AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Fourth Annual North American Agrifood Market Integration Workshop

Contemporary Drivers of Integration

NORTH AMERICAN AGRIFOOD MARKET INTEGRATION CONSORTIUM

NAAMIC

Fourth Annual North American Agrifood Market Integration Workshop

Contemporary Drivers of Integration

Edited by:
Karen M. Huff,
Karl D. Meilke,
Ronald D. Knutson,
Rene F. Ochoa,
and James Rude

Edited by:
Karen M. Huff,
Karl D. Meilke,
Ronald D. Knutson,
Rene F. Ochoa,
and James Rude

Page Layout/Cover Design by:
David P. Ernstes
Agricultural and Food Policy Center, Texas A&M University

Published by:
Texas A&M University
University of Guelph
Instituto Interamericano de Cooperación para la Agricultura-México

Printed by:
Friesens
Altona, Manitoba

Photo Credits: The USDA Photography Center (http://www.usda.gov/oc/photo/opchomea.htm); Agricultural Research Service Image Gallery (http://www.ars.usda.gov/is/graphics/photos/); and David P. Ernstes.

Includes bibliographic references and earlier publication references.

1. North American Free Trade Agreement 2. Energy Policy 3. Bioenergy Policy 4. Agrifood Supply Chains 5. World Trade Organization

I. Karen M. Huff (University of Guelph) II. Karl D. Meilke (University of Guelph)
III. Ronald D. Knutson (Texas A&M University) IV. Rene F. Ochoa (SAGARPA)
V. James Rude (University of Alberta) VI. Friesens (Altona)

All rights reserved. Readers are encouraged to use, quote, and distribute this material freely. We request only that full citation of author and source be made. The North American Agrifood Market Integration Consortium and sponsors of the Workshop assume no responsibility beyond that of presentation for views, opinions, and conclusions expressed by authors, presenters, and discussants.

Printed in Canada
Copyright © 2008
ISBN
Catalogue
July 2008

Table of Contents

Acknowledgements iv

Karen M. Huff, Karl D. Meilke, Ronald D. Knutson, Rene F. Ochoa, and James Rude

1 **Background and Purpose of the Workshop** 1

Karen M. Huff, Karl D. Meilke, Ronald D. Knutson, Rene F. Ochoa, and James Rude

2 **The Future of World Oil Prices: Some Keys to the Puzzle** 7

James M. Griffin

3 **Bioenergy – Agricultural Issues and Outlook** 25

Joe L. Outlaw, Heloisa L. Burnquist, and Luis A. Ribera

4 **North American Ethanol Bioenergy Policies and Their NAFTA Implications** 51

Glenn Fox and Kenneth Shwedel

5 **Agrifood Supply Chains in the NAFTA Market** 89

Jill E. Hobbs and William A. Kerr

6 **North American Retailers and Their Impact on Food Chains** 113

Dalila Cervantes-Godoy, David Sparling, Belem Avendaño, and Linda Calvin

7 **Implications of WTO Development for Market Integration** 147

Alex F. McCalla

8 **Doha Development Round Agricultural Negotiations** 171

Gloria Abraham

9 **Program and Participants** 195

Acknowledgements

The following organizations provided financial support for the 2007 NAAMIC workshop held in Cancún, Quintana Roo, México. Support was also provided for the editing, printing, and distribution of this publication. In addition, some of these institutions contributed authors, discussants, and session chairs. Farm Foundation and the Agricultural and Policy Center at Texas A&M University post the workshop documents on their websites providing early and easy access to the workshop materials and policy contributions. The coordinating committee acknowledges these contributors and expresses deep gratitude for their continued support which helps make the work of the consortium an ongoing success.

Canada

- Agriculture and Agri-Food Canada – *Ottawa, Ontario*
- Ontario Ministry of Agriculture, Food and Rural Affairs – *Guelph, Ontario*
- University of Guelph – *Guelph, Ontario*

United States

- Agricultural and Food Policy Center - Texas A&M University – *College Station, Texas*
- Farm Foundation – *Oak Brook, Illinois*
- United States Department of Agriculture – *Washington, DC*
  - Agricultural Marketing Service
  - Economic Research Service
  - Foreign Agricultural Service - Emerging Markets Program

Mexico

- Instituto Interamericano de Cooperación para la Agricultura-México – *Mexico City*
- Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA) – *Mexico City*
- Senado de la República – *Mexico City*

Individuals from several government agencies, universities, agrifood organizations, and private sector representatives participated in the workshop as authors, discussants, and session chairs. The active participation of every one of the attendees was an important part of the success of this event.

The Agricultural and Food Policy Center at Texas A&M University took the lead role in providing the necessary local arrangements for the workshop. David Ernstes carried out the important task of designing and developing this document and its executive summary. He is also in charge of the NAAMIC website at Texas A&M University. Pat Fleming of the Department of Food, Agricultural and Resource Economics, University of Guelph provided invaluable administrative support for the NAAMIC. The hard work and dedication of these individuals is truly appreciated.

NAAMIC Coordinating Committee

- Gloria Abraham – IICA
- Karen Huff – University of Guelph
- Ronald D. Knutson – Texas A&M University
- Karl D. Meilke – University of Guelph
- Rene F. Ochoa – SAGARPA
- James Rude – University of Alberta
- Renée Schwartz – United States Department of Agriculture
- Tulay Yildirim – Agriculture and Agri-Food Canada
- Steven Zahniser – United States Department of Agriculture

Background and Purpose of the Workshop

Karen M. Huff, Karl D. Meilke, Ronald D. Knutson, Rene F. Ochoa, and James Rude

INTRODUCTION

This volume of papers presents the proceedings of the *Fourth North American Agrifood Market Integration Workshop* organized by the North American Agrifood Market Integration Consortium (NAAMIC). NAAMIC consists of a group of agricultural economists from Canadian, Mexican, and United States universities and governmental agencies including Agriculture and Agri-Food Canada (AAFC), the Mexican Ministry of Agriculture or SAGARPA (Secretaría de Agricultura, Ganadería, Desarollo Rural, Pesca, y Alimentacíon), and the US Department of Agriculture (USDA). NAAMIC has a mandate to encourage frank and open discussion among policy-makers, agrifood business leaders, and academics on any agrifood-related market integration issues that arise among the NAFTA members. NAAMIC brings together experts from these areas to promote a harmonized set of science-based agrifood policies, programs, and regulations under the NAFTA. Greater harmonization results in a higher level of market integration, reduced conflict, increased trade, and higher levels of direct foreign investment among NAFTA countries. While NAAMIC's focus is on NAFTA, it has increasingly examined options for higher levels of economic integration within the Western Hemisphere while monitoring developments in broader global markets that could impact NAFTA.

In the three previous NAAMIC workshops, suggestions were made on how to improve the effectiveness and efficiency of NAFTA in achieving further market integration in its agrifood sectors both internationally and within the region. The 2007 workshop placed emphasis on three contemporary drivers of agrifood market integration that will have a major impact on

the future direction of the NAFTA's agrifood sector and developments in the broader Western Hemisphere. These drivers include:

- using agricultural resources for the production of biofuels;
- evolving cross-border agrifood supply chains; and
- developing World Trade Organization influences.

THE CHAPTERS

The fourth NAAMIC workshop was held in June 2007 in Cancun, Mexico. Seven groups of authors were commissioned to contribute on a variety of topics related to NAFTA and the global agrifood marketplace, each followed by formal comments from discussants representing academia, the agrifood industry, producers and producer groups, and government policy-makers. In addition to the formal discussions, each presentation generated a great deal of informal discussion among workshop participants both during the formal meetings and at the informal receptions that concluded each workshop day. These contributions were developed into chapters two through eight. A brief overview of the remaining chapters follows.

Biofuels

High and unstable fossil fuel prices and supply interruptions as well as the widespread replacement of methyl tertiary butyl ether (MTBE) as a gasoline additive have resulted in agriculture being called upon to become a major supplier of renewable energy. This development involves both economic incentives and regulatory policy. That is, current high oil prices make production of ethanol from corn, sugar, and other agricultural feedstocks profitable in the short-run regardless of government subsidies and mandates. These incentives for building biofuel capacity are sufficiently strong that traditional markets for food and feed are threatened by shortages and higher prices. These traditional agrifood markets have been highly NAFTA-oriented. Comparable profit incentives for the development of nonagricultural energy supplies, cellulosic technologies, and conservation measures make the future role of agriculture as a profitable energy source without government assistance uncertain. These seldom discussed long-run issues and their implications are addressed by the first three chapters of this volume.

James Griffin of Texas A&M University points out that the success or failure of biofuels is critically dependent on the future prices of gasoline and diesel fuel, which depend on the price of their key input – crude oil. This chapter focuses on the world oil market and the future price of crude oil and makes the argument that this depends critically on three factors: 1) the ability and willingness of OPEC oil producers to expand future production capacity; 2) the magnitude of long-term price-induced

conservation; and 3) the supply responsiveness of nonconventional fuels. Griffin concludes that investors in nonconventional fuels would do well to remember that price volatility is a permanent feature of the world oil market subjecting their investments to considerable risks.

Joe Outlaw of Texas A&M University, Heloisa Burnquist of University Sao Paulo, and Luis Ribera of Texas A&M University explore bioenergy production in the Western Hemisphere. They address the question of whether this emerging industry will crumble if the world price of oil declines or if governments reduce or eliminate current incentives (e.g., tax credits and mandated use of biofuels). They conclude that the ultimate success of the bioenergy sector depends not only on the price of oil, but also on the bioenergy costs of production, especially feedstock costs. There will likely be combinations of low and high oil prices and feedstock costs that will result in profits or losses for the bioenergy sector, with or without government support. This chapter attempts to shed some economic insight into these questions for the NAFTA countries, Brazil, and other important countries in the biofuel sector of the Western Hemisphere.

Glenn Fox of the University of Guelph and Kenneth Shwedel of Rabobank in Mexico discuss the challenges that biofuel production poses for the pursuit of more open trade in the Western Hemisphere. They argue that the emergence of the modern ethanol vehicle fuel industry in Brazil, the US, and Canada is the antithesis of freer trade and marks a continuation of extensive government subsidies to agriculture. They conclude that the current policy emphasis on supporting the development of renewable energy sources rather than the pursuit of aggressive measures to discourage the use of nonrenewable energy is not justified given the inability of biofuels to be economically viable without continued government support.

The Development of Cross-Border Supply Chains

Food retailers have found that effectively serving the wants and desires of today's consumers requires supply chains that assure a consistent supply of quality food products. Increasingly those products have to be traceable to their processing and farm origins. Ideally those supply chains would span across NAFTA borders and be equally accessible to all farmers. However, it appears that the evolving supply chains are often country-specific, seldom extend across borders, and are less accessible to producers and processors from other NAFTA countries. While issues such as sanitary and phytosanitary barriers to trade have been the focal point of previous NAAMIC workshops, their impacts and other factors influencing the development of supply chains have not been addressed fully. These issues and their resulting impacts on competition and the access that farmers and processors in the NAFTA countries have to the

entire North American market are addressed in the next two chapters in this volume.

Jill Hobbs and William Kerr of the University of Saskatchewan examine agrifood supply chains in the NAFTA market and point out that borders still matter, in that they alter supply chain coordination relative to supply chains that do not cross borders. Border frictions and independent national policy-making still inhibit the deepening of economic integration among the NAFTA markets by curtailing the use of the most cost-effective supply chain coordination alternatives. They conclude that questions surrounding transboundary agrifood supply chain relationships in the NAFTA market remain an important area for academic investigation.

Dalila Cervantes-Godoy of the OECD, David Sparling of the University of Guelph, Belem Avendaño of Universidad Autónoma de Baja California, and Linda Calvin of USDA's Economic Research Service examine the factors driving change in the North American food retail industry and the impact on food supply chains, specifically the implications for shippers and producers. Retail chains will continue to expand internationally and competition will come from anywhere in the world. The importance of food safety will continue to increase and meeting the food safety standards set by retailers, commodity organizations, or governments will be the price of entry into the market. While many large shippers are prepared to meet those challenges, this issue is one of the motivations for continued consolidation in agriculture across North America. For small farmers, this trend poses many challenges. The authors suggest possible long-term strategies such as aligning with shippers and organizing into associations. However, their ultimate success will depend on their ability to meet retail needs for product quality, volume, and new product development.

The Implications of WTO Developments for NAFTA Market Integration

The apparent lack of success of the Doha Development Round of multilateral agricultural trade negotiations at the World Trade Organization (WTO) at the time of the workshop and beyond has implications for NAFTA. One particular concern is the increased importance of developing countries in the negotiations and the inability of negotiators to arrive at strategies that effectively deal with transition policies for developing country industries and workers in disadvantaged industries adversely affected by freer trade policies and the operation of principles of comparative advantage.

The final two chapters in this volume explore the role of the WTO in the future; how trade disputes will be handled; the role and importance of regional trade agreements; options for strengthening NAFTA, including provisions that deal with issues that would otherwise have been addressed

by a Doha Round Agreement; and strategies that will enhance the chances for a successful conclusion of the WTO negotiations.

Alex McCalla of the University of California at Davis speculates on the nature of a potential Doha Round Agreement and then examines the impact of such a deal versus no deal on the NAFTA countries. He concludes that while neither scenario would have much of an impact on NAFTA, the consequences for the global economy of a failure would be severe. Possible impacts could include the loss of potential welfare gains from additional WTO reforms, an erosion of the WTO's importance, increased regionalism, increased protectionism, adverse shocks to global financial markets, and the lost opportunity to achieve meaningful change for the poorest developing countries.

Gloria Abraham of the Inter-American Institute for Cooperation on Agriculture examines a number of possible scenarios for a Doha Round Agreement. She also concludes that the crisis in the negotiations will have a significant impact on international trade if not resolved. Similar to McCalla, she predicts an increase in trade disputes, a strengthening of regionalism and bilateralism, an increase in spending on domestic subsidies, and the loss of the WTO's credibility as a governing body for world trade.

FUTURE NAAMIC ACTIVITIES

This workshop is the fourth annual workshop planned by NAAMIC to coincide with the final stages of NAFTA's implementation. The NAAMIC workshops provide an excellent opportunity to stimulate dialog among government, industry, and academic players about issues of concern and ways these issues can be addressed. The contributions presented in this volume are a good example of this kind of discussion, with their emphasis on NAFTA's member countries; additional alliances that may develop; and the importance of adapting policies, programs, and regulations to contemporary and anticipated developments in the agrifood industry.

As this volume goes to press, many questions remain unanswered about the future of the biofuel industry in the Western Hemisphere, cross-border supply chains in the NAFTA region, and the multilateral trading system under the WTO. Hopefully, the reader is now better prepared to understand the challenges that the NAFTA members face in order to take full advantage of more complete and secure access to each other's markets and the global marketplace.

REFERENCES

Knutson, R., R. Ochoa, K. Meilke, and D. Ernstes. 2007. *Contemporary Drivers of Integration – Executive Summary*. Oak Brook, IL: Farm Foundation, September.

The Future of World Oil Prices: Some Keys to the Puzzle

James M. Griffin[1]

INTRODUCTION

More Since the success or failure of biofuels is critically dependent on the future price of gasoline and diesel fuel, it is altogether fitting that we should begin by examining the world oil market and its future pricing prospects. The prices of ethanol and biodiesel will essentially be set by the prices of gasoline and diesel fuel, whose prices depend critically on the price of their key input – crude oil. The purpose of this chapter is to focus our attention on the world oil market and the future price of crude oil. The second section provides useful background information, describing four distinctive characteristics of the world oil market. This chapter argues that the future oil price puzzle will depend critically on three factors. The first piece of the puzzle is the ability and willingness of OPEC oil producers to expand future production capacity; accordingly, the third section examines five potential constraints that could, in principle, prevent capacity expansions. The other two pieces to the puzzle are the magnitude of long-term price-induced conservation and the supply responsiveness of nonconventional fuels. In the fourth section, a simulation model of the world oil market is used to quantify the magnitude of these effects. The chapter ends with concluding thoughts.

FOUR DISTINCTIVE CHARACTERISTICS OF THE WORLD OIL MARKET

In thinking about the price of crude oil, it is important to keep in mind several background facts. First, the price of oil is determined in one worldwide market. Indeed, Adelman used the analogy of a huge

[1] The author thanks Rebecca Willis and Leslie McDonald for able research assistance.

"bathtub" to describe the world oil market. The faucets running into the bathtub correspond to the various oil producing countries, while the drains from the bathtub carry oil to the various consuming nations. When the flow rate into the bathtub is less than the withdrawal rate from the bathtub, world oil prices rise sufficiently to equilibrate supply and demand. Even though crude oils are molecularly quite different and transportation costs tie certain oil producing and consuming countries together, crude oils are "fungible" and the market is "worldwide," being governed by worldwide supply and demand conditions. For example, even though Mexican crude oils tend to be heavy (low gravity) with high sulphur content, complex refineries can convert these crude oils into the same slate of refined products as produced by light (high gravity), sweet crude oils like West Texas Intermediate. Likewise, the flexibility and low cost of transporting crude oil in supertankers mean that if the price of one particular crude oil becomes cheaper than other crude oils destined for a particular location, it will be bid away and redirected to the higher priced market.

Much has been said in the press about the shortage of US refining capacity to process heavy, sour crude oils, resulting in a widening price differential between light, sweet crude oils and heavy, sour crude oils. In addition, the Environmental Protection Agency's (EPA) practice of approving boutique blends of gasoline to meet an individual city's air pollution limits has further exacerbated the refinery flexibility problem here in the US. Consequently, in areas with very stringent gasoline blends, gasoline prices sell for a premium compared to the cost of the crude oil. Nevertheless, problems of refining shortages for heavy, sour crude oils and boutique gasoline blends can and will be overcome with investment in refining capacity. Consequently, the bathtub analogy still holds as a reasonable approximation of reality. Because of the bathtub, we must expand our view of the "market" from NAFTA to the world.

A second distinguishing feature about the supply and demand for crude oil is its short-run price inelasticity – or lack of responsiveness of both consumption and production to price changes. For crude oil, the short run responsiveness of demand to price increases is very "inelastic" – about -0.1 or less.[2] Immediately following a price shock, consumers have little ability to substitute petroleum products for either other fuels or other consumption items. They must still get to work and buy groceries, and the fleet of autos on the road cannot be replaced instantaneously. Thus, the short-run demand for gasoline as well as most petroleum products is very price inelastic. On the

[2] Economists measure the price elasticity of demand (or supply) by computing the ratio of the percentage change in consumption (or production) to the percentage change in price. Thus, a price elasticity of -0.1 indicates that a 100 percent price increase would induce only a ten percent reduction in consumption.

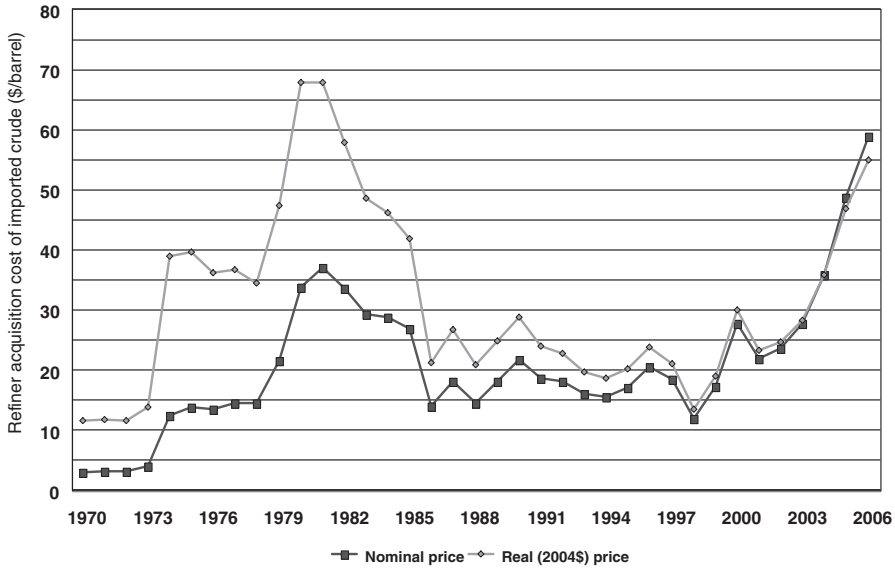
supply side of the market, most of the wells (at least those in the non-OPEC countries) are producing at their engineering capacity limits, so higher prices do not elicit substantially higher oil production in the short-run.

Why should we care that both the short-run price elasticities of supply and demand are very inelastic? Small supply disruptions can create large price spikes just like an oil glut can provoke a precipitous price drop. High price volatility is the norm for this market. I mention this because extreme price volatility has important risk implications for an emerging biofuels industry.

A third distinctive characteristic of the world oil market is that it is not a competitive market, governed by the forces of supply and demand. Instead, since the early 1970s, the OPEC cartel has succeeded in artificially holding oil prices above their competitive levels. The cartel assigns production quotas to its members and monitors their production for compliance. Figure 2.1 shows the path of world oil prices since 1970, both in current and 2006 constant dollars. The cartel gained widespread attention in 1973-74 when it engineered a four-fold price increase during the Arab Oil Embargo of 1973-74. Oil prices doubled again in 1979-80, as Iranian oil production plummeted during the Iranian Revolution and the Saudis unilaterally cut production. But even a monopolist can charge too high a price, and market forces took their revenge on the cartel during the period 1981-1986 as oil prices plummeted. The cartel found itself caught in a vise between falling world demand and increasing oil production from non-OPEC countries. OPEC was forced to reduce prices.

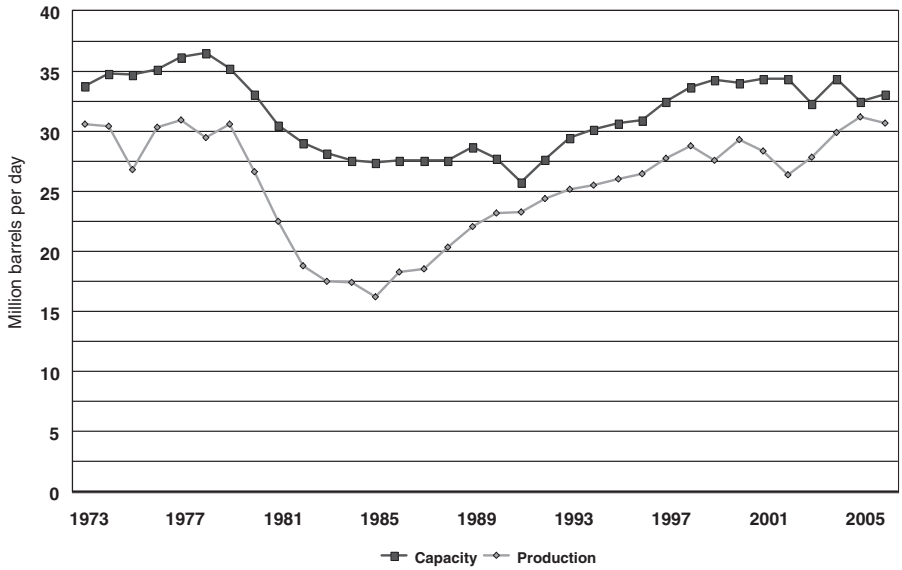
Over the period 1986 to 2003, energy policy and concerns about OPEC largely disappeared as oil prices fluctuated in a range between $15 and $30 per barrel – well below the peak reached in 1981. A widespread assumption was that OPEC was ineffectual, serving only to ratify what the market would have done in its absence (Alhajji and Heuttner). As shown in figure 2.2, sharply higher oil prices from 1973-81 resulted in a large drop in the demand for OPEC crude as world oil demand stagnated while non-OPEC oil production continued to march steadily upward. The line showing OPEC's production capacity shows that for much of the period there was considerable spare capacity in the cartel, which contributed to cheating on the production quotas (Griffin and Neilson). Even though oil prices continued to fluctuate in the same range, OPEC's bargaining strength steadily improved in the 1990s. The demand for OPEC crude oil began to increase steadily because worldwide oil demand was growing faster than supply from non-OPEC sources, leading to steadily increasing OPEC sales. Relative political stability allowed OPEC countries to expand production capacity to

Figure 2.1: World oil prices, 1970-2006.



Source: US Energy Information Administration.

Figure 2.2: OPEC production vs. production capacity, 1973-2006.



Source: Alhajji and Huettner; Griffin and Neilson.

keep pace with the rising demand, leaving a cushion of two to three million barrels per day (MMB/D).

Beginning in 2003, things began to unravel. With the political instability caused by Hugo Chavez's rise to power in Venezuela, production capacity fell while increasing world demand left little spare capacity. Not surprisingly, oil prices began ratcheting upward. Figure 2.3 demonstrates that even though oil prices were rising, so too was world oil consumption. Indeed, between 2003 and 2006, world oil consumption grew from 79.7 MMB/D to 84.3 MMB/D – while the price of crude oil effectively doubled.[3] What could explain this apparent contradiction of the law of demand?

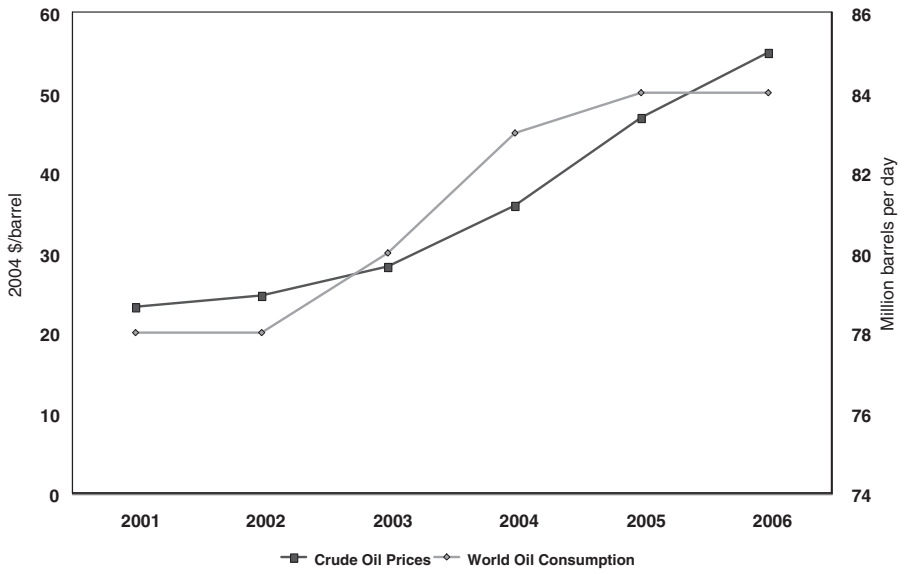
This brings us to the fourth distinctive characteristic of the world oil market – the emergence of China and other Asian countries as major oil consumers. Figure 2.4 decomposes the annual increments in world oil consumption to see what regions best explain this abnormally high rate of demand growth. For each year, we compute the total increase in consumption and then ask what the source of this demand growth was. Demand growth is broken into five groupings – China, India, Other Asia, USA, and Rest of World. China, by itself, is the single largest contributor. With the Chinese economy growing at a ten percent rate, it should not be surprising to see that China's absolute increases in consumption are growing sharply over time. Indeed, by 2006, China's oil consumption put it in second place in the world. India and other Asian countries have played smaller, but nevertheless prominent roles. By 2006, India's oil consumption put it in fifth place. Since its economy is growing at a rate of seven to eight percent, it will surely move up in coming years. In sum, rapid GDP growth by China, India, and other Asian countries has added a new component to world oil demand to go along with the US and other consuming nations. Particularly, if these rapid GDP growth rates for Asian countries persist, world oil consumption may well grow significantly despite the dampening effects of higher oil prices on future consumption. This brings us to the first piece of the puzzle – the prospects for capacity expansions.

THE FIRST ELEMENT OF THE PUZZLE: THE ABILITY AND WILLINGNESS OF OPEC TO EXPAND CAPACITY

The current run-up in world oil prices is understandable in retrospect, even if it was not predictable. World oil consumption has grown at an unexpectedly rapid rate while political instability in many oil producing regions has hampered capacity expansions. At the same time, while oil consumption was growing by 4.6 MMB/D over the period 2003-2006,

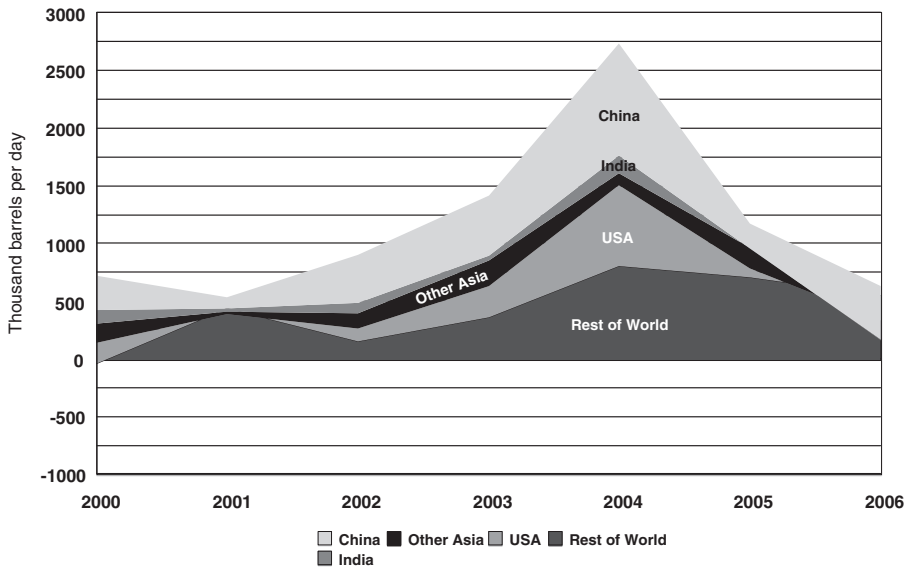
[3] Unless otherwise stated, oil statistics used in this chapter are from the US Department of Energy's Energy Information Administration website.

Figure 2.3: Oil prices and world oil consumption, 2001-2006.



Source: US Energy Information Administration.

Figure 2.4: Annual increase in oil consumption, 2000-2006.



Source: US Energy Information Administration.

non-OPEC oil production grew only by 1.1 MMB/D. This meant that the call on OPEC crude increased rather sharply by 3.5 MMB/D. As shown in figure 2.2, this surge in OPEC's demand pushed production up near its production capacity, creating a "tight" market in which oil price increases are to be expected.

Clearly, the limitations on OPEC capacity were a major factor in explaining the current price run-up, but what about the future? OPEC's capacity to produce is a key decision variable. It is not cast in stone. But what factors could impact the capacity expansion decision? Listed below are five factors that are often discussed as constraints:

1. physical limitations on the size of the underlying oil reserve base;
2. the technical expertise to expand capacity;
3. investment funds necessary to finance such expansions;
4. geo-political constraints; and
5. the implications of wealth maximization.

Let us consider each of these potential constraints on the ability of key oil producing countries to expand production.

Physical Resource Constraints?

Concerns about the adequacy of the underlying resource bases of the OPEC countries is a relatively new concern best illustrated by Simmons' recent book, "Twilight in the Desert." Simmons argues that productive capacity in Saudi Arabia's giant Ghawar field will soon decline and that Saudi reserves may well be considerably overstated. He notes that while Saudi Aramco has been successful in finding additional fields, the sizes of these fields tend to be much smaller than Ghawar and other giant and super-giant Saudi fields.

Simmons' assertions stand in sharp contrast to official reports that Saudi Aramco has identified 80 known oil fields in the kingdom and is only producing from 12 fields. There are apparently only about 1000 plus producing wells in the kingdom as compared to more than 300,000 in the US (US Department of Energy). Furthermore, oil reserves are like groceries on a shelf – not an immutably fixed supply. They can be replenished by additional exploration. Indeed, the US Geological Survey (USGS) estimates that in addition to Saudi Arabia's 263 billion barrels of known reserves, there are another 87 billion barrels of undiscovered reserves. Assuming an ultimate resource base of 350 billion barrels, we have computed the feasibility of increasing production from 11 MMB/D in 2006 to 25 MMB/D by 2016. Figure 2.5 shows that production could theoretically be ramped

Table 2.1: Actual reserves, undiscovered reserves, and years remaining.

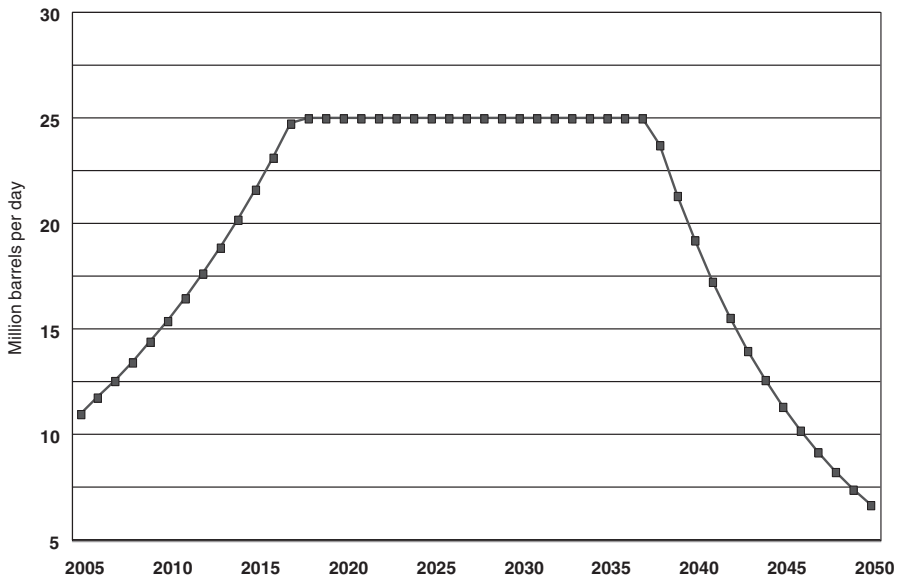
Country	Reserves[a]	Estimated Undiscovered	Total	Years Remaining[b]
Saudi Arabia	263	87	350	86.9
Iraq	115	45	160	240.9
Iran	133	53	186	125.9
Venezuela	77	20	97	88.4
Kuwait	99	4	103	106.8
The United Arab Emirates	98	8	106	105.6

[a] In billion barrels as of 2005.
[b] Assuming current production rate.
Sources: British Petroleum Statistical Review, United States Geological Survey.

up to 25 MMB/D and sustained at that rate for another 20 years before resource constraints would push production down. Obviously, unless Saudi oil reserves are a complete fabrication, it is clear that in the absence of other constraints, production could be increased sharply to accommodate rapidly expanding oil consumption.

But as shown in table 2.1, Saudi Arabia is not the only OPEC country with a large reserve base compared to its production. Venezuela's

Figure 2.5: Physically possible Saudi production through 2050.



Source: US Department of Energy.

heavy oil reserves are not even included in these figures. If included, Venezuela's reserves are estimated to be 315 billion barrels, eclipsing Saudi Arabia's reserves (Fox and Wilpert). Nevertheless, dividing the total resource base (reported reserves plus USGS estimated undiscovered reserves) by annual production gives the number of years that current production could theoretically be maintained at a constant rate. We see in table 2.1 that at current production rates the estimated total reserve base exceeds 87 years remaining for all six OPEC countries. Years remaining greater than ten years indicate that productive capacity could be significantly increased.[4] In principle, most of these countries, like Saudi Arabia, could double their productive capacity without the reserves to production ratio falling below ten. Furthermore, as illustrated in figure 2.5, these higher production rates could be sustained for a number of years. These calculations suggest that the magnitude of the underlying resource base is not a constraint for the foreseeable future.

It should be remembered that doomsday predictions have been around for a long time in the oil patch. During the energy crisis of the 1970s, probably the most influential book published was "Energy: Global Prospects 1985-2000" by the prestigious MIT Workshop on Alternative Energy Strategies. Based on world oil reserves of 658 billion barrels in 1975, the report concluded that world oil production would peak sometime between 1983 and 1993 and decline precipitously thereafter. Curiously, the world consumed 800 billion barrels of oil between 1976 and 2006, and yet oil reserves in 2007 totaled 1317 billion barrels! Oil reserves are like groceries on a shelf in the grocery store. They can be replaced and the only question is at what price. Obviously, at some point, their replacement cost will rise to a level that other substitutes will be preferred and conventional oil production will decline. There is no reason to think that this transition date will lead to massive economic upheavals. In sum, even if Simmons is correct about Saudi reserves being grossly overstated, the reserve estimates for other OPEC countries suggest that there is no "physical" constraint on the ability to sharply increase future production capacity. For the foreseeable future, OPEC will remain in business.

Technical Constraints on Capacity Expansion?

A common feature of oil production in most OPEC and many non-OPEC countries is the monopoly position of its own state-owned oil company. Today, 77 percent of the world's reserves are in the hands of state-owned oil companies. State-owned companies represent 14

[4] Reservoir engineering constraints limit the rate of current production relative to the remaining reserves because faster production can severely reduce ultimately recoverable reserves. As a rough rule of thumb, we use a reserves-to-production ratio of ten as an approximate guide.

of the largest 20 oil companies in the world in terms of production (Baker Institute for Public Policy). There is little question that these state-owned oil companies tend to be high-cost, inefficient operations compared to the international oil companies (Baker Institute for Public Policy). Not only are they higher-cost operators, but they tend to not have the level of technical expertise as the international oil companies, which are quite active in many high-tech applications.

The more salient issue, however, is whether these state-owned companies can obtain the requisite technological know-how necessary to exploit oil fields in their country and elsewhere around the world. There are a large number of privately-owned oil field service providers who stand ready to provide key technical support to these state-owned oil companies. Furthermore, for the development of these fields, which are predominantly onshore, a high level of technical expertise is not necessary. In sum, state-owned companies may be high-cost and inefficient, which can slow development, but in the end, technical expertise is not a binding constraint on the ability to expand capacity.

Financial Constraints – Limited Investment Funds?

Rational self interest would suggest that a government would grant favorable treatment to its major cash source and thus place top priority on funding capacity expansions. Under President Hugo Chavez, Venezuela seems to be defying the paradigm. The conflict between Petroleos de Venezuela (PDVSA) and Socialist President Chavez had dire repercussions for the company and its top management. Following a widespread oil strike in December 2002, production plummeted from almost three MMB/D to only 630,000 B/D. The top managers – along with 17,000 workers – were fired and replaced by individuals loyal to Chavez. Since then, Venezuelan production has recovered only to 2.5 MMB/D, yet the work force loyal to Chavez has risen by 29 percent. Even more ominous are the implications for Venezuela's ability to develop its enormous deposits of heavy oil contained in the Orinoco Belt. In the 1990s, the international oil companies were encouraged to bring their expertise to develop these reserves, which many believe could match that of Saudi Arabia. Now President Chavez is threatening to expropriate the assets of Exxon-Mobil, Conoco-Phillips, and Chevron and place these properties under the management of PDVSA (New York Times).

While the profit maximization or wealth maximization paradigm applies to the Exxon-Mobils of the world, state-owned oil companies like PDVSA operate in an entirely different setting with different objectives and operating constraints. Unlike private firms that can simply go to financial markets for additional exploration or

development funds, national oil companies (NOCs) generally face far greater impediments in obtaining funds to provide capacity expansions. For many of the NOCs, the lack of financial transparency and history of government intervention makes access to foreign capital markets prohibitively expensive. For these, the question is whether internally generated funds can finance such expansions or if these funds be diverted elsewhere.

In most OPEC countries, oil revenues are a major government revenue source. Therefore, the national oil companies serve as a cash cow to support government expenditures of a diverse nature, meaning that NOCs must vie with other government agencies for development funds. For example, PDVSA is a major funding source for Chavez's social programs. Two-thirds of PDVSA's budget is dedicated to social welfare. In addition, many NOCs receive diminished revenues because of the subsidy on fuels for domestic consumption. Iran has some of the highest product subsidies in the world, with the price of gasoline selling for $0.10 per liter ($0.38/gallon). Low prices stimulate consumption, thus reducing the crude oil available for export. Indeed, it has been estimated that by 2011 Iran will no longer be a net exporter of oil (Baker Institute for Public Policy).

Still another factor restricting the availability of investment funds is the typically large labor forces employed in the NOC. In Mexico, PEMEX is a typical example of a state-owned oil company with a bloated bureaucracy. In effect, NOCs are asked to perform a number of noncommercial obligations that sacrifice wealth maximization, such as supporting government welfare initiatives, subsidizing domestic fuel consumption, and employing a large labor force. The Baker Institute study concludes that these inefficiencies vary considerably among NOCs, but they generally have a pronounced negative effect on the ability of NOCs to expand capacity.

It would be a mistake to paint all NOCs as grossly inefficient and incapable of expanding production. Saudi Aramco stands as an example of a well-run firm whose success the government values. Even for those mired in government-mandated noncommercial constraints, there is recognition – both by the company and the government – of the critical importance of the NOC to the government. At some point, noncommercial objectives must be relegated to the long-run viability of the NOC. Paradoxically, during periods of high oil prices, these companies are flush with cash and government is free to divert funds for a variety of non-investment uses. Instead of there being strong incentives to expand production at high prices as with profit maximizing firms, NOCs find themselves under little pressure to expand production. Curiously, when oil prices fall to low levels,

government leaders of oil rich countries know that rising future oil revenues are critical to economic development and their ability to remain in power. To get higher oil revenues, a country must invest in additional capacity. Curiously, the pressures to increase capacity may be stronger in an environment of low oil prices than high prices, adding to the underlying instability of the oil market.

Geopolitical Constraints?

In looking at the six OPEC countries listed in table 2.1, it appears that three of the six have been significantly constrained by geopolitical events. We are, of course, referring to Iran, Iraq, and Venezuela. For example, prior to the Iranian Revolution in 1978, oil production in Iran stood at almost six MMB/D. Following the revolution and the war with Iraq, production was constrained by hostilities. However, with the return of peace in 1989, oil production recovered only to 2.8 MMB/D, and in 2006 production averaged four MMB/D. Over the same period, internal consumption almost trebled, leaving only 2.5 MMB/D for export. Thus, despite the impressive reserves shown in table 2.1, Iran's role in the world oil market has diminished dramatically because of political instabilities.

Another example is Iraq. Prior to its invasion of Kuwait in August 1990, Iraqi production stood at 3.3 MMB/D. Even with the "Oil for Food Program," Iraqi production reached only 2.5 MMB/D prior to the US led invasion of Iraq in April 2003. Following the departure of Saddam Hussein and the ensuing revolution, 2006 production stood at only two MMB/D. Years of neglect have no doubt taken their toll on Iraqi infrastructure. Likewise, one should not overlook PDVSA, Venezuela's state-owned oil company. Following the abortive attempt to depose Chavez in December 2003, the top management of the company was replaced with those loyal to Chavez and production capacity has continued to shrink. Compared to earlier periods, geopolitical instabilities have emerged as particularly strong factors impeding the ability to expand production from those key countries with exceptional oil reserves.

Constraints Imposed by Wealth Maximization?

There is yet another reason why key OPEC countries might consciously decide not to expand production capacity. Namely, it might not be in their economic self-interest to do so! Wealth maximization might dictate that they should simply freeze production capacity at current prices, allowing prices to rise sufficiently to limit demand to available supply. But would such a strategy maximize the wealth of the OPEC

countries – particularly those shown in table 2.1 – which have large reserves capable of producing at the same rate for 50 or 100 years?

The power of discounting is particularly instructive in answering this question. Consider the following hypothetical situation. Should an oil producer like Saudi Arabia produce an additional barrel today at a price of $65 per barrel or defer production of that barrel for say 50 years from now and sell it at some future price? To be conservative, let us assume that the Saudis adopt a very conservative real discount rate of five percent to convert future oil revenues into their present value or value today.[5] For example, the present value of selling a barrel of oil next year using a five percent discount rate is $61.90 since, theoretically, if one had $61.90 today, he could invest it at a five percent interest rate and have $65 next year. The next question is what price (expressed in 2007 dollars) would they anticipate selling that barrel of oil for 70 years from now? Would it be $65, $100 or even $200 per barrel? We know that alternative energy forms will place an effective ceiling on the price of oil. Indeed, after considering the variety of long-run oil substitutes, it is difficult to imagine long run prices far in excess of $100 per barrel when measured in 2007 dollars. Adopting the conservative discount factor of five percent and substituting in future prices of $65, $100, or even $200 per barrel, we get some astounding results. The present value of that barrel of oil varies from $2.24 to $3.45 to $6.90 per barrel, respectively. Conversely, by selling the barrel today, the present value of the barrel is $65. Indeed, even if oil prices fell to half their current levels, wealth maximization would still dictate to expand production capacity and sell the oil today. Griffin and Xiong reach similar conclusions using a sophisticated model of the world oil market that incorporates cartel incentives.

TWO OTHER KEY PIECES TO THE PUZZLE

The preceding section might leave one with the impression that the future of oil prices will depend solely on the ability and willingness of OPEC countries to expand production. To be sure, this is a key consideration, but two other factors deserve particular attention as well. They relate to the long-run price elasticity of oil demand and the long-run supply elasticity of oil substitutes like oil sands, gas-to-liquids, and biofuels. As noted earlier, the short-run price responsiveness of demand to price increases is very price inelastic. But there is considerable evidence that in the long-run – after consumers adjust their auto fleet and diesel vehicles to higher prices – there is considerable elasticity. Using annual data spanning the period 1961-99 for 16 OECD countries, we found, as expected, a very inelastic short-run demand elasticity of

[5] Note that this is a real rate of discount which factors out inflation. Nevertheless, it is very conservative compared to discount rates typically applied in the private sector.

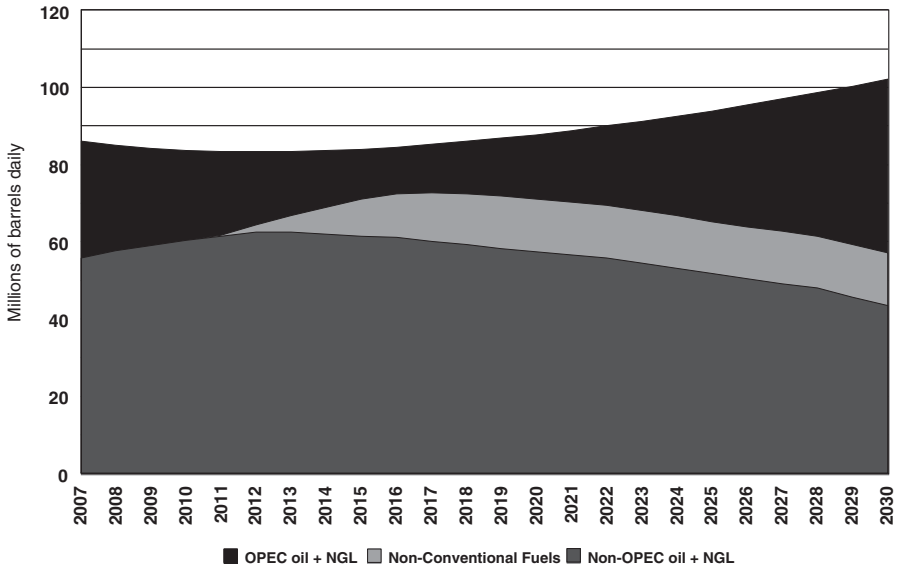
-0.09. But the long-run elasticity was -0.94 (Griffin and Schulman). It should be noted that this elasticity is measured with respect to the "retail prices" of petroleum products – not the wholesale price of a barrel of oil. Because of taxes and the costs of refining and distribution, the markup over crude prices in many countries exceeds twice the price of crude oil, meaning that the implied elasticity with respect to the price of crude oil would be cut in half. Yet, even with a long-run elasticity of -0.47, conservation effects are quite significant.

To illustrate the potential impact of higher oil prices on the long-run growth in oil consumption, we have simulated a mathematical model of the world oil industry called OPEC Genie. Figure 2.6 assumes that the price of oil remains constant at $70 per barrel for the period 2007 to 2030. To illustrate the sensitivity of oil consumption to long-term price changes, we show in figure 2.7 an example of the effects of oil prices ratcheting down to $30 per barrel by 2010 and remaining constant in 2007 dollars thereafter. In the low price scenario, price has no dampening effect on oil consumption, whereas rising world GDP causes oil consumption to grow at an approximate annual rate of 3.1 percent. Even though world GDP is assumed to grow at the same rate in both cases, the conservation effects of higher prices largely counterbalance the effects of rising GDP in the high price scenario out to 2015. Beyond 2015, the primary driver of oil consumption is world GDP because the long-run effects of the price increases in 2004-2007 have been realized. But because oil consumption is growing from a smaller base, oil consumption reaches 102 MMB/D by 2030. In contrast, under the low price scenario, world consumption reaches 145 MMB/D by 2030. Clearly, Genie posits that the magnitude of the long-run price elasticity will play a critical role in determining the world's demand for crude oil. In principle, world oil demand, not OPEC's ability to expand capacity, could over the next ten years be the constraining factor on prices.

