THE ROLE OF INTRAINDUSTRY TRADE IN INTERREGIONAL TRADE IN THE MIDWEST OF THE US

by

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Abstract

In the past two decades, the theoretical underpinnings of *new trade theory* have taken hold. In particular, the study of market structure, imperfect competition, and intraindustry trade has become increasingly important. This new realm of trade research can also make an important contribution to the study of regional trade, or trade within countries. In this paper, trade among five U.S. states (Illinois, Indiana, Michigan, Ohio and Wisconsin) is reviewed. It is shown that some of the hypothesized determinants of international intraindustry trade are relevant for this region. In addition, some descriptive measures of the extent of intraindustry trade, including the Grubel-Lloyd index of trade overlap, also point to the importance of trade within this region. Some key sectors which internationally exhibit a high degree of vertically integrated trade are examined. Finally, considerations for future study and policy implications are considered.

1. Introduction

The subject of international trade among countries has long been of concern to policy makers and academics alike. As economic activity has become more and more international in scope, the potential impact of international trade on regional economic growth and income distribution has become central to many studies. Within economics, the study of industrial organization, particularly with respect to imperfect competition and economies of scale and agglomeration, has influenced developments in international trade theory in the past few decades. In identifying the determinants of trade among countries, issues such as market size, relative level of GNP per capita, market structure, etc., have all become important, as well as the more traditional determinants of trade, e.g., capital and labor endowments. Furthermore, there has been an

increasing realization of the role and influence of location in explaining trade and trade patterns (see Krugman, 1990; Futita et al., 1999; Hanson, 1996; Martin, 1999)

But what about trade among regions, within countries? If international trade has significant impacts on economic growth and welfare concerns (employment, income, etc.), it should follow that trade within countries may also merit much further consideration. In the U.S. Midwest, the volume of trade among states exceeds the volume of foreign trade originating from those states by several orders of magnitude. For example, Table 1 summarizes the volume of export flows between Illinois and some of the U.S. largest trading partners, and between Illinois and other states in the Midwest.

Table 1 Largest Volumes of International and Interregional Exports from Illinois, 1995

Country	Volume (US$ Billion)	State	Volume (US$ Billion)
Canada	6.29	Indiana	17.7
Japan	2.19	Michigan	17.5
Mexico	2.08	Ohio	19.9
UK	1.34	Wisconsin	18.0
Germany	1.28		

(Source: Hewings, *et al*., 1997).

One can infer from this table that domestic trade flows among these states are a significant economic force in that region. At the same time, international trade to and from the Midwest is also substantial, but the trade among states within the Midwest certainly merits further study. In some cases, this interregional trade may even be the driving force behind increased international trade from the Midwest (Hewings, *et al*., 1997).

Not only has there been little discussion of the role of interregional trade, for over two decades, little or no information was available to document the magnitude of state-to-state flows. As a result, it is difficult to do more than infer from other information the nature and growth of this trade. In this paper, attention will be focused on the *nature* of this trade and its association with economic structure. In particular, the analysis will explore the degree to which the trade is dominated by interindustry rather than intraindustry trade. Concomitantly, the emerging trade interdependence will be explored in connection with the degree to which the economies of the Midwest share a similar economic structure. The next section will review recent developments

in international trade theory with a particular focus on intraindustry trade. Then, some descriptive measures of trade among these five Midwestern states and some indices of trade overlap within industries will be reported. Given these trading patterns, the next section will examine the similarities and differences in the economic structures of these state economies. Finally, policy implications and directions for future study will be discussed.

2. Conceptual Framework

In this section, two parallel literatures will be explored in preparation for the analysis that follows. The first concentrates on the role of trade in regional development, promoting an evolutionary view in which transportation and communication costs assume the most significant roles.

