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Transportation costs and trade clusters: Some empirical evidence from U.S. customs districts

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ABSTRACT

This paper assesses the impact on transportation costs of the mix of goods imported from Canada into the United States. The analysis focuses on merchandise imports processed through eight U.S. customs districts over 1990–2013. The extent to which transportation costs are influenced by the nature of "trade clusters" is examined for various factors that may give rise to trade cluster effects. A trade cluster is defined as a geographical concentration of traded commodities that are in the same industry or in closely related industries. Trade clusters may exist in groups of distinct industries if some other factor provides positive spillover effects in trade.
The paper first presents and discusses the average costs of transporting imports for each of eight sample customs districts. These estimates of transportation costs are derived from documents that require importers to report the value of imports and the cost of freight and insurance. Next, measures of concentration and similarity such as Herfindahl-Hirschman and Grubel-Lloyd indices are constructed and related to trade clusters. These measures are used in fixed-effects regressions for transportation costs, and the results suggest that trade cluster effects matter. The paper concludes with a discussion of policy implications that follow from the regression findings.

1. Introduction

Much has been written over the years about the phenomenon of spatial clustering and agglomeration effects. Specifically, there is an abundant literature focusing on the potential external economies of scale that participants in specific activities can capture by being physically located in close proximity to one other. Krugman (1991) provides a seminal analysis of the conceptual advantages and disadvantages of geographical clustering by producers, while Malmberg and Maskell (2002) review the empirical literature. There is also substantial empirical evidence identifying the determinants and consequences of geographical clustering across a range of industries and economic activities, such as production, sourcing of labor and other factor inputs, and innovation (see, for example, Bell (2005), and Globerman, Shapiro, and Vining (2005).)

Most of the literature on clustering tends to focus on the benefits of firms co-locating "upstream" value chain activities such as research and development and production in a given geographic location, although the precise boundaries of the locations vary across studies. In most studies, the presence and strength of agglomeration economies are identified at the level of the city or metropolitan area, although regional clusters (e.g. Silicon Valley) are also frequently cited (see Porter (2003) and Goerzen, Geisler Asmussen, & Bernhard Nielsen (2013)). There is a broad empirical consensus that agglomeration economies are an important economic phenomenon and that the economic performances of organizations in a given location will be strongly influenced by the strength of the clusters in which they participate (Delgado, Porter, & Stern, 2010; Porter, 2003).

A focal issue in the literature on industrial clustering is whether external economies or diseconomies operate "within" relatively narrowly defined economic units or whether they also arise within clusters of complementary industries (Delgado, Porter, & Stern, 2012). Equivalently, do external economies such as technology spillovers primarily benefit organizations within narrowly defined industries or are there significant inter-industry spillovers?[1] While the issue is not settled, the preponderance of available evidence suggests that the benefits of industrial clustering tend to be manifested most strongly across sets of "complementary" industries (Feldman & Audretsch, 1999; Porter, 2003).

The impact of production clustering has been examined with respect to a variety of standard economic measures including growth of employment (Bonte, 2004), wage growth (Sonobe, Higuchi, & Otsuka,

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[1] For some empirical evidence on intra and inter-industry productivity spillovers, see Bernstein (1998).

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2013), productivity (Ciccone & Hall, 1996) and indices of innovation (Baptista & Swann, 1998; Jaffe, Trajtenberg, & Henderson, 1993). In contrast, there has been little research on the impacts of clustering on logistical activities, particularly transportation.

This paper assesses the impact of the mix of goods imported from Canada into the United States on transportation costs. The specific focus of the analysis is on eight U.S. customs districts which account for the bulk of the imports coming into the U.S. from Canada.[2] For various factors that may give rise to "trade clusters," the study identifies the extent to which transportation costs are influenced by the size and nature of the trade clusters, holding other factors constant.

The paper proceeds as follows. Section Two discusses how transportation costs might be affected by the composition of trade flows processed through land border ports. The focus is on how transportation costs might be influenced by the industrial scope of the traded goods, as well as the degree to which trade is characterized as intra-industry as opposed to inter-industry. Section Three provides an overview of the data used in the study including estimates of transportation costs for goods imported from Canada. Specifically, the analysis focuses on merchandise imports from Canada that were processed through U.S. customs districts over the time period 1990–2013. Estimates of the average cost of transporting those imports for each of the sample customs districts are presented and discussed. In Section Four, an empirical model of transportation costs is specified and estimated across the sample custom districts over time, and the results are discussed. A summary, conclusion, and a discussion of policy implications are provided in the final section.

2. Transportation costs and trade clusters

Transportation costs are an important determinant of the size of the relevant geographic markets for goods, particularly in the context of international trade (Yeats, 1980). A number of recent studies have identified higher transportation costs as contributing to "border thickening" in the context of U.S. trade with both Canada (Globerman & Storer, 2008) and Mexico (Walke & Fullerton, 2014).