Also shown in figures 2.6 and 2.7 is the potential for nonconventional fuels to significantly augment supply outside of OPEC. Assuming a return to $30 per barrel oil, the supply of nonconventional fuels is assumed to make an insignificant impact. At a $70 per barrel oil price, however, the model suggests there could be as much as 12.5 MMB/D coming on-stream within ten years. Production of Canadian oil sands is already ramping up to a projected 4.4 MMB/D by 2015. Estimated reserves of Canadian oil sands are 174 billion barrels (National Energy Board of Canada). Even though gas-to-liquids (GTL) plants are in their infancy, there are huge supplies of "stranded" natural gas that can be converted to sulphur-free diesel fuel.[6] Construction is currently

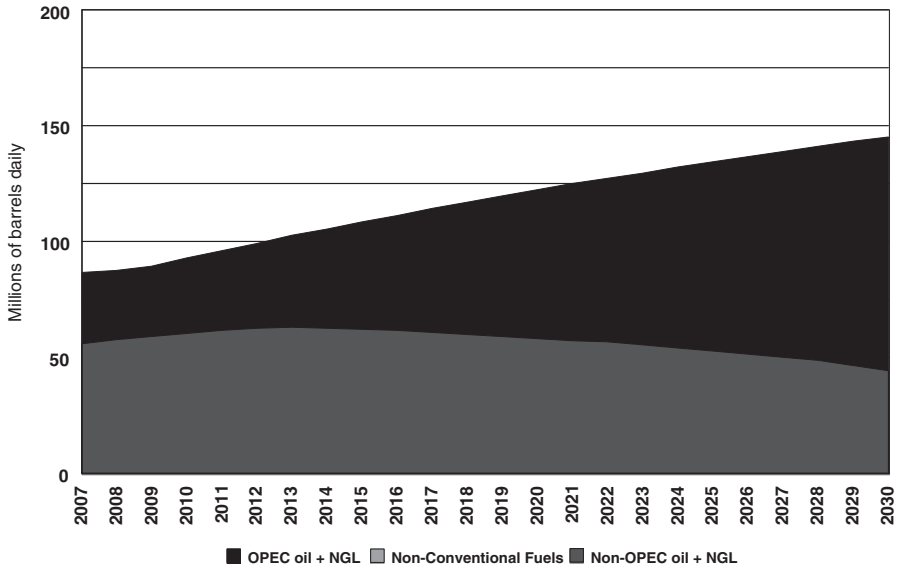
[6] Stranded gas supplies are located in areas sufficiently far from major consuming areas as to prevent their transport by pipeline. Consequently, their value is quite low and in the past, natural gas was flared as an unwanted byproduct of oil production in many remote areas.

Figure 2.6: The supply/demand balance under continued high prices.



Source: Author's calculations.

Figure 2.7: The supply/demand balance under reversion to low prices.



Source: Author's calculations.

underway for a 140,000 B/D Shell plant in Qatar. Also, Exxon-Mobil has a 154,000 B/D plant under construction in Qatar, which boasts almost 15 percent of world gas reserves and the world's largest gas field (Lyne). Shell and Exxon-Mobil are not alone, as virtually all of the large international oil companies have plans to build GTL plants. Finally, there is enormous potential for biofuels such as ethanol. Current forecasts predict that by 2010 ethanol production will reach 570,000 B/D. President Bush's recent State of the Union speech proposed US production of 2.3 MMB/D of biofuels by 2017. In sum, if high oil prices persist, the future for nonconventional fuels appears quite promising.

Interestingly, to the extent that long-run conservation effects slow the future growth in world oil demand and the supply of nonconventional fuels expands rapidly, this could have monumental effects on OPEC and in turn on the price of oil they choose. Because OPEC is a cartel, it is the residual supplier. At whatever price level OPEC chooses, OPEC supplies the quantity of oil remaining after subtracting nonconventional and non-OPEC conventional oil supply from world demand. As a consequence, should OPEC choose to leave prices at current levels, it could, according to Genie, lead to potentially intolerably low levels of OPEC production, as shown in figure 2.6. If such a scenario were to evolve, OPEC's resolve to defend prices at high prices becomes extremely problematic.

SUMMING THINGS UP

Ultimately, the pricing of ethanol and other biofuels will be determined not within the confines of NAFTA, but by the world oil market, which is best thought of as a huge bathtub. The world oil market has the following additional distinctive characteristics: 1) extremely price inelastic short-run supply and demand elasticities giving rise to great price volatility; 2) a reasonably effective OPEC cartel; and 3) rapidly growing oil consumption buoyed by Asian economic growth. Oil prices will fluctuate widely. The critical question is whether they will oscillate in the current high price range or return to the price pattern experienced in the 1985-2002 period. The answer to this puzzle appears to depend critically on: 1) the willingness and ability of OPEC countries to expand oil production; 2) the long-run price elasticity of oil demand; and 3) the price responsiveness of nonconventional fuels.

In today's world oil market, national oil companies increasingly dominate world oil reserves and, unlike private companies, their objectives diverge widely from the usual paradigm of shareholder wealth maximization. My analysis suggests that these companies'

ability and willingness to expand capacity are not constrained by either the magnitude of the physical resource base or the technical expertise to exploit such reserves, or even the implications of wealth maximization. On the other hand, financial constraints coupled with geopolitical instabilities have hamstrung many of the national oil companies operating in countries with the largest potential for capacity expansion.

Before concluding that the future belongs to nonconventional fuels, like ethanol and biodiesel, one should be aware of two dark clouds on the horizon. Even if efforts to expand capacity are thwarted by all the noncommercial constraints facing the national oil companies, there are two other pieces to the puzzle that could make the issue of capacity expansion a moot issue. These are the long-run price responsiveness of oil demand and increased supplies of nonconventional fuels. Comparison of OPEC production under high versus low oil prices in figures 2.6 and 2.7 points us to the possibility that factors beyond OPEC's control may make current high prices unsustainable.

Genie tells us that the viability of the high price scenario could well be undermined by a combination of long-run price-induced conservation effects coupled with a rapid expansion of nonconventional fuels. Because OPEC is a cartel and thus the residual supplier, it could be the major loser in the high price scenario. In the years ahead, price induced lagged conservation effects could potentially offset rising worldwide GDP resulting in anemic demand growth. With increased non-OPEC production due to both increased conventional oil supplies and nonconventional fuels production, OPEC could find itself in a shrinking market share situation.

If indeed OPEC's market share shrinks as indicated in figure 2.6, all of the same factors contributing to the meteoric rise in oil prices over the last few years could work in the opposite direction. Paradoxically, state-owned oil companies which seem so inept at increasing production in a high oil price world may aggressively expand production in a low price world as a means for generating additional national revenues and staying in power. Cartel cohesion would be undermined, and the history of the 1981-86 period could be replayed.

Even if Genie overestimates the strengths of the long-run conservation and nonconventional fuel responses, investors in nonconventional fuels would do well to remember that price volatility is a permanent feature of the world oil market subjecting their investments to considerable risks.

REFERENCES

Adelman, M.A. 1984. "International Oil Agreements." *The Energy Journal* 5:1-5.

Alhajji, A.F., and D. Huettner. 2000. "OPEC and World Crude Oil Markets from 1973 to 1994: Cartel, Oligopoly, or Competitive?" *The Energy Journal* 21:31-60.

Baker Institute for Public Policy of Rice University. 2007. "The Changing Role of National Oil Companies in International Energy Markets." Policy Report No. 35. Houston: Baker Institute.

British Petroleum. 2006. "BP Statistical Review of World Energy." Available at: <http://www.bp.com/statisticalreview>. Accessed September 2007.

Energy Information Administration. 2005. "Saudi Arabia Country Analysis Brief." Available at: <http://www.eia.doe.gov/emeu/cabs/saudi.html>.

___. 2007. "Petroleum Data, Reports, Analysis, Surveys." Available at: <http://www.eia.doe.gov/oil_gas/petroleum/info_glance/petroleum.html>.

Fox, M., and G. Wilpert. 2005. "International Energy Agency Increases Venezuela's Oil Production Estimates, Maybe." Available at: <http://www.venezuelanalysis.com/articles.php?artno=1729>.

Griffin, J.M, and W. Neilson. 1994. "The 1985-86 Oil Price Collapse and Afterwards: What Does Game Theory Add?" *Economic Inquiry* pp. 543-62.

Griffin, J.M., and C.T. Schulman. 2005. "Price Asymmetry in Energy Demand Models: A Proxy for Energy-Saving Technical Change?" *The Energy Journal* 26:1-21.

Griffin, J.M., and W. Xiong. 1997. "The Incentive to Cheat: An Empirical Analysis of OPEC." *Journal of Law and Economics* 40:289-316.

Lyne, Jack. 2004. "Shell Signs on to Build $5B Gas-to-Liquid Plant in Qatar." Available at: <http://www.siteselection.com/ssinsider/snapshot/sf040202.htm>. Accessed 23 April 2007.

National Energy Board of Canada. 2006. "Canada's Oil Sands – Opportunities and Challenges to 2015: An Update." Available at: <http://www.neb.gc.ca/clf-nsi/rnrgynfmtn/nrgyrprt/lsnd/pprtntsndchllngs20152006/pprtntsndchllngs20152006-eng.pdf>.

New York Times. 2007. "Deadline Nears in Chavez Fight Against Big Oil," 10 April.

Simmons, M.R. 2005. *Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy*. Hoboken, NJ: John Wiley.

US Department of Energy, Energy Information Administration. 2005. "Saudi Arabia Country Analysis Brief." Available at: <http://www.eia.doe.gov/emeu/cabs/saudi.html>.

US Energy Information Administration. 2007. "Official Energy Statistics from the US Government." Available at: < http://www.eia.doe.gov/>.

US Geological Survey. 2005. "World Petroleum Assessment 2000." Available at: <http://pubs.usgs.gov/dds/dds-060/ESpt2.html#EXECUTIVE>.

Workshop on Alternative Energy Strategies. 1977. *Energy Global Prospects 1985-2000*. New York: McGraw Hill.

Bioenergy – Agricultural Issues and Outlook

Joe L. Outlaw, Heloisa L. Burnquist, and Luis A. Ribera

INTRODUCTION

Global interest in bioenergy production and consumption has surged over the past five years. While Brazil (ethanol) and Germany (biodiesel) have relatively more mature biofuels markets, there are other countries such as the United States, Canada, China, and India that have recently elevated bioenergy production and consumption in terms of national importance. For example, in the United States, bioenergy has gone from initially drawing support from a small number of commodity groups and some environmentalists to being counted on to:

- help lessen reliance on foreign oil imports;
- increase farm commodity prices thereby reducing commodity program expenditures;
- enhance the perception of being more environmentally conscious by using more environmentally friendly fuels; and
- enhance rural development through a dispersed bioenergy industry.

Governments around the world have enacted policies designed to encourage bioenergy production and use, and to protect bioenergy producers from international competition. Some countries, such as the United States, have policies in place to do all three for the ethanol industry. In the short-run, it can be argued that some encouragement is needed to develop a new industry through government policies, as well as policies that are designed to protect a new industry from international competition. However, in the

Table 3.1: 2006 ethanol production for all uses for selected countries.

	Millions of liters	Millions of gallons
Brazil	16,998	4,491
US	18,376	4,855
China	3,849	1,017
India	1,900	502
France	950	251
Russia	647	171
South Africa	386	102
UK	280	74
Saudi Arabia	197	52
Spain	462	122
Thailand	352	93
Germany	765	202
Ukraine	269	71
Canada	579	153
Poland	250	66
Indonesia	170	45
Argentina	170	45
Italy	163	43
Australia	148	39
Japan	114	30
Pakistan	91	24
Sweden	114	30
Philippines	83	22
South Korea	61	16
Guatemala	79	21
Cuba	45	12
Ecuador	45	12
Mexico	49	13
Others	1124	297
Total	51,056	13,489

Source: Renewable Fuels Association.

long-run, the cost of production will determine whether or not bioenergy can be viewed as a viable energy alternative.

Bioenergy production is generally perceived in a positive light by the public. However, there are many industry observers who wonder whether the industry will crumble if the price of oil declines or if the government reduces/eliminates the blenders' tax credits. The answer is – it depends. Knowing what the price of oil is only gives you part of the information

needed to address this question. One also needs to know the bioenergy costs of production, especially feedstock costs. For example, in May 2006 the price of corn in the US was roughly one-half of the May 2007 price – nearly $4 per bushel. There will likely be combinations of low and high oil prices and feedstock costs that result in profits or losses for the bioenergy sector, with or without government support. This chapter attempts to shed some economic insight into these questions for the NAFTA countries and other important countries in the Americas. To understand the likely economic consequences, we first provide some background on the two primary biofuels[1] (ethanol and biodiesel).

STATUS OF ETHANOL AND BIODIESEL

Ethanol

Table 3.1 presents annual ethanol production data for 2004 to 2006 (for all uses, not necessarily transportation fuel) of the major producers in the world. Brazil and the United States are by far the largest producers while Canada and Mexico have been minor players up to this point. Before addressing the current situation in the NAFTA countries, it may be helpful to have a better understanding of the situation in the country with the most advanced ethanol industry in the world – Brazil.

Brazil While most of the world is initiating new ethanol research and development programs, Brazil already has a long and successful history with biofuels. This experience started in 1975, after the first oil shock, with the establishment of a National Ethanol Program or Programa Nacional do Alcool (Proalcool) for the particular purpose of reducing oil imports. Brazilian ethanol production has been based on sugarcane processing with coordinated efforts between the cane and biofuels sectors. These were the primary determinants of the program until the mid 1980s when 95 percent of the automobiles sold in the country were exclusively fueled by ethanol.[2] Brazil managed to establish an efficient and coordinated production and consumption system. This was not a trivial task since it involved a harmonic development of appropriate engine technology, increased sugarcane and ethanol production capacity, and the very challenging task of establishing a continental infrastructure and logistics system for distribution.

However, the convergence of three factors: 1) dropping oil prices in the international market; 2) the end of tax incentives for producing and purchasing vehicles that run on ethanol; and 3) the ethanol supply crisis of 1989, led consumers to switch back to vehicles powered by gasoline.

[1] Biofuels are fuel for transport derived from biological sources (e.g., agricultural).

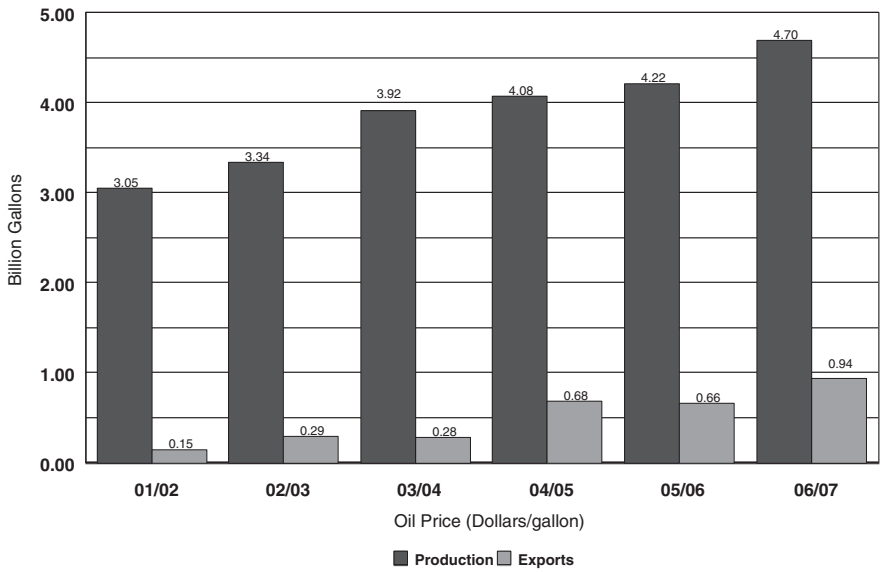
[2] Brazil produces two types of ethanol: 1) hydrated ethanol which is used in cars adapted to be fueled exclusively by ethanol; and 2) anhydrous ethanol which is mixed with gasoline to obtain gasoline C, which can contain a maximum of 25 percent of anhydrous ethanol.

As a consequence of the relative price change, the Brazilian ethanol fuel program underwent a major setback in the 1990s. By 2001, the production of vehicles fueled only by ethanol was almost completely phased out and consumers were back to vehicles fueled by gasoline.

Despite all of these changes, ethanol fuel consumption was sustained in Brazil through a 1994 law that mandated all gasoline in the country should contain 20 to 25 percent anhydrous ethanol. This kept Brazilian cane producers from redirecting all of their production to sugar. In March 2003, flex-fuel vehicles that run on either ethanol or gasoline (or a combination of these) started to be produced and sold to Brazilian consumers. This was the cornerstone of a new phase for the Brazilian fuel ethanol program. With flex-fuel cars, Brazilian consumers have the ability to choose the fuel combination that offers a relatively better price. More specifically, consumers are allowed to choose between filling their car with hydrated ethanol or with gasoline C, composed of 25 percent anhydrous ethanol, or a combination of the fuels, according to their relative fuel prices.

Although ethanol is currently distributed throughout Brazil, applied research has shown that in general, ethanol consumption has been concentrated near production units, particularly in the State of Sao Paulo, which is the most important producer of the Center South region

Figure 3.1: Brazilian ethanol production and exports, 2001/02 – 2006/07.



Source: UNICA (2007).

(Agencia Nacional de Petroleo). In addition, research conducted to better understand Brazilian domestic markets and fuel consumption of flex fuel car owners has indicated that there is still not a very well defined pattern in fuel usage (Ibope). Only 17 percent of flex-fuel car owners use a mix of ethanol and gasoline. About 25 percent alternate between using gasoline or ethanol and 57 percent use only one type of fuel.

Despite its peculiarities, domestic consumption of Brazilian ethanol is much higher than its exports. Figure 3.1 shows that in 2006/07 about 80 percent of total ethanol production was consumed internally.

The capacity of the market to absorb fuel ethanol in the coming decades will determine Brazil's potential to maintain its current advantages, both in domestic and foreign contexts. So far, the domestic market has absorbed a much higher portion of ethanol production than foreign markets. In fact, building global markets for ethanol has been one of the greatest challenges for Brazilian producers and policy-makers involved in cane, sugar, and ethanol production.

The participation of flex-fuel vehicles in total car sales has increased substantially and gained extra strength, particularly after the 2005 international oil price increase. Car producers in Brazil have indicated that since 2005, for every ten vehicles sold in the country, seven were flex-fuel (Unica 2005). Sales of flex-fuel cars were 82 percent of the total number of vehicles sold in the country in 2006, and are expected to increase to 88 percent in 2007 and 90 percent between 2007 and 2013. In addition, it is important to note that 90 percent of flex-fuel vehicles are located in states where the price parity between ethanol and gasoline favors the use of the former. It is expected that through time, 85 percent of flex-fuel vehicles in these states will exclusively use ethanol as fuel (Unica 2007).

Canada Canada has a small but growing ethanol industry of around seven plants with an annual production capacity near 599 million liters (158 million gallons). There are also two plants under construction that will boost production to 839 million liters (222 million gallons) by the end of 2007. The industry has a target output of 2.74 billion liters (0.72 billion gallons) by 2010. The Canadian ethanol industry utilizes corn and wheat as feedstocks in their plants. Ethanol costs of production in Canada are comparable to corn-based ethanol plants in the United States, and as such, their profits are currently being squeezed with the higher corn and wheat prices (AAFC 2006b). Canadian and US corn prices are almost identical, so their ethanol costs of production from corn should also be very close (AAFC 2007a). Canada is also home to Iogen, which

makes ethanol from wheat straw in a cellulosic conversion process[3] in a demonstration plant.

The Canadian government recently announced C$2 billion in new incentives for renewable fuels consisting of C$1.5 billion over seven years for ethanol and biodiesel producers and a C$500 million fund for commercialization of next generation renewable fuels technologies. There is also a government regulation requiring five percent renewable content in gasoline and two percent renewable content in diesel fuel by 2010 (Canadian Renewable Fuels Association). The five percent regulation is expected to result in a medium-term increase in biodiesel output to a level of 300 to 400 million liters (79 to 106 million gallons) which is significantly higher than current industry output of 95 million liters (25 million gallons). There are federal excise tax exemptions of C$0.10/liter (C$0.38/gal.) of ethanol blended with gasoline and C$0.04/liter (C$0.15/gal.) for biodiesel. In addition, several provinces have fiscal incentives for renewable fuels (AAFC 2006a).

Mexico Mexico has just recently started examining and debating the merits of alternatives to fossil fuels. The Mexican Government has become increasingly interested in developing their biofuels capacity because they see it as a way to reduce political pressure related to a number of agricultural commodities, particularly corn and sugar, in light of the upcoming full implementation of NAFTA in 2008 (USDA FAS).

Mexico produced 80 million liters (13 million gallons) of ethanol (ethylic alcohol) in 2006 from sugarcane. Ethanol produced in Mexico is not presently used for fuel purposes but by the chemical, alcoholic beverage, and pharmaceutical industries. Currently Mexican consumption of ethanol for these uses is 165 million liters (44 million gal.), thus Mexico imports the remaining volume needed, mainly from the US, Brazil, and recently China (USDA FAS).

According to Mexico's Ministry of Energy, there is currently no specific biofuels promotion program in the country (F.O. Licht 2006). The National Energy Plan of 2001-2006 goes the furthest towards defining a national strategy by mandating that the state-run electricity generation firm, Comision Federal de Electricidad is to produce at least 1,000 mega-watts of energy from renewable sources by 2006.

Due to the recent interest in ethanol, the Mexican Government has decided to analyze the true potential of biofuels and other alternative sources of energy (F.O. Licht 2007). The Mexican Congress has also gotten involved

[3] Cellulosic or cellulose ethanol is identical in molecular structure to grain-based ethanol. The difference is that cellulosic ethanol uses the non-food portion of renewable feedstocks such as cereal straws and corn stover (Iogen Corporation 2005b).

in this debate. Two laws are proposed which would establish the legal framework under which the Ministry of Energy will define its strategy for biofuels and other sources of energy. The first is a law regarding the use of renewable sources of energy, which includes the creation of a trust fund that will allow renewable energy sources to reach eight percent of national electricity generation by 2012. The second is a law concerning the development and promotion of biofuels, which initially stated that gasoline should include a minimum of ten percent ethanol blend, but that was deemed by the petroleum industry as nearly impossible to comply with in the short-term. Thus, in the current version under discussion, the percentage requirement has been replaced with a "gradual phase-in" mechanism. Both of these proposed laws have been brought up for vote in Congress and are currently going through amendments.

According to Chavez, Nawn, and Martinez, the Mexican Customs Administration (Aduana Mexico) refers to traded ethanol as "ethyl alcohol." There is no equivalent to the US Harmonized Tariff Code (HTC) 9901.00.50, which defines ethyl alcohol or mixture of ethyl alcohol to be used as fuel or in producing fuel. Ethyl alcohol imports face a mixed tariff of 10 percent ad valorem plus $0.36 per kilogram.

Chavez, Nawn, and Martinez report estimates of total potential ethanol capacity of 7.95 billion liters (2.1 billion gallons), of which, 5.7 billion liters (1.5 billion gallons) would come from corn and the remainder from sugarcane. However, it is worth mentioning that this calculation which was meant for scientific purposes implies that all available resources would be devoted to ethanol production. This is, of course, not feasible for Mexico.

United States The US ethanol industry initially began to take shape in the late 1970s producing what was then called "gasohol" in response to a doubling of oil prices to nearly $30 per barrel. As a result of crude oil prices rising to nearly $40 per barrel in the early 1980s, the industry expanded rapidly and by the middle 1980s, there were an estimated 170 plants producing approximately 1.51 billion liters (400 million gallons) per year (Vander Griend). However, by July 1986, the price of oil retreated back to $10 per barrel and the gasohol industry collapsed as costs were not competitive with gasoline at lower oil prices. Few stayed in the industry, but those that did began focusing on decreasing production costs. By the late 1990s, the costs of production (primarily due to larger plants realizing scale economies, reduced enzyme costs, and higher corn to ethanol conversions) for ethanol were competitive with gasoline. It should be noted that the blenders' tax credit remained in place throughout the 1970s and 1980s, providing about the same amount of incentive now as was provided some thirty years ago.

Table 3.2: 2006 ethanol production for all uses for selected countries.

Country	Millions of litres	Millions of gallons
Brazil	1,641.6	433.7
Costa Rica	135.9	35.9
El Salvador	145.7	38.5
Jamaica	252.8	66.8
Trinidad & Tobago	93.9	24.8
Total	2,472.7	653.3

Source: Renewable Fuels Association.

There are well over 100 ethanol plants in operation in the United States, with around 50 more supposedly under construction. The US ethanol industry has been expanding as fast as plants can feasibly be built. Over the past year, as corn prices nearly doubled, some of the proposed ethanol plants have dropped their plans and/or put them on hold (Renewable Fuels Association). Most industry observers realize the Renewable Fuels Standard (RFS) contained in the Energy Policy Act of 2005 will not be a constraint since it will be reached ahead of schedule. There are a number of proposals in the US Congress that would significantly increase the mandated amount of ethanol used in the United States. These measures would provide additional growth signals for the industry.

Rest of the Americas Other than dehydration plants which operate under the Caribbean Basin Initiative (CBI), there is limited ethanol production in the rest of the Americas. The CBI allows a Caribbean country to dehydrate ethanol from Brazil and sell in the United States without paying the 14.27 cents per liter tariff ($0.54/gallon). Table 3.2 contains the imports into the United States, by exporting countries from 2002 to 2006. Discussed below are countries where there have been published reports of significant ethanol production activity and/or investments.

In Argentina, the Congress approved a biofuels law on 19 April 2006, aiming to promote the use and production of biodiesel, ethanol and biogas (Renewable Fuel News 2006b). Only small-scale biofuels suppliers are currently in production, but large suppliers are under development. A program of tax incentives, including a 15-year exemption from the country's tax on diesel fuel, is being offered to spur the development of the industry. Beginning 1 January 2010, the government will mandate five percent use of biodiesel and ethanol in all diesel oil and gasoline consumption. Currently, the addition of ethanol to gasoline is permitted by law up to a five percent blend without an indication at the pump and up to a 12 percent blend with indication at the pump (Renewable Fuel News, 2006b). Projected gasoline consumption in 2010 is 1.1 million liters (0.3 billion gallons) which would require 55,000 liters (14,500 gallons)

of ethanol. Argentina produces ethanol mainly from sugarcane. Total ethanol production in 2006 was 170 million liters (45 million gal.) (table 3.1).

In Bolivia, small scale ethanol plants are currently in production using sugarcane as the feedstock (F.O. Licht 2006). In July 2005, the government approved a law allowing up to 25 percent ethanol blends in gasoline. The law is incrementally phased-in initially allowing ten percent blends, increasing to 25 percent blends over the next five years.

In Colombia there has been a mandated ten percent ethanol blend added to gasoline in metropolitan areas, which accounts for 60 percent total gasoline consumption (Renewable Fuel News, 2006a) since July 2005. Five sugarcane-based ethanol facilities are currently in production with an approximate total output of 367 million liters (97 million gal.).

Paraguay has blended ethanol with gasoline since 1982 (Renewable Fuel News, 2006a). Currently, a maximum of 18 percent ethanol blend is permitted. A new law under consideration considers a mixture of five percent biodiesel content in diesel and 25 percent ethanol content in gasoline (Renewable Fuel News, 2006a). Paraguay's President Nicanor Duarte said that domestic ethanol production will reach 114 million liters (30 million gal.) in 2007, up from 53 million liters (14 million gal.) last year. State oil company Petropar will purchase 38 million liters (10 million gal.) of ethanol this year to mix with gasoline (Renewable Fuel News, 2006a).

Biodiesel

Table 3.3 presents the 2005 annual production of the major biodiesel producers in the world. Biodiesel production largely has been located in Europe, with Germany by far the largest producer in the world.

Canada Only three years ago, there was no Canadian biodiesel production or industry. As the industry develops, Canadian biodiesel plants will primarily use canola and soybean oil as their feedstocks. Canadian production of biodiesel is slowly coming on stream with annual production estimated to reach 95 million liters (25 million gal.) in 2006-2007 (AAFC 2006a). Agriculture and Agri-Food Canada indicates that to date, most of the biodiesel manufactured in Canada has been exported to the United States.

With limited supplies of yellow grease and tallow available in Canada, expansion of the biodiesel sector is going to be dependent on available supplies of canola and soybean oils. Just as in the United States, increased

Table 3.3: Biodiesel production for selected countries in 2005.

	Millions of liters	Millions of gallons
Germany	1,921	507
France	557	147
United States	284	75
Italy	227	60
Czech Republic	136	36
Austria	85	22
Spain	84	22
Denmark	80	21
Poland	80	21
United Kingdom	74	20
Brazil	70	18
Australia	57	15
Sweden	7	2
Other Countries	102	27
World	**3,762**	**994**

Source: F.O. Licht (2006).

oilseed production will happen if producer returns are higher for oilseeds than for feed or food grains. If the two percent mandate is put in place, it will create the demand for 360 million liters of biodiesel (95 million gal.) per year in Canada (AAFC 2006a).

Mexico Due to the recent interest by Mexico in biofuels, the biodiesel industry has not yet been developed. The only information currently available for biodiesel production is an agreement that ITESM University and Energeticos, a private fuel company signed to produce biodiesel from animal fats and oils and to use the resulting fuel in buses used by ITESM's student transport system (Masera et al.). In July 2005, a small plant with a potential output of one million liters (265,000 gal.) of biodiesel per month was inaugurated. This plant, whose products are still being tested, is currently producing between 492,000 and 606,000 liters (130,000 and 160,000 gal.) per month, and all the biodiesel produced is used in buses.

The potential biodiesel production in Mexico, if all available resources are used only for this purpose, is 281 million liters (74 million gal.) (Masera et al.). The main feedstock sources would be avocado (231 million liters or 61 million gal), coconut (26 million liters or seven million gal.), soybeans

(23 million liters or six million gal.), and sunflower (one million liters or 300,000 gal.).

United States The US biodiesel industry has been experiencing rapid growth increasing from only two million liters (500,000 gal.) per year in 1999 to 284 million liters (75 million gal.) in 2005. As of January 2007, there were 105 biodiesel plants in the US (National Biodiesel Board). Traditionally the industry was composed of relatively small plants (less than 39 million liters or ten million gallons per year). Over the past two years, there have been numerous announcements of larger plants (more than 114 million liters or 30 million gallons per year) to begin construction. The rapid growth experienced over the past the past eight years appears to be slowing as vegetable oil prices have increased significantly pressuring plant margins.

In the future, the pressure on plant margins is expected to intensify as relatively higher margins for corn production in the United States will continue to cause a decline in soybean acreage. There are a number of studies that indicate that plants will operate below capacity due to reduced profitability (FAPRI; Caldwell).

Brazil There are major differences between ethanol and biodiesel in Brazil. Besides being a relatively new priority (the National Program for the Production and Use of Biodiesel was only created in 2003), the industry has characteristics and objectives quite distinct from ethanol. In 2005, the Brazilian government implemented a law that established minimum percentages of biodiesel mix to diesel oil as well as the monitoring of the introduction of this new fuel in the market.

The law established three periods for market development:

1. 2005 to 2007: The law permits two percent of biodiesel to be added to all diesel oil consumed in the country. This represents a potential market of 840 million liters (222 million gal.) per year. However, it is not mandated.
2. 2008 to 2012: The two percent allowed in the first period becomes mandated, creating a market of 1 billion liters (264 billion gal.) per year for biodiesel.
3. Beyond 2013: The law establishes a mandated five percent addition of biodiesel to diesel consumed in the country. Expectations are that this will represent a market of 2.4 billion liters (635 million gal.) per year.

Currently, biodiesel production is not competitive with petroleum diesel in Brazil. It is believed that the establishment of some type of incentive such as federal tax incentives is needed.

Rest of the Americas Unlike ethanol production which has been concentrated in Brazil and the United States, biodiesel production is underway throughout the Americas. Listed below are several countries where there have been published reports of significant biodiesel production activity and/or investments.

In Argentina, biodiesel is produced primarily from soybeans. Argentina's ten biodiesel plants can produce up to 68 million liters (18 million gal.) per year. American firms Cargill and Bunge plan to invest an estimated $1.5 billion constructing biodiesel plants in Argentina. The Seattle, Washington based company, Imperium Renewables, will be building a 379 million liter (100 million gal.) plant (Stephens). Moreover, in early February of 2007, Argentine President Kirchner signed an executive order to create a national biofuel law designed to make Argentina a biodiesel exporter. Kirchner put a low five percent export tax on biofuels, compared with a 24 percent export tax on soybean oil.

Ecuador is a major producer of palm oil. EarthFirst Americas, Inc. has shipped palm oil-based biodiesel to the US since late 2005 (F.O. Licht 2006).

In El Salvador, Bio Energía S.A., a subsidiary of the state-controlled investment fund, Corporación Salvadoreña de Inveriones (Corsain), launched production at its $2.5 million biodiesel plant in the Valle de Zapotitlán. The plant, which has the capacity to handle 28,000 tons of raw materials per year, will initially process imported palm oil from Guatemala (F.O. Licht 2007).

In Honduras, two biodiesel plants are currently in production with an output of 3.7 million liters (966,000 gal.) per year. African palm is the feedstock used by these plants. About 75 percent of production is self-consumed by producers, while the remainder is commercialized as automotive fuel for buses in the capital, Tegucigalpa. Biofuels specifications are being revised by the Central American Customs Union (CACU) (F.O. Licht 2007).

In Panama, Houston-based Texas BioDiesel is reported to have under construction a 379 million liters (100 million gal.) a year biodiesel plant. This plant is expected to use palm, mustard seed, and other vegetable products supplied by local farming cooperatives (F.O. Licht 2007) as feedstocks.

In Paraguay, the state oil company, Petropar, plans to invest three to four million dollars to produce 102,000 liters (27,000 gal.) of biodiesel (F.O. Licht 2007).

The Peruvian Cabinet recently approved a bill mandating a two percent biodiesel blend starting in 2009, being increased to five percent in the following year, and a seven percent ethanol blend mandate starting in 2010. The proposal will now be sent to a congressional commission before the final voting (F.O. Licht 2007).

ECONOMICS OF ETHANOL AND BIODIESEL

As indicated earlier, in the long-run, the relative costs of production between biofuels such as ethanol and biodiesel will determine whether they are legitimate alternatives to gasoline and diesel produced from petroleum oil. The following is a review of the latest cost of production estimates developed by the authors of this chapter, as well as those from other published research. It should be noted that the majority of the available research on costs of production is for plants operating in the United States.

Ethanol

The primary feedstocks used to produce ethanol are grains (corn, grain sorghum, and wheat) and sugar cane. The process of making ethanol from grains has evolved such that the grain (especially corn and grain sorghum) to ethanol conversion rate has risen while conversion costs have declined over the past decade.[4] Brazil has nearly perfected the process of converting sugar cane to ethanol over the past 30 years. Ethanol yields per acre are higher for sugar cane based ethanol than any other currently available feedstock. Around the world, scientists are racing to develop a low cost process to convert the cellulose from biomass to ethanol. While viewed as the future of ethanol production, it is discussed here because it will have a profound impact on the structure and viability of the current biofuels industry.

Grain Ethanol costs of production using grain will vary from country to country depending on variables such as grain transportation costs, natural gas prices, and the level of technology adopted. In the US, plant development has transitioned into a cookie cutter approach for new plants that are approximately 379 million liters (100 million gallons) per year dry mill plants. In other countries, such as Canada, the grain-based ethanol industry utilizes corn and wheat as feedstocks. Over the past few

[4] Those new to the area may wish to view the extensive set of presentations given at four conferences on bioenergy coordinated by the Farm Foundation at their website: www.farmfoundation.org.

months there has been an announcement of a grain-based ethanol plant for biofuels production potentially being constructed in Mexico, however, to the authors' knowledge, this has not happened.

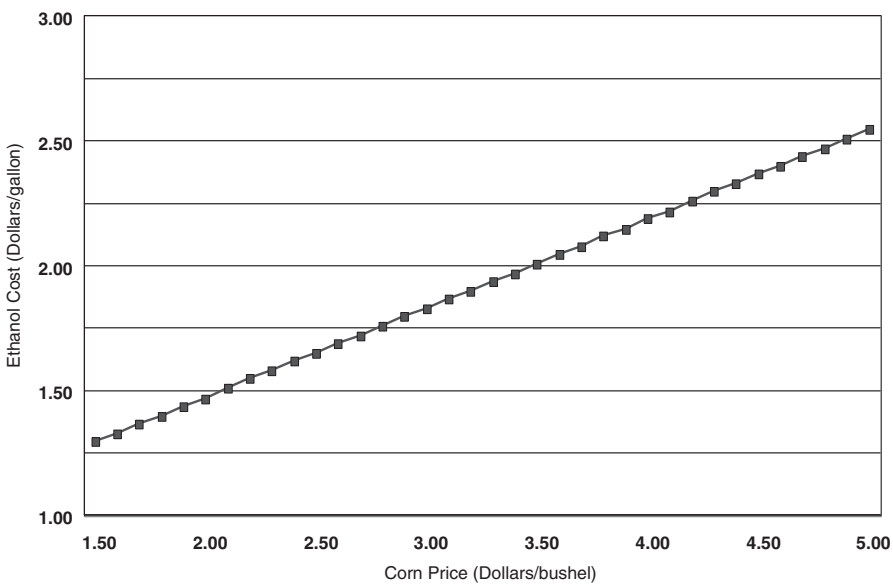
Figure 3.2 shows the estimated relationship between the feedstock cost in dollars per bushel of corn and the cost of ethanol produced in dollars per gallon. The cost of ethanol (measured on the vertical axis) does not reflect the credit for distillers dried grains with soluables (DDGS)[5] sales.

Table 3.4 contains a detailed breakout of per liter and per gallon costs of corn-based ethanol. As indicated, the price of corn makes up more than two-thirds of the cost of ethanol production. The other significant cost component is natural gas. The cost of ethanol increases around $0.07 per liter or $0.25 per gallon for each $1 increase in the price of corn as long as DDGS prices maintain their normal relationship with corn prices (Eidman).

Richardson et al. estimate that the total costs of ethanol production are $1.81 per gallon ($0.48 per liter) in 2007 with a corn price of $2.99 per

[5] Distillers dried grains with solubles is the product obtained after the removal of ethyl alcohol by distillation from yeast fermentation of a grain or a grain mixture by condensing and drying at least three-fourths of the solids of the resultant whole stillage by methods employed in the grain distilling industry (Iowa Corn).

Figure 3.2: Ethanol cost of production given changes in feedstock cost.



Source: Author's calculations.

Table 3.4: Estimated costs for a 50 million gallon per year dry mill ethanol plant, 2006.

	$/liter	$/gallon
Corn [a]	4.13	1.09
Enzymes	0.15	0.04
Yeast and chemicals	0.08	0.02
Denaturant	0.19	0.05
Natural gas	1.06	0.28
Electricity	0.19	0.05
Labor	0.11	0.03
Maintenance and repairs	0.11	0.03
General services and administration	0.23	0.06
Depreciation	0.49	0.13
Interest	0.26	0.07
Total	7.00	1.85

Source: Urbanchuk.
[a] Corn costs $3.01/bu assumed.

bushel. With an average ethanol price estimated at over $2.10 per gallon ($0.55/liter) and a $0.35 per gallon ($0.09/liter) credit for DDGS sales, the plant has an expected profit of $0.64 per gallon ($0.17/liter) without any consideration of the blenders' tax credit. Other researchers have estimated similar ethanol costs, with the primary difference being the corn price at the time of the study (Eidman; Urbanchuk; Shapouri and Gallagher; Tiffany and Eidman).

There are limits to the amount of grain that can be used to produce ethanol. For example, if the entire US corn crop were used to produce ethanol, it would only represent 15 percent of US gasoline needs (Felmy). The feed and food industries, as well as our export customers, would be subjected to significant shortages and higher prices in the short-run. In the longer-run, the US would likely lose customers and nearly all of its cost advantages in livestock production. This is the primary reason most industry observers feel that, to make a meaningful dent in energy needs, cellulosic ethanol is what is needed.

Sugarcane Ethanol is being produced from sugar cane in a number of countries such as Brazil and India. Table 3.5 indicates Ribera et al.'s estimates of Brazilian and US ethanol production from sugar cane. Chaves stated that the cost of production in 2005 was $0.89 per gallon ($0.24 per liter) with the exchange rate of three Real per US dollar. However, due to the depreciation of the US currency against the Brazilian Real to around 2.20 Real per US dollar in 2006, the cost per gallon has increased to $1.22 ($0.32 per liter). The estimated total cost of production per gallon of ethanol from sugarcane in the US is $1.87 ($0.49 per liter) (Ribera et al.), assuming it costs $17/ton ($15.42 per metric tonne or MT) for cane.

Table 3.5: Estimated costs of production of sugarcane-based ethanol.

	Brazil[a]		US	
	$/liter	**$/gallon**	**$/liter**	**$/gallon**
Sugarcane cost	0.22	0.84	0.25	0.95
Administrative and processing costs	0.10	0.38	0.12	0.47
Capital and other costs			0.12	0.45
Total cost	0.32	1.22[b,c]	0.49	1.87

Source: Ribera et al.
[a] Chaves
[b] Excludes capital costs.
[c] Cost of production was $0.89/gallon ($0.24/liter) with an exchange rate of three Real/$ in 2005.

Due to the US sugar price support program, cane for sugar production is worth around $24/ton ($21.77/MT), thus making sugarcane-based ethanol unable to compete with sugar production.

The US numbers should be viewed with some care as there is currently no sugarcane-based ethanol in the United States. There are relatively few other estimates of cost of production for sugarcane-based ethanol. A recent USDA/LSU study showed the lack of economic feasibility to convert raw and refined sugar into ethanol in the US (Shapouri et al.). However, the costs of production cited above convert sugarcane juice and/or molasses into ethanol, not raw and/or refined sugar.

Cellulosic Depending upon who is being quoted, cellulosic ethanol is anywhere from three to ten years away from cost competitive commercial production (Khosla; Dale). Currently there is only one cellulosic ethanol plant in operation. Iogen Corporation (2005a) has a demonstration plant in Ottawa, Ontario that uses wheat, oat, and barley straw as its feedstock. The plant is designed to produce up to three million liters (793,000 gal.) of ethanol annually. As indicated earlier, a number of companies located in countries around the world are rapidly moving toward commercial-scale plants. For example, Abengoa which has grain-based plants located in Spain and the United States is reportedly going to begin producing cellulosic ethanol in Spain during 2007. In addition, Dedini, a Brazilian enterprise, which is one of the largest sugar mill and ethanol refinery builders in the world, has developed a process to convert bagasse into ethanol.

Current cost estimates of commercial-scale cellulosic ethanol production in the United States are in the neighborhood of $2.50 per gallon ($0.66 per liter) with the expectation that within five years, costs would decline to around $1.20 per gallon ($0.32 per liter) (Dale).

There are a number of scientific breakthroughs that are needed to bring down the cost of converting cellulose to ethanol. Other cost factors that get less attention but are equally important are the logistics and transportation costs associated with collecting, transporting, and storing the biomass feedstock. Considerable research is needed to reduce these costs and develop a workable system for handling large quantities of biomass. One alternative that seems to be getting some attention is module builder type equipment patterned after cotton handling equipment. Once the biomass has been harvested, modules could be built, like in cotton, for easy delivery to the ethanol plant.

Biodiesel

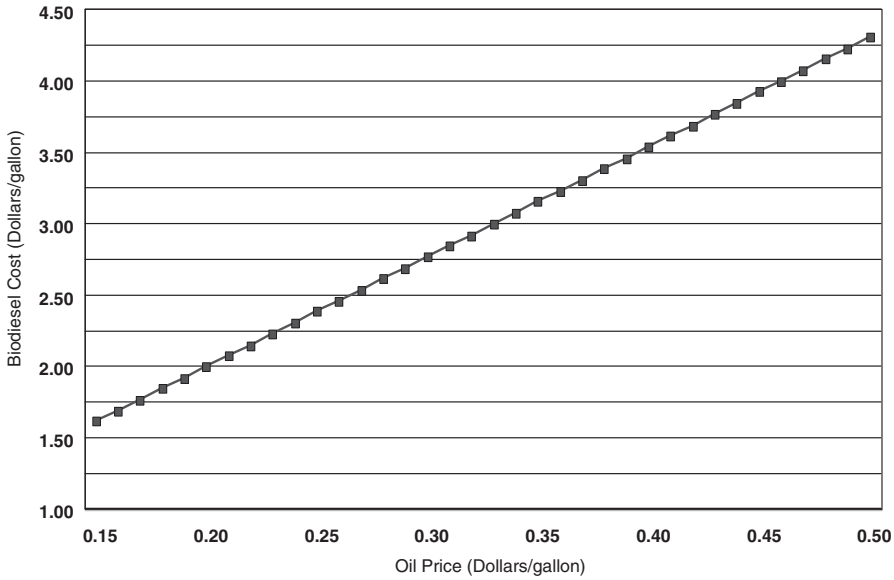
The primary feedstocks that are currently used to produce biodiesel are vegetable oils and animal fats such as chicken fat, beef tallow, and lard. Used cooking oil is also collected and processed into biodiesel and this activity has the added benefit of using a waste product to produce a biofuel rather than potentially becoming a biohazard if not disposed of properly. While the biodiesel industry is in its infancy in the Americas, it is a mature industry in Europe. The process of making biodiesel, which is called transesterification, is basically the same around the world. In the process, glycerin is separated from the fat or vegetable oil leaving behind methyl esters (the chemical name for biodiesel) and glycerin.

The primary differences in biodiesel production and costs from plant to plant are the costs of the feedstocks and the quality of the biodiesel from various feedstocks. Feedstock costs represent two-thirds of the cost of biodiesel production. Different feedstocks yield different biodiesel quality. For example, canola is believed to be a superior feedstock to other vegetable oils. Palm oil, which has been relatively inexpensive, has poor cold weather properties.

Unlike the ethanol industry, there does not appear to be as many areas where the costs of production can be greatly reduced with technology advancements. One major area of concern for biodiesel producers is the development of "renewable diesel" by oil refiners using refining-type technologies (hydrotreating) (Caldwell). The renewable diesel produced by hydrotreating can be produced in the same facilities that are producing petroleum diesel which give economies of scale and are fungible with petroleum-derived diesel. Currently, renewable diesel qualifies for the blenders' tax credit that was provided to biodiesel.

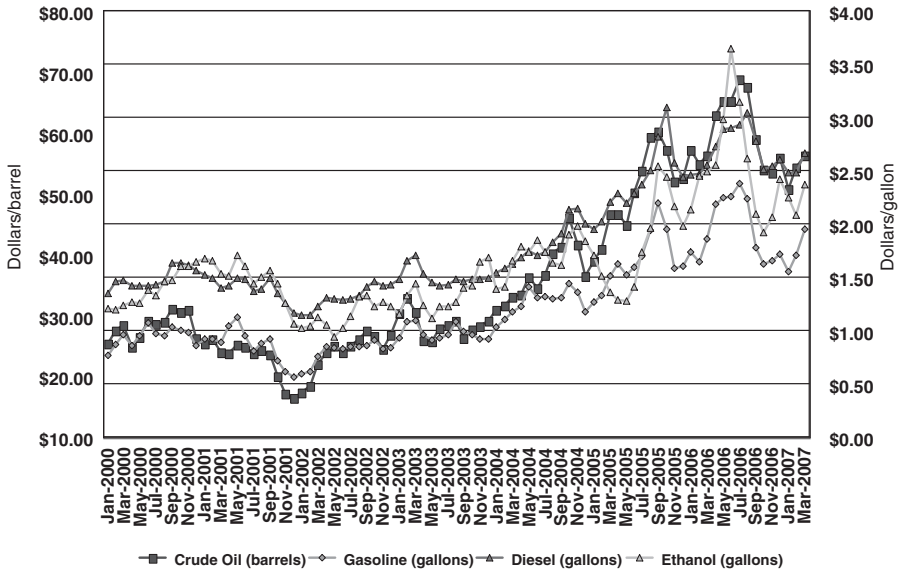
Oilseeds Canola, soybean oil, and, to a limited extent, cottonseed oil are the primary feedstocks in the NAFTA countries. It is estimated that close to 90 percent of the biodiesel processed in the United States uses

Figure 3.3: Biodiesel cost of production given changes in feedstock cost.



Source: Author's calculations.

Figure 3.4: US Prices of Crude Oil, Regular Gasoline, #2 Diesel, and Ethanol, Monthly, January 2000 - March 2007.



Source: U.S. DOE, EIA.

Table 3.6: Estimated costs for a ten million gallon per year biodiesel plant using soybean oil as the feedstock, 2006.

	$/litre	$/gallon
Soybean oil[a]		2.48
Catalyst		0.03
Methanol		0.12
Utilities		0.06
Labor		0.06
Transportation		0.05
Maintenance and repairs		0.01
General services and administration		0.05
Depreciation		0.06
Interest		0.02
Total		2.94

Source: Fortenbery.
[a] Soybean oil costs of $0.33/lb. assumed.

soybean oil as the feedstock. This primarily reflects availability and cost. When comparing vegetable oil prices, soybean oil has historically been the lowest cost and most available in the United States as it traditionally was a secondary product with the soymeal being the product with the greatest demand. The emerging biodiesel industry has increased the demand for vegetable oils in general which has led to higher soybean oil prices due to its use as a biodiesel feedstock. Vegetable oil prices have increased more than $0.10 per pound ($0.22 per kg) over the past year which has greatly reduced the economic viability of plants using vegetable oils as the feedstock.

Figure 3.3 shows the relationship between the feedstock cost in dollars per pound of oil and the cost of biodiesel in dollars per gallon. The estimated costs per gallon of biodiesel for a small scale plant are contained in table 3.6. Feedstock costs represent $2.48 per gallon ($0.65/liter) or 84 percent of the $2.94 per gallon ($0.78/liter) cost of production with a $0.33 per pound ($0.73/kg) soybean oil price. Again, other studies differ based on assumed feedstock costs but are generally in the same area (Eidman; Paulson and Ginder).

