Agrifood Supply Chains in the NAFTA Market

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INTRODUCTION

One of the major expectations of regional trade agreements, which by WTO rules require that "the duties and other restrictive regulations of commerce … are eliminated on substantially all the trade" (GATT 1947, Article XXIV 8 (b)) is that, over time there will be a considerable "deepening" of economic integration among the markets of the member states. What constitutes deepening is not well defined but implies that there should be a realignment of commercial interactions beyond the simple increases in cross-border trade expected to arise from the removal of border measures. Among other things, we should expect to see a growth in cross border supply chains, including vertical integration across national boundaries. Ultimately, if borders no longer matter, we expect to see no difference in the way in which supply chains are organized within a country and between countries. What has been the NAFTA experience to date? Do borders still matter, and why?

Economists attempting to evaluate the efficacy of a regional trade agreement face a challenging task. First, there are a plethora of factors at work causing a realignment of commercial interactions. Second, deepening will only take place over a considerable period of time, in part because the agreements have long phase-in periods and, in part because it is likely to entail considerable investment in both physical production facilities and relationship building. There have been major changes to the organization and structure of agribusiness in the markets of the North American Free Trade Agreement (NAFTA) since the agreement came into force in 1994 – some of which can be attributed to the NAFTA but much of which cannot. It is the classic *ceteris paribus* question faced by

economists, and one which is difficult to answer definitively due to the absence of appropriate data.[1]

An alternative approach is to compare the forms of industrial organization, such as supply chain relationships, arising in a market which is unfettered by differences in political jurisdiction relative to those that exist among firms operating in the context of the NAFTA market. The large US market allows for this form of comparison. If the NAFTA had led to a truly integrated market, then one would expect to see the same supply chain relationships developing among firms operating in two or more NAFTA countries as observed for firms operating exclusively within the US market. In other words, borders would no long matter.

The empirical work that has been done on NAFTA market integration using gravity models, while suggesting border effects have declined, consistently shows that borders still matter in general (Clausing) and for agricultural products (Jayasinghe and Sarkar). Moodley, Kerr, and Gordon find similar results when examining the integration of NAFTA markets. One would expect that deepening also continues to be affected by the Canada-US and Mexico-US border – in other words, supply chain relationships that develop across borders will vary to some degree from those that exist within and among firms operating primarily within the US market.

The structure of supply chain relationships can be broadly classified as strategic approaches to vertical coordination. If borders still matter, there are at least two potential hypotheses pertaining to their effect on the vertical coordination strategies of firms engaged in transborder commerce. First, firms might pursue a strategy of closer vertical coordination across borders because they can better plan for the friction caused by borders, providing information and taking other proactive measures to reduce border irritants. Alternatively, firms may choose a lower degree of vertical coordination to reduce dependency-based risks that are associated with border closures, disruptions, and potential increases in border-related costs. It is unlikely that one of these hypotheses predominates, but will be dependent on the characteristics of the particular industry and the ways in which the border affects the particular product. The position of the border within the supply chain – whether raw material, semi-processed, or consumer-ready products cross the border – may also be important. This chapter provides an introduction to the drivers for change in agrifood supply chains; drawing on insights from the transaction cost literature. It

[1] Even evaluating the effect of regional trade agreements on trade flows is fraught with difficulties (see Moodley, Kerr, and Gordon). Attempting to examine empirically the question of the degree of deepening attributable to the NAFTA would represent a major empirical challenge.

then examines the effect of national borders on the evolution of agrifood supply chains in the North American market.

TRANSACTION COST ECONOMICS AND VERTICAL COORDINATION: A CONCEPTUAL FRAMEWORK

While pockets of self-sufficient or subsistence farmers remain in some developing countries, the vast majority of food products are produced by one set of citizens to be consumed by a broader base of consumer. The movement of food products from producers to consumers must somehow be organized or coordinated. Vertical coordination may be as simple as a peasant farmer choosing to transport his produce physically to a local market once a week, displaying the food on a blanket for villagers to purchase. Alternatively, vertical coordination can involve a farmer signing a complex contract with a supermarket chain on a different continent, with the product moving through many hands, being transformed a number of times, and combined with a multitude of ingredients that eventually wend their way into the ready meals counter of a supermarket. The latter represents a long and complex supply chain – but a supply chain that must still be vertically coordinated. A plethora of institutional arrangements comprise the available coordinating mechanisms. Coordination may conjure up visions of individuals proactively managing the movement of products, but within-firm managerial orders are only one potential mechanism of coordination; faceless spot markets are at the other end of the coordination spectrum with middlemen, alliances, contracts, joint ventures, etc. ranged in between. The study of the institutional arrangements used to coordinate agricultural supply chains has a long history (Thompson; Mighell and Jones).

The vertical coordination of supply chains is not static. Changing supply chain relationships are of interest because there are efficiency, distributional, and competitiveness implications. Over the last two decades there has been a trend towards closer vertical coordination of agrifood supply chains: a movement away from coordination through spot markets, auctions, etc. toward greater coordination through contracts, joint ventures, and vertical integration (managerial orders in a within-firm supply chain). A number of drivers lie behind these changes.

Drivers for Change

Increasing consumer interest in food quality and greater diversity in the choice of foods available have been pivotal factors in the move to closer vertical coordination in agrifood supply chains. There are a number of underlying demographic changes that are contributing to changes in consumer preferences, including: increased participation of women in the workforce, longer hours in the workplace, and smaller households. These

changes have led to a demand for convenience-oriented food offerings. The expanding ethnic diversity of the US and Canadian population stimulated interest in many new food products. Consumers, particularly the aging baby boomers, now have a wealth of information available on the relationship between food and health, which has led to a demand for a wide range of products that are fresh, low fat, low salt, trans-fat free, high in essential fatty acids, etc. The rising middle class in Mexico has tended to mirror the preferences of consumers in the other NAFTA partner countries. Product differentiation requires supply chain relationships that provide accurate quality signals to producers and facilitate credible quality assurances to consumers.

