United States chicken and grain exports to Mexico: competing for the same market?

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Abstract

The impacts of maintaining increasing rates of Mexican chicken meat imports from the United States on United States grain sorghum price and Mexican GS imports from the United States were modeled using a non-spatial, partial equilibrium, econometric, and simulation international trade model. Twenty five equations were simultaneously estimated and validated as a system using three stages least squares. A 9-year baseline was estimated under existing projections and the impacts of the increasing rates of Mexican chicken meat imports from the United States were simulated and compared with the baseline.

Key Words: Supply, Demand, NAFTA, International trade, Grain sorghum, Chicken meat exports

Introduction

During the 15 first years of NAFTA chicken meat production in Mexico has grown from 1,383 to 2,853 thousand MTon from 1994 to 2008 and up to 2,809 thousand MTon in 2010 (PS&D, 2010). In this period of time, imports have also increased from 102 to 525 thousand MTon from 1994 to 2010, respectively. According to this data, per capita consumption during the same years has reached almost 30 kg (PS&D, 2010). Salazar, Mohanty, and Malaga (2005) estimated the demand for chicken meat in Mexico up to the year 2025 and projected the average per capita consumption to be 29.4 kg in 2025, which already has been surpassed in 2010. The same authors projected a growth of chicken meat production of 70% in the next decade. It is important to note that by 2010 imports of chicken meat from the United States (US) represented 14% of the per capita consumption of this type of meat in Mexico. The fact that imports have been rising over the last 10 years at a rate of 9% annually, means that the domestic production is not enough to satisfy the demand (PS&D, 2010). Velasquez et al. (2009) using an econometric model to analyze the impact of deregulation of the chicken meat import market through NAFTA found that the elasticity of import price of frozen chicken leg quarters and fresh chicken with

respect to Mexican production cuts were -6.77 and -2.56, respectively which indicates a strong relationship of chicken meat imports to domestic production.

On the other hand, the Mexican chicken meat production demand for grains accounts for roughly 25% of all the grains used in the livestock sector (SAGARPA, 2009). Grain sorghum (GS) and yellow corn are among the main grains used in this activity. Duch-Carvallo and Malaga (2010) estimated a partial-equilibrium econometric GS international trade model and found that the ratio of GS price to corn price, chicken production, and policy dummies were statistically significant in the Mexican GS demand equation.

By 2010, Mexico was the fourth world's largest producer of GS. Albeit several Mexican government strategies to assure that the domestic production of GS is consumed, local production supplies only about 50% of the domestic demand which has made the Mexican feed industry highly dependent on foreign suppliers. Additionally, within few years, the US has became Mexico's only supplier of GS and Mexico has became the main market for US GS, importing about 60% of the US GS exports. However, Duch-Carvallo and Malaga (2010) suggested that rearrangements that may occur in the Mexican chicken industry when chicken trade between both countries is tariff free, would be of particular importance in the future of GS trade. As NAFTA ended, the US became Mexico's main supplier of both chicken meat and grain sorghum.

Due to the facts that there is an increasing chicken meat demand in Mexico that is being satisfied through imports and that domestic production mainly uses GS as feedstock, which is also being imported, it can be hypothesized that there is an indirect competition between chicken meat and GS for the Mexican market. Increasing imports of chicken meat would eventually decrease domestic production and thus, the need for imported GS as a feed staple. The objective

of this study is to determine the impact that changes in the Mexican chicken sector will have on the US grain sorghum sector.

Data

Time series from 1970-2009 for all variables were used to estimate the model. United States, Mexican and Japanese variables were obtained from official institutions: ERS-USDA (2009), FAO-STATS (2009), FATUS (2009), Japanese Ministry of Economy (2009), PS&D (2010), and SAGARPA (2007). Prices of sorghum and corn were deflated relative to 2000 prices. Projections for exogenous variables were obtained from official sources (FAPRI, 2010; SAGARPA, 2007; etc).

Methodology

The model

A non-spatial, partial equilibrium, econometric, and simulation international trade model was estimated and validated to describe the GS production-utilization-trade process (Duch-Carvallo and Malaga, 2010). The model included behavioral equations for demand and supply in the United States, Mexico and Japan, as well as, price transmission equations. Equilibrium prices, quantities, and net trade are determined by equating excess demands and supplies across countries and linking country prices to a world price which in this case is the US price (Devadoss and Meyers, 1990). Each set of equations was specified according to the situation and characteristics of the countries involved. In total, 25 equations were simultaneously solved using three stages least squares to obtain a baseline prediction. Estimated results of all parameters have the expected sign and are statistically significant. The baseline forecast for endogenous variables was solved using the estimated model parameters and projections from official institutions (FAPRI, 2010; SAGARPA, 2007; etc.) of the exogenous variables. The forecast period was from

2010 to 2018. For a complete description of the model and the estimates results please refer to: "Grain sorghum international trade model" (Duch-Carvallo and Malaga, 2010).

