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# **Gains and Losses in the Paraguayan Beef Market After the Boom of Beef Exports**

María José Patiño\*, Julieta Frank\*, and Manuel Ferreira\*\*

\*University of Manitoba, \*\*Universidad Nacional de Asunción

María José Patiño

Department of Agribusiness & Agricultural Economics

University of Manitoba

353 Agriculture Building

Winnipeg, MB R3T 2N2 - Canada

E-mail: [umpatinm@cc.umanitoba.ca](mailto:umpatinm@cc.umanitoba.ca)

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# GAINS AND LOSSES IN THE PARAGUAYAN BEEF MARKET AFTER THE BOOM OF BEEF EXPORTS



UNIVERSITY  
OF MANITOBA

María José Patiño\*, Julieta Frank\*, Manuel Ferreira\*\*

\* University of Manitoba, \*\* Universidad Nacional de Asunción



Picture taken by Christine Rawluk



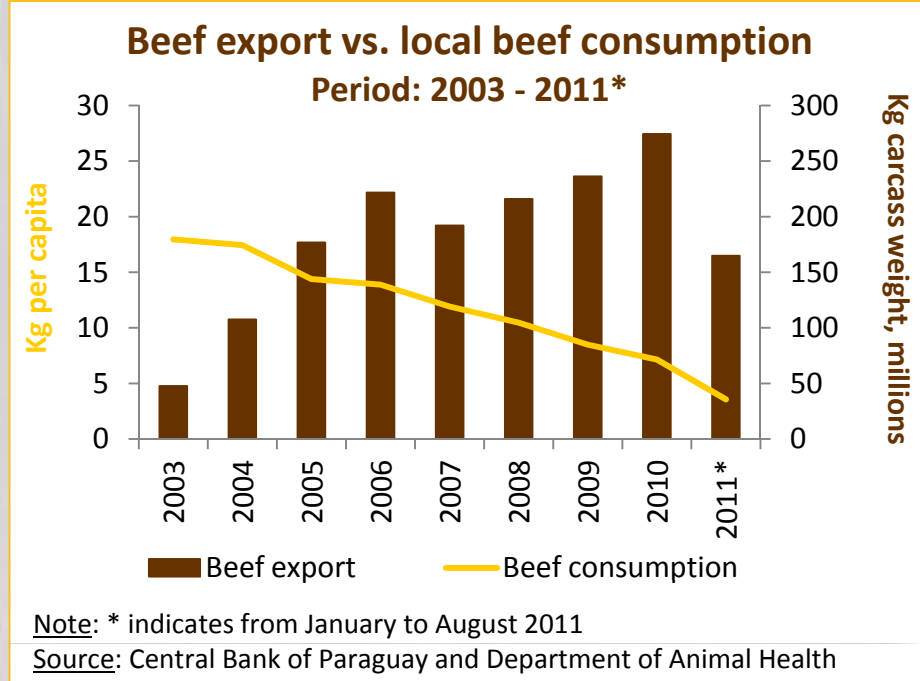
## Background

### Paraguayan livestock industry

- ❖ Paraguayan beef is highly competitive due to low levels of production costs and consequent low prices in the local market. There is no consumption of imported beef and historically beef production levels satisfy the local market only (Ferreira 2006).
- ❖ During January 2003 to August 2011 the volume of exports grew at the remarkable rate of 246%. In 2011 volume of exports represented more than 700 millions constant U.S. dollars for the Paraguayan economy.
- ❖ The overall effects of the boom of exports on all sectors of the supply chain is not clear. Beef exports grow imply a supply reduction for the local market because the local production is not enough to satisfy both markets at the same time (Ferreira 2006).
- ❖ What is the impact of the large increase of Paraguayan beef exports on the different sectors of the beef supply chain? While producers may have benefited from the higher prices in the export market, consumers argue that the local market was left with only low quality and overpriced cuts. Little has been done to assess the impact of the boom of exports on the beef supply chain and consumers in Paraguay.

| Economic indicators                          |       |
|--|-------|
| Beef meat production over total meat         | 81%   |
| Average share of livestock in GDP *          | 5.3%  |
| Accumulated economic growth of livestock*    | 208%  |
| Accumulated cattle herd growth*              | 51%   |
| Livestock industry share on agricultural GDP | 23%   |
| Employment in livestock industry             | 17.5% |

Note: \* Indicates last 20 years  
Sources: Central Bank of Paraguay, Department of Animal Health and Rural Association of Paraguay



## Paraguayan Beef Supply Chain



Note: Since 2000 the Department of Animal Health passed a regulation that meat processing plants that are allowed to export cannot buy animals from cattle markets; they can only buy animals directly from producers. Therefore, meat processing plants serve international markets only and slaughterhouses serve the local market only.

Source: Ferreira (2006).

## Objectives

- Estimate demand and supply equations for the *Fattening, Slaughter and Beef Markets*.
- Assess welfare changes of the economic agents in the livestock supply chain due to the increased levels of beef exports.

