International Food and Agribusiness Management Review
Volume 10, Issue 3, 2007

Economic Analysis of Incentives for Foreign Direct Investment in Beef Systems in Argentina and Uruguay

Eric Thor, III [a], DeeVon Bailey [b]Ⓘ, Alejandro R. Silva [c], and Steven S. Vickner [d]

[a] *Former Graduate Student, Royal Agricultural College and Utah State University, 13641 S. 33rd Street, Phoenix, AZ, 85044, USA*
[b] *Professor and Interim Head, Department of Economics, Utah State University 3530 Old Main Hill, Logan, UT, 84322-3530, USA*
[c] *Director Professor, Agroindustrial Economics & Management, School of Agronomy University of Buenos Aires, Avda. San Martín 4453, C1417DSE – Buenos Aires, Argentina*
[d] *Associate Professor, Department of Economics, 3530 Old Main Hill, Utah State University, Logan, UT, 84322-3530 USA*

Abstract

The European Union's (EU) ban of hormone-treated beef products in 1989 has virtually eliminated beef exports to the EU from countries where cattle are routinely implanted with growth hormones. This study examined whether or not foreign direct investment in beef systems in Argentina and Uruguay would provide a profitable method for investors who want to export beef to the EU. The results indicate that while investment in these systems is potentially profitable, government interventions designed to keep domestic beef prices low inject considerable risk into the investment decision.

Keywords: Investment in beef systems, South America, risk, cointegration

Ⓘ Corresponding author: Tel: + 435.797.2300
Email: d.bailey@usu.edu

Other contact information: E.Thor: Thor_iii@yahoo.com
A. Silva: silva@agro.uba.ar
S.Vickner: svickner@econ.usu.edu

Introduction

The European Union's (EU) ban of hormone-treated beef products in 1989 has virtually eliminated beef exports to the EU from countries, such as the United States (US) and Canada, where cattle are routinely implanted with growth hormones. The elimination of beef imports from locations such as North America at the same time that European beef production and exports have been declining in the aftermath of the European BSE crisis in the mid 1990s and the major foot-and-mouth (FMD) outbreak in the United Kingdom (UK) in 2001, has led to a relatively dramatic increase in beef imports into the EU from South America; especially from Argentina and Uruguay.

The EU became a net importer of beef in 2003 and interest is growing in places like the US for gaining access to the large EU beef market (USDA, FAS, 2005). Using hormone implants is illegal in Argentina and Uruguay and both countries have also established or are establishing traceability systems. Consequently, Argentine and Uruguayan beef meets the specifications demanded by the EU. This raises the question of whether or not foreign direct investment (FDI) in beef systems in countries like Argentina and Uruguay, which can export more freely to the EU than can the countries of North America, would provide profitable access to the EU beef market.

One objective of this research was to examine the potential profitability of FDI in the beef systems of Uruguay and Argentina. While prices and costs can be used to obtain a point estimate of profitability for FDI in these countries, significant market risk also exists as a result of government policies affecting cattle and beef prices, especially in Argentina. Also, animal disease outbreaks, such as FMD, can affect the ability to export beef from both of these countries. Consequently, a second objective was to assess the risk to FDI that has resulted from the impact of government policies and FMD outbreaks. This research examines events which have lead to the cessation or the reduction of beef exports from Argentina and Uruguay and which have thus increased the risk associated with FDI. These events include both the effects of government policies, such as currency devaluations and taxes, and also animal disease outbreaks.

Background

We are unaware of publicly available published research studies which directly address the issue of FDI in the beef systems of Argentina and Uruguay for the purpose of exporting beef to the EU. However, a sizeable literature exists dealing with issues that would affect FDI decisions in the beef systems of these two countries. The following discussion attempts to place the current discussion and analysis into context with the most relevant portion of the literature addressing the issues that could affect the FDI decision.

The EU's trade ban on hormone-treated beef is one of the most contentious trade issues between the EU and the US (Alfnes and Rickertsen, 2004; Charlier and Rainelli, 2002). The EU represents one of the largest beef markets in the world with domestic production and consumption in the EU-25 countries totaling over 7.8 million and 8.2

metric tones (MT) per year, respectively (USDA, FAS, 2006).[1] EU beef production and exports have declined since 1990 in the aftermath of their BSE and FMD crises and imports have trended upward. It is reported that EU imports of beef will reach 1 million MT within the next decade (Robertson, 2007).[2] Consequently, there are huge incentives for beef exporters to try to be involved in exporting beef to the EU.

US beef exporters are generally uncompetitive if they are forced to meet EU requirements relating to assurances and/or certifications that American beef has not been treated with hormones (Clemens and Babcock, 2002). Consequently, eliminating or reducing the EU's ban is a top priority for the US. This explains why there has been continued pressure on the EU by the US to eliminate the export ban. However, the EU has continued to maintain the ban even though the World Trade Organization has ruled in favor of the US in this matter (e.g., Hill, 2001; Taylor, Walsh, and Lee, 2003; Alfnes and Rickertsen, 2004; and Charlier and Rainelli, 2002).

Considerable research has been done examining EU consumer attitudes regarding the ban on hormone-treated beef with most of the results concluding that European consumers prefer non-hormone treated beef (e.g., Lusk, Roosen, and Fox, 2003; Alfnes and Rickertsen, 2004; Alfnes, 2004). This suggests that there is political support within the EU for maintaining the ban. Possible solutions such as labeling imported beef as being hormone-treated have also not been acceptable to either side even though European consumers prefer mandatory labeling for hormone-treated food products (Alfnes and Rickertsen, 2004; Chakraborty, 2005).

The impasse relating to hormone-treated beef imports into the EU at a time when the market for imported beef into the EU is trending upward is a significant concern for US beef exporters (USDA, FAS, 2005). All of these factors including political support for the ban in the EU, resistance to labeling products as being hormone-treated, and the growth in the EU beef import market suggest that strong incentives exist for beef exporters in North America to find alternative methods for exporting beef to the EU.

One alternative might be for beef producers from North America or elsewhere to simply invest directly in beef systems in countries that are free to export to the EU, such as Argentina and Uruguay. Both Argentina and Uruguay have been increasing their beef exports since 2000 with much of this increase going to the EU especially to fill their so-called "Hilton" Quota (Boland, Perez, and Fox, 2007) (Figure 1). Reasons for increased exports from Argentina and Uruguay include the efforts by these countries to eliminate FMD (Ekboir et al., 2002) and world demand and supply conditions (Steiger, 2006)[3]. These two countries, together with Brazil, are expected to continue to capture market share in the international trade of beef (Steiger, 2006).

[1] By contrast, US beef production is typically in the neighborhood of 11.5 – 11.8 million MT annually.
[2] By contrast, US beef exports to Japan at their peak were in the neighborhood of 600,000 MT annually.
[3] Boland, Perez, and Fox (2007) report that Uruguay was declared FMD free in 1995.