Heightened consumer awareness of food safety issues has also been a key driver for change. The media is quick to highlight stories regarding foodborne illnesses, as well as production and processing methods with (whether perceived or actual) food safety implications. Agrifood firms and governments have responded to the increased public sensitivity to food safety. The food industry has put in place tighter food safety protocols, including more stringent requirements of their suppliers. Governments have imposed stricter regulations, safety procedures, and in some cases, labeling requirements (Phillips, Smyth, and Kerr; Hobbs and Young 2001). Beyond issues of food safety, some consumers have ethical concerns about how food is produced (e.g., animal welfare, biotechnology, environmentally friendly). These issues have implications for supply chain relationships as retailers seek to provide consumers with credible quality assurances. To provide information about on-farm production practices, producers, processors, and retailers must communicate – entailing closer vertical relations.

The ongoing revolution in information technology means that information now exists that was unimaginable even a few decades ago – information that can be used to increase operational and managerial efficiency. If individual firms interact through spot markets, this information usually remains proprietary to the firms and is not available to increase the efficiency of other firms or the supply chain. Closer vertical coordination can enable firms to capture gains from better information. Other drivers include rising concerns with the environment that may provide a relative advantage to larger integrated production units due to economies of scale in waste management. Spot markets tend to be volatile, meaning individual firms bear the entire brunt of price risk, while contracts and vertical integration facilitate risk sharing or internalization of risk over the supply chain – leading to a lower risk profile and, hence lower financing

costs (Hobbs and Young 2001). Summarizing these drivers for change, Hobbs and Young (2001) state:

> Members of many agrifood supply chains have moved to closer vertical coordination for five reasons: to produce and deliver in a timely fashion the quality attributes demanded by the consumer; to communicate these attributes, many of which are invisible, to the consumer; to ensure that members of the supply chain are compensated for the costs involved; to meet regulatory requirements, both health and environmental; and to meet associated concerns about liability (p.24).

While the drivers for changing coordination within agrifood supply chains can be catalogued and described, the development of testable hypotheses or predictive assertions regarding which forms of vertical coordination will predominate requires a coherent economic framework. A useful theoretical approach is Transaction Cost Economics (TCE), which falls under the broad umbrella of New Institutional Economics.

Transaction Costs

Unlike neoclassical economics, TCE explicitly recognizes that transactions do not occur in a frictionless economic vacuum – buyers and sellers incur costs to coordinate a transaction. These costs arise because of bounded rationality, opportunism, information asymmetry, and asset specificity (Williamson 1986; Eggertsson).[2] Transaction costs may arise ex ante to the transaction (e.g., the expenditure of time and resources identifying suitable trading partners, specifying/identifying product quality, gathering price information) and comprise "information/search costs." Costs may arise during the transaction – "negotiation costs" (e.g., retaining the services of a lawyer, paying fees to agents or middlemen such as auctions, costs of determining contractual terms). Finally, costs occur *ex post* to a transaction, i.e., the ongoing "monitoring/enforcement costs" of ensuring that the pre-agreed terms of the transaction are adhered to (Cheung).

If external drivers increase the transaction costs associated with using spot markets or auctions, closer forms of vertical coordination such as contracts or vertically integrated supply chains are expected to arise (Coase; Williamson 1979). Competitive pressure, *ceteris paribus*, will lead to the eventual exit of those firms who fail to adopt the most transaction cost efficient coordination mechanism. If firms cooperate with other

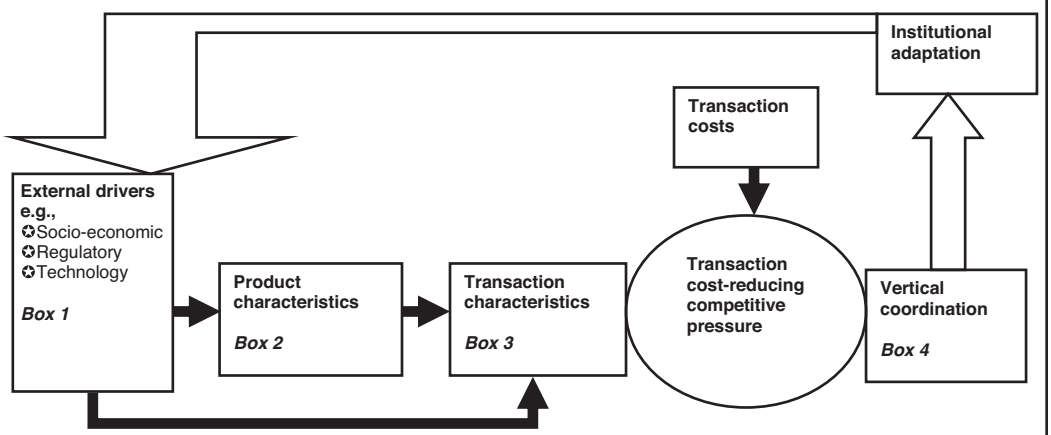
[2] In neoclassical economics the strong assumption of perfect information excludes the possibility of information asymmetry, economic actors can be perfectly rational (prescient) when making decisions, and any attempts at opportunism would be anticipated and thwarted. The assumption of perfect information is relaxed in TCE.

members of the supply chain there may also be system efficiencies that result in increased competitiveness of the entire supply chain.

Figure 5.1 depicts a conceptual model of the forces behind closer vertical coordination in agrifood supply chains. The model has four components (linked with solid arrows) as well as a feedback mechanism (linked with hollow arrows). Following Williamson (1979), we recognize that certain transaction characteristics affect the institutions used to accomplish vertical coordination through their influence on transaction costs. This is depicted by the relationship between boxes 3 and 4 in figure 5.1.

