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Tradable earthquake certificates

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ABSTRACT

This article presents a market-based idea to compensate for earthquake damage caused by the extraction of natural gas and applies it to the case of Groningen in the Netherlands. Earthquake certificates give homeowners a right to yearly compensation for both property damage and degradation of living space. The level of compensation is a percentage of the joint annual gas revenues of the Dutch government, Shell and ExxonMobil and may vary based on the intensity of earthquakes in the previous year. These certificates are tradable within the Netherlands to stimulate the illiquid housing market in the province of Groningen. Although frequent earthquakes have decreased property values in this province, a seller will still receive an efficient price for his house because he can also sell his earthquake certificate. A buyer of this certificate receives an annual stream of income and may use these revenues, for instance, to repay his mortgage or to maintain his house at reduced tax levels. However, multiple implementation problems make the viability of this market-based instrument difficult if not questionable, such as the political decision on the aforementioned level of revenue sharing and the behavioral complexity of the options that tradable earthquake certificates offer to homeowners.

1. Introduction

In 1959 the biggest onshore gas field in the world was discovered in the province of Groningen in the Netherlands. Since 1991 this province suffers from earthquakes caused by the extraction of natural gas by the *Nederlandse Aardolie Maatschappij* (NAM), a joint venture of Shell and ExxonMobil. More than one thousand earthquakes have been registered in this region since the nineties, thus far with a maximum magnitude of 3.6 on the Richter scale reached in 2012 but with a relatively strong impact due to the shallow geological location of the field (Van Thienen-Visser and Breunese, 2015). While the city of Groningen has not been much affected, there has been a significant impact on the many small villages that surround this city. The earthquakes not only cause damage to homes but also lead to reduced enjoyment of the environment and create a conflict of interests between the inhabitants of Groningen, NAM and the rest of the Netherlands. NAM and the remainder of the inhabitants of the Netherlands benefit from gas extraction, while the inhabitants of the province of Groningen bear the burden of the damage, in the form of cracks in the walls of their houses, perceived unsafety due to the risk that buildings may collapse and a faltering regional housing market (Van der Voort and Vanclay, 2015).

Earthquakes caused by natural gas extraction can be seen as externalities: damage to third parties without or with incomplete compensation (e.g. Koster and Van Ommeren, 2015; Couwenberg, O, 2015). According to economic theory (e.g. Pigou, 1920; Coase, 1960), externalities should be fully internalized by those who cause them, which in this case would be NAM. However, on October 5, 2016, the Groningen District Court ruled that NAM shares this liability with state-owned company *Energiebeheer Nederland* (EBN), which implies that the Dutch government is also indirectly responsible for the earthquake damage. If complete internalization does not occur, the welfare of people in Groningen decreases as a result of a commercial activity with harmful side effects. This decrease in welfare should be prevented or repaired. The question is how.

This article adds to the sparse legal and economic literature on gas-induced seismicity (e.g. Ehrman, 2017; Holz et al., 2017) by constructing a market-based policy innovation. It first explains that the current set of policy instruments does not fully cover the earthquake damage and that it also entails significant transaction costs: after each earthquake the inhabitants of Groningen have to ask loss adjusters to prepare a damage report before they receive compensation (Section 2). Building upon and expanding Dulleman and Woerdman (2017), the

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[1] Both authors own a house in the province of Groningen, the Netherlands, where earthquakes occur due to the extraction of natural gas.

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article then considers a market-based alternative: tradable earthquake certificates (Section 3).[2] These certificates give homeowners in the earthquake area of Groningen a (yearly) entitlement to a share of the joint annual gas revenues of the Dutch government and NAM plus a variable payment based on the intensity of the earthquakes in the previous year. This entitlement can also be sold, for example to people who decide to move to Groningen, which stimulates the housing market. Because people have different attitudes to risk, they will respond differently to the options that the tradable earthquake certificates provide (Section 4). The options that are created do confront the people of Groningen with new transaction costs, but their benefit consists of a continuous stream of compensation that makes the contested damage reports redundant and also makes it possible for people to move to a different house, even outside the earthquake area. This article continues by discussing some of the many implementation problems of this market-based instrument, which would render its adoption difficult if not questionable (Section 5). Finally, a conclusion is presented (Section 6).

2. Current earthquake policy

The (*Napoleonic*) Mining Act of 1810 entered into force in the Netherlands during the French occupancy and applied until 2003 (Roggenkamp, 2007). This Act could be seen as to give the Dutch State (hence not the landowner) property rights over any minerals in the ground as it required mining companies to obtain a production concession from the Crown and entitled the government to a percentage of those companies' revenues. In 1963 NAM obtained a perpetual concession to exploit the Groningen gas field and under a separate cooperation agreement the government was entitled to 50% of the gas revenues (10% directly and 40% via EBN). However, the Dutch government currently receives about 90% of the total annual gas revenues and NAM the remaining 10% (primarily due to an additional private contract concluded in the seventies, referred to as *Meeropbrengst Regeling Groningen*) (Van der Hoeven, 2008).