Although market conditions appear favorable for increasing exports from these countries, political issues and animal disease outbreaks may affect the ability of these markets to grow their beef exports. This is especially true for Argentina where

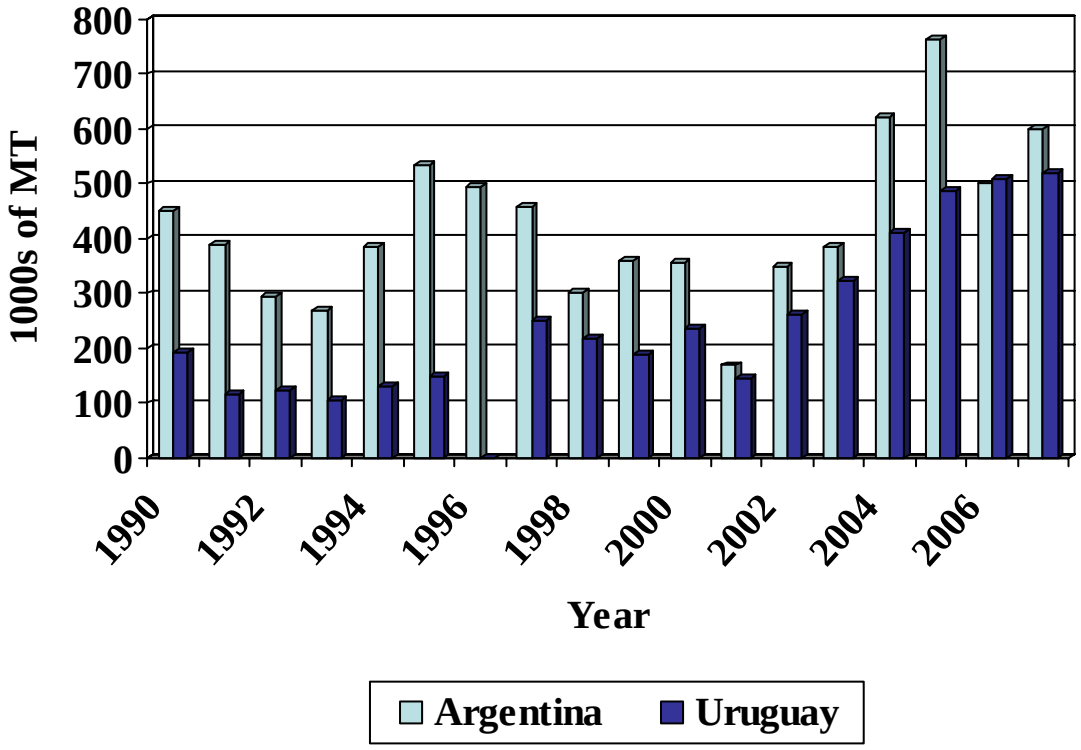

Figure 1: Beef and Veal Exports from Argentina and Uruguay, 1990-2007 project.

government policies are often designed to keep domestic beef prices low (Steiger, 2006; Thor, 2006). Work by Argentina and Uruguay to eliminate FMD has also contributed to export growth, but the re-emergence of FMD could eliminate or greatly reduce these markets (Boland, Perez, and Fox, 2007; Thor, 2006; Ekboir et al., 2002). Consequently, exogenous political risks and animal disease risks exist in these markets and should be examined when considering the possibility of investing in these markets.

Some large American food companies have had investments in the food industry of Argentina for sometime including investment in some of Argentina's largest food companies. Much of the American FDI in the food industry of Argentina is invested in food industries other than beef (USDA, ERS, 1998a). American investments in Argentina's food industry totaled slightly over $1 billion in 1996. The total stock of American FDI for all industries in Uruguay in 2004 was reported by the Department of State to be $533 million (U. S. Department of State, 2005) and was approximately $11 billion in Argentina in 2003 (U. S. Trade Representative, 2005).

There appears to have been limited American FDI in the past in the beef marketing chains in Argentina and Uruguay upstream from actual food products. One notable exception to this is the recent joint venture between Tyson, Cactus Feeders, and Cresud in Argentina which is designed to provide grain-fed beef into domestic and export markets. Understanding the limiting factors relating to FDI in beef systems in Argentina and Uruguay should be helpful to potential investors considering the possibility of investing in beef systems in South America as a means for accessing the EU market. It is also important for researchers and academics to understand the incentives, risks, and barriers to FDI in these markets as total international beef trade increases and as the market share of world beef exports for Argentina and Uruguay continues to increase. This paper attempts to address some of these issues by examining profitability at different levels of the cattle marketing chain in Argentina and also price risks associated with exporting beef from Argentina and Uruguay.

Procedures

Personal interviews were conducted in Argentina and Uruguay during the week of June 9, 2006 with industry participants from all levels of the marketing channel (e.g., producers, feedlot operators, and meat processors) as well as university researchers in both countries. Dr. Alejandro Reca of Rabobank International in New York City introduced the interviewers to Dr. Alejandro Silva of the Universidad de Buenos Aires. The interviews were then organized by Dr. Silva with additional help in setting up interviews being provided by Dr. Carlos Mezquita Benitez of the Universidad de la Republica, Uruguay and Dr. DeeVon Bailey of the Utah State University, USA.[4]

The purpose of these interviews was to familiarize the researchers with the economic environment relating to the beef systems of both countries that might contribute to their competitive advantage in international beef trade. The interviews also attempted to identify government policies and market events that might influence cattle and beef prices and thus contribute to risks associated with FDI. The interviews were undertaken in Buenos Aires and Villa Mercedes, Argentina and Montevideo, Uruguay. No set questionnaire was used during these interviews which were conducted by the researchers.

In summary, the interviews provided the blueprint for the analysis conducted in this research. From the interviews a basis for understanding the challenges and opportunities facing the beef industry in these two countries was established. This led to the selection of methodology and data used to conduct the research. The methodology included a detailed budgeting analysis of profitability at the different levels of the marketing chain to identify potentially profitably points in the chain for FDI. Also, because the interviews suggested that considerable price risk exists in Argentina and Uruguay as a result of government interventions and FMD outbreaks, an econometric analysis was conducted to quantify the potential risks associated with

[4] Additional detail about who was interviewed and how the interviews were set up and conducted is available in Thor (2006).

these events (i.e., government intervention and FMD). A further discussion of the selection of methodology and a description of the data used to conduct this analysis is provided in the following paragraphs.