Williamson discusses frequency, uncertainty, and asset specificity as determinants of contractual choice. Hobbs and Young (2000, 2001) argue that these specific transaction characteristics are the result of product characteristics – box 2 in figure 5.1 – which, in turn, are shaped by regulatory, technological, and socioeconomic drivers – box 1. Figure 5.1 also recognizes that some of the drivers can affect transaction characteristics directly by influencing the environment within which those transactions are conducted. For example, in the wake of the 9/11 attacks there were significant regulatory changes at US borders that

Figure 5.1: Relationship between product characteristics, drivers, and transaction characteristics.



Source: Adapted from Hobbs and Young (2000).

Table 5.1: The relationship between product characteristics, drivers, and transaction characteristics.

	Transaction Characteristics						
	Uncertainty for buyer quality	Uncertainty for buyer: supply reliability (timeliness and quantity)	Uncertainty for buyer and seller: price	Uncertainty for seller: finding a buyer	Frequency of transaction	Relationship-specific investment	Complexity of transaction (variety of outcomes)
Product Characteristics, e.g.,							
Perishability	✖	✖		✖	✖		✖
Product differentiation	✖	✖	✖	✖		✖	✖
Quality variable and visible		✖	✖	✖			✖
Quality variable and invisible	✖	✖	✖				✖
New characteristics of products of importance to consumers	✖	possibly	✖	✖		✖	✖
Regulatory Drivers, e.g.,							
Liability	✖			✖		possibly	✖
Traceability				✖		✖	✖
Border measures	✖	✖	✖				✖
Technology Drivers, e.g.,							
Firm (market)-specific technology						✖	possibly

Source: Adapted from Hobbs and Young (2000).

affected the transaction costs associated with coordinating supply chains moving products from Mexico or Canada into the US.

Changes in the relative costs of coordinating transactions provide an impetus for the development of transaction cost-reducing innovations in firms and within governments – a feedback loop. For example, in the wake of the 9/11 attacks and rising concern regarding bioterrorism, border procedures associated with moving food products into the US became more costly in terms of both time and resources(Kerr 2004). As a result, a number of private firms began to offer or expand their services designed to reduce the transaction costs associated with transborder movements of products along supply chains (see Heinze; Purolator). These Third Party service providers often worked with the US Homeland Security Agency to obtain regulatory changes that would accommodate their service offerings. The US Government also introduced transaction cost-reducing initiatives such as the GreenLane Maritime Cargo Security Act as part of their border security strengthening initiatives (Heinze) and have generally attempted to limit the transaction cost effects of their biosecurity border measures (Kerr 2004). Figure 5.1 depicts the feedback loop as a range of potential institutional adaptations.

Changes in transaction characteristics increase or decrease transaction costs, which in turn alters the form of vertical coordination. Table 5.1 provides examples of the relationships between product attributes and transaction characteristics, *ceteris paribus*. Uncertainty can be classified in four ways (Hobbs and Young 2000, 2001). There is uncertainty for the buyer over product quality, which imposes sorting (search) costs on

the buyer in determining the true quality of a product (Barzel). Buyer uncertainty also arises with respect to the reliability of supply, both in terms of quantity and timeliness. For example: a supplier of beef patties to McDonald's must have an assured supply of beef to fulfill its contractual obligation to the restaurant chain. A supply disruption may result in the loss of the contract.

Buyers and sellers both face price uncertainty. At the time a production decision is made, there is uncertainty over prices that will be received/paid. This is particularly important in agriculture where there are biologically determined lags in production – for crops to mature, for animals to grow, etc. Sellers face uncertainty in finding a buyer, particularly if their product has idiosyncratic qualities. This raises their search costs. As uncertainty increases, we expect closer forms of vertical coordination to be selected as a means to mitigate higher search and monitoring costs.

When uncertainty is low, frequently repeated transactions tend to be coordinated through spot markets as they induce learning and reputation effects become important. As a result, opportunistic behavior is reduced.

Investments that are specific to the transaction relationship – asset specificity – arise when one party has made an investment in a production process specific to one buyer or seller (e.g., a food processor investing in a machine that packages products to the specifications of a particular supermarket chain). Asset specific investments leave the firm vulnerable to opportunistic behavior by the other transaction partner in an attempt to capture rents from the investment. In this situation, the likelihood increases of the transaction being internalized within a vertically integrated firm (Klein, Crawford, and Alchian; Douma and Shreuder).

Transactions can also be characterized by the degree of complexity. A variety of outcomes result from an increase in complexity (Hobbs and Young 2000); in most cases requiring closer coordination. At the very least, a detailed contract would be required to deal with the range of contingencies that may arise. Alternatively, vertical integration may be the least cost method to govern complex relationships.

As indicated in both figure 5.1 and table 5.1, product characteristics affect the characteristics of the transaction. For example, perishability means that buyers are less certain about the quality of the product they are purchasing. Perishability creates uncertainty for the seller in locating a buyer as the product cannot be held back from the market until a suitable buyer is located. Perishability also increases the complexity of a transaction: the potential for quality deterioration imposes transaction costs on buyers. Negotiation costs arise because clear delineation of

responsibility for product quality at the various stages of production, processing, and distribution must be established. Enforcement costs arise *ex post* in seeking redress should quality deteriorate as a result of mishandling during product transit or storage.

Regulatory, socioeconomic, and technological drivers can affect transaction characteristics directly, as shown in figure 5.1. For example, heightened border measures (e.g., inspections, paperwork, delays) increase uncertainty in a multitude of ways: buyers face uncertainty over the timeliness of delivery; both buyer and seller face increased (net) price uncertainty if border measures increase transportation costs; buyers face more quality uncertainty if the product is perishable given the potential for delays at the border; and crossing a border can significantly increase the complexity of the transaction. A more detailed analysis is presented in the following section.