2.1 Trade and Regional Development

One of the most imaginative contributions to the regional development literature was provided by Thompson (1966) in his *Preface to Urban Economics*. His ideas about the evolutionary path of a regional economy provided an important vehicle in which to marry the ideas of export base analysis, linkage development and the ideas associated with growth in the level of intermediation in an economy. Perhaps, his work might be considered as based on Marshallian principles but with a strong trade orientation (see Martin, 1999). Furthermore, they provide insights into what is, essentially, a network evolution of trade with attention being paid to the internal and external division of this trade. Thompson's ideas will be used as the basis for the development of this conceptual theory. However, the evolution will be considered for a two-region context and the focus will be on an understanding of the nature and extent of interregional trade. In some senses, these ideas find an echo in Hanson's (1996) recent work, but with a different regional geography implied (interregional within a nation rather than between countries).

2.1.1 Early Development Stages

Assume two isolated regions, separated by a wilderness with very poor interregional transportation access. Accordingly, there will be very little specialization as the possibilities for exchange are limited by high transportation costs. Further assume that the regions are

themselves located in a nation that is poorly connected to the rest of the world. Now assume that a highway or railroad is constructed between the two regions, significantly lowering transportation costs; the mechanics of the process described by Thompson can begin to unfold. Specialization will be possible now that exchange can be effected. Each region will begin to specialize in a set of goods and services in which they enjoy some comparative advantage vis a vis the other region. Trade will be dominated by interindustry exchange; within each region, new suppliers will locate to provide inputs into the firms making goods and services for export to the other region thereby creating an increase in the intraregional multipliers. In all probability, intraregional exchange may increase more rapidly than interregional trade as localization economies assume considerable importance.

2.1.2 Early Maturity

As these economies mature, agglomeration economies will serve to strengthen each region's competitive position in the production of goods and services that they export. Increases in export activity will generate innovations in the transportation sector, offering the possibility of lower costs of transportation between the regions. Internally, the level of intermediation will increase, increasing the intraregional multipliers but, at the same time, external trade will also increase.

2.1.3 Late Maturity

The next stages offer a more complex pattern of evolution spurred by two important developments, a significant reduction in the costs of transportation and communication in general and the integration of the regions into a global economy. The reduction in transportation costs is effected by significant investments in transportation infrastructure, reducing the role of these costs in the production function of the average firm and increasing the tradability of goods produced. As a result, market orientation becomes a more dominant force in location decision-making. Further, the spatial scale of agglomeration economies shift from the urban or metropolitan scale to the regional or even the multiregional scale as the regions become integrated in the global economy. Most importantly, returns to scale are now complemented by returns to scope with the following expectations

- internal returns to scope to an individual establishment will be lower, as a smaller number of secondary products will be produced and there will be a lowering of the dependence on local (intraregional) suppliers and markets for exchange, resulting in a decrease in the intraregional multiplier *without* a concomitant decrease in levels of production;

- external to the establishment (but internal to the firm) returns to scope will be higher with secondary products produced by establishments allocated across many multiregion operations, thereby increasing interregional trade, interregional dependence and the interregional multiplier.

Changes in the spatial structure of returns to scope can be explained by the increasing role played by returns to trade, namely the increasing impact of each additional dollar invested in transportation on lowering production costs. Equally importantly, there will be a change in the composition of interregional trade with interindustry interregional trade replaced by intraindustry interregional trade. Within the regions, even though the volume of output may continue to increase, the hollowing out process will result in a decrease in the intraregional multiplier. Spatial clustering of activities will focus on different attributes of the regional economy (e.g., the role of a region's occupational capital) as firms search more widely for the highest quality and cheapest inputs knowing that transportation investments have significantly broadened the effective geography within which they can search. By exploiting returns to scope over a larger range of establishments, firms and regions can enjoy a more favorable international competitive position.

