Failure of the Virtual Water Argument?

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Is it a failure of Theory or Practice?

- Well known economic theorem; "it works in theory, but not in practice!"
- Virtual water seems to reverse this dictum; "it works in practice, but not in theory!"
- Can Practice fail?
- Does it really matter? Remember Deng Xiaoping's "white cat/black cat."
- It is not really about water, but about multiple factor inputs in production functions.

What's Special about Water?

- Nothing in particular, other than it is usually considered a non-mobile input factor in internationally traded commodities.
- Use of water, however, as an input usually has significant external effects than other inputs.
- Green water within a country is assumed to be fixed, but blue water can be substituted for by recycling and desalination.
- Finally it is not just about agriculture

Academics spend too much time beating up on the theory

- Two main approaches, both have serious drawbacks to predict decisions on virtual water as either an exporter or an importer
- Both Ricardo and Heckscher-Olin have assumptions that go well beyond the messy details of actual embedded water transfers
- Not a fruitful avenue for research; we already know that the theory does not hold

Major Economic Criticisms about Virtual Water Trade. Garrido, A., et al. 2010

- Green and blue water components are crucial to determine whether observed exchanges contribute to a sustainable world economy
- The virtual water metaphor addresses resource endowments but not production technologies, hence it does not include the concept of comparative advantage
- Political and economic considerations often outweigh water scarcity concerns, limiting the potential of trade to mitigate water scarcity. Very little of the calculated virtual water trade is due to water scarcity.
- Other factors, like land, nitrogen , phosphorus, and potassium, should be added to water scarcity measurements.
- Emphasizing virtual water imports is not a neutral policy for a water scarce country, since this affects, among other things, urbanization, rural-urban migration and income distribution.
- Expanding agricultural commodities trade generates overall welfare gains, but also winners and losers among trading partners.

Global Perspective: Impact of Trade Liberalization on Virtual Water

What are the implications of assuming free trade?

Ramirez-Vallejo and Rogers (2004) carried out some simulation experiments on this and predicted a large increase in virtual water exports for the US, most of it stemming from export of animal products. An increase of 87 cubic km above the predicted 2020 baseline of 183 cubic km would occur for the US if animal products and cereals were completely liberalized.

Table 3 Amount of virtual water in net trade of meat (km^3)

Country/Region	Virtual water Baseline scenario	Virtual water Full liberalization scenario	Net effect km^3	
United States	–183	–267	84	Increase in water exports
EU15	–72	–54	18	Decrease in water exports
Japan	96	105	9	Increase in water imports
Former SU	75	99	24	Increase in water imports
Latin America	–72	–159	87	Increase in water exports
Sub-Saharan Africa	9	45	36	Increase in water imports
West Asia/North Africa	54	39	15	Decrease in water imports
South Asia	15	69	54	Increase in water imports
Southeast Asia	15	39	24	Increase in water imports
East Asia	162	198	36	Increase in water imports

Note: In virtual water trade, negative figures indicate amount of water being exported, and positive figures indicate water being imported

Ramirez Vallejo and Rogers, 2004.Assuming full trade liberalization by 2020

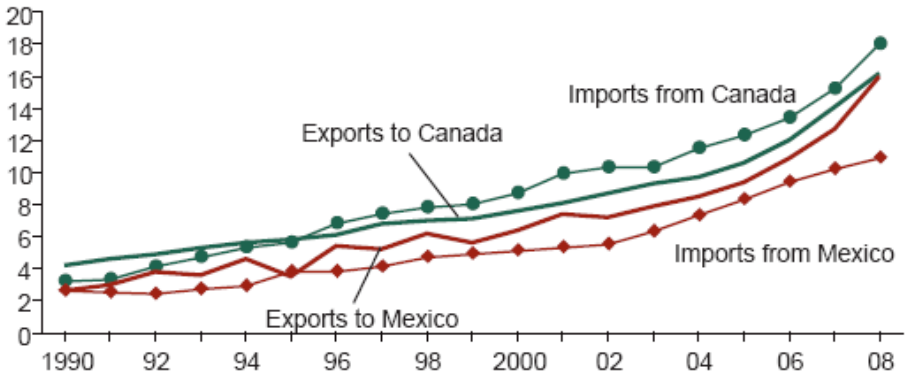
Regional Perspective: NAFTA

The Mexican economy is the world's 13th largest, and is the United States 3rd largest trading partner and the 2nd largest market for US exports.

From 1992-2007 the value of US agricultural exports worldwide grew by 65% , but exports to NAFTA partners grew by 165%. By 2007 US supplied 72% of Mexico's total ag imports.