Agrifood supply chains in developed countries have been evolving steadily away from spot market transactions. Probably the most well known example is the US poultry industry where contractual arrangements or vertical integration are used almost exclusively. Similarly, the US pork industry has been moving to a reliance on contracting. In the beef industry fewer and fewer animals move through auctions. Given the variety in both product characteristics and transaction characteristics in the agrifood sector, a plethora of vertical coordination mechanisms exists, nevertheless, the general trend toward closer coordination is clear. It is also true that multiple coordination mechanisms coexist across parallel supply chains. Competitive pressures are seldom dramatic and it takes time for all supply chains to adapt or fail. As with any competitive environment that is subject to exogenous shocks, equilibrium is elusive. A constant state of disequilibrium means that snapshots fail to provide much information and may indeed be misleading because the vertical coordination mechanism that exists today may not exist next year. As a result, empirical verification of differences in vertical coordination between agrifood supply chains that operate exclusively in the US and those that are transboundary is difficult, if not impossible. Given that borders matter, it is unlikely that transboundary supply chains can achieve all of the potential cost savings that might otherwise arise within a single country. As a result, the competitiveness of cross border supply chains will be lower, implying that the value of trade is less than its potential. The next section examines challenges to the development and growth of cross border supply chains within North America.

TRANSBOUNDARY AGRIFOOD SUPPLY CHAINS IN NAFTA

Despite its name, free trade does not apply everywhere in the NAFTA agrifood market. For example, formal trade barriers still exist between

the US and Canada in dairy products due to the large degree of policy intervention in both countries. Sugar imports into the US are limited. Access to Canadian chicken, turkey, and egg markets is restricted by tariff-rate-quotas due to the Canadian policy of supply management. In these cases, cross border supply chains either do not exist or are poorly developed. In Canada, international trade in wheat and barley originating in the Canadian prairies is controlled by a state trading enterprise, the Canadian Wheat Board, which has inhibited the development of private sector grain marketing – both domestic grain and grain of foreign origin.

On the other hand, NAFTA has provisions that go beyond the removal of border measures. For example, NAFTA's Chapter 11 provides protection to foreign investors from changes in government policy and regulations. This has been particularly important in Mexico which, prior to NAFTA, often actively discouraged foreign investment; assets held by US firms were vulnerable to capricious acts by governments. As a result, US firms were often deterred from making investments, and the opportunity to vertically integrate across the border was seriously curtailed. The improved protection for foreign investment in the NAFTA facilitated Walmart's expansion into the Mexican market, thus facilitating transboundary vertical integration. Similarly, Cargill's greenfield investment in a beef packing plant in High River, Alberta and Tyson Food's purchase of a beef plant in Brooks, Alberta opened the possibility for cross border vertical integration. For example, boxed beef moving from Cargill's Canadian packing plant into the US is centrally marketed (along with beef from Cargill plants in the US) from the US head office.

The removal of tariffs and quantitative restrictions on the movement of products is likely to have been more important for increasing transborder trade than for deepening economic relations through closer vertical coordination. This is particularly the case for tariffs – a transparent and therefore a predictable border impediment. Having to pay a tariff will reduce the profitability of transborder transactions, but it will not alter the nature of a product's characteristics or the characteristics of the transaction. In contrast, quantitative restrictions do have the potential to alter the characteristics of a transaction, depending on how the import quotas are administered. For example, if annual quota allotments are distributed on a first-come-first-served basis the allocation may be used up early in the year, and a buyer cannot rely on a steady foreign supply. As a result, buyers must source from a diverse supplier base, increasing the costs of identifying potential suppliers and requiring greater coordination to ensure continuity of supply throughout the year. Prior to the Canada-US Trade Agreement (that preceded the NAFTA) import quota limits on beef imports into the US, while seldom binding, were perceived as a border irritant by the Canadian beef industry. Even the threat of intermittent

supply chain disruptions due to the potential for import quota limits being reached were sufficient to deter reliance on Canadian suppliers by US beef buyers.

If the NAFTA borders still matter, in that they alter supply chain coordination relative to supply chains that do not cross borders, two types of border effects can be identified: border frictions and independent national policy-making. Both inhibit the deepening of economic integration among the NAFTA markets by curtailing the use of the most cost-effective supply chain coordination alternatives.

Border Frictions

While formal barriers to trade such as tariffs and import quotas have largely been removed, transiting the Canada-US and US-Mexico border is far from seamless. One only has to contrast the transit of the Dutch-Belgian border or the Belgian-French border in Europe: often the only indication that one has arrived in a new country is a change in the language on road signs – no passports, no border inspections, no delays at all. Reports of trucks lined up at the Windsor-Detroit crossing or the Laredo-Nuevo Laredo crossing stand in stark contrast (Haralambides and Londono-Kent).

One of the major innovations leading to supply chain efficiencies, not just in agrifood supply chains but in supply chains in general, is just-in-time (JIT) delivery systems. Efficiency gains come from reductions in the costs of holding inventory. Just-in-time systems require close cooperation between buyers and sellers. In the most sophisticated operations the computing systems of firms are linked and point-of-sale information on inventory draw downs are instantaneously transformed into new orders communicated directly to suppliers. Business-to-business (B-to-B) applications of e-commerce reduce information, negotiation, and monitoring costs, leading to system efficiencies for inventory management and more competitive supply chains.