2.1.4 Link with the new trade theory

The apparent tensions between the ideas of the comparative advantage and the new trade theory have been shown by Krugman (1990) and others to be more apparent than real. Initial factor endowments will still allow for specialization to occur with cost advantages leading to a cumulative process of product differentiation. This process, in turn, will lead to the exploitation of increasing returns and thus to increasing trade between regions. However, this trade will be more heavily concentrated in intraindustry trade for many of the reasons provided by Krugman. It so happens these are reasons that find their fullest expression in the state economies of the Midwest of the US. For example, if the economies in question are large, of similar size and with

few differences in factor endowments then something other than comparative advantage has to be proposed to explain trade. Per capita income is high - thus providing opportunities for product differentiation to serve the demand for higher quality products and a greater variety of products. Scale economies exist and capital/labor ratios and high and similar (no comparative advantage here). However, it is the lower transportation costs, the region-wide agglomeration effects, the effectiveness and ease of information flows that all combine to facilitate intraindustry specialization. At the level of trade between regions that is focused on intermediate goods and services, it is unlikely that much of the apparent cross-hauling can be explained by product differentiation. The development of niche products and markets probably accounts for the vast majority of this intraindustry trade.

Further, this process indicates a potential difference in the role of trade between nations and between regions within a nation. For example, in Hanson's two-region model, the production network involves consideration of one region dominated by higher skill requirements and another in which the skill requirements are lower. In the interregional trade within a country case, there may be few differences in skill endowments. Thus explanation of trade must focus on other factors and on the nature of this trade. In this regard, Hummels et al., (1998, 1999) attention to the role of vertical specialization in trade offers a plausible alternative explanation. One of the characteristics of vertical specialization (the use of imported goods in production that is ultimately exported) will be the importance of intraindustry trade. Now attention will be directed to the received theory on the role of intraindustry trade

2.2 Intraindustry Trade

In a traditional, Heckscher-Ohlin model of international trade, trade is driven by differing factor endowments between regions. Countries specialize in the production of goods that use the most abundant factor most intensively, allowing them to capture comparative advantage through trade. The Heckscher-Ohlin model cannot adequately explain the large degree of trade taking place among similar economies, and the increasing domination of intraindustry trade in particular. In this section, theoretical developments in the study of intraindustry trade will be discussed, as well as their application for regional trade models. First, broad-based determinants of

intraindustry trade will be outlined. From these general categories, the type of production specialization, market structure, regional economic issues, and welfare concerns will be examined in greater detail.

2.2.1 Determinants of IIT

If intraindustry trade[1] is at odds with the more traditional Heckscher-Ohlin framework of comparative advantage, one must first grapple with the determinants of such trade. Stone (1997) separates the determinants of IIT into two categories: industry-based determinants, and regional characteristics. The industry-based determinants include: product differentiation, scale economies, industry specific cost structures, and transportation costs. On the other hand, regional determinants are based on macroeconomic characteristics: income level, and the relative capital/labor ratios, for example. By separating out these two components of IIT, one can learn more about both in characterizing trade flows (Balassa and Bauwens, 1987).

Stone summarizes and elaborates on the hypotheses surrounding the emergence of IIT. Not all of these determinants are incompatible with a trade regime that is characterized by a Heckscher-Ohlin (H-O) framework. However, the large volume of *bilateral intraindustry trade flows* that emerge with high levels of IIT do not conform to H-O assumptions.

Hypotheses of IIT:

1. IIT will increase as income differences decrease because demand structures become more similar.

2. The share of IIT in total trade will increase as the difference in factor composition (e.g., capital/labor ratios) falls.

3. The share of bilateral IIT will increase as the average income level increases.

4. The share of bilateral IIT will increase as the difference in relative incomes, as a measure of the economy's size, of trading partners fall.