The interviews consisted essentially of the same questions about the market environment for the appropriate level of the marketing channel, sources of market information, government policies affecting cattle and beef prices, and other risks associated with the cattle and beef business such as animal disease outbreaks. Interview responses were recorded in written form by the researchers and were then distilled by the researchers to identify the main conclusions that could be drawn from the interviews. These conclusions used to develop a general overview of the competitive advantage of the beef industries in both countries and also the principal government policies and other events during the previous 10 years that had had major effects on the beef industry in the two countries. These policies and events were then incorporated into the price analyses used in this research to determine how they contributed to risks associated with FDI during the study period.

The interviews revealed that one of the principal difficulties associated with conducting this type of research in Argentina and Uruguay was the unavailability of publicly available data for costs and returns in the beef and cattle industry. Through the interviews we discovered that information for gross margins for different segments of the Argentine cattle industry is published monthly in a magazine called *Margenes Agropecuarios Magazine* (various 1996-2006). These estimates are reported in this study for cow/calf operations, grass fattening operations, and feedlot operations on a monthly basis between January 1995 and October 2006. These data provide some idea of the profitability existing at different stages of the beef marketing chain in Argentina and to a large degree also likely reflect conditions in Uruguay.
Although a complete set of publicly available time series data for all costs and returns in the beef systems of Argentina and Uruguay was not available, the interviews established that monthly average cattle prices were available from the Liniers Market in Buenos Aires and the INAC (Instituto Nacional de Carnes) in Uruguay. These cattle prices were analyzed using data between January 1996 and June 2006.

Information was also discovered during the interviews in Argentina and Uruguay suggesting that government policies and FMD outbreaks have likely affected cattle prices in the two countries. Combining this information (cattle prices, government policy, and FMD outbreaks) into regression models using binary variables to depict government policies and FMD outbreaks provided an estimate of the absolute impact of these events on cattle prices. The government policies considered most important by the interviewees included the unpegging of the Argentine peso to the US dollar (devaluation) in 2002, the levying of a major export tax on beef in Argentina, and the recent export moratorium imposed by the Argentine government on beef exports. The interviews also uncovered when FMD outbreaks between 1996 and 2006 had occurred in Argentina which resulted in the interruption of beef exports from that country. Because Uruguay had no FMD outbreaks during this study time period, we measured what the effect of an FMD outbreak in Argentina would have on Uruguayan cattle

prices. That is, if the much larger Argentine beef market was closed to export, one might expect this to have a positive impact on the beef market in Uruguay as importers substituted away from Argentine beef to Uruguayan beef.

An analysis of the relative impacts of these events was also completed by examining price differences between local cattle prices in Argentina and Uruguay and the Chicago Mercantile Exchange's (CME) nearby live cattle futures price (sometimes referred to as the "world" cattle price). This yielded a basis analysis for Argentina and Uruguay which described how government policies and FMD outbreaks in Argentina have affected Argentine and Uruguayan prices relative to the rest of the world. This part of the analysis (relative prices) was important because it essentially revealed the opportunity costs associated with government policies and FMD outbreaks that restricted or disrupted beef exports during the study period. The following equations were used to analyze cattle prices in Argentina, with similar equations used to analyze prices in Uruguay:

$$PRICE_{jt} = \lambda_0 + \lambda_1 PRICE_{jt-1} + \lambda_2 QT1_{jt} + \lambda_3 QT2_{jt} + \lambda_4 QT3_{jt} + \lambda_5 MOR_{jt} + \lambda_6 DEV_{jt} + \lambda_7 FMD_{jt} + \lambda_8 NEWDES_{jt} + \lambda_9 TAX_{jt} + \lambda_{10} RES_{jt} + \rho_{jt} \quad (1)$$

$$BASIS_{jt} = \mu_0 + \mu_1 BASIS_{jt-1} + \mu_2 QT1_{jt} + \mu_3 QT2_{jt} + \mu_4 QT3_{jt} + \mu_5 MOR_{jt} + \mu_6 DEV_{jt} + \mu_7 FMD_{jt} + \mu_8 NEWDES_{jt} + \mu_9 TAX_{jt} + \mu_{10} RES_{jt} + \sigma_{jt} \quad (2)$$

The λs and μs in equations (1) and (2), respectively, were estimated parameters and ρ and σ are error terms. $PRICE_{jt}$ and $BASIS_{jt}$ represent the real, exchange-rate adjusted cattle price in Argentina during time period t in US dollars for the jth livestock type (j=400-420 kg., 480+ kg. in Argentina and steers, cows in Uruguay) and the basis between the real, exchange-rate adjust cattle price in Argentina and the deflated CME price in time period t, respectively. The variables $PRICE_{jt-1}$ and $BASIS_{jt-1}$ were lagged dependent variables for equation (1) and (2), respectively, and would be expected to have positive parameter estimates because current price levels should be positively related to price levels in the immediate past. Prices for cattle weighing 400-420 kg. represented primarily animals going to the domestic market in Argentina while those weighing over 480 kg. were similar to cattle that would eventually be exported as meat. Steers and cows in Uruguay represent markets for muscle meat and hamburger, respectively.

The three variables *QT1, QT2, QT3* were quarterly dummy variables and were used to correct for seasonality in the dependent variables in Argentina and Uruguay. The fourth quarter was used as the base. Typically one would expect prices to be highest in the spring (*QT3*) compared to the summer (*QT4*) because of the seasonal availability of cattle. *MOR* was a binary variable equal to one during the period of the export moratorium and zero otherwise. *MOR* would be expected to have a negative parameter estimate because restricting exports should reduce domestic cattle prices. At the time the personal interviews were conducted, a moratorium on beef exports had been in

place for four months and was thought by interviewees to be negatively affecting all parts of the cattle business in Argentina.

DEV was a binary variable describing the impact on cattle prices and the basis resulting from the devaluation in Argentina's currency in 2002. This was when the Argentine government decided to unpeg the one-to-one ratio between the peso and the US dollar. *DEV* was set equal to one following this devaluation and was zero otherwise. *DEV* would be expected to have a negative parameter estimate, especially for the basis equation, because after the devaluation domestic prices in Argentina should have declined relative to prices in the US.

The binary variable for *FMD* was equal to one when the EU market was closed to Argentine beef exports as a result of an FMD outbreak in Argentina. *FMD* was expected to have a negative parameter estimate for the Argentina model because a cessation in trade would be expected to result in lower domestic prices for exporters. However, *FMD*[5] was expected to have a positive parameter estimate for the Uruguay model because a cessation of beef exports from Argentina would be expected to enhance the demand for Uruguayan beef. In this respect, *FMD* in the Uruguay model becomes a proxy for the effect on Uruguayan prices of events in Argentina that either stopped or hindered Argentine beef exports.

