (Cabinet Office, 2012), the peak oil theory informs a wide range of political and scientific resilience concepts. The peak oil theory, not least, frames the social movement of Transition Towns, that has spread particularly in the Anglo-Saxon world, and centers around the concept of resilience (Hopkins, 2011).

The particular view on the causes of supply shocks and energy stress has an impact on the indicators relevant for resilience, because the severity of such a shock for society depends on the concrete circumstances. Since fossil fuels, and oil in particular, are such important commodities for modern societies, a supply shock or restriction of any kind will have considerable repercussions. However, a limited shock in availability or a temporarily forced reduction in oil use is different from a more far-reaching supply shock that is embedded in a general downturn of global oil production. First of all, the strategic perspectives of agents will differ according to whether the shock or stressor is temporary or not. This will lead to different forms of adaptation and, prospectively, of preparation in view of such risks. Secondly, and in relation with the first aspect, a temporary reduction of a vital resource, be it severe or not, does not put into question the basic viability of infrastructure, expectations and norms that are coupled to the qualities of the resource. To the contrary, a permanent and general downturn of the supply of a vital resource will forcibly change infrastructure, expectations and norms of all agents relevant in a society. Thirdly, such a general downturn will affect more or less severely the abilities of a society to change its resource base and the infrastructure, expectations and norms that relate to it.

While a temporary shock or stress in the supply of a vital resource can be handled by conventional means of crisis and disaster management, a permanent reduction in supply, whether or not it takes on the form of a shock, cannot be handled by any conventional means, but points towards the necessity of a socio-ecological transformation, i. e., to transform the relations of society to nature, thus including the economy. Such a transformation will benefit from crisis and disaster management capacities since it will continue to rely on resources that might be affected by shocks and stressors, but cannot be reduced to it. Thus, a political constraint on oil supply, which will rather manifest itself as a sudden shock, will in general not have the same scope, temporality and modality as a long-term change in supply due to the geological peak oil – irrespective of possible short-term shocks, which can for instance be triggered by political supply constraints in addition to the long-term trend.

These general remarks can be put in relation with the specific issues the peak oil theory is likely to raise. Above all, a mere technical understanding of resilience as can be found in more conventional approaches to energy security, is not adequate if the whole web of social relations is put under stress by a permanent and increasingly narrow constraint on a resource supply, as the peak oil theory implies. The technological system of a society develops in relation to specific infrastructure, expectations and norms, and thus cannot be analyzed in separation from the socio-economic system. Consequently, the notion of resilience takes on a holistic character, and one has to ask for the conditions of a

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