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Spatial preferences of logistics development

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Abstract

This study aims to empirically estimate the relative impact of various accessibility, location and policy factors on logistics development as a land-use change process. A distinction is made between four different types of logistics development with the purpose of identifying any differences in the relative importance of spatial drivers for different types of logistics firms. Logistics land-use change data is derived from a historical dataset depicting logistics growth in the East - Southeast transport corridor of the Netherlands between 1980 – 2020 and a discrete choice modelling approach is employed.

1. Introduction

Owing to the strong growth of the logistics sector in recent decades, there has been an increase in demand for logistics real estate. The rapidly expanding spatial footprint of logistic complexes has led to logistics sprawl that has raised concerns regarding deteriorating quality of life in the hinterland (Aljohani and Thompson, 2016). This highlights the need for a better understanding of the spatial factors affecting location dynamics of logistics firms that will benefit stakeholders involved in the planning process, including policymakers and real estate developers. In this regard, past studies have largely focused on describing the spatial patterns of distribution centre locations and logistics sprawl, but very few have empirically identified the spatial drivers underlying these patterns (Bowen, 2008; Heitz et al., 2018; Onstein et al., 2019; van den Heuvel et al., 2013; Verhetsel et al., 2015; Woudsma et al., 2008). Although accessibility is believed to be a major factor, hardly any studies have quantified the effects of multiple aspects of accessibility on different types of logistics development, and the results are usually dependent on the regional context.

2. Region and policy context

The study focuses on the East - Southeast freight transport corridor of the Netherlands that stretches across four provinces, namely, North Brabant, Zuid-Holland, Gelderland and Limburg. This region, which lies between the sea port of Rotterdam and the German and Belgian hinterlands, is home to many logistics companies that serve key markets within 500 km in Northwest Europe, reaching a population of approximately 150 million. As a result, this region is also critical for the national spatio-economic policy agenda. One of the earliest policies in this regard was the Mainport policy of 1980s which sought to strengthen the position of the port of Rotterdam via the construction of port and hinterland infrastructures. More recently, the spatial-economic policy shifted focus, from financing heavy infrastructure in the entire hinterland corridor to stimulating economic 'Top Sectors' in specific locations. Logistics was one of these identified 'Top Sectors'. In this study, we seek to estimate the impact of this 'Top Sector' policy on logistics development.

3. Data and methodology

For the analysis we use open access geodata of logistic buildings in the East - Southeast corridor (Nefs, 2021) between 1980 and 2020. The dataset was compiled using various available sources, such as the Dutch building administration including construction year (BAG), a Dutch business estates database (Ibis) and company microdata (LISA). All buildings larger than 500 m^2 within a business estate in the corridor, and marked as either a company of transportation and warehousing (including e-commerce), or wholesale and import-export, were selected. Transportation and warehousing companies larger than 40,000 m^2 are labelled XXL distribution. The XL retail category was selected by retail company code in a business estate (exluding e-commerce). The resulting data includes ca. 10,000 buildings, ca. 4,000 of which are larger than 2,500 m^2. The period of analysis used for this study is 1996-2019. The vector data from these years is rasterised to 100m in order to model logistics development as a discrete land-use change process, in which each 100m grid cell represents a unit of observation. Multinomial logistic regression is applied in which the dependent variable has five categories which represent no change (the reference) and change to each of the four logistics categories described earlier. The explanatory variables employed in the model represent various location, accessibility and policy factors identified from prior theoretical and empirical knowledge on logistics location choice.

4. Results

Table 1 presents the results of multinomial logistic regression for estimating the effects of various spatial drivers on the development of four different types of logistics services. There is a positive effect of proximity to highway exits on the likelihood of development of all types of logistics. Highway accessibility has been shown to be an important factor for logistics location in previous studies as well (Bowen, 2008; Verhetsel et al., 2015). Proximity to urban area and customer/employee base also contributes positively to logistics development. However, proximity to train stations does not seem to be important for logistics development with the exception of XL retail. Presence within the highly urbanised Randstad region also lowers the likelihood of logistics growth perhaps due to lower availability of land. Higher land prices also contribute negatively to logistics growth. There seems to be a clear distinction between factors influencing the growth of XL retail type of logistics and other types since XL retail centres are expected to be closer to central city locations (as can also be inferred from a non-negative impact of the presence of urban amenities indicated by the urban attractiveness index). Presence of multi-modal terminals seems to positively impact the development of all logistics with the exception of retail. Finally, the presence within a 'Top sector' policy region increases the likelihood of development of transport and warehousing as well as XXL distribution centres. This is further verified when the same analysis is performed for both pre- and post-policy periods separately (results not shown here). There is a clear increase in the size and significance of the effect during the post-policy period (2006-2019) as compared to the pre-policy period (1996-2005).

	Dependent variable: Land-use change to logistics (1996-2019)			
	Transport & logistics	XXL distribution	Trade, import & export	XL retail
Location				
Hedonic land price, residential (2007 Euros)	-0.00270***	-0.0132***	-0.00189***	-0.000273
	(0.000481)	(0.00128)	(0.000372)	(0.000385)
Urban attractiveness index	-12.35***	-16.55***	-5.390***	1.732*
	(1.688)	(4.777)	(0.876)	(0.887)
Ln (distance to urban area)	-0.212***	-0.152***	-0.249***	-0.257***
	(0.00846)	(0.0175)	(0.00794)	(0.0167)
Within Randstad	-1.450***	-0.970***	-0.0365	-0.498**
	(0.120)	(0.231)	(0.116)	(0.245)
Accessibility				
Ln (distance to nearest highway access/exit)	-0.181***	-0.273***	-0.232***	-0.310***
	(0.0100)	(0.0135)	(0.00896)	(0.0166)
Ln (distance to nearest train station)	0.00151	0.0467	-0.0851**	-0.322***
	(0.0484)	(0.0947)	(0.0425)	(0.0823)
Ln (travel time to nearest 100,000 inhabitants)	-2.177***	-2.469***	-2.051***	-1.353***
	(0.108)	(0.187)	(0.0977)	(0.183)
Ln (distance to nearest multi-modal node)	-0.315***	-0.726***	-0.190***	0.0299
	(0.0436)	(0.0565)	(0.0401)	(0.0886)
Spatial Policy				
Within *Logistics top sector* region	1.257***	0.722***	0.147	-0.143
	(0.0856)	(0.136)	(0.104)	(0.235)
Constant	1.875***	3.640***	1.163***	-3.007***
	(0.364)	(0.575)	(0.334)	(0.652)
Observations	808,188	808,188	808,188	808,188
Pseudo R^2	0.106	0.106	0.106	0.106

Table 1: Multinomial logit estimates of logistics land-use change from 1996-2019. Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

This study analyses the relative importance of various spatial drivers for four different types of logistics development in the Netherlands. Higher land prices discourage logistics growth in general. Local (highway) accessibility and regional accessibility are both important factors for promoting all types of logistics development. Proximity to multi-modal transport nodes is also critical for warehousing and distribution type of logistics, but not for XL retail centres. XL retail centres seem to have distinct location preferences as compared to other logistics types. The spatio-economic 'Top sector' policy of stimulating logistics growth in certain locations seems to have the desired positive effect on transport, warehousing and XXL distribution type of logistics.

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