## Contact information

María José Patiño  
Department of Agribusiness & Agricultural Economics  
University of Manitoba  
353 Agriculture Building  
Winnipeg, MB R3T 2N2 - Canada  
E-mail: umpatinm@cc.umanitoba.ca

## Methods

### 1. Simultaneous equations

- ❖ Partial Equilibrium Model for the Paraguayan beef supply chain. Three groups affected by the recent market changes were identified: beef producers, slaughterhouses and consumers. Estimation of supply and demand system of equations is performed using 3-Stage Least Squares (Jeong, Garcia, and Bullock 2003).

#### Fattening market:

$$\begin{aligned} \text{Demand: } Q_{c,t}^d &= f(P_{cm,t}, P_{sl,t}, S_t) \\ \text{Supply: } Q_{c,t}^s &= f(P_{cm,t}, P_{cf,t}, Q_{cf,t}, R_t, F_t, P_{t,t}, P_{v,t}, Q_{c,t-1}) \\ \text{Market clearing: } Q_{c,t}^d &= Q_{c,t}^s \end{aligned}$$

#### Slaughter market:

$$\begin{aligned} \text{Demand: } Q_{sl,t}^d &= f(P_{sl,t}, P_{bf,t}, E_t, Q_{bf,t-1}, Q_{bf,t-2}, Q_{bf,t-12}) \\ \text{Supply: } Q_{sl,t}^s &= f(P_{sl,t}, P_{cm,t}, P_{cf,t}, P_{st,t}, D, R_t, F_t) \\ \text{Market clearing: } Q_{sl,t}^d &= Q_{sl,t}^s - X_t \end{aligned}$$

#### Beef market:

$$\begin{aligned} \text{Demand: } Q_{bf,t}^d &= f(P_{bf,t}, P_{ck,t}, P_{pk,t}, Y_t, Q_{bf,t-1}, Q_{bf,t-2}) \\ \text{Supply: } Q_{bf,t}^s &= f(P_{bf,t}, P_{sl,t}, K_t, Q_{bf,t-7}) \\ \text{Market clearing: } Q_{bf,t}^d &= Q_{bf,t}^s \end{aligned}$$

#### Variable description

##### Endogenous variables

Quantities demanded and supplied ( $Q$ ) and prices ( $P$ ):  
 $c$ : male calves,  $sl$ : carcass and  $bf$ : beef (kilogram per capita).