Gas-induced earthquakes occur since the nineties but they have recently grown in number and magnitude (e.g. Van Thienen-Visser and Breunese, 2015). NAM has a duty of care under Article 33 of the new Mining Act of 2003 and is strictly liable for the earthquake damage based on Article 6:177 of the Dutch Civil Code. Currently the government of the Netherlands takes action against the earthquakes caused by gas extraction by direct regulation limiting NAM's ability to extract gas, especially around the epicenter of the municipality of Loppersum. Gas production was capped at 42.5 billion cubic meters in 2014, 27 billion cubic meters in 2016 and 21.6 billion cubic meters in 2017, with the government's intention (expressed in 2018) of setting the cap at 12 billion cubic meters 'as soon as possible'.[3] NAM itself finances the repair of cracks in the walls of houses: loss adjusters, in the past also paid by NAM but recently paid by the Ministry of Economic Affairs, have to determine whether those cracks were caused by (1) earthquakes as a result of (2) mining activities (double causality). In addition to compensating homeowners for proven damage, NAM also gave 4000 euros to every household where such property damage had been established. Those 4000 euros could only be spent on energy saving measures, such as solar panels and home insulation. This subsidy ended by February 1, 2016, but the Dutch Parliament restored the subsidy on April 3, 2017. In addition, if a homeowner in the province of Groningen succeeds in selling his house, NAM compensates for the reduction in price as a result of the earthquakes. Moreover, the weakest houses in the mining area of Groningen will be made earthquake-resistant, which is financed by the government. Private engineers commissioned by an independent executive agency (*Centrum Veilig Wonen*) apply public safety standards to determine which houses are relatively weak, while a public body (*Nationaal Coördinator Groningen*) prioritizes where and when the inspections will take place (NCG, 2017a).

From an economic perspective, current earthquake policy in the Netherlands is inadequate because homeowners in the province of Groningen are not fully compensated for mining damage. First, only the visible damage is restored: there may be hidden damage such as cracks in beams behind plasterboards or under floors. Moreover, after every earthquake that created damage, inhabitants need loss adjusters to prepare damage reports, which implies significant transaction costs. Second, the one-off compensation of 4000 euros for energy saving is only for households in Groningen whose property damage has been recognized (by NAM or the government) and whose damage is at least 1000 euros; people in the earthquake area of Groningen without cracks in their walls do not have access to this money. Third, houses have become less valuable both for homeowners with and without property damage, albeit to a different degree, as a result of the mining activities. This drop in house prices usually is much greater than the one-size-fits-all amount of 4000 euros (De Kam, 2016), although different calculation methods lead to different (also lower) estimates of this price fall (Bosker et al., 2016; Koster and Van Ommeren, 2015). NAM does provide compensation for the lower value of the house, but only for those homeowners who have been able to sell the house, which may be difficult and sometimes even impossible.[4] Fourth, it is expected that both the extraction of natural gas and the earthquakes will continue for years, which will lead to a certain degree of unsafety and reduced enjoyment of the environment also in the future. It can therefore be expected that the liquidity of the housing market in the province of Groningen will remain impaired for many years to come, although recently this housing market has shown slight improvement thanks to a recovering economy (Boumeester and Lamain, 2017). Finally, the weakest houses in Groningen will be made earthquake-resistant, starting in the municipality of Loppersum, but progress has been very slow.[5]

Homeowners have had some success obtaining additional compensation through litigation. On September 2, 2015, the Groningen District Court (*Rechtbank Noord-Nederland*) ruled that NAM has to compensate for property devaluation, even in the absence of a sale prospect, in the earthquake area. NAM filed an appeal against this verdict but the company was not successful: on January 23, 2018, a Dutch Court of Appeal (*Gerechtshof Arnhem-Leeuwarden*) upheld the original judgement. On October 5, 2016, the Groningen District Court ruled that both NAM and *Energiebeheer Nederland* (EBN), whose shares are fully owned by the Dutch State, are (strictly) liable for the earthquake damage caused by mining activities in the country. The court reasoned that EBN (hence the State) is a 40% owner of the gas wholesale company

[2] Our idea of tradable earthquake certificates was first published in Dutch, in the main trade journal for economists in the Netherlands called *Economisch Statistische Berichten* (Dulleman and Woerdman, 2017). The present article in English builds upon and considerably expands and nuances the aforementioned short paper in Dutch.

[3] https://www.rijksoverheid.nl/onderwerpen/gaswinning-in-groningen/inhoud/minder-gaswinning-groningen.

[4] One or two real estate agents assess the value loss due to the earthquakes on a case-by-case basis, which usually results in compensation by NAM between 1% and 5% of the sales price (http://www.nam.nl/feiten-en-cijfers/voortgang-waarderegeling.html). Based on some of the literature (e.g. De Kam, 2016), one could doubt whether these percentages cover the entire value loss of the real estate. As a next step, the government started a pilot in 2016 - on the basis of 10 million euro paid by NAM- to buy up damaged houses that do not sell on the housing market from owners who suffer from socio-economic problems (e.g. old and sick homeowners who have obtained a medical indication to be hospitalized in a nursing home) only in the central part of the earthquake area (https://www.nationaalcoordinatorgroningen.nl/themas/k/koopinstrument). In 2016 there were 179 applications and by the end of 2017 NAM had bought 36 homes.

[5] Engineers calculated that about 90.000 of the 241.300 buildings in the earthquake area of Groningen need to be made earthquake-resistant, which is equal to 152.000 addresses (Van Rossum, 2015: 10). Early 2015 NAM said that 15.000 homes will have been inspected by the end of that year and that 8.000 homes will have been made safer by 2017 (EIF, 2015). In the epicenter of the earthquake area, where about 22.000 buildings can be found, a total of 4.567 inspections had been carried out by the end of 2017 and only 571 houses had been made earthquake-resistant (NCG, 2017b: 14).