Tariff oriented Supply Chain Management: Implications of trade agreements on strategic decisions

Dipl.-Wi.-Ing. Johannes F. Plehn [a], Dipl.-Wi.-Ing. Gandolf R. Finke [a] and Dipl.-Wi.-Ing. Alexander Sproedt [a]

[a] *ETH Zürich, BWI Center for Enterprise Science, Kreuzplatz 5, Zürich, 8032, Switzerland,*
Email: {jplehn@ethz.ch, gfinke@ethz.ch, asproedt@ethz.ch}

Global trade of finished goods as well as global sourcing of components and raw material is gaining importance. The paper aims to investigate the impact of trade agreements and tariffs on global Supply Chains and to describe the implications for strategic supply chain management decisions in terms of supplier selection and plant locations. The present system of trade agreements and tariffs among single countries and economic areas is introduced, followed by a qualitative and quantitative assessment of their impact on a global Supply Chain. Furthermore, the authors illustrate how trade agreements can be used to reduce tariff costs and which implications for the Supply Chain structure arises. Moreover, the authors highlight potential risks and problems of a tariff oriented Supply Chain Design. The paper concludes with three scenarios that demonstrate the variability of Local Content calculations.

Key Words: Supply Chain Management, Free Trade Agreement, Rules of Origin, Local Content, Risk

1 INTRODUCTION

Global sourcing as well as global manufacturing has continued to be a necessity for companies competing in today's global market (Zeng and Rosetti, 2003). Globalization has increased significantly, which is also reflected in the exponentially growing investment volume. Within the last 10 years the amount of foreign investment has increased over 300% (Abele et al., 2006). As a consequence, affiliated companies' sales revenues are estimated at $19 trillion, accounting for a tenth of world GDP (United Nations, 2002).

While companies are trying to optimize their global supply chain, governments are aiming for the protection of their local industries. Popular instruments for governments to accomplish their endeavor are Preferential Trade Agreements such as Free Trade Agreements, custom unions, common markets and single markets. Governments apply them to prevent the labor from moving to foreign countries and to encourage companies to transfer their value adding activities to their domestic economic area (Hirsch, 2002). The number of Preferential Trade Agreements and especially Free Trade Agreements is increasing rapidly. By the end of 2002, the World Trade Organization (WTO) had been notified of the existence of some 250 Free Trade

Agreements. At the end of 2008 the number was already 421 and in the year 2010 the WTO expects a total number close to 350 of additional Free Trade Agreements implementations, nearly doubling the existing amount (World Trade Organization, 2010).

To remain competitive, global acting companies need to take the constraints into account that are implied by Free Trade Agreements when designing their Supply Chain. As illustrated by the strategic logistics model of Munson and Rosenblatt (1999), these effects need to be considered in strategic Supply Chain decisions. Ideally, companies are able to exploit the emerging opportunities but also need to be aware of possible threats. A major opportunity occurs when the companies meet the Free Trade Agreement's requirements and are allowed to trade tariff free within the economic area. In most cases, this requires a certain amount of value adding (Value Content) to take place within the domestic area.

One threat arises in a situation in which the Supply Chain structure was aligned to meet Value Content requirements and suddenly the requirements cannot be satisfied anymore due to environmental changes. Free Trade Agreements and in particular Value Content requirements are man-made interferences and therefore can change rapidly. The strict orientation of plant location and sourcing decisions along the fulfillment of Value Content requirements could induce long term investments and strategic decisions about the Supply Chain structure, whereas the basis for the decision-making - the Value Content requirements and the Value Content itself - can change overnight. According to Gotschaelkx et al. (2002) few strategic Supply Chain Design Models are calculating Value Content requirements when determining the optimal configuration in global logistics systems. However, none of them addresses the potential risk that occurs when the design of Supply Chains is adjusted to Value Content requirements. This issue will be investigated in this paper.

For this purpose,the first part of this paper discusses Free Trade Agreements, providing a definition and description of existing Free Trade Agreements, Rules of Origin and Value Content requirements. Using literature research, the result of this part is an investigation on the current situation of Rules of Origin and their influence on Supply Chain Designs. This is followed by an outline on calculations of Value Content requirements and the illustration of their impacts on Supply Chains using an example of a truck manufacturer in the North American Free Trade Agreement (NAFTA) (chapter 2). In the second part, this paper stresses the volatility of the Value Content calculation and the potential risks in tariff oriented Supply Chan Designs (chapter 3). The result of this part consists of a list of parameters that affect the Value Content calculation and three scenarios where a changing environment leads to the failure of Value Content requirements. The paper closes with a conclusion of the discussed topics, supplemented by an outline of the limitations of this paper.