Transportation costs are influenced by a variety of factors including fuel costs, mode of transportation, distance traveled, the state of the physical infrastructure used and the mix of goods being transported (Blonigen & Wilson, 2006; Schurenberg-Frosch, 2011). Regulatory and security procedures at border crossings can also influence costs incurred in transporting goods across national borders (Anderson, 2012). In this regard, a number of published studies have identified the contribution of waiting times at border crossings to higher costs of transporting goods across the Canada-U.S. border (DAMF Consulting, 2005; Taylor, Robideaux, & Jackson, 2003). A major contributor to increased wait times for commercial shipments in the post-2001 period has been tighter security arrangements imposed after the 9/11 terrorist attacks. Other studies indirectly support claims that higher transportation costs have contributed to border thickening through findings that bilateral trade between the U.S. and Canada grew at a slower pace post-2001 than would have been predicted given the behavior of traditional determinants of trade (Globerman & Storer, 2008).

It is widely recognized that the physical infrastructure of ports, along with the administrative procedures, including customs and security inspections carried out at those ports, potentially affect the costs incurred in shipping goods across borders (Anderson, 2012). At the same time, there is very little available evidence on the extent to which border ports, particularly land ports, benefit from external economies of scale and specialization. The extent to which trade clusters affect transportation costs is important from a policy perspective for several reasons. First, to the extent that trade clusters can be identified at specific border ports, it would be useful information for shippers making tradeoffs between longer travel distances and shorter wait times when choosing specific border crossing points. Second, the identification of trade clusters can help government policy makers in prioritizing infrastructure and related investments across ports. For example, investments in additional infrastructure would presumably be a higher priority in the case of ports characterized by trade clusters, other things constant, since the social benefits of those investments are likely to be relatively large.

In this study, a trade cluster is defined as a geographical concentration of traded commodities that are in the same industry or in closely related industries. Trade clusters may exist in groups of distinct industries if some other factor provides positive spillover effects in trade. The presence of trade clusters can be expected to increase the efficiency of processing the relevant commodities for several reasons. One is that customs and border protection personnel should become more knowledgeable about the trade, health and safety and security regulations that apply to the goods in question which, in turn, should facilitate faster processing of those goods through border ports. A second reason is that it should be increasingly feasible to "customize" a border port's physical and non-physical infrastructure, the narrower and more similar is the set of goods processed through the port. A third is that shippers should find it easier to consolidate goods for shipments, the fewer the number of customers and the more similar the goods being shipped are in terms of characteristics such as value to weight ratios, safety regulations and the like. The ability to consolidate shipments, in turn, should mitigate the need for less-than-full-load trucking, resulting in lower unit costs of shipping owing to economies of scale. As discussed in Bradbury (2010), larger trucking firms are more likely to pay the fixed costs associated with qualifying for "trusted shipper" status. Qualifying as a trusted shipper enables trucking companies to use dedicated lanes at border ports and should also reduce the frequency of secondary inspections that the companies must undergo.

All other things constant, therefore, the attributes of trade clusters should lower the transportation costs of shipping any volume of goods through a border port. On the other hand, if trade becomes extremely specialized, the likelihood of having empty backhauls increases along with transportation costs. For an extreme example, imagine that in the Canada-U.S. context, the only traded good is wood products. Canada exports a given volume of one species of wood and imports smaller volumes of a second species from the U.S. Given the trade imbalance, there will likely be some empty backhauls from the U.S. to Canada. In this case, since Canadian exports exceed Canadian imports, Canadian exporters will have higher transportation costs associated with compensating their shippers for empty backhauls.

Another consideration is that companies carrying out intra-firm trade are likely pursuing just-in-time inventory strategies. For these companies, shipment delays are especially costly, since the delays can significantly impact production and distribution scheduling. One would therefore expect the companies to build "safety margins" into their shipping scheduling, such as paying for extra drivers and trucks to be on standby, or paying for trusted traveler status to expedite border crossings.

In summary, the impact of trade clusters on transportation costs is empirically uncertain. While there are certain external economies of scale that might be anticipated from having more specialized intra-industry trade between Canada and the U.S., other factors related to specialized trade clustering might contribute to higher transportation costs for any given volume of bilateral trade.

The next section of the paper identifies the transportation costs of imports from Canada into the U.S. for eight sample customs districts over the time period 1990–2013. The analysis, of necessity, is carried out at the level of the custom district rather than at the level of the individual border port, since requisite data for constructing several of the key variables are not available at the individual port level.

[2] By way of illustration, the eight districts accounted for approximately 84% of total imports from Canada in 2000 and 72% of total imports in 2013.