Just-in time delivery relies on logistics systems working with clockwork precision. One of the most contentious issues in the implementation of the NAFTA has been US regulations that prevent long-haul Mexican trucks from operating beyond strictly delineated border regions (Condon and Sinha). The result is that:

> Often, it still takes from two to five days and at least three pieces of equipment (trucks and trailers) and three or four drivers, to cross the Rio Grande River with a loaded truck, while actual

> driving time from Chicago to Laredo (1600 miles) is only two days (Haralambides and Londono-Kent, p. 172).

While the extra cost of moving goods from Mexican to US trucks can reduce the competitiveness of Mexican suppliers, if the cost advantage in production were sufficiently large, Mexican exports would still occur – in other words the extra cost does not necessarily lead to a different supply chain relationship. The key words in the quote above are "it takes from two to five days". In other words, the existence of the border creates uncertainty. This variance in delivery times is not acceptable in a just-in-time system and Mexican suppliers will be excluded from participating. Instead, Mexican suppliers wishing to export will be confined to other, less efficient, supply chain relationships. Southbound movements into Mexico are also fraught with timing uncertainties as Mexico refuses to allow US trucks to operate in Mexico in tit-for-tat retaliation for US intransigence on the issue of Mexican trucks operating in the US. As a result:

> Transport of a trailer over the 1,600 miles from Chicago to Monterrey involves ten movements with a minimum of three different trucks and various pieces of equipment for loading and unloading. A US long-haul truck is barred from crossing into Mexico. As a result, the US driver leaves the trailer in a US trucking terminal facility (movement 1) and returns with or without a trailer (movement 2). With a team of drivers the trip from Chicago to Laredo takes 32 hours, plus or minus two hours. …
>
> The trailer with cargo to Mexico is subsequently moved to the Mexican broker's warehouse facility (in the United States) by a drayage truck (movements 3 and 4). The drayage truck then returns empty to the garage (movement 5). The cargo is inspected, counted, and assessed by the Mexican broker to complete pre-clearance for entry into Mexico; *a process that takes 12 to 74 hours*. …
>
> Once the pre-clearance process is compete, another drayage truck is called (movement 6) to transfer the trailer through US inspection, cross the bridge, go through Mexican inspection and, finally, enter a designated "corral" (movement 7). … The crossing time *varies 1 to 8 hours* … (emphasis added) (Haralambides and Londono-Kent, pp. 175-177).

Again, beyond the additional effect on competitiveness of higher transportation costs, the lack of certainty regarding the time it takes to move a load across the border precludes these goods from being included in just-in-time supply chain relationships. Given all the steps

and arranging for intermediate transport (drayage), there are increased possibilities for mistakes and delays, further increasing the time variance. Haralambides and Londono-Kent calculate that the time at the border moving north from Mexico to the US at Laredo/Nuevo Laredo varies from 1.6 to 13.1 hours and southbound from the US to Mexico from 12.1 to 82.4 hours. These types of delays are even more problematic for perishable agricultural products due to the risks of quality deterioration. From a transaction cost perspective this raises monitoring costs for buyers in determining if quality meets pre-agreed specifications.

Canadian trucks are allowed to operate in the US, and vice versa, so the barriers at the Canadian-US border are less that those at the Mexican-US border; nevertheless, the movement of trucks is not seamless (Heinze). There is still a random timing element in crossing the border due to congestion and changing levels of alert status pertaining to expectations of terrorist activity. This inhibits the development of truly JIT supply chain relationships.

One of the technology-driven changes to supply chain coordination is the use of business to consumer (B-to-C) direct marketing through the internet. The development of these supply chains has been particularly important for niche market products, often produced by small and medium sized enterprises (SME). Essentially, B-to-C supply chains allow SMEs to access a much larger pool of consumers through internet marketing, shipping product directly to consumers using commercial courier companies. Inside national borders, SME food producers have been able to utilize e-commerce-based B-to-C supply chains effectively, not just for non-perishables but also for perishable products such as steaks, exotic wildlife meat products, and specialized poultry (Boyd, Hobbs, and Kerr).

Crossing national borders presents greater challenges for B-to-C transactions in the food industry. Perishable products are usually inspected when they cross the border. The border inspection system is set up primarily for bulk transport of perishable products. Boyd, Hobbs, and Kerr found that lumpiness in border inspection costs was sufficient to prevent the use of B-to-C transborder supply chains for a number of livestock products. If transborder shipments of these products took place at all, alternative supply chain relationships were required: either firms would need to vertically integrate across the border, moving product in bulk and then using a facility in the foreign country as the place of origin for the B-to-C supply chain; or bulk shipments would have to be sold to a foreign distributor.

The failure to harmonize standards among NAFTA countries can inhibit trade in agricultural products, for example, different organic standards

including the definition of organic, the protocols governing production processes, and labeling requirements (Sawyer). Transborder movements of organic products may require much closer vertical coordination if the firms selling imported organic products need to be assured that foreign producers have followed the importing country's protocols. Rudge found similar border effects for natural health product trade at the US-Canada interface.

Natural health products or nutraceuticals, and functional foods are a rapidly expanding segment of agricultural production, responding to a growing consumer interest in the link between diet and health. These products are regulated more stringently in Canada than the US, inhibiting the development of US to Canada supply chains. Restrictive Canadian regulations with respect to health claims on functional foods (e.g., currently only five allowable health claims in Canada versus 17 in the US), and severe restrictions on the marketing of fortified foods in Canada relative to the US (e.g., prohibition of mineral and vitamin enhancement except under stringent conditions), have been identified as a source of significant lost opportunities for the Canadian food and beverage sector (Zecchini). The different regulatory environments in Canada and the US lead to somewhat bizarre supply chain developments. Yeung, Hobbs, and Kerr cite cases where the stringency of Canadian regulations prevented the development of within-Canada supply chains. Instead, Canadian firms were developing supply chain relationships to sell their products in the US – but not attempting to sell them in Canada! In some cases, the raw ingredients were imported from offshore by Canadian firms, used in formulations prepared in Canada and then shipped to the US; again with no attempt to obtain approval to sell the product in Canada.

