



## Effects of trade and agricultural policies on the structure of the U.S. tomato industry



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### ABSTRACT

Over the last few decades, accelerated growth of Mexican tomato imports to the United States has caused several trade disputes with U.S. growers. A data-driven approach was used to analyze trade flows in the tomato industry from 1970 to 2015 and all structural changes to policy interventions implemented during the same period were linked. Tests for endogenous breakpoints reveal that NAFTA and trade pricing policies are two of the main factors that caused structural changes in the tomato industry in 1992 and 1999. While U.S. agricultural policies sought to protect domestic tomato producers, they did not stop Mexican tomatoes from taking an important share of the U.S. market. Mexican imports to the United States, especially post-NAFTA, have a high explanatory power for U.S. domestic production.

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### 1. Introduction

Following China and India, the United States is the third global largest producer of tomatoes, a heavily traded crop (FAOSTAT, 2013). Trade flows bilaterally in North America with imports to the U.S. arriving mainly from Mexico and Canada. Tomato imports to the United States have increased dramatically over the last few years. In 2014, Mexico accounted for nearly 90% of tomato imports and Canada for 9.5% (USDA, 2015-FAS); the remaining imports came mainly from Europe and Central and South America. Canada and Mexico are also the two main destinations for U.S. tomato exports. Unlike imports, however, U.S. exports have declined over the last decade. U.S. exports peaked in 2000 at 186,133 metric tons (mt) but had declined 45% by 2014, to 83,760 mt. The current export levels are the lowest since the United States started to extensively export tomatoes 1989 (USDA-FAS, 2015).

Heavy concentration and significant shifts in the tomato markets in North America have resulted in several trade disputes. Beginning in 1978, tomato producers in Florida argued that Mexican growers were dumping tomatoes into the U.S. market (Baylis and Perloff, 2010). Escalating disputes have resulted in a “Great Tomato War” (Bredahl et al., 1997), specifically between Florida and the Mexican province of Sinaloa, the largest tomato-growing region in Mexico (Kosse et al., 2014). Trade tensions have intensi-

fied and, as a result, several policy interventions have been enacted on both sides. Nevertheless, Mexican exports to the United States continue to rise while U.S. domestic production declines.

This article analyzes how trade flows in the tomato industry have structurally changed from 1970 to 2015 using a data-driven approach in which the analysis is conducted solely on trade data. The model does not account for policy interventions and has no prior knowledge of possible interventions. The results of the data-driven structural shifts are later linked to policy interventions implemented around the time of the structural shifts. In order to accomplish this goal it is important to (1) identify the structural breakpoints in exports, U.S. domestic production, and tomato prices as well as imports from Canada, Mexico, and the rest of the world; (2) evaluate causal patterns among the innovations of the variables of interest; and (3) analyze the contemporaneous and lagged effects of trade agreements and policy changes in the tomato industry.

Evidence of a structural break in the tomato industry was found following the signing of the North American Free Trade Agreement (NAFTA), but the Mexican peso was undergoing a significant devaluation at the same time. This concurrence has raised a major point of debate in the literature with regard to which of these factors contributed more to the increase in Mexican tomato exports to the United States (Almonte-Alvarez and Conley, 2003). Results from this research suggest that NAFTA had a higher impact on the tomato industry than the mid-1990s Mexican peso devaluation. Policies had an influence on three distinct time periods:

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pre-NAFTA (1/1970–12/1991), NAFTA (1/1992–7/1999), and post-NAFTA (8/1999–12/2014). Significant infrastructure investments in the Mexican and Canadian tomato industries geared toward improving greenhouse production were imperative in boosting U.S. market share. Other trade pricing policies also seem to have affected the structure of the tomato industry in North America.

This research identifies the main factors that have resulted in structural changes in the tomato industry in the face of several international trade policy interventions. The rest of the article is structured as follows. Section 2 provides a background description of the seasonality and supply of tomatoes in the United States, Mexico, and Canada, which is useful to understanding tomato trade flows over the course of the year. Section 3 overviews the set of potential trade policies and trade agreements that may have affected the industry since 1970. Section 4 presents the data and methods used to identify structural breakpoints and establish causal relations. Section 5 reports results and implications, and Section 6 concludes.