Animal Fats and Waste Grease Animal fats and waste grease have historically been priced at roughly one-half the cost of vegetable oils. As vegetable oil prices have increased, so have the prices of animal fats and to a lesser extent, waste grease. Smaller-scale biodiesel plants tend to have more flexibility in shifting between feedstocks than larger plants. In light of recent soybean oil price increases, biodiesel producers have begun blending cheaper animal fats and waste grease (when available) with relatively high-priced vegetable oils to reduce feedstock costs.

RELATIONSHIP WITH THE BROADER ENERGY MARKET

In order to determine whether biofuel plants will remain profitable in the future, it is important to understand biofuel's relationship with the broader oil market. Figure 3.4 illustrates the strong positive relationship between gasoline, diesel, and ethanol prices (all measured on the right axis) and the acquisition costs of crude oil (measured on the left axis). One phenomenon that quickly jumps out is the large increase in ethanol prices during the summer of 2005 that is attributed to the unanticipated phase out of MTBE as a summer oxygenate. While the graph helps explain trends, a more meaningful analysis is needed to see the actual statistical relationship between prices. The following simple equations were estimated by the authors to provide more insight into the price relationships, but not to predict or forecast fuel prices because these relationships may not hold in the future.

(1) Monthly Ave. Price of Gasoline in $/Gal. = $0.0917 + 0.0311 * Price of Crude Oil/Barrel

(2) Monthly Ave. Price of Diesel in $/Gal. = $0.4499 + 0.0378 * Price of Crude Oil/Barrel

(3) Monthly Ave. Price of Ethanol in $/Gal. = $0.5206 + 0.0310 * Price of Crude Oil/Barrel

The R^2 goodness of fit measures for the US gasoline and diesel equations were 0.96 and 0.97, respectively. The R^2 for the estimated ethanol equation was 0.72 or roughly 72 percent of the variability in ethanol prices can be explained by the variability in crude oil prices. This indicates that there are other factors such as government policies (i.e., the Renewable Fuel Standard and tax credits) affecting ethanol prices other than its role as a gasoline extender. Using these simple equations, the estimated gasoline, diesel, and ethanol prices are presented in table 3.7 for a range of crude oil prices. Ethanol prices are higher than gasoline prices at all oil prices because in the US ethanol is not priced on a Btu basis, but as a gasoline additive to replace MTBE.

At current feedstock prices, even with the excise tax credit in the United States, biodiesel producers will not cover costs at crude oil prices much below $50 per barrel. There have been studies that indicate that ethanol is currently selling at a slight premium to gasoline in the United States on a Btu basis (Tokgoz et al.) and the economic situation is much better for ethanol. Ethanol will cover its cost of production given current feedstock prices with oil below $40 per barrel with the excise tax credit and around $50 per barrel without the excise tax credit. All this holds

Table 3.7: Estimated prices of gasoline, diesel, and ethanol for various crude oil prices.

Crude Oil	Gasoline		Diesel		Ethanol	
$/barrel	$/l	$/gal	$/l	$/gal	$/l	$/gal
30.00	0.27	1.03	0.42	1.58	0.38	1.45
40.00	0.35	1.34	0.52	1.96	0.46	1.76
50.00	0.44	1.65	0.62	2.34	0.55	2.07
60.00	0.52	1.96	0.72	2.72	0.63	2.38
70.00	0.60	2.27	0.82	3.10	0.71	2.69
80.00	0.68	2.58	0.92	3.48	0.79	3.00

Source: based on authors' analysis.

assuming that the price relationship between ethanol and gasoline doesn't change abruptly.

TRADEOFFS – FOOD, FUEL, AND FEED

As ethanol production began taking off over the past five years, livestock organizations in the NAFTA countries voiced their concerns that a short crop would cause their sector considerable economic difficulty. Their angst has increased considerably over the past eight months as feedgrain prices have nearly doubled. Most recognize that at least in the short-term there will be losses for livestock producers (Collins). However, there are representatives of the ethanol industry that feel there is no need for any policy changes that would result in slowing the rate of growth in the industry (Jennings).

FUTURE OF THE INDUSTRY IN 20 YEARS

The future for bioenergy in general and biofuels specifically appears bright. One reason for this optimism is that governments around the world are embracing ethanol and biodiesel as an initiative with the potential:

- to help lessen reliance on foreign oil imports;
- to increase farm commodity prices thereby reducing commodity program expenditures;
- to enhance the perception of being more environmentally conscious by using fuels that are generally referred to as more environmentally friendly; and
- to enhance rural development through a dispersed bioenergy industry.

The capacity to spread the advantages and gains expected from the bioenergy boom within a large number of countries is becoming one of

the greatest concerns for policy-makers. Some countries do not have (and have strong restrictions to develop) the productive capacity required to benefit substantially from higher feedstock prices. However, consumers in these countries could benefit from lower fuel prices. Time will tell who the winners and losers will be. As with many technologies, early adopters will possibly reap the greatest benefits while those slow to embrace low-cost technologies will likely fall behind. It must be stressed, however, that those countries currently producing (and consuming) ethanol understand that the best strategy is to concentrate their efforts to stimulate fuel ethanol adoption within a large number of other economies. This would allow the consolidation of an international market for the product increasing the probability of gains by early adopters and those that already dominate the technology.

However, at this point there is no clear leader. Brazil has led in ethanol production and with a very low cost of production. Brazil might be able to maintain its competitiveness only if the new technologies and options for biofuel production introduced are compatible with its production process.

Currently, cellulosic technology seems to be the alternative with higher potential to come on line to increase biofuel production capacity. When this happens, the one thing that is certain is that those governments willing to invest in technologies will be giving their industries at least the advantage of being early adopters.

For Brazil, the introduction of cellulosic technology increases the potential to sustain its leading position, for several reasons. It has logistical advantages for exploring cheap feedstock at the mill. In addition, it has been identified as one of the few countries with the capacity to increase production due to land and water availability. This could further increase its competitiveness due to gains related to scale of production.

REFERENCES

Agência Nacional de Petróleo (ANP). 2007. "Dados Estatisticos." Available at <http://www.anp.gov.br/petro/dados_estatisticos.asp> Accessed May 2007.

Agriculture and Agri-Food Canada (AAFC). 2006a. "Biodiesel." *Bi-weekly Bulletin*, Vol. 19., No. 15, Market Analysis Division, Research & Analysis Directorate, Strategic Policy Branch, Winnipeg, Manitoba, 27 October.

___. 2006b. "Ethanol." *Bi-weekly Bulletin*, Vol. 19., No. 18, Market Analysis Division, Research & Analysis Directorate, Strategic Policy Branch, Winnipeg, Manitoba, 8 December.

___. 2007a. "Vegetable Oils: Situation and Outlook." *Bi-weekly Bulletin*, Vol. 20., No. 4, Market Analysis Division, Research & Analysis Directorate, Strategic Policy Branch, Winnipeg, Manitoba, 23 March.

___. 2007b. "Vegetable Oils: Situation and Outlook." *Bi-weekly Bulletin*, Vol. 20., No. 7, Market Analysis Division, Research & Analysis Directorate, Strategic Policy Branch, Winnipeg, Manitoba, 4 May.

Caldwell, L. 2007. "Refining Industry Investments in Biofuels." Paper presented at the Informa Economics and F.O. Licht conference, Ethanol: The New Energy Paradigm: The Impact of Ethanol on Energy Supply in the Americas, San Antonio TX, January.

Canadian Renewable Fuels Association (CRFA). 2007. "Biofuels Get Big Boost in 2007 Budget." CRFA Press Release, 19 March.

Chaves, I. 2006. Telephone conversation with the authors, 3 August.

Chavez, L., J. Nawn, and D. Martinez. 2006. *Mexico Biofuels Annual Report 2006*. Washington, DC: USDA Foreign Agricultural Services, Gain Report No. MX6503, 26 June.

Collins, K. 2006. "Economic Issues Related to Biofuels." Testimony Before the United States Senate Committee on Appropriations Subcommittee on Agriculture, Rural Development, and Related Agencies, Sidney MT, 26 August.

Dale, B. 2007. Testimony before the United States Senate Committee on Finance Hearing on, "Grains, Cane, and Automobiles: Tax Incentives for Alternative Fuels and Vehicles." Washington DC, 19 April.

Eidman, V. 2005. "Agriculture's Role in Energy Production: Current Levels and Future Prospects." Paper presented at the USDA/DOE conference, Energy from Agriculture, St. Louis, Missouri, December 14-15, 2005.

F.O. Licht. 2006. *World Ethanol and Biofuels Report*. Vol. 4, No. 16, 26 April.

___. 2007. World Ethanol and Biofuels Report. Vol. 5, No. 16, 25 April.

Felmy, J. 2007. "Biofuels: A Petroleum Industry Perspective." Paper presented at the 2007 EIA Energy Outlook, Modeling & Data Conference, 28 March.

Food and Agricultural Policy Research Institute (FAPRI). 2007. *Returns to Biofuel Production*. FAPRI - UMC Report #06-07, University of Missouri, Columbia MO, March.

Fortenbery, T.R. 2004. "Biodiesel Feasibility Study: An Evaluation of Biodiesel Feasibility in Wisconsin." Renk Agribusiness Institute, UW-Madison, August.

Ibope. 2007. Available at: <http://www.ibope.com.br/calandraWeb/servlet/CalandraRedirect?temp=0&proj=PortalIBOPE&pub=T&db=caldb>.

Iogen Corporation. 2005a. "Facilities." Available at: <http://www.iogen.ca/company/facilities/index.html> Accessed 3 December 2007.

_____. 2005b. "What is Cellulose Ethanol?" Available at: <http://www.iogen.ca/cellulose_ethanol/what_is_ethanol/index.html> Accessed 3 December 2007.

Iowa Corn. 2007. "Frequently Asked Questions about DDGS."Available at: <http://www.iowacorn.org/ethanol/ethanol_12.html> Accessed 28 November 2007.

Jennings, B. 2007. "Market Will Deliver." *Bioenergy Business*. 1(2):21.

Khosla, V. 2007. Testimony before the United States Senate Committee on Finance Hearing on "Grains, Cane, and Automobiles: Tax Incentives for Alternative Fuels and Vehicles." Washington DC, 19 April.

Masera, O., N. Rodriguez, I. Lazcano, L. Horta, I. Macedo, S. Trinidade, D. Thran, O. Probst, M. Weber, and F. Muller. 2006. "Potenciales y Viabilidade del Uso de Bioetanol y Boidiesel para el Transporte en Mexico." Sener/BID/GTZ Proyecto ME-T1007 – ATN/DO-9375-ME y PN 042148.7-001.00. Mexico D.F., Mexico, November.

National Biodiesel Board. 2007. "IRS Ruling Could Leave Promising Biodiesel Industry on a Bridge to Nowhere." Available at: <http://www.biodiesel.org/resources/pressreleases/gen/20070416_renewabledieselnrfinal.pdf>. Accessed April 2007.

Paulson, N.D., R.G. Ginder. 2007. "Growth and Direction of the Biodiesel Industry in the United States." Center for Agriculture and Rural Development working paper 07-WP 448, May.

Renewable Fuels Association. 2007. "Industry Statistics." Available at <www.ethanol.org/industry/statistics> Accessed 11 December 2007.

Renewable Fuel News. 2006a. Vol. XVIII, No. 9, February 27.

___. 2006b. Vol. XVIII, No. 32, August 7.

Ribera, L.A., J.L. Outlaw, J.W. Richardson, J. da Silva, and H. Bryant. 2007. "Integrating Ethanol Production into a US Sugarcane Mill: A Risk Based Feasibility Analysis." Departmental working paper. Agricultural and Food Policy Center, Department of Agricultural Economics, Texas A&M University, College Station TX.

Richardson, J.W., B.K. Herbst, J.L. Outlaw, and R.C. Gill, II. 2007. "Including Risk in Economic Feasibility Analyses: The Case of Ethanol Production in Texas." *Journal of Agricultural and Applied Economics*. Forthcoming.

Shapouri, H. and P. Gallagher. 2005. "USDA's 2002 Ethanol Cost-of-Production Survey." Washington DC:US Department of Agriculture, Report 841, July.

Shapouri, H., M. Salassi, and J.N. Fairbanks. 2006. *The Economic Feasibility of Ethanol Production from Sugar in the United States*. Washington, DC: USDA, July.

Stephens, W.R. 2007. "Biodiesel Around the World: Americas to Asia" *Fuel* First Quarter.

Tiffany, D.G. and V.R. Eidman. 2003. "Factors Associated with Success of Fuel Ethanol Producers." Staff Paper Series, Department of Applied Economics, University of Minnesota, Minneapolis MN, August.

Tokgoz, S., A. Elobeid, J. Fabiosa, D.J. Hayes, B.A. Babcock, T. Yu, F. Dong, C.E. Hart, and J.C. Beghin. 2007. "Emerging Biofuels: Outlook of Effects on US Grain, Oilseed, and Livestock Markets." Staff Report 07-SR 101, Center for Agricultural and Rural Development, Iowa State University, Ames IA, May.

União da Indústria de Cana de Açúcar (UNICA). 2005. "Avaliação final da safra Região Centro-Sul." Available at <http://www.portalunica.com.br/portalunica/?Secao=referência&SubSecao=palestras%20e%20apresentações> Accessed June 2007.

___. 2007. "Avaliação final da safra Região Centro-Sul." Available at <http://www.portalunica.com.br/portalunica/?Secao=referência&SubSecao=palestras%20e%20apresentações> Accessed June 2007.

US Department of Agriculture, Foreign Agricultural Service (FAS). 2006. *Mexican Biofuels Outlook*. August.

Urbanchuk, J M. 2007. "Economic Impact on the Farm Economy of Cooperative Ownership of Ethanol Production." Paper presented at the Agricultural Outlook Forum 2007, Agriculture at the Crossroads: Energy, Farm & Rural Policy, Arlington VA, 1-2 March.

Vander Griend, D. 2006. "The Impact of the Fuel Ethanol Industry on Rural America." Paper presented at the Farm Foundation Round Table meeting titled, Energy from Agriculture – Exploring the Future. Wichita, Kansas, June 16.

North American Ethanol Bioenergy Policies and Their NAFTA Implications

Glenn Fox and Kenneth Shwedel[1]

Subsidized ethanol is a very inefficient way to raise farm income. It would be much more economical to burn straight gasoline in our automobiles and pay farmers a direct subsidy equal to the amount that they would receive as a result of ethanol production (Gavett, Grinnell, and Smith).

A final consideration is that legislation could be adopted that makes it less favorable to import ethanol into the US; while Congress would likely respect trade agreements that have been ratified, it is possible that more inventive legislation would be considered if imports grew and had a significant impact on the US market. Therefore, it is necessary to keep one eye on the markets and the other on the politicians as ethanol trade evolves (Richman).

The closest thing to a state religion in America today isn't Christianity – it's corn. Whether liberal or conservative, Democrat or Republican, urban or rural, virtually everyone in the business of offering opinions is in firm and total agreement that America's ills, from Islamic terrorism to global warming to economic stagnation in the heartland, could be solved by a hefty dose of 200-proof grain alcohol (Taylor and Van Doren).

The experience of the 1970s and 1980s taught us that if a technology is commercially viable, then government support is not needed and if a technology is not commercially viable, no amount of government support will make it so (Lee, Ball, and Tabors).

Patria: tu superficie es el maíz … y los veneros del petróleo el diablo (López Velarde).

INTRODUCTION

Ethanol poses formidable challenges for the agenda of trade liberalization.[2] In fact, the emergence of the modern ethanol vehicle fuel industry in Brazil, the United States, and more recently in Canada, is the antithesis

[1] We gratefully acknowledged comments by Danny LeRoy, Al Mussel, Kate Tsiplova, Predrag Rajsic, Maria Klimas and Zahoor Haq on earlier versions of this paper.

[2] This chapter focuses on ethanol. Many of the conclusions, nevertheless, are valid for biodiesel, both in terms of the potential trade distorting impacts as well as with regards to the implications regarding food and hunger.

of freer trade and represents a continuation of extensive government subsidies to agriculture. Brazil and the United States are currently the largest vehicle fuel ethanol producing nations in the world. Production in Brazil expanded in the 1970s as a response to chronic balance of payments problems, admittedly exacerbated by higher nominal oil prices, but fundamentally arising from profligate monetary policies in the previous decade. The development of the Brazilian industry has been an important element of an import-substitution reaction to domestic inflation. Production of ethanol in the United States has grown rapidly in the last decade, first as a "clean" alternative to fossil fuels and more recently in an attempt to offset much-loathed "dependence" on oil imports. There is ample evidence that offshore sources of fuel ethanol either are or soon would be available to the United States at lower cost than the current grain-based domestic production systems. But it is unlikely that the current policy environment in the United States would tolerate imported ethanol any more than it is comfortable with imported oil. The growing interest in ethanol production in Mexico, while seen as an effective instrument of rural development, is also being promoted as an import substitution alternative.[3] In the United States and Canada as well as in Brazil, the development of the ethanol industry has been built on a foundation of extensive government subsidies and various forms of market intervention. Mexico, apparently learning from example, is contemplating subsidizing the development of a domestic ethanol industry.

Ethanol policy in the United States and Canada is complex, dynamic and increasingly controversial. Policy is at a formative stage in Mexico. Our overall purpose in this chapter is to assess first the prospects for international trade in ethanol with specific reference to the NAFTA countries and also to identify potential areas where trade frictions might emerge. One of the areas of potential trade conflict could be the different levels of support or other differences in policy approaches among the three NAFTA countries. We will review and compare the changing levels and instruments of support as part of our analysis. But assessing the likelihood of trade or, for that matter, trade conflict, requires going beyond comparisons of existing policies. It is important to understand the political economy of ethanol policy in the North American context in order to get a sense of whether trade or trade conflicts involving ethanol might emerge in the future. This task requires an examination of aspects of price trends in oil and gasoline markets, an examination of the available evidence on the competitiveness of ethanol as a vehicle fuel, an assessment of the various rationales for policy that have been used to justify support for the ethanol industry, and finally, a discussion of the emerging controversies surrounding ethanol policy. Ultimately, speculation about prospects for either trade or trade conflicts requires a framework for understanding of

[3] Mexico, which is a major petroleum exporter, faces a trade deficit in gasoline and other secondary petrochemical products. Estimates suggest that import savings could reach $2 billion by 2010.

the political economy of ethanol policy, particularly in the United States. We sketch the outlines of such a framework at the end of this chapter.

ETHANOL POLICY IN CONTEXT

The extent to which biofuels are produced in a policy-dominated environment is clear from a recent International Food and Agricultural Trade Policy Council discussion paper that identifies a long list of support measures used in various countries, including fuel excise tax exemptions and rebates; production mandates of specified levels of biofuels; compulsory blending mandates with fossil fuels; government-procurement preferences and purchase mandates; local tax breaks on property taxes and/or state/provincial taxes; accelerated write-off schedules for eligible biofuels-related capital; tax exempt bonds for finance (typically in the United States); subsidized loans, loan guarantees, special capital gains exemptions, or deferrals on sale of biofuel plant and infrastructure; regulatory exemptions and waivers including environmental impact waivers; state (provincial) producer credits either for all producers or those below a certain size or having a certain organizational structure (e.g., farmers' cooperatives); state/provincial/federal subsidies towards purchase of vehicles and infrastructure that can use biofuels; environmental legislation mandating certain specific types of fuel additives (typically for fuel oxygenation) related to reducing vehicle exhausts; government purchases of surplus agricultural stocks for conversion to bioethanol (particularly wine in the EU); subsidies not normally associated directly with biofuels, such as agricultural farm supports in the US, the EU, and elsewhere; and finally, government supported R&D for biofuels ranging from basic research to technology demonstration plants. If this list doesn't represent a full employment plan for biofuel trade economists, we don't know what does.

The rationale for government support for ethanol as a vehicle fuel has taken several forms since 1978. Proponents have advocated fuel ethanol as a cleaner burning fuel than petroleum-based gasoline, as a means of increasing farm income, as an environmentally superior fuel additive relative to MTBE (methyl-tertiary-butyl ether), and as a method of reducing oil consumption or imports (in the United States), first as a balance of trade issue and more recently as an anti-terrorism policy, but also as a means of reducing greenhouse gas emissions. All of these rationales have come under attack, increasingly so as ethanol production has expanded in the last few years. So far, the policy coalition promoting ethanol policy support by governments has been reasonably successful at maintaining sufficient political momentum to advance its interests. If that momentum is sustained, our anticipation is that trade in fuel ethanol will not be regularized any time soon. On the other hand, if the increasingly pointed criticism of ethanol policy starts to produce an ethanol backlash,

this could threaten the protected status of the emerging industry. But, in our view, this outcome does not lead to freer trade either, since erosion of policy support would likely trigger a contraction on both the supply and demand sides of the ethanol "market."

Current government policies supporting ethanol production, especially in the United States and more recently in Canada, are facing a growing chorus of criticism on environmental, trade, economic and distributional grounds. Lieberman; Lewis; Bovard; Taylor and Van Doren; Green; Pimental; Runge and Senauer; Koplow; and Sopuck have raised concerns about the ambiguous effect of ethanol fuel use on air quality relative to gasoline, about the limited extent to which corn-based ethanol actually displaces petroleum use, about the impact of increased ethanol production on food and feed grain prices, about the cost involved in securing the manifold putative benefits from ethanol use in vehicle fuel, and about the level of subsidization and interference with international trade in ethanol embodied in current policy. But, as Lieberman, and before him, Bovard have acknowledged, support for ethanol did not emerge from a vacuum. Politically well-positioned interests have, so far, been able to resist reform.

Ethanol Production Trends

Global ethanol production is expanding rapidly. Klein and LeRoy report that global production has doubled in the last five years. World production fluctuated around the 20 billion liter per year level from 1995 to about 2001, but had risen to about 45 billion liters per year by 2005 (Klein and LeRoy). The United States is now the largest ethanol-producing nation, followed closely by Brazil, both producing about 16 billion liters per year, which amounts to over 70 percent of world production. In contrast, current Canadian production is estimated to be about 230 million liters per year and Mexican production is about 50 million liters per year. Olar et al. project Canadian production to reach two billion liters annually in the next decade, based on current policy targets.

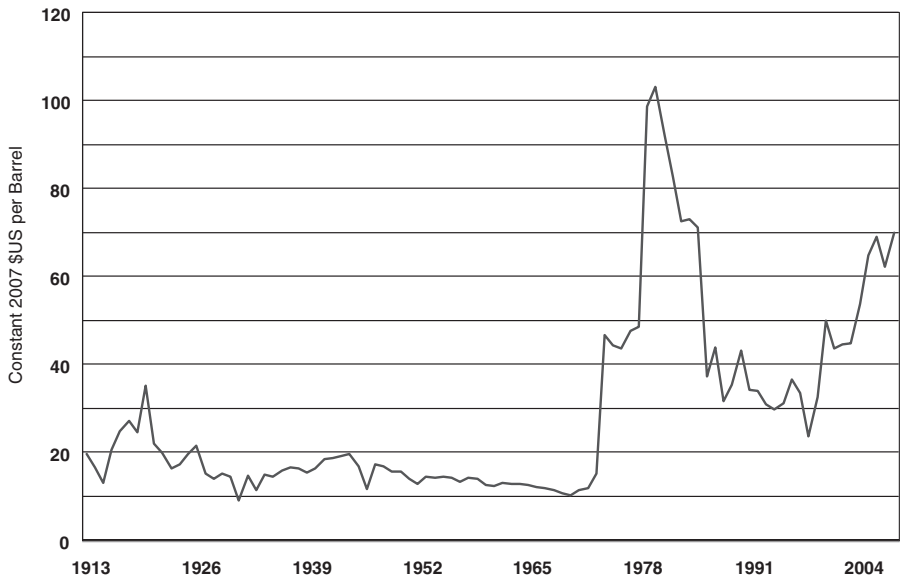
Rapid expansion of ethanol production in the United States may be starting to put supply-side pressure on prices. The Credit Suisse "US Biofuel Outlook" anticipates a short to medium-term surplus in the US ethanol market, putting downward pressure on ethanol prices. According to their analysis, existing and soon to be operational capacity, along with the prospects of increased finished gasoline imports from the EU, are putting and will continue to put downward pressure on gasoline and ethanol prices in the United States. They estimate that supply growth will exceed demand growth in the US gasoline market by 1.2 percent for 2007-2009. In addition, they speculate about the disintegration of the political coalition supporting biofuels production, particularly as

the connection between biofuel production and agricultural commodity prices comes under closer scrutiny. More recently, "BioProducts Update" (Checkmate) has projected bleak profit results for the rapidly expanding US ethanol industry in the wake of increased grain prices.

Oil and Gasoline Price Trends

One of the more durable rationales for government policy supporting ethanol is that biofuels in general can serve as an alternative to what is perceived to be increasingly scarce petroleum-based fuels. The general consensus, at least up to mid-2005, seems to have been that ethanol could not compete on price with petroleum-based gasoline. But volatility in oil and fuel markets since the summer of 2005 have cause many observers to ask if the historical relative price situation has changed. Discussion of this issue, however, continues to be confounded by the pervasive money illusion that seems to exist regarding oil and gasoline prices. During late 2005, media outlets in North America were dominated by reports of what were hailed as record oil prices. Of course, these prices reached record levels only in nominal terms. One of the artifacts of the relatively low inflation rates in North America over the last 25 years is that people have forgotten that even low rates of inflation distort nominal prices over time. Figure 4.1 reports constant dollar oil prices from 1913 to 2007. In real

Figure 4.1: Price of crude oil in constant (2007) dollars 1913-2007.



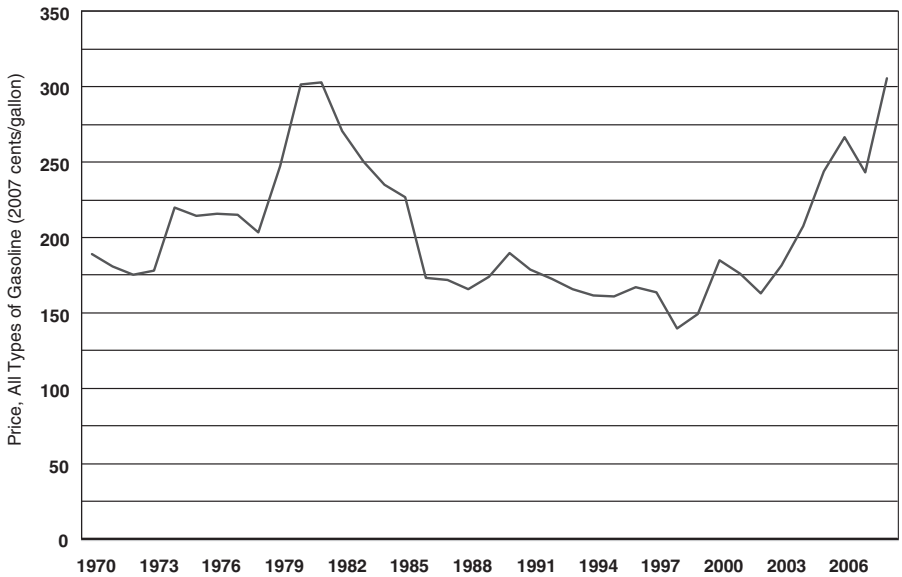
Source: Author's calculations.

terms, record oil prices[4] occurred not in 2005-2006, but rather in 1981, when prices reached a peak of about $100 per barrel, in 2007 constant dollars. These prices were approximately twice the level of real oil prices during the so-called energy crisis of the early 1970s. Nominal oil prices, in 2005-2006, peaked somewhere around $77 per barrel, then retreated to the $55 per barrel range in early 2007 before rebounding to current prices in the low $60 range. What is especially noteworthy in the present context is that by the late 1990s, oil prices had fallen to the $15 range, as exploration and development on the supply side as well as conservation on the demand side, triggered by the price spike of the early 1980s came on line. Huber and Mills; Lomborg; Simon; and Adelman have studied long term trends in oil availability and concluded that recurrent anxiety about future energy supplies is misplaced. Runge and Senauer, on the other hand, based on projections from the US Energy Administration, anticipate "sustained upward pressure on oil prices." It is beyond the scope of this chapter to resolve what has proven to be the most important and most difficult question in resource economics over the past 50 years, namely, "Is energy, especially oil, becoming more scarce?". If the oil pessimists are right, and the correct answer to this question is "yes", then the rationale for ethanol production as part of an energy policy becomes stronger, at least the rationale for considering it economically as an alternative to increasingly scarce oil. On the other hand, if the petroleum optimists are correct, at least in the short to medium-term, then this would relegate ethanol into the category of ideas whose time has not yet arrived. We tend to side with the oil optimists, but we will leave this question for you, the interested reader, to examine for yourself.

The story with domestic gasoline prices in the United States and Canada appears to be even more subject to money illusion than has been the case with oil. For domestic policy reasons, retail gasoline prices follow a different trajectory in Mexico. Figures 4.2, 4.3, and 4.4 report retail gasoline prices in the United States, Canada, and Mexico, respectively, adjusted for the effects of inflation. Media reports on gasoline prices in the United States and Canada have been full of trepidation since the late summer of 2005. Dire consequences for the national economies of both countries have been anticipated with each up-tick in the retail price of gasoline. When we strip away the money illusion, however, quite a different story emerges. Retail gasoline prices in the United States and Canada have been remarkably stable, in constant dollar terms, for 25 years. There has been an upward trend in retail prices since 1999, but remember that oil prices bottomed out at about $22 per barrel in that year, measured in 2007 constant dollars. A recent Credit Suisse report,

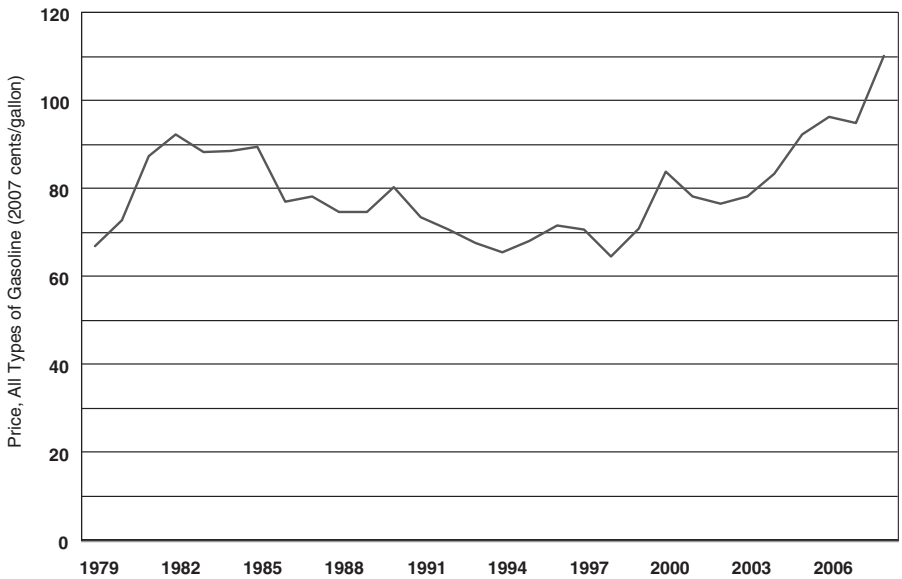
[4] In constant dollar terms, oil prices prior to 1913 were actually higher than even 1981. We have truncated our time series at 1913, however, for two reasons. First, oil played quite a different role in the global economy in the late 19th and early 20th centuries than it does today, and second, the problems associated with measuring inflation with price indexes over long periods of time make conversion of prices from 100 years ago into contemporary monetary magnitudes speculative.

Figure 4.2: US real gasoline prices, 1970-2007 (2007 cents/gallon).



Source: US Energy Information Administration.

Figure 4.3: Toronto real gasoline prices, 1979-2007 (2007 cents/liter).



Source: Statistics Canada; Ontario Ministry of Energy.

however, expresses US gasoline expenditure as a share of disposable income from January 1970 to January 2007. The ratio is relatively flat from about 1986 to 2005 and rises afterwards. The current ratio of a little over 3.5 percent, however, is still less than the value of 4.5 percent reached in 1980 and 1981.

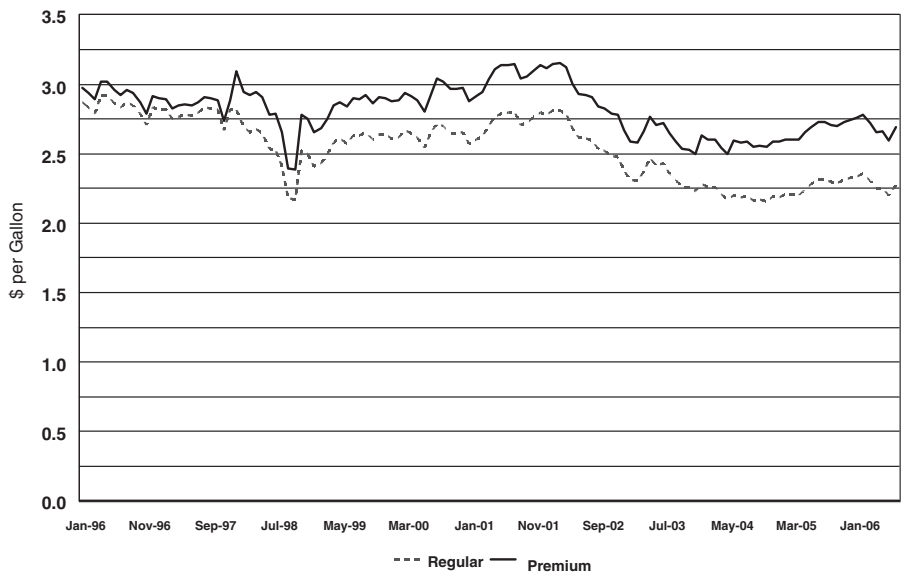
The Mexican case is somewhat different. The Mexican Constitution grants the state exclusive control over the distribution of gasoline. Prices are not market-driven, but policy-driven, and are not set by Pemex, the state oil company, but rather the Treasury Department (*Secretaria de Hacienda*). Presently the government adjusts gasoline prices monthly, based on expected inflation. What this does is effectively isolate the economy from the impact of international oil prices movements. It means that when prices are rising, Mexican users do not feel the inflationary effect. Likewise, when prices fall, Mexican users do not benefit from lower gasoline prices.

Summary of Evidence on Production Costs for Grain-Based Ethanol

There seems to be a strong consensus in the literature that grain-based ethanol is expensive[5] relative to petroleum-based vehicle fuel –

[5] Of course, Buchanan's warning about the futility of producing objective cost of production estimates in general is still relevant.

Figure 4.4: Constant (July 2006) peso Mexican gasoline price (premium and regular) converted to US dollars, Jan 1996 - Jul 2006.



Source: Secretaria de Energia.

Table 4.1: Comparison of ethanol production costs.

Country and Feedstock	OECD Estimated Production Cost for 2004[a] ($ per liter)	OECD Estimated Production Cost Adjusted[b] to Petroleum Based Gasoline Equivalent[c] ($ per liter)	OECD Estimated Breakeven Oil Price[d] ($ per barrel)
Brazil – Sugar Cane	0.219	0.332	29.00
United States - Corn	0.289	0.438	44.00
Canada - Wheat	0.563	0.853	150.00
Canada - Corn	0.335	0.508	65.00
EU – Sugar Beet	0.560	0.848	95.00
Gasoline Supply Price[e] (Regional Supply Costs)	0.311	0.311	39.00

[a]OECD (Table 1, p. 11)
[b]Assuming that one liter of ethanol is equivalent to 0.66 liters of petroleum-based gasoline
[c]Authors' calculations based on OECD data.
[d]OECD (Figure 3, p. 14).
[e]National gasoline prices, net of fuel taxes, were reported as $0.384 per for the United States, $0.401 for Canada, $0.394 for Brazil, and $0.406 for the EU.

particularly if the costs are adjusted for differences in energy efficiency (see below) – and also relative to ethanol produced from sugar cane and other tropical crops. Various attempts have been made to estimate ethanol production costs for various feedstocks for various locations around the world, including Gavett, Grinnell, and Smith; Berg; Fulton, Howes, and Hardy; and the Organization for Economic Cooperation and Development (OECD). These cost comparisons generally have concluded that corn-based ethanol production could not compete on a cost basis with petroleum, which is subject to taxation from which ethanol is generally exempt, at least for oil price conditions prior to the second half of 2005. Of course, as Buchanan explained almost 30 years ago, cost of production estimation confronts challenging subjective valuation problems if we want to understand opportunity costs.

The available evidence also suggests that production of ethanol from grain corn or from feed wheat or barley is not competitive with production using sugar cane or other tropical crop feedstocks. Estimates of production costs continue to be controversial, however, for predictable reasons. Hill et al. report that ethanol production has not been competitive with petroleum-based gasoline until recent increases in the price of oil. Table 4.1 summarizes some of the findings of an OECD report that compared ethanol production costs for various feedstocks with petroleum-based fuel costs for 2004. On a per liter of gasoline equivalent basis,[6] Brazilian sugar-based ethanol was almost competitive with the supply cost (i.e, exclusive of fuel taxes) of petroleum-based gasoline for market price conditions of 2004. Corn-based ethanol production in the United States would start to become competitive with oil if oil prices rose 32 percent relative to their 2004 level. The corresponding oil prices that would make Canadian wheat and corn-based ethanol competitive with oil would be 157 and 63 percent,

[6] Conversion of ethanol quantity to gasoline equivalent assumed one liter of ethanol was equivalent to 0.66 liters of petroleum based gasoline. Other sources report higher ethanol to gasoline equivalency conversions. And ethanol also is used as an octane enhancer in gasoline.

respectively, while the corresponding oil price for EU sugar beet ethanol production would be 157 percent. Of course, oil prices did rise appreciably in 2005 and 2006, making the short-run economics of ethanol production more attractive, relative to oil, but it remains to be seen if oil prices will continue at the higher levels observed over the past two years. It seems to be generally acknowledged that oil production from the Canadian tar sands becomes profitable at about $40 per barrel. And the reserves in the Canadian tar sands are at least as large as the petroleum reserves of Saudi Arabia, suggesting that this will be an important source of supply-side pressure on prices. And ethanol feedstock prices in North America have also risen steeply in the last two years. Berg reports that raw materials account for 70 to 80 percent of ethanol production costs, so increases in grain prices would have a significant effect on the competitiveness of grain-based ethanol production.

Unfortunately, ethanol prices are difficult to obtain for Canada. There are a small number of production facilities and an even smaller number of distribution firms and publically available data do not currently exist. But US data are more readily available. The California Energy Commission reports ethanol prices as well as retail gasoline prices for the state of California for the last 18 months. The retail price of ethanol, with existing tax exemptions, fluctuated in a range from $0.45 to $0.71 per liter since late 2005, except for the period from April to July of 2006, when prices spiked to the $1.05 per liter level. Regular retail gasoline prices in California reached $0.84 per liter in the late spring and early summer of 2006, about the time of the ethanol price spike, it then retreated to the $0.68 per liter level the following winter. California regular retail gasoline prices rebounded to the mid $0.80s per liter by the late spring and early summer of 2007. Although ethanol prices in California followed the rise of retail regular gasoline prices during the summer of 2006, this has not apparently happened during the summer of 2007. One possible explanation is that the rapid expansion of ethanol production capacity in the United States over the last 12 months has begun to have an effect on prices. As we suggest elsewhere, this may be an early indication that the bloom is off the rose for profitability of investments in ethanol plants in the United States. It is important to remember as well that these prices are expressed on a per unit of volume and not a per unit of energy basis. Ethanol as vehicle fuel is widely reported to be less productive than gasoline, in the sense that a higher volume[7] of ethanol is required to propel a vehicle a specified distance compared to gasoline. Estimates of the productivity difference are varied. We have encountered estimates ranging from 1.25, that is, 1.25 liters of ethanol are required to propel a vehicle the same distance as one liter of gasoline, to a value of 1.33 reported by the Canadian Renewable Fuels Association, to a value of

[7] Of course, ethanol also serves as a substitute for MTBE, so that energy content is not the only consideration in determining its value relative to gasoline, but clearly addition of ethanol does not decrease the price at the pump.

1.6 reported by Olar et al. The price of ethanol relative to retail regular gasoline in California in the summer of 2006, $1.05 to $0.84 per liter or a 25 percent price premium for ethanol, increases to nearly 80 percent if we assume that ethanol contains 70 percent of the energy equivalent of regular gasoline. The Minnesota Department of Agriculture reports price data for ethanol and unleaded regular gasoline from 1994 to 2007 for the Minneapolis/St. Paul market. Early in the time period reported, from about 1994 to 2000, the price of ethanol was consistently about twice the retail price of gasoline. Recall from figure 4.1 that this was a period of time with relatively low world oil prices. Both ethanol and gasoline prices in Minnesota rose after 2000. The gap between the price of ethanol and the price of gasoline has fluctuated but generally decreased as a proportion of the gasoline price. However, the most recent Minnesota price data (Minnesota Department of Agriculture) indicate that ethanol is 58 percent more expensive than gasoline ($0.63 per liter for ethanol compared to $0.40 per liter of gasoline). Again, this price comparison is expressed on a volumetric basis. Applying the same assumption that we used in the California case would increase the energy equivalent price premium to over 120 percent during the winter of 2006.

The Economic and Political Rationales for Ethanol Production

The technology to use ethanol as vehicle fuel is not new. In the early years of the automobile industry, ethanol was given serious consideration as a fuel source, until petroleum reserves were discovered and developed at a unit cost that made ethanol uncompetitive. Since the early 20th century, however, ethanol advocates have repeatedly claimed that ethanol's time has come.

Typically, support for ethanol production is presented in terms of externalities and market failures to adequately price environmental goods, national security and public welfare in general, and rural welfare in particular. We have identified six major policy rationales for ethanol production. Responding to differing clientele groups and objectives, in a number of cases the rationale tend to overlap. While this list may not be all inclusive, we do think that it adequately represents the state of the policy discussion regarding the rationale for ethanol production. Examination of each of these policy rationales is critical to the assessment of prospects for trade in ethanol. If these rationales continue to drive policy, then trade volumes are likely to be meager.

Balance of Payments Brazil's ethanol program was initiated in the 1970s as a means of conserving on foreign exchange. Although it is not the major driver behind Mexico's recent decisions to develop an ethanol-based industry, estimates place foreign exchange savings from incorporating a ten percent blend into the gasoline supply as high as $2 billion. This

comes from both savings on gasoline imports and substitution for MTBE. But as we intimated earlier, import substitution policies are generally applied to mask the symptoms of serious and chronic problems with national monetary policy. Countries with such problems generally don't make trade liberalization a policy priority.

Environmental Benefits Kerr and Loppacher have claimed that the major policy motivation for ethanol policy in the EU, Brazil, Canada, and the United States has been to correct for the market failures associated with the use of petroleum fuel. If this view is correct, then this would place ethanol into a category of environmental goods, which are subject to different trade disciplines than, say, agricultural or industrial goods. This claim, however, is often made by assertion. Increasingly, critics of the ethanol industry have raised environmental concerns about the current and projected scale of ethanol production within North America and even globally, implying that ethanol's status as an environmental good is contentious.

The putative environmental friendliness of ethanol has several dimensions. One aspect is the claim that ethanol production reduces greenhouse gas emissions. Another aspect is that ethanol is a cleaner burning fuel than gasoline in terms of non-greenhouse gas emissions. A third dimension of the claimed environmental benefits of ethanol has to do with its ability to replace MTBE as a fuel ingredient. All of these claims, however, are controversial.

The claim of reduction in greenhouse gas emissions from ethanol use is closely related to analysis of the net petroleum displacement achieved from ethanol use. If vehicle fuel consists of a 10 percent ethanol blend, then every gallon of a blended fuel reduces petroleum use by some amount. The magnitude of the reduction in petroleum use, of course, depends on the size of the energy equivalency adjustment that we discussed earlier. However, using corn as the feedstock for ethanol production, however, means that the petroleum used directly and indirectly to produce the corn, as well as the fossil fuel energy used to process that corn into ethanol, as well as energy used in the transportation of ethanol must be taken into consideration. Of course, indirect energy use occurs in the petroleum supply chain as well.

Our view is that comparing the net energy balance of ethanol versus petroleum-based gasoline faces an unresolvable problem of infinite regress. Early advocates of ethanol claimed that every liter of ethanol used replaced 0.66 liters of petroleum-based gasoline, when adjustments are made for Btu (British thermal unit) content. Critics of ethanol responded that oil was used in the production of the corn that went into the ethanol and that an oil-equivalent of coal or natural gas was used to generate the

electricity used in the ethanol plant, so these oil or oil-equivalent inputs should be charged against the ethanol to produce a net oil displacement figure. But ethanol proponents countered that oil is used in the production and transportation of oil as well, so that should be counted. But, pursuing this line of reasoning, oil was used in the production of the tractors that are used to grow the corn. And oil is used to fuel the iron ore freighters that delivered the ore to the steel plants that made the steel that went into the tractors that were used to produce the corn. Of course, being consistent, this indirect oil consumption should be charged against the oil rigs, that are also made of steel, that extract the oil from the oil fields. And then there is the fuel that is used by the employees of the tractor factory, the steel plant, the oil refinery, and the ethanol plant to drive to work. Should that be counted? As with other so-called life cycle analyses, there is no non-arbitrary stopping point for this type of analysis. So any physical estimate of net energy displacement with ethanol has to choose some arbitrary stopping point. The temptation to choose a stopping point that confirms the analyst's prior beliefs is great. Analytically, this is a familiar problem to economists. It is precisely one of the fatal flaws of the labor theory of value developed by the classical economists. The only way out of this morass is to abandon the hopeless project altogether and assess petroleum-based gasoline and ethanol on the basis of prices. On that basis, however, ethanol from grain is not a clear winner in a competition with petroleum-based gasoline. We will discuss the controversy around the net-energy balance calculations for ethanol below. In any case, as a means of reducing greenhouse gas emissions, ethanol use seems to be a high-cost means of reducing those emissions. Henke, Klepper, and Schmitz estimated costs of greenhouse gas reduction in the range of €200 to €1,000 per metric ton of CO_2 equivalent, which is far more expensive than readily available alternatives. Forge reports Natural Resources Canada estimates that vehicle fuel using ten percent ethanol produced from corn generates three to four percent lower greenhouse gas emissions compared to conventional fuel. Forge projects that national use of a ten percent ethanol blend fuel would reduce Canada's greenhouse gas emissions by one percent. This suggests that the reliance of the Government of Canada, as well as other governments, on ethanol production as a pivotal element of its climate change policy is, at best, ill advised.

Another aspect of the claim of environmental benefit is that ethanol is an alternative to MTBE in the formulation of gasoline. MTBE has been phased out through a combination of regional bans on its use and the expiration of a legislative shield from liability for its use. Johnson and Libecap's discussion of the history of the debate over the relative environmental demerits of ethanol versus MTBE, however, suggests to us that discerning the truth on this issue is not easy.

Frequently, estimates of the potential environmental benefits and costs do not take into consideration the impact of promoting plantings on marginal land and/or additional water use requirements.[8] An inappropriate choice of crops and technologies can result in negative environmental effects.

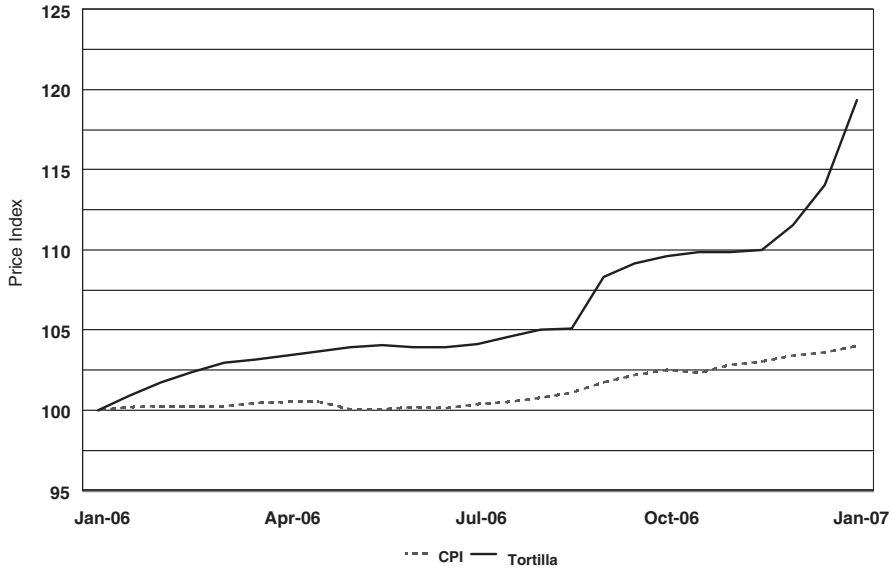
Farm Income Support and Rural Development A long-standing rationale for ethanol production in the United States and Canada is that ethanol increases demand for grains, which increases the price of grains, benefitting grain farmers. Gavett, Grinnell, and Smith, among others, have suggested that ethanol subsidies are an inefficient way of transferring income to farmers, however. Of course, higher grain prices, especially higher feed grain prices, are a mixed blessing at best for the agricultural sector, as these higher prices translate into higher livestock feeding costs (Centre for International Economics) and increased crop acreage in response to ethanol demand-driven grain price increases puts pressure on wildlife habitat (Avery). Mexican and Canadian corn farmers have also benefited from the higher prices for corn on the US market while livestock producers face higher costs for their feed and consumers pay more for their tortillas in Mexico, as figure 4.5 illustrates. Note from figure 4.6, that the burden of increased corn prices falls more heavily on low-income households. Furthermore, as Klein and LeRoy have recently concluded, higher grain prices are quickly capitalized into higher land prices. Another rural development argument that has been offered in support of the ethanol industry is that farmer-investors, as owners of small-scale regional ethanol production facilities, can benefit from profits in ethanol production as well as from higher grain prices. This too, however, may be a short-run phenomenon. Rationalization of ethanol production into larger and larger plant sizes seems to be underway in the United States. There is evidence that economies of size exist in ethanol production, at least up to a plant size of about 150 million liters of production per year.