2 FREE TRADE AGREEMENTS, RULES OF ORIGIN AND THEIR IMPACT ON SUPPLY CHAINS

Free Trade Area & Free Trade Agreements

"A free trade area (FTA) is a form of preferential trading area which entails full free trade amongst members but in which each country chooses its own external tariff" (Richardson, 1994). The paper will use the term *Free Trade Agreement* synonymously.

As mentioned before, the global economy has experienced a significant increase of FTAs, which have enabled and enhanced global trade by reducing or eliminating trade barriers and transformed the way products are procured and manufactured (see also Ju and Krishna, 2005). Some of the most prominent FTAs are the European Union (EU), the North American Free Trade Agreement (NAFTA), the Central European Free Trade Agreement (CEFTA) and the Singapore-Australia Free Trade Agreement (SAFTA) (Li et al. 2007).

FTAs have been investigated by various authors from an economic perspective (e.g., Krueger (1993) and Chase (2003)) as well as on their macro influences on industries (e.g., Krueger (1993) and Bair and Gereffi (2003)).

One problem of the FTAs is the so called trade deflection. In case of no Common External Tariff (CET) among the member countries, companies would enter the Free Trade Area at the lowest tariff entry point. Goods could then be shipped to the final destination within the FTA without additional tariff costs. This would result in tariff revenue transfer effects, since this trade deflection transfers tariff revenue to the country with the lowest tariff within the FTA (Estevadeordal and Suominen, 2005). Countermeasures to trade deflection are the Rules of Origin, which define the prerequisites to trade goods tariff-free within the Free Trade Area.

Rules of Origin

"A good is eligible for zero tariffs in the FTA only if it originates there. Rules of Origin (RoO) specify conditions which have to be met for such origin to be granted" (Ju and Krishna, 2005).

In the literature, Rules of Origin have been discussed by various authors include Estevadeordal and Suominen (2004), Krueger (1993) and Ju and Krishna (2005). RoO can be separated into preferential and non preferential RoO. While preferential RoO define the conditions for a product to be regarded as a local product in the FTA, non preferential are used to implement safeguard measures and anti-dumping duties. This paper focuses on preferential RoO. For a detailed study on non-preferential RoO see Estevadeordal and Suominen (2005).

There are basically two ways to specify the conditions under which a good is treated as local in a preferential RoO. First, the good can be "wholly obtained or produced", meaning the good has been entirely grown, harvested, or extracted from the soil of the member country, or has been manufactured from any of these products. Due to the focus on global Supply Chain Designs, this type of RoO is not examined in detail in this paper. Second, the good has gone through a "substantial transformation". This criterion has three aspects that can be used in a combination or on a stand-alone basis (Estevadeordal and Suominen, 2005):

1.) **Value Content (VC):** The Value Content criterion defines the minimum amount of local value in the target country that is needed to be regarded and treated as a local product. The VC can be expressed in three ways:

- Regional Value Content (RVC): The minimum percentage of value that must have been added in the target country
- Import Content (MC): The difference between the value of the final good and the costs of the imported inputs
- Value of parts (VP): The minimum percentage of originating parts out of the total

The paper will use the terms Value Content and Local Content synonymously.

2.) **Change in Tariff Heading (CTH):** This criterion is fulfilled as soon as the imported good has been processed in a way that alters the Tariff Code in the Harmonized System.

3.) **Technical Requirements (TECH):** This criterion defines a list with processes and/or inputs that are prohibited or need to be realized within the Free Trade Area

Although there are basically only the above mentioned three main components to distinguish foreign from domestic products, the values of the calculations and the calculation method itself can vary dramatically among the several FTAs worldwide (see Estevadeordal and Suominen, 2005).
Moreover, when calculating Value Content there are a lot of specific parameters that need to be evaluated. The number of different parameters and their impact on the Value Content of a good becomes obvious when regarding the net-cost-method RVC calculation in the North American Trade Agreement.