Forecast scenarios

Parameters obtained from the estimation of the baseline were used to simulate the impact of increasing Mexican chicken meat imports on US GS price and Mexican GS imports from the US. Since the model does not include US chicken meat imports to Mexico as a variable but uses Mexican chicken production and since the imports from the US comprise about 90% of all Mexican imports of this meat, to construct the simulation scenarios we adjusted the Mexican chicken production as follows: assuming chicken meat consumption in Mexico to be the sum of domestic production plus imports, we held consumption levels constant and increased the imported amount, thus, obtaining the adjusted Mexican production amount to be used by the model. In this manner, using FAPRI's projected chicken consumption levels from 2010 to 2018 and annual Mexican chicken meat import rates of 0.2% annually, as well as, the actual annual Mexican chicken meat import rates from the US for the last five and 10 years (7.6 and 9.1% respectively), three scenarios were analyzed: 1) a baseline, which also included FAPRI's Mexican chicken production projections, 2) Mexican chicken production adjusted using an annual increase of 7.6% in chicken meat imports, and 3) Mexican chicken production adjusted using an annual increase of 9.1% in chicken meat imports. The forecast period was from 2010 to 2018.

Empirical results

Results of the three simulated scenarios are presented in tables 1 and 2 and figures 1 and 2. According to the projected baseline, US GS price is expected to decrease about 28% by 2018

with respect to prices in 2009. Grain sorghum Mexican imports from the US, on the other hand, would increase about 88% at the end of the forecast period.

Both alternative scenarios produced changes in US GS price and Mexican GS imports from the US with the same tendency. United States GS price decreased and Mexican GS from the US increased over the forecast period.

The decline at the end of the forecast period on US GS prices in the scenarios with Mexican chicken meat import rates of 7.6 and 9.1% was about 34 and 36%, respectively. The tendency of this decrease is similar to that observed on the baseline, although, US GS prices in each simulated year under both alternative scenarios were lower than the prices on the baseline.

The increment on Mexican GS imports from the US by 2018 with respect to that of 2009, was about 51 and 42% for the scenarios with Mexican chicken meat import rates of 7.6 and 9.1%, respectively, which are considerably lower than the increase of 88% observed in the baseline. As in the case of US GS prices, amounts of GS imported by Mexico from the US in each simulated year are lower in the alternative scenarios than in the baseline.

Final remarks

Although in the three scenarios analyzed GS exports from US to Mexico are expected to grow in the next several years, the results showed that when rates of Mexican chicken meat imports from the US were increased (with the consequent decrease on the level of Mexican chicken production) a lower rate of growth in the Mexican GS imports was observed. Furthermore, US GS prices decreased under all scenarios. This research suggest that US GS exports to Mexico are strongly dependent on how the demand for chicken meat in that country is satisfied. Grain sorghum trade is highly sensitive to changes on the Mexican chicken industry.

Table 1. Forecast changes with respect to the baseline on US grain sorghum price (dollars / MTon.) under two alternative scenarios of Mexican chicken meat imports from the United States.

Year	Baseline	Chicken meat import rate of 7.6%	Percentage change	Chicken meat import rate of 9.1%	Percentage change
	Dollars / MTon	Dollars / MTon	%	Dollars / MTon	%
2010	0.070	0.070	0.00	0.07	0.00
2011	0.077	0.074	-4.21	0.073	-4.55
2012	0.079	0.076	-4.73	0.075	-5.31
2013	0.078	0.074	-5.95	0.073	-6.80
2014	0.080	0.075	-6.68	0.074	-7.83
2015	0.080	0.074	-7.39	0.073	-8.86
2016	0.078	0.072	-7.75	0.070	-9.59
2017	0.075	0.069	-7.88	0.068	-10.14
2018	0.072	0.067	-8.18	0.065	-10.94

Table 2. Forecast changes with respect to the baseline on Mexican grain sorghum imports from the United States(MTon.) under two alternative scenarios of Mexican chicken meat imports from the United States.