5. The share of bilateral IIT will increase as total size of trading partners increases (Stone, 1997).

2.2.2 Product Differentiation

Within the IIT theoretical literature, there are differing assumptions regarding the type of product differentiation within an industry that leads to IIT. The three general types of product differentiation include horizontal differentiation, vertical differentiation, and the vertical integration of production. Krugman (1991) has championed the case for horizontal differentiation leading to increased IIT. In his model, as economies become more similar and per capita income rises, consumer preferences become more diverse. Thus, consumer goods become differentiated by type or variety. As each region specializes in a certain variety of a good, incentives for trade arise. Central to this argument is the assumption that the demand structure of the trading regions is very similar in nature, as are relative capital and labor endowments. This model is most applicable to the study of trade among highly developed economies, with a predominance of trade in capital-intensive goods and a high level of technology.

A second, more problematic explanation of IIT trade is that of vertical product differentiation. In this case, IIT can take place among less similar economies than required for the case of horizontal specialization. Flam and Helpman (1987) employed such a framework to study IIT between economies with differing levels of per capita income. In such a model, products within an industry are differentiated by quality. This difference in quality may be due to differences in technical efficiency or intensity of production, as well as labor productivity or differences in human capital. Lambertini (1997) theorizes that under certain conditions, such trade can benefit both trading regions, although some more welfare concerns can arise. In any case, IIT among regions with differing income distributions can potentially benefit one region more than another.

A third type of IIT that arises is due to trade in intermediate goods, or the vertical integration of production. Hummels, et al. (1998) postulated that the internationalization of production led to vertically linked economies. In this model, regions specialize in a particular stage of the production process, thus leading to increased IIT as production increases. In their definition of vertical specialization, a good must be produced in multiple sequential stages, and must cross at

[1] Henceforth intraindustry trade will be referred to as IIT.

least one international border more than once (Hummels et al., 1998). For example, in the simplest form, one country can export an intermediate good to another country that completes production of the good, and then exports the final product back to the first country. Vertical integration occurs more readily in economies with a relatively higher percentage of GNP derived from trade.

Because each of the three scenarios above requires differing production conditions leading to IIT, it is likely that each scenario yields differing welfare concerns for the trading regions. One of the greatest problems of studies of IIT is that the causes of IIT are usually quite complex. It is possible for all three types of specialization to be occurring in the trade flows between regions. In most cases, it is probably best to study each industry in each region separately to determine what is the driving force of trade in order to determine optimal public policy.

2.2.3 Market Structure and Scale Economies

Central to any study of IIT is the issue of market structure. For a traditional H-O framework, one must assume a perfectly competitive market structure with constant returns to scale. This assumption is too restrictive for more complex economies where scale economies are important and market imperfections rampant. Innovations in the theory of industrial organization have allowed for examining alternate market structures and IIT.

With respect to economies of scale, there are different types of increasing returns. Marvel and Ray (1987) and Ethier (1979) state that increasing returns due to *internal economies* (increasing returns at the firm level) do not lead to increases in IIT. Instead, some authors focus on *external economies* (at the industry level) as a more important factor in IIT. In this case, increasing returns arise due to market concentration, larger markets, or decreased transportation and information costs. Trade in intermediate inputs, or vertically integrated trade, also becomes possible with external economies of scale (Helpman and Krugman, 1995).

As mentioned previously, the effect of scale economies on IIT depends on industry characteristics. Certain industries more than others would have scale economies leading to IIT. Lancaster (1980) stresses that monopolistic competition is the most competitive market structure in industries characterized by diverse consumer preferences and production specifications, but

not in all cases does the presence of scale economies imply IIT. Hummels and Levinsohn (1995) provide a useful method for classifying the industries most likely to contribute to IIT, depending on the nature of scale economies. They state that industries with a small number of firms are most likely oligopolistic in nature. On the other hand, industries with a large number of firms likely exhibit increasing returns to scale. In the second case, product differentiation is more likely to occur, leading to increases in IIT.

