Transportation Research Part A 82 (2015) 110–129

Contents lists available at ScienceDirect

Transportation Research Part A

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

Accessibility and transport infrastructure improvement assessment: The role of borders and multilateral resistance

María Henar Salas-Olmedo, Patricia García, Javier Gutiérrez *

Dpt. Human Geography, Complutense University Madrid, Av. Profesor Aranguren, s/n, Ciudad Universitaria, 28040 Madrid, Spain

ARTICLE INFO

Article history:
Received 26 April 2015
Received in revised form 14 July 2015
Accepted 15 September 2015

Keywords:
Accessibility
Transport infrastructure impacts
Border effect
Spatial Multilateral Resistance European Union

ABSTRACT

The market potential indicator is a commonly used tool in transport planning for evaluating the potential economic effects derived from improvements in transport infrastructures. The general assumption is that exports from a given region will rise with increased accessibility, thus benefiting economic activities. However, the specification of the market potential model is typically very simple and ignores both the impact of competing rivals and the role of international borders, which leads to unrealistic results. Spatial interaction models on bilateral trade have already proved that international trade is affected by multilateral resistance, borders, adjacency, language or currency. Nevertheless, apart from some recent analyses that simply calibrate the distance decay parameter from trade datasets, these variables have hardly been integrated into research on market potential. This paper sets out to demonstrate that more realistic results are obtained by calibrating the distance-decay parameter and introducing the impact of competing rivals and border effects into the market potential formulation. The proposed model is then applied to the assessment of the accessibility impacts of new road transport infrastructure in the European Union between 2001 and 2012, which shows that the greatest improvements in accessibility were experienced by peripheral countries with high road infrastructure investment.

1. Introduction

The concept of accessibility established by Harris (1954) and Hansen (1959) refers to the measurement of opportunities available to a particular place. Seen from this viewpoint, it is accessibility, rather than transport infrastructure, that is a key factor in understanding regional development, both existing and potential (Wegener, 1995), based on consideration of the relative position of a particular place in relation to the whole system. Different specifications of potential accessibility have been used to estimate the number of opportunities available to a certain place. These potential accessibility indicators assume that the number of trade opportunities increases with the size of each destination and decreases with the distance between origin and destination.

Knowing the potential accessibility to markets, and where potential markets are located, is of great help to policy makers for designing regional development strategies. Similarly, transport planners, both at regional level and above, are interested in knowing which markets are less accessible as a result of insufficient or inefficient transport networks. In addition, market potential figures serve as an assessment tool for checking the impact of transport measures on the potential development of regions, a good example being the pan-European analysis by Spiekermann and Wegener (2006).

* Corresponding author.
E-mail addresses: mariahenar.salas@pdi.ucm.es (M.H. Salas-Olmedo), patgar11@ucm.es (P. García), javiergutierrez@ghis.ucm.es (J. Gutiérrez).

http://dx.doi.org/10.1016/j.tra.2015.09.009
0965-8564/

In the case of potential accessibility to international markets, the effect of borders on trade has to be considered in order to obtain accurate estimations of the number of opportunities that are reachable from a particular location in an international environment. There is a broad literature on assessment of the magnitude of such border effects, especially since the study by McCallum (1995), who found that Canadian provinces trade 22 more times between themselves than with a US state, distance and other factors being equal.

In addition to the role of international borders and other proxies for cultural closeness, there is a need for estimations of market potential to integrate the relative position of each particular place in relation to the whole system. In this way, the number of opportunities reachable from a particular place can be calibrated in relation to the size of all markets and the distance between them. This issue of so-called multilateral resistance was addressed by Anderson and van Wincoop (2003).

While special care is taken to produce homogeneous results throughout the European territory, apart from size and distance between origin and destination other factors affecting potential accessibility are rarely considered. In contrast to the above-mentioned findings on the effects of borders on trade and the role of competing rivals, border effects and multilateral resistance are usually ignored in most research on potential accessibility.

