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Landfill taxes and Enhanced Waste Management: Combining valuable practices with respect to future waste streams

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ABSTRACT

Both landfill taxes and Enhanced Waste Management (EWM) practices can mitigate the scarcity issue of landfill capacity by respectively reducing landfilled waste volumes and valorising future waste streams. However, high landfill taxes might erode incentives for EWM, even though EWM creates value by valorising waste. Concentrating on Flanders (Belgium), the paper applies dynamic optimisation modelling techniques to analyse how landfill taxation and EWM can reinforce each other and how taxation schemes can be adjusted in order to foster sustainable and welfare maximising ways of processing future waste streams. Based on the Flemish simulation results, insights are offered that are generally applicable in international waste and resource management policy. As shown, the optimal Flemish landfill tax that optimises welfare in the no EWM scenario is higher than the one in the EWM scenario (93 against €50/ton). This difference should create incentives for applying EWM and is driven by the positive external effects that are generated by EWM practices. In Flanders, as the current landfill tax is slightly lower than these optimal levels, the choice that can be made is to further increase taxation levels or show complete commitment to EWM. A first generally applicable insight that was found points to the fact that it is not necessarily the case that the higher the landfill tax, the more effective waste management improvements can be realised. Other insights are about providing sufficient incentives for applying EMW practices and formulating appropriate pleas in support of technological development. By these insights, this paper should provide relevant information that can assist in triggering the transition towards a resource-efficient, circular economy in Europe.

1. Introduction

In the 1960s, as a result of the rise of mass production and growing consumption that led to a steep incline in waste generation, landfills were popping up everywhere. Starting in the 1970s however, public attitude towards waste started to change as people became more sensitive to the negative environmental externalities caused by landfilling and the valuable space it occupies (Strasser, 1999; Van Passel et al., 2013; Walsh, 2002). In combination with the emergence of what is nowadays called the NIMBY (Not In My BackYard) syndrome (Levinson, 1999), policy makers imposed restrictions on the expansion of landfills which caused the remaining landfill capacity to be regarded as a non-renewable, scarce resource.

A first well-known concept to internalise external effects such as noise, odour, groundwater pollution and air emissions, is landfill taxation. Flanders (Belgium) has a rich history of complicated landfill and incineration tax systems which have a double purpose. First, they want to reduce the amount of waste that is landfilled and incinerated. Secondly, they want to make environmentally friendly handling of waste and recycling of materials more attractive (Bartelings et al., 2005). The Flemish landfill tax was introduced in 1990 at a standard rate of almost €10/ton albeit with some differentiation in function of the type of waste. For combustible waste for example, the category with the highest tax rates, the nominal tax level rose from €15/ton to €50/ton between 1993 and 1997. During the following 9 years, this tax increased only moderately and in 2007 it was raised from €64/ton to €75/ton (Bartelings et al., 2005; Weissenbach, 2007). From July 2015 onwards, all environmental taxes were multiplied by a factor of 1.5. According to the permitted types of waste streams, Flemish landfills belong to one or more of three different categories of

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landfills. In this paper, as hazardous and inert waste streams are small and less suitable for valorisation, we focus on category two landfills that contain inorganic non-hazardous industrial waste, household waste and industrial waste that is comparable to household waste. For this type of landfills, taking into account their waste composition, the increase in tax level results in an average landfill tax rate of €42/ton (including municipal surcharges). This figure was calculated based on a report of the Flemish public waste agency (OVAM, 2015b).

Comparing Flanders with other European countries, we find a wide variety of diverging taxation rates with Flanders belonging to those regions that apply the highest rates. As Europe is moving towards an open market for waste management, calls are made to harmonise waste policies across borders (Dubois, 2013a, 2013b). Considering that several front runners in waste management, including Flanders, have high landfill taxes, the arguments for high and harmonised landfill taxes in Europe seem strong. In addition, high landfill taxes directly target the lowest level of the Waste Hierarchy by raising the cost of landfilling such that other waste treatment methods become more attractive (Calcott and Walls, 2005; Dinan, 1993; IVM, 2005; Watkins et al., 2012). Although there is some evidence on the effectiveness of a landfill tax to reduce landfilling (Monier et al., 2011; OECD, 2012; Oosterhuis et al., 2009), not all economic scholars are convinced that high landfill taxes are justified (Dijkgraaf and Vollebergh, 2004; Dubois, 2014; Eshet and Shechter, 2005; Kinnaman, 2006). These scholars argue that external costs of modern sanitary landfills with methane extraction are rather low (€5–30/ton). A Pigovian tax would therefore be positive, but typically lower than current landfill tax rates in Belgium or in the UK (CEWEP, 2012). The question then arises how to reconcile the economic perspective with policy discourses.