2.2.4 IIT and the Study of Regional Economies

One of the most important contributions of the study of IIT has been a renewed focus in regional economies. Traditional trade theory largely ignores spatial issues: such as industry location, shared borders, and agglomeration effects. However, along with new trade theory, many authors have "rediscovered" the geography of trade (Krugman, 1991). Industry linkages and agglomeration economies in highly complex economies cause regions to become more interdependent, and can further intraindustry specialization. Krugman (1993) discusses the development of pecuniary externalities that develop from demand and supply linkages between firms in a given region. Backward linkages arise as manufacturing locates to an area with large nearby demand: demand is generated from the concentration of increased manufacturing production. Forward linkages arise because it then becomes more desirable to live and produce near a concentration of manufacturing production. Due to transportation costs, manufactured goods are cheaper near to where they are produced. As intraindustry specialization increases, so should IIT.

What sort of regional developments are taking place in the Midwest and how do they potentially affect levels of IIT? According to Hewings *et al*., (1998), for the Chicago region, internal interaction (within the Chicago MSA) is being replaced by external interaction - both with the Midwest and beyond. In particular, increases in trade of intermediate inputs between the Chicago region and the rest of the Midwest are likely to increase. This process was referred to by Okazaki (1987) as *hollowing-out*. Until now, there has not been an explicit link between this phenomenon and new trade theory, but is likely that any growing interdependence of the Midwestern states occurs concomitantly with an increase in IIT.

2.2.5 Some Welfare Concerns

How does the advent of IIT affect consumers? One of the biggest predictions of IIT is the proliferation of product varieties. Most economists agree that the increases in product variety, ceteris paribus, can provide a benefit to the consumer in that more variety leads to increased utility. However, Greenaway and Tharakan (1986) theorize that there may be a "socially optimal" level of product variety, beyond which no further gains are realized. Thus, the effect of IIT on consumers is also complex.

Conventional trade theory has some specific predictions for changes in income distribution; namely, that the real income of the relatively scarce factors of production will decline as trade increases between regions. In contrast, new trade theory emphasizes ways in which intraindustry trade can potentially offset the costs of income distribution. Two types of gains can occur from IIT. First, an increase in IIT can increase the overall volume of trade. Secondly, the ability for firms to specialize within an industry can result in increased production through the realization of scale economies, which in turn can have beneficial impacts on the employment within that industry (Greenaway and Tharakan, 1986). Though increased trade can certainly have some disruptive effects on regional employment, they could be offset by the gains from intraindustry specialization. Helpman and Krugman (1985) state that this case is most likely when countries are sufficiently similar in factor endowments and scale economies are important to production. In this case, changes in relative factor prices are moderate, and the gains from specialization directly offset income redistribution effects. Indeed, increased IIT, it has been claimed, has enabled the OECD countries to undertake the trade liberalization programs of GATT precisely *because* those economies are so similar and distributional effects minimal (Krugman, 1991).

Thus, in terms of welfare concerns, again an industry-specific study may be worthwhile. In determining present and future employment changes for a specific industry within a specific region, it would be useful to view trade flows to and from that industry to determine whether intraindustry specialization plays an important role in the development of that industry and its trade patterns. Then, the level of IIT can aid with economic forecasts and long-term welfare implications for that industry.

3. IIT and Midwestern Trade

What drives trade between states in the Midwest? How are key industries changing over time, and how can new trade theory aid in making sense of complex trade flows? Appendices 1 through 3 summarize some quantitative exploration of these trade flows.

3.1 The Grubel-Lloyd Index of Trade Overlap

Perhaps the most important descriptive measure of IIT is the Grubel-Lloyd index of trade overlap. This index is measured as (Stone, 1997):

$$SIIT_{jk} = 1 - \left\{ \sum_i \left| X^{e}_{jki} - M^{e}_{jki} \right| \Big/ \sum_i \left(X^{e}_{jki} + M^{e}_{jki} \right) \right\} \quad (1)$$

where:

$$X^{e}_{jki} = X_{jki} \left\{ \left(X_{jk} + M_{jk} \right) \Big/ 2X_{jk} \right\}$$