| Year	Baseline (FAPRI)	Chicken meat import rate of 7.6%	Percentage change	Chicken meat import rate of 9.1%	Percentage change
	MTon	MTon	%	MTon	%
2010	3458.62	3458.62	0.00	3458.62	0.00
2011	3940.08	3862.34	-1.97	3856.18	-2.13
2012	4141.54	3929.39	-5.12	3908.60	-5.62
2013	4326.11	3995.04	-7.65	3955.43	-8.56
2014	4528.52	4069.91	-10.12	4006.46	-11.52
2015	4773.60	4189.80	-12.22	4097.47	-14.16
2016	5013.62	4317.05	-13.89	4191.48	-16.39
2017	5137.40	4352.52	-15.27	4190.17	-18.43
2018	5220.82	4363.36	-16.42	4160.03	-20.31
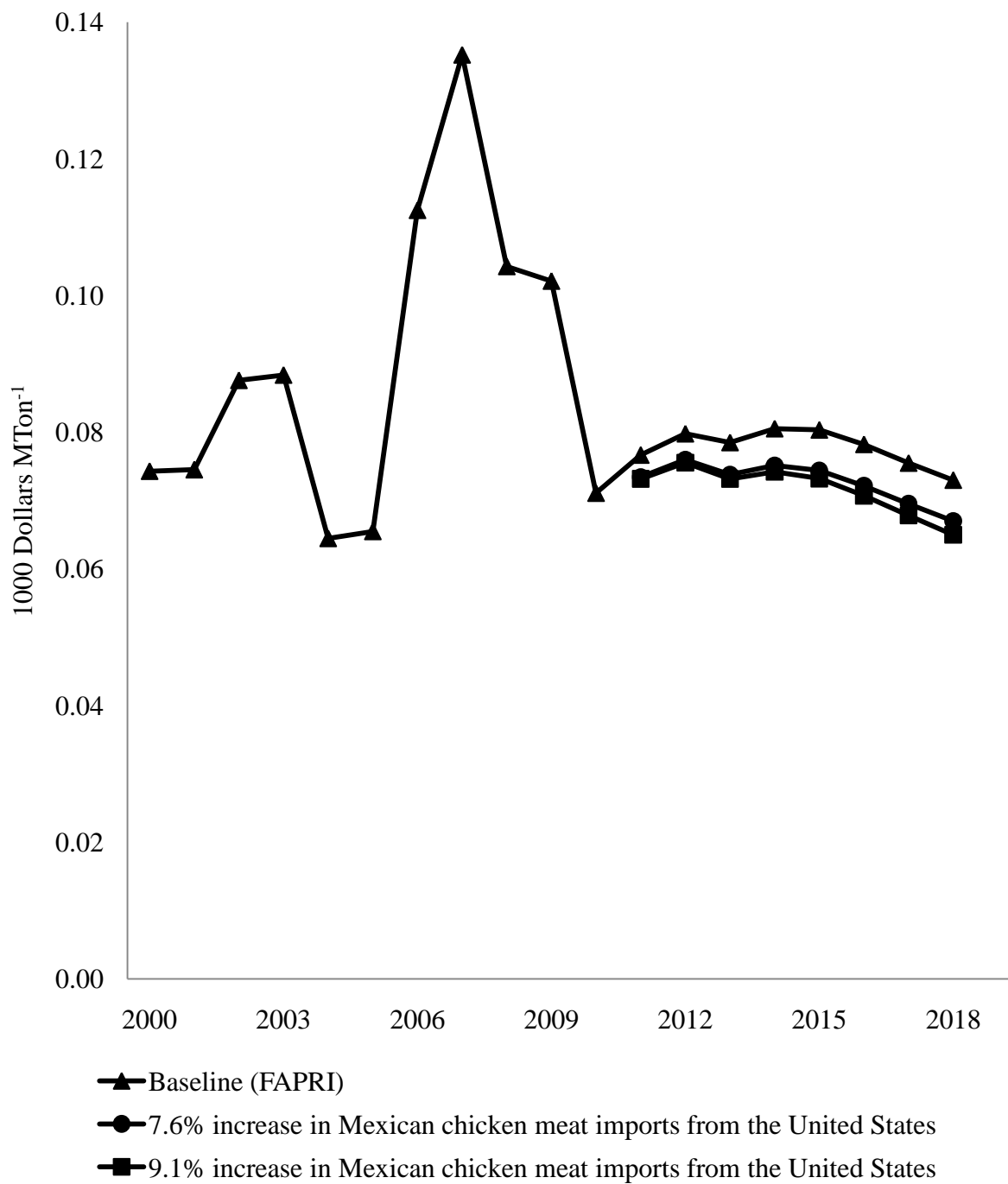
Fig. 1. United States grain sorghum price baseline (2000-2018) under two alternative scenarios of Mexican chicken meat imports from the United States (2010-2018).
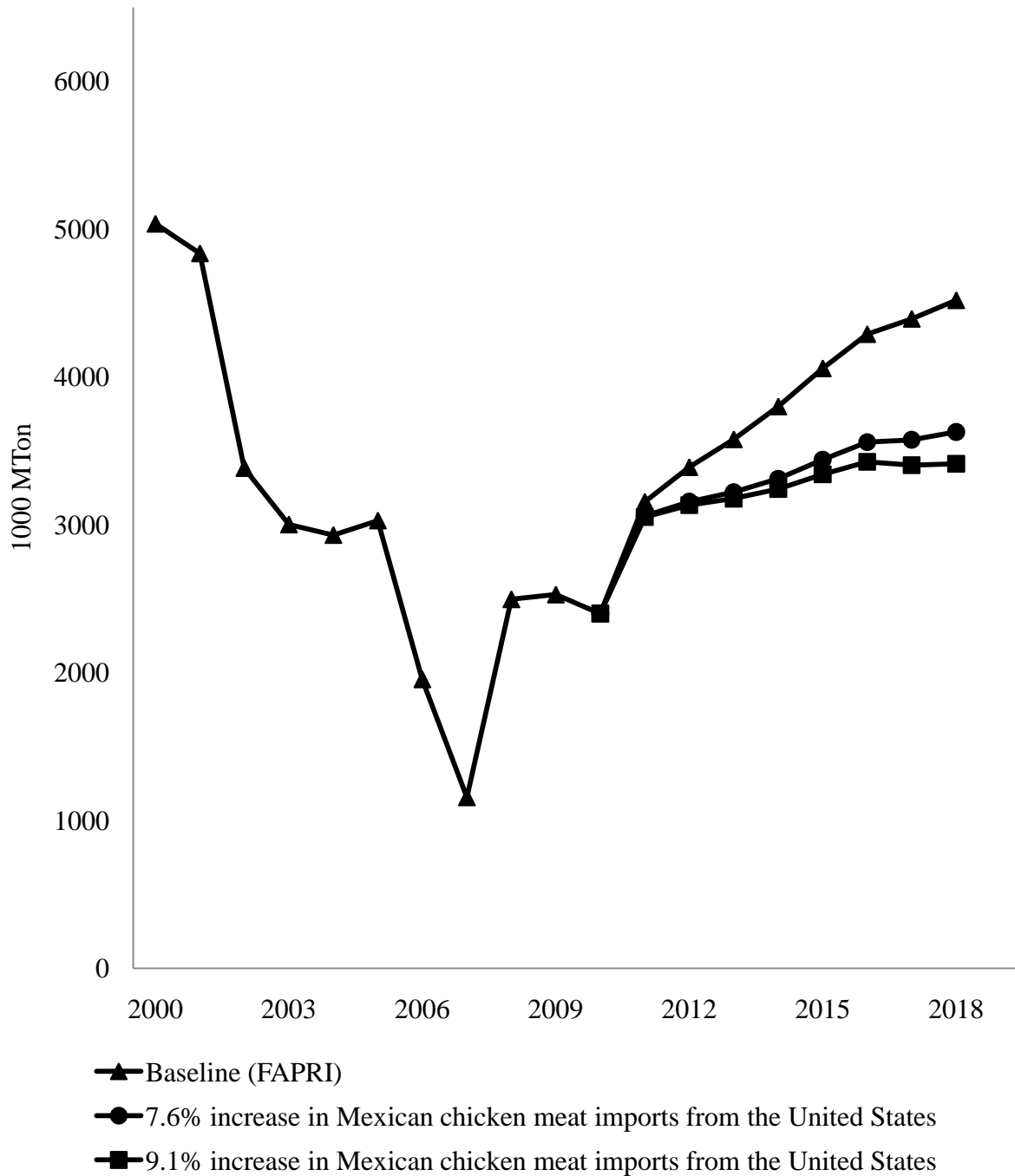
Fig. 2. Mexican grain sorghum imports from the United States baseline (2000-2018) and under

two alternative scenarios of Mexican chicken meat imports from the United States (2010-2018).

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