Being part of the bigger picture of sustainable development, Sustainable Materials Management (SMM) forms only one of several existing terminologies used for an approach to promote sustainable material use. By promoting this, SMM is closely linked to the flagship initiative on resource-efficiency in the EU 2020 strategy, which aims to create a framework for policies to support the shift towards a resource-efficient and low-carbon economy. As resource efficiency implies that natural resources, raw materials, products and also waste are used as efficiently and as environmentally responsible as possible, the link with waste management and waste valorisation is obvious. Speaking about waste and resources, another relevant concept that deserves adequate attention is the circular economy package. In a quest for ways to facilitate the move towards a more circular economy, this package establishes a clear and ambitious long-term vision to increase recycling, reduce landfilling and address obstacles in terms of improvement of waste management. Two concepts that can be imbedded into the framework of a transition towards a more mature SMM and a resource-efficient Europe, are Enhanced Landfill Mining (ELFM) and Enhanced Waste Management (EWM) (Jones et al., 2010; Wante, 2010). EWM consists of two pillars, of which the first one is built around the idea that future landfills become temporary storage places or future mines for those materials that cannot be directly recycled with existing technologies or show a clear potential to be recycled in a more effective way in the near future. The second pillar is actually nothing more than the ELFM concept itself. With regard to this second ELFM pillar, it was defined as "the safe conditioning, excavation and integrated valorisation of (historic and/or future) landfilled waste streams as both materials (Waste-to-Material, WtM) and energy (Waste-to-Energy, WtE), using innovative transformation technologies and respecting the most stringent social and ecological criteria" (Danthurebandara et al., 2015a; Hermann et al., 2014; Jones et al., 2013). In Europe, the first steps towards the development of these concepts were taken when excavation and recovery of landfilled materials emerged as a promising strategy to solve the increasing shortage of landfill capacity. At the same time, benefits such as the revenues from recovered materials and reclaimed land could be obtained and the growing need for remediation of old landfills and removal of deposits hampering urban development increased interest in landfill mining as well (European Commission, 2011; Krook et al., 2012; Krook and Baas, 2013). In 2008, a trans disciplinary consortium of experts was established in Flanders in order to develop a general ELFM approach and to integrate landfilling in a radically more sustainable waste management practice called EWM. The fact that the ELFM and EWM concepts have only been under development since 2008 underlines their innovative nature and results in an academic literature review that is growing but rather limited. In 2013, a Flemish study showed that technology, regulation and markets have a clear impact on the economic potential of landfill mining and that this potential is positive for Flanders (Van Passel et al., 2013).

In the current paper, as we focus on future incoming waste streams, the focus lies on the first pillar of EWM. Therefore, the remainder of this paper will speak of EWM when referring to waste management. Based on foregoing descriptions, it can be seen that it may be difficult to find a perfect balance between imposing landfill taxes and defining the taxation level on one hand and applying EWM practices on the other. After all, as landfill taxes have the effect of mitigating the scarcity issue of landfill capacity by reducing landfilled waste volumes, less material is made available for valorisation and the application of EWM practices also becomes less essential from a capacity point of view. This has the effect that no extra incentive is given for valorising future incoming waste streams. Similar reasoning can also be applied the other way around. As EWM practices substantially reduce the volumes of permanently landfilled waste, remaining free capacity will be practically inexhaustible. This has the effect that landfill taxes are made redundant from a depletion postponing point of view. Only their use in terms of internalising external effects as a Pigovian tax remains in that case partially valid. In the remainder of this paper, technological data from a Flemish case study are being used and generalised to the Flemish situation (Danthurebandara et al., 2015a,b,c). These data are shown below in Fig. 1 and Appendix A, and will be discussed in more detail in chapter 2. By using dynamic optimisation techniques, it will be analysed how landfill taxation and EWM can reinforce each other in practice and how taxation schemes can be adjusted in order to foster sustainable and welfare maximising ways of processing future waste streams. As the paper identifies these sustainable ways of processing waste, we believe it can provide generally applicable and policy relevant insights about how to develop and bring into practice sustainable waste management practices. Furthermore, the paper can serve as a theoretical background to the concept of the circular economy, which would otherwise risk to remain a simple word without precise meanings. This theoretical background should provide policy support and ensure that the concept of the circular economy is put into practice by triggering a resource-efficient and low-carbon economy.

The next section discusses the different elements of the dynamic optimisation model. Based on this theoretical underpinning, different scenarios are simulated in the third section. These simulations will focus on category two landfills, as this is the most representative type of landfill where those streams belong that lend themselves best to being valorised. Finally, the article concludes with a discussion and an overview of the most important findings.