$$M^{e}_{jki} = M_{jki} \left\{ \left(X_{jk} + M_{jk} \right) \Big/ 2M_{jk} \right\}$$

where: j is the country, k is the time period, and i is the industry. This index displays the level of trade *within* an industry relative to trade *between* industries. A value of 1 would imply perfect trade overlap, or that the value of that region's exports from a given industry was equal to the value of imports to that same industry. A value of 0 would imply perfect specialization within that industry (that the value of either exports or imports was equal to zero). Comparing the Grubel-Lloyd indices for the five Midwestern states is a good point of departure for understanding trade flows within this region. Appendix 1 summarizes these findings. The data used in calculating these indices come from the Commodity Flow Survey (U.S. Bureau of the Census and U.S. Department of Transportation Statistics, 1996) for the years 1969-1993. These data were aggregated at the two-digit level of the Standard Industrial Classification scheme (SIC) and integrated with consistently developed input-output tables for the same states.

Thus, one can roughly assume that for a given industry, a value of the Grubel-Lloyd index approaching 1 would imply a predominance of IIT. Conversely, a value approaching 0 may

imply trade driven by other causes, such as relative factor endowments (as in a Heckscher-Ohlin framework). For each of the five states, five industries with the highest (trade overlap) and lowest (trade driven by industry specialization) indices are reported. In addition, the state of destination is reported[2]. As predicted by new trade theory, some of the more "high-tech" industries appear in the first column – that of high trade overlap; e.g., fabricated metal, transportation equipment, machinery, transportation equipment and food or kindred products (agricultural processing). Conversely, in the column reporting more specialized trade, some industries appear that are more natural-resource based, or have lower levels of high-tech production methods; e.g., coal, textile mill products, pulp or paper products, metallic ores and furniture and fixtures. However, these results are somewhat equivocal. In a few cases, an industry that exhibits a high level of trade overlap for one state is specialized in another state; e.g., photographic and optical instruments, leather or leather products, and clay, concrete glass or stone. This finding perhaps points to the complexity of these trade flows. It is likely that trade driven by both intraindustry specialization and comparative advantage occurs. Another interesting finding is that for all states, most of the IIT is directed to other states in the Midwest. For Illinois, Ohio and Wisconsin, more of their trade to the Midwest is driven by IIT, while their trade to states outside the Midwest is predominantly specialized. This observation underscores the importance and interdependence of trade flows among states within this region and further suggests that agglomeration effects are being manifested at the multistate level rather than for individual metropolitan or state economies.

3.2 Income Trends in the Midwestern States

Appendix 2 summarizes changes in per capita income from 1969-1993. These data were derived from REIS data (Regional Economic Information System: 1969-1994, U.S. Department of Commerce, Bureau of Economic Analysis, Washington, D.C.). Income was reported in constant 1987 U.S. dollars. An index of percentage change in per capita income during this time period is reported. A value equal to 1.00 would imply no change. For all the five states, income increased over this time period, but at a lower rate than the national average.

[2] The abbreviation RUS stands for "Rest of United States," i.e., any domestic state other than the five Midwestern states.