Example for RVC calculation

Article 402 NAFTA defines the following formula:

$$RVC = \frac{NC - VNM}{NC} \; x \; 100\%$$

VNM value of non-originating materials used by the producer in the production of the good

NC net cost of the good

According to Article 415 NAFTA, net cost means total cost minus sales promotion, marketing and aftersales service costs, royalties, shipping and packing costs and non-allowable interest costs that are included in the total cost. Article 402 NAFTA provides three calculation schemes for companies to determine the net costs (see Article 402 NAFTA).

The Value Content requirement is fulfilled in this example as soon as the RVC of the traded goods exceeds the Value Content that is defined by the Free Trade Agreement RVC_{FTA}. The motivation for companies to fulfill the requirements is shown in the following case of a truck manufacturer in the NAFTA area.

Example for the impact of Value Content fulfillment

We are assuming the case of an American Truck Manufacturer which produces his trucks in the United States and afterwards ships them to the NAFTA member countries Mexico and Canada. The manufacturer will face the following tariff situation as shown in Fig. 1.

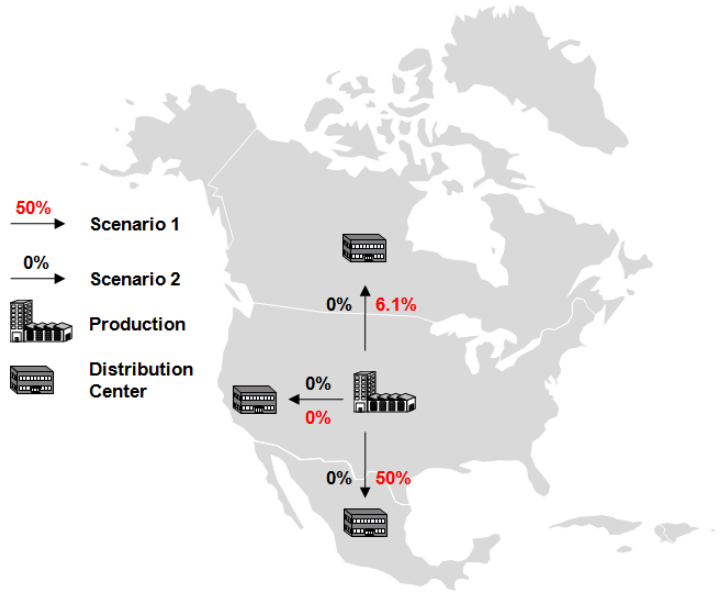

Fig.1: Impact of Value Content fulfillment in the NAFTA
(Source: Market Access Database 2007)

The Figure shows the significant impact of the Value Content. There are two possible scenarios from a Value Content perspective. In scenario one the Value Content is not fulfilled due to global sourcing of the components and small amount of value adding in the United States. The truck is regarded as a foreign product which means that the manufacturer has to pay 50% of the final product's value when exporting it from the United States to Mexico and 6.1% when exporting the truck to Canada. In scenario two, the Supply Chain structure has been designed according to the Value Content requirements by shifting value adding activities to the NAFTA member countries. Therefore, the final product is regarded as a domestic good. This enables the manufacturer to ship his trucks tariff free to the member countries.

Although this example is simplifying the Supply Chain structure it shows the leverage of tariff orientation in Supply Chain Design. Furthermore, it shows the potential risk when taking strategic Supply Chain decisions according to tariff optimization. In scenario one the manufacturer could benefit from low sourcing costs due to a global sourcing approach, supplemented by potential savings due to production in low cost countries. In scenario two the manufacturer relinquishes the benefits of a global Supply Chain, but is able to exploit the savings of tariff free shipments within the NAFTA due to his tariff oriented Supply Chain structure. Problems and competitive drawbacks emerge as soon as the Value Content of his product or the governmental Value Content requirement changes. As a consequence the company might suddenly be locked in his local Supply Chain and cannot compete with global competitors anymore due to relatively high sourcing costs. There are several reasons, why such a situation may occur. The next chapter therefore identifies the relevant parameters for this and illustrates them in three scenarios.