In 2005, Argentina tripled export taxes on domestic beef exporters. *TAX* is a binary variable that estimates the effect this tax had on cattle prices. *TAX* was equal to one during the period the tax was in force and zero otherwise. *TAX* was expected to have a negative parameter estimate because an export tax is expected to reduce the amount of beef exported and, hence, domestic cattle prices. *NEWDES* was a binary variable used to account for changes in reported weights at the Liniers market during the study period and had no *a priori* expectation relating to the sign of its parameter estimate. *NEWDES* was equal to one for cattle reported as weighing 430-460 kg. and zero for cattle reported as weighing 401-420 kg. The final variable, *RES,* represented the residuals of the cattle price or basis time series off a linear trend line. This captured the effects of systematic rises and falls in cattle prices in Argentina and Uruguay due to cattle cycles. *RES* was expected to have a positive parameter estimate because prices above the trend line had a positive value for *RES* while prices below the trend line yielded a negative value for *RES*.

Finally, Johansen's (1991) cointegration tests were used to determine whether cattle prices in Argentina were cointegrated with US cattle prices. The analysis was then repeated for Uruguayan and US cattle prices. For a thorough discussion of cointegration methodology applied to agribusiness price analysis see Vickner and Davies (2000 and 2002). If the prices were cointegrated, it indicated that the prices in both pairs of markets adjust to the same information and that the markets are relatively efficient (if one considers the US cattle market price to be efficient). Efficient

[5] Because Uruguay was FMD free during the study period, *FMD* in the Uruguay model examined the impact on Uruguayan prices of export cessations from Argentina resulting from FMD outbreaks.

markets are essential for one to have confidence that the market reacts appropriately and quickly to new information as it becomes available. The existence of inefficient markets would be a very negative signal for FDI because investors could not be certain that prices would adjust to actual supply and demand conditions. The vector error correction (VEC) model used to determine whether the Argentina or Uruguay price (P_1) is cointegrated with the US price (P_2) is given by a typical specification:

$$\Delta P_{1t} = \alpha_{10} + \alpha_{11}\Delta P_{1t-1} + \alpha_{12}\Delta P_{1t-2} + \beta_{11}\Delta P_{2t-1} + \beta_{12}\Delta P_{2t-2} + \phi_1(P_{1t-1} - \delta - \gamma P_{2t-1}) + \varepsilon_{1t} \quad (3)$$

$$\Delta P_{2t} = \alpha_{20} + \alpha_{21}\Delta P_{1t-1} + \alpha_{22}\Delta P_{1t-2} + \beta_{21}\Delta P_{2t-1} + \beta_{22}\Delta P_{2t-2} + \phi_2(P_{1t-1} - \delta - \gamma P_{2t-1}) + \varepsilon_{2t} \quad (4)$$

where the unknown parameters will be estimated using maximum likelihood methods. It is easily observed that the VEC is simply a vector autoregressive (VAR) model with an additional term $P_{1t-1} - \delta - \gamma P_{2t-1}$ (i.e., the cointegrating relationship). The VAR expresses changes in price at time t as a function of both own and related price changes in earlier time periods (t-1 and t-2 specifically). The α and β parameters capture these effects in the VAR portion of the VEC. The cointegrating relationship $P_{1t-1} - \delta - \gamma P_{2t-1}$ relates the level of prices, not changes in price levels, in the last period. Both δ and γ are common across (3) and (4). The key parameter here is γ since it characterizes the long-term relationship between the Argentine or Uruguayan cattle price (P_1) and the US cattle price (P_2). *A priori* we expect $\gamma < 0$ since the two series move opposite one another when plotted. The remaining ϕ parameters are the well-known speeds of adjustment. They characterize the length of time (P_1) and (P_2) take to get back into equilibrium in the short-run if the system experiences some kind of shock or disturbance to the long-run equilibrium path.

The following section relates the results of the profit and price analyses. The results indicate that profit potential exists for strategic FDI in the beef systems of these countries, but that this depends on the strategic business arrangements developed and the absence of government policies interfering with free trade.

Results

General Overview of Potential Competitive Advantage

The interviews suggested that both Argentina and Uruguay have a competitive advantage in producing cattle and beef, but both countries also face significant problems relating to expanding beef exports. For example, both Argentina and Uruguay have strong domestic demand for beef as well as growing export markets. However, Argentina has a larger land and grain production base than Uruguay and, consequently, could support a cattle feeding industry more easily than Uruguay. Both countries have specialized work forces and good infrastructures that support the beef industry. While both countries have governments that are strongly committed to their

respective beef industries, Argentina often experiences governmental interference in its cattle and beef markets. On the other hand, the government of Uruguay promotes transparent and export-oriented markets and marketing strategies.

Both countries are well-engineered for producing beef. However, Argentina's beef market faces considerable risk resulting from the threat of FMD and also governmental policies which are not conducive for the international beef trade. Uruguay has a strong commitment to the international beef trade, but lacks the land base and grain production to significantly increase its export base. These conditions suggest that both countries have significant opportunities and barriers that could affect the growth in their beef export markets. Consequently, investors need to consider institutional influences beyond just costs of production and transportation costs when examining the possibility for FDI in the beef industries of these two countries.

Budgeting Analysis of Historical Profitability

Based on average profitability reported in *Margenes Agropecuarios Magazine* (various 1996-2006) between 1996 and 2006, cow/calf operations (mean $7.92/hectare and standard deviation $7.73/hectare) and grass fattening (mean $9.30/hectare standard deviation $24.06/hectare) have positive average returns while feedlots (mean -$11.20/head and standard deviation $15.03/head) have negative average returns. Returns are obviously cyclic, as would be expected, because of the substantial biological lag associated with cattle production (Figure 2).