## 2. Tomato seasonality and supply

### 2.1. United States

Fresh tomatoes are produced commercial in sixteen states in the United States. Production is dominated by California and Florida, which accounted for nearly 70% of U.S. fresh tomatoes in 2014, followed by Tennessee, South Carolina, North Carolina, and Virginia (USDA-NAL, 2015; USDA-NASS, 2015). Florida ranks first in acres planted and harvested, but California has a higher yield per acre. Tomato production in the United States is highly seasonal. In Florida, production spans from October to June, with peak production in April–May and November–January. In California, production takes place most of the year, except from November through March (USDA-AMS, 2015). During the winter season, Mexico provides fresh tomatoes to most of the western United States and Florida to most of the eastern United States (Boriss and Brunke, 2005). In 2014, around 13% of U.S. domestic production was exported. Meanwhile, the volume of imports was almost twice the volume of U.S. domestic production. The main destinations for U.S. fresh tomato exports are Mexico (90% of U.S. exports) and Canada (7% of U.S. exports) (USDA-FAS, 2015) (Fig. 1).

### 2.2. Mexico

Tomatoes are produced year-round in Mexico and are the country's most important agro-industrial crop with respect to exports and employment (Barron and Rello, 2000). Sinaloa is the most important tomato-producing region, with 37% of production in 2013, followed by Baja California, Zacatecas, San Luis Potosi, and Jalisco, which together produced 30% (SIAP, 2014). The main export markets for Mexican tomatoes are the United States and Canada, accounting for 95% of total exports (SAGARPA, 2010, 2012). Sinaloa production peaks between January and March, while Baja California's most productive months are from June to November (Padilla-Bernal and Thilmany, 2003). Mexico can produce more tomatoes during winter months than the United States because of warmer weather conditions (Cook and Calvin, 2005). Although most Mexican tomatoes were traditionally grown in open fields, the production of greenhouse tomatoes has recently increased to the point where five times as many tomatoes are produced in greenhouses as in open fields after Mexico made vast investments to improve the infrastructure and logistics of greenhouse production and exports (SAGARPA, 2012).

### 2.3. Canada

Since the 1970s, the United States has been an important supplier of tomatoes to the Canadian market. In 1985, approximately 85% of Canadian tomato imports were supplied by the United States (mostly by Florida) and the remaining 15% by Mexico. Up to that point, Canada had not been a significant tomato producer despite increasing demand for tomatoes. As a result, Canada increased import tariffs and devoted more resources to the development of its greenhouse tomato industry (Darko-Mensah and Prentice, 1987). During the early 1990s, the North American greenhouse tomato industry expanded rapidly, especially in Canada, which became the largest producer of greenhouse tomatoes in North America. In 1992, field tomatoes represented 65% of Canadian fresh tomato production; by 2003 this share was reduced to only 11%. Greenhouse tomatoes are produced primarily in Ontario (64% of total production), British Columbia (22%), and Quebec (11%), with production taking place from March through December (Agriculture and Agri-Food Canada, 2013). Most Canadian tomato exports are greenhouse tomatoes destined for the U.S. market. Canadian exports have increased while U.S. exports to Canada have remained stable (Agriculture and Agri-Food Canada, 2013). Over the last two decades, greenhouse tomato production has gained market share. Mexico is the only North American country that still produces a considerable quantity of fresh field-grown tomatoes.

## 3. Market structure

The United States, Mexico, and Canada are significant producers and consumers of fresh tomatoes. These countries compete for market share and have been specializing and investing in increasing their competitive advantage using strategies such as producing certain varieties of tomato, investing in infrastructure, or competing with prices. Demand for tomatoes has increased as new varieties are introduced. Besides the traditional round, red, ripe tomato, it is now possible to find grape, roma, plum, cherry, mature greens, on the vine, hydroponic, greenhouse, organically grown, heirloom, and alternatively colored tomatoes. Most of these varieties are available year-round (Estes, 2003).

Padilla-Bernal et al. (2003) explored market integration between Mexico and the United States and found higher market integration between regions that are geographically closer to one other. This is the case for Los Angeles, California, which has a probability of having perfect market integration with Mexican markets of 83%. Market integration is lower for regions that are more distant from one other. Boston has a higher probability of perfect market integration with California and Florida (54%) than with Mexico (6%). Padilla-Bernal et al. (2003) noted that "as distance between markets increases, it could be argued that the risk of doing business in those markets increases due to time lags for shipping and the associated loss in quality, and consequently, the probability of having higher non-observable transaction costs or a longer adjustment period increases" (p. 444).

In addition to seasonality, market integration helps determine product differentiation and consumer choices (Grant et al., 2010); an example might be decreasing demand for U.S. mature green tomatoes due to increased foreign competition and change in consumer preferences (Cook and Calvin, 2005). Consumer trends also reveal that around 70% of the fresh tomatoes were consumed at home and 30% away from home during the 1990s (USDA-ERS, 2016), reflecting the fact U.S. fresh tomato markets include both foodservice and retail consumer sales.

Some researchers consider the U.S. tomato market oligopolistic and vertically integrated (Thompson and Wilson, 1997). This is also true of Canada, where five firms produced around 82% of exports to

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