In Mexico the thrust of the ethanol program is sugar cane. The current rationale is that it will support rural welfare by creating more jobs from expanding sugar cane production and investment in local processing plants. Because of the concern about the availability of corn for human consumption, there is a movement underway to modify the existing legislation to withdraw support from corn-based ethanol.

Sopuck estimates that provincial ethanol support measures in Manitoba cost about $Cdn75,000 per job "created." And none of the advocacy of ethanol as a farm support and rural development policy makes the claim that there is a net gain overall from the subsidization and promotion of ethanol production. Ethanol subsidies, and the marginal excess burden

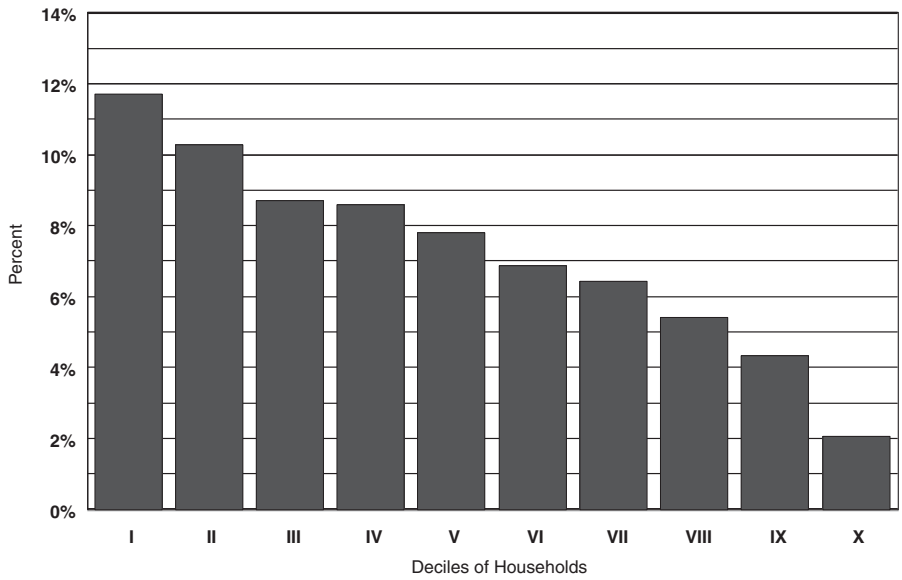
[8] The issue of environmental damage and sustainability, for example, is of particular concern for the production of biodiesel from palm oil.

Figure 4.5: Index of consumer level tortilla prices and the overall CPI in Mexico: Jan 2006 = 100.



Source: Author's calculations.

Figure 4.6: Share of household expenditure used for corn products in Mexico.



Source: Author's calculations.

created when the taxes are raised to finance them, impose costs elsewhere in society. So the apparent farm income and rural development benefits are, in reality, income and wealth transfers from other sectors of the economy. In Mexico, because of the importance of corn in the diet of Mexican consumers, one would be particularly hard pressed to make the case that there is an overall net benefit to society from higher corn prices to farmers.

Reduce Reliance on Oil Imports – the Energy Balance Controversy

The current primary rationale for ethanol policy in the United States is that ethanol production will reduce demand for imported oil. For Canada and Mexico, however, as net oil exporters, this rationale does not have much relevance, although as pointed out previously, Mexico is an importer of secondary petrochemical products. As in the case of the greenhouse gas reduction rationale, the imported oil argument hinges on the net energy gains (or losses) realized with grain-based ethanol production, and is subject to the same criticism (See discussion above). Pimental has recently estimated that ethanol production from corn in the United States uses 30 percent more energy than is present in the ethanol. Hill et al. have recently concluded that ethanol production from corn in the United States generates 25 percent more energy than it consumes, although almost all of the net gain is attributed to the energy credit estimated for the dried distillers' grains, a byproduct of ethanol production. Olar et al. summarize a number of studies on net energy estimates for ethanol. They conclude that there is a slight upward trend in these values for more recent estimates, but the variability of available estimates is quite high. Sopuck also summarizes estimates of net energy balance for corn-based ethanol production and also presents his own estimates. His summary of nine previous studies, which includes two sets of results produced by Pimental, gives and average positive net energy balance of about 1,100 Btu per liter. Sopuck's own estimate is about 5,500 Btu per liter.

Several practical factors contribute to the variability of estimates of the net energy balance of ethanol production from corn, in addition to the analytical problems discussed previously. First, corn yield is influenced by weather, disease, insects, and operator error. This means that there is variability in output from any given combination of land, fuel, seed, fertilizer, and pesticide products applied to a particular stand of corn. Depending on growing conditions, a given level of fossil fuel input results in a range of corn, and hence corn energy outputs. Second, corn is grown using a wide range of production systems, systems that vary, among other ways, in the level of fossil fuel used. There is no provenance provided with each bushel of corn that arrives at the ethanol plant documenting the nature of the production system used to produce that corn. So no one really knows what energy inputs have been applied. So these inputs are estimated or assumed. And there continues to be controversy about

estimates of inputs used in corn production. For example, extension personnel in Ontario have claimed for some time that farmers are applying fertilizer at rates that exceed the profit maximizing level of nitrogen use. On the other hand, aggregate data on total nitrogen use and nutrient budget calculations suggest that the quantity of nitrogen removed in the form of grain corn, at a provincial level, is reasonably close to balanced with total nitrogen fertilizer inputs. Depending on which data one uses, the net energy balance from corn-based ethanol in Ontario would be quite different. A third factor has to do with the treatment of byproducts from ethanol production. Some of the most recent estimates reporting small positive energy balances from ethanol produced from corn charge some of the corn production energy inputs against the byproducts. In fact, the magnitude of the positive energy balance is approximately equal to this byproduct attribution. Economically, this is problematic. Ethanol and the byproducts are joint products. Production economists have long recognized that allocation of production costs over joint products in a non-arbitrary way is not possible. Some arbitrary rules have been developed, such as cost allocation based on share of revenue. If we used recent relative prices for Dried Distillers' Grains (DDGs) and Ethanol, assuming an ethanol yield of 10.26 liters of ethanol per bushel of corn (2.7 US gallons), which would be worth about $6.75, assuming a price of $2.50 per gallon, and DDGs output of about 17 lbs. (7.7 kg) per bushel of corn input, which would be worth approximately $0.62 at current prices, this would result in 91 percent of the corn energy budget being allocated to the ethanol and nine percent to the DDGs. But this ratio may overstate the share of revenue derived from DDGs in the future as ethanol capacity expands putting downward pressure on DDG prices. In any case, our 91 percent to nine percent ratio is a much lower energy input allocation than has been used in studies that have found a net energy gain from ethanol.

In addition to the net energy balance question, the limited capacity of available cropland in the United States, to say nothing of the opportunity cost of the feed and food grain uses of grains currently grown on that cropland, caps potential import replacement at a relatively low level. And even projected growth of ethanol production in the United States would not put much of a dent in oil consumption. US gasoline consumption in 2004 exceeded 500 billion liters. Even doubling current US ethanol production would only constitute about six percent of 2004 gasoline consumption. Hill et al. have estimated that if all US corn and soybean acreage was devoted to ethanol and biodiesel fuel production, this would meet only 12 percent of gasoline and six percent of diesel fuel demand.

The Infant Industry Argument The infant industry argument has been proposed as a rationale for government support for the ethanol industry in the United States, Canada, and most recently in Mexico. The essence

of this argument is that new industries, or industries that are new in a particular jurisdiction, need government support to overcome learning and technology development costs if they are to compete internationally with established firms on the world stage. There are several long-standing criticisms of this argument. First, and this is the main point of Lee, Ball, and Tabors in the quotation at the beginning of this paper, is that we have tried this before and it didn't work. A more general criticism of the infant industry argument is that the children, having grown up in such an artificial and protected environment, never grow up. They need perpetual protection. Finally, in the case of grain-based ethanol, it is difficult to see how, biophysically, very much growing up is possible. This is not a new technology. Costs are dominated by biologically determined input-output ratios. This point is driven home in the Center for Agricultural and Rural Development (CARD) study (Tokgoz et al.) which states that under present price levels "the demand for fuels with greater than ten percent ethanol will be small in the next ten years without a change in government policy (p.2)."

Advocates of grain-based ethanol production sometimes, when confronted with this criticism, retreat to "well, grain-based ethanol is just a stepping stone to cellulose-based ethanol production." Interestingly the CARD study, when referring to the possibility of switchgrass, concludes that "in the Corn Belt [switchgrass] will make economic sense only if it receives an additional subsidy that is not provided for corn-based ethanol (p.41)." Of course, the policy coalition that sustains ethanol policy has nothing to gain and much to lose from cellulose-based ethanol. And it seems to be generally accepted that cellulose-ethanol is a long way from commercial scale operation.

Ethanol as Part of an Overall Renewable Energy Program The interest in ethanol is often part of a large effort to develop alternative and renewable sources of energy. Among the other alternatives include geothermic energy, wind, and waves. Ethanol, along with biodiesel, for many of the reasons listed above, has attracted most of the public's attention and budget outlays. This has effectively turned energy policy into "ethanol," and to a lesser extent "biodiesel," policy, to the detriment of the development of alternative renewable energy sources. Likewise, the focus on ethanol and biodiesel is politically attractive. The message is that energy conservation is secondary. Funding for energy conservation programs, including research and subsidies, pales in comparison to the resources going to the development of ethanol and biodiesel-based industries. Consumers in the well-to-do nations are being told that they can essentially continue their energy spending/wasting lifestyles since there are and will be readily available alternative energy sources.

But alternative energy sources are not just alternatives to oil, but also to one another. One of the "others" is ethanol production from tropical crops in equatorial climates. And the critical question for any alternative energy system is "are we there yet?"

General Issues

Is Differential Taxation a Subsidy? Policy support for the ethanol industries in United States and Canada takes many forms. In Mexico there has yet to be official support forthcoming for biofuels, although Congress recently passed a bill that signals the intent to support biofuels – and particularly ethanol. Capital and operating grants and concessional loans are being widely used in Canada. Import tariffs protect domestic firms in the United States and Canada. Differential application of excise taxes on fuel is also used.[9] Some analysts, for example, Koplow, include the US excise tax exemption as part of their subsidy calculations. In fact, Koplow concludes that the excise tax exemption is the largest subsidy directed toward ethanol production in the United States. But is a tax exemption a subsidy? Differential tax rates on goods may be perceived to be unfair and may raise controversial distributional issues. They may promote market distortions. They may be inconsistent with obligations of WTO members or NAFTA signatories, but, in our view, it is incorrect to view differential taxation as subsidization. If a government levies a tax of X percent on product A and does not tax product B, it has not subsidized product B. It has not taken wealth or income from taxpayers or consumers and handed it over to producers of product B. To treat differential taxation as a subsidy is to assume that the government owned an entitlement in the tax revenue, not the producer, and that, by failing to collect its entitlement, it conveyed a subsidy to producers of product B.

Food versus Fuel The tradeoff between grain production for feed and food versus production for fuel has become more visible in the last 18 months. Various livestock industry groups have raised concerns about the effect of increased ethanol production on feed grain costs for some time. To support what are assumed to be higher long-run corn prices the CARD study (Tokgoz et al.) concludes that the livestock industry will cutback production in order to pass on the higher costs to consumers.[10] But the increase in corn prices[11] in particular, over the last 18 months has precipitated a more general concern, not just within North America,

[9] Because an important component of prices at the gas pump is state taxes, this is a particularly attractive policy to promote ethanol use in US cornbelt states.

[10] The increased use of corn for fuel in North America, along with the anticipated contraction in livestock production, will have important consequences for future commodity trade flows, opening the way to potentially new trade disputes.

[11] Klein and LeRoy report an increase of 86 percent in US corn prices, of 32 percent in US soybean prices, and of 39 percent in US oat prices, as well as increases of 54 and 59 percent in Canadian feed barley and feed wheat prices, respectively, between 1 March 2006 and 1 March 2007.

but globally. According to a recent estimate, around 15 percent of last year's US corn crop was used for ethanol production. If we assume a short-run supply elasticity of 0.5, a new source of demand of this magnitude could increase prices by 30 percent. Changes in corn prices have not gone unnoticed in land markets. A survey by the Federal Reserve Bank of Chicago reports that the value of "good" land in the corn and soybean growing states of Illinois and Iowa grew by seven percent and 16 percent respectively during the first quarter of 2007. The key driver in this reversal from the situation last year, according to the Bank is "the expectation that the higher corn and soybeans prices relative to a year ago will be sustained by continued growth in demand for these crops, particularly to make biofuels."

As figures 4.5 and 4.6 illustrated earlier, the food versus fuel debate takes added relevance in the Mexican context. Mexico is one of the few countries where corn and corn products directly play an important part in the consumer diet. According to the United Nations Food and Agricultural Organization data, in 2004, the average Mexican consumed 308.3 grams of corn per day making it the most important food product in terms of volume (FAOSTAT). Likewise, the Mexican National Statistics Institute (Instituto Nacional de Estadística, Geografía e Informática) reported that for the average Mexican household, six percent of the total food bill is for corn and corn products, e.g., tortillas (INEGI). For the poorest households, the percentage of the food bill spent on corn and corn products reaches 12 percent.

As figure 4.5 reports, by the beginning of 2007, tortilla prices had risen 19.4 percent compared with the level one year earlier. The overall Consumer Price Index (CPI) grew by four percent over the same period. Fearing both the political repercussions from consumer discontent over higher corn and tortilla prices and the impact of high prices on efforts to control inflation, the government cajoled the industry into holding the line on tortilla prices. They also authorized emergency corn imports, i.e., outside the NAFTA-based quota system. At the same time, they offered to make additional funds available to support corn production in the country. While one would think that higher corn prices would facilitate the transition to an open market in 2008 under the NAFTA, the short-run reaction of the government has been to turn its back on market mechanisms, and to take a step backwards to quasi-price controls and extensive support to corn production.

Globally, Runge and Senauer project that the accompanying price increases from the use of food products to produce biofuels will "exacerbate world hunger." Rather than the 23 percent decline in the number of hungry people in the world that they projected in 2003, they are now predicting

that the number of chronically hungry in the world will rise by 600 million more in 2005 than the previous estimates.

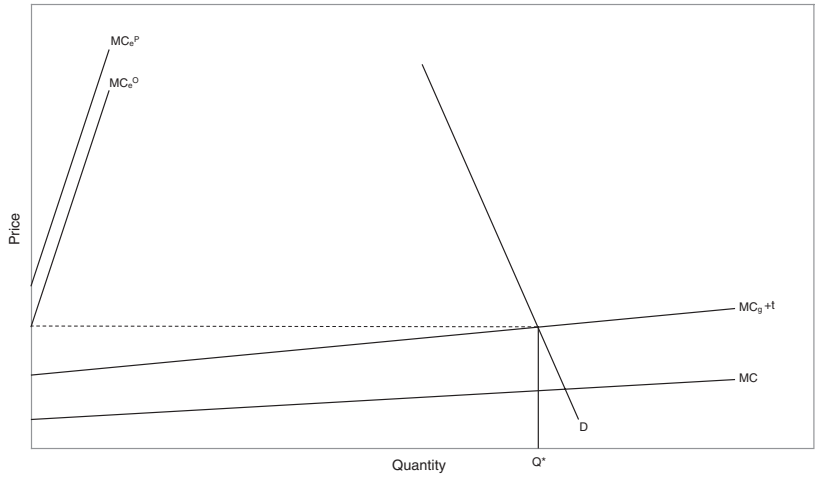
Underlying the impact of the use of food products for biofuel production is the question of whether or not there is enough land available to produce both the world's food and fuel needs. The answer, of course, depends on a number of assumptions, including changes in productivity. It also revolves around the extent to which ethanol or biodiesel are included in the fuel mix, as well as the choice of feedstock. Calculations by the Mexican Secretary of Energy estimate that to achieve a ten percent ethanol blend level in gasoline would require one million hectares of corn production. Because Mexico is already a net importer of food products, without a change in technology, we have to conclude that land used for production of crops destined to produce ethanol would mean that Mexico's food trade deficit would increase.

THE ECONOMIC ANALYTICS OF THE ETHANOL AND GASOLINE MARKETS

Certain aspects of current ethanol support policy in Canada and the United States are represented in a series of supply and demand diagrams, presented as figures 4.7, 4.8, and 4.9. Figure 4.7 illustrates the approximate relative positions of the demand for fuel (D) and the marginal costs of petroleum based gasoline (MCg) and ethanol (MCe) in North American markets. The superscript O or P on the marginal cost schedule for ethanol distinguishes between an optimistic (O) and a pessimistic (P) cost comparison with petroleum based gasoline. The retail supply of gasoline is represented as MCg + t where t represents the tax. Demand for vehicle fuel, D, is drawn as relatively inelastic. Of course, the marginal cost of gasoline, exclusive of taxes, does fluctuate, although, as we showed earlier, not generally to the extent commonly perceived. In any case, this implies that the MCg + t schedule does move up and down. Fuel ethanol is generally exempt from excise and other taxes, but based on what we have seen, is not able to compete on a cost basis with retail gasoline, which is taxed. The marginal cost of ethanol is more steeply sloped than the marginal cost of gasoline, owing to the limited land base and the impact of grain use for ethanol on grain prices. For the optimistic ethanol cost scenario, (O), ethanol is close to being competitive, on a price basis, with gasoline. For the pessimistic scenario, (P), the marginal cost of untaxed ethanol lies above the retail price of gasoline.

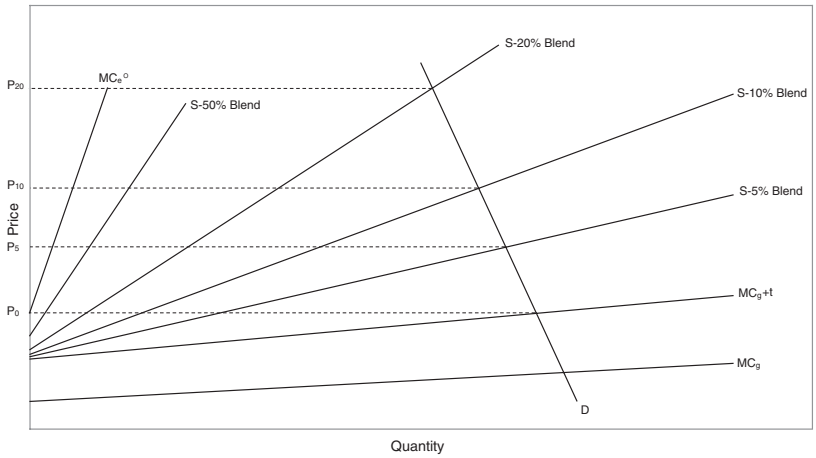
Figure 4.8 extends figure 4.7 and illustrates the effect of blending requirements on fuel supply and on retail fuel prices. In Figure 4.8, the ethanol portion of blended fuel is exempted from tax. Even modest blending requirements have potentially significant impacts on retail prices, given the limited production capacity of domestic farmland to

Figure 4.7: The demand for vehicle fuel and the supply of gasoline and ethanol.



Notes: MC_e^P = Marginal cost of ethanol (pessimistic view); MC_e^O = Marginal cost of ethanol (optimistic view); MC_g = Marginal cost of gasoline; MC_g+t = Marginal cost of gasoline plus tax; D = Demand for gasoline/ethanol.

Figure 4.8: The potential effects of ethanol blending requirements on vehicle fuel prices.



Notes: MC_e^O = Marginal cost of ethanol (optimistic view); S-50% Blend = Supply of 50% blend ethanol; S-20% Blend = Supply of 20% blend ethanol; S-10% Blend = Supply of 10% blend ethanol; S-5% Blend = Supply of 5% blend ethanol; MC_g = Marginal cost of gasoline; MC_g+t = Marginal cost of gasoline plus tax; D = Demand for gasoline/ethanol.

produce ethanol feedstock, relative to current continental levels of vehicle fuel use.

Figure 4.9 illustrates the possibility of ethanol imports from Brazil, which, based on the information available to us, we believe would be competitive with retail unblended gasoline on a price basis in the United States at the present time. However, the import duty currently applied largely precludes this from happening.[12] Even if import duties were removed, however, we have represented the import supply curve from Brazil as relatively steep, given the size of the US domestic fuel market relative to Brazil's capacity to export. So removing trade barriers to Brazilian imports would not provide much price relief from the effects of blending requirements.

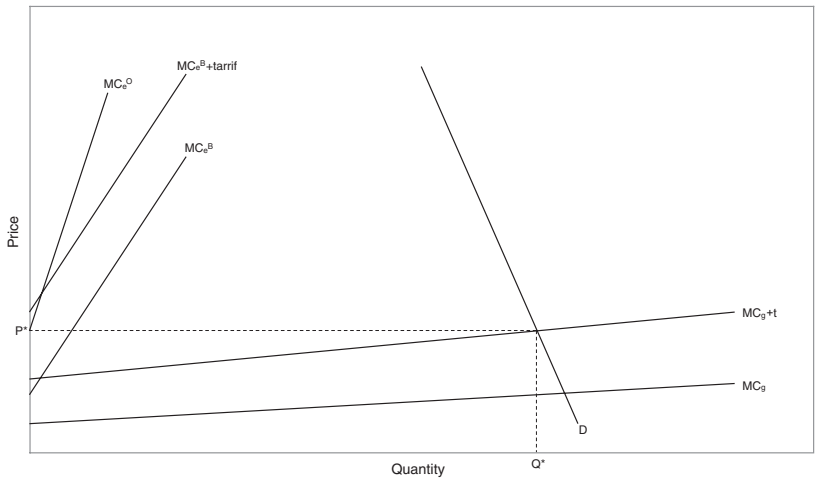
NATIONAL POLICIES

Canada

The main federal policy initiatives promoting ethanol production are an import duty of C$0.10 per liter imposed on imports from non-NAFTA

[12] We have seen some evidence that small amounts of Brazilian ethanol in fact do enter the US market under the current tariff regime, but this may be due to imbalances between regional requirements and production or to limited availability of infrastructure.

Figure 4.9: The potential competitive impacts of Brazilian ethanol imports.



Notes: MC_e^O = Marginal cost of ethanol (optimistic view); MC_e^B = Marginal cost of Brazil-produced ethanol; MC_e^B+tarrif = Marginal cost of Brazil-produced ethanol plus tarrif; MC_g = Marginal cost of gasoline; MC_g+t = Marginal cost of gasoline plus tax; D = Demand for gasoline/ethanol.

countries, a C$0.10 per liter federal excise tax exemption dating from 1992, capital grant or concessional loan programs, starting with the Ethanol Expansion Program in 2003 and currently through the Biofuels Opportunities for Producers and the ecoAgricultural Biofuels initiatives announced in the most recent budget, a federal fuel procurement preference, and a recently announced target of five percent ethanol in national gasoline consumption by 2010. The recent federal budget also announced that the C$0.10 excise tax exemption is to be replaced by a C$0.10 producer incentive payment "where industry requires support to remain profitable." Under the Ethanol Expansion Program, loan amounts ranged from C$0.08 to C$0.20 per liter of capacity, assuming a 25 percent marginal excess burden. There were seven loans totaling $CDN 78.2 million approved under the program for a total additional capacity of about 750 million liters per year. Repayment terms for these loans are lenient, since repayments are contingent on net return targets. If these loans are treated as grants and amortized over five years, the subsidy would range from C$0.02 to C$0.04 per liter. If we assume that the principal will be repaid and the subsidy is the interest rate, say, at eight percent real, then the subsidy ranges from C$0.005 to C$0.013 per liter.

Provincial policies vary. Walburger et al. report provinces exempt ethanol from provincial fuel taxes. This exemption ranges from C$0.09 per liter in Alberta to C$0.20 per liter in Quebec. In Ontario, the largest producing province, the exemption was C$0.147 per liter, but this was phased out when minimum blending requirements were introduced. In the case of Quebec, the exemption is up to 130 percent of the current C$0.152 per liter tax. British Columbia, Saskatchewan, Manitoba, and Quebec stipulate that the provincial tax exemption only applies to ethanol produced within the province.

In addition to federal and provincial government support, municipal governments have promised property tax reductions as well as attractive terms for real estate acquisition in efforts to attract ethanol plants in Canada. The process has resembled, at the level of smaller rural municipalities, the rivalry of larger urban centers for professional sports franchises.

Mexico

Until just recently, when Congress passed the bioenergy law, Mexico had no real policy towards biofuels generally, let alone ethanol. At the end of April the Congress passed a bioenergy law.[13] As discussed above, the main focus was on the support of bioeneregy development to stimulate rural

[13] For the law to go into effect it has to be published in the Mexican equivalent of the Federal Registry. As of this writing it has yet to be published, leading to speculation that it will undergo further modifications.

development. In fact, a major criticism of the law is that it does not fully contemplate the role of energy-related institutions in the development and distribution of a biofuels market. While the bill was still in Committee in the Congress there was talk of a ten percent blending requirement. The final version did not set a specific blending target, nor overall use targets for biofuels, except in so far as it would serve as an oxygenation agent in existing fuels. Some law-makers are considering proposing changes in this recently passed law. These may include specific and quantifiable blending requirements or biofuel use targets. The law, as it now stands, is vague on the specifics of support. It does, however, contemplate support for bioenergy products, including capital subsidies for processing facilities.

The policy environment for fuel has its foundation in the Mexican Constitution. The state is granted the exclusive right to petroleum resources including refining, distribution, and sale of gasoline. The production of ethanol, according to a number of sources, is not the exclusive right of the state, nor is the sale of 100 percent ethanol by private individuals or companies limited to the state. If the ethanol is blended with gasoline, however, the state assumes the exclusive right to distribute the blended fuel.[14]

Gasoline is subject to a value added tax (VAT). The recently passed Bioenergy Law does not contemplate a special tax regime for ethanol blended fuels. This suggests that ethanol blended fuels would be subject to the same tax structure as non-ethanol-based fuels.

As indicated above, the price for gasoline in Mexico is set by the government according to a fixed formula which is presently based on expected inflation. The Bioenergy Law does not consider a special pricing regime for biofuels. This, again, would suggest that ethanol blended fuels would be subject to the same price structure as non-ethanol-based fuels.

The United States

Zhang, Vedenov, and Wetzstein trace the recent growth of the ethanol industry in the United States to the provisions of the 1990 Clean Air Act amendments, even though ethanol had been subject to fuel tax exemptions since the 1978 Energy Tax Act. The 1990 Clean Air Act amendments required minimum oxygen content standards. Ethanol and MTBE emerged as substitute fuel additives used to comply with the oxygen standards. Due to cost considerations, however, ethanol was not able to realize a significant share in the fuel additive market until MTBE began to be phased out for environmental and human health reasons. The relatively rapid withdrawal of MTBE created substantial new demand for ethanol. Berg divides the post-1990 history of ethanol production in

[14] The state does franchise the distribution of gasoline to private individuals.

the United States into three sub-periods, attributing modest growth in output between 1990 and 1998 to the oxygenate requirements of the Clean Air Act amendments, more rapid growth between 1998 and 2005 to the growing concerns about MTBE and the projected 30 plus percent growth between 2005 and 2012 to the Renewable Fuels Standards of 2005. Runge and Senauer identify an earlier boost to ethanol production in the United States, when demand increased in response to the phase out of lead in gasoline in the 1970s and 1980s.

Koplow's recent synopsis of federal and state government support measures for ethanol is the most detailed and comprehensive analysis available. An earlier survey by MacDonald of the California Energy Commission also compared state level policies in the United States. Yacobucci has also reviewed current US policy. The main elements of US federal policy are a federal excise tax exemption, income tax credit that has ranged from $0.51 per gallon ($0.134 per liter) to $0.54 ($0.142 per liter), an ad valorem import duty of 2.5 percent as well as a supplemental import duty of $0.54 per gallon ($0.142 per liter), a small producers' (originally up to 30 million gallons per year production, but later raised to 60 million gallons per year) income tax credit of $0.10 per gallon ($0.026 per liter), and under the Energy Policy Act of 2005, a renewable fuels standard mandating minimum blend requirements for ethanol in gasoline nationally. Koplow; MacDonald; Yacobucci; and others have also documented the wide range of state level programs, which include fuel tax exemptions, support payments and blending requirements as well. The history of blending requirements is complex, beginning with the Clean Air Act Amendments of 1990, which established an oxygenate standard which created demand for ethanol and MTBE as fuel additives. The Energy Policy Act of 2005 dropped the oxygenate standard from the 1990 Amendments and instituted the national Renewable Fuel Standard, setting requirements of 15.1 billion liters of ethanol in 2006, increasing to 28.4 billion liters by 2012. In addition, the Energy Policy Act did not contain an expected liability protection provision for MTBE manufacturers, further accelerating the shift toward ethanol.

Koplow's compilation and analysis of US biofuel subsidies includes not only import tariffs, renewable fuel blending standards, and excise tax exemptions, but also includes procurement preferences and input subsidies for capital, feedstocks, water, land, and labor. Kaplow treats reduced levels of excise taxes on ethanol or on inputs used in ethanol production as subsidies. He also includes the negative effect of US agricultural policies on world grain prices as one of his categories of input subsidies. His overall estimate of support for ethanol production ranges from $1.42 to $1.87 per gallon ($0.37 to $0.49 per liter) of gasoline equivalent, when he applies 2006 programs to 2006 production levels. If the ongoing benefits of programs from earlier years are incorporated in the

calculations, his estimates rise to $1.44 to $1.96 per gallon ($0.38 to $0.51 per liter) of gasoline equivalent. The bulk of this support, however, comes from his estimate of the federal excise tax credit, which is responsible for about 50 percent of his subsidy estimates. About 20 percent of Koplow's subsidy estimate is attributable to blending requirements.

Other trade-related aspects of US ethanol policy include the Caribbean Basin Initiative (CBI), under which ethanol produced in a Caribbean country with a specified level of local feedstock enters the United States at concessional duties. Up to 60 million gallons, or seven percent of US production is duty free. Bovard; and Elobeid and Tokgoz have discussed the evolution of this policy, however, and suggest that the opportunity for Caribbean countries to export ethanol to the US market is more apparent than real. There has been, nevertheless, increasing interest recently by Brazilian investors to use the CBI countries as a point of final processing of Brazilian ethanol. This essentially would allow Brazilian product to enter the US market duty free. In addition to the Caribbean Basin Initiative, ethanol from NAFTA countries enters the United States duty free, subject to country of origin.

US policies, including proposals for inclusion in the upcoming Farm Bill, also include a number of support elements. These include budgetary support for actions ranging from loan guarantees for biofuel plants, to grants for biobased energy technologies and products, as well as funding for educational programs. Of particular interest is a proposal to fund feasibility studies for the construction of dedicated ethanol pipelines. This responds to the problems of transporting ethanol. To the extent that feasibility studies lead to ethanol infrastructure, it will create a set of vested interests that will work against competing energy alternatives, including trade-based initiatives.

Policy Comparisons

Table 4.2 summarizes and compares the main policy measures used to promote ethanol production and consumption in the NAFTA countries. Support has been converted to $/liter units to facilitate comparison. Several interesting points of comparison between Canada and the United States can be seen. First, federal support for ethanol seems to play a more significant role in the United States, as well as in Mexico, than it does in Canada compared to state and provincial support, respectively. The main exception is Minnesota, which looks more like a province than a state. Second, provincial commitments to ethanol are more broadly distributed in Canada than appears to be the case in the United States, where support is highest in midwestern grain producing states. Ironically, Canadian grain producers have already received substantial benefits, in the form of higher grain prices, as a consequence of US ethanol policy.

Table 4.2: Comparison of ethanol support policies in Canada, Mexico, and the US[a].

	Canada[b]		Mexico	United States	
Category of Support	**Federal**	**Provincial**	**Federal**	**Federal**	**State[c]**
Import Duties	$0.09/liter[d]	Not Applicable	$0.63/liter[e]	$0.142/liter	Not Applicable
Excise Tax Exemptions and Income Tax Credits	$0.09/liter	Alberta $0.081/liter British Columbia $0.13/liter Manitoba $0.30/liter[f] Ontario $0.132/liter[g] Quebec $0.18/liter Saskatchewan $0.135/liter	Not contemplated in Bioenergy Law	$0.134/liter	Illinois[h] $0.079/liter Iowa $0.003/liter California $0.079/liter Indiana[i] $0.03/liter
Capital Grants/ Concessional Loans	Ethanol Expansion Program[j] up to $0.03/liter	Ontario Ethanol Growth Fund up to $0.09 per liter of capacity	Ad hoc support from Federal Agricultural Infrastructure Fund		
Operating Grants	2007 Budget $0.09/liter[k]	Alberta $0.126/liter Ontario up to $0.099/liter			Minnesota $0.053/liter Texas $0.053/liter Wisconsin $0.053/liter
Blending Requirements	5 percent by 2010	Alberta British Columbia Manitoba 8.5 % in 2005 Ontario rising to 10% by 2010 Quebec Saskatchewan	No target given, but government will make effort to use blended fuel		Minnesota 10 percent

[a] Data in this table were derived from various sources, including Walburger et al.; Koplow; MacDonald; and various government press releases.
[b] A US$ to C$ exchange rate of C$1.00 to US$0.90 was assumed.
[c] Reported calculations are for the ten largest ethanol consuming states.
[d] Scheduled to be phased out in 2008 and replaced with an equivalent "incentive payment."
[e] Refers to denatured ethanol from countries where no trade treaty exists. Imports from Canada and the US are duty free as long as they are not sugar-based ethanol which has benefited from the Sugar Reexport Program.
[f] In Manitoba, fuel ethanol is exempted from a C$0.20/liter excise tax and the excise tax on ten percent blend fuel is reduced by C$0.015/liter on the gasoline portion. Since, in a ten percent blend, nine liters of gasoline are mixed with each liter of ethanol, the reduction in provincial excise tax is C$0.20 per liter for the ethanol exemption plus C$0.135 for the tax reduction on the gasoline in the blended fuel, for a total exemption of C$0.335/liter. The exemption on the ethanol portion will be reduced to $0.135/liter from 2007 to 2010 and to $0.09/liter from 2010 to 2013.
[g] The exemption has been replaced by a provincial blending requirement.
h Illinois reduces the sales tax on E10 and above blends from 6.25 to five percent. If the retail price of gasoline is $2.50 per gallon inclusive of sales tax at 6.25 percent, then this would fall to $2.47/gallon at a five percent tax rate. The $0.03/gallon reduction is gained for having 0.10 gallons of ethanol, so the tax reduction is $0.30/gallon of ethanol, or $0.079/liter.
[i] State income tax credit.
based ethanol which has benefited from the Sugar Reexport Program.
[f] In Manitoba, fuel ethanol is exempted from a C$0.20/liter excise tax and the excise tax on ten percent blend fuel is reduced by C$0.015/liter on the gasoline portion. Since, in a ten percent blend, nine liters of gasoline are mixed with each liter of ethanol, the reduction in provincial excise tax is C$0.20 per liter for the ethanol exemption plus C$0.135 for the tax reduction on the gasoline in the blended fuel, for a total exemption of C$0.335/liter. The exemption on the ethanol portion will be reduced to $0.135/liter from 2007 to 2010 and to $0.09/liter from 2010 to 2013.
[g] The exemption has been replaced by a provincial blending requirement.
[h] Illinois reduces the sales tax on E10 and above blends from 6.25 to five percent. If the retail price of gasoline is $2.50 per gallon inclusive of sales tax at 6.25 percent, then this would fall to $2.47/gallon at a five percent tax rate. The $0.03/gallon reduction is gained for having 0.10 gallons of ethanol, so the tax reduction is $0.30/gallon of ethanol, or $0.079/liter.
[i] State income tax credit.

Recent Canadian policy initiatives, by virtue of the small share of the North American corn market produced in Canada, are likely to have such small additional price effects as to defy measurement.

Apart from comparative support levels, this brief summary of biofuels policies in the NAFTA countries illustrates several important points. First, the ongoing expansion and even the existence of a corn-based ethanol industry is contingent on government support. The matrix of policies at the federal, provincial, and state levels is complex and dynamic. Second, the policy rationale for supporting ethanol has changed frequently since 1978. Ethanol has been promoted on environmental, economic, and geopolitical grounds. Third, the dramatic increase in ethanol production over the past two or three years has galvanized critics of current policy and challenged virtually all aspects of the rationale for government involvement in the biofuels market.

Potential Trade Issues

International trade in ethanol does occur, but the level and even the direction of trade is volatile. Berg describes the Brazilian ethanol net trade position as "erratic." For example, Elobeid and Tokgoz report that in the fall of 2005, Brazilian ethanol, inclusive of import duties and transportation costs, was available in the US market for $2.07 per gallon ($0.54 per liter), compared to the US domestic price of $2.47 per gallon ($0.65 per liter). Brazil exported 19.7 million liters of ethanol to the United States in October and 10.2 million liters in September 2005, but did not export anything to the US market in August of that year. Gallagher et al. report a brief episode of US ethanol exports to Brazil, in 2000, when sugar prices drove up the cost of Brazilian ethanol to a level about equal to the landed price of US ethanol. Schmitz, Schmitz, and Seale report that Brazil imposed a 30 percent import duty on ethanol in 2001, presumably as a precaution against recurrence of this type of spontaneous international exchange ever happening again. Laney estimates that Brazil currently exports about 3 billion liters of fuel ethanol per year, which amounts to about 19 percent of its production.

In spite of the limited current experience with international trade in ethanol, a recent discussion paper from the International Food and Agricultural Trade Policy Council and also Kerr and Loppacher have argued that WTO disciplines do apply to biofuels, and, given the rapid growth in global production of these commodities, the need for clarification of the extent to which obligations under the WTO have implications for national biofuels policies is becoming more acute. The Council compares current biofuel mandates in the United States and Japan to the domestic capacity to produce biofuels relative to national fuel demand and concludes that trade will be inevitable. They identify three issues that need to be clarified in the application of WTO rules to this pending trade: 1)the determination of whether ethanol should be treated as an agricultural, an industrial, or an environmental good; 2) the determination of how ethanol subsidies should be treated in terms of existing categories of WTO subsidy rules; and 3) the assessment of compliance of domestic rules with WTO standards on technical barriers to trade. Kerr and Loppacher also consider clarification of whether fuel ethanol is an industrial, agricultural, or environmental good to be a critical trade issue. They also identify implications of the EU/US dispute over biotechnology as an impediment to EU/US trade.

On the US side, net imports of ethanol since 1992 have generally been small relative to national production and consumption. Data reported by Berg indicate that net US ethanol imports amounted to a little over two percent of domestic consumption in 1994, which was the highest share for the 1992-2003 period. In 2003, the import share was only 0.3 percent.

Berg projects growth in world ethanol trade from a 2005 volume of about 1.4 billion liters annually to over eight billion liters per year by 2012. This growth is dominated by projected imports by Japan. He does not project much growth for ethanol imports into the United States.

Most recently a concern has been raised in some circles in Mexico about the possibility of "dumping" DDGs onto the Mexican market, with the effect of depressing corn prices faced by local farmers. As discussed previously, when valuing DDGs, one runs into the classic problem of assigning costs to joint products. The probability of successfully arguing a dumping case against DDGs we consider to be minimal, at best. Nevertheless, it is interesting to contemplate the possible trade disputes arising from corn-based ethanol production.

Biotechnology Kerr and Loppacher have identified differing national treatments of biotechnology as a potential future trade tension for ethanol. The concern to increase productivity to respond to the demand for agricultural feedstock for the production of ethanol has given new life to supporters of biotechnology, particularly the use of genetically modified (GM) crops. The argument is that GM technology to enhance productivity already exists and the future depends on the extent that GM research and adoption is supported. This has especially been the case in Mexico, where compared with Canada and the US, the use of GM technology has been significantly limited. With regards to trade, it is not clear whether countries that prohibit or limit GM agricultural imports will also use this to limit ethanol or biodiesel which uses GM feedstock.

Lack of Transparency The market for commodity ethanol has been expanding rapidly in the United States and Canada, driven by a complex array of policy measures at the federal, state, provincial, and even the municipal level. Compiling current information on the effective level of support for this dizzying array of programs is a daunting task, made more challenging by the rapid rate of policy change and by the possibility of subsidy stacking. Actions of competing jurisdictions have come to resemble the behavior of rival cities hoping to host the Olympic games or to be future homes to professional sports teams. The economic implications of the comparison are not encouraging. Even something like obtaining reliable price data for ethanol is problematic in Canada, making trade and market analysis speculative ventures.

Provincial and State Production Preferences and National Treatment Principle Offers of provincial support for ethanol producers from the governments of British Columbia, Saskatchewan, Manitoba, and Quebec that explicitly favor ethanol produced in the province from feed

stock grown in the province would appear to be contrary to the national treatment principle embodied in the WTO and the NAFTA.

Potential for International Trade Liberalization Although we will argue later that the realistic prospects for trade liberalization in ethanol are not bright, some analytical work has been done to assess the impact of liberalization on world prices and national production and consumption levels. Elobeid and Tokgoz modeled the effect of removing US barriers to ethanol imports. They used a multi-market partial equilibrium market model that linked ethanol markets with the sugar and feed grain markets. Their model was calibrated for 2005. Their results indicate that unilateral liberalization by the United States, consisting of dropping the duty rate of 2.5 percent as well as the levy of $0.54 per gallon ($0.142 per liter), leads to a rise in world ethanol prices (23.9 percent), a decrease in the domestic US ethanol price (13.6 percent), a reduction in US domestic ethanol production (7.2 percent) and an increase in US consumption (3.6 percent). In the model, US net imports of ethanol double.

However, there are several reasons to believe that trade liberalization in ethanol or other biofuels will not happen any time soon. First, the two leading ethanol producing nations, Brazil and the United States, have made large and, in the case of Brazil, long-standing commitments to developing a domestic ethanol industry for reasons that fly in the face of the venerated principle of comparative advantage. The United States is pursuing a biofuel development import substitution policy to reduce dependence on imported oil. It is unlikely that advocates of this policy would see much advantage to swapping dependence of foreign oil for dependence on foreign ethanol. Neither country currently shows any inclination to reverse course on domestic support policies and embrace free trade in biofuels. Second, saturation of the domestic vehicle fuel market with ethanol has not been reached in either Brazil or the United States. The modest level of current Brazilian ethanol exports seems to have found an attractive outlet in the EU. The limited domestic capacity of the United States to produce ethanol relative to domestic fuel requirements means that it is unlikely to enter the export market any time soon. Furthermore, as Kerr and Loppacher have explained, the long-standing tension between the EU and the United States on biotechnology has effectively closed the EU market to US corn-based ethanol. Given the high priority on directing domestic production to domestic use in both countries, it would be unlikely that either nation would mount a WTO complaint on the other's trade barriers. Ethanol consumption is projected to expand substantially in Japan over the next ten years and the Japanese market will likely be an attractive destination for south and south-east Asian ethanol and biodiesel production, reducing the probability of a WTO challenge against US trade barriers from that region.

Within the NAFTA, Canadian production will be hard pressed to fill the blending requirements announced recently at the federal level and there is very little ethanol production in Mexico. The limited policy on biofuels does not contemplate exports of ethanol as a policy objective. There are some projects in the pipeline that do consider the possibility of exporting ethanol to the US market. Because Mexican produced ethanol would enter the US duty free under the NAFTA, Mexican ethanol producers would be able to take advantage of the US price structure for ethanol. This would imply that they would be secondary beneficiaries of the ethanol subsidy in the US While the completion of these projects may result in some ethanol being exported to the US, the overall impact on the US market will likely be minimal. If anything, it will probably be more political than economic. Because, as indicated above, in order to achieve a ten percent blending target, Mexico will need to dedicate approximately one million hectares to grow crops for ethanol instead of food, a massive movement of ethanol from Mexico to the US is highly unlikely. So, there will be little in the way of international pressure on the United States through its trade agreement obligations.

PUBLIC CHOICE ANALYSIS OF THE EMERGING ETHANOL INDUSTRY IN THE UNITED STATES AND CANADA

Both the prospects for regularized international trade in ethanol, as well as assessment of the likelihood of trade disputes arising from that prospect are contingent on future developments in the policy environment, especially in the United States and Brazil, since they are currently the leading ethanol producers. The current policy approach in both countries mitigates against regularization of international trade, to put it mildly. But policies can change. Actual outcomes of policy processes are notoriously difficult to predict. Perhaps understanding the dynamics of those processes somewhat better is the best thing economists can hope to contribute.

Yandle has developed a public choice- based explanation for the existence of what, on the surface, might appear to be paradoxical coalitions that he had observed in environmental policy development in the United States. In several different contexts, Yandle observed environmental groups and industry groups both supporting, albeit sometimes in different ways, the development of US federal environmental regulations. Yandle calls his explanation the "Baptists and Bootleggers" theory. This metaphorical label refers to a quasi-hypothetical situation where a local government is considering a ban on retail alcohol sales on Sundays. The Baptists, according to Yandle, support a ban on moral grounds. People should be at church on Sundays, not reveling in bars. A ban on retail alcohol sales would strengthen the moral fiber of the community, or something like that. Bootleggers, on the other hand, might very well support a ban, but

for more prosaic reasons. Closing retail alcohol outlets on Sundays, to the bootleggers, removes some of their competition from the market. Of course, the bootleggers, being bootleggers after all, have no intention of abiding by the proposed ban. But they suspect that licensed retail outlets will comply rather than lose their permits to sell alcohol on the remaining six days of the week. This increases the demand for bootleggers' products on Sundays, probably making higher prices possible.

Ethanol support policy in the United States and Canada has attracted a series of Baptist and bootlegger coalitions over the last 30 years. The composition of these coalitions has changed over time, just as the leading rationale for ethanol production has changed. Early on, environmental groups were generally supportive of ethanol, first as a means of phasing out lead in gasoline, later as an alternative to MTBE under the US oxygenate requirements. But more recently, particularly as the net energy issue and the environmental impacts of corn production have become more prominent, environmental groups have become at best lukewarm to ethanol promotion and some have joined the chorus of critics. Corn farmers have been staunch members of the ethanol political coalition, for obvious reasons. Joining corn farmers, large-scale ethanol producers, Archer Daniels Midland, according to Bovard and others, being the most prominent, have played a critical role politically in sustaining support for the industry.

Farmers, environmentalists, and large-scale agribusiness – we will leave it as an exercise for the interested reader to assign groups into Yandle's categories, since this designation is not our primary interest. We think that there is an implication of Yandle's theory that even Yandle has not recognized. Economists generally argue that cartels are inherently unstable. Members of a cartel might agree to a common course of action, but the incentive for individual cartel members to cheat is strong, and, if cheating becomes widespread, the desired gains from cartel behavior are not realized. Political coalitions are like cartels, in some respects, but Baptist and bootlegger coalitions have a unique characteristic that enables them to survive longer than other types of political coalitions or economic cartels. Baptist and bootlegger coalitions can defend themselves against criticism better than other types of political coalitions. The "Baptists", by taking the putative high moral ground, can help the coalition forestall criticism. Their cause is righteous. They are acting altruistically for the good of the community. People who would criticize the coalition can be painted as unenlightened. Also, the "Baptists", by making a moral-looking argument, can forestall economic criticism, by pitting concerns about costs relative to benefits of a policy against a "do the right thing" proposition.

The apparent durability of Baptist and bootlegger coalitions has important implications for one of the main themes of this paper – that practical trade liberalization in biofuels in North America should not be expected any time soon. None of the parties in the current coalition has a compelling interest in expanding international trade in biofuels and it is unlikely that any parties external to this coalition will be able to mount an effective campaign to change existing policy. Johnson and Libecap's insightful examination of the policy process that yielded US ethanol policy confirms many aspects of Yandle's theory. Their documentation of the political reaction to Gavett, Grinnell, and Smith's economic assessment of fuel ethanol is a particularly revealing narrative about the durability of the kinds of cartels analyzed by Yandle. The ability of the ethanol coalitions to manage information flows, which is a focal point of Johnson and Libecap's analysis, is critical to cartel durability and to maintaining policy momentum. For that matter, Gavett, Grinnell, and Smith's discussion of the development of ethanol policy in the United States up to 1986 also confirms Yandle's theory and is still worth reading today.