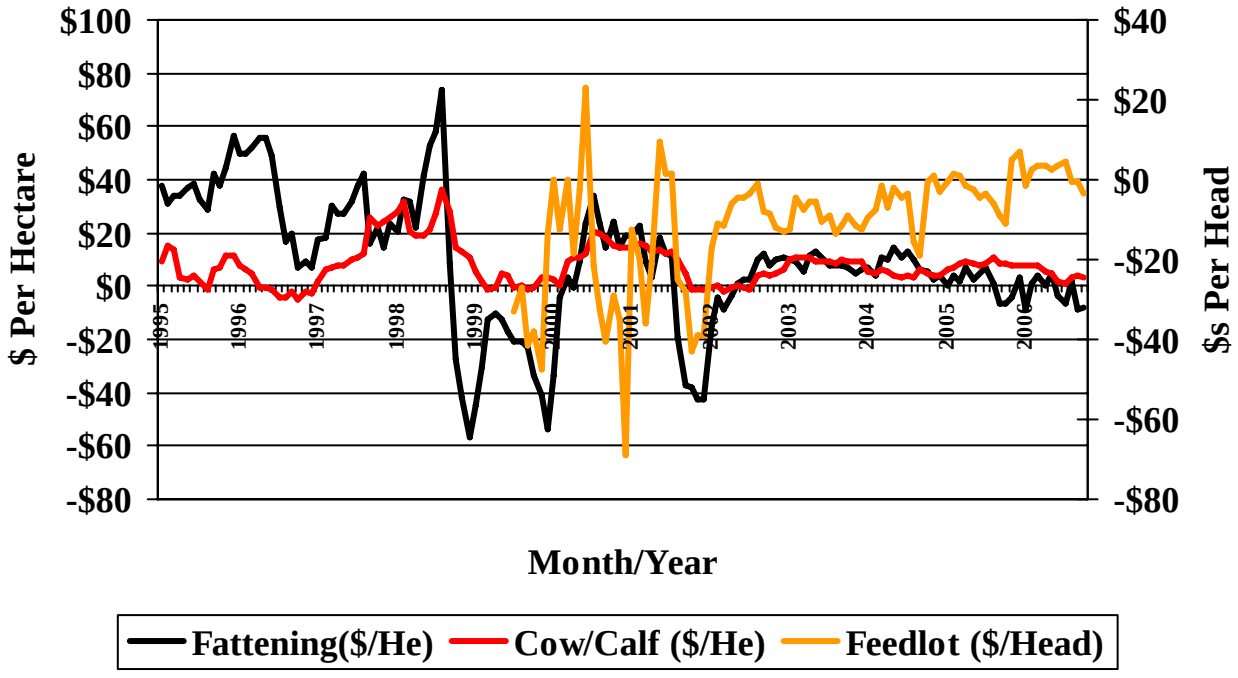

Figure 2: Exchange Rate-Adjusted Profitability for Different Segments of the Cattle Marketing Chain in Argentina Reported in US Dollars, January 1995 – October 2006.

Returns for grass-based operations are consistently positive (75% of the months for grass fattening and 84% of the months for cow/calf operations). Feedlot operations were profitable for only 17% of the months between 2000 and 2006. However, profitability in feedlots has been consistently improving since 2002 (Figure 2). These figures are also consistent with Silva's (2003) point estimates for profitability at the different stages of production in the beef marketing chain in Argentina. Because the data include a charge for land, the results are essentially an estimate of economic profit. They also reflect statistically speaking that economic profits are basically zero or normal. This suggests that markets are competitive at these three levels and as such may not represent significant opportunities for FDI as far a generating higher than normal profits.

Although returns are statistically zero for all three of these levels of the marketing chain, a discussion of the cost structure of the cattle industry at each stage of the marketing chain may be instructive as far as understanding the relative variability in returns at the three different levels. Cow/calf operations in these countries rely on few inputs other than land. In this sense, the cow/calf sector is a "closed system" in this part of South America that buys few inputs on the market (purchased inputs include sanitary products, labor, professional services, and tax services). Short-run exogenous shocks have limited direct effect on profit due to the long production cycle (15-16 months for calves and 33-35 months for cows).

Profits in grass fattening operations depend heavily on the purchase price for calves being placed on grass for fattening. For example, according to Silva (2003) if the ratio of calf price and steer prices exceeds 1.20, profit tends to be negative (the average ratio was 1.07 between 1990 and 2000). The price of calves represents about 61% of total cost for grass fattening operations, according to information reported in *Márgenes Agropecuarios Magazine* (2006).

Feedlots are more "open" systems than cow/calf or grass fattening operations and their profits are heavily influenced by short-run exogenous shocks due to the relatively short production cycle for feedlots (113 days/cycle on the average). Examples of potential exogenous shocks include such things as the prices of feeder cattle, grains, energy, and finished cattle. Short-run prices, of course, are also influenced by government policies and animal disease outbreaks. Pearcey (1999) suggests that feedlots in Argentina and elsewhere have high fixed costs due to investments in machinery and equipment. Consequently, capacity utilization is an important driver of profitability for feedlots.

Grass feeding cattle is the most efficient method of rearing cattle in Argentina, both in energy and economic terms (Silva, 2003), so it is not surprising that the results indicate that positive profits usually exist for the cow/calf and grass fattening segments, and negative profits for the feedlots.[6] If one accounts for the increase of energy prices by the

[6] It should be noted that there were only 88 point estimates for feedlots and 142 for cow/calf and grass fattening segments.

previous Argentine administration (2002) and present administration (2003)[7], the profit figures depicted in Figure 2 can be easily explained. Most grass fattening operations are diversified meaning that they are also cropping operations where cattle are considered a low-risk sideline investment but not the primary source of income for the operation (Silva, 2006).

Conditions in the meat packing and exporting industries were also considered. The overall four-firm concentration ratio (CR4) for meat packing in Argentina is only 9% and the Herfindahl-Hirschman Index (HHI) is 248 (Silva, 2003). This compares to the CR4 in the US of 80% (Barkema, Drabenstott, and Novack, 2001) and for Australia of 29% (CICCRA, 2004). The US Department of Justice estimated a HHI for the US of1936 (Barkema, Drabenstott, and Novack, 2001). The Hilton Quota market in Argentina has a CR4[8] of 40% and a HHI of 653, showing greater concentration in exporting than in meat packing. Low concentration in meat packing suggests a relatively competitive market at that level. Exporting appears to be a less competitive market than meat packing. However, exporting plants have been systematically increasing their profit margins, due to extraordinarily high prices in the international market. The signals revealing that exporting firms expect to achieve important profits are the acquisition of local exporting firms by transnational corporations such as Cargill (US), Friboi (Brazil) and Tesco (UK) (Silva, 2006).

A point estimate of profitability in the packing industry for domestic and exported beef is provided in Table 1.[9] Silva (2006) believes that this point estimate is fairly representative of typical conditions in the packing industry in Argentina. The results presented in Table 1 indicate that the packing industry in Argentina is profitable. However, the results also indicate that exported beef has a higher profit margin than domestic beef. The reason for this is the value of the Hilton Quota in exporting to the EU.

The growth in beef imports expected in the EU might lead one to speculate that over time there will be increased incentives offered by the EU to beef importers. If so, then meat packing for export would appear to be an increasingly attractive investment over time. The results related to meat packing, qualified by the fact that they are based on a point estimate, support the notion that FDI will be drawn to the packing and export sectors. This conclusion would appear to be supported by the recent investments in beef exporting in Argentina by transnational companies.

Uruguay lacks the large amount of agricultural land existing in Argentina and is also energy dependent on imports. Consequently, Uruguay is committed to beef cattle production and forestry because exports industries are viewed as the main drivers for national development in Uruguay. The most important barrier to further FDI in

[7] The prices of energy have been heavily regulated in Argentina since the devaluation in 2002.
[8] CR4 and HHI as reported here were estimated in March 2007 using export quantities for the Hilton Quota in 2003.
[9] The results presented in this study are valid for the time period considered and for conditions during the period for when point estimates were made. Additional research that incorporated a time series for export and domestic packing industries would be appropriate in another study.