The original NAFTA negotiators understood that failure to harmonize technical regulations and standards would inhibit the full potential of the free trade area. As a result, a number of committees dealing with different aspects of agrifood trade were established in the agreements of the NAFTA – these were intended to provide mechanisms for the elimination of technical barriers to trade (Hayes and Kerr). It is not clear how well the NAFTA working groups have functioned. Meilke, Rude, and Zahniser and Green et al. suggest that progress has been made on regulatory coordination in some areas (e.g., pesticides regulations) through workaday cooperation, including ongoing communication and discussions among mid-level government officials. However, in general, Kerr (2006) observes that while the absence of regulatory harmonization was recognized by those who negotiated the NAFTA through the establishment of technical committees, these committees have not produced the harmonization of standards within the NAFTA countries after a decade of operation. While some of the technical committees have produced limited results (e.g., pesticides), in general, even relatively straightforward issues such

as the grading of beef remain unresolved. Issues as seemingly simple as the size of food containers increase the costs of supplying more than one NAFTA market: Canada prescribes standard container sizes for processed foods such as soup, baby foods, and fruit and vegetable juices, while no such regulations exist in the US and Mexico (Zecchini). It is clear that further economic integration will require ongoing efforts at regulatory coordination. Lack of regulatory harmonization remains the rule in the NAFTA market, leading to more costly transborder supply chains and, often, differences in their coordination. Although Meilke, Rude and Zahniser explore a number of options for deepening economic integration across the NAFTA region, there remains no parallel initiative within NAFTA similar to the single market initiative in the EU aimed at eliminating nontariff barriers within the regional trade agreement.

The absence of harmonized regulatory standards creates transaction costs. In turn, institutional adaptation occurs to reduce or mitigate these costs, for example, the growth of private standards aimed at facilitating the international movement of goods. These are often initiated by large retailers attempting to ensure that imported products are acceptable to consumers. Private standards initiatives are particularly important for products originating in developing countries, including Mexico. Good agricultural practices (GAPs), such as EUREPGAP are an example, and require close vertical coordination of supply chains through contracts, verification systems and inspections (Hobbs; Fulponi). The development of proprietary GAPs systems can be seen as a form of institutional adaptation in response to high transaction costs.

Commercial legal systems between the three NAFTA countries differ considerably. As a result, transboundary legal relationships are governed by private international law, which is cumbersome and lacks transparency. As suggested above, rising consumer concerns over food safety have led the agrifood industry to initiate increased efforts to be able to trace the movement of products along supply chains (table 5.1). One of the reasons for having traceability is to facilitate assigning liability if there is a food safety breakdown in the supply chain and to provide an incentive for due diligence among all members of the supply chain. Bessel, Hobbs, and Kerr found that private international law was particularly opaque regarding transboundary liability. The liability damages awarded in the US are considerably higher than those typically awarded in Canada. While proving liability in a transborder context may be more difficult than if the supply chain remained entirely within one country, Canadian courts would likely enforce large US liability awards.

The threat of large US liability settlements may deter Canadian firms from being willing participants in traceability systems, restricting them to supply chains that provide consumers with lower levels of quality

assurance, and potentially excluding these suppliers from lucrative markets. Retailers and other downstream food firms with in-house traceability systems may be deterred from sourcing products originating across the border due to the additional costs and the opaque nature of private international law. Alternatively, uncertainties stemming from the outcome of legal processes could provide an impetus for vertical integration across the border to ensure that between firm assignations of liability do not inhibit transactions. Cross border liability and traceability issues increase the complexity of transactions and create uncertainty.

Unlike the EU, there is no single currency initiative among NAFTA member countries, and each country issues and manages its own currency. These currencies float relative to each other; there is currency risk in supply chains that cross borders – something that is not manifest in supply chains that begin and end in one country. While it is possible to use futures markets to hedge short-term currency risk, hedging is not a costless activity and risks cannot be perfectly offset. Small firms may have difficulty hedging due to lumpiness in contract sizes. It is difficult to hedge against longer-term shifts in the relative values of currencies over the life of an investment. Clearly, the significant appreciation of the Canadian dollar against the US dollar in recent years has altered the relative competitiveness of the Canadian hog processing sector (among others), which had been benefiting from a relatively low Canadian dollar. In the context of this analysis, exchange rate risk could be added to table 5.1 under the category of regulatory drivers; exchange rate risk leads to price uncertainty for sellers and buyers. Vertical integration across the border may emerge as a strategy to internalize the price risk within the firm.

While transborder supply chains entail the movement of goods, the movement of persons may also be required to facilitate cross-border business. In the context of building an international supply chain, personnel costs manifest themselves as a component of search, negotiation, and monitoring/enforcement costs. Prior to entering into a transaction, it may be necessary to assess potential business partners in face-to-face meetings, or to visit a production plant to be assured that the supplier can produce the requisite quality. Once a transaction partner has been selected, direct negotiations are usually required to set the terms of the transaction. Following negotiation of the transaction, there may be the need for onsite visits to ensure that the terms of the transaction are being adhered to. In addition, technical experts, repair personnel, and troubleshooters may need access to products at any point in the supply chain. All of this requires the movement of personnel across a national border. The movement of persons is governed by immigration departments. While the NAFTA has provisions on the right of entry for business purposes for some professions, these provisions are far from comprehensive. Indeed, considerable documentation is required.

