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Environmental performance and firm strategies in the dutch automotive sector

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ABSTRACT

This paper explores how automotive firms positioned their portfolio since the introduction of energy labels for cars. Using data on product characteristics of automobiles offered on the Dutch market over the period 2001–2010, we analyse how car manufacturers' product portfolios have changed. Portfolio changes by the top 15 car manufacturers in the Netherlands are analysed. Though the analysis shows that manufacturers move in a similar direction towards a portfolio with cleaner vehicles, the different manufacturers have chosen very different portfolio management strategies. In particular the manufacturers that followed a portfolio strategy of relatively large propulsion efficiency improvements without large weight changes increased their sales numbers compared to other car manufacturers. Manufacturers lagging behind with CO_2 emission reduction performed weak in terms of sales.

1. Introduction

Both in the EU and in the US energy-labelling or eco-labelling schemes are an increasingly popular instrument to stimulate the demand for and supply of more environmentally friendly goods (EPA, 2011; EU Directive, 1992/75/EC; EU Directive, 1999/94/EC). The main idea of energy-labelling schemes is that these labels will increase consumer demand for eco-friendly goods and, as a consequence, stimulate firms to produce and supply more of those goods. Firms can achieve a cleaner product portfolio by reducing the environmental impact of existing products, through adding products with low environmental impact to their portfolio, and/or by discontinuing the supply of their most polluting products. It has, however, been difficult to assess whether energy-labelling schemes realise their intended outcomes and in several studies no clear environmental effect of energy-labelling was found (AEA, 2011; OECD, 1997; Teisl et al., 2002).

Most studies focus on the demand side rather than on the supply side effects of emission reduction incentives such as energy labels and carbon taxes, as ultimately the behaviour of consumers determines the effectiveness of such incentives, e.g. (Noblet et al., 2006; Rogan et al., 2011; Small, 2012; Beck et al., 2013; Van der Vooren and Alkemade, 2012). An exception is Jamalpuria (2012), who demonstrates that from a social welfare perspective it is desirable that governments provide tax incentives to firms to encourage the use of energy labels. Thus by attaching financial incentives to the labels, policymakers have an additional influence on firm and consumer behaviour. For policymakers it is also important to understand the effects of these incentives as it is an intermediate step in realising the intended benefits of energy-labelling schemes. The extent to which firms adapt their product portfolios should be taken into account when assessing the effects of energy labels and other emission reduction incentives. Firms decide on product portfolio decisions not only in relation to consumers, but also with

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respect to the (expected) strategies of other firms, and other incentives provided by EU and national regulations. These product portfolio decisions of firms are the topic of the current paper.

Energy labels provide consumers with information about the environmental performance of a product (Gallastegui, 2002). Energy labels thereby introduce an additional product characteristic that consumers can take into account in their purchase decision (Truffer et al., 2001). Consumers differ in their preferences for environmentally friendly products, but environmental characteristics have generally gained importance in recent years (Banerjee and Solomon, 2003). For firms, environmental performance thus provide an additional source of consumer heterogeneity. Firms can exploit this heterogeneity through strategic product positioning (Anderson et al., 1992). For firms, the introduction of energy labels thus creates opportunities for repositioning. The results of a firm's positioning strategy therefor strongly depend on whether competitors choose similar or different strategies. The aim of this paper is to investigate firms' behaviour since the introduction of energy-labelling schemes. Our application domain is the automotive sector. The car market is one of the largest for durable goods and is a large contributor to the emissions of greenhouse gasses (IPCC, 2011). In 2001 the EU implemented a labelling scheme for cars (EU Directive, 1999/94/EC), and more recently the US adopted this policy instrument (EPA, 2011). The main research question of the paper is therefore:

How have the portfolios of car manufacturers changed with the introduction of energy labels?

To study how the introduction of a new characteristic affects changes in product portfolios we make use of evolutionary theories of economic change (Nelson and Winter, 1982). Evolutionary theories describe that firms need to adapt to changes in the selection environment in order to survive (Metcalfe, 1994; Nelson and Winter, 1982; Silverberg et al., 1988). The introduction of a new characteristic such as energy labels is a typical situation of a change in the selection environment. In particular theoretical extensions of Lancaster's characteristics approach (Lancaster, 2002) by Saviotti and Pyka (1995, 2008a,b) and Saviotti and Metcalfe (1984) on products clouds and characteristics contribute to insights into portfolio change. Portfolio dynamics can be observed empirically when the cloud of products change position and shape, showing differentiation or specialisation strategies of firms and changes in the intensity of competition.

The empirical base for the analysis is a unique database consisting of all 41,000 car models (versions) that were offered on the Dutch car market between 2001 and 2010. The database contains information on performance characteristics of the car models, including energy labels and CO_2 emissions but also characteristics describing fuel type, weight and type of car (for example, hatchback or sedan). Using this database we determine the product portfolio strategies regarding three strongly related characteristics: the CO_2 emissions, the weight and the list price of the cars. Changes in car manufacturers' portfolios regarding these characteristics provide us with insight into firm strategies and competition in the automotive sector. The results of the analysis show that manufacturers move in a similar direction towards cleaner vehicles, however the different manufacturers have chosen very different portfolio management strategies. Manufacturers with relatively large reductions in CO_2 emissions tend to perform better than manufacturers with relatively small reductions.

The remainder of this paper is structured as follows: Section 2 provides a background on evolutionary theories of economic change and product portfolios, Section 3 describes the Dutch car market and the introduction of energy labels. Section 4 provides the data and methods. Section 5 presents the empirical analysis and Section 6 concludes.

2. Theory

In evolutionary theories of economic change, the firm is usually the unit of selection. A firm with a high fitness, i.e. a high degree of adaptation to its selection environment, will increase its sales numbers, profits or other performance measures compared to other firms with lower fitness (Metcalfe, 1994; Nelson and Winter, 1982; Silverberg et al., 1988). Cantner et al. (2012) argue that in reality it is not the firm but its multiple products that are subject to direct market selection. The fitness of the firm is determined by the aggregated fitness of its individual products. However, for multi-product firms this aggregation might be complex as they are influenced by different, possibly interrelated, selection processes in parallel (Cantner et al., 2012). This paper is therefore focused on the product portfolio of a firm.

This paper describes the products in a firm's portfolio by using the characteristics approach, in which consumers select one of the products based on their preferences for a number of characteristics that the product possesses (Hotelling, 1929; Lancaster, 2002; Saviotti and Metcalfe, 1984). According to Anderson et al. (2006) the characteristics approach provides an adequate representation of product competition. Consumers thus have preferences for the characteristics of the product and not for the product as such. As long as a homogenous product population is analysed a rather similar set of characteristics can be expected. The products of various firms and the different products within a single firm's portfolio differ in their values or performance levels of the same characteristics (Saviotti and Pyka, 1995).

Saviotti and Metcalfe (1984) extended the characteristics approach by representing a technological model by its performance on two sets of characteristics: the internal structure of the product's technology and the services provided by the product technology to consumers, which are labelled the technological characteristics and the service characteristics, respectively. The services performed for its consumers follow from the technological characteristics of the product technology. So, innovation in technological characteristics determines changes in the environmental impact of the product, i.e. the service characteristic. Because consumers select on service characteristics and not so much on changes in technological characteristics, in this paper we focus mainly on changes in service characteristics. Graphically, each product can be represented by one point in an n-dimensional space of characteristics. Since firms produce multiple products with different performance on the service characteristics, the technological population is represented by a cloud of points. Fig. 1 illustrates different