3 PROBLEMS AND RISKS IN TARIFF ORIENTED SUPPLY CHAINS

The problems and risks of tariff oriented Supply Chains emerge from the type of the decisions that need to be made regarding:

- number and location of the production facilities,
- the capacity of each facility,
- the allocation of each market region to one or more production sites and
- supplier selection for sub-assemblies, components and materials

(Chopra and Meindl, 2006).

All of them are strategic decisions and rather inflexible once they are taken and often combined with either long term investments in facilities or long term dependencies towards suppliers. This contradicts the short term nature of the RoO and in particular the Value Content. Concerning the formula that determines the RVC introduced in chapter 2, there are the two values NC and VNM which can vary in the Value Content calculation. According to Jackson and Vermulst (1989) the parameters which define the Value Content are:

- Originating materials
- Taxes and duties paid on such materials but refunded on export
- Direct labor
- Manufacturing overheads
- Inner containers
- Other packing expenses
- Profit

The values of those parameters decide whether the company fulfills the governmental Value Content requirements or not. This variability is supplemented by a possible variation of the Regional Value Content, requested by the governments RVC_{FTA}. To stress the volatility of the Value Content, the authors show three scenarios, where an altering environment causes problems with the RVC fulfillment.

Scenario a – Supplier shortfall (VNM)

One lever of tariff oriented Supply Chain Design is sourcing. Companies could decide whether they want to access the cost benefit of global sourcing, or consider FTA requirements to benefit from an improved tariff treatment. When assuming that a company decides for local sourcing to match Value Content requirements, a supplier shortfall could have a crucial impact on

tariff costs. In case there are no local suppliers to substitute, the company would be forced to switch to a global sourcing strategy. This would increase the amount of VNM and therefore decreases the RVC of the final product.

Scenario b – Increasing capacity utilization (NC)

Another strategic Supply Chain decision is the capacity of each facility. A problem from a Value Content perspective emerges as soon as increased capacity utilization reduces the total cost per product. This could happen because of, for example, manufacturing overheads being allocated to a greater amount of final products. As a decrease in total cost increases the NC, this could cause a reduction of the RVC when calculating with the net cost method.

Scenario c – Rise of the Value Content requested by the government (RVC_{FTA})

Moreover, the variation of the RVC_{FTA} could cause RoO requirements to be missed. If, for instance, a company reallocated parts of its value adding activities by moving its production facilities to the Free Trade Area only to benefit from the free trade among the member countries; it would be vulnerable to an increasing RVC_{FTA}. The relevance of this factor is shown by an investigation on the trend of the RVC in the NAFTA region for light vehicles, defined in Article 403 NAFTA. While the RVC was at 50% in January 1st, 1994, it raised up to 56% in January 1st, 1998 and finally to 62.5% in January 1st, 2002 (Canadian Border Service Agency, 2010).

Above mentioned are only three scenarios that have been picked by the authors to illustrate the sensitivity of a Value Content calculation. Although there are various scenarios in which the RVC may be changed, the risks when designing the Supply Chain in terms of Value Content fulfillment are obvious.

4 CONCLUSION AND OUTLOOK

This paper introduced the impact and the constraints of tariff oriented Supply Chain Designs. For this purpose, the literature on FTAs and RoO has been reviewed and the RVC calculation was introduced. Moreover the calculation and the impact of Value Content fulfilment have been demonstrated by an example of a Truck Manufacturer in the NAFTA. The example showed the potential benefits of Supply Chains that meet Value Content requirements. Furthermore, the parameters of the RVC calculation have been investigated and compiled in a list. Using this list, the problems and risks of tariff oriented Supply Chain Design are discussed and the contradiction between long term investments in the Supply Chain structure and the volatile environment of the Value Content calculations has been stressed.

The results of the investigation indicate that the potential benefit of a tariff oriented Supply Chain structure is significant. Nevertheless, companies which seek to exploit those advantages need to be aware of the underlying risks due to the quick changing environment of the FTA regulations. Moreover, the risks of a long term Supply Chain decision need to be evaluated and the robustness of the Value Content calculation needs to be tested, before strategic Supply Chain decisions are made. To be able to react on variation of the Value Content requirements from a Supply Chain perspective, further research needs to be done, to increase the flexibility of Supply Chains from a Value Content perspective. Hence, sourcing and production strategies need to be investigated in terms of whether an improved strategy could ensure the robustness of the Supply Chain in case of a changing Value Content or Value Content requirement.