Obtaining the required documentation is not a transparent process, and often entails delays and costs. Contrast this situation to the document-free movement of individuals within the subset of EU countries governed by the Schengen Agreement.[3] The documentation requirements within NAFTA have recently become more complex with the requirement for the use of passports for all air travel into the US, and which is set to extend to land border crossing in the near future,. While Canada and Mexico do not require US citizens to have passports, the US will require its citizens to have passports in order to reenter the US. Currently, only about one-third of US citizens have passports.

The movement of individuals has been further restricted in the wake of the 9/11 attacks. In particular, racial profiling may increase the hassles associated with crossing the border and increase the time it takes for legitimate business persons from distinct ethnic groups to cross the border. A considerable proportion of recent immigration to Canada comes from countries that may be targets for racial profiling. Many of these immigrants came under Canadian programs that positively selected those that would start their own businesses upon arrival in Canada. Of course, the movement of Mexican citizens into the US is well known for being difficult even for legitimate business persons.

These border impediments to the free movement of persons can impact the ways in which transborder supply chains are coordinated. Firms may have to set up subsidiaries in other NAFTA countries to coordinate their after-sales service activities, whereas they would simply send individuals across the border from head office in the absence of border hassles. Instead, the hiring and training of additional foreign staff located in the importing country is required. This may be particularly difficult in the market entry stage for new businesses when sales volumes cannot justify a separate foreign service staff. Alternatively, it may be necessary to contract with existing foreign firms to undertake repairs and other after-sales service activities whereas these activities would be done in-house in the absence of restrictions on the movements of individuals across national borders. Clearly this has implications for the structure of supply chain relationships and the degree of vertical integration across borders.

Probably the obvious smoking gun indicating that borders still matter in the NAFTA is the plethora of firms providing services targeted at reducing the transaction costs associated with the transborder movements of goods (figure 5.1). These firms simply would not exist if borders did not matter. Institutional adaptations (innovations) occur when transaction costs are high. Hiring a transaction cost-reducing firm to facilitate transborder commerce is one response to these costs. Solutions that alter supply chain

[3] Originally France, the Netherlands, Belgium, Germany, and Luxembourg; later expanded to include a number of other European countries.

relationships is another, for example, suppose a firm-to-firm spot market transaction is the least cost coordination method in the absence of a border. When that same transaction must take place across a border, with the commensurate cost of the specialized service provider, it may be less costly to acquire the expertise in-house. The transaction is internalized within a vertically integrated transnational firm. In other cases, the opposite might be true. Rather than being vertically integrated across the border, it may be less costly (lower risk) to use spot markets and hire the service provider. In either case, the most transaction cost efficient means of supply chain coordination will be altered due to the existence of the international boundary.

While border frictions undoubtedly affect the coordination of supply chains, whether these frictions will lead to closer or looser coordination will depend upon the particular transaction characteristics and product characteristics (figure 5.1). We cannot make generalizations about the effect on supply chains. At the margin, the increased costs of internalizing the transaction within a vertically integrated structure will be weighed against the cost of conducting the transaction through a cross-border market interface. In many cases, while transborder supply chains are likely to be more costly than those operating entirely within one country, the costs associated with the border will be neutral in their effect on supply chain coordination.

Over time, transaction cost-reducing institutions, such as firms specializing in border services, emerge. As a result, the effect of borders on supply chains will be mitigated to a considerable degree, meaning that fewer differences in the coordination of supply chains are likely to be observed. The only way to test this observation empirically would be to collect data on the degree and nature of cross-border commerce and the growth (or decline) of third party service providers over time. Although border frictions should not be dismissed even given institutional adaptation to mitigate their effect, far more important to the development of NAFTA-wide supply chains, is the tendency of governments to seek national (rather than regional) solutions in times of crisis.

National Policy Responses to Regional Problems

There are few limitations on the ability of NAFTA countries to take independent economic action. NAFTA's Chapter 11, which deals with investment, provides an example of a limitation on independent action. It allows firms to sue NAFTA governments for compensation when policy changes are made that result in expropriation, or action equivalent to expropriation, of a foreign firm's investment. As suggested above, the protection in Chapter 11 has probably contributed to the willingness of US firms such as Cargill, Walmart, and Tyson Foods to make investments

in Mexico and Canada, thus creating the opportunity for the vertical integration of transboundary supply chains.[4] Chapter 11 has been very contentious due to the limits (perceived or actual) it places on the ability of governments to act independently.

For the most part, however, NAFTA governments are allowed to seek national solutions when major economic challenges arise. These national solutions often have large scale and widespread economic effects and greatly increase the risks associated with investing in activities associated with transborder supply chains. For example, the independent management of the Mexican economy led to the Mexican economic crisis of December 1994. Poor management of Mexican foreign reserves led to nervousness among international investors and a subsequent capital flight. The Mexican peso lost half of its value in a matter of days. According to Clement et al.:

> The end result of economic miscalculation and freely flowing international capital is that they can lead, as they have done in Mexico since December 1994, to currency devaluations, inflationary spirals, tight fiscal and monetary policies – all of which also put in peril the possibilities for free trade in the future. … NAFTA was not designed as an instrument to stabilize economic activity in the North American market. To do that would require a movement to a much more formal economic union than any of the NAFTA partners desired to accept (pp. 273-274).

In contrast, this type of economic disaster is virtually impossible among individual members of the Euro area with its common central bank – the European Central Bank – and common currency.[5]

The effect on pan-North American supply chains is fairly clear. While the management of the Mexican economy has exhibited considerable stability since 1994, given that no constraints exist in NAFTA on independent economic action, a repeat of 1994 cannot be entirely ruled out. A 50 percent devaluation of the peso would make supply chains moving product into Mexico extremely vulnerable. If this possibility threatened, agrifood supply chains that terminate with Mexican consumers would likely source more product locally to diversify their risk rather than relying exclusively

[4] The limits of Chapter 11 have yet to be fully tested. For example, a group of Canadian beef producers gave serious consideration to mounting a Chapter 11 challenge against the US when the US failed to reopen the border to trade in live cattle once the BSE risk was dealt with in Canada. The case would have argued that the investments made by the producers in the NAFTA beef market had been nullified by the extended closure of the US border to Canadian cattle.