CONCLUSIONS AND IMPLICATIONS

The evidence suggests that in the North American market, under existing conditions, grain-based ethanol-based biofuels are not economically viable without extensive government support. Likewise, in Mexico, internationally competitive ethanol from sugar cane would require government intervention to achieve important changes in the institutional structure governing the sugar industry. While current US and Canadian government policy supports ethanol production and use, our view is that the current policy approaches do not adequately evaluate and adjudicate negative environmental and social impacts. Emerging literature examining the development of ethanol policy in the United States reveals that serious consideration of environmental and social impacts of biofuel promotion and consideration of trade obligations were never really on the agenda. The direction of policy support works against freer trade and, for that matter, the operation of genuinely free markets, generally. Arguments of energy security, in particular, serve to justify these policies. If the market is indeed seriously inefficient at pricing nonrenewable energy, and we suggest that diagnosis by assumption has all too often gone unchallenged on this question, then that would suggest that some measures of government intervention might be needed. Wolf's caveat is still relevant, however. We need to be more aware that the policy cure may be worse than the market failure disease. Up to this point, the emphasis has been on supporting the development of renewable energy sources and not aggressive measures to discourage the use of nonrenewable energy. It is not yet clear that either emphasis, however, is really justified.

REFERENCES

Adleman, M. 1995. "Trends in the Price and Supply of Oil." In J. Simon, ed. *The State of Humanity*. Oxford: Blackwell.

Avery, D. 2006. *Biofuels, Food or Wildlife? The Massive Land Costs of US Ethanol*. Washington DC: Competitive Enterprise Institute, Issue Analysis, 21 September.

Berg, C. 2004. *World Ethanol Analysis and Outlook*. Tunbridge Wells: F.O. Licht, April.

Bovard, J. 1995. *Archer Daniels Midland: A Case Study in Corporate Welfare*. Washington DC: Cato Institute, Policy Analysis no. 241.

Buchanan, J. 1969. *Cost and Choice*. Chicago: University of Chicago Press.

California Energy Commission. 2007. "Weekly Transportation Fuels Trend." Available at: <http://www.energy.ca.gov/gasoline/index.html>. Accessed April 2007.

Canadian Renewable Fuels Association (CIE). 2006. "RFS Draft Policy Paper." Consultant's report prepared by (S&T)2 Consultants and Meyers Norris Penny LLP, 6 July.

Centre for International Economics. 2005. *Impact of Ethanol Policies on Feedgrain Users in Australia*. Canberra: CIE Report, August.

Checkmate. 2007. "Biofuel Profitability Fades." *BioProducts Update*. Available at: <http://news.tradingcharts.com/futures/0/9/95100790.html>. Accessed April 2007.

Credit Suisse. 2007. *US Biofuel Outlook*. 9 May.

Elobeid, A. and S. Tokgoz. 2006. "Removal of US Ethanol Domestic and Trade Distortions: Impact on US and Brazilian Ethanol Markets." Working Paper 06-WP 427, Center for Agricultural and Rural Development, Iowa State University.

FAOSTAT. 2007. "FAO Statistical Database." Available at: <http://faostat.fao.org/>. Accessed April 2007.

Federal Reserve Bank of Chicago. 2007. "Agricultural Newsletter, Number 1936." May.

Forge, F. 2007. *Biofuels – An Energy, Environmental or Agricultural Policy?* Ottawa: Parliamentary Information Research Service, 8 February.

Fulton, L., T. Howes, and J. Hardy. 2005. *Biofuels for Transport: An International Perspective*. Paris: OECD, International Energy Agency.

Gallagher, P., G. Schamel, H. Shapouri, and H. Brubaker. 2006. "The International Competitiveness of the US Corn-Ethanol Industry: A Comparison with Sugar-Ethanol Processing in Brazil." Agribusiness 22(1):109-134.

Gavett, E., G. Grinnell, and N. Smith. 1986. *Fuel Ethanol and Agriculture: An Economic Assessment*. Washington, DC: USDA, Office of Energy, Agricultural Economic Report No. 562.

Green, K. 2006. "Bring Down Gas and Oil Prices." *Environmental Policy Outlook* Washington DC: American Enterprise Institute.

Henke, J.M., G. Klepper, and N. Schmitz. 2005. "Tax Exemption for Biofuels in Germany: Is Bio-ethanol Really an Option for Climate Policy?" *Energy* 30:2617-2635.

Hill, J., E. Nelson, D. Tilman, S. Polasky, and D. Tiffany. 2006. "Environmental, Economic and Energetic Costs and Benefits of Biodiesel and Ethanol Biofuels." *Proceedings of the National Academy of Sciences* 103(30):11206-11210.

Huber, P. and M. Mills. 2005. *Bottomless Well: The Twilight of Fuel, the Virtue of Waste and Why We Will Never Run Out of Energy*. New York: Basic Books.

Instituto Nacional de Estadística, Geografía e Informática (INEGI). 2004. "Tablas de base de datos, Ingresos y Gastos." Available at: <http://www.inegi.gob.mx/inegi/default.aspx?s=est>. Accessed March 2008.

International Food and Agricultural Trade Policy Council. 2006. *WTO Disciplines and Biofuels: Opportunities and Constraints in the Creation of a Global Marketplace*. Washington, DC: IPC Discussion Paper, October.

Johnson, R. and G. Libecap. 2001. "Information Distortion and Competitive Remedies in Government Transfer Programs: The Case of Ethanol." *Economics of Governance* 2:101-134.

Kerr, W. and L. Loppacher. 2005. "Trading Biofuels: Will International Law Be a Constraint?" *Current Agriculture, Food and Resource Issues* 6:50-62.

Klein, K. and D. LeRoy. 2007 "The Biofuels Frenzy: What's in it for Canadian Agriculture?" Green Paper for Alberta Institute of Agrologists, 28 March.

Koplow, D. 2006. *Biofuels at What Cost? Government Support for Ethanol and Biodiesel in the United States*. Geneva: Global Subsidies Initiative, International Institute for Sustainable Development, October.

Laney, K. 2006. *Biofuels: Promises and Constraints*. Washington, DC: IPC Discussion Paper, International Food and Agricultural Trade Policy Council, December.

Lee, T., B. Ball, and R. Tabors. 1990. *Energy Aftermath*. Cambridge MA: Harvard Business School Press.

Lewis, M. 2005. "Corn is King." *Alternatives*. Washington, DC: Competitive Enterprise Institute, pp:36-38.

Lieberman, B. 2007. "The Ethanol Mandate Should Not Be Expanded." *Backgrounder*. Washington, DC: Heritage Foundation, No. 2020, 11 April.

Lomborg, B. 2002. *The Skeptical Environmentalist: Measuring the Real State of the World*. Cambridge: Cambridge University Press.

MacDonald, T. 2004. *Ethanol Fuel Incentives Applied in the US Reviewed from California's Perspective*. Sacramento, CA: California Energy Commission Staff Report, January.

Mexican Secretary of Energy (Secretaria de Energía). 2006. Potenciales y Viabilidad del Uso de Bioetanol y Biodiesel para el Transporte en México. Available at: <http://www.sener.gob.mx/webSener/res/169/Biocombustibles_en_Mexixo_Estudio_Completo.pdf>. Accessed April 2007.

Minnesota Department of Agriculture. 2007. *Ethanol Market Report*. St. Paul, MN: Agricultural Marketing Services Division, February.

Olar, M., R. Romain, N. Bergeron, and K. Klein. 2004. *Ethanol Industry in Canada*. Quebec, PQ: Centre for Research in the Economics of Agrifood, Laval University, SR.04.08.

Ontario Ministry of Energy. 2007. *Regular Unleaded Average of West and East Toronto, Mixed Full and Self Serve*. Toronto.

Organization for Economic Cooperation and Development (OECD). 2006. *Agricultural Market Impacts of Future Growth in the Production of Biofuels*. GR/CA/APM(2005)24/FINAL. Paris: Directorate for Food, Agriculture and Fisheries, Committee for Agriculture, Working Party on Agricultural Policies and Markets, 1 February.

Pimental, D. 2003. "Ethanol Fuels: Energy Balance, Economics and Environmental Impacts are Negative." *Natural Resources Research* 12(2):127-134.

Richman, S. 2006. "The Status and Potential of Ethanol Imports into the United States." *International Sugar Journal* 108(1287):148-151.

Runge, C.F. and B. Senauer. 2007. "How Biofuels Could Starve the Poor." *Foreign Affairs* 86(3):41-53.

Schmitz, T., A. Schmitz, and J. Seale. 2003. "Brazil's Ethanol Program: The Case of Hidden Sugar Subsidies." *International Sugar Journal* 105(1254):254-265.

Secretaria de Energia, "Precios de la Gasolina." Available at: <www.energia.gob.mx>.

Simon, J. 1996. *The Ultimate Resource* (Revised Edition). Princeton NJ: Princeton University Press.

Sopuck, R. 2002. *Ethanol: The Promise and the Peril, A Critical Analysis of the Case for Subsidizing Ethanol Production in Manitoba*. Winnipeg, MB: Frontier Centre for Public Policy, Policy Series No. 12, October.

Statistics Canada. 2005. *Average Retail Prices For Gasoline and Fuel Oil, by Urban Centre, Monthly*. CANSIM Table 326-0009, Ottawa.

Taylor, J. and P. Van Doren. 2007. "The Ethanol Boondoggle." *Milken Institute Review* 1:16-27.

Tokgoz, S., A. Elobeid, J. Fabiosa, D.J. Hayes, B.A. Babcock, T. Yu, F. Dong, C.E. Hart, and J.C. Beghin. 2007. "Emerging Biofuels: Outlook of Effects on US Grain, Oilseed, and Livestock Markets." Center for Agricultural and Rural Development (CARD), Iowa State University Staff Report 07-SR 101.

US Energy Information Administration. 2007. "Energy Prices." Available at: <http://www.eia.doe.gov/emeu/mer/prices.html>.

Walburger, A., D. LeRoy, K. Kaushik, and K. Klein. 2006. "Policies to Stimulate Ethanol Production in Canada: Lessons from Europe and the United States." Report prepared for BIOCAP Canada, University of Lethbridge, 24 November.

Wolf, C. 1979. "A Theory of Non-Market Failure: Framework for Implementation Analysis." *Journal of Law and Economics* 21(1):107-139.

Yacobucci, B. 2006. *Fuel Ethanol: Background and Public Policy Issues*. Washington, DC: Congressional Research Service, Library of Congress, CRS Report for Congress, 19 October.

Yandle, B. 1997. *Common Sense and Common Law for the Environment: Creating Wealth in Hummingbird Economies*. Lanham, MD: Rowman and Littlefield Publishers, Inc.

Zhang, Z., D. Vedenov, and M. Wetzstein. 2007. "Can the US Ethanol Industry Compete in the Alternative Fuels Market?" Paper presented at the Southern Agricultural Economics Association Meetings Mobile, Alabama.

Agrifood Supply Chains in the NAFTA Market

Jill E. Hobbs and William A. Kerr

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

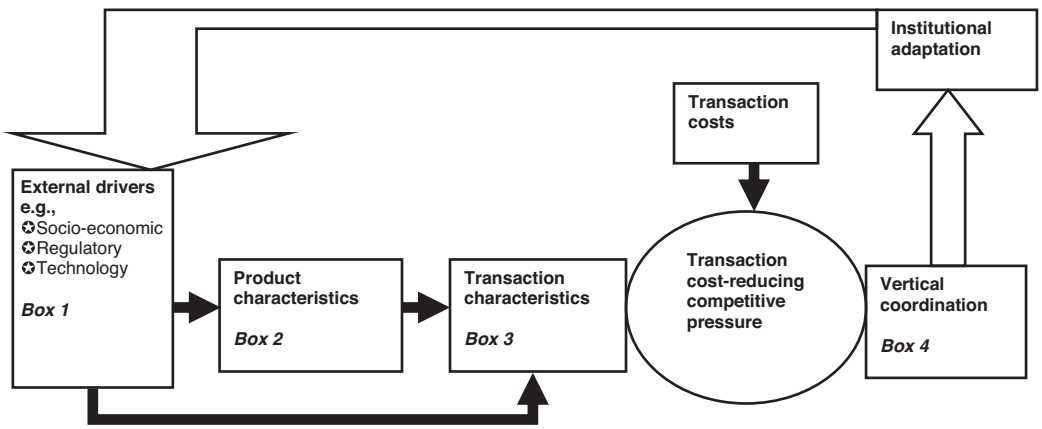
[2] In neoclassical economics the strong assumption of perfect information excludes the possibility of information asymmetry, economic actors can be perfectly rational (prescient) when making decisions, and any attempts at opportunism would be anticipated and thwarted. The assumption of perfect information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

REFERENCES

Barzel, Y. 1982. "Measurement Costs and the Organization of Markets." *Journal of Law and Economics* 25(1): 27-48.

Bessel, K.M., J.E. Hobbs, and W.A. Kerr. 2006. "Food Safety and Private International Law: Liability, Traceability and Transboundary Marketing." *Journal of International Food and Agribusiness Marketing* 18 (1 & 2): 29-48.

Boyd, S.L., J.E. Hobbs, and W.A. Kerr. 2003. "The Impact of Customs Procedures on Business to Consumer E-commerce in Food Products." *Supply Chain Management* 8 (3): 195-200.

Cheung, S.N.S. 1987. "Economic Organization and Transaction Costs." In J.M. Eatwell, M. Milgate and P. Newman, eds. *The New Palgrave: A Dictionary of Economics*, vol. 2. London: Macmillan Press, pp.55-57.

Clausing, K.A. 2001. "Trade Creation and Trade Diversion in the Canada-United States Free Trade Agreement." *Canadian Journal of Economics* 34:677-696.

Clement, N.C., G. del Castillo Vera, J. Gerber, W.A. Kerr, A.J. MacFadyen, S. Shedd, E. Zepeda, and D. Alarcon.1999. *North American Economic Integration - Theory and Practice*. Cheltenham: Edward Elgar.

Coase, R.H. 1937. "The Nature of the Firm." *Economica* n.s. 4:386-405.

Condon, B. and T. Sinha. 2001."An Analysis of an Alliance: NAFTA Trucking and the US Insurance Industry." *The Estey Centre Journal of International Law and Trade Policy* 2: 235-245.

Douma, S and H. Schreuder. 1992. *Economic Approaches to Organizations*. Hemel Hempstead: Prentice Hall.

Eggertsson, T. 1990. *Economic Behavior and Institutions*. Cambridge Surveys of Economic Literature. New York: Cambridge University Press.

Fulponi, L. 2006. "Private Voluntary Standards in the Food System: The Perspective of Major Food Retailers in OECD Countries." *Food Policy* 31: 1-13.

Gerber, J. and W.A. Kerr. 1995. "Trade as an Agency of Social Policy: NAFTA's Schizophrenic Role in Agriculture". In S.J. Randal and H.W. Konrad, eds. *NAFTA in Transition*. Calgary: University of Calgary Press, pp. 93-111.

Green, T., L. Hanson, L. Lee, H. Fanghanel, and S. Zahniser. 2006. "North American Approaches to Regulatory Coordination". In K. M. Huff, K. D. Meilke, R. D. Knutson, R. F. Ochoa, and J. Rude, eds. *Agrifood Regulatory and Policy Integration under Stress*. 2nd Annual North American Agrifood Market Integration Workshop. Texas A&M University, University of Guelph, and Inter-American Institute for Cooperation on Agriculture-Mexico, pp9-47.

Haralambides, H.E. and M.P. Londono-Kent. 2004. "Supply Chain Bottlenecks: Border Crossing Inefficiencies Between Mexico and the United States". *International Journal of Transport Economics* 31 (2): 171-183.

Hayes, D. and W.A. Kerr. 1997. "Progress Toward a Single Market: The New Institutional Economics of the NAFTA Livestock Sectors." In R.M.A. Loynes, R.D. Knutson, K. Meilke, and D. Sumner, eds. *Harmonization/Convergence/ Compatibility in Agriculture and Agrifood Policy: Canada, United States and Mexico*. Winnipeg: University of Manitoba, Texas A&M University, University of Guelph, University of California - Davis, pp. 1-21.

Heinze, C. 2006. "Cross Border Transport: Keeping Free Trade Safe and Sound." *Inbound Logistics*. Available at: <http://www.inboundlogistics.com/articles/ features/0506_feature04.shtml>. Accessed 9 May 2007.

Hobbs, J.E. 2003. *Incentives for the Adoption of Good Agricultural Practices (GAPS)*. Background document, FAO Consultation on Good Agricultural Practices, Rome: Food and Agricultural Organization. Available at: <http:// www.fao.org/prods/GAP/archive/Incentives_en.htm>.

Hobbs, J.E. and L.M. Young. 2000. "Closer Vertical Coordination in Agri-food Supply Chains: A Conceptual Framework and Some Preliminary Evidence." *Supply Chain Management* 5 (3 & 4): 131-142.

___. 2001. *Vertical Linkages in Agri-food Supply Chains in Canada and the United States*. Ottawa: Agriculture and Agri-Food Canada. Available at: <http:// www.agr.gc.ca/pol/index_e.php?s1=pub&s2=vertical>.

Huff, K.M., K.D. Meilke, C.G. Turvey, and J. Cranfield. 2004. "Modelling Bioterrorism in the Livestock Sectors of NAFTA Members." *Current Agriculture, Food and Resource Issues* 5.:1-22.

Jayasinghe, S. and R. Sarker. 2004. "Effects of Regional Trade Agreements on Trade in Agrifood Products: Evidence from Gravity Modeling Using Disaggregated Data." Working Paper 04-WP 374, Center for Agricultural and Rural Development, Iowa State University, Ames.

Kerr, W.A. 2004. "Homeland Security and the Rules of International Trade." *Estey Centre Journal of International Law and Trade Policy* 5: 1-10.

Kerr, W.A. 2006. "NAFTA's Underdeveloped Institutions: Did They Contribute to the BSE Crisis? In K.M. Huff, K.D Meilke, R.D. Knutson, R.F. Ochoa and J.Rude, eds. *Agrifood Regulatory and Policy Integration Under Stress*. 2nd Annual North American Agrifood Market Integration Workshop Texas A&M University, University of Guelph, and Inter-American Institute for Cooperation on Agriculture-Mexico, pp.213-226.

Klein, B, R.G. Crawford, and A.A Alchian. 1978. "Vertical Integration, Appropriable Rents and the Competitive Contracting Process." *Journal of Law and Economics* 21 (2): 297-326.

Loppacher, L.J. and W.A. Kerr. 2005. "The Efficacy of World Trade Organization Rules on Sanitary Barriers: Bovine Spongiform Encephalopathy in North America." *Journal of World Trade* 39 (3): 427-443.

Meilke, K.D., J. Rude, and S. Zahniser. 2007." The Search for 'NAFTA Plus'". In K.M. Huff, K.D. Meilke, R.D. Knutson, R.F. Ochoa, and J. Rude, eds. *Achieving NAFTA Plus*. 3rd Annual North American Agrifood Market Integration Workshop. Texas A&M University, University of Guelph, and Inter-American Institute for Cooperation on Agriculture-Mexico, pp.7-46.

Mighell, R.L. and L.A. Jones. 1963. *Vertical Coordination in Agriculture*. Washington D.C.: US Department of Agriculture, ERS, Agr. Econ. Rep.19, February.

Moodley, R.D., W.A. Kerr, and D.V. Gordon. 2000. "Has the Canada-US Trade Agreement Fostered Price Integration?" *Weltwirtschaftliches Archiv* 136 (2): 334-354.

Phillips, P.W.B., S.J. Smyth, and W.A. Kerr, eds. 2006. *Governing Risk in the 21st Century*. New York: Nova Science Publishers.

Purolator. "Trade Without Borders: New Paradigms for Business." *Purolator Trade Solutions*. Available at: <www.purolator.com/pts/project_eagle.pdf>. Accessed 9 May 2007.

Rudge, T.J. 2005. "Increasing Regulations for Natural Health Products: An Investigation of the Trade Effects." M.Sc. Thesis, Department of Agricultural Economics, University of Saskatchewan.

Sawyer, E.N. 2004. "The Economic Impacts of Harmonizing Organic Standards Internationally." M.Sc. Thesis, Department of Agricultural Economics, University of Saskatchewan.

Thompson, C.W. 1916. "Relation of Jobbers and Commission men to the Handing of Produce." In T.N. Carver, ed. *Selected Readings in Rural Economics*. Boston: Ginn and Company, pp. 769-782

Williamson, O.E. 1979. "Transaction Cost Economics: The Governance of Contractual Relations." *Journal of Law and Economics* 22: 232-262.

___. 1986. Economic Organization: Firms, Markets and Policy Control. Brighton: Harvester Wheatsheaf.

Yeung, M.T., J.E. Hobbs, and W.A. Kerr. 2007. "Accessing US and EU Markets for Nutraceuticals and Functional Foods: Legislative and Technical Barriers Facing Agribusiness Marketers." *Journal of International Food and Agribusiness Marketing* 19 (1): 53-79.

Zecchini, G. 2007. "The Persistent Border: Regulatory Incompatibility and Agri-Food Competitiveness." Discussant presentation at 4th North American Agrifood Market Integration Consortium Worshop: Contemporary Drivers of Integration, Cancun, Mexico. Available at: <http://naamic.tamu.edu/cancun2/zecchini_files/frame.htm>.

North American Retailers and Their Impact on Food Chains

Dalila Cervantes-Godoy, David Sparling, Belem Avendaño, and Linda Calvin[1]

INTRODUCTION

Food retail chains are becoming more global, extending both their distribution and supply networks around the world. Some changes are in response to consumer expectations of greater variety and year-round availability, but others are in response to advances made in extending, managing, and capturing the value associated with global food chains. This has allowed retailers to offer consumers more choices in products and greater availability of seasonal products, all at competitive prices. Since the creation of NAFTA, the food retail industry has changed in all three countries, but the changes have been most dramatic in Mexico, where retail chains on a national level are relatively new.

As retail chains become larger and more global, their changing requirements drive change throughout the food chain, right down to the producer level. Although food retailers exert considerable control and influence over food supply chains, they generally do not develop them. In most cases, food supply chains are created and evolve over time to meet the changing needs and expectations of food retailers. In some cases, their purchasing preferences and patterns simply influence directions and mandates for food chains; in others, retailers may dictate standards and conditions for suppliers.

In this chapter, we examine the factors driving change in the North American food retail industry and the impact on food supply chains, specifically the implications for shippers and producers. Most of the

[1] The views expressed in this chapter are those of the authors, and may not be attributed to the Economic Research Service or the US Department of Agriculture.

work looks at the produce industry. This chapter pulls together new and existing work on this topic including two new studies that look at small produce growers in Mexico facing new retail and food safety standards (Cervantes-Godoy; Avendaño and Narrod); older work on the US produce industry that examines the impact of retail consolidation on shippers, but not producers (Calvin et al.); and another new study that examines the efforts of small veal producers in Canada trying to target increasing retail demands for differentiated products (Snoek and Sparling).

The chapter begins by looking at trends in the food retail industry. Trends in Mexico are following the same pattern as in the United States and Canada. Retail demands in all three countries have affected the marketing options of shippers. If shippers do not or can not comply with retail demands, they have well-established alternative markets such as smaller stores and wholesale markets. These alternative venues are particularly important in Mexico where national and international retail chains are not yet as pervasive as in the United States and Canada. Then we look generally at the impact of changes at the retail and shipper level on producers.

The chapter next delves into several cases studies. The first looks at the changing retail situation in the fresh produce industry in Mexico, and the implications for producers, particularly small producers who make up such a significant proportion of the industry. Using a case study of four producer groups, the conditions necessary for small producers to participate in retail food chains are analyzed. Then the focus turns to another case study looking at food safety and small Mexican produce growers. Food safety for produce has been a growing concern for retailers. Now, several commodity groups in all three countries have introduced or are facing government-imposed mandatory food safety standards. The US and Canadian mandatory food safety programs are self-imposed and apply to all production within a certain region regardless of final buyer. In Mexico, mandatory standards affect only export markets so far. An analysis of how Mexican cantaloupe producers fared when food safety demands increased in export markets demonstrates the challenges, particularly for smaller growers. Some Mexican growers, mainly smaller growers, are being forced out of the lucrative export market and having to refocus their efforts on the Mexican domestic market. As retail demands for food safety in Mexico increase, small growers that can not adapt may be forced out of that market too. The final case examined in this chapter looks at the development of value chains for high quality veal in Canada and considers the impacts of

adding another level to the chain supplying the retailer. The chapter ends with brief summary comments.

TRENDS IN THE NORTH AMERICAN RETAIL INDUSTRY

Changes at the retail level have led to numerous changes in the food supply chain, right down to the growers. In the relatively mature retail food markets of Canada and the United States, competition is intense and growth is slow. Expansion-oriented firms have two options – take over competitors in current markets or enter new markets. Over the last decade, retail firms have been doing both, becoming larger, transnational organizations in the process (Barkema, Drabenstott, and Novack; Dobson, Waterson, and Davies; Tittleson). The change has been significant. By 2003, the top five retail companies in the world accounted for one-third of the modern global food market and had operations in 85 countries, compared to only 15 countries in 1993 (Reardon and Timmer).

The movement of large retailers into developing countries has also been facilitated by more liberal foreign direct investment (FDI) regulations (Reardon 2005). There is still considerable room for growth. While many retailers have gone global, none have had as much impact as Wal-Mart, the largest retailer, and now the largest "food" retailer in the world. In 1998, Wal-Mart had just 3.2 percent of the US market, but by 2005 it dominated the US market with 19 percent of grocery sales (Cotterill; Turock and Rogers). The company is making similar inroads in Canada and Mexico. In Mexico, Wal-Mart controlled roughly 20 percent of the total Mexican food retail sector in 2005 (Datamonitor).

Retail markets are quite concentrated in all three North American countries. In Mexico, supermarkets controlled 45 percent of the retail food market in 2002 (Traill). Merger and acquisition activity has increased the level of concentration, with the US market share of the five largest firms (CR5), doubling from 24 to 48 percent between 1997 and 2006. Table 6.1 highlights some of the differences in the food industries among North American countries. Retailers in Canada are more concentrated than those in the United States. In Canada, the top three controlled 61 percent of retail food sales in 1998 (Boylaud and Nicoletti). In 2002, that percentage had increased only 0.5 percent and the CR4 was 68.5 percent.

THE NORTH AMERICAN MARKETING CHAIN FOR PRODUCE FACES CHANGES

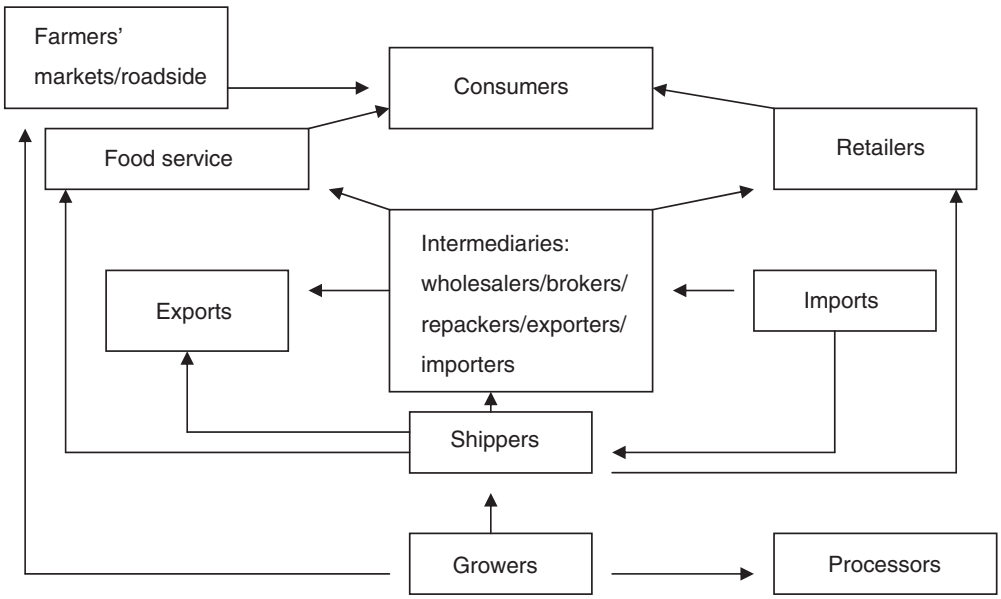
In general, growers can market their fruit and vegetables through shippers (including cooperatives) or sell directly to consumers at farmers' markets

Table 6.1: Key country statistics.

Country	Population (2005)	% Urban	% Involved in agriculture	Food Industry Revenue ($ US 2005)	% of retail share of market	Trends in retail	Number of farmers	Key trends
Canada	32.8 M	81.1%	2.2% GDP 2% employment	$ 62 B	Supermarkets - 47.6% Hypermarkets - 23.7% Discounters - 12.2%	High value Organic Online	246,923 More than 50% sell less than $C 100,000	Consolidation, expansion into other products, entry of Wal-Mart into food retail
Mexico	106.2M	76%	3.4% GDP 15.1% employment	$45.2B	Supermarkets - 43.5% Food Specialists - 18.7% Hypermarkets - 10.8%	New Formats Product Innovation	4,437,863 6% commercial, 18% transition 76% subsistence	Urbanization and income growth support supermarket expansion
US	295.7M	80.8%	1% GDP 0.7% employment	$678.2B	Supermarkets - 55.8% Convenience Stores - 14.5% Warehouse Clubs and Super Centers - 9.1%	High value Organic	2,121,107 1,231,378 sell less than $10,000 per year	Consolidation of traditional formats, rapid growth of natural/organic formats, online developing

Sources: Kaiser Family Foundation; Central Intelligence Agency; World Services Group; Statistics Canada; Institute of Agri-food Policy Innovation; Federation of International Trade Associations; Hoppe and Banker.

Figure 6.1: North American fresh produce market chain.



Source: Golan et al.

and roadside stands (figure 6.1). Shippers market produce from growers or others such as importers. Grower-shippers, vertically integrated growers who also pack and market their products, are common. Some grower-shippers market only their own products. But other grower-shippers pack and market for other growers as well. Shippers may sell directly to retailers and the foodservice industry (restaurants, hospitals, military institutions, schools, etc.) or to a range of market intermediaries who in turn sell to retailers and the foodservice industry. So while small farmers are unlikely to sell directly to a large retail chains, they could market to retailers through shippers. Of course, a small local farmer could be a grower-shipper selling to a nearby retailer. In some cases, marketing cooperatives act as shippers.

Changes in retail, not all due to retail consolidation, affect the entire food marketing chain including shippers and growers. We first discuss the changes in retail and how that affects produce shippers. While much of this section is based on analysis of the US produce industry, the trends apply to both Canada and Mexico, as well (Calvin et al.). Many of these changes are thought to favor larger shippers. Choices may be more limited for smaller shippers without the volume to serve big retail chains but there are still many marketing options including wholesale markets, regional chains, and local stores. Then, we turn to ideas of how these changes might affect growers.

Changing Consumer Demand

Many changes in retail needs are driven by changes in consumer demand. Consumers now demand more produce items. The typical grocery store carried 345 produce items in 1998, compared with 173 in 1987. Retailers are more likely, all other things being equal, to use a supplier that can provide a wide range of products rather than just one or two. As a result, many shippers offer wider lines; for example firms that sell a wide range of vegetables; specialized firms that sell the complete range of berry products; and firms that sell the complete range of tree fruit.

Consumers now also demand many produce items on a year-round basis. Improvements in transportation and technologies to improve the life of fresh produce have brought prices down to levels that consumers will accept. Cherries from Chile during the December holidays are just one example of this phenomenon. Retailers may prefer to buy from shippers that have put together a year-round supply through investment in production in different regions (including foreign countries) or through marketing arrangements with suppliers in other regions. Larger shippers are more likely to be able to handle the logistics and risks of such an operation. Some retailers may prefer to play this role themselves,

particularly if they are multinational firms sourcing for their own stores all over the world.

Consumers are also demanding more convenience in their produce and the fresh-cut industry (e.g., bagged salads, bagged baby carrots) is booming. The bagged lettuce industry has very high capital costs which act as a barrier to entry. In 1999, the two largest US bagged salad firms accounted for 76 percent of retail sales. By 2006, their share increased to about 90 percent (Calvin 2007). Fresh-cut products are more akin to regular grocery items than traditional commodities with consumer brand names, supply contracts, and fixed prices over the year – features requiring more sophisticated management.

Consumers are buying many new differentiated products. A banana is not just a banana anymore. It may be a fair trade banana or an organic banana. With more characteristics, vertical integration or coordination to maintain the integrity of the product through the supply chain may become more important. With the market for organic products growing at roughly 20 percent per year, retail organizations cannot ignore organics. Many retailers have embraced organic products wholeheartedly as a means to shift their focus to high-value products and away from direct price competition with Wal-Mart.

Movements promoting local food consumption have developed from concerns over the environmental impacts of shipping food around the world. The local food movement places different consumer pressure on food chains and in some cases has changed both the buying and shipping patterns of food retail organizations. Interest has grown recently with increasing awareness of global warming and concern over the long-term viability of local farmers. Guptill and Wilkins also found that many retailers make an effort to promote local products (e.g., dairy, seasonal fruits, and vegetables). Some governments have taken more interest, implementing preferred purchase programs for local foods and promoting regional food consumption. For example, the government of Ontario recently implemented several programs to encourage consumption of local foods including government purchase programs and support for urban agriculture. Books like the "100-Mile Diet" are encouraging consumers to "buy local" for environmental reasons and to support local producers (MacKinnon and Smith).

Retail Growth and Product Volume

Competitive pressure for retailers to continually lower prices has had an impact on how retailers and shippers interact. New retail requirements are the same for all shippers but the ability to meet the requirements

varies; many large shippers may be able to adjust on their own but some smaller shippers may be at a considerable disadvantage.

With many stores to supply, retailers have also developed their own distribution centers, taking over many of the wholesaling activities previously done by others, such as purchasing goods from suppliers, arranging for shipment to distribution warehouses, and replenishing store-level inventory. Supply-chain management practices such as continuous inventory replenishment are becoming more common. Under this system, shippers have access to retail sales data and are responsible for providing the correct amount of produce, on a just-in-time basis, to each distribution center served, potentially reducing the size and cost of retail distribution centers. It also allows retailers to streamline and downsize their produce buying offices. Shippers typically must control substantial volume to meet the needs of distribution centers and to undertake the management such an operation demands.

Large retailers are increasingly using contracts to guarantee steady supply and to specify product characteristics to maintain consistency across their many stores. Use of contracts can also have structural impacts, as shippers often need to increase their procurement to ensure sufficient supply to guarantee volume commitments.

As product volumes increase, large retailers are relying more and more on larger shippers that can supply their needs and reduce total procurement transaction costs. In 1999, a survey of US retailers found that they used just four shippers or suppliers to provide between 85 and 97 percent of total supplies for a number of produce items (Calvin et al). Shippers are also consolidating to meet the purchase requirements. For example, in 1999, there were 25 fresh-market tomato shippers (excluding greenhouse tomato shippers) in California, but by 2007 there were only 15.

Supply Chain Processes and Technologies

Retailers are interested in working with shippers to improve category profitability by designing effective sales, product mix, and pricing strategies, potentially benefiting preferred suppliers as well as the retailer. Investing in the human resources and technology necessary to analyze category information, however, may be difficult for smaller shippers to finance. The California Tomato Commission, a grower-shipper mandated marketing program, developed category management programs with several retailers, enabling shippers of all sizes to share in the benefits.

Technological improvements which generate greater efficiency and/or higher quality provide a competitive advantage for adopters. Consequently,

retailers often force new technologies on their suppliers. The most recent example has been with radio frequency identification tags (RFID). Wal-Mart, for example, mandated that its suppliers move to RFID at the case level, although this may not affect most produce suppliers at this point. Systems will be phased in over several years, beginning with the largest suppliers. RFID also improves traceability, an important management tool and critical component of food safety.

Pressure for technological change isn't only coming from retail chains, consumers are also looking for technologies that make their shopping experience easier and quicker. A recent poll by TNS Canadian Facts found that 75 percent of shoppers were interested in trying RFID checkout at the supermarket, primarily to save time at checkout (Backbone).

The Growth of Private Labels

Use of private labels adds a new dimension to retailer efforts to differentiate themselves from their competitors. The expansion of retailer private label products has changed supermarket involvement in product development and delivery. Private label sales in Canada accounted for 20 percent of consumer products, compared with 15 percent in the United States and only one percent in Mexico (AC Nielson). There is still considerable room for private label growth in North America. Globally, private labels accounted for 28 percent of refrigerated and frozen food sales, and 17 percent of shelf food sales, with growth rates of four to six percent for those segments (ACNielson).

When supermarkets put their names on products, their level of concern and participation in the process to determine the quality of those products naturally increases. Larger shippers may be able to respond more easily to providing a wide range of products. Alternatively, for small retailers, a small shipper may be able to fill a particular product line. These products might offer a distribution alternative for small producers without the marketing capabilities to support national or regional brands. They can use the retailer's brand power to market their products, but to do so they must meet strict quality, pricing, and development criteria.

Changing Food Safety Requirements

Large retailers, as well as large foodservice firms, are more and more concerned with food safety. With well known brand names to protect, they are not willing to take risks. Many large retailers demand third-party audits for compliance with Good Agricultural Practices (GAPs), the US Food and Drug Administration's (FDA) voluntary guidelines for food safety practices in the field to minimize the risk of microbial contamination for

fresh produce. Many retailers and foodservice buyers require additional food safety and quality practices above the GAP guidelines.

Buyers are most likely to require GAPS for a group of produce items that have been associated with previous foodborne illness outbreaks, including leafy greens, tomatoes, cantaloupe, green onions, and herbs. This is a relatively new phenomenon beginning in the late 1990s after several well publicized foodborne illness outbreaks in the United States associated with fresh produce. There are no statistics on adoption of these food safety programs, but the conventional wisdom is that most of the larger firms use them, but not all smaller producers do. Buyers may also require Hazard Analysis Critical Control Point (HACCP) systems and other food safety systems for produce packing houses.

IMPACT OF CHANGE AT THE RETAIL AND SHIPPER LEVEL ON GROWERS

The impact of change at the retail and shipper level on growers is not well understood. Shippers aggregate supplies; this insulates growers, to some degree, from demand for larger volumes. Clearly, growers will have to adjust to new demands for quality and food safety. Some growers may not be able to comply with new standards and will drop out of the market.

What are the shippers' incentives with respect to growers? A shipper could be a vertically-integrated grower-shipper and only ship his or her own production. This would give ultimate control over production which is a particular benefit for traceability and food safety. This arrangement would also minimize transaction costs, including traceability costs which are a critical issue for food safety. Not using other farmers also eliminates a particular type of business risk. Shippers often provide production credit to their growers. Small producers, without many alternative sources of credit, can pose a risk and a shipper may not want to be too exposed. This credit issue is of particular concern in Mexico. However, many large shippers are unlikely to be able to control enough production to make selling just their own product feasible. A grower-shipper could also market for other producers in addition to his or her own production. There are other factors that would lead a shipper to want to diversify production with a number of growers. When putting together a portfolio of producers, a shipper would consider several factors that would favor using a number of growers. Shippers need a number of growers to: 1) reduce production risk; 2) extend the season (particularly important for a perishable product with limited storage options); 3) provide a full range of products, varieties, and qualities; and 4) reduce business risk. In many produce industries there is keen competition for good growers, regardless of farm size. Land for horticultural production is often in small parcels so small producers may be essential for a shipper. Some commodities are

dominated by very small producers (e.g., snow peas, some berries, some organic products, etc.).

A study of US imports of Mexican winter vegetables through Nogales, Arizona from Sinaloa provides detail about produce shippers (Calvin and Barrios). Originally, most imports from Mexico were sold by US importers – shippers with no production of their own. Over the years, as this industry matured, vertically integrated or coordinated Mexican grower-shippers took over much of the importing business with offices on the US side of the border. In 1996, Mexican grower-shippers accounted for a large percentage of the total volume of imports of tomatoes (63 percent), peppers (71 percent), eggplant (78 percent), and snap beans (60 percent). Turning to statistics on all shippers importing winter vegetables from Mexico, at least 76 percent of a shipper's volume for each commodity came from their largest grower. The average number of growers per shipper per commodity ranged from 3 to 4. Squash imports were quite different. On average, only 18 percent of sales of squash came from one grower and the largest grower only accounted for 59 percent of sales. The average squash shipper sells for 11 growers. Squash is an easy crop to grow, matures rapidly, and can be planted before other crops – many farmers grow squash. Shippers could be grower-shippers only selling their own production for one product and possibly only a shipper for another product.

What are the growers' options? They always have a choice between just production, and production and marketing. The two strategies require different skills, resources, and inclinations. A grower could start with one strategy and later transition to another. Growers could operate as grower-shippers and sell directly to retail or foodservice buyers. With the growth of interest in local produce, some retailers buy directly from small local growers (a very small grower-shipper) but this is usually just a small part of a retailer's sales during the summer months. But these sales can be a critical marketing outlet for small growers. The enthusiastic demand for local produce compensates retailers for the extra costs of dealing with small purchases. Retailers are also interested in unique items that could be exclusive to their stores. In this situation, small producers might receive more marketing help than if they sold a product that could easily be purchased from a large national shipper. However, more and more, retailers require the same food safety standards from small local producers that they require for big commercial suppliers. It is too risky to make exceptions.

Growers can market through local shippers. That might not be as lucrative as being a grower-shipper, but it is also a less complicated business. A farmer might want to concentrate just on growing and leave the marketing to someone else. Another possibility for growers is to band together with

other growers to market jointly as part of a cooperative. Many famous American produce brands are cooperatives – Ocean Spray Cranberries, Inc. and Sunkist Growers, Inc.

New standards can change the competitive position of farmers. After the 2006 foodborne illness outbreak in the United States and Canada associated with bagged spinach, the California leafy green industry developed a new State marketing agreement (Calvin 2007). This marketing agreement requires all participants selling California leafy greens to sell only product grown with new food safety standards. In 2007, the first year of operation, shippers representing about 99 percent of California leafy green production have volunteered to participate in the program. Several components of the new program will raise costs. More frequent water testing will raise costs for growers, but it is not yet clear whether this will affect any particular size grower more than another. Farmers with the fewest number of wells per acre will be in the best position. Distribution of field sizes and location will also be important. Growers must maintain buffer zones around their fields when they are adjacent to livestock or wildlife. The particular buffer size depends on many site-specific factors. All things equal, this would have a more detrimental impact on those with small fields. For example, a grower with a five-acre, square field (467 feet by 467 feet) and a 100-foot buffer would only be able to use 62 percent of the field for leafy green production. A grower with a ten-acre, square field (934 feet by 934 feet) would be able to use 80 percent of the field for production.

RETAIL CHAINS IN MEXICO

In Mexico changing demographics and incomes have facilitated the rapid expansion of supermarkets. Urbanization has increased in Mexico with two important consequences for the food system. Consumers in urban areas have higher average incomes than their counterparts in rural areas and less time to shop and prepare meals. Consequently, they have a strong preference for a one-stop shopping alternative. A Pacific Economic Cooperation Council (PECC) study in 2005 concluded that as per capita income approaches $10,000, supermarket penetration reaches about 50 percent of the food retail market, and at income levels above $20,000, this share tends to level off at 70 to 90 percent.

The expansion of supermarkets in Mexico has imposed requirements that are often at odds with the capabilities and structure of much of Mexico's agriculture. While the food retail picture is becoming more similar across NAFTA, the population of farmers and the distribution of wealth among farming families varies dramatically. Although Canada and the United

States have large populations of small farms, most are not subsistence farms; the owners often have off-farm jobs.

In Mexico the situation is different. More than three quarters (76 percent) of Mexican farms would be considered subsistence farms; another 18 percent are transition farms, producing some surplus food which can be sold. Only six percent are commercial farms. For most small farms off-farm income is important. Among ejidatario households, off-farm income contributes more than one-half of family income (de Janvry and Sadoulet). Major changes to food chains may dramatically affect Mexico's more than three million farmers, particularly those already involved in retail food chains. For this reason, the impact of retail changes on Mexican producers as members of retail supply chains is a major focus of this chapter.

In general, supermarkets have different and more stringent transaction requirements than traditional markets. Shippers and growers must be able to meet these standards if they want to sell to retail markets. Those who are not prepared to market to these retail chains may become increasingly more marginalized (IFPRI). The alternatives for these farmers are the traditional street markets and public markets which do not impose any special requirements but pay lower prices. These traditional markets pass on lower prices to consumers because of lower fixed costs and the fact that some are officially tax exempt. As long as traditional markets continue to exist, most small-scale farmers will keep selling to them.

There have been recent initiatives to connect small farmers to supermarkets, including the federal government, through its "Comercio Directo" (direct trade) program from Apoyos y Servicios a la Producción Agropecuaria (ASERCA), or the joint initiative undertaken by the National Peasants' Confederation (CNC) and the National Association of Supermarkets and Departmental Stores (ANTAD), and with Wal-Mart. The idea of these agreements was to show supermarkets' interest or willingness in buying directly from farmers, however given the stringent marketing requirements, such agreements have not produced notable results; small-scale farmers still have trouble selling to these markets.
Supermarkets around the world are moving to larger distribution centres to achieve economies of scale, more efficient inventory management, reduced intermediation costs, and to assure product consistency and supply. Figure 6.2 illustrates the flow of fruits and vegetables to supermarkets in Mexico based on interviews with six major retail chains in 2006 (Cervantes-Godoy). About 80 percent of fruits and vegetables going to supermarkets in Mexico moves through distribution centers, sourced from CEDAs (Central de Abasto),[2] imports, and large farmer/

[2] CEDAs or wholesale markets are trusts created with federal, state, and municipal resources in the 1970s or early 1980s to provide efficient distribution of fresh produce to

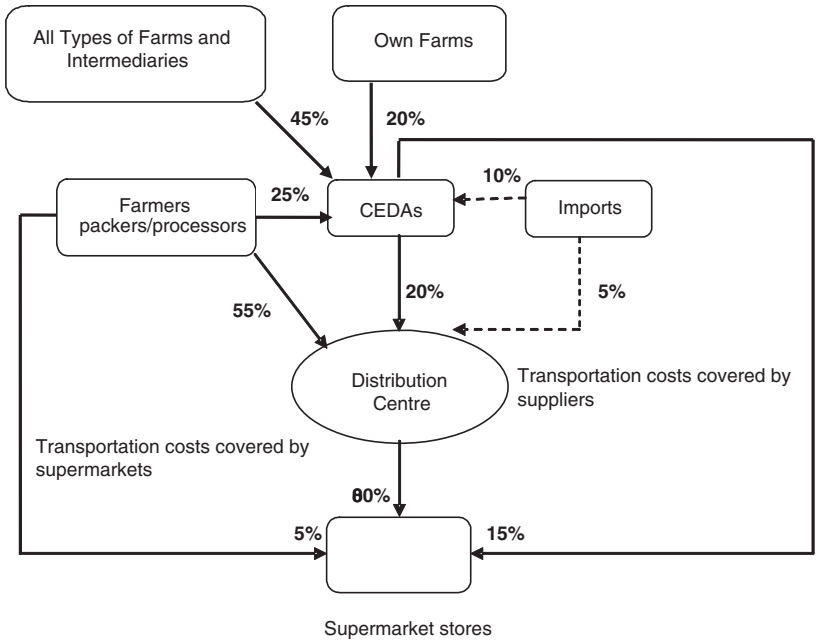
packers. Roughly 15 percent comes directly from CEDAs and five percent is shipped directly from grower/packers (Cervantes-Godoy).

According to Schwentesius and Gomez (2002), supermarkets have moved through three phases of supply networks. They bought directly from growers and/or intermediaries during the 1960s and 1970s but since few growers were able to meet the supermarkets' requirements for quality, quantity, consistency, or continuity they moved to buying from wholesale centers known as CEDAs during the 1980s. Although CEDAs offer higher prices than middlemen, they are not a real alternative for small-scale farmers due to transportation costs to the CEDA and the demands among some wholesalers for selection and packaging beyond the capabilities of small farmers.

The third phase started in the 1990s when supermarkets diversified procurement, shifting back towards procurement in production regions and creating their own distribution centers, moving gradually away from CEDAs. Avoiding wholesalers can reduce costs between ten and 20 percent (Schwentesius and Gomez). However, CEDAs still supply from

Mexican consumers. The 60 wholesale markets in Mexico are located in major cities and are operated by private companies.

Figure 6.2: Flow of fruits and vegetables to Mexican retailers.



Source: Cervantes-Godoy.

50 percent of the produce required by large supermarkets to 95 percent of the fruits and vegetables needed by smaller chains.

In Mexico, leading chains like Wal-Mart, Soriana, Gigante, and Comercial Mexicana, have distribution centers strategically located in large cities such as Mexico City, Guadalajara, and Monterrey, among others. Some small chains, such as Chedraui, rent warehouses in CEDAs rather than creating their own distribution centers. As supermarket chains grow, producers will face demand for very large volumes from national procurement systems managed directly by the chains (Reardon 2004). Approximately 80 percent of produce bought by retailers passes through their own distribution centers. Supermarkets procure about 60 percent of their fruits and vegetables through individual large and medium farmers; 35 percent through CEDAs, and five percent through imports.

Not all product passes through distribution centers. About 15 percent comes directly from CEDAs, usually when there is no product available in the distribution center, or when the distribution center does not have the appropriate infrastructure to store the product. Lastly, five percent comes directly from farmers located in the same region as the stores they supply.

Ninety-five percent of product comes from large farms and only five percent is supplied by small-scale farmers. Small-scale farmers that are able to sell directly to supermarkets almost always belong to an association. Of the 35 percent supplied by CEDAs to supermarkets, 45 percent comes directly from farmers of all scales, but mostly small-scale via middlemen. About 25 percent comes from local and regional packers, and 20 percent from farms (owned or rented) by wholesalers operating in CEDAs (Cervantes-Godoy). Lastly, the remaining ten percent comes from imports.