This is evidenced by the absence of any consideration of this issue in the extended review by Rietveld and Bruinsma (1998), the brief mention it gets in the review by Spiekermann and Neubauer (2002), and the abundance of models assuming that opportunities are equally accessible in a national and an international environment (ESPON, 2015, 2007; Schürmann and Talaat, 2002; Stelder, 2014). Concern about the role of competing rival countries was only linked to the estimation of the border effect after it was addressed by Anderson and van Wincoop (2003), but was usually simplified into remoteness indices or fixed effects. Some exceptions are found in the work by Head and Mayer (2004) and Huber et al. (2006), who introduced the border effect and other impedances to international trade. However, their estimation of multilateral resistance was based simply on fixed effects and they failed to give a realistic measurement of the distance between origin and destination.

Most research on the role of borders and other factors influencing international trade has paid little attention to the way distance is measured and integrated in the model. Although there was great interest in defining the effects of borders or competing rivals, distance was typically measured without considering real connectivity through the transport network. Most of the discussion focused on the bias arising from the way domestic versus international distances were estimated. Based on the discussion started by Wei (1996), Head and Mayer (2002) provided a methodology to measure both international and domestic distances homogeneously, which was subsequently used by Chen (2004) and more recently by Mayer and Zignago (2011) and by Bruyne et al. (2013). However, none of them addressed the impact of approximating transport costs through a realistic measurement of distance.

This is surprising, given the globalisation trend in which real transport costs are less directly linked to physical distance – not to mention the simplistic Euclidean or great circle distance. Still, most applications use a simple distance conceptualisation, such as great circle distance (Anderson and van Wincoop, 2003; Bacaria-Colom et al., 2013; Behrens et al., 2012; Bruyne et al., 2013; Bussière et al., 2005; Chen, 2004; Head and Mayer, 2004, 2002; Wei, 1996) or area-based functions (Helliwell and Verdier, 2001; Helliwell, 2002; Nitsch, 2000). A few exceptions are found in American literature with the use of kilometres along the road network according to a road atlas (Wolf, 2000, 1997) or the reported distance gathered from a survey (Hillberry and Hummels, 2003).

Building upon homogeneous methodology to estimate both domestic and international measurements, Salas-Olmedo et al. (2014) provide an in-depth analysis on the influence of different distance conceptualisations on the estimation of border effects. According to them, travel time is considered to be a realistic approach to generalised transport costs. Both of these more realistic and complex distance measurements suggest an underestimation of previous home bias estimations derived from Euclidean distances.

Our interest lies in assessing the economic impact of transport infrastructure in Europe by integrating the above-mentioned three lines of research: potential accessibility, border effects and multilateral resistance. We introduce two subsequent improvements to the market potential model. First, the role of all competing rivals is introduced with a new variable measuring multilateral resistance. The next step is to test and calibrate this and other significant variables, such as borders, adjacency or language, using a trade gravity model. The calibrated parameters of the significant variables are then included in the market potential specification in order to analyse the impact of new infrastructures on accessibility. Unlike previous papers, which overestimate the international impact of new infrastructures, we obtain more realistic results, since the role of competing countries and the effect of borders is taken into consideration.

The structure of the paper is as follows: Sections 2 and 3 set out the specific background on previous research related to market potential, and to the border effect and multilateral resistance, respectively. Section 4 details the methodology and includes a final subsection describing the data sources. The main results of this research are presented in Section 5, with subsections devoted to a deeper understanding of the role of competing rivals, calibration of the model and the market potential distribution at national and regional level in 2012, as well as the changes brought about by investment in transport infrastructure since 2001. The last section of the paper consists of conclusions and final remarks.

2. Measuring accessibility: the market potential indicator

Accessibility is a blurred concept that has been defined in many ways. In-depth reviews and typologies can be found in Rietveld and Bruinsma (1998) and Geurs and van Wee (2004). In this study, we are interested in the seminal definition pro-