[5] Of course, the US organized international financial measures to mitigate the effect of the 1994 Mexican peso crisis but this was not undertaken under the auspices of NAFTA; it was an independent national economic response to a neighbor's economic distress.

on products sourced from the US. Supply chain participants are also less likely to enter into long-term commitments or to invest in assets that could be stranded by US supplies becoming uncompetitive as the relative value of the dollar rose in the face of a major Mexican devaluation.

Mexican domestic politics also presents risks for those investing in NAFTA agrifood supply chains. For example, one of the unsuccessful candidates in the recent Mexican presidential elections indicated that he wished to slow or reverse some of the country's agricultural reforms.[6] If the election had turned out differently and the promises on agriculture had been implemented, it could have threatened investments in cross border supply chains. Prudent investors must anticipate such eventualities and make their investment decisions accordingly.

The wholesale changes to US border security measures in the wake of the 9/11 attacks also represent national solutions that have significant economic effects (Kerr 2004). The US response to the attacks of 9/11 resulted in a widespread ramping up of many of the border frictions discussed in the previous section. While investors in NAFTA supply chains could not have anticipated the 9/11 attacks, now having seen the US response they are likely much more cautious in their investments. A similar attack in future would probably result in a further ramping up of border security measures. If an attack took the form of agriculturally-based bioterrorism, the effects on transborder supply chains would be particularly disruptive (Huff et al.). This may be one reason why we have not witnessed greenfield investments on the scale of Cargill's investment in the beef processing plant in High River, Alberta since the 9/11 attacks. One only has to look at the effect of bovine spongiform encephalopathy (BSE) on transborder supply chains and related investments to glean insights into the potential magnitude of a major agriculturally-based bioterrorism event.

The response to the discovery of BSE in Canada brought home the vulnerability of Canadian-US supply chains to national solutions. Despite agreed-upon international protocols, exports of Canadian beef and cattle were prohibited for long periods of time, much longer than international norms suggested, and much longer than the border was closed by Mexico. The processes for reopening the US border to Canadian beef and particularly live cattle lacked transparency (Loppacher and Kerr). While Canada received better treatment by the US than any other country that has reported cases of BSE, investments made in supplying the NAFTA market for beef were adversely affected all along the beef supply chain,

[6] One of the reasons that Mexico entered into NAFTA was to provide international treaty obligations as a rationale and cover for reforms to Mexico's agricultural sector. It was hoped that the existence of NAFTA would make agricultural reforms difficult, if not impossible, to reverse (Gerber and Kerr).

starting with Canadian cow-calf producers.[7] While the reopening of the Canada-US border to Canadian beef and cattle exports has led to the reestablishment of pre-BSE supply chains, the broader livestock sector in Canada is aware of the risks associated with having undiversified supply chain investments. The effects on future NAFTA-oriented supply chain investments are not yet clear.

Other smaller scale examples of the willingness to pursue national solutions within the NAFTA market is the persistence of anti-dumping and countervail actions. While removing or reforming anti-dumping was a serious topic for negotiation in the Canada-US Free Trade Agreement, even the weak provisions pertaining to reform within the bilateral agreement were removed in the NAFTA (Hayes and Kerr). Anti-dumping and countervail actions disrupt transborder supply chains and increase the costs and risks of investments in these supply chains. One response is to vertically integrate across the border to reduce the transparency of pricing policies that might be the spur to an anti-dumping action. Furthermore, the ongoing threat of the imposition of country-of-origin labeling by the US represents another example of a national solution that threatens to disrupt supply chain relationships, as it would require the segregation of supply chains and identity preservation systems to be put in place.

The ability to seek national solutions within the NAFTA market threatens disruptions to transborder supply chains and is relatively difficult to anticipate ex ante. The potential magnitude of the supply chain disruptions arriving from this source go beyond those of border frictions. Long-term investment strategies in NAFTA market supply chains are affected. These effects are difficult to analyze given the time span over which supply chain relationships may be affected by sunk investments and the lack of transparency in the motivation for investment decisions. In any case, there exists no more political appetite for European Union-style cooperative solutions to economic challenges in North America today than there was when the NAFTA was negotiated. As a result, the potential transaction cost efficiencies from more closely coordinated cross border supply chains will fail to be realized.

CONCLUSIONS

Given that borders still matter within NAFTA, the full potential for deepening economic integration will remain unrealized. Bilateral transborder supply chains within North America will be more costly that those that operate wholly within one country. How this inefficiency will manifest itself in the organization of supply chains – whether closer supply

[7] Given the experience of the British beef industry with BSE, the absence of a concerted effort by cattle producers in North America to deal proactively with procedures for re-opening borders is hard to understand.

chain coordination, or looser supply chain relationships, or in a neutral fashion – depends upon the product characteristics, the transaction characteristics, and the nature of the border effect. Transborder supply chains will continue to be shaped by the forces that affect the evolution of agrifood supply chains generally. In this regard, NAFTA supply chains will have to respond to changes in consumer tastes and attitudes, as well as technological developments, and regulatory pressures.

Research in this area is challenging because systematic data is not collected, information is often proprietary, outcomes are not discernable in the short-run, and equilibriums are seldom reached before additional shocks occur. Hence, theoretical propositions can only be evaluated anecdotally (or possibly through expensive collection of primary data using surveys). Despite these limitations, the questions surrounding transboundary agrifood supply chain relationships in the NAFTA market remain an important area for academic investigation.

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