Table 1: Point Estimate of Relative Mark1eting Margins for Domestic and Exported Meat FOB Packing Plant, Argentina.

Calculation of Export Carcass Cut-Out Value:[1]

Carcass Weight (kg.)	Primal Cut	%	Weight (kg.)	Beef Yield (kg.)	By Products Fat & Bone (kg.)	Price[2] (US $/kg.)
	Pecho (Chest)	36	100	68	32	$2.32
	Parrillero	14	38.92	35	3.92	$2.32
278	(Grill)					
	Rump & Loin	21	58.38	35.71	22.67	$7.97
	Rueda	26	72.28	49.71	22.57	$2.32
	Shrinkage	3	8.34			
			Weight Average			**$3.38**

Relative Marketing Margin for Export Meat Packing Plants As of April 6, 2007 (RMM):[3]

Live Price for 480 kg. Steer	$1 US/kg
Export Packer Price FOB[4]	$3.38 US/kg
RMM	70%

Relative Marketing Margin for Domestic Consumption RMM[3]

Live Price for 420 kg. Steer	$1 US/kg
Meat Packer Wholesale Price[5]	$1,72 US $/kg. (Sold on a carcass basis)
RMM	42%
Retailer Price[6]	$2.60 US $/kg (deboned carcass basis)
RMM	34%

[1] Technical information for calculating weights for cuts taken from Iriarte (2003).
[2] Includes just the revenue from beef, not from by products.
[3] RMM= (Sales Price – Purchase Price)/Sales Price [Relative Marketing Margin]. Export Prices for EU Hilton Quota: $7,970 $/MT and other fresh cuts 2,320 $/MT
[4] The slaughter service (toll) is paid from the revenue from by products sold by the meat packing plant. The user of the service receives the carcass cut in halves with no cash costs beyond this.
[5] Average price for a kg. of beef in the carcass with an average yield of 58% from live weight.
[6] Average price for a kg. of beef sold over the counter with an average yield of 81.88 % from carcass weight.

Uruguay is the limited cattle herd and unavailability of additional land for cattle production. In the future there may be increasing cooperation between Uruguay and Argentina such as expanding the packing industry in Uruguay and slaughtering an increasing number of cattle from Argentina. Grain costs are lower in Argentina thanin Uruguay, due to its relative abundance of land and infrastructure. Uruguay is closer to Buenos Aires or Rosario than many of the major cattle producing provinces in western, southern and northern Argentina (Silva, 2006). These factors would seem to indicate that incentives exist for Argentina and Uruguay to establish cooperation in developing cattle markets.

Econometric Analysis of the Impact of Government Interventions and FMD Outbreaks

The price analysis results are presented in Tables 2-5. The signs for the parameter estimates were those expected for almost all of the independent variables. The discussion in this section will focus on the variables of most interest (i.e., government

intervention and FMD). The analysis revealed that the impact of government policies and FMD outbreaks can have a substantial negative impact on absolute cattle prices in Argentina, but that the impact is even larger on relative prices as measured by the basis (see parameter estimates for *MOR*, *FMD*, *DEV*, and *TAX* in Tables 2 and 3).

Table 2: Price Regression Analysis Results for Argentina.

401/420 Price	Parameter Estimate	Standard Error	R^2	480+ Price	Parameter Estimate	Standard Error	R^2
INTERCEPT	8.965**	2.003	0.984	*INTERCEPT*	9.455**	1.978	0.981
$PRICE_{t-1}$	0.827**	0.042		$PRICE_{t-1}$	0.801**	0.043	
Q1	0.065	0.441		*Q1*	0.317	0.433	
Q2	-0.101	0.442		*Q2*	0.134	0.436	
Q3	-0.367	0.440		*Q3*	-0.033	0.436	
MOR	-0.828	1.496		*MOR*	-0.897	1.475	
DEV	-1.198	0.854		*DEV*	-1.278	0.790	
FMD	-2.952**	0.728		*FMD*	-3.026**	0.686	
NEWDES	-0.871	1.321		*NEWDES*	-0.953	1.304	
TAX	-1.585**	0.709		*TAX*	-1.777**	0.688	
RES	0.252**	0.050		*RES*	0.291**	0.051	

**Statistically significant at the 5% level.

Table 3: Basis Regression Analysis Results for Argentina

401/420 Basis	Parameter Estimate	Standard Error	R^2	480+ Basis	Parameter Estimate	Standard Error	R^2
INTERCEPT	-6.046**	1.356	0.970	*INTERCEPT*	-8.087**	1.406	0.968
$BASIS_{t-1}$	0.608**	0.048		$BASIS_{t-1}$	0.575**	0.048	
Q1	0.847	0.719		*Q1*	1.017	0.694	
Q2	0.461	0.742		*Q2*	0.499	0.722	
Q3	-0.431	0.739		*Q3*	-0.530	0.723	
MOR	-1.436	2.480		*MOR*	-1.598	2.395	
DEV	-3.797**	1.270		*DEV*	-3.930**	1.161	
FMD	-7.018**	1.101		*FMD*	-6.942**	1.019	
NEWDES	-1.146	2.163		*NEWDES*	-1.547	2.092	
TAX	-4.743**	1.146		*TAX*	-4.902**	1.090	
RES	0.533**	0.062		*RES*	0.601**	0.061	

**Statistically significant at the 5% level.

Table 4: Price Regression Analysis Results for Uruguay

Steer Price	Parameter Estimate	Standard Error	R^2	Cow Price	Parameter Estimate	Standard Error	R^2
INTERCEPT	-1.218**	0.583	0.984	*INTERCEPT*	-0.900	0.477	0.985
$PRICE_{t-1}$	0.970**	0.014		$PRICE_{t-1}$	0.973**	0.014	
Q1	1.573**	0.418		*Q1*	0.909**	0.336	
Q2	1.293**	0.414		*Q2*	0.832**	0.336	
Q3	2.222**	0.426		*Q3*	1.970**	0.338	
FMD	0.735	0.374		*FMD*	0.576	0.298	
RES	0.110**	0.037		*RES*	0.096**	0.035	

**Statistically significant at the 5% level.

Table 5: Basis Regression Analysis Results for Uruguay.