3.3 Vertically Integrated Trade in the Midwest

Hummels *et al.* (1998, 1999) recently conducted a study to estimate the degree of vertically integrated trade among OECD countries. They defined vertically integrated trade as trade for goods that are produced in multiple sequential stages, and that cross a border more than once (Hummels et al., 1998). In such cases, firms exploit both economies of scale and locational advantages. Economies of scale are achieved if the scale of production can increase as certain regions specialize in the production of a certain stage (or stages) of a good's production. Locational advantages are realized by locating production according to access to particular markets or by taking advantage of regional wage differentials. The authors also found that the degree of vertically integrated trade varies considerably among industries. For their sample[3], they determined that the following industries exhibited the greatest level of vertically specialized trade: motor vehicles, shipbuilding, aircraft, industrial chemicals, nonferrous metals, petroleum and coal products. Conversely, those industries with the lowest levels of vertical trade were agriculture, mining, wood products and paper products (Hummels et al., 1998). Following their results, some indices of growth in certain industries in the Midwest were calculated. The industries that may exhibit high levels of vertically integrated trade in the Midwest include: motor vehicles; manufacturing; fabricated metals; chemicals; petroleum products; and transportation and utilities. Conversely, industries for which a lower level of vertically integrated trade include: farm products, mining, lumber and wood, and paper products. Appendix 3 summarizes indices of growth for these selected industries. The data were obtained from REIS Gross State Product tables (Regional Economic Information System: 1969-1994, U.S. Department of Commerce, Bureau of Economic Analysis, Washington, D.C.) at the two-digit SIC level using constant 1987 U.S. dollars.

For all the Midwestern states, more industries in the group hypothesized to have higher levels of vertically integrated trade experienced growth relative to national changes in these industries. However, for all the states except Illinois, growth was experienced in at least one industry that would not likely have high levels of vertically integrated trade. Therefore, growth in vertically integrated trade is certainly not the only driving force of production increases in the Midwest for

the period 1977 to 1991. However, for certain industries, such as chemicals and petroleum products, growth higher than the national average was seen by all but one state (Ohio and Illinois, respectively). Hummels *et al*., (1998) also noted strong trends in these two industries. In order to further study vertically integrated trade in the Midwest, much more complete data would be needed, but from these growth indices, one can assume that such trade is likely to be important to the region.

4. Directions for Further Study

Trade flows within the Midwestern states need to be examined in great detail. Countless studies have been conducted regarding the welfare effects of international trade, but there is a paucity of such studies at the regional level. Some of the evidence presented in this paper indicates that significant regional differences do exist, though in general the economies of the Midwest are becoming more similar over time. What will be the outcome of increased trade flows within the Midwest? Will they be mutually beneficial and lead to per capita income across the region? Or will some states fare better than others because of initial advantages in "growth" industries, while others specializing in more traditional industries decline in relative terms? In order to begin to answer such questions, much more must be known about these trade flows. Based on the findings of Hummels *et al*. (1998, 1999), it appears that some industries that have proven to be contributors to increased production and economic growth are *also* faring well in the Midwest, but this finding is not found across the board. One policy implication may be to identify those industries that are most likely to expand production, scale and growth through their trade links within the Midwest.

Another related question involves the role of economies of scope and agglomeration. Many authors have argued that in high-tech, decreasing cost industries, economies of scale are significant. Trade in intermediate inputs, intraindustry trade, and vertically integrated trade all facilitate such growth, and such trade is only likely to increase over time. New trade theory is useful to a study of regional economies because it focuses on the role of industrial organization and market structure in fostering trade flows that are otherwise inexplicable. If initial factor

[3] Based on OECD trade data for the years 1968 to 1990 using the 4-digit SITC classification scheme.

endowments led to industrial specialization, the exploitation of scale economies leads to product differentiation and thus bilateral intraindustry trade. In addition, the renewed focus of many on the geography of trade flows leads to a better understanding of the role of industry location and path-dependent regional development. However, attention to issues of clustering as a development strategy may be misplaced in a context in which the costs of spatial interaction across considerable distances are minimal. Recent empirical analysis of the Brazilian Northeast region and the Midwest of the US (Magalhães *et al.*, 1999) revealed a strong contrast in the degrees of interaction and thus pointed out the continued important role that connectivity plays in understanding trade

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Appendix 1 Grubel-Lloyd Index Results