In Mexico, the CEDAs, located in different strategic points across the country, have functioned as the default suppliers of supermarkets for more than two decades. Thus the short-term impact of supermarkets on small-scale farmers may be less observable, since intermediaries will gather, select, pack, and distribute the product according to the needs of their clients. Longer-term, the intermediaries will impose higher standards on their supplies to increase their ability to meet retail standards. Farmers unable to meet the standards will be forced to sell into shrinking traditional markets.

In Mexico, supermarkets have become major suppliers of produce, increasing their retail market share in fresh fruit and vegetables from 21 percent in 2002 to about 28 percent in 2004 (Schwentesius and Gomez;

Acosta). In 2005, supermarkets and self-service stores accounted for 25 percent of fruit and vegetable sales, the traditional markets accounted for 38 percent, and other small venues accounted for another 37 percent. Analysis of supermarket fruit sales shows interesting variation in consumer behaviour. In 2005, 44 percent of consumers with at least $3,000 in income bought fruit in supermarkets and only 26 percent of those with lower incomes did. The Mexican retail market share is expected to rise with future income growth (PECC). Supermarket sales also vary by city, ranging from 50 percent in Guadalajara to 45 percent in Mexico City, with an average of 26 percent in other cities (ANTAD).

The next sections of this chapter report on two studies looking at small Mexican produce growers. Cervantes-Godoy interviewed retailers in Mexico to identify suppliers who were small growers. She found only 12 examples of small-scale farmers who were able to directly supply supermarkets, and they accomplished this only through associations. These appear to be exceptional cases and not a generalized phenomenon. Undoubtedly, more small growers were supplying retailers via larger shippers or wholesale market operations. Avendaño took a different approach and interviewed small cantaloupe growers in a particular region and then identified their marketing strategies.

SMALL FARMERS AND STRINGENT RETAIL DEMANDS

The opportunities for farmers to sell directly to supermarkets depend on their ability to comply with marketing requirements (IFPRI). The principal marketing requirements imposed by supermarkets on their horticultural suppliers were identified as: 1) volume and consistency; 2) quality; 3) price; 4) registration process; 5) discounts; 6) internet services; 7) packing requirements; 8) transportation; 9) invoicing; and 10) payment system.

Four associations were selected for further analysis, two producing cactus pear and two producing mango. The analysis examines the characteristics of the associations and the farmers belonging to them. Table 6.2 summarizes the characteristics for all four associations.

Association "Cactus One" was created in 2001 and went into operation in 2002 in the State of Zacatecas. A farmer with entrepreneurial vision invited friends and relatives to organize themselves. They then invited other farmers with good reputations from the community to participate in a new association created to sell directly to differentiated markets in order to get better prices. Cactus One included 35 members, 25 cactus pear farmers and ten women who assembled boxes to pack the cactus pears. The project received state and federal government support at every stage from the feasibility study, to organizational training, construction

Table 6.2: Main characteristics of the organizations selected.

Variable	Cactus one	Cactus two	Mango one	Mango two
Product	Cactus Pear	Cactus Pear	Mango	Mango
Number of farmers	35	82	414	51
Number of active farmers	25	76	60	30
Clients	Supermarkets, CEDAs, processors/packers and export	Supermarkets, CEDAs, and export	Supermarkets and processors/packers	Supermarkets and CEDAs
State	Zacatecas	Zacatecas	Nayarit	Guerrero
Number of years selling to supermarkets	3	2	3	4
Percentage sold to supermarkets in 2004	53%	11%	41%	40%
Number of farmers interviewed	20	47	40	21
Average characteristics of farmers interviewed				
Age	47	57	54	52
Years schooling	7	4	5	8
Yield relative to state average	143%	70%	90%	114%
Hectares per farmer	11	9	8.5	10.7
Percentage that had gone to work in US at least once	80%	77%	50%	34%

Source: Cervantes-Godoy.

of packing facilities, credit, and marketing. The association built packing facilities in 2002.

Interviews were obtained from 20 of the 25 farmers in Cactus One. Most were male except for two women left in charge of their farms when their husbands emigrated to the United States. Cactus pear sales contributed an average of 43 percent of family income but off-farm income was critical; remittances from the United States contributed 23 percent, businesses such as butcher shops, tortilla shops, and convenience stores another 15 percent, and salaries from off-farm jobs 15 percent, and four percent from other sources.

Cactus One's main clients were national supermarket chains and CEDAs receiving 53 and 20 percent of sales in 2004, and 33 and 30 percent of sales in 2005, respectively. Remaining sales went to the US export market, processors, packers, and other intermediaries.

Association "Cactus Two", also in Zacatecas, was established in 1983, although in 2001 new members were added and the name and corporate

body changed in part to obtain access to government programs such as access to credit, training, and technical support. The association had two packing facilities, one built in the 1980s and another in 2005. Cactus Two consisted of four groups representing 82 members. One group of six women assembled wooden packing boxes. Of the 76 cactus pear farmers, 47 were surveyed. Eighty-seven percent of these farmers were male and 13 percent female. The distribution of family income was 36 percent from cactus pear sales and 32 percent from remittances from the United States.

Cactus Two sold primarily to CEDAs (81 and 67 percent of sales in 2004 and 2005, respectively) although they have focused on increasing supermarket sales recently (sales increased from 11 to 33 percent from 2004 to 2005). Cactus Two has also tried to export part of its production, but with no success since they were unable to find a broker they could trust (exports fell from eight percent of sales to nothing from 2004 to 2005). Stories abound of brokers who take the product and never pay the growers.

Members of "Mango One" lived in seven communities in the state of Nayarit in the lower northwest coast of Mexico. The association was created in 2001, integrating 18 groups in ten communities for a total of 600 farmers. After two seasons, 200 farmers were removed. The association now includes nine groups in seven communities with 414 farmers and 1,033 hectares of mango. However, of the 414 farmers, only 60 (15 percent) are active members selling their fruit partially or totally through Mango One. The rest sell their fruit individually to different markets. Mango One has three packing facilities located in the communities with more active members.

Mango One was created by a group of farmers with political aspirations, supported by municipal and state governments. The objectives were twofold; to sell directly to differentiated markets, and for the farmers with political aspirations to be recognized in the region. The latter objective may explain the size of the association. But as a result, most farmers were never convinced of the efficacy of the association – hence the lack of commitment to the organization.

Forty of the 60 active members were surveyed, all male. Mango sales contributed 60 percent of family income, other crops 13 percent, livestock nine percent, and the remaining 18 percent came from other sources.

For the first two years, the main client of Mango One was a national supermarket chain (100 percent of sales went to supermarkets in

2002 and 2003). Then, in 2004, its client portfolio expanded when the association started to sell to two packing facilities located in the states of Sinaloa and Jalisco and sales to supermarkets fell to 41 percent with the remainder going to the packers. In 2005, the association could not operate due to a debt problem. In the previous year, the association loaned money to members for maintenance of the plantations. Unfortunately, one-third of the credit was not repaid. Mango One has taken legal actions against those farmers; however, the association was still not able to get credit to operate in 2005.

Association "Mango Two" was created in 1992 by farmers to sell their mango directly to different markets. Since then, it has changed its corporate structure to sell to supermarkets and its packing facilities have been rebuilt and improved. The association had 51 members, of which only 30 were active. Twenty-one were surveyed, all male. Mango production contributed 61 percent of household income, own business (such as butcher shops, convenience stores, taxis, or others) 24 percent, and 15 percent from other sources. The association's main clients during the 2002 to 2004 period were supermarket chains, receiving 80 percent of Mango Two's sales in 2002 and 2003 and 40 percent of sales in 2004.

For more than five years the association rented a spot in the Mexico City CEDA. After pre-selection at the packing facilities, the product was shipped to the Mexico City CEDA where the post-harvesting process was finished and mangos were then sent to supermarket distribution centers. Mangos were also sold to other clients at the CEDA. In 2005, the association was not able to sell to supermarkets when a drought diminished the quality of the mangos and the supermarket chain did not purchase product from the association. The association ceased operations in 2005 and its members sold their products individually, although some are still trying to market in groups.

Services Provided by Associations to Their Members

The use of associations has worked as a catalyst for small-scale farmers to participate in supermarket procurement systems in Mexico. All of the associations were involved in: 1) post-harvest activities, such as cleaning, washing, sorting, and packaging; 2) administrative and financial activities of the marketing process, such as searching for new markets, contracting transportation as well as pallet and container pooling companies, using the internet for financial matters, among

Table 6.3: Small farmer strategies for meeting supermarket requirements.

Supermarket requirements	Farmer's function	Mechanism of solution
Volume and consistency	Sufficient production	Supply consolidation through farmers' associations.
Quality	New and better technologies and techniques of production.	Access to technical assistance and credit is easier through farmer associations. Technical and credit services are generally not accessible to individual small farmers but farmers are able to get these services through governmental programs designed exclusively for organized farmers.
Packing and transport requirements	Packing facilities and credit for working capital.	Access to credit for the construction of packing facilities and for working capital has been achieved through associations.
Administrative and financing aspects	Human resources, registration as commercial taxpayers, bank account.	Access to training in administration, and financing areas was obtained through governmental programs.
Use of Internet and EDI for ordering	Human resources, equipment	Equipment was obtained through credit. Hiring of trained individuals (general managers) has occurred in the many associations.
Payment system and discounts	Cope with delays in payments. Supermarkets' payment system takes between 21 and 31 days.	Associations may overcome delays in time-to-payment with the use of factoring (credit).
Trust environment in the process of commercialization	Ensure sales of product to the association and from there to supermarkets. Learning the logistics.	High level of commitment between farmers and their associations. Trust between supermarkets and the association, frequency of transactions.

Source: Cervantes-Godoy.

others; and 3) securing credit and technical assistance. Table 6.3 summarizes association activities.

Associations were more involved in marketing than in production. However, the associations were always alert about any support (governmental or not) that could be accessed, whether it was technical assistance, training, credit, etc. Only Mango Two used accounts receivable billing whereby supermarkets' payments occurred 72 hours after product delivery. All associations met frequently with their members (every weekend during harvest season, and every three to four weekends out of harvest season), to discuss aspects related to the market such as clients, prices, quality requirements, administration and organization problems, credit issues, action plan for the season, among others. The level of attendance was

commonly high, up to 100 percent in harvesting season in most of the associations, except Mango One.

Prices, Costs, Credit, and Profits

Production costs for association members were 29 and 16 percent higher for cactus pear and mango producers, respectively, relative to non-participants. Transactions costs related to marketing the product, such as packing and transportation, were also higher for participants both in terms of dealing with supermarkets versus traditional markets and compared to nonparticipants' costs.

Since most producers were not in a position to absorb the higher production and processing costs associated with selling to supermarkets, credit or subsidized credit was essential. Certain types of government loans were designed exclusively for organized farmers, providing capital for packing facilities, working capital for each production season, and a plantation maintenance credit. Credit was only available to individual farmers who could meet the collateral requirements, usually not by small-scale farmers. Associations allow small producers to access credit collectively. Ninety-five and 40 percent of Cactus One and Cactus Two members, respectively, had access to credit relative to zero percent of non-participants, while 73 and 100 percent of Mango One and Mango Two producers, respectively, had access to credit relative to 32 percent of nonparticipants.

To justify the significantly higher production and transaction costs for products destined for supermarkets, prices had to be higher. In the chains examined, supermarkets paid nearly three times the price of traditional markets for cactus pear and mango. The higher prices received from supermarkets more than compensated for the higher production costs, resulting in higher profits – cactus pear and mango profits were nearly three times as large when selling to supermarkets versus traditional markets.

These profit estimates will be slight overestimates because the producers incur their production costs over their entire crop and some may not be suitable for supermarkets and must be sold into traditional markets. However, profits of more than double those of traditional markets provide a powerful incentive for producers to cooperate to access supermarket supply chains. Farmers also cited one other important reason for selling into supermarkets – certainty of payment. While supermarkets may pay

more slowly, they pay more and the certainty of receiving payment is much higher than with traditional markets.

SMALL FARMERS AND FOOD SAFETY

Food safety has also been a powerful agent of change in food supply chains. The changes are not always driven by supermarkets; grower organizations and governments may step in to regulate industries in an attempt to maintain the viability of the industry, particularly in the case of export-oriented industries. The experience of cantaloupe growers in Colima demonstrates how small growers have fared in an environment of increased demand for food safety (Avendaño and Narrod).

Cantaloupe Food Safety

Cantaloupe in Mexico is grown in 13 different states, both for the domestic and export markets. Production in different regions of the country provides a year-round supply. There are many small producers and the industry is not well organized because of it is geographic dispersion.

From 2000-2002, there were annual foodborne illness outbreaks in the United States associated with Mexican cantaloupe contaminated with Salmonella (Calvin 2003). The food safety problems with cantaloupe have had a profound impact on the industry. In 1999, US cantaloupe imports from Mexico reached a record level and accounted for 39 percent of US imports. Between 1999 and 2006, cantaloupe imports from Mexico declined 92 percent and in 2006 accounted for just three percent of US imports.

In response to the repeated outbreaks, in 2002, the Mexican government developed a new mandatory program for cantaloupe exports with guidelines for food safety practices aimed at reducing the risk of microbial contamination (SAGARPA). Parts of the program were in place on a voluntary basis in some states in fall 2002. But in October 2002, the FDA issued an import alert against all Mexican cantaloupe which meant no imports were allowed. Exporters were hurt by the closing of the US market, but all Mexican growers suffered from lower prices as cantaloupe intended for the export market were redirected to the domestic market. In November, the FDA cleared two Mexican growers for export after they complied with GAPs. Later, the government of Mexico took over the certification process for firms that were allowed to export to the United States. The Secretariat of Agriculture, Livestock, Rural Development, Fisheries, and Nutrition (SAGARPA), through the Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria (SENASICA), issues the

certification that field operations and/or packing houses comply with Mexican government regulations.

Relatively few firms now export. With mandatory GAPs for field production and Good Manufacturing Practices (GMPs) for packing houses, costs for exports have increased about 20 percent. As of March 2007, SENASICA had certified 13 Mexican companies to export cantaloupe to the United States. Twelve are firms where both the field operations and packing houses are certified – ten in Sonora; two in Colima, and one in Michoacán. One firm in Nuevo Leon is just certified for field operations. While Mexican firms have tried to deal with the new export protocols, US imports from Central America have largely replaced Mexican imports. Between 1999 and 2005, Mexican cantaloupe production declined by 24 percent.

Impact of Food Safety Requirements on Mexican Cantaloupe Farmers

To understand the impact on Mexican farmers, an analysis was undertaken looking at growers in Colima, which has a history of cantaloupe exports and was not involved with the US outbreaks. Colima is located on the west coast of Mexico near the State of Guerrero, which was involved in several outbreaks. In 2007, Colima had 48 melon growers (cantaloupe and other melons), 1,900 hectares planted to melons, and eight packing houses, two of which were certified for cantaloupe export. Interviews with 17 small cantaloupe growers were conducted in January 2007. In addition, interviews with two larger packers and exporters provided a more complete view of the challenges for small growers. The difference in food safety levels is quite striking between smaller and larger producers.

Small Growers

Most growers in Colima are small scale *ejidatarios*. Four had ten hectares or less and 13 had between 11 and 60 hectares. Cantaloupe is considered a profitable product for small growers; the environmental and climatic conditions favor cantaloupe and it fits in well with a rotation including tomatoes and corn. Most growers had started with smaller cantaloupe acreage but expanded over the years. Small growers do not generally have packing facilities which would be very costly for small volumes of production.

Before the 2002 import alert, an estimated 80 percent of production from small growers was accepted for export. The rest was sold in the domestic market. Growers received higher prices in the export market than in the domestic market. The problems in 2002 reversed this situation and currently, 83 percent of smallholders' production is sold to the domestic

market. Some growers switched to focus on other crops with fewer potential problems, such as chile peppers, tomatoes, and papayas for the domestic market.

Sixteen of the 17 growers preferred to sell their cantaloupe to buyers who came to their fields. This reduced the transaction costs since growers did not have to arrange for transportation. The buyer determined the price; the price was generally lower than if the grower delivered cantaloupes to a local packing house but growers were usually paid on the spot. The buyers purchased on commission for cantaloupe sellers in the Guadalajara wholesale market.

Marketing was also flexible. Contracts were not common among the surveyed growers. Only two of the 17 growers had contracts with buyers; one was written and one was informal. Growers wanted to maintain freedom to choose who to sell to and take advantage of any better deals that might materialize. Almost one-half of the growers had changed their minds about informal marketing plans.

Of the surveyed growers, almost one-half had just an elementary school education. These growers also had low business management skills with limited accounting records and business planning. Much of their information about production practices was derived from their input suppliers, but these people have not been trained in food safety and it was not their primary objective. Input suppliers also were the source of most production credit. According to the input suppliers, they provided production credit to 70 percent of the cantaloupe growers for the purchase of certified seeds, pesticides, fertilizers, and some other inputs.

Awareness of food safety issues is quite low among small cantaloupe growers. Eighty-eight percent said they had not previously been involved in any food safety issues. The others recognized that they had been involved indirectly via the 2002 import alert that reduced domestic prices for cantaloupe. Knowledge of GAPs was also very low. Only two farmers said they knew what GAPs were. Most respondents said they hadn't implemented a food safety program because they had no information. Several said since they had not faced any food safety problems in the past; there had been no need to implement one. When asked under what conditions they would implement a food safety program, many growers responded that they would need information and training support while several said the regulations would have to be flexible.

Water quality is a critical issue for food safety. With deep water wells, it is easier to exercise control over potential microbial contamination. In this case, however, 88 percent of growers use river water and they know very

little about its quality. Testing water for microbiological contamination and pesticide residues is not yet part of the regular production process for small growers. Over one-half had at least one water test at some point, although the cost was absorbed by the buyer.

Toilet and hand-washing facilities are required for GAPs but can be very expensive for small producers to provide. About one-quarter of the small growers provide these facilities because the buyer demands it for the export market. However, GAPs require toilets within 400 meters of the working area and only one grower of the four providing toilets complied with this standard; the rest had toilets that were more than one-half of a mile away. This is a critical control point for small growers in complying with GAPs and GMPs.

Small growers reported on the most important needs to improve their businesses in the domestic market and to access the export market. Thirty-five percent agreed on the need to improve quality which would give them a better price in the market. Adopting a food safety program came in second place as growers now understand how critical this is to entering the export market. Growers were also aware of the restrictions of participating in just one wholesale market (the Guadalajara CEDA) and the importance of eliminating middlemen in the market chain to gain higher prices.

Small growers want more government support to upgrade their operations. Market information is their first concern. Forty-one percent of small growers mentioned that timely information on prices, the demand of different markets for cantaloupe (domestic and export), and how to streamline marketing to eliminate middlemen are their major concerns. For one-third of the growers, government assistance such as preferred credit to improve production practices and invest in packing facilities was their most critical need.

There are a range of associations and government programs that could help small producers but they have not provided much assistance yet. COEMEL (the State Council of Melon Producers), which was formed in 2004, represents melon growers but the interests of larger producers dominate. Issues of concern include enhancing markets, improving product quality, representing growers, and implementing special programs to increase profitability. The organization does not have a specific food safety agenda but it has provided some training in GAPs which has benefited mostly the larger farmers. Because of distance, many small farmers are not able to participate fully in the organization.

A government program helps small growers organize for legal purposes. This allows them access to credit and special government support for rural

development. The government supplies advisors on technical aspects of production. The technical advisor is available for six months, and the term can be renewed once for a total of one year. The advisors do not have specific information on food safety, but they are open to new information and techniques that can improve the growers' production skills.

The government also introduced Product Systems for producers growing specific commodities. In Colima there is a Cantaloupe Product System that looked at institutional ways to improve smallholders' (mainly *ejidatarios*) market access after the US import ban. Growers reported that their ability to access the export market was limited by the high cost of production, lack of credit, sanitary problems, oversupply, lack of uniformity in the applications of food safety regulations, and lack of technical assistance. To date, this program has had no impact on small growers.

Medium and Large Growers

Before the Mexican government imposed mandatory export standards, many of the larger growers were already using GAPs voluntarily for their US buyers. Many US buyers only purchase from suppliers using GAPs. For these growers, the main difference is that now food safety practices are mandatory, not voluntary. These farmers had an advantage over their competitors who had not previously invested in food safety and therefore had to incur all of the costs at once to maintain their market presence rather than spreading them out over a number of years.

In Colima, there was one large and one medium-sized export-oriented firm that obtained SENASICA certification and regained access to the US cantaloupe market. The cost of complying with the SENASICA regulations is quite high. Another medium-sized firm has not achieved SENASICA certification and turned to exporting honeydew melons since that commodity does not face the same food safety requirements. Honeydew melons have not been implicated in numerous outbreaks like cantaloupe. Both certified firms have a long history in cantaloupe production and consider Guatemala as their main competition in the export market and the State of Guerrero in the domestic market.

The food safety practices used by the medium and large-sized firms provide a stark contrast to those used by smaller farmers. The certified firms conduct soil and water tests, maintain records on land use, and fence their land to protect their fields from potential contamination from wild animals. These firms also use well water that is tested frequently (each month during production and harvesting) for microbiological contamination and both have water osmosis plants to control water quality. In addition to upgrading field operations, firms have to cover

packing operations to prevent potential contamination. Toilet and hand-washing facilities comply with Mexican government rules – one for every 20 workers of each sex; located within 400 meters of the work area; and equipped with running water, washing stations, soap, and towels. Supervisors monitor hygiene and work rules are posted in visible areas throughout the ranch, packing facility, workers' common area, and toilets. Prior to beginning work, employees take training classes on food safety principles and hygiene. All food safety practices are documented and records are kept available for official visitors (usually government representatives from SENASICA or the US FDA) and clients that usually visited operations at least three times during production, harvest, and packing.

LESSONS FROM STUDIES INTO MEXICAN PRODUCE CHAINS

The pressure on Mexican producers to adopt new quality and food safety practices is being driven by changes in the retail industry, by experiences in food chains, and food safety problems. As retail organizations become larger and more global, their needs change, and those changes are reflected in more challenging requirements for suppliers. The requirements may be transmitted to producers directly from retailers or through intermediaries such as shippers. The result is the same for small producers, unless they can cooperate to meet retail expectations they are relegated to selling to local markets or middlemen at much lower prices.

The price of not meeting retail and foreign market expectations, particularly with respect to food safety, is painfully clear in the case of the Mexican cantaloupe industry. After repeated food safety problems, the market was lost to foreign competitors. The damage went beyond anything that could be repaired by voluntarily meeting standards. The government stepped in to try to save the industry, with limited success to date.

Regardless of whether the standards or requirements come from local food retailers or from regulators trying to protect international markets, the implications for producers are the same – meet the requirements or sell elsewhere. The strategies for success are relatively clear, but unattainable for many. While some producers are large enough to supply food retailers directly, the majority have neither the scale nor the resources. Those who wish to participate in more lucrative retail markets have two choices – market via a larger shipper or work cooperatively,

creating cooperatives or associations to create the scale and capabilities necessary to access retail markets.

The experience in Mexican produce markets reveals that even the association path does not guarantee success in marketing to food retailers. Several lessons may be observed from the Mexican case studies.

Lessons from Cactus Pear and Mango Growers

The lessons learned by Mexican cactus pear and mango growers include:

1. Associations can be a successful way to sell into supermarkets, as well as to CEDAs. The associations were all able to successfully sell into supermarket supply chains. However, volumes fluctuated widely. Supermarkets have a large number of suppliers (middlemen, CEDAs, producers, private packing facilities, etc.) and market power seems to lie primarily with the supermarkets. Farmers frequently complained during the interviews that they had too much production with the quality required by supermarkets but the amounts ordered were low. Selling to retailers may be riskier than the traditional market.
2. Associations pay. Although costs increase, prices increase more, resulting in higher profits for producers.
3. Credit appears to be an essential ingredient in absorbing higher costs and allowing producers to meet supermarket requirements. Associations were able to secure credit where individual producers could not, and they passed that credit on to producers. Producers are a better risk collectively than individually.
4. There are definite risks associated with associations. In addition to processing and distribution activities, all associations offered credit, but in one case, problems with credit to members resulted in the association losing its credit and ceasing operations.
5. Production risks affect an association's relationship with its supermarket customers. Being regional, problems in one area can damage or cause the demise of an association's relationship with supermarkets.
6. All the associations studied focused on only one product. Are there opportunities for associations that can meet more than one need for their customers?
7. Although associations may list many members, as in the case of Mango One, the optimal size of operating members ranged from 20-60 members. This may have something to do with their feelings of contribution to and control over the association.
8. Promotion of efficient farmer organizations, such as cooperatives and associations, has to be intensified if more direct trade between supermarkets and small-scale farmers is desired. However, the

creation of associations must be accompanied by efficient extension services, such as technical assistance, market and production information, infrastructure for transport, efficient financing services, education, and training. These are necessary to improve producer capabilities to meet market requirements and to be more responsive to market demands. If this cannot be achieved then the best way for small-scale farmers to access supermarkets could be through intermediaries, leaving the rest to market to diminishing and less efficient traditional markets.

Lessons from Cantaloupe Growers

The lessons learned by Mexican cantaloupe growers include:

1. Small producers would like to be able to do more sophisticated marketing and not just sell to representatives of wholesale markets who come to their farms, but they lack the resources to meet the more rigorous standards for the retail and export markets.
2. Without access to reasonably priced credit and extension services, small farmers may not be able to make the investments necessary to comply with food safety demands. There is a clear trade off – provide credit and extension to small farmers or see them lose access to more lucrative export markets.
3. Better market information is crucial for smaller producers – a service the government could provide.
4. The small producers in this group were not very conversant with food safety standards. At a minimum, in order to export, small growers would need to have GAPs for their fields. If they had their own packing facilities they would have to comply with GMPs. If growers exported to Europe, they would need to comply with EurepGAPs.[3] As export markets become more complicated, there is more need for extension efforts to help small producers navigate complicated food safety standards.
5. Small growers need institutions so they can jointly buy inputs in bulk at lower prices. As a group, small growers could more easily access the existing Mexican research institutions such as Fundación Produce and INIFAP. Packing facilities and cold storage are critical requirements for producing the quality demanded by retailers; no small producer could afford these facilities on their own but an organized group of small producers could. Again, government sponsored assistance might be required to help small producers overcome that hurdle.
6. Organization of growers is a critical factor in whether growers can rally from one food safety problem and maintain their market access. Cantaloupe growers did not take immediate and unified action against food safety problems. After the US closed its borders to Mexican

[3] This is the European version of GAPs.

cantaloupe, only large growers could afford to pursue certification for the export market. In 2003 there was an outbreak of foodborne illness in the United States associated with Mexican green onions. The Mexican green onion growers involved in the export market, who generally owned larger farms and were geographically concentrated, took immediate action to resolve their food safety problems; they mandated that all farmers who export had to produce using Good Agricultural Practices (Calvin, Avendaño, and Schwentesius, 2004). Since the growers did not have an appropriate legal framework to use to implement this program, they asked their government to impose mandatory standards for green onion exports. There is a government role for strengthening grower organizations in Mexico to deal with these kinds of problems (Avendaño and Calvin).

7. With time, demand may increase for Mexican cantaloupe in the United States. If that happens, growers who are certified for export would have two options. They might go back to previous patterns and market for smaller producers in the area. This would require that the smaller producers become certified. The exporters may be willing to provide credit to small producers if the market opportunities are sufficient. Alternatively, with increased scrutiny of food safety practices, exporters may think that they need to expand their own production which they can control better than rely on the actions of other farmers.

COMPLEX RETAIL CHAINS - THE ONTARIO VEAL INDUSTRY

The last case considered in this chapter examines a more complex supply chain in Canada; the retail supply chain for Ontario veal (Snoek and Sparling). In this case, the industry had an existing association, the Ontario Veal Association (OVA), to represent producers. In 1999, a small retail chain which focused on ethnic markets contacted the OVA and expressed an interest in developing a higher value line of veal products to provide the chain with an advantage over competitors.

This case is somewhat different from the examples in Mexico because the OVA had actually created its own internal quality program, the Ontario Veal Quality Assurance Program (OVQAP) designed to promote quality enhancement through a food safety training program, and on-farm feeding and animal care certification performed by an independent third party veterinarian. The program also specified processing requirements, again with certification and audit requirements. Branding, cooking instructions, and a money-back guarantee rounded out the offerings to consumers.

The OVQAP was designed to improve overall quality and producer capabilities, but was initially driven internally. When the small retail chain

contacted OVA to provide a high quality product, the quality program was in place, but did not have a committed chain of production. The OVA had to organize producers to join the retail program and identify appropriate processors. Convincing producers to commit production where the costs and benefits were uncertain was a challenge for the OVA but the small scale made that somewhat easier. The project was successful and the knowledge gained by the project managers and producers prepared the association to take on a larger project with a major retail chain.

A national retail chain approached the OVA to undertake an initiative to halt the gradual decline in the sale of veal within the chain. The result was the "Taste of the Day Quality Assured Ontario Veal" initiative which targeted 69 Ontario stores in 2004. In this case, the processor was selected by the food retail chain, in part so that the OVA could avoid being seen as favoring a single processor. Organizing a complete chain to meet stringent standards is no small process. It required almost two years to establish and was helped by funding from a provincial funding agency. Once organized the chain went into operation quickly with initial success.

The challenges for the chain came later. The retailer wished to vary product offerings and volumes through the year. This created the challenge for the OVA and processor about what to do with the cuts not desired by the retailer at a given time. In an attempt to resolve this problem the OVA tried to create a food service value chain which would use the remaining cuts. However, supplying that chain meant that product had to be frozen and stored by the processor at busier times to be supplied to food service companies at a later date. The processor would not take on the additional risk associated with holding longer-term inventory and ultimately the food service initiative failed. This in turn limited processor flexibility to supply the retail chain and volumes declined to levels where the processor felt that it could manage the cuts with limited demand.

Ultimately, challenges with varying product offerings at the retail level have meant that the project achieved far less than any parties had hoped. To date there has been no resolution of this challenge.

Lessons from the Ontario Veal Chain

The OVA case highlights a different set of issues for producers. Meeting retail requirements still drives the chain but in this case the requirements extend beyond safety and quality minimums to developing a premium product that can provide a competitive advantage for the chain. The association played a role in anticipating the needs of the industry and in preparing a strategy for achieving higher quality. It was able to use those capabilities in successfully launching a premium product in response to the needs of a small retail organization. However, when volume increased,

the needs of the retailer conflicted with those of the processor and the chain failed to achieve the desired results.

The need for processing changed the structure and operation of the supply chain and the requirements for success. While the retailer still influenced the final product offerings to consumers, they did not exert complete control over the chain. The association specified requirements to the processor and in turn the food processing company imposed its requirements on the chain. Ultimately, it was the processor's requirements which determined the level of success of the project.

LOOKING AHEAD

The future for food retail chains and their relationship with shippers and farmers appears to be more of the same trends, with some new twists. Retail chains will continue to expand internationally and competition will come from anywhere in the world. The importance of food safety will continue to increase, driven by high profile food safety failures in global food chains. Meeting the food safety standards set by retailers, commodity organizations, or governments will be the price of entry into the market.

The requirements to meet higher standards and assure supply are part of the modern retail landscape. Many large shippers are prepared to meet those challenges, investing in production and in people to be a part of global food chains. This is one of the motivations for continued consolidation in agriculture across North America. Shippers who cannot meet these requirements will become marginalized into other markets. There are many challenges for small farmers; long-term strategies may include aligning themselves with shippers or organizing themselves into associations. However, their ultimate success will depend on the ability of the association to meet retail needs for product quality, volume, and new product development. Investments in training and technology will be necessary, with the objective of gradually elevating the skills and capabilities of growers. In the process, the growers may gradually shift from small-scale to medium, or even large. Doing so will provide the resources to better meet market requirements. The growth of demand for local food is providing opportunities for some small farmers to sell directly to retail. However, this trend may be more developed in the United States and Canada than in Mexico.

REFERENCES

ACNielson. 2003. "The Power of the Private Label: A Review of Growth Trends around the World." *ACNielson Global Services Executive News Report*, July. Available at: <http://www2.acnielsen.com/news/20030916.shtml>. Accessed June 2005.

Acosta, T.R. 2005. "Retailers-Agribusinesses-Producers Integration as a Key for Competitiveness in Mexico." Paper presented at the Pacific Economic Cooperation Council, Food and Agriculture, Singapore, 15-16 November.

La Asociación Nacional de Tiendas de Autoservicio y Departamentales ANTAD. 2005. *Trends in Mexico, Attitudes of the Consumer and the Supermarket*. ANTAD México.

Avendaño, B. and C. Narrod. 2007. "Food Safety Requirements in Latin American Cantaloupe Exports and Their Impact on Small Farmers." Washington, DC: IFPRI Working Paper.

Avendaño, B. and L. Calvin. 2006. "Impact of US Good Agricultural Practices on the Mexican Fruit and Vegetable Industry." Presentation at AAEA Pre-conference Workshop: New Food Safety Incentives and Regulatory, Technological, and Organizational Innovations, Long Beach, California, 22 July. Available at: <www.fsn-aaea.org/workshop_06/US_standards_Mexican_produce.pdf>. Accessed April 2007.

Backbone Magazine. 2007. "Grocery Checkout: One Beep, Goodbye – Canadians Want RFID Chips on their Carrots and Oreos." *Backbone Magazine* May/June, p. 10.

Barkema, A., M. Drabenstott, and N. Novack. 2001. "The New US Meat Industry." *Federal Reserve Bank of Kansas City - Economic Review* pp. 33-56.

Boylaud, O. and G. Nicoletti. 2005. Regulatory Reform in Retail Distribution. Paris: *OECD Economic Studies*, No. 32, 2001/I 253. Available at: <http://www.oecd.org/dataoecd/30/52/2732142.pdf>. Accessed February 2007.

Calvin, L. 2003. "Produce, Food Safety, and International Trade: Response to US Foodborne Illness Outbreaks Associated with Imported Produce." In J. Buzby, ed. *International Trade and Food Safety*. Washington, DC: USDA, ERS, AER Number 828, Nov. Available at: <www.ers.usda.gov/publications/aer828/aer828g.pdf>. Accessed April 2007.

___. 2007. "Outbreak Linked to Spinach Forces Reassessment of Food Safety Practices." *Amber Waves* USDA, Economic Research Service. Available at: <www.ers.usda.gov/AmberWaves/June07/Features/Spinach.htm>. Accessed July 2007.

Calvin, L., B. Avendaño, and R. Schwentesius. 2004. *The Economics of Food Safety: The Case of Green Onions and Hepatitis A*. Washington, DC: VGS-305-01, USDA, Economic Research Service. Available at: <www.ers.usd.agov/publications/vgs/nov04/vgs30501>. Accessed April 2007.

Calvin, L., and V. Barrios. 1998. *Marketing Winter Vegetables from Mexico*. Washington, DC: Vegetables and Specialties, VGS-274. USDA, Economic Research Service. Available at: <www.ers.usda.gov/briefing/tomatoes/tomatopdf/MarkWintVegMex.pdf>. Accessed April 2007.

Calvin, L., R. Cook (coordinators), M. Denbaly, C. Dimitri, L. Glaser, C. Handy, M. Jekanowski, P. Kaufman, B. Krissoff, G. Thompson, and S. Thornsbury. 2001. *US Fresh Fruit and Vegetable Marketing: Emerging Trade Practices, Trends, and Issues*. Washington, DC: USDA, Economic Research Service AER-795, January.

Central Intelligence Agency (CIA). 2007. "Field Listing - GDP - Composition by Sector." *The World Factbook*. Available at: <https://www.cia.gov/library/publications/the-world-factbook/fields/2012.html>. Accessed 24 March 2007.

Cervantes-Godoy, D. 2007. "The Growth Of Supermarkets In Mexico: Impacts On Market Choice, Production And Transaction Costs Of Small Farmers" Ph.D. dissertation, University of Guelph.

Cotterill, R.W. 1999. "Continuing Concentration in Food Industries Globally: Strategic Challenges to an Unstable Status Quo." University of Connecticut, Food Marketing Policy Center Research Report No. 49.

Datamonitor. 2006. "2006 Reports on Food Retail: Canada, Mexico and the United States." Available at: <www.datamonitor.com>. Accessed 5 April 2007.

de Janvry, A and Sadoulet, E. 2001. "Income Strategies among Rural Households in Mexico: The Role of Off-farm Activities." *World Development* 29:467-480.

Dobson, P.W., M. Waterson, and S.W. Davies. 2003. "The Patterns and Implications of Increasing Concentration in European Food Retailing." *Journal of Agricultural Economics* 54:111-25.

Federation of International Trade Associations (FITA). 2007. "Mexico." Available at: <http://fita.org/countries/mexico.html>. Accessed 24 March 2007.

Golan, E., B. Krissoff, F. Kuchler, L. Calvin, K. Nelson, and G. Price. 2004. *Traceability in the US Food Supply: Economic Theory and Industry Studies*. Washington, DC: USDA, Economic Research Service, Agricultural Economic Report No. 830, March. Available at: <http://www.ers.usda.gov/publications/aer830/aer830.pdf>. Accessed April 2007.

Guptill, A. and J.L. Wilkins. 2002. "Buying into the Food System: Trends in Food Retailing in the US and Implications for Local Foods." *Agriculture and Human Values* 19:39-51.

Hoppe, R.A. and D.E. Banker. 2006. *Structure and Finances of US Farms: 2005 Family Farm Report*. Washington, DC: US Department of Agriculture, Economic Research Service, Economic Information Bulletin No. EIB-12.

Institute of Agri-food Policy Innovation. 2006. "Canada Farm Income Analysis Data Summary." Available at: <http://iafpi.ca/xl/Canada_summary.htm>. Accessed 24 March 2007.

International Food Policy Research Institute (IFPRI). 2003. "Will Supermarkets Be Super for Small Farmers?" IFPRI Forum, December. Available at: <http://www.ifpri.org/pubs/newsletters/ifpriforum/if4.pdf>. Accessed March 2007.

Kaiser Family Foundation, GlobalHealthFacts.org. 2007. "Urban Population (Percent of Total Population Living in Urban Areas) 2007." Available at <http://www.globalhealthfacts.org/topic.jsp?i=66#notes>. Accessed 4 April 2007.

MacKinnon, J.B and Smith, A. 2007. *The 100 Mile Diet: A Year of Local Eating*. Toronto: Random House Canada.

Pacific Economic Cooperation Council (PECC). 2005. "Pacific Food System Outlook 2005-2006: A Revolution in Food Retailing."Available at: <http://www.pecc.org/food/papers/pfso2005-06.pdf>. Accessed 04 March 2008.

Reardon, T. 2004. *The rise of supermarket in Mexico*. Washington, DC: Chemonics International Inc., USAID.

___. 2005. "Retail companies as integrators of value chains in developing countries: Diffusion, procurement system change, and trade and development effects." Final report prepared for Deutsche Gesellschaft fr Technische Zusammenarbeit (GTZ) GmbH, Eschborn, Germany.

Reardon, T. and C.P. Timmer. 2007. "Transformation of Markets for Agricultural Output in Developing Countries since 1950: How Has Thinking Changed?" In R.E. Evenson, and P. Pingali, eds. *Handbook of Agricultural Economics*. Amsterdam: Elsevier Press, edition 1, volume 3, number 1.

Schwentesius,R. and Gomez, M.A. 2002. "Supermarkets in Mexico: Impacts on Horticulture Systems." *Development Policy Review* 20:487-502.

Secretaría de Agricultura, Ganadería, Desarrollo, Rural, Pesca y Alimentación (SAGARPA). 2002. "Requisitos para la Aplicación y Certificación de Buenas Prácticas Agrícolas y de Manejo para la Producción y Empaque de Melón cantaloupe." NOM-EM-038-FITO-2002. Available at: <http://www.cofemermir.gob.mx/uploadtests/2593.59.59.1.NORMA%20EMERAGENTE%20MELON.doc>. Accessed 04 March 2008.

Snoek, G. and D. Sparling. 2007. MSc. thesis and personal interviews with value chain participants, University of Guelph.

Statistics Canada. 2003. "Canadian Farm Operations in the 21st Century." Available at: <http://www.statcan.ca/english/agcensus2001/first/farmop/01front.htm#top>. Accessed 24 March 2007.

Tittleson, J. 2000. "Global Supermarkets." *Nutrition Today* p. 35.

Traill, B.W. 2006. "The Rapid Rise of Supermarkets?" *Development Policy Review* 24(2):163-74.

Turock, A. and D. Rogers. 2005. "Competing with Wal-Mart & Son of Wal-Mart (aka the Supercenter." *Canadian Grocer* 119:50-55.

World Services Group. 2007. "Labor Force - by Occupation." Available at: <http://www.worldservicesgroup.com/countries.asp>. Accessed 24 March 2007.

Implications of WTO Developments for Market Integration

Alex F. McCalla[1]

INTRODUCTION

Trade negotiations follow tortuous and unpredictable paths. Therefore accepting assignments to analyze impacts of agreements before they are concluded is fraught with danger. Yet some authors seem frequently to be trapped by their willingness to agree to give an assessment of the outcome of GATT/WTO negotiations well in advance of their scheduled conclusion, only to have the negotiations delayed or suspended, perhaps never to be concluded. It has happened to this author now three times. First in 1993 before the conclusion of the Uruguay Round (McCalla 1993), again in 2003 when Doha was supposed to be well along before the Cancun Ministerial (McCalla 2003) and in 2006 when he agreed to do this paper just days before Pascal Lamy, the Director General of WTO, recommended an indefinite time-out in WTO Doha negotiations (McCalla and Nash). So for a third time, in this chapter, speculation is required on whether there will be an agreement, on what might it look like, as well as on its potential impacts on NAFTA.

But, the task faced by this chapter is even more challenging. Given that there is currently no agreement and prospects do not seem promising, it needs also to explore the consequences for market integration (NAFTA) if there is no Doha Agreement.

The chapter begins by reviewing what appears to be the current status of the Doha Development Round as of July 2007. This is followed by a

[1] The author benefited greatly from inputs from Dan Sumner, Colin Carter, Ellen Terpstra, and Bruce Zanin. Ron Knutson provided much clarity as to the purpose of the paper. However, none of them should be held responsible for the chapter's content. Duncan Pohl deserves much credit for converting illegible handwriting into a manuscript. Finally, thanks for comments received at the NAAMIC Workshop.

discussion of why an agreement seems so elusive – is it simply a continuation of long-standing problems on agricultural trade negotiations which have dragged out previous Rounds? Or is the new WTO ungovernable given its rapid expansion in membership and its old decision modality of consensus? Or are there new developing country forces/negotiating blocs at work which are challenging traditional developed country hegemony? Or have opponents of globalization so trumpeted trade skepticism that anti-liberalization forces are winning, or has an era of bilateralism and regionalism become the new global mantra? The answer probably involves pieces of each explanation, but no doubt the growing power of developing countries is key. Therefore the third section of this chapter is devoted to exploring how they could benefit from an agricultural agreement that would be the minimally acceptable agreement to them. The fourth section contains wild speculation about what an agreement might look like. Then the final two sections look at consequences of the scenarios – "DEAL" or "NO DEAL" – in Doha for market integration in NAFTA.

APPARENT STATUS OF THE DOHA ROUND AGRICULTURAL NEGOTIATIONS

The Uruguay Round Agreement on Agriculture (URAA) committed WTO members to initiate further negotiations before the end of 1999 (or early 2000). Thus, discussions of further agricultural trade reform were initiated in March of 2000 despite the Seattle debacle in December 1999. They were given a significant boost by the Doha Ministerial decision in November 2001 to initiate a new round of general trade talks, the Doha Development Agenda. The agriculture timetable was ambitious – an agreement on modalities for determining further commitments no later than 31 March 2003, submission of comprehensive draft schedules to the Fifth Ministerial in Cancun, September 2003 and a completed agreement by 1 January 2005. As is well known, none of these mileposts were accomplished. The Cancun Ministerial ended in disagreement rather than progress. The explicit issues which split developed and developing countries were the so called Singapore issues of adding items such as investment, competition rules, and procurement transparency to the trade agenda. Nevertheless, the lack of any agreement on how to move forward in agriculture greatly troubled delegates before the breakdown occurred (WTO 2003).

Despite the Cancun breakdown, agricultural discussions continued, and on 1 August 2004, after an all-night session, the delegates agreed on a framework/outline to be used to complete the "modalities" on agriculture. Discussions of modalities started in October 2004 with the hope of an agreement by July 2005 and a presentation to the December Hong Kong Ministerial. Again, modalities were elusive and in the Declaration of the Hong Kong Ministerial the only firm agreement was one to eliminate

export subsides by the end of 2013 and the only other progress reported was agreeing to three bands for reductions in Aggregate Measures of Support (AMS) but no further details. The negotiators did, however, reaffirm commitments to complete the mandate on agriculture set out in the Doha Declaration (WTO 2005).

But 2006 turned out to be no better and on 24 July 2006, Director General (DG) Pascal Lamy issued a statement.

> The situation is now very serious. Without the modalities in Agriculture and NAMA, it is clear that it will not be possible to finish the Round before the end of 2006… I believe the only course of action I can recommend is to suspend the negotiations across the Round as a whole… I do not intend to propose any new deadlines or a date for resumption of activities… And let me be clear: there are no winners and losers in this assembly. Today, there are only losers (WTO 2006).

After a six-month period of reflection and informal consultations, DG Lamy announced on 7 February 2007 "We have resumed negotiations fully across the board" (WTO 2007e). On 9 May 2007, DG Lamy further laid down the challenge, underlining "…my belief that a successful outcome to the Round is possible, even in the small amount of time remaining until the end of this year. I have warned governments that if they do not compromise soon, they will be forced to confront the unpleasant reality of failure. This would mean foregoing the very significant package of trade opening and rule-making that the Round represents, and breaching the commitment which was taken to work for a more developing-friendly world trading system (WTO 2007d)." In the same report he underlined the critical importance of establishing modalities in agriculture if any progress was to be made.

Finally, it can be noted that the Chair of the Agriculture Negotiating Group, Ambassador Crawford Falconer of New Zealand, circulated a "Challenges" paper on 30 April 2007 (WTO 2007a) which was a rambling discourse on the many divergences and few convergences of opinions on issues in agriculture. He did, however, attempt a first pass at setting the boundaries within which any agreement would be required to fit and tried to identify any "centers of gravity" that might be emerging. On 7 May 2007, he reported that member's comments showed they were starting to negotiate content rather than rejecting it (WTO 2007c). He circulated a second installment on 25 May 2007 which further elaborated on the wide differences that existed on special and differential treatment

for developing countries but reported no further convergence on other issues (WTO 2007b).

At the time this chapter was written, negotiations had restarted, an ambitious timetable had been laid out and leaders were professing optimism of having some kind of a deal before the end of 2007. Based on past performance, one cannot help but be pessimistic, but maybe facing a real possibility of failure will focus governments' attention and get things moving. Time will tell but at the moment it seems to be a very steep path.[2]

On top of the situation in Geneva, of course, is the fact that Fast Track negotiating authority in the United States, the world's largest trader, expired on 30 June 2007.[3] Given that any deal had to be submitted by April first, there will be NO DEAL unless that authority is renewed. At this point, it is foolhardy to hazard a prediction. Conversations with some usually reliable sources in Washington say an extension may be possible despite the Democratic takeover of Congress last November and point to a recent agreement including labor and environmental issues in trade discussions (Weisman) as evidence that something may still be possible.[4]

WHY IS AN AGRICULTURAL AGREEMENT SO DIFFICULT?

It would be easy to argue that the problems in Doha are simply a continuation of the problems caused by entrenched agricultural protectionism in rich countries. After all, declaring an agricultural impasse was all that saved the Kennedy and Tokyo Rounds from failure and agriculture delayed the completion of the Uruguay Round by three years. But this is history (McCalla 2003). In the end, there was some progress in the Uruguay Round, at least in bringing agriculture under the same rules as other sectors in the new WTO. But the second part of the URAA was to actually begin to liberalize, and in this there has been limited progress. But one could also argue that negative outcomes in Seattle, Cancun, and Hong Kong were not the sole, or even, major responsibility of failures in agriculture. Therefore, we need a longer list of potential suspects.

Agriculture, of course, has to remain on the suspects list, but others should be added. Some make the case that the new WTO with 150 members cannot use the old GATT modality of consensus for decision-

[2] Indeed, G-4 ministers meeting in Potsdam in late June failed to narrow differences and revive the Doha Round (The Economist).

[3] Democratic leadership in the US House of Representatives at the end of June "…quietly scuttled the president's authority to negotiate trade agreements (Broder)."

[4] Later Democratic leaders in both houses indicated restoring "fast track" was not high on either of their agendas.

making. Others have argued it is a result of new power blocs involving the growing number of developing country members who are challenging the hegemony of OECD. Yet others contend that the opponents of globalization are winning as more people believe freer trade is a bad thing, not a good thing. Finally, since the last WTO Agreement in 1994 there has been a proliferation of regional and bilateral trading agreements. Perhaps this is the new way of doing business. Let us explore each quickly because each may be part of the problem.