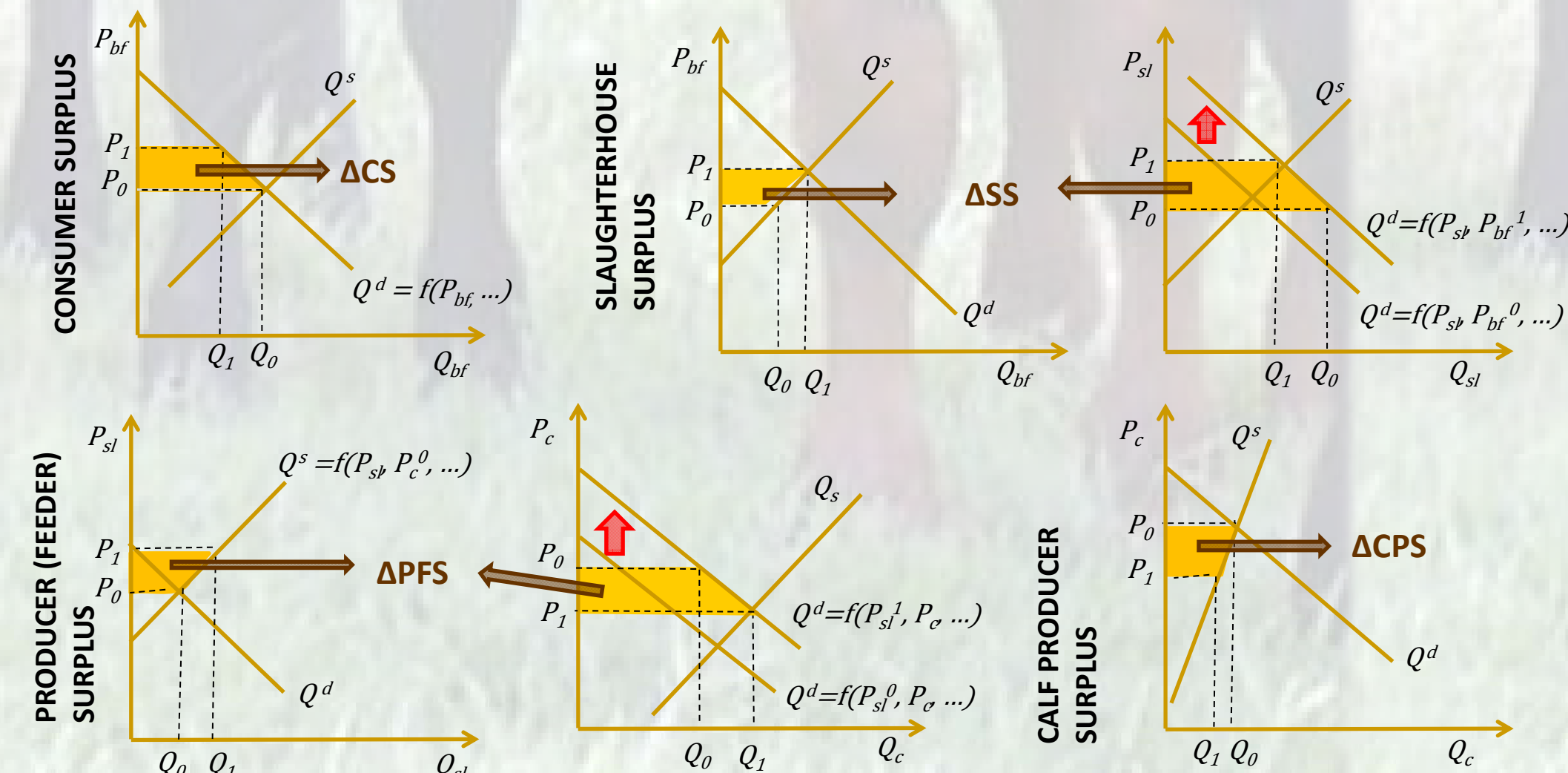
##### Exogenous variables

$S_t$  is a ratio between total slaughtered animals and total herd;  $R_t$  is rains in livestock areas;  $F_t$  private livestock funding;  $P_{t,t}$  is bull prices;  $P_{vt}$  is cow price;  $E_t$  is exchange rate;  $P_{st,t}$  is steer price;  $D$  is a dummy for winter period;  $X_t$  is volume of exports;  $P_{ckt}$  is chicken price;  $P_{pkt}$  is pork price;  $Y_t$  is income which is an index of economic monthly activity;  $K_t$  is capital cost and is commercial lending rate.

Note: all prices are in constant Guaranies (Paraguayan currency, USD 1 = Gs. 4,481)

### 2. Welfare changes

- ❖ Welfare changes were measures by sequentially summing the areas behind the beef demand function (consumers), input demand function (slaughterhouse and feeder) and output supply function (slaughterhouse, producer (feeder) and calf producer). We follow the method proposed by Just, Hueth and Schmitz (1982) to overcome the path-dependency problem due to multiple price changes. The areas are:



## Data

- ❖ Quantities and prices of calves; beef, steer, bull and cow prices and private livestock funding are from *Investor Economia*. Quantities of carcass and total herd are from *Department of Animal Health*. Carcass, chicken and pork prices; income; capital cost; exchange rate and volume of beef export are from the *Central Bank of Paraguay*. Rain is from the *Department of Meteorology*. Population is from the *International Monetary Fund*.
- ❖ Monthly data, from February 2008 to August 2011 (42 observations, except for Fattening market, 40 observations)

## Results

### Short-run elasticities

| Product            | Own-price demand | Own-price supply |
|--------------------|------------------|------------------|
| <b>Beef</b>        | - 1.30           | 3.89             |
| <b>Carcass</b>     | - 3.59*          | 16.03*           |
| <b>Calf (male)</b> | - 1.84*          | 0.57             |

Note: \*regression coefficient significant at 5% level.

- ❖ All demand and supply elasticities show the expected signs.
- ❖ All three markets are elastic, with the slaughter market being the most sensitive to price shocks.
- ❖ Male calf own-price supply appears to be inelastic; in the short-run quantities of calf are fixed as they cannot change with an increase/decrease of beef demand due to biological constraints.

### Welfare changes

| Supply chain sector                      | Guaranies   |
|--|-------------|
| <b>Δ CS (per capita)</b>                 | - 125.45    |
| <b>Δ CS (total population, millions)</b> | - 795.44    |
| <b>Δ SS (millions)</b>                   | - 17,723.52 |
| <b>Δ PFS (millions)</b>                  | 55,499.44   |
| <b>Δ CPS (millions)</b>                  | - 241.28    |

- ❖ *Consumers* are worse off due to the increase of local beef prices.
- ❖ Welfare change for *slaughterhouses* show the highest lost from all sectors in the supply chain.
- ❖ *Producer (feeders)* are better off as they serve both slaughterhouses and meat processing plants.
- ❖ *Calf producers* are worse off mainly due to a decrease in the calf price.

## Conclusions

- ❖ The structural change observed in Paraguay given by the unprecedented increase in beef exports conveyed changes in welfare at all levels in the beef supply chain.
- ❖ Only cattle producers (feeders) show a positive welfare change while consumers, slaughterhouses and calf producers experienced a negative welfare change. Cattle producers' (feeders) positive change is large and exceeds all other sectors' negative change, yielding an overall positive change for the beef supply chain.

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