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Do Alpacas Represent the Latest Speculative Bubble in Agriculture?

Tina L. Saitone

Richard J. Sexton

Department of Agricultural and Resource Economics
University of California, Davis

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Abstract: Alpacas were introduced into the U.S. from South America in 1984, and the domestic alpaca herd has grown rapidly in the succeeding 20 years. The benefits of raising alpacas are touted routinely on national television, and alpaca breeding stock in the U.S. sells routinely for prices in the range of $25,000 per head, many times higher than prices obtainable in Peru, where the world's largest alpaca herd resides. We study the evolution of the U.S. alpaca industry and ask whether today's current prices for alpaca stock can be justified by fundamental economic conditions governing the industry, or whether alpacas represent the latest speculative bubble in American agriculture.

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The alpaca industry in the United States began when these camelids were first imported in 1984 from South America. Since this time owners, breeders, and speculators alike have been promoting the industry, pushing for national herd expansion to facilitate a base of animals adequate to sustain a viable alpaca textile industry. Touted in advertisements on national television (e.g., see exhibit 1) as an alternative to the corporate lifestyle for average Americans, the U.S. alpaca herd has grown substantially over the past twenty years, with the stock of registered animals exceeding 62,000 at the start of 2004.[1]

The average auction price of alpaca breeding stock in the U.S. may exceed $25,000 while in Peru, where over three million alpacas reside and the world's only viable alpaca textile industry is maintained, alpacas sell for a small fraction of this price. The pricing dichotomy is even more striking when considering that all U.S. alpacas are of South American origin and boast few, if any, distinguishing characteristics from their ancestors.

While Dutch tulip mania, the South Sea bubble, and the Mississippi bubble are on most short lists of famous, speculative manias with dire consequences, the agriculture industry has not been immune to speculative bubbles. Merino sheep, Berkshire hogs, Broom corn, and Rohan potatoes are examples of commodities attracting speculation during the pre-Civil War period of U.S. history (Cole, 1926), while more recent bubbles have surrounded increasingly exotic specimens such as Emus, Shetland ponies, Boer goats, and ostriches (Gillespie and Schupp, 2002). Due to the striking similarities between the auspicious beginnings of these industries and the U.S. alpaca industry, it is important to consider whether alpacas represent the latest speculative bubble in agriculture.

[1] Ohio, with 8,565 registered animals, is the leading state in the U.S. in terms of alpaca population followed by Washington, Oregon and Colorado, respectively (Alpaca Registry Inc., 2004).

This paper investigates the evolution and current state of the alpaca industry in the U.S. and addresses whether current alpaca prices are supportable by market fundamentals or, instead, likely reflect a speculative bubble that is destined to burst to the ultimate dismay of investors swayed by the pervasive advertising campaigns and the animals' appealing appearance. Most speculative bubbles throughout history have been studied from an *ex post* perspective, using retrospection and econometric tests to assess whether market fundamentals or self-fulfilling speculation determined the historical pattern of prices. This paper is a rare attempt to investigate a potentially ongoing speculative bubble. The practical benefit of this research is to advise those who are considering investments in alpacas. A more fundamental contribution is to examine the circumstances that have led the U.S. alpaca industry to its present state and distill the lessons that can be distilled from it.

Exhibit 1
Alpaca Television Advertisement Transcript

Actor/Alpaca Rancher: *I love alpacas because back in 1993 I was getting burned out in a high-stress medical practice. I discovered that raising alpacas allowed me to live a comfortable rural lifestyle and to spend more time with my family. Now, 10 years later, I can still say that it was a great decision.*

Announcer: *Alpacas are gentle and easy to raise. To get the full story, visit an alpaca farm or ranch. To locate one near you, go to Ilovealpacas.com.*

Advertisement transcribed from "On the Record," Fox News Channel, August 24, 2005

In the following sections, we describe the introduction of alpacas to the U.S. and examine the subsequent growth of the industry. We discuss several barriers to entry that have been erected in the industry and that effectively prohibit the importation of alpacas to the U.S. Subsequently, we investigate the market status of alpaca fiber, the sole marketable product produced by alpacas and, thus, the main source of their value, apart from the speculative value associated with breeding stock.