Agriculture Is Still a Problem

There is no question agriculture remains a difficult nut to crack. Much of the progress that took place in the Uruguay Round of bringing agriculture under the regular rules of GATT/WTO can be attributed to factors that were different in that Round – The United States was a very strong advocate for agricultural liberalization and there was a new power bloc – the Cairns Group of agricultural exporters – who refused to agree to other parts of a Uruguay outcome until there was progress in agriculture. The EU also was moving in the direction of less costly and less trade-distorting policies, not necessarily because they loved free trade but because, with EU expansion, the continuation of the old Common Agricultural Policy (CAP) model was unsustainable from a budget perspective. The other big subsidizers of agriculture like Japan, Korea, and Norway focused on making sure there was enough flexibility in how the three pillars were implemented (e.g., the ingenious tariff-rate-quota which turns out to be a pretty effective quantitative restriction) so that they could continue to have very high levels of protection.

Since the Uruguay Round was completed, several things have changed. The United States has reverted back to high levels of coupled subsidies, starting with ad hoc bailouts in the late 1990s which were locked in permanently with the 2002 Farm Bill. There is nothing to suggest in the current debate leading up to the 2007 Farm Bill renewal that things will change much. In fact, the big push seems to be for more commodities to get access to the money spigot than before rather than closing off the subsidies. Therefore, the US is no longer a credible advocate for liberalization despite the periodic rhetoric of the US Trade Representative advocating a more liberal trade regime in agriculture. The Cairns Group has experienced some fractures, in part, because the Canadians can't decide which side they want to be on, and, in part, because some developing country members are being pulled into new more powerful mixed groups of developing countries who are less sure they want to liberalize their agricultural policies in exchange for better access to developed country markets. So, if anything, there seems to be fewer forces within the agricultural sector pushing for reform. Given internal reforms in the CAP, the EU is less strident about keeping protection, but certainly

is not yet a flaming reformer. Thus, given the power of farm groups in developed countries, there is still strong resistance to major changes.

Expanding Membership - Is the WTO Ungovernable?

The number of countries participating in GATT negotiations never exceeded 38 up to and including the fifth Round, the Dillon Round (1960-61). The number "participating" increased to 62 in the Kennedy Round (1964-67), 102 in the Tokyo Round (1973-79) and 123 by the end of the Uruguay Round (1986-94). However, participation included a lot of observers. Further, given the dominant modality was first, bilateral offer-response negotiations by tariff line between the two major traders, and second, generalization to all members (MFN), numbers "participating" were not a big issue. Within this model, the decision mode of GATT was consensus which appeared to work.

When WTO came into being on 1 January 1995 there were 76 members. Over the course of 1995, 36 more joined and by 11 January 2007, there were 150 members and an estimated 30 more are negotiating for membership. With the creation of WTO, a more formal governance structure was codified which involved a hierarchical structure with the "Ministerial Council" meeting every two years as the highest body, with day-to-day decision-making done in the second tier by the "General Council," made up of resident ambassadors or representatives of all members in Geneva. At the third level, there are three Councils: 1) Trade in Goods; 2) Trade-Related Aspects of Intellectual Property Rights (TRIPS); and 3) Trade in Services. Under the Council for Trade in Goods, the dominant modalities are 11 "sector/topical committees," including agriculture and nonagricultural market access (NAMA). Each of these committees is open to all members and decisions are by consensus. Only in specific cases is there provision for voting by qualified majority. The bottom line is this: an agriculture agreement will require a consensus of 150 countries and four levels of agreement before it can go out for country ratification.

Historically, some difficult decisions have required an initial breakthrough. Early on this involved prenegotiations by a small group called the "Quad"– Canada, the EU, Japan, and the United States – but since the turn of the century this group has been expanded to include Brazil, India, and Australia representing the Cairns Group. In agriculture, since 2005, four, five, or six of the following group – Australia, Brazil, the EU, India, Japan, and the US – have met as "the new Quad" (Brazil, the EU, India, and the US); the "Quint' also called FIPS or five interested parties (Australia, Brazil, the EU, India, and the US); or the "G-6" (the Quint plus Japan). The Doha Round was suspended in July 2006 when the G-6 could not agree on a way forward (WTO 2007g). In addition, there are proliferations

of other groupings which have emerged which are discussed in the next section.

Some, such as Jeffrey Schott of the International Institute of Economics (IIE), have argued that the WTO is ungovernable because a committee of the entire 150 members makes for a cumbersome and inefficient decision process. He argues for a World Bank/International Monetary Fund (IMF) form of governance with an Executive Board to direct the organization, permanent participation of the major industrial countries, and weighted voting (WTO 2007h). Further, it is clear that rigid adherence to a consensus model leads to the tyranny of the minority. The WTO has yet to produce a serious trade agreement. Therefore, the jury is still out as to whether it is functional in making decisions in difficult areas such as agriculture.

New Groupings Emerge as Developing Countries Organize to Check Rich Country Hegemony

Prior to the creation of the WTO, the GATT was largely a rich countries' club, dominated by the old "Quad" (the US, the EU, Japan, and Canada). As argued above, the creation of the Cairns Group in the late 1980s had a significant impact on the outcome of the Uruguay Round regarding agriculture. The creation of the WTO in 1995 which formalized a decision structure of ministerials, councils, and committees, which coupled with rapidly expanding membership provided enticing opportunities for new groups to form. The failure of the Seattle Ministerial in 1999 signaled the end of business-as-usual, and the initiation of a new Round in Doha in 2001 was a turning point which encouraged new groups beyond the Cairns Group to form. As Wolfe states, "the group process has been evolving since the creation of the WTO, especially after the 1999 Seattle ministerial conference, and new patterns of coalition activity were in evidence at the Doha ministerial, but the 2003 Cancun ministerial was a shock because it seemed to mark a clear break from the conventional pattern."

There are two excellent papers (Wolfe; Kaukab) which analyze the new groupings in agricultural trade negotiations. Wolfe argues that three groupings of developing countries influenced the agenda for the Doha Development Round. These were the African Group, The African, Caribbean, and Pacific (ACP) Group of States (77 countries given preferences by the EU) and the Least Developed Countries Group.[5] At Cancun, these groups acted together as the G-90 to block discussion of the Singapore issues, and a new group of larger developing countries, the G-20, rejected an EU/US paper on agricultural market access. These actions essentially derailed the Cancun Ministerial. The G-20 (not always

[5] Descriptions of these and other groups discussed below are contained in Appendix 1.

Table 7.1: Small Groups Relevant to Agriculture.

Regional Groups	Offensive Coalitions	Defensive Coalitions	Cross-Coalition	Managerial
ACP African Group LDCs G-90	C-4 G-11 Cairns Group (NS) G-20 (S/S)	G-10 G-33 RAMs SVEs	G-4 FIPs G-6 FIPs Plus	Mini-ministerials Green Room "Senior Officials"

Source: Wolfe.

exactly 20) contains many developing countries that were members of the Cairns Group and includes major agricultural players like Brazil, Argentina, India, and South Africa. Kaukab notes that it has become a major player in agricultural negotiations.

Kaukab argues that it would be a serious mistake to think that all developing countries have the same interests. Some have strong interests in opening and liberalizing markets (i.e., many developing country members of the Cairns Group), and therefore focus on reforming the three pillars,especially market access. The G-11, a coalition of Latin American countries, pushes for liberalization of tropical products. Others, he says, have defensive interests in terms of special treatment for developing countries like the G-33. But Kaukab concludes that a majority of developing countries have interests both ways.

Other groups have also formed such as the G-11, rich country importers like Japan, Norway, Switzerland, Korea, and Taiwan, who wanted to protect their right to subsidize their farmers. But this is enough to demonstrate that the political economy of agricultural negotiations has become much more complicated. Wolfe classifies the various groups into five categories – regional, offensive, defensive, cross-coalition, and managerial. His classification is presented in table 7.1.

Wolfe argues that in a group of 150 members, who must make decisions by consensus, coalitions are essential if progress is to be made. He defines two kinds of power that groups seek. One is the power to "block" things the group doesn't want. Here the group can be small. However, the more useful power is the power to "influence" outcomes, and this kind of power requires lots of partners. Given that developing countries now predominate in terms of the number of members, they have the potential to form coalitions that can influence outcomes, not just block things they don't want. Clearly, the developing countries are now in the driver's seat and will demand that any agreement meets their highest priorities. The traditional rich country leaders will have to learn this and live with it before any new WTO agricultural agreement can be forged.

Are the Opponents of Globalization Going to Kill Freer Trade?

A further possible explanation for Doha difficulties is the continuing chorus of anti-globalization, anti-trade rhetoric that comes from many NGOs; most labor unions; any remaining adherents of Marxian/dependence-dominance paradigms, such as Fidel Castro in Cuba; and newly emerging voices of a growing number of developing country leaders, such as Hugo Chavez of Venezuela, who rail against rich country, and particularly US, hegemony. As we all know, economic change/progress creates winners and losers and it is always easier to motivate losers to act collectively. Thus, every government participating in the WTO must deal with strong differences of view at home. High oil prices, negative threats about global warming, loss of forests and biodiversity, imports of contaminated food, and apparent increases in the power of mega-multinational corporations, all feed the fears about opening ones borders and "allowing market forces to determine my destiny." Agriculture, as a producer of an essential ingredient of life, and being made up, in developing countries, of many small, generally poor farmers, obviously becomes a very sensitive topic. In the absence of compelling evidence that developed countries will fully reform, open their borders, and stop subsidizing big farmers, and that this in turn will lead to significant gains for developing countries, will make completing Doha difficult. Clearly, the need for significant concessions is in the developed countries' court.

Are Bilateral and Regional Trade Agreements the Wave of the Future?

Finally, as we are all aware, there has been an explosion in the number of bilateral and regional free trade agreements, both completed and under negotiation. Is this being driven by: 1) fear of global approaches; 2) lack of progress in the Doha round; 3) the belief that more limited liberalization with like-minded neighbors is a safer way to go; Or 4) by the belief by producers of import sensitive products that this approach provides greater possibilities for protecting their interests? We know that sensitive agricultural products are often excluded from bilateral and regional preference schemes. Thus, embattled commodity interests may prefer smaller agreements as the lesser of two evils. Clearly, the willingness of major traders like the United States and the EU to actively pursue these arrangements in recent years has spurred their growth. For whatever reason, the growth has been rapid.

Members of the GATT/WTO are required to notify the GATT/WTO of their entry into a Regional Trading Agreement (RTA). Under WTO definitions, a RTA may be bilateral or plurilateral. In the 44 years of the GATT's existence (1948-1995), it received 124 notifications, of which only 38 remain in force. Since the WTO was formed in 1995, over 240 additional

arrangements have been notified. Every member of WTO except one (Mongolia) is involved in at least one RTA. The rate of notification is accelerating. For example, under GATT it was less than three per year, while in the first ten years of the WTO, it averaged 11 per year, and in the period January 2004 to February 2005, a record 43 were notified. (Crawford and Fiorentino) As of December 2006, the WTO reported that 215 were in force and that by 2010 they estimate close to 400 will have been implemented (WTO 2007f). The whole process is in a state of constant change so these numbers must be seen as approximations only.

The characteristics of RTAs are instructive. Of those in force, under negotiation, and proposed, 96 percent are free trade agreements (FTAs). Seventy-five percent of all RTAs, and almost 90 percent of those under negotiation, are bilateral agreements. An interesting characteristic is that while early RTAs were predominantly regional in nature, a rising number of new proposals are cross-regional. Europe, as a region, is the most heavily engaged. The EU, (known in WTO now as the European Communities (EC)), entered into 17 bilateral RTAs between 1995 and 2005 and Europe, as a region, is projected to average 30-35 RTAs per country/regional association by 2010. The United States, in the early going, was a reluctant participant, signing only four agreements between 2001 and 2005, but recently has switched strategies and is aggressively engaged in negotiations. These statistics and many more interesting tables and maps are contained in an excellent working paper by Crawford and Fiorentino. They do not, however, estimate one number which would be very interesting, namely, the share of world trade conducted under RTAs. It must be growing rapidly.

The bottom line is that as more and more RTAs come into force it puts increased pressure on those not so engaged, to be so. The implications seem clear. In the absence of major progress in the WTO, the rate of proliferation in the number of RTAs seems likely to continue. The complexity is mind-boggling. How many bilateral pairing are possible between potentially 180 WTO members? One hundred and eighty factorial is a big number.

Conclusion

The answer to the question as to why agricultural negotiations are so difficult in Doha is likely a combination of all the possible reasons just discussed and probably more, but the most important new contributing factor is clearly the emerging power of developing countries.

WHAT CAN DEVELOPING COUNTRIES GAIN FROM A DOHA DEAL?

If, as argued in the preceding sections, developing countries are in the driver's seat in WTO, what could they gain from a Doha Agreement? This question has probably had more attention over the past six years than any other. Many papers have been written and many modeling results reported. Bouët, in his wide-ranging paper, compares no less than 16 different general equilibrium modeling efforts since 1999 and reaches some provocative conclusions. First, on balance, they show gains for the aggregate of all developing countries, but these gains are very small as a percentage of GDP. They range from 0.2 to 3.1 percent over the period to 2015 and the most recent estimates show smaller gains. The variation between models in terms of the magnitudes of the gains is huge –15 times difference between the largest and the smallest – and there are also wide differences in the distribution of gains between developed and developing countries and between regions.

Huff, Krivonos, and van der Mensbrugghe compare results of six earlier modeling exercises – three using partial equilibrium approaches, two using general equilibrium, and one using both. Again, results vary significantly in magnitude and in their distribution between developing and developed countries. These findings are consistent with those reviewed by Bouët in that the magnitudes of welfare gains are really quite small. The US Congressional Budget Office has also produced a survey paper on the effects of agricultural trade liberalization which provides further insights.

Bouët spends considerable time trying to uncover why there is so much variability, and why more recent papers produce magnitudes of gain that are consistently smaller than earlier estimates. All exercises are essentially static and therefore cannot capture dynamic effects often attributed to trade liberalization in terms of increasing productivity and increasing the stock of capital. But even if coefficients for growth in productivity are added, the impacts projected seem very small.

No group has done more analysis on these issues than the trade group at the World Bank. Extensive results are published in Anderson and Martin. In a subsequent paper, Martin and Anderson present summary results under the very relevant title for this section of "The Doha Agenda Negotiations on Agriculture: What Could They Deliver?" Using the World Bank's LINKAGE model which builds on version 6 of the GTAP Model (Hertel, McDougall and Itakura), their projection of gains from full global reform is $287 billion per year. Agricultural reform would contribute 63 percent of the gain despite agriculture's small share (seven percent) in global production and trade, demonstrating how heavily distorted

Table 7.2: Benefits of Agricultural Trade Reform under the Three Pillars.

Benefiting Regions	Tariffs	Domestic Subsidies	Export Subsidies	All
Developing Countries	106	2	-8	100%
High-Income Countries	89	6	5	100%
World	93	5	2	100%

Source: Martin and Anderson.

Table 7.3: Potential Global Economic Gains from Liberalization by Sector.

Sector	Percent
Rice	20
Sugar	18
Meats (especially beef)	16
Other grains	11
Oilseeds products	7
Dairy products	5
Other (agriculture and food products)	23
Total	100

Source: Martin and Anderson.

agricultural trade is. Fifty-five percent comes from liberalization in developed countries, "and a still sizeable 45 percent from developing countries (Martin and Anderson p.1211)."

Looking only at developing countries classified as low and middle income by the World Bank, their total gain is $86 billion, which is 0.8 percent of their GDP, compared to the gain of the industrial countries of 0.6 percent of GDP. Further, 63 percent of the developing countries gain comes from agricultural trade liberalization. The authors also look at what components of agricultural liberalization benefit developing countries most. Here, the results are striking and consistent with most other studies. Their results are reproduced in table 7.2.

For developing countries, virtually all of their gains come from improved access/reduced tariffs. Just two percent of their gains comes from domestic subsidy reductions and removing export subsidies, in fact, costs them benefits. This outcome clearly suggests that the primary focus for developing countries should be on access, because reducing rich country subsidies doesn't help them much. This is clearly at variance with much of the rhetoric of the early Doha period that railed against the damage massive rich country subsidies to agriculture did to developing countries. In terms of sectors, the biggest gains are in rice, sugar, and meats, as is shown in table 7.3.

In summary, it appears that developing countries gain a larger percentage increase in their GDP from full liberalization compared to developed

countries and all of the gains come from lower tariffs and better access. But no one in their right mind believes there will be full liberalization either in agricultural or nonagricultural (NAMA) goods trade. Therefore, it is necessary to look at what kind of deals for agriculture are currently under discussion. After that it will be appropriate to come back to Martin and Anderson to see what their model says about the benefits that might result from a possible deal.

WHAT MIGHT BE A MINIMALLY ACCEPTABLE "DEAL?"

What Is on the Table?

First, let us be clear about "what is not" on the table at Doha in terms of agriculture. We are not going back to square one. Everything agreed upon in the URAA is still in place:

- tariffs only, bound at announced levels;
- no nontariff barriers/quantitative restrictions (NTBs/QRs), old or new (although the tariff-rate-quota somehow snuck in);
- no new export subsidies, a cap on existing ones, and limits on expenditures;
- caps on tariff lines and limits on AMS (aggregate measure of support) spending in the amber box;
- Agreement on Trade-related Intellectual Property Rights (TRIPs);
- science-based sanitary and phytosanitary rules (SPS Agreement); and
- a much more robust dispute settlement mechanism that has been tested and works.

In sum, part one of the URAA about getting agriculture under the rules of the WTO and, part two, the agreed upon reductions in the three pillars and the capping of them at the reduced levels, are still there. The Doha Round is about further liberalization of the three pillars – domestic subsidies (AMS), export assistance, and market access.

But let's be honest, the agreed upon reductions in the URAA were not onerous and were open to multiple interpretations and self-definition. Two examples will suffice to indicate why actual liberalization was limited. First, while the URAA provided some general guidelines as to how to tariffy (i.e., convert quantitative and other administrative restrictions on trade to tariff equivalents), countries could exercise a lot of creativeness. The result was that many countries set their bound tariff rates very high and implemented actual tariffs below them, giving them the leeway to raise tariffs and still be WTO legal. The difference between the bound level and the actual is called "tariff overhang" or

"water in the tariff." The result is that if, for example, India has its bound tariff set at 100 percent and its actual tariff is 50 percent, the bound tariff would have to be cut more than 50 percent to have any impact on India's trade. The second example is on the allocation of policies to the domestic support boxes – green (decoupled), amber (distorting/coupled), and blue (direct payments tied to land or historical production, therefore, in theory, decoupled). The way countries notified the WTO as to how they classified their policies has been contentious and some have been tested in dispute settlement cases (i.e., the US Cotton case). So there also was considerable flexibility regarding how a country's AMS commitment was determined. Finally AMS commitments are fixed and how binding they are is reduced by higher commodity prices as for example are US counter cyclical payments.

Current State of Play

This section explores what appears to be the current state of play on the three pillars, relying primarily on the Chairman's Text of 30 April 2007 (WTO 2007a) and his "Second Installment" of 25 May 2007 (WTO 2007b). He identifies several contentious areas where parameters/numbers here will be necessary to define a deal.

Domestic Support The issues here are the number bands of AMS support (apparently three have been agreed upon), their numerical boundaries, and the agreed upon reductions in each band. As these bands are multicommodity averages, there also is an issue of whether there should be commodity-specific caps on support. There is also a proposal to reduce and cap blue box expenditure. This would primarily impact the EC.

Export Assistance The need here is to confirm the elimination of export subsidies, decide whether to keep the target date of 2013, and agree on a revised schedule for phasing in implementation. Under this category, there are also issues of: 1) food aid and as to whether shipping surplus commodities is a form of export subsidy; 2) whether export credits and credit guarantees are export subsidies; and 3) whether State Trading Enterprises embody potential export subsidies. Apparently, little progress has been made on these three.

Market Access All that has been agreed upon in this area is to use a tiered formula with linear cuts to tariffs within each tier, as opposed to using average cuts or a Swiss formula that cuts high tariffs the most. There appears to be an agreement on having four tiers, but what the boundaries would be and how much would be required in terms of cuts is open and views are divergent. So, here the quantitative needs are the

boundaries of the tiers and the magnitude of the reduction for each tier. These are very large issues given the critical importance of market access to developing countries and how much water is in current tariffs.

Special and Differential Treatment for Developing Countries
Here, there are three broad issues. First, should developing countries be required to make lesser reductions, over a longer time period? Remember, in the URAA, the agreement was two-thirds as much as developed countries and over a ten instead of a six year period. The consensus to date appears to be to continue the lesser requirement of two-thirds and the longer time frame.

The second issue is about "sensitive products." These presumably are products that countries somehow define critical to national interests and are therefore sensitive. They likely are the currently highly protected products: rice in Korea, dairy and the feather industries in Canada, dairy and sugar in the US, wheat and rice in India, rice in Bangladesh, etc. The argument is that every country should have a numerical quota of tariff lines that would be subject to lower cuts (or, as some developing countries are arguing, no cuts at all). Apparently, the range of numbers that are on the table is one to five percent of tariff lines eligible. Bear in mind that tariff lines can be broad, or very specific – a country might have 2,000 tariff lines but have 95 percent of the value of its trade in ten lines or less. Thus, if this country were given a one percent special product exemption, it could place more than 95 percent of its trade in the sensitive product category.

The third issue is a new category called "special products", which would be limited to developing countries and would, in the extreme, be exempt from any discipline. This may be something akin to the "Development Box" discussed earlier in the negotiations. Numbers proposed here range from five to 20 percent of tariff lines and so far there appears to be nothing close to any understanding as to how to proceed on this issue. It is clear that for practical purposes, giving any country an exemption of 20 percent of their tariff lines is functionally equivalent to a total exemption. Where this comes out is critical, as will be evident in a minute, because even a small percentage of sensitive and/or special product exemptions drastically reduce trade disciplines and the benefits from liberalization. The whole thing remains a complicated can of worms, which left the Chairman asking if the whole process is fatally complicated.

Table 7.4: Proposed Cuts and Scenarios.

Proposal	Top Tariff Cut %	Sensitive Products %	EU/US AMS Cut %
US	85-90	1	83/60
EU	60	8	70/60
G-20	75	-	80/70
Chairman	70-80	1-5 5-8 (special)	(75-80)/(65-70)
Martin and Anderson	75	0-5	75/75

What Might a Deal Look Like?

Table 7.4 summarizes some of the proposals including those of the US, the EU, the G-20, the Chairman, and Martin and Anderson.

Given the argument that the developing countries are in the driver's seat, let's first look first at the G-20 proposal which is: 1) a 75 percent cut in the top tariff tier; 2) an 80 percent cut for the EU in their AMS; and 3) a 70 percent cut for the US in their AMS. This is very close to the one analyzed by Martin and Anderson, so their results can be used for guidance. They first tested the sensitivity of benefits to the percentage of tariffs lines allowed under sensitive/special products. For example, looking at EU average tariffs, they found that if there are no sensitive products permitted, the average EU tariff would be cut by 40 percent; with one percent of tariff lines permitted as sensitive, the reduction in average tariff is less than 20 percent; and with eight percent of lines exempted, the reduction in the average EU tariff is less than five percent. The bottom line is that even with very low levels of sensitive products exemptions, average tariff cuts are drastically reduced.

Martin and Anderson's overall model results are very interesting. Their first run featured a 75 percent cut to top level tariffs, and the same proportional cut in other tiers, a 75 percent cut in EU and US AMS subsidies and no sensitive products. This produced estimated welfare gains for developed countries of 0.2 percent of GDP (compared to 0.4 percent for full agricultural liberalization) and 0.1 percent of GDP for developing countries (compared to 0.5 percent for full agricultural liberalization). If developed countries are allowed to make smaller cuts of 15 percent on just two percent of their tariff lines, benefits drop to 0.05 percent for developed countries and nothing for developing countries. If developing countries do not get any special advantage and cut the same as developed countries, their GDP rises more than 0.2 percent, while developed countries rise 0.3 percent. The bottom line is that benefits are substantially reduced by the potential deal compared to full liberalization and that further lessening of disciplines for developing countries more than proportionally reduces their benefits. It is thus very clear that if

there are to be large benefits to both developed and developing countries, substantially larger cuts than these will be necessary. One final note is that when Martin and Anderson disaggregate their model results by country, countries such as Thailand and Brazil get significant positive results (almost one percent of GDP for Thailand, over 0.5 percent for Brazil) in terms of benefits, but others, such as Bangladesh and Mexico lose marginally.

But these estimates of benefits are for developing countries on average. What about the poorest, least developed countries, most of whom are net importers of food? Panagariya, among others, has argued that the poorest countries lose from agricultural liberalization. Liberalization would cause world food prices to rise, therefore, net-importing countries would lose. Further, liberalization reduces poor countries' special preferences (preference erosion), such as under the the European Communities' Everything But Arms Program (EBA). Tangermann analyzes the question of developing country benefits and concludes that for each particular country it is an empirical question. Clearly, farmers in poor countries gain from higher prices and, overall, the country may gain from the stimulation of growth by market liberalization. Anderson and Valenzuela argue that if there is full liberalization of all trade and of services, then all developing countries have a positive net gain.

So where does the whole process stand? It seems clear that the G-20 proposal minus high levels of sensitive and special product exemptions is the absolute minimum for generating sufficient benefits to all to have any chance of countries selling the deal in national capitals. It further seems clear that anything less than this will have minimal impact on anything.

CONSEQUENCES FOR NAFTA

So now this chapter moves on to market integration and NAFTA. What are the implications of a minimal "DEAL" versus "NO DEAL" for the NAFTA members?

Consequences of a "Deal" for NAFTA Market Integration

A G-20 type deal would likely have minimal impact on NAFTA. Why? First regarding cuts in AMS, Producer Subsidy Estimate (PSE) levels in NAFTA are already quite low.[6] The 2003-05 average PSE for Canada was 22, 15 for Mexico, and 16 for the US (OECD), so even 60-80 percent cuts in AMS ceilings are not going to bite much, if at all, on Mexico both because

[6] Brink argues that a country's PSE measure usually includes support from a larger set of policies than does the current total AMS. Therefore the PSE number will generally be slightly larger than the AMS.

of the low level of support and because of its developing country status. Martin and Anderson argue that "the United States has relatively less of a buffer from commitment overhang and so would need to reduce actual support under any of the three proposals, most notably under the G-20 proposal for a 70 percent cut." However, rising market prices, and modest changes in the 2002 Farm Bill forced by the cotton case ruling, would not make the impact on US agriculture onerous. The issue for Canada is less clear. Martin and Anderson argue that Canada has sufficient overhang to avoid serious impact. However, since Canada's last WTO notification, Canada's AMS has risen as a result of policy changes to compensate for BSE market impacts and the strong appreciation of the Canadian dollar. Thus, it would be possible with a very small sensitive product exemption that support to the dairy and feather industries could be impacted.

Regarding tariff reductions, the issue would be the impact on tariff preferences within NAFTA vis-à-vis third parties, i.e., preference erosion. In theory, this is a real issue where commodities traded within NAFTA at zero tariffs could see more competition if external tariffs came down, but finding examples is hard. Perhaps US exports of tomato paste to Canada and Mexico would be subject to less protection against Chinese imports, or hot house tomatoes going from Mexico and Canada to the US would be more challenged by Dutch imports, but it is really hard to make the case that a minimal Doha deal would materially alter much in NAFTA regarding agricultural trade.

On the other hand, there would be several positive benefits. First, global tariff reductions are the only potential for real gains if NAFTA tariffs are already low or gone. This is the trade creation benefit. Second, given that the WTO addresses domestic subsidies and export assistance as well as border restrictions, Mexico and Canada may see a Doha Agreement as a benefit by putting further pressure on the United States to limit big subsidies to US farmers. Finally, a positive Doha outcome keeps the trading system in a dynamic movement, however slowly, towards a more freely functioning world market.

Consequences of "No Deal" for Market Integration in NAFTA

Now what are the consequences of "NO DEAL?" First, let's be clear. Not having a Doha Round deal does not mean the end of the WTO. As noted earlier, everything that was in the URAA would still be in place. What would be lost is the opportunity for real reductions in agricultural protectionism. No doubt it would diminish any future prospects for more reduction. Also lost would be the already agreed upon abolition of export subsidies which clearly would have had positive benefits for NAFTA members, but not for NAFTA per se. Further, with no Doha Agreement, and with the Peace Clause expired, one would expect more and more trade

disputes to be approached using the dispute settlement mechanism. This is costly to all parties.

Some have argued that a failure of Doha would increase pressure to broaden RTAs such as NAFTA. Would it, for example, improve the chances of a Free Trade Agreement of the Americas (FTAA) as NAFTA members seek bilateral and regional approaches to reducing trade barriers, even at the cost of greatly increased complexity of trade? This is by no means clear. For countries like Brazil, the absence of further WTO checks on US domestic subsidies would be seen as a barrier to the creation of the FTAA.

But there is a broader cost. Many have argued that trade regimes are never static. If they are not periodically kicked in the direction of liberalization they will inevitably retrogress in the direction of protectionism. It is always easier to organize specific losers or potential losers than to organize broad gainers like consumers who have, after all, benefited the most through lower prices and more buying choices. In the next and concluding section, a few other views on the consequences of failure are presented.

CONCLUDING COMMENTS

This has been a very difficult chapter to write. Preliminary analysis suggested that whatever, if anything, came out of the Doha Round in agriculture would have little impact on NAFTA. Further, no deal at all would similarly have little or no negative impact. So, why spend a lot of time trying to figure out where things are in Doha if, for the specific purpose, it doesn't seem to matter? However, overriding was a deep foreboding that a failure in Doha caused by an agricultural failure would have very severe consequences for the global economy.

Schott observes sagely that "it's fairly easy to classify risks of a failure of the Doha Round, even if it's difficult to quantify the extent of the losses." He lists six costs:

1. loss of welfare gains from new WTO reforms;
2. systematic erosion of the WTO, the "WTO would not implode, but rather, begin a slow descent into oblivion;"
3. increased regionalism;
4. increased protectionism;
5. precipitatation of adverse shocks in financial markets; and
6. opportunity costs to the poorest developing countries of foregone opportunities to use global liberalization as a catalyst for their own liberalization from which they have the most to gain.

"In sum, the costs of failure in the WTO talks would be substantial." Hufbauer and Pischedda consider several possible consequence scenarios of a Doha stalemate:

1. erosion of the world trading system and the rise in protectionism;
2. expanded regionalism on a big scale – Free Trade Area of The Asian Pacific (FTAAP) or Transatlantic Free Trade Area; or
3. proliferation of bilateral trade agreements, possibly including the US-Japan, the EU-Korea, etc.

They present a "Bold Forecast:" the above prospects are so dire that big countries, led by the US, would make some kind of a deal to keep the WTO in the game. To do this the US gets a six-month extension of Trade Promotion Authority.[7]

Where it will come out no one knows. All we know is that the clock has been ticking a long time and the fuse is getting very short.

REFERENCES

Anderson, K. 2006. "Reducing Distortions to Agricultural Incentives: Progress, Pitfalls, and Prospects." American Journal of Agricultural Economics 88:1135-1146.

Anderson, K., and W. Martin, ed. 2006. Agricultural Trade Reform and the Doha Development Agenda. London, Palgrave Macmillan and Washington DC: The World Bank.

Anderson, K., and E. Valenzuala. 2007 "Do Global Trade Distortions Still Harm Developing Country Farmers?" Review of World Economics 143:108-139.

Bouët, A., 2007. "The Expected Benefits of Trade Liberalization on World Income and Development" Working paper, IFPRI, April.

Brink, L. 2007. "Classifying, Measuring and Analyzing WTO Domestic Support in Agriculture: Some Conceptual Distinctions." CATPRN Working Paper 2007-2 April. Available at: <www.catrade.org>.

Broder, D.S. 2007. "Doing what the nation needs." Sacramento Bee, 5 July.

Hufbauer, G. and C. Pischedda. 2007. "After Doha: Evolution or Revolution in the World Trading System?" CATPRN Commissioned Paper CP 2007-1 February. Available at: <www.catrade.org>.

Hertel, T., R. McDougall, and K. Itkatura. 2001. GTAP Model Version 6.0. Center for Global Trade Analysis, Purdue University.

Huff, H.B., E. Krivonos, and D. van der Mensbrugghe. 2007. "Review and Synthesis of Empirical Results of Studies of World Trade Organization Agricultural Trade Reform." In A.F. McCalla and J. Nash, ed. Reforming Agricultural Trade for Developing Countries: vol. 2. Quantifying the Impact of Multilateral Trade Reform. Washington, DC: The World Bank.

Martin, W., and K. Anderson. 2006. "The Doha Agenda Negotiations on Agriculture: Want Could They Deliver?" American Journal of Agricultural Economics 88:1211-1218.

[7] We know to date this has not happened and seems very unlikely as of mid July 2007.

McCalla, A.F. 1993. "Agricultural Trade Liberalization: The Ever-Elusive Grail" American Journal of Agricultural Economics 75:1102-1112.

___. 2003. "Liberalizing Agricultural Trade: Will It Ever Be a Reality?" Journal of Agricultural and Resource Economics 28:419-434.

McCalla, A.F., and J. Nash, eds. 2007. Reforming Agricultural Trade for Developing Countries: vol. 1. Key Issues for a Pro-Development Outcome of the Doha Round. Washington, D. C.: The World Bank.

OECD. 2006. Agricultural Policies in OECD Countries at a Glance. Paris: OECD Publishing.

Panagariya, W., 2005. "Agricultural Liberalization and the Least Developed Countries: Six Fallacies." World Economy 27:1149-71.

Schott, J., 2006. "Completing the Doha Round." Policy Brief in International Economics #PB06-7. Institute of International Economics Washington, D.C. October, pp 1-8.

Tangermann, S., 2005. "OECD Agricultural Policies and the Interests of Developing Countries." American Journal of Agricultural Economics 87: 1128-44.

The Economist. 2007. "Mangling Trade." 28 June.

US Congress, Congressional Budget Office. 2005. The Effects of Liberalizing World Agricultural Trade: A Survey. Washington, DC: CBO Paper, December.

Weisman, S.R. 2007. "Bush and Democrats in Accord on Trade Deals." New York Times May 11.

Wolfe, R., 2006. "New Groups in the WTO Agricultural Trade Negotiations: Power, Learning and Institutional Design," CATPRN Commissioned Paper CP 2006-2 May. Available at: <www.catrade.org>.

World Trade Organization (WTO). 2003. "Day 4: As Ministers Comment on New Draft, Chairperson Warns of Dangers of Failure" Available at: <http://www.wto.org/english/thewto_e/minist_e/min03_e/min03_13sept_e.htm>. Accessed 21 May 2007.

___. 2005. "Ministerial Declaration" Available at: <www.wto.org/english/thewto_e/minist_e/min05_e/final_text_e.htm>. Accessed 19 May 2007.

___. 2006. "DG Lamy: Time Out Needed to Review Options and Positions." Available at: <www.wto.org/English/thewto_e/minist_e/min03_emin03_e.htm>. Accessed 18 May 2007.

___. 2007a. "Communication from the Chairman of the Committee on Agriculture, Special Session." Available at: <www.wto.org/english/tratop_e/agric_e/chair_texts07_e.htm>. Accessed 20 May 2007.

___. 2007b. "Communication from the Chairman of the Committee on Agriculture, Special Session – Second Installment" Available at: <http://www.wto.org/english/tratop_e/agric_e/chair_texts07_e.htm>.Aaccessed 11 June 2007

___. 2007c. "Farm talks chair sees real negotiation in comments on text." Available at: <www.wto.org/English/news/_e/archive_e/agng_arc_e.htm>. Accessed 18 May 2007.

___. 2007d. "Lamy Warns Failure Would Mean 'Breaking the Commitment for a More Developing-Friendly World Trading System.'" Available at: <www.wto.org/english/news_e/news07_e/gc_chair_tnc_9may07_e.htm>. Accessed 18 May 2007.

___. 2007e "Lamy: "We Have Resumed Negotiations Fully Across the Board." Available at: <www.wto.org/English/news_e/news07_e/gc_dg_stat_7feb07_e.htm>. Accessed 18 May 2007.

___. 2007f. "Regional Trade Agreements (RTAs) Have Become in Recent Years a Very Prominent Feature of the Multilateral Trading System (MTS)." Available at: <www.wto.org/English/tratop_e/region_e/region_e.htm>. Accessed 22 May 2007.

___. 2007g Understanding the WTO: The Organization "Membership, Alliances and Bureaucracy." Available at: <www.wto.org/English/thewto_e/whatis_e/tif_e/org3_e.htm.> Accessed 20 May 2007.

___. 2007h. Understanding the WTO: The Organization "The WTO is 'member-driven', with decisions taken by consensus among all member governments." Alternative View, Available at: <www.wto.org/English/thewto_e?whatis_e/tif_e/org1_e.htm>. Accessed 20 May 2007.

APPENDIX

Appendix: Glossary of WTO Groups Relevant to Agriculture.

Name (date formed)	Description	Membership
ACP	Group of 77 African, Caribbean and Pacific countries (56 WTO members) with preferential trading relations with the EU.	Angola, Antigua and Barbuda, Barbados, Belize, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Cote d'Ivoire, Cuba, Democratic Republic of the Congo, Djibouti, Dominica, Dominican Republic, Fiji, Gabon, The Gambia, Ghana, Grenada, Guinea, Guinea-Bissau, Guyana, Haiti, Jamaica, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Papua New Guinea, Rwanda, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Senegal, Sierra Leone, Solomon Islands, South Africa, Suriname, Swaziland, Tanzania, Togo, Trinidad and Tobago, Uganda, Zambia, Zimbabwe
African Group	Holds joint positions in many negotiating issues.	All African Union countries who are also WTO members, currently 41 countries
Cairns Group (1986)	Group of agricultural exporting nations lobbying for agricultural trade liberalization.	Argentina, Australia, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Guatemala, Indonesia, Malaysia, New Zealand, Pakistan, Paraguay, Philippines, South Africa, Thailand, Uruguay
C-4 (2003)	"Cotton Four" group of countries with specific interest in cotton.	Benin, Burkina Faso, Chad, Mali
FIPs (2004)	Five interested parties	Australia, Brazil, EU, India, USA
FIPs plus (2005)	FIPS plus friends	FIPs plus Argentina, Canada, China, Japan, New Zealand, Switzerland
G-4 (2005)		FIPs less Australia
G-4 plus Japan (2005)		G-4 plus Japan
G-6 (2005)		FIPs plus Japan
G-10 (2003)	Importers. Multi-functionality of agriculture and need for high levels of domestic support and protection	Chinese Taipei, Republic of Korea, Iceland, Israel, Japan, Liechtenstein, Mauritius, Norway, Switzerland
G-11 (2005)	Full liberalization in tropical products	Bolivia, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Panama, Peru, Nicaragua, Venezuela
G-20 (2003)	Elimination of export subsidies and domestic support and liberalization of market access in agriculture	Argentina, Bolivia, Brazil, Chile, China, Cuba, Egypt, Guatemala, India, Indonesia, Mexico, Nigeria, Pakistan, Paraguay, Philippines, South Africa, Thailand, Tanzania, Uruguay, Venezuela, Zimbabwe
G-33 (2003)	Developing country importers.	Antigua and Barbuda, Barbados, Belize, Benin, Botswana, China, Congo, Cote d'Ivoire, Cuba, Dominican

Appendix (continued): Glossary of WTO Groups Relevant to Agriculture.

	Differentiated treatment of developing countries on basis of food security, sustainable livelihoods and rural development needs-Special Products and Special Safeguard Mechanisms	Republic, Grenada, Guyana, Haiti, Honduras, India, Indonesia, Jamaica, Kenya, Republic of Korea, Mauritius, Madagascar, Mongolia, Mozambique, Nicaragua, Nigeria, Pakistan, Panama, Peru, Philippines, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Senegal, Sri Lanka, Suriname, Tanzania, Trinidad and Tobago, Turkey, Uganda, Venezuela,
G-90 (2003)	Coalition of African, ACP and least-developed countries (currently 64 members of the WTO)	African Group, ACP, LDCs
Mini-ministerial	Regular participants at mini-ministerials in 2005.[1]	Argentina, Australia, Bangladesh, Benin, Brazil, Canada, Chile, China, Costa Rica, Egypt, EU, Hong Kong (China), India, Indonesia, Jamaica, Japan, Kenya, Korea, Malaysia, Mexico, New Zealand, Nigeria, Norway, Pakistan, Rwanda, Singapore, South Africa, Switzerland, Thailand, USA, Zambia
LDCs	Least developed countries according to the UN definition (currently 32 members)	Angola, Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Democratic Republic of the Congo, Djibouti, Gambia, Guinea, Guinea Bissau, Haiti, Lesotho, Madagascar, Malawi, Maldives, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Senegal, Sierra Leone, Solomon Islands, Tanzania, Togo Uganda, Zambia
Quint (1989)		Australia, Canada, EU, Japan, USA
RAMs	Recently acceded members	Albania, Croatia, Georgia, Jordan, Moldova, Oman
Senior Officials	Regular participants at meetings of senior officials in 2005	Australia, Brazil, Canada, China, Egypt, Hong Kong (China), India, Japan, Kenya, Malaysia, South Africa, USA, Zambia
Senior Officials	New group in 2006	G-6 (Australia, Brazil, EU, India, Japan, USA) plus Canada, Egypt, Malaysia, Norway
SVEs (2003)	Small and vulnerable economies	Antigua and Barbuda, Barbados, Belize, Bolivia, Cuba, Dominica, Dominican Republic, El Salvador, Fiji, Grenada, Guatemala, Guyana, Honduras, Jamaica, Mauritius, Mongolia, Nicaragua, Paraguay, Papua New Guinea, Solomon Islands, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago

[1] For an analysis of the principles of selection, see Wolfe.

Doha Development Round Agricultural Negotiations

Gloria Abraham

INTRODUCTION

The multilateral trading system has been bolstered since the conclusion of the Uruguay Round with the inclusion of agriculture, services, and intellectual property in its disciplines. The challenge undertaken in the current multilateral trade negotiations, better known as the Doha Development Round, has been dealing with a very ambitious agenda that will "allow for more equitable global distribution of the welfare gains of free trade, which, until now, have mainly benefited developed countries" (WTO 2001).

The opening of trade brings many benefits with it and, in the case of agriculture the greatest benefit is enhanced access to markets, because it provides consumers with cheaper products, while encouraging more efficient use of national resources. However, in the opening of markets, countries need to amend their domestic policies to phase out some policies that distort international markets.

The current negotiating process is extremely ambitious in that it establishes development as the central issue in the adoption of disciplines. This has led to countless disagreements and hindered the progress of the talks by adding a further dimension of complexity. Nonetheless, recent events have been encouraging and there are signs that the dialog will recommence.

The risks associated with another breakdown in the talks are many and diverse. Of particular concern is the potential loss of credibility of the multilateral trading system, which could lead to an intensification

of treasury wars, with dire consequences for world trade, especially in developing nations.

The intention of this chapter is to give a brief description of the evolution of the Doha Development Round, from its beginnings in 2001 to the current situation in the negotiations, which as of June 2007 are now recommencing after a period of crisis. We will also be analyzing scenarios that may arise in the immediate future and their implications for market integration.

THE NEGOTIATION PROCESS: FROM DOHA 2001 TO GENEVA 2006

The Doha Development Round was launched in Qatar in December 2001 in the aftermath of the terrorist attacks on the United States, which is why certain observers viewed the Ministerial Declaration, which marked the beginning of a new negotiating period for the WTO, as nonviable. However, not only was a negotiating mandate achieved, but for the first time, the agenda of this multilateral organization for the regulation of world trade included a series of provisions to address the development concerns expressed by WTO developing member countries.[1]

In the Doha Declaration, WTO Member Countries committed themselves to holding negotiations that would "allow for more equitable global distribution of the welfare gains of free trade, which, until now, have mainly benefited developed countries" (WTO 2001). This commitment and the objectives of the Doha Round highlight a concern for development previously absent from the GATT agenda.

The objectives of the Doha Development Round can be summed up as follows:

1. to proceed with the reform process and the liberalization of trade policies;
2. to ensure that international trade plays an important role in the promotion of development and the alleviation of poverty;
3. to make a concerted effort to see that developing countries, particularly least developed nations, share in the growth of international trade;
4. to promote greater and more beneficial integration of least developed countries into the multilateral trading system and the global economy;

[1] It should be noted that, during the reform period initiated once the WTO came into force, the countries embarked on an intense information exchanging process. Likewise, the various coalitions formed by developing nations that are members of the WTO participated actively in the Doha Round.

5. to work in conjunction with the Breton Woods institutions with a view to drawing up a more coherent global economic policy; and
6. to make a commitment to sustainable development.

Negotiations on agriculture commenced at the beginning of 2000, pursuant to article 20 of the WTO Agriculture Agreement on the continuation of the reform process as follows:

> Recognizing that achieving the long-term objectives of substantial and progressive reductions in support and subsidies that translate into a fundamental reform is a continuous process, the members agree that negotiations on the continuance of this process should commence one year before the end of the implementation period, taking into account:
>
> a) Experience gained up to this date in the implementation of commitments to reduce support and subsidies;
> b) The effect of commitments to reduce support and subsidies on international trade in the agricultural sector;
> c) The non-trade related concerns and special and differential treatment of developing countries and the objective of establishing an equitable, market-oriented commodities trading system, in addition to the other objectives and concerns mentioned in the Preamble to this Agreement;
> d) That new commitments are required to achieve the aforementioned long-term objectives (WTO 1994a).

By November 2001, when the Doha Ministerial Conference was held, 121 governments had already submitted numerous negotiating proposals. These negotiations will continue, under the framework of the mandate set forward in paragraphs 13 and 14 of the Doha Declaration, which also included a series of negotiating deadlines. The Declaration builds on the work already undertaken, confirms and elaborates on the objectives, and sets a negotiating timetable.

The Doha Declaration includes key deadlines for:

- The submission of formulas and other "modalities" for the commitments undertaken by member countries: by 31 March 2003 at the latest.
- Global commitment projects: by the Fifth Ministerial Conference held on 10-14 September 2003 in Cancún, Mexico.

- Balance:[2] by the Fifth Ministerial Conference held on 10-14 September 2003 in Cancún, Mexico.
- Deadline for conclusion: not later than 1 January 2005, as part of the single undertaking.

It should be noted that none of the Doha negotiation deadlines have been met due to differences in the viewpoints of Member Countries. Agriculture currently forms part of the so-called "single undertaking," in which virtually all of the linked negotiations were to end by 1 January 2005, a deadline that was extra-officially pushed back, first to the end of 2006 and then to 2007.

The Doha Declaration confirms the long-term objective already stipulated in the current Agriculture Agreement: "establish an equitable, market-oriented trading system through a program of fundamental reform" (WTO 1994a). The program encompasses strengthened rules and specific commitments on government support and protection for agriculture. Its aim is to correct and prevent restrictions and distortions in world agriculture markets.

During this process and based on the pillars of the Agriculture Agreement, member governments commit themselves to comprehensive negotiations aimed at:

1. market access: substantial improvements;
2. export subsidies: reductions of, with a view to phasing out, all forms of these;[3] and
3. domestic support: substantial reductions in support that distorts trade.[4]

Likewise, the Declaration makes special and differential treatment for developing countries integral throughout the negotiations, both in countries' new commitments and in any relevant new or revised rules and disciplines. It says the outcome should be effective in practice and should enable developing countries to meet their needs, particularly in the areas of food security and rural development.

[2] The Fifth Session of the Ministerial Conference was to take stock of progress in the negotiations, provide any necessary political guidance, and take decisions as necessary (WTO 2001).

[3] The July framework agreement of 2004 established a more precise mandate, while the Hong Kong Declaration of December 2005 provided for the complete elimination of all forms of export subsidies by the year 2013 (WTO 2004, 2005).

[4] As part of the WTO July framework agreement of 2004, developing countries agreed to reduce domestic subsidies that distort trade by 20 percent, as soon as the negotiated agreement comes into force.

The ministers also took note of nontrade concerns (such as environmental protection, food security, rural development, etc.) reflected in the negotiating proposals already submitted, and confirmed that the negotiations will take these into account, as provided for in the Agriculture Agreement.

Since the beginning of the negotiating process in December 2001, progress has been slow, which has created frustration, especially among developing member countries. At this point, it should be mentioned that in the process of mutual gain that takes place under the framework of multilateral negotiations, the functioning of the WTO allows for and encourages the formation of coalitions among nations that share the same interests. The most relevant actors in the Doha process that largely determine the outcome are: the European Union, whose 25 members negotiate with one voice and form the first world trade bloc; the United States, which, until the Uruguay Round, tended to lead the multilateral negotiations and whose interests generally coincide with those of the European Union, Japan and other developed nations, and, finally, the G-20, a bloc created at the Cancún Summit that includes the major developing countries with large export and domestic markets. This bloc is spearheaded by Brazil, India, and China.[5] The cohesion of the G-20 bloc undermined the leadership of the Cairns Group,[6] formed by developed countries and developing nations that export agricultural products, who played a major role in the Uruguay Round negotiations.

Also deserving of mention is the G-90, a group of 49 members classified as least-developed countries and another 40 poor nations, mainly in Africa and East Asia. There is another bloc known as the G-33,[7] comprised of 46 countries that have played an important role in the negotiating process, particularly at the Hong Kong Ministerial Summit.

Throughout the negotiation process, several Ministerial Conferences have been held in line with the negotiation deadlines. These conferences are the supreme body of the WTO, responsible for the adoption of decisions

[5] The G-20 emerged as a result of the Cancún Ministerial Meeting and has sustained an extremely aggressive stance in the negotiating process. Its members are: Argentina, Bolivia, Brazil, Chile, China, Cuba, Egypt, Philippines, Guatemala, India, Indonesia, Mexico, Nigeria, Pakistan, Paraguay, South Africa, Tanzania, Thailand, Uruguay, Venezuela, and Zimbabwe.

[6] Member countries of the Cairns Group include Argentina, Australia, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Philippines, Guatemala, Indonesia, Malaysia, New Zealand, Paraguay; Peru, South Africa, Thailand, and Uruguay.

[7] The G-33 is comprised of Antigua and Barbuda, Barbados, Belize, Benin, Bolivia, Botswana, China, Congo, Korea, Ivory Coast, Cuba, Dominica, El Salvador, Philippines, Grenada, Guatemala, Guyana, Haiti, Honduras, India, Indonesia, Jamaica, Kenya, Madagascar, Mauricio, Mongolia, Mozambique, Nicaragua, Nigeria, Pakistan, Panama, Peru, Dominican Republic, St. Kitts and Nevis; St. Lucia, San Vicente and the Grenadines, Senegal, Sri Lanka, Suriname, Tanzania, Trinidad and Tobago, Turkey, Uganda, Venezuela, Zambia, and Zimbabwe.

and the drawing up of the organization's policies, and must be convened at least once every two years.

The Fifth Ministerial Conference of the WTO was held in Cancún, Mexico on 10-14 September 2003. The main task of this meeting was to weigh the progress made in the negotiations and other work within the framework of the Doha Development Program. However, the meeting bore little fruit due to a disagreement on the pillars of the Agriculture Agreement, including a reduction in cotton subsidies, while the "Singapore issues"[8] resulted in a stalemate. The G-20 played a relevant role in this process.

When the Ministerial Conference of September 2003 ended in a deadlock, WTO members in Geneva resumed efforts to get the negotiations and the rest of the work program back on track. These efforts were stepped up in the first half of 2004, with the objective of reaching a consensus on a package of framework agreements and, at the end of July, the so-called "July Package" was adopted as a basis for the establishment of binding commitment modalities in the agricultural sector. Consensus on a rapprochement of standpoints vis-à-vis the three pillars of the Agriculture Agreement allowed negotiations to resume.

The most significant outcomes of the so-called "July Package" included changes to market access, export competition, and domestic support, each of which are discussed in turn.

Market Access

Substantial progress was called for on the rules governing market access, which must be applied to all agricultural products. A category of sensitive products subject to differentiated treatment was included and member countries were given the flexibility to designate these without defining tariff line percentages. A tiered formula for structuring tariff cuts that provided for greater reductions in the highest overall tariffs was introduced. Developing members demanded proportionality measured in relation to the results of tariff cuts, while developed countries argued that proportionality should be reflected in the components of the reduction formula and not necessarily the outcome. The definition of tariff reduction percentages was left to the second phase of the negotiations, as was the definition of the percentage of sensitive products that each member could designate.

[8] The Singapore issues were: investment, trade facilitation, competition policy, and transparency in government procurement. At the Singapore Ministerial Conference, it was stated that these issues should be included in the next trade negotiations round, but the only issue incorporated in the Doha Round was trade facilitation.

On the issue of special and differentiated treatment, the July Package established lower tariff cuts and longer implementation periods for developing countries. It also stated that developing countries could designate an undefined number of products to be classed as special products and that a special agricultural safeguard mechanism was to be developed for use by developing countries. Regarding article 5 of the Agriculture Agreement, the current clause provides for the use of a special agricultural safeguard by all Member Countries, but the text of the July agreement takes no position on its retention.

Export Competition

A commitment was established for the elimination of export subsidies and the definition of procedures and rules for food aid, state trading enterprises, and export credits.

Domestic Support

A commitment was undertaken to achieve substantial reductions in all trade-distorting support, bearing in mind the following criteria:

- countries with the highest levels of trade-distorting domestic support will be subject to higher reductions;
- the setting of limits on specific products that receive benefits included in the Aggregate Measure of Support (AMS);
- a reduction in permitted *de minimis* levels, with special and differentiated treatment for developing countries;
- the introduction of limits on blue box subsidies (five percent of the value of production in the case of developed countries and ten percent in the case of developing countries); and
- the sum of blue and amber box plus *de minimis* support will be reduced by 20 percent during the first year of implementation of the new reduction commitments.

Clearly the July Package achieved a degree of conceptual consensus that facilitated the negotiating process. Divisive issues, such as tariff reduction coefficients, the process of disciplining domestic support and deadlines for compliance were left to a later phase of the negotiations.

The Sixth Ministerial Conference of the WTO was held in Hong Kong, China, on 13-18 December 2005, where the progress achieved during the year and a half since the Geneva Meeting was assessed. While the results can be judged minimal, the final declaration (WTO 2005) encompassed agreements reached on a series of issues, indicating that differences between the members were being smoothed over. More importantly, it

pointed to a way forward and a possible consensus in the negotiations. At this meeting, a new negotiating timetable for 2006 was agreed on and the members decided to conclude the negotiations by the end of that year at the very latest. By then, the initial deadline of 1 January 2005 had expired.

Based on a paper by Chibbaro, the main outcomes and debates that took place at the Hong Kong meeting can be summed up for the three pillars of reform as follows.

Market Access

Four bands were established for the structuring of tariff cuts, but no agreement was reached on thresholds. Special and differential treatment was permitted, with different bands being established for developed and developing countries. One of the modalities yet to be defined was the tariff reduction formula. The G-20 and the United States proposed the same thresholds, except that the latter did not take into account special and differential treatment. The European Union's proposal differed from that of the G-20 in that it established broader intervals for developed nations. The European Union and G-20 proposed a ceiling on tariffs of 100 percent for developed countries and of 150 percent for developing countries, while the United States proposed an upper limit of 75 percent.

As regards sensitive products, the majority of proposals provided for one percent of tariff lines to be included in this category, with the exception of the European Union, which requested eight percent. No agreement was reached on this issue.

Developing member countries were to be given the flexibility to self-designate an appropriate number of tariff lines as special products, based on food security, livelihood security and rural development criteria, although no further specifications were made.

It was agreed that tariff-rate-quotas should remain in place, but opinions differed as to their utilization: the G-20 and the United States proposed an increase based on consumption, while the European Union suggested using historic imports as a base.

As for the special agricultural safeguard mechanism, the Hong Kong Ministerial Declaration states that higher safeguard duties can be triggered automatically when import volumes rise above a certain level, or if prices fall below a certain level. However, it was not stipulated whether the coverage of this mechanism would be limited or if it would apply to

all products. The proposal provided for the triggering of the safeguard in the year in which it could be implemented.

In the case of safeguards triggered by import volumes, it remains to be decided whether the calculation will be, based on imports themselves or in relation to consumption levels, what the reference period will be and what the base period will be. In the case of safeguards triggered by a drop in prices, the central issue was the price variation level under which it would be appropriate for the mechanism to be employed. Several proposals were put forward, but no consensus was reached.

Export Competition

It was agreed that export subsidies would be eliminated by the end of 2013. With respect to disciplines on export credit programs and credit guarantees, the proposed reforms call for maxiumum repayment periods of no more than 180 days. As well, the programs are to be self-financing in the sense that insurance premiums are to be set so that they cover the operating costs and program losses over a five-year time frame. There are special and differential treatment provisions under which developing countries would have longer phase-in periods to implement the proposed disciplines, and the repayment of loans for the acquisition of basic foodstuffs by the least developed and net food importing countries could extend beyond one year.

On food aid, commitment to maintaining an adequate level and to take the interests of food aid recipient countries into account was reconfirmed. To this end, a "safe box" for *bona fide* food aid was provided for to ensure that there was no unintended impediment to dealing with emergency situations. Beyond that, it was agreed that commercial displacement should be eliminated and that effective modalities should be established for this purpose.

Disciplines on export credits, export credit guarantees or insurance programs, exporting state trading enterprises, and food aid were to be agreed upon by 30 April 2006 as part of the modalities, but this deadline was not met.

Domestic Support

The agreement adopted in Hong Kong provided for the establishment of three bands for reductions in the final bound total AMS and in the overall cut in trade-distorting domestic support, with larger linear cuts in higher bands. The member with the highest level of permitted support – the European Union – would be in the top band; the two members with

the second – and third-highest levels of support – the United States and Japan, respectively – would be in the middle band and all other members would be in the bottom band. The need to develop disciplines to achieve effective cuts in trade-distorting domestic support was also discussed.

The overall reduction in trade-distorting domestic support would still need to be made, even if the sum of the reductions in the final bound total AMS, *de minimis*, and blue box payments, were otherwise less than the overall reduction. The idea here was to avoid displacements from one box to another. Developing country members with no AMS commitments would be exempt from reductions in *de minimis* and the overall cut in trade-distorting domestic support.

The Hong Kong Agreement stipulated that modalities for all three pillars should be established prior to 30 April 2006 and that a schedule of commitments should be submitted before 31 July of that same year. To date, no agreement has been reached.

In keeping with the deadlines set forth in the 2006 calendar, ministers and delegation heads met in Geneva in July of that year to lay the groundwork for the final text of the Doha Round. However, the negotiating platforms of the main actors, known as the G-6,[9] were particularly inflexible on the issues of agriculture and nonagricultural market access (NAMA) and resulted in the collapse of the meeting. The chances of reaching a minimum consensus seemed remote and it was under these bleak circumstances that the Director General of the WTO announced the indefinite suspension of negotiations, marking the beginning of a period of reflection.

THE SUSPENSION OF NEGOTIATIONS

The "sole agreement" system, which implies that nothing has been negotiated until everything on the agenda has been negotiated, was adopted for the Uruguay Round negotiations. According to this provision, the agreements reached between 2001 and the Hong Kong Ministerial Summit are not valid until the entire Round of negotiations is concluded.

Whereas under the GATT system a handful of developed countries would reach agreements among themselves and extend these to other nations, generally in the form of special and differential treatment for developing countries, the WTO system ensures that its rules are applicable to all Member Countries and that its decisions are legitimate because they are

[9] The G-6 is comprised of Australia, Brazil, the United States, India, Japan, and the European Union.

agreed on during a negotiating process that includes both developed and developing nations.

There are significant differences of opinion on issues that make up the so-called "negotiating triangle" – access to agricultural markets, domestic subsidies, and access to markets for industrial products – and it is these issues that have impeded consensus on a draft of the final package. Consequently, what we have seen during the negotiating process is a confrontation between developed and developing countries on core issues and, as such, the blame for the Doha Round crisis falls equally on the shoulders of all members, both developed and developing.

The G-6 proved to have an internal conflict of interest and assumed an offensive position on certain issues and a defensive one on many others. Multilateral negotiations between such different countries are never straightforward, while the ambitious scope of the negotiating agenda in such a short period of time only served to exacerbate the problem.

The impasse in the negotiations pivoted around the "triangle" issues of access to agricultural markets, domestic subsidies, and nonagricultural market access (NAMA). Each of these is now discussed in more detail.

Access to Agricultural Markets

Pressure is on the European Union, Japan, and India. The European Union and Japan are being asked to make deeper tariff cuts. Brazil is asking for a reduction of 54 percent, the United States 66 percent, and Australia 60 percent. They are also being asked to reduce their list of sensitive products[10] that would not be subject to normal tariff cuts to less than eight percent of tariff lines. Likewise, the European Union is asking India to reduce its list of special products[11] to less than 20 percent of tariff lines. These tariff line percentages would allow the European Union, India, and Japan to restrict the majority of agricultural imports.

[10] In the July Package of 2004, it was agreed that every Member Country could designate sensitive products, the number of which was to be negotiated. These products would face lower tariff cuts in return for improved market access via tariff rate quotas (WTO 2004). Positions currently vary between one and 15 percent of tariff lines.

[11] The July Package stipulates that developing Member Countries may designate special products, the number of which was not specified and has yet to be negotiated, while the Hong Kong Ministerial Declaration (WTO 2005) clarifies that: 1) each developing member country may self-designate special products; 2) that an "appropriate number of products" may be designated special products; and 3) that these products will be selected based on indicators and food security, livelihood security, and rural development criteria. But translating these guidelines into practical modalities has not proven an easy task.

Domestic Subsidies

On this issue, pressure is on the United States, which is being asked to reduce domestic support linked to production and prices from its $19 billion ceiling to ten to $12 billion. In its proposal submitted in October 2005, the United States offered to restrict these payments to $22 billion, which would imply an increase in current payment levels. The European Union, Australia, Brazil, and India are pressuring the United States to make more substantial reductions.

Another controversial issue is the selection of base years. The original proposal suggests using the 1995-2000 period, but the United States is proposing 1999-2001, a period in which US spending on domestic support programs was higher. This would give the United States consolidation levels much higher than the reductions demanded of other countries.

Nonagricultural Market Access

The European Union, the United States, and Japan are asking countries like Brazil, India, and several of their negotiating allies to reduce tariffs to less than 15-20 percent, which would imply cuts of about 60 percent in their bound tariffs. It is in the interests of many developing member countries to strengthen south-south trade with nations that have potentially large markets. However, both Brazil and India find this proposal inadmissible and argue that reducing tariffs on industrial products using the same reduction coefficient used by all other countries would require them to make greater cuts, because they have higher levels of protection.

It is plain that the G-6 members were insistent in their demands for other countries to open up their markets, but were not so willing to open up their own, and this was one of the reasons for the breakdown in trade negotiations. Moreover, the "sole agreement of understanding" concept, which states that nothing is negotiated until everything is negotiated, means that the agreements reached and progress made since 2001, not just in agriculture and industrial products, but in other areas, have been jeopardized by the suspension of the negotiations.

The following are some of the agreements that could go to waste if the negotiating process is not resumed:

1. the total elimination of export subsidies in the agricultural sector by 2013, which was accepted by the European Union and the United States in the Hong Kong Ministerial Declaration of 2005;
2. a substantial reduction in domestic support for agriculture;

3. a significant improvement in access to markets for agricultural, industrial, and service-sector products;
4. facilitation of trade, which would expedite customs flows and formalities for merchandise in transit and reduce costs;
5. the commitment to grant tariff and duty-free market access to least developed countries;
6. "Aid for Trade" programs for developing countries;
7. the tightening of antidumping regulations to ensure that these are not used for protectionist purposes and rules on fishing subsidies; and
8. the strengthening of the Dispute Settlement Understanding.

Nonetheless, it should be pointed out that developing countries have more at stake in this process, because they are the ones who stand to lose most if attempts to strengthen the multilateral trading system fail.

The situation of countries that have not yet managed to open their markets using bilateral or regional free-trade agreements is more complex, because these nations depend on the multilateral system to gain market access through the Most-Favored-Nation Clause (WTO 1994b).

Finally, there is the risk of a general loss of confidence in the multilateral trading system if the negotiations are not brought to a satisfactory conclusion. Since the creation of the WTO in 1995, there has been the perception that the organization and its agreements benefit mainly developed countries. Consequently, in order for the WTO to consolidate its reputation as a preeminent international economic institution, the Doha Development Round needs to be brought to a close with an agreement that satisfies both developed and developing member countries.

Vitally important to the WTO negotiating schedule is the expiration this June of the US President's Congressional Trade Promotion Authority (TPA). At the moment, it is unlikely a final text will be submitted to Congress in compliance with the established deadline. And since the United States will be holding presidential elections in 2008, there is no way of knowing whether Congress will grant the TPA again so trade negotiations can continue with the certainty that the US has TPA in place. This issue constitutes one of the greatest concerns for the continuation of the negotiations, with some observers pointing out that TPA was initially granted by a small majority and it is not likely to be granted again, especially in the current situation, where protectionist interests predominate.

The impasse in the negotiations and the limitations set by established deadlines lead us to predict that an agreement as ambitious as that of the Uruguay Round negotiations will not be achieved. Negotiations on

"triangle" (domestic support, market access, and NAMA) issues are expected to be concluded in the coming months, but this leaves little time to calculate and revise tariff reductions for all goods, especially those that require special treatment, and even less time to address the other issues on the agenda.

IMPACT OF THE CRISIS

The crisis in the negotiating process has a major impact on several levels. On a global level, we can talk of the lost economic welfare derived from the liberalization of multilateral trade, which, according to OECD estimates, would be in the region of $44 billion a year, derived mainly from the opening of agricultural markets (OECD). A more severe, long-term impact of the crisis is the threat it poses to the credibility and legitimacy of the WTO. Other potential effects of the negotiating crisis include a potential increase in the number of trade disputes, an increase in the number of regional trade agreements, elimination of preferential treatment for developing countries, increased opposition within the WTO to preferential trade practices, and loss of momentum for domestic policy reforms. Each of these is now discussed briefly.

Trade Disputes

Failure of the Doha Round likely will result in an increase in the number of trade disputes. Many countries do not currently resort to WTO panels, as they are confident that the opening of trade will solve some of their present problems. However, if the Doha Round negotiations do not produce results in the near future, these countries are likely to turn to the dispute settlement system.

In this respect, we should also mention the extinction of the Peace Clause set forth in Article 13 of the Agriculture Agreement, which calls for "due restraint" in the filing of disputes against export subsidies and domestic support within the individual countries' reduction commitments.

Furthermore, the United States lost the dispute over domestic support for cotton farmers filed against it by Brazil and must now make corrections to several programs included in the 2002 Farm Bill. This sets a precedent for countries that feel adversely affected by US domestic support to file complaints against similar programs that benefit other basic products protected under US legislation.

Regional Trade Agreements

There will be an increasing tendency for countries to enter into bilateral and plurilateral free trade agreements. Just as we saw with the extension of the Uruguay Round negotiations in the early nineties, many countries that aren't seeing an increase in their concessions within the multilateral framework will embark on a race to enter into bilateral trade agreements with the United States and the European Union in a bid to gain access to markets that they haven't been able to tap into via the Most-Favored-Nation Clause.

Under such circumstances, Asia will most likely gain ground over Latin America. Australia recently declared an interest in negotiating a free-trade agreement with Asia and the South Pacific. In this context, countries that haven't signed free-trade agreements, like Brazil and Argentina, will be most affected. This is not, however, the case for Mexico and Chile, which enjoy preferential access to many markets and will find it easier to negotiate mutual concessions.

Preferential Trade Agreements

Another significant consequence of the failure of these negotiations is that developed countries will probably step up efforts to eliminate the preferential treatment they unilaterally grant to some developing countries. The current trend in the United States and Europe is to negotiate reciprocal obligations to open up markets rather than to grant unilateral preferential treatment to select countries.

In this respect, the United States Trade Representative has announced the second phase in the review of its Generalized System of Preferences (GSP) program, under which the United States grants preferential treatment to imports from certain developing countries (USTR). Brazil, India, Indonesia, Philippines, and South Africa are a few of the countries that may not be granted continued preferential treatment and will most likely seek out bilateral talks when faced with the prospect of losing preferential market access under unilateral agreements. One of the reasons for this is that the United States does not want to "reward" countries that it feels are not contributing to the conclusion of the Doha Round negotiations[12] with preferential treatment.

WTO Opposition to Preferential Treatment

There is also the risk of greater opposition within the WTO to the preferential treatment granted to certain countries by the United States

[12] Many of these countries are members of the G-20.

and the European Union. Under GATT provisions that were later adopted by the WTO, countries that grant unilateral preferences to a certain group of countries must request a waiver from Member Countries, as this implies exemption from the provisions of the organization's general principles relating to the Most-Favored-Nation Clause. In this regard, there are several developing member countries that are not protected by preferential treatment and that feel they are at a disadvantage vis-à-vis other developing countries that enjoy preferential market access under unilateral agreements.

The European Union's GSP and the United States' Caribbean Basin Initiative require the granting of authorization or exemption by all WTO members, something that is looking increasingly complicated to achieve. Indeed, a few years ago, India, Pakistan, and Paraguay won a trade dispute filed against the European Union's GSP on behalf of the Central American and Andean nations.

The opening of trade potentially afforded by the Doha Round would give developing member countries greater access to markets in the European Union and the United States under the principle of Most-Favored-Nation. However, the suspension of negotiations will lead to less flexibility vis-à-vis the preferential treatment they enjoy.

Loss of Momentum for Domestic Policy Reform

Finally, we should mention that the impasse in the multilateral negotiations makes it difficult to pursue the tightening of domestic support programs that create price and trade distortions in international markets. Failure of the Doha Round will definitely not help when it comes to promoting domestic policy reform programs.

THE 2007 US FARM BILL AND HOW IT RELATES TO THE DOHA ROUND

A special mention must be made with regard to the adoption of the 2007 Farm Bill which is currently in progress in the US (Thompson). Special interest groups are pressuring the US government in order to have a greater degree of influence in the design of this policy. Likewise, these groups seek to obtain greater impact on US policies in multilateral negotiations due to the high content of governmental support programs for certain products.

The 2007 Farm Bill differs in its conception from the 2002 Farm Bill. First of all, the "Ethanol Boom" has caused an increase in the price of certain products. This is particularly true in the case of corn. Secondly,

there is concern in Washington with the federal trade deficit. This creates pressure to decrease public spending on agricultural programs. Thirdly, the WTO negotiations currently underway seek to obtain a greater degree of free trade on a multilateral level.

There are two other elements that loom over the discussion of the current Farm Bill. The first element is the presidential electoral process that creates a more protectionist environment. The other element looming over the talks is the fact that certain groups of producers not directly benefiting from government subsidies are taking a proactive approach in the talks. These producers represent almost two-thirds of the total number of US producers.

The aforementioned circumstances contribute to a very different debate with regards to previous Farm Bill debates. Nevertheless, it is important to remember that three different Farm Bills were adopted (1985, 1990, and 1996) during the Uruguay Round negotiations. These bills progressively reduced the links between the monetary incentives for production and the prices of specific products. This happened because the incentives went from more "distorting" programs (amber box) to less "distorting" programs (green box).

There was a surplus in the federal budget for the 2002 Farm Bill. Also, the consolidated ceilings for the AMS at the WTO were considered a goal to be achieved rather than a parameter to be reduced. This resulted in the reintroduction of amber box programs that do create distortions in the world prices for certain products.[13]

Currently, there are two types of organizations that lobby to achieve a custom-made agricultural legislation. First, representatives of some of the most influential commodity groups in the US (corn, cotton, soy, rice, and wheat) favor a continuation of the 2002 Farm Bill with a few minor adjustments. An argument set forth by this group is the increase in the production of ethanol in the US. According to them, increasing ethanol sales will create more benefits for the US economy than those that can be achieved in the Doha Round. Second, citizen groups representing a diverse array of interests ranging from the environment to support for agricultural development have used the US loss to Brazil in the cotton case as a means to obtain changes in US agricultural subsidies. Their main argument is that the funds directed towards American producers are inequitable and poorly distributed. Thus, the goals of helping families and promoting agricultural development are unfulfilled.

[13] The most notorious case is the commercial controversy about cotton in which a WTO panel determined that all programs previously classified as green box were, in fact, amber box programs. This created a distortion in the world prices for certain products and they need to be terminated or reduced.

On a different note, there are also international factors that impact the 2007 Farm Bill. Accordingly, some Members of Congress and some in the agricultural department consider that the number of commercial disputes with regards to current policies may increase. They fear more disputes like the aforementioned cotton controversy. Some of their proposals include: 1) a reduction in marketing orders; 2) a reduction in counter-cyclical payments; and 3) getting rid of restrictions with regards to the types of crops that can be planted on land that is eligible for direct payments.

Lastly, it can be said that there are two main tendencies regarding the design of the 2007 Farm Bill. On the one hand, there are those that support the status quo and promote an extension of the 2002 Farm Bill. On the other hand, there are those that think that this is a good time for the US to adopt and introduce the needed agricultural reforms in order to satisfy both domestic and international demands.

The 2007 Farm Bill and the Doha Round impact each other: if the 2007 Farm Bill is adopted before a multilateral agreement is reached, then US laws would not be able to build upon the agreements reached at Doha. This is particularly true in the case of cuts to internal subsidies. In this light, the US negotiators have declared that they do not intend to offer better terms than those presented in October 2005 unless the US is granted greater access to the markets of its commercial partners.

POSSIBLE SCENARIOS

Due to these circumstances, and with the continuation of negotiations, it is important to consider possible scenarios for moving forward. There are three possible outcomes. Each outcome has its own prerequisites and consequences.

Scenario 1: Minimal Accord

This scenario requires that the main players lower their ambitions and their expectations in order to achieve an accord that leads to a completed round of negotiations in the medium term. The requirements for this scenario are as follows.

- Cuts in all forms of agricultural protection. The cuts in tariffs and production subsidies would be modest. They would include the elimination of all cotton subsidies.[14] They would also include the total elimination of export subsidies by 2013.[15]

[14] The cotton subsidies topic has been a priority in the Doha Round ever since the Ministerial Meeting in Cancún. So much so, that a special negotiation group was established within the framework of the Agricultural Committee.
[15] This announcement was part of the Hong Kong Ministerial Declaration.

- Modest cuts in tariffs of industrial goods (NAMA) which, nevertheless will allow developed countries to export to developing countries. Specially those members of the G-20 and, particularly, those countries with attractive markets such as: China, India, Brazil, and South Africa.
- Minimum accords will be reached in the service industry which would not include those subjects that are most controversial such as the deregulation of services in developing countries or free worker mobility from developing to developed countries (WTO 1994c).
- A support package for the Least Developed Countries (LDCs) with emphasis on technical and financial support in order to increase their export capacity and free access of their products to the developed nations as suggested by the Hong Kong declaration. These measures would provide some sort of substance to the concept of development and would only apply for all LDCs and not for all developing nations.

If such an accord could be reached, it would allow closing this round of negotiations during 2007. The achievements obtained would help consolidate the WTO, allow for some continuity, and silence those that consider it ineffective. However, this scenario presents some obstacles such as not fulfilling the expectations of most developing countries. This, in turn, will make it necessary to start a new round of negotiations in the medium-term, thus creating the need to secure the leadership of certain countries.

Scenario 2: Extension of this Round of Negotiations

The purpose of this extension would be to seek a more ambitious accord. This calls for extending the negotiation dates for at least two more years to try and obtain an agreement that satisfies all Members and fulfills the objectives set forth in the Doha Declaration. It wouldn't be the first time that the multilateral negotiation process is extended. Both the Uruguay and the Tokyo Rounds of negotiation took four years longer than originally scheduled. A delay in the Doha Round shouldn't represent a major problem, given these antecedents. The new schedule would call for the Doha Round to end towards the end of this decade.

This scenario is the only one that allows the benefits of free trade to fully materialize. The risk is that nothing guarantees that the US president will be granted TPA, as mentioned above, so all negotiators must work without any certainty that the US congress will approve the TPA. The negotiators will face a great deal of pressure to reach an ambitious accord which must also have a great deal of development content.

On the opportunity side of things, if the Round manages to end and the subsequent accord manages to expand and further clarify existing norms, the WTO will demonstrate that it is capable of reaching great goals and this would position it as the cornerstone of future world economic governance. This scenario will generate greater benefits for global customers. However, it is uncertain that the WTO could manage to bring the process to a satisfactory end.

Scenario 3: A Collapse of the Doha Round and WTO Reform Efforts

This is an unlikely scenario which would only happen if the G-6 members become more extreme in their positions and make it impossible to reach a minimum accord. G-20 member countries are more likely to not accept an agreement which does not have a great deal of prodevelopment content. The underlying argument being that the Uruguay Round greatly benefited the developed countries. As a result, the Doha Round should compensate for this imbalance. This means that the developed countries must greatly reduce their agricultural protectionism.

This is a totally negative scenario, no doubt about it. It will have very serious multilateral consequences and prevent some of the potential benefits of free trade from materializing. It will also halt the adoption of new rules and regulations that could be approved in a legitimate and agreed upon fashion. The timing couldn't be worse since current market conditions suggest that such rules and regulations are necessary. The collapse of the Doha Round will create tension in international relations among different countries and groups of countries. This will cause the WTO to immerse itself in a deep crisis. It will also force the WTO to re-evaluate its functions and its decision-making methods.

A multilateral failure could open the door for the strengthening of bilateral and regional commerce processes. These processes are flawed in that they do not incorporate topics such as what to do with regards to domestic support programs, antidumping rules and ways to settle commercial controversies.

CONCLUSIONS

The Doha Round negotiation process has been slow and complex. The tackling of such an ambitious agenda which incorporates criteria that favor a greater and better distribution of the benefits of world agricultural trade demands the adoption of rules and regulations that have deep repercussions in domestic agricultural policies. Those are the probable causes as to why the process has been on the border of collapse twice.

The first time was in Cancun in 2003 and again at Geneva in 2006. Nevertheless, there is a strong will to find an acceptable conclusion to the Doha Round among certain groups whose efforts have included a complex web of underground contacts and meetings. The goals of these meetings have been to bridge the differences amongst different positions which will, in turn, lead to the writing of a final negotiated text.

After a careful analysis of the Doha Round it becomes clear that there are conceptual agreements. Problems arise when the conceptual agreements are translated into figures, amounts, compromises, and deadlines. This requires the adoption of multilateral commitments and also the reform of certain national policies.

The possible consequences of a crisis in the negotiating process create complex situations on a global level. These situations have a significant impact on trade. Most of the risks are associated with:

- an increase in trade disputes;
- a strenghtening of regionalism and bilateralism;
- elimination of preferential bilateral agreements;
- enhancement of domestic subsidy programs; and
- the loss of WTO credibility as a governing body for world trade.

The implementation of multilateral rules and regulations will allow for the adoption of ways to overcome problems such as dumping, trade disputes, domestic subsidies, and other domestic help programs. The strengthening of market integration requires a bilateral normative framework that regulates access to different markets. It also requires a different set of multilateral institutions to serve as a guide and to provide efficient procedures to solve any disputes derived from trade.

Different possible outcome scenarios for the Doha Round have been analyzed. Perhaps the best possible scenario, in terms of creating benefits for all 150 WTO Member Countries, is the extension of the negotiations for two more years. This will allow the achievement of the goals set forth in the negotiating process as well as satisfying the demands of all parties involved. Nevertheless, there is concern amongst all parties involved that the US Congress may not grant the President new TPA.

Recent developments within the WTO lead us to identify a renewal of the negotiating process. The WTO Director General has said that there is the will and the necessary agreement to end the Doha Round this year (WTO 2007d). This is the result of intense underground activity whose goal was to bridge the differences between the different negotiating positions.

By the same token, the President of the Agricultural Committee, Mr. Crawford Falconer from New Zealand, presented documents on 30 April and 25 May 2007 (WTO 2007a, 2007b) that reflect the fact that the different negotiating positions have been brought closer to each other. The documents also contain several propositions (dubbed the "center of gravity") for each main topic on the agricultural project. These documents seek to foster consultations between the Member Countries reflected by a greater degree of agreement within the documents. Therefore, the involved parties are better prepared to continue the negotiations.

The Director General of the WTO, Mr. Pascal Lamy, stated that the aforementioned reflection period helped clarify the fact that a positive outcome is still possible for this Round of negotiations (WTO 2007c). This, in spite of the precious little time left, since the schedule calls for an end of the negotiations by the end of 2007. The challenges ahead are partly technical but mostly political in nature. They require strong leadership, a serious commitment from Member Countries, and the acknowledgment of common goals to guarantee success.

BIBLIOGRAPHY

Chibbaro, A. 2007. "Current situation and developments of the agricultural negotiations at the WTO." The Inter-American Institute for Cooperation on Agriculture (IICA): Montevideo, Uruguay.

Organization for Economic Cooperation and Development (OECD). 2006. *Agricultural Policy and Trade Reform: Potential Effects at Global, National and Household Levels*. OECD Publishing.

Thompson, R. 2006. "Prospects for Reform US Agricultural Policy With or Without Doha", Cato Center for Trade Policy Studies, August.

United States Trade Representative (USTR). 2006. "Administration to Review Whether to Continue Trade Benefits under the GSP Program." Available at: <http://www.ustr.gov/Document_Library/Press_Releases/2006/August/Administration_to_Review_Whether_to_Continue_Trade_Benefits_under_the_GSP_Program.html>. Accessed 19 February 2008.

World Trade Organization. 1994a. "Agreement on Agriculture." Available at: <http://www.wto.org/english/docs_e/legal_e/14-ag_01_e.htm >. Accessed 19 February 2008.

___. 1994b. "General Agreement on Tariffs and Trade 1994." Available at: <http://www.wto.org/english/docs_e/legal_e/06-gatt_e.htm>. Accessed 19 February 2008.

___. 1994c. "General Agreement on Trade in Services." Available at: <http://www.wto.org/english/docs_e/legal_e/26-gats_01_e.htm>. Accessed 19 February 2008.

___. 2001. "Doha WTO Ministerial 2001: Ministerial Declaration." Available at: <http://www.wto.org/english/thewto_e/min01_e/minded_e.htm>. Accessed 19 February 2008.

___. 2004. :Doha Development Agenda: Doha Work Programme: Text of the 'July package' – the General Council's post-Cancún decision." Available at: <http://www.wto.org/english/tratop_e/dda_e/draft_text_gc_dg_31july04_e.htm>. Accessed 19 February 2008.

___. 2005. "Doha Work Programme: Ministerial Declaration." Available at: <http://www.wto.org/english/thewto_e/minist_e/min05_e/final_text_e.htm>. Accessed .

___. 2007a."Agriculture chair circulates 'challenges' paper." Available at: <http://www.wto.org/english/tratop_e/agric_e/agchairtxt_30apr07_e.htm>. Accessed 19 February 2008.

___2007b. "Second set of 'challenges' circulated for farm talks." Available at: <http://www.wto.org/english/tratop_e/agric_e/agchairtxt_25may07_e.htm>. Accessed 19 February 2008.

___. 2007c. "Lamy asks for support on "final stretch" of negotiations." Available at: <http://www.wto.org/english/news_e/sppl_e/sppl57_e.htm>. Accessed 19 February 2008.

___. 2007d. "Lamy: Chairs working towards revised papers." Available at: <http://www.wto.org/english/news_e/sppl_e/sppl62_e.htm>. Accessed 19 February 2008.

Program and Participants

WORKSHOP PROGRAM

Welcome
Chair: Rene F. Ochoa – Texas A&M University

Session I – Energy
Chair: Karl Meilke – University of Guelph

The Future of World Oil Prices: Some Keys to the Puzzle
James Griffin – Texas A&M University

Open Discussion

Session II – Bioenergy
Chair: James Rude – University of Alberta

Bioenergy – Agricultural Issues and Outlook
Joe L. Outlaw – Texas A&M University
Heloisa L. Burnquist – University of Sao Paulo, Brazil
Luis Ribera – Texas A&M University

Discussants
Hosein Shapouri – USDA Office of Energy Policy and New Uses
Kurt Klein – University of Lethbridge
Enrique Dominguez - Confederación de Porcicultores Mexicanos

Luncheon Address
Rodrigo Sanchez Mujica – FIRA – Bank of Mexico

Session III – Bioenergy – Policy Issues
Chair: Tulay Yildirim – AAFC

North American Ethanol Bioenergy Policies and Their NAFTA Implications
Glenn Fox – University of Guelph
Kenneth Shwedel – Rabobank International, Mexico

Session IV – Industry Panel
Chair: Ron Knutson – Texas A&M University

Panel
Martin Rice – Canadian Pork Council
Terry Francl – American Farm Bureau Federation
Mauricio Marroquin – Industrias Mexstarch

Session V: NAFTA Supply Chain Management
Chair: Walt Armbruster – Farm Foundation

Agrifood Supply Chains in the NAFTA Market
Jill E. Hobbs – University of Saskatchewan
William A. Kerr – University of Saskatchewan

North American Retailers and Their Impact on Food Chains
Dalila Cervantes-Godoy – OECD
David Sparling – University of Guelph
Belem Avendaño - Universidad Autónoma de Baja California
Linda Calvin – USDA Economic Research Service

Discussion
Gemma Zecchini - Food and Consumer Products of Canada

Luncheon Address
Lloyd Day - USDA

Session VI – WTO
Chair: Merritt Chesley – USDA Foreign Agricultural Service

Implications of WTO Development for Market Integration
Alex F. McCalla – University of California

Doha Development Round Agricultural Negotiations
Gloria Abraham Peralta – IICA

Discussion Panel
William Kerr – University of Saskatchewan
Suzanne Heinen – USDA

Session VII – Wrap Up Panel
Chair: Ron Knutson – Texas A&M University

Panel
Lloyd Day – USDA
Cameron Short – AAFC
Jeffrey Jones – Under Secretary SAGARPA

PARTICIPANTS

Canada

Christine Angelo
Counsellor – Agriculture and Food
The Embassy of Canada to Mexico
Apartado Postal 105-05
Mexico, D.F., Mexico 11580
Email: Christine.Angelo@international.gc.ca

Lucy Bourque
Chief
Strategic Policy and Priorities
Agriculture and Agri-Food Canada
Sir John Carling Building
Floor 2, Room 219A
930 Carling Avenue
Ottawa, ON K1A 0C5 Canada
Phone: 613.759.7459
Email: bourquel@agr.gc.ca

Andrea Brocklebank
IKE Project Manager
Canadian Cattlemen's Association
#310, 6715-8th Street NE
Calgary AB T2E 7H7 Canada
Phone: 403.2750.8558
Email: brocklebanka@cattle.ca

Christiane Deslauriers
A/Director General
Bioproducts and Bioprocesses
Agriculture and Agri-food Canada
440 University Avenue
Charlottetown, PE C1A 4N6 Canada
Phone: 902.626.2786
Email: deslauriersc@agr.gc.ca

Glenn Fox
Professor
Food, Agricultural and Resource Economics
University of Guelph
Guelph, Ontario N1G 2W1 Canada
Phone: 519.824.4120 Ext. 52768
Email: gfox@uoguelph.ca

Jill Hobbs
Professor and Department Head
Department of Bioresource Policy,
Business & Economics
University of Saskatchewan
51 Campus Drive
Saskatoon, SK S7N 5A8 Canada
Phone: 306.966.2445
Email: jill.hobbs@usask.ca

David Hope
Assistant Deputy Minister-Regulated Marketing Division
Ontario Ministry of Food, Agriculture and Rural Affairs
5th Floor SW, 1 Stone Road W
Guelph, ON N1G 4Y2 Canada
Phone: 519.826.3406
Email: dave.hope@omafra.gov.on.ca

Bill Kerr
Professor and Van Vliet Chair
Department of Bioresource Policy, Business & Economics
University of Saskatchewan
51 Campus Drive
Saskatoon, SK S7N 5A8 Canada
Phone: 306.966.4022
Email: william.kerr@usask.ca

Kurt Klein
Professor
Department of Economics
University of Lethbridge
4401 University Drive
Lethbridge, AB T1K 3M4 Canada
Phone: 403.329.2438
Email: klein@uleth.ca

Bob MacGregor
Chief
Agriculture and Environment Policy Analysis
Agriculture and Agri-food Canada
Sir John Carling Building
Floor 6, Room 689
930 Carling Avenue
Ottawa, ON K1A 0C5 Canada
Phone: 613.759.1796
Email: macgrbo@agr.gc.ca

Karl Meilke
Professor
Food, Agricultural & Resource Economics
University of Guelph
Guelph, Ontario N1G 2W1 Canada
Phone: 519.824.4120 Ext. 52769
Email: kmeilke@uoguelph.ca

Martin Rice
Executive Director
Canadian Pork Council
1101-75 Albert Street
Ottawa, Ontario K1P 5E7 Canada
Phone: 613.236.9239
Email: rice@cpc-ccp.com

James Rude
Associate Professor
Department of Rural Economy
University of Alberta
569 General Services Building
Edmonton, AB T6G 2H1
Phone: 780.492.4890
Email: james.rude@ualberta.ca

Cameron Short
Executive Director
Policy Analysis
Agriculture and Agri-Food Canada
Sir John Carling Building
Floor 6, Room 6109
930 Carling Ave.
Ottawa, ON K1A 0C5 Canada
Phone: 613.759.7426
Email: shortc@agr.gc.ca

David Sparling
Associate Dean, Research and Graduate Studies
Department of Business
University of Guelph
Guelph, Ontario N1G 2W1 Canada
Phone: 519.824.4120 Ext. 56808
Email: dsparlin@uoguelph.ca

Tulay Yildirim
Director
Economic and Industry Analysis
Agriculture and Agri-Food Canada
Sir John Carling Building
Floor 6th, Room 689
930 Carling Avenue
Ottawa, Ontario K1A 0C5 Canada
Phone: 613.759.1748
Email: yildirimt@agr.gc.ca

Gemma Zecchini
Senior Vice President
Public Policy
Food & Consumer Products of Canada
885 Don Mills Road
Suite 301
Toronto, ON M3C 1V9 Canada
Phone: 416.510.8024
Email: gemmaz@fcpc.ca

United States

Walt Armbruster
President
Farm Foundation
1211 West 22nd Street, Suite 216
Oak Brook, IL 60523 USA
Phone: 630.571.9393
Email: walt@farmfoundation.org

Linda Calvin
Agricultural Economist
Economic Research Service
United States Department of Agriculture
1800 M Street NW
Room S5040
Washington, DC 20036-5831 USA
Phone: 202.694.5244
Email: lcalvin@ers.usda.gov

Lloyd Day
Administrator
Agricultural Marketing Service
United States Department of Agriculture
1400 Independence Avenue
Washington, DC 20250 USA
Phone: 202.720.5115
Email: lloyd.day@usda.gov

David Ernstes
Research Associate
Agricultural and Food Policy Center
Department of Agricultural Economics
Texas A&M University
2124 TAMU
College Station, TX 77843-2124 USA
Phone: 979.845.7042
Email: d-ernstes@tamu.edu

Terry Francl
Senior Economist
Economic Analysis Department
American Farm Bureau
600 Maryland Avenue SW
Suite 1000W
Washington, DC 20024 USA
Phone: 202.406.3621
Email: terry@fb.org

James Griffin
Professor, Director of the Economics of
Public Policy Program, and Bob Bullock
Chair in Public Policy and Finance
The Bush School of Government and
Public Service, Texas A&M University
College Station, TX 77843-4220 USA
Phone: 979.845.9950
Email: jgriffin@bushschool.tamu.edu

Christopher Hansen
Deputy Director General
Inter-American Institute for Cooperation on Agriculture
Directorate of Stategic Partnerships
1889 F Street NW, Suite 360
Washington, DC 20006 USA
Phone: 202.458.3767
Email: christopher.hansen@iica.int

Suzanne Heinen
Minister-Counselor for Ag Affairs
Foreign Agricultural Service
United States Department of Agriculture
U.S. Embassy
P.O. Box 9000
Brownsville, TX 78520-0900 USA
Phone: +52 55.5080.2847
Email: suzanne.heinen@fas.usda.gov

Ron Knutson
Regents Professor Emeritus
Agricultural and Food Policy Center
Department of Agricultural Economics
Texas A&M University
TAMU 2124
College Station, TX 77843-2124 USA
Phone: 979.845.5913
Email: rknutson@tamu.edu

Alex McCalla
Professor Emeritus
Department of Agricultural and Resource Economics
University of California, Davis
2116 Social Science & Humanities
One Shields Avenue
Davis, CA 95616
Phone: 530.752.1529
Email: alex@primal.ucdavis.edu

Joe Outlaw
Professor and Co-Director
Agricultural and Food Policy Center
Department of Agricultural Economics
Texas A&M University
2124 TAMU
College Station, TX 77843-2124 USA
Phone: 979.845.5913
Email: joutlaw@tamu.edu

Luis Ribera
Department of Agricultural Economics
Texas A&M University
2124 TAMU
College Station, TX 77843-2124 USA
Phone: 979.845.5913
Email: joutlaw@tamu.edu

Hosein Shapouri
Agricultural Economist
Office of Energy Policy and New Uses
United States Department of Agriculture
1301 New York Avenue, NW
Washington, DC 20250 USA
Phone: 202.401.0531
Email: hshapouri@oce.usda.gov

Steven Zahniser
Agricultural Economist
Economic Research Service
United States Department of Agriculture
1800 M Street NW
Room N5134
Washington, DC 20036-5831 USA
Phone: 202.694.5230
Email: zahniser@ers.usda.gov

México

Belem Avendaño Ruiz
Profesor
Faculdad de Economia y Relaciones Internacionales
Universidad Autónoma de Baja California
Calzada Tecnologico
14418 Mesa de Otay
Mexicali, BC México
Phone: 664.682.0832
Email: belem_avendano@yahoo.com

Gloria Abraham Peralta
Directora
Interamerican Institute for Cooperation on Agriculture - IICA
Insurgentes Sur 1106, Piso 5
Col. Del Valle
México, D.F. 03100 México
Phone: +52 55.5559.8519 x. 235
Email: gabraham@iica.org.mx

Rodrigo Carlos Diez de Sollano Elcoro
Director General
Fideicomiso de Riesgo Compartido
Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación
Municipio Libre # 377 / Piso 9, Ala A
Col. Sta. Cruz Atoyac
México, D.F. 03310 México
Phone: +52 55.3871.1000 x. 34435
Email: rdiezsollano@sagarpa.gob.mx

Enrique Domínguez Lucero
Director General
Confederación de Porcicultores Mexicanos
Juan de la Barrera # 38 / 3er Piso
Col. Condesa
México, D.F. 06140 México
Phone: +52 55.5212.1290
Email: wera49@aol.com

Claudio Fernández Mancera
Director Ejecutivo
Agribusiness Support
Fideicomiso de Riesgo Compartido
Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación
Municipio Libre # 377
Piso 9, Ala A
Col. Sta. Cruz Atoyac
México, D.F. 03310
Phone: +52 55.3871.1000 x. 34448
Email: cfernandez.firco@sagarpa.gob.mx

Ernesto Fernández Arias
Director General
Dirección General de Apoyo al Financiamiento Rural
Subsecretaría de Fomento a los Agronegocios
Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación
Municipio Libre # 377
Piso 4, Ala B
Col. Sta. Cruz Atoyac
México, D.F. 03310
Phone: +52 55.3871.1000 x. 33643
Email: efernandez@sagarpa.gob.mx

Jeffrey Max Jones
Subsecretario
Subsecretaría de Fomento a los Agronegocios
Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación
Municipio Libre # 377
Piso 4, Ala B
Col. Sta. Cruz Atoyac
México, D.F. 03310 México
Phone: +52 55.3871.1000 x. 33610
Email: jjones@sagarpa.gob.mx

Luis Lorence
Director General
Mexstarch SA de CV
Av. Constitución 2184, int.101, Col. Obispado, Monterrey, N.L. México
Phone: +52 668.815.7797
Email: llorence@centli.com.mx

Mauricio Marroquín
Director General
Industrias Mexstarch, S.A. de C:V
Ave San Jeronimo #800 Pte., Col San Jeronimo, Monterrey, N.L. 64640 México
Phone: +52 88.8333.0182 x. 121
Email: mmarroquin@centli.com.mx

Rene F. Ochoa
Director General
Dirección General de Estudios del Sector Agropecuario y Pesquero
Subsecretaría de Fomento a los Agronegocios
Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación
Municipio Libre # 377
Piso 4, Ala B
Col. Sta. Cruz Atoyac
México, D.F. 03310 México
Phone: +52 55.3871.1000 x. 33660
Email: rochoa@sagarpa.gob.mx

Ken Shwedel
Vicepresident
Food & Agribusiness Research
Rabobank International – México
Bosques Alisos # 47-B Piso 2
Col. Bosque de las Lomas
México, D.F. 05120 México
Phone: +52 55.5261.0039
Email: ken.shwedel@rabobank.com

Pablo Sherwell Cabello
Director General Adjunto
Dirección General de Estudios del Sector Agropecuario y Pesquero
Subsecretaría de Fomento a los Agronegocios
Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación
Municipio Libre # 377
Piso 4, Ala B
Col. Sta. Cruz Atoyac
México, D.F. 03310 México
Phone: +52 55.3871.1000 x. 33635
Email: psherwell@sagarpa.gob.mx

North American Agrifood Market Integration Consortium

Fourth Annual North American Agrifood Market Integration Workshop
Contemporary Drivers of Integration
June 2007, Cancún, Quintana Roo, México

Sponsors:

- Agricultural and Food Policy Center - Texas A&M University – College Station, Texas
- Agriculture and Agri-Food Canada – Ottawa, Ontario
- Farm Foundation – Oak Brook, Illinois
- Instituto Interamericano de Cooperación para la Agricultura-México (IICA) – Mexico City
- Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación – Mexico City
- United States Department of Agriculture – Washington, DC
  - Agricultural Marketing Service
  - Economic Research Service
  - Foreign Agricultural Service - Emerging Markets Program
- University of Guelph – Guelph, Ontario

Coordinating Committee:

Gloria Abraham – IICA – Mexico
Karen Huff – University of Guelph
Ronald D. Knutson – Texas A&M University
Karl Meilke – University of Guelph
Rene F. Ochoa – SAGARPA
Luis Ribera – Texas A&M University
James Rude – University of Manitoba
Renée A. Schwartz – U.S. Department of Agriculture/Foreign Agricultural Service
Tulay Yildirim – Agriculture and Agri-Food Canada
Steven Zahniser – U.S. Department of Agriculture/Economic Research Service

The fourth in a series of workshops organized by the North American Agrifood Market Integration Consortium designed to foster dialog among policy makers, agrifood industry leaders, and academics on agriculture and food-related market integration issues among NAFTA countries.

Photo Credits: The USDA Photography Center (http://www.usda.gov/oc/photo/opchomea.htm); Agricultural Research Service Image Gallery (http://www.ars.usda.gov/is/graphics/photos/); and David P. Ernstes

NORTH AMERICAN AGRIFOOD MARKET INTEGRATION CONSORTIUM
NAAMIC