Steer Basis	Parameter Estimate	Standard Error	R^2	Cow Basis	Parameter Estimate	Standard Error	R^2
INTERCEPT	-4.952**	1.328	0.951	*INTERCEPT*	-5.518**	1.519	0.938
$BASIS_{t-1}$	0.935**	0.024		$BASIS_{t-1}$	0.919**	0.028	
Q1	1.943**	0.922		*Q1*	1.348	0.888	
Q2	2.063**	0.921		*Q2*	1.707	0.881	
Q3	1.183	0.966		*Q3*	1.015	0.915	
FMD	0.988	0.810		*FMD*	0.853	0.772	
RES	0.245**	0.063		*RES*	0.267**	0.065	

**Statistically significant at the 5% level.

For example, the average real, exchange-rate adjusted price for 480+ kg. cattle at the Liniers auction during the study period was approximately \$33/cwt. (\$0.73/kg.). The average impact of a *FMD* outbreak on domestic (relative) prices was -\$3.03/cwt. (-\$6.94/cwt.), all other things being equal (Tables 2 and 3). This suggests a loss of 9% (21%) in the value of domestic live cattle that were sold during an FMD outbreak. This would be in addition to losses in the export market. For example, in 2006 Argentina exported approximately 500,000 MT of beef. The cessation of exports, if an FMD outbreak had been experienced during the entirety of 2006, would have been foregone income from exports of almost \$1.7 billion (\$3.38/kg.[10] * 1000 kg. * 500,000 MT). This would be in addition to losses experienced on live cattle sold domestically during that same time period. Consequently, the combined losses from cattle sales and lost exports would be much higher.[11] There are obviously huge incentives to avoid FMD outbreaks and this explains why so much effort has been made to eliminate FMD in Argentina and Uruguay.

A similar analysis could be conducted for the export tax (*TAX*). Based on the parameter estimate in Table 3, *TAX* would have resulted during the taxation period in reducing values for domestic cattle in Argentina relative to the rest of the world by approximately \$23.52/head (\$4.90/cwt. * 4.8 cwt.). The Argentine devaluation in 2002, while likely being an appropriate government policy, resulted in a drop in the relative price of cattle in Argentina of approximately \$18.86/head (\$3.93/cwt.[12] * 4.8 cwt.). The result of *DEV* was to make Argentine beef cheaper on world markets and exports from Argentina did increase after 2002 (Figure 2). The result of the devaluation was a stimulation of beef exports. This appears to run counter to government policies in Argentina that are often designed to eliminate or reduce beef exports as a method to keep domestic beef prices low. Consequently, subsequent government policies such as *TAX* and *MOR* may have been an attempt to counter the effects of the devaluation.

Government actions designed to keep beef prices low eliminated or significantly reduced the ability of exporters to participate in world trade when world prices were

[10] See Table 1 for explanation of export value (i.e., \$3.38/kg.).
[11] The cattle inventory of Argentina is over 50 million head (USDA, ERS, 1998b). If only 20% of these went to market each year, this could result in a potential loss of another \$145 million (\$3.03/cwt. * 4.8 cwt. * 10 million head.)
[12] See Table 3.

relatively high (i.e., the basis with world prices becomes weaker when world prices increase). Consequently, government involvement represents a significant risk to FDI in beef systems, especially in Argentina. This is much less of a problem in Uruguay were government policy is designed to promote beef exports. The effect of *MOR* in Argentina was negative but not statistically significant (Tables 2 and 3). The reason for this may be that the moratorium had been in place for only four months at the time the analysis was completed and this may have been an insufficient amount of time to establish the impact of *MOR* statistically.

No governmental policy variables were included in the models for Uruguay because the Uruguayan government had not implemented such policies during the study period (see Tables 3 and 4). However, *FMD* was included in the Uruguayan models essentially as a proxy for events in Argentina affecting Argentine beef exports and which might then have affected the Uruguayan cattle market indirectly. The parameter estimates for *FMD* in Tables 3 and 4 are positive as expected, but are not statistically significant. This would suggest that there is not strong statistical evidence that a cessation or reduction of beef exports from Argentina effects cattle prices in Uruguay. The reasons for this are likely the relatively small size of the Uruguayan market compared to Argentina and the fact that Uruguay faces significant barriers to increasing exports substantially in the short run.

There was not a statistically significant seasonal component to either prices or basis for Argentina (*Q1*, *Q2*, and *Q3* in Tables 2 and 3), but seasonality was indicated for steers in Uruguay, but not for cows (Tables 4 and 5). This should not be surprising because the price of cows is likely less influenced by world prices than the price of steers (steer meat would be more frequently traded in world markets). Cattle cycles had a strong influence on both prices and the basis in both countries (see *RES* in Tables 2-5). That is, when domestic cattle numbers are relatively low (high) prices tend to be higher (lower) resulting in an improving (weakening) basis with world prices.

These results indicate that a significant amount of risk is present in the cattle market in Argentina as a result of government policies and FMD outbreaks.[13] This analysis provides estimates of the negative impacts caused by these events. The impacts are of sufficient magnitude that investors should consider the probability of such events occurring when considering investment strategies in Argentina.

Cointegration Tests

In Table 6, we found the Argentina price to be cointegrated with the US price, and the Uruguay price to be cointegrated with the US price.[14] This is a robust result as

[13] The results are, of course, qualified by the time period of the analysis (1996-2006), but should represent a long enough period to present a fairly accurate picture of the impact of government interventions and animal disease outbreaks.
[14] Due to page limitations, full model results, including parameter estimates in each VEC model and results from the battery of ADF tests and related specification tests, are available upon request from the authors.

Table 6: Johansen Cointegration Test Results for Argentina and Uruguay.

401/420 kg. in Argentina and US CME

Hypothesis	Likelihood Ratio Statistic	5% Critical Value	P-value	Eigenvalue
Trace				
r = 0	28.2357	15.4947	0.0004	0.2381
r ≤ 1	1.0359	3.8414	0.3088	0.0103
Max-Eigen				
r = 0	27.1998	14.2646	0.0003	0.2381
r ≤ 1	1.0359	3.8414	0.3088	0.0103

480+ in Argentina and US CME

Hypothesis	Likelihood Ratio Statistic	5% Critical Value	P-value	Eigenvalue
Trace				
r = 0	27.5846	15.4947	0.0005	0.2305
r ≤ 1	1.3732	3.8414	0.2412	0.0136
Max-Eigen				
r = 0	26.2113	14.2646	0.0004	0.2305
r ≤ 1	1.3732	3.8414	0.2412	0.0136

Uruguay Steer and US CME

Hypothesis	Likelihood Ratio Statistic	5% Critical Value	P-value	Eigenvalue
Trace				
r = 0	29.2838	15.4647	0.0002	0.2429
r ≤ 1	1.4495	3.8414	0.2286	0.0143
Max-Eigen				
r = 0	27.8343	14.2646	0.0002	0.2429
r ≤ 1	1.4495	3.8414	0.2286	0.0143

Uruguay Cow and US CME

Hypothesis	Likelihood Ratio Statistic	5% Critical Value	P-value	Eigenvalue
Trace				
r = 0	27.8883	15.4947	0.0004	0.2346
r ≤ 1	1.1445	3.8414	0.2847	0.0113
Max-Eigen				
r = 0	26.7437	14.2646	0.0003	0.2346
r ≤ 1	1.1445	3.8414	0.2847	0.0113

it persists using both the trace and eigenvalue likelihood ratio tests for each respective pair of price series. In each case, we rejected the null hypothesis of no cointegrating vector. That is to say under the null hypothesis r = 0, where r is the number of cointegrating vectors in the system, we strongly reject this hypothesis. It is noted r can be at most one minus the number of price series in the model. In this study, then r can be at most one. For this test, we failed to reject the null hypothesis of at most one cointegrating vector ($r \leq 1$), again in each case. Thus, each pair of prices was

cointegrated indicating that the time series are reacting to the same market information and are therefore essentially the same efficient market. Further, these price series are negatively cointegrated ($\gamma < 0$) as expected a priori. This implies that the series tend to react to the same market information but move in opposite directions.