	Most Overlap	SIC	State of Destination	Most Specialization	SIC	State of Destination
Illinois	Farm Products	01	Indiana	Fresh Fish	09	Indiana
	Lumber or Wood Products	24	Indiana	Coal	11	RUS
	Clay, Concrete, Glass or Stone	32	RUS	Ordinance or Accessories	19	RUS
	Fabricated Metal Products	34	Indiana	Petroleum or Coal	29	RUS
	Machinery	35	Indiana	Clay, Concrete, Glass or Stone	32	RUS
Indiana	Farm Products	01	Illinois	Fresh Fish	09	Illinois
	Non-metallic Minerals	14	Ohio	Leather or Leather Products	31	Illinois
	Food or Kindred Products	20	RUS	Textile Mill Products	22	Ohio
	Clay, Concrete, Glass or Stone	32	Illinois	Furniture or Fixtures	25	Ohio
	Photographic, Optical Instruments	38	Ohio	Coal	11	Illinois
Michigan	Machinery Excluding Electrical	35	Ohio	Textile Mill Products	22	Ohio
	Food or Kindred Products	20	RUS	Apparel or Finished Textiles	33	Illinois
	Leather or Leather Products	31	Ohio	Non-metallic Minerals	14	Indiana
	Primary Metal Products	33	RUS	Electrical Machinery	36	Illinois
	Fabricated Metal Products	34	Ohio	Photographic, Optical Instruments	38	Indiana
Ohio	Non-metallic Minerals	14	Indiana	Metallic Ores	10	RUS
	Rubber or Miscellaneous Plastic	30	Wisconsin	Ordinances or Accessories	19	RUS
	Transportation Equipment	37	Illinois	Apparel or Other Finished Textiles	23	Wisconsin
	Fabricated Metal Products	34	Indiana	Waste or Scrap Materials	40	RUS
	Machinery Excluding Electrical	35	Michigan	Misc. Freight Equipment	41	RUS
Wisconsin	Rubber or Misc. Plastic Products	30	Ohio	Farm Products	01	Ohio
	Primary Metal Products	33	RUS	Ordinance or Accessories	19	RUS
	Fabricated Metal Products	34	Indiana	Pulp, Paper or Allied Products	26	Michigan
	Electrical Machinery Equipment	36	Indiana	Leather or Leather Products	31	RUS
	Photographic, Optical Instr.	38	Illinois	Misc. Freight Equipment	41	Illinois

Appendix 2 Income Trends in the Midwestern Region, 1969 – 1993

Average Percent Change in Income Per Capita, 1969 - 1993
(1.00 = no change)

Illinois	1.31
Indiana	1.34
Michigan	1.31
Ohio	1.28
Wisconsin	1.41
U.S. Total	1.51

Average Percent Change in Income Per Capita, 1969 - 1993
Relative to Total Change in U.S. Income

Illinois	0.88
Indiana	0.90
Michigan	0.88
Ohio	0.86
Wisconsin	0.94

Appendix 3

Industries With a High Degree of Vertically Integrated Trade Internationally
Average Growth Indices for 1977 - 1991 Weighted by US Total Growth (1.00 = no change)

	Motor Vehicles	Manufacturing	Fabricated Metals	Chemicals	Petroleum Products	Transportation and Utilities
Illinois	1.42	0.86	0.88	1.01	0.65	0.93
Indiana	0.95	0.90	0.88	1.06	1.10	0.91
Michigan	0.89	0.77	0.87	1.02	1.15	0.84
Ohio	1.10	1.10	0.91	0.98	1.10	0.86
Wisconsin	0.85	0.99	1.10	1.11	1.13	0.91
US Total	0.82	1.11	1.07	1.12	1.08	1.24

Industries With a Low Degree of Vertically Integrated Trade Internationally
Average Growth Indices for 1977 - 1991 Weighted by US Total Growth (1.00 = no change)

	Farm Products	Mining	Wood	Paper Products
Illinois	0.65	0.86	0.99	0.89
Indiana	0.72	0.90	1.12	0.85
Michigan	0.93	0.77	1.08	0.86
Ohio	0.84	0.88	1.26	0.92
Wisconsin	0.95	0.99	1.13	1.04
US Total	1.138	0.99	1.08	1.11