With regard to possible limitations of this paper, it must be stated that the benefit and impact of tariff oriented Supply Chain Designs were only exemplified in the NAFTA. For a broader validation of the introduced results however, the empirical evidence of additional case studies would be needed. Furthermore the problems and risks of tariff oriented Supply Chains are only illustrated in three scenarios. To assess the risks holistically, a framework would be needed. For this purpose, it is intended to validate the introduced impact with several case studies and to identify potential risks which will be then compiled in a framework, enhancing the existing strategic logistics models with a risk assessment from a Value Content perspective.

5 REFERENCES

1 Abele, E.; Kluge, J.; Näher, U.: Handbuch Globale Produktion. Carl Hanser Verlag, München Wien, 2006.

2 Bair, J.; Gereffi, G.: Upgrading, uneven development, and jobs in the North American apparel industry. Global Networks – A Journal of Transnational Affairs Vol. 3, No.2, 2003, pp. 143–169.

3 Canadian Border Service Agency: Trilateral Customs Guide through NAFTA, http://www.cbsa-asfc.gc.ca/publications/pub/c-124-eng.pdf, accessed: March 4th, 2010.

4 Chase, K.: Economic interests and regional trading arrangements: The case of NAFTA. International Organization, Vol. 57, No. 1, 2003, pp. 137–174.

5 Chopra, S.; Meindl, P.: Supply chain management. Strategy, planning, and operation. Upper Saddle River, NJ Prentice Hall, 2006.

6 Estevadeordal, A.; Suominen, K.: Rules of Origin in FTAs in Europe and in the Americas: Issues and Implications for the EU-Mercosur Inter-Regional Association Agreement. Inter American Development Bank, Working Paper, 2004.

7 Estevadeordal, A.; Suominen, K.: Multilateralism ans Regionalism The New Interface - Chapter V - Rules of Origin. United Nations Conference on trade and development, 2005, pp. 50–78.

8 Goetschalckx, M.; Vidal, C. J.; Dogan, K.: Modeling and design of global logistics systems: A review of integrated strategic and tactical models and design algorithms. European Journal of Operational Research, Vol. 143, No. 1, 2002, pp. 1–18.

9 Hirsch, M: International Trade Law, Political Economy and Rules of Origin A Plea for a Reform of the WTO Regime on Rules of Origin. Journal of World Trade Vol.36, 2002, pp. 171–189.

10 Jackson, J. H.; Vermulst, E.: Antidumping law and practice: A comparative study. Ann Arbor: The University of Michigan Press, 1989, pp. 444–445.

11 Ju J., Krishna, K.; Firm Behaviour and Market Access in a Free Trade Area with Rules of Origin. The Canadian Journal of Economics, Vol. 38, No. 1, 2005, pp. 290-308.

12 Krueger, A. O.: Free Trade Agreements as protectionist devices: Rules of Origin. National Bureau of Economics Report, Working Paper, 1993.

13 Li, Y.; Lim, A.; Rodrigues, B.: Global sourcing using local content tariff rules. IIE Transactions, Vol.39, No.5, 2007, pp. 425-437.

14 Market Access Database, 2007. http://mkaccdb.eu.int/mkaccdb2/indexPubli.htm, accessed March 2nd, 2007.

15 Munson, C. L.; Rosenblatt, M. J.: The impact of local content rules on global sourcing decisions. Production and Operations Management, Vol. 6, No. 3, 1999, p. 277.

16 NAFTA: Chapter Four: Rules of Origin. http://www.sice.oas.org/trade/nafta/chap-041.asp, accessed: March 5th, 2010.

17 Richardson, M: Tariff revenue competition in a free trade area. European Economic Review, Vol 39, No. 7, 1995, pp. 1429-1437.

18 United Nations: Transnational Corporations and Export Competitiveness. World Investment Report, 2002.

19 World Trade Organization: Statistics on Regional Trade Agreements. http://www.wto.org/english/tratop_e/region_e/region_e.htm, accessed March 5th, 2010.

20 Zeng, A. Z.; Rossetti, C.: Developing a framework for evaluating the logistics costs in global sourcing processes − An implementation and insights. International Journal of Physical Distribution & Logistics Management, Vol. 33 No. 9, 2003, pp. 785-803.