Based upon this foundation, we formulate a conceptual model to determine the capital asset value of an alpaca, following the seminal approach developed by Jarvis (1974), who designed a livestock valuation framework based upon animals' essential characteristics as a capital good, with their current value as slaughter animals and future value in reproduction utilized to determine the animals' inherent worth. This model was extended subsequently to the valuation of animals whose worth is derived from byproducts such as draft power, milk, manure, and hide (Jarvis, 1982). We adapt the livestock capital asset framework to incorporate the unique features of alpacas, including their value as fiber producers. We ultimately combine the conceptual and empirical evidence to address and answer the fundamental question of whether contemporary prices for alpacas in the U.S. can be explained by market fundamentals or are driven by speculation and represent a bubble that is destined to burst.

Evolution of the U.S. Alpaca Industry

Four years after the first alpaca was imported into the U.S. from South America, the Alpaca Owners and Breeders Association (AOBA) was established in 1988. Immediately upon inception, the AOBA created the Alpaca Registry, Inc. (ARI) to undertake blood typing, DNA testing, and the registering of animals being imported into the U.S. Originally, any alpaca could be registered with the ARI regardless of its country of origin, but as time progressed and the population of alpacas grew, the AOBA began expressing concerns surrounding the genetic integrity and overall quality of the U.S. herd (Safley, 2004a). Consequently, screening processes were instated and became increasingly stringent over time until the ultimate closure of the registry in 1998 when the ARI began restricting registration to only those offspring (cria) of a registered sire and dam. As a consequence of the registry closure, all animals are now blood typed prior to registration in order to confirm their parentage. Currently, nearly 99% of all alpacas in the U.S. are registered, and animals in the U.S. without this distinction have minimal value as breeding stock or in auctions and are extremely difficult to sell via private transactions (Collins, 2000).

Genetic integrity and quality of the U.S. herd were cited as the primary reasons for the closure of the registry. According to Safley (2004b), pedigrees make alpacas more valuable and become increasingly important as a decreasing percentage of the national herd is without documented parentage. Opposition to the closure of the registry was based upon the belief that the gene pool in the U.S. is not large enough and that the closure limits and ultimately compromises the potential for genetic improvement in the herd. Individuals who contest the closure argue that the most effective and judicious way to improve herd quality, and thereby fiber quality and confirmation, is, in fact, through imported genetics.

Culling defective or less desirable traits from domestic animals through selective breeding is the only option available in the U.S. as a result of registry closure. However, in an industry dominated by new and novice owners, herd improvement through culling and selective breeding may be unrealistic to expect. First, novice owner/breeders are unlikely to be proficient at genetic mapping and selecting breeding stock to improve their herds. Second, given that most revenues from alpaca production are generated through the sale of alpacas for new herds or expansion of existing herds, there is little incentive to not utilize the entire breeding stock, thereby expanding the national herd as quickly as possible without regard to quality considerations. An alternative to the dubious, genetics-based explanation for closure of the registry is that the registry was closed to create barriers to entry and effectively implement a supply restriction and, therefore, add value to alpacas conceived in the U.S. of registered parents.

In addition to requirements surrounding the parentage and genetic integrity of all cria accepted into the registry, the ARI prohibits the registration of cria conceived through "unnatural" methods such as artificial insemination and embryo transfer. These limitations on reproduction within the alpaca herd do little if anything to limit the growth rate of the domestic herd, which is determined primarily by the reproductive capacity of the adult females in the herd. However, the restrictions potentially create a broader market for herd sires to be used in reproduction.

Male alpacas that are considered unsuitable as herd sires are castrated. These geldings or "fiber males" have lower testosterone levels, allowing them to produce better quality fiber for longer periods of time then unaltered males. Therefore, the primary measure of a gelding's value is the fineness, uniformity, and quantity of his fleece (Gardiner, 2005). While geldings tend to be more accommodating to human interaction than breeding males and female alpacas, the "pet" market is extremely limited.

Although the registration requirements and the closure of ARI represent a form of supply restriction and a barrier to the importation of alpacas, additional import restrictions are in place due to disease concerns because Peru, which has endured outbreaks of foot and mouth disease (FMD) as recently as 2001, is not classified by the U.S. Department of Agriculture (USDA) as a FMD-free country.[2] Peru's FMD status precludes the importation of any ruminant from Peru into the U.S.[3