For example, if market conditions tend to move the world price higher, local prices tend to move lower. This pattern is visually evident when plotting the respective pairs of prices (Figure 3). This could be explained by government interventions designed to keep local prices low when world prices increase. This result suggests that government policies of the past have provided at least some disincentive to invest in beef exporting from Argentina because exporters are unable to fully participate in world markets when prices are high.

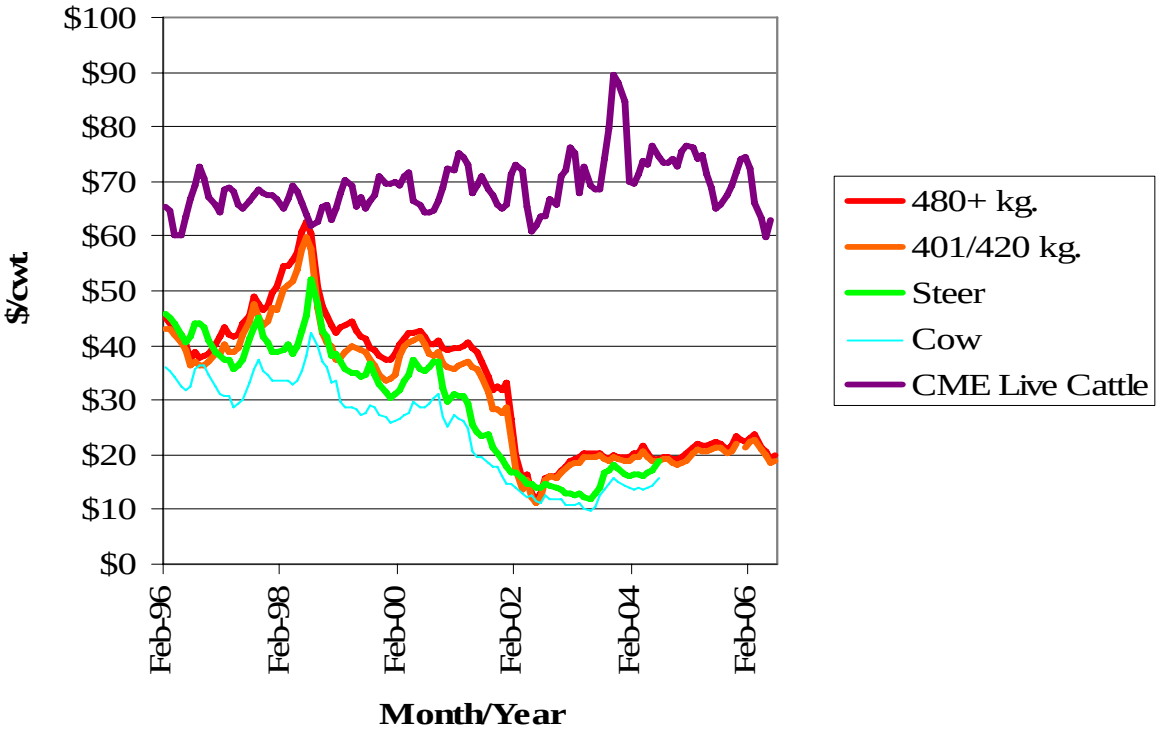

Figure 3: Real, Exchange-Rate Adjusted Cattle Prices in the United States, Argentina, and Uruguay, 1996-2006.

This result suggests that governmental policy needs to align with corporate objectives to encourage FDI in the beef industry in South America. This does not necessarily mean that exporting from these countries is unprofitable because apparently it is a profitable venture as the profitability analysis, especially for meat packing provided above, demonstrates. However, profits appear to be limited from time to time by different governmental actions and FMD outbreaks.

Conclusions

The expected growth in beef imports in the EU and the fact that North American beef exports are essentially shut out of the EU market provides significant incentives for finding alternative ways for exporting beef to the EU. This research examines the profit potential for FDI in the beef systems of Argentina and Uruguay by investors from places like North America so that they can become involved in exporting beef to the EU. Interviews with industry experts in Argentina and Uruguay established the foundation for this analysis and resulted in the selection of historical budgeting and econometric models being used as the basis for examining this question.

The findings suggest that while Argentina and Uruguay have a competitive advantage in beef production that should provide incentives for FDI in their beef systems, the potential for government policy interventions in cattle and beef markets (especially in Argentina) and FMD outbreaks inject considerable risk into these investments. FDI opportunities appear to be primarily at the export packer level rather than in raising cattle. Joint ventures by export packers and feedlots (i.e., Tyson, Cactus Feeders, and Cresud) and the expansion of the number of feedlots in Argentina suggest FDI strategies involving export packers are being positioned to enhance the quality of meat being both exported and sold domestically. Entrée to the export market appears to be a critical element of the FDI decision in Argentina and Uruguay and explains the current joint venture and FDI strategies being pursued by international firms investing in the beef systems of these two countries.

Cattle markets in Argentina and Uruguay appear to operate efficiently, based on the cointegration analysis, but government intervention that restricts or eliminates beef exports results in lower domestic cattle prices than if beef exports were allowed to flow in an unrestricted fashion. Profitable FDI appears possible, especially in beef exporting, if markets are left unhindered by government intervention.
During the next decade, beef exporters can hardly ignore the export potential that exists into the EU. Restrictions on beef exports with added hormones coupled with additional requirements such as traceability make South America and specifically Argentina and Uruguay apparent targets for FDI by beef exporters. Some investment is occurring and is almost certainly being driven by the opportunities looming in the EU. However, the growth in FDI for beef exporting from Argentina and Uruguay is still relatively small but will likely continue to grow. However, this growth will probably occur more slowly than one might otherwise expect because of limitations inflicted on the beef export market by government policies in Argentina and limited expansion capability for beef in Uruguay.

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