Figure 1

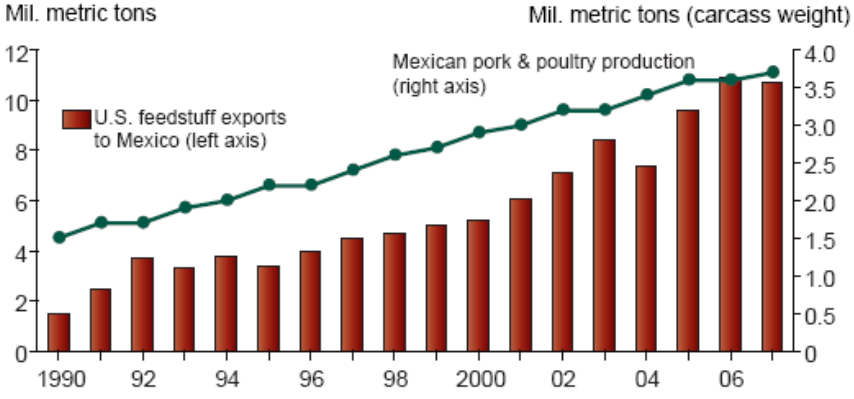
U.S. agricultural trade with its NAFTA partners has more than tripled since the agreement's implementation in 1993



Source: USDA, Foreign Agricultural Service (2009).

Figure 3

U.S. feedstuffs are crucial to Mexican pork and poultry production



Note: In this graph, feedstuffs are defined as encompassing the commodity groupings of feed grains ans products, feeds and fodders (excluding oilcake), and oilseeds and products.

Sources: USDA, Foreign Agricultural Service (2009) (exports); Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca, y Alimentación, Servicio de Información Agroalimentaria y Pesquera (SAGARPA/SIAP) (2009b) (production).

Table 4

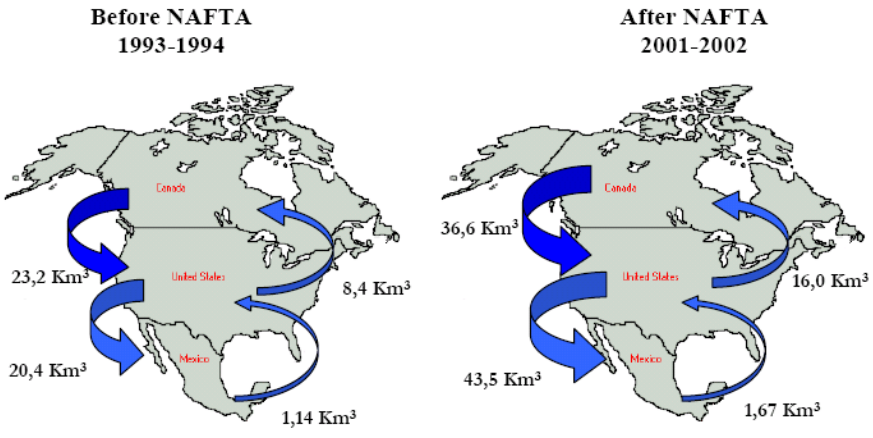
Selected most-favored-nation tariffs of the NAFTA countries, 2008

Product	Canada	United States	Mexico
		Percent	
Hams (fresh or chilled, not processed)	Free	Free	20.0
Butter	298.5*	35.3*	20.0
Cheddar cheese	245.5*	24.0*	125.0
Durum wheat	0.4**	1.3	67.0
Corn	Free	0.4	Free
Barley	0.4**	0.4	115.0
Potatoes	1.0	1.8	245.0
Apples	Free	Free	20.0
Raspberries	Free	Less than 0.05	20.0
Soybeans	Free	Free	3.8
Rapeseed	Free	1.2	Free
Raw sugar (cane or beet, solid form, not containing added flavoring or coloring)	9.3	91.5*	73.5
Crude soy oil	4.5	19.1	10.0
Crude rapeseed oil	6.0	6.4	10.0
Malt extract	8.5**	9.6	17.0
Uncooked pasta (not containing egg, not stuffed)	1.2	Free	10.0
Strawberry jam	12.5	2.2	51.0
Peanuts (shelled)	Free	131.8*	Free

* = Over-quota tariff; ** = In-quota tariff. Some tariffs were converted to ad valorem equivalents using unit import values and other trade data, as compiled by Global Trade Information Services, Inc.

Sources: Canada Border Services Agency, Mexico Secretariat of Economy, and U.S. International Trade Commission.

The Virtual Waterfall of NAFTA



Source: J. Ramirez-Vallejo and P. Rogers, 2006.

“The virtual waterfall of NAFTA.”

NAFTA generated an increase in virtual water imports to Mexico of more than 100%. From an annual level of 20.4 km^3 before the agreement, virtual water imports increased to a level of 43.5 km^3 after NAFTA. This explains why, currently, Mexico is the second largest virtual water importer in the world after Japan with imports of more than 50 cubic kilometres per year, mostly coming from the United States (Ramirez-Vallejo and Rogers, 2004).

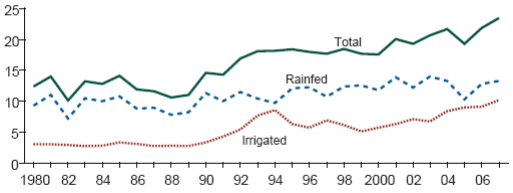
Role of Subsidies

If the H-O theorem applied to water, then the virtual water concept would have to be consistent with the concept of opportunity cost of water use. Countries in which water is particularly scarce might benefit by importing water-intensive agricultural goods. In Mexico, water tariffs are way below the opportunity cost of water. Moreover, the opportunity cost of water is not considered when seeking an efficient allocation of scarce water resources. Therefore, the country would probably produce water-demanding goods above the optimal level, where the right mix of production and imports satisfies domestic demand

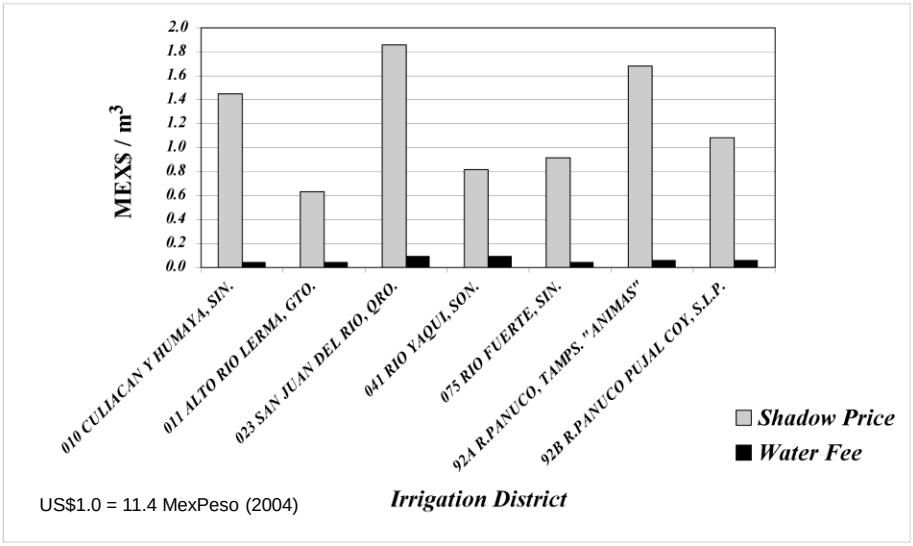
Figure 5

Mexican corn production, agricultural years 1980-2007

Mil. metric tons



Source: Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca, y Alimentación, Servicio de Información y Estadística Agroalimentaria y Pesquera (SAGARPA/SIAP) (2009a).



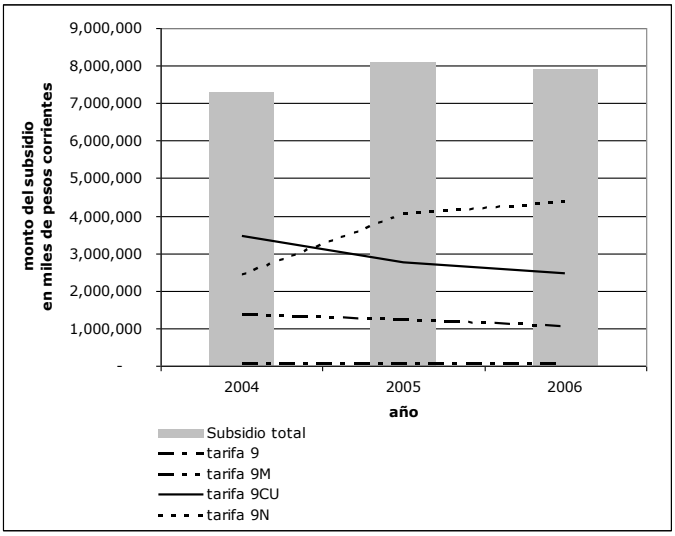
US$1.0 = 11.4 MexPeso (2004)

Discrepancy between water fees and estimated shadow prices in Mexico

Source: Ramirez-Vallejo, 2003.

Gráfica 3: Evolución del subsidio total y por tarifa, 2004-2006

Subsidies for electricity for irrigation pumps



In 2006 an annual direct subsidy of over MexPeso 7 billion (US$ 650 million) for electricity for groundwater pumping (Guevara-Sangines, 2007)

Some Conclusions

The concept of virtual water is an appealing means toward educating public officials and society in general that water in some parts of the world is a scarce resource and that agriculture uses the great majority of water resources available on earth.

The argument also offers an implicit lesson underscoring the importance of running irrigation districts efficiently so that water can be allocated to other uses including ones benefiting the environment.

However, the virtual water argument, if applied improperly, can send the wrong message in terms of policy-making in agriculture and water resources. For instance, a country may delay important investments now, deciding instead to import food grains; or it could choose not to remove price subsidies with the objective of saving water.

Where do we go from here?

- Beyond agriculture
  - Continue work on water footprints
  - Expand the analysis to multiple factor productivity
  - Account for external effects.
- Focus research on:
  - Trade of virtual water in all commodities
  - Trade of water technology and services
  - Trade of international public goods, eg. green water offsets
- Analyze role of water in intergovernmental trade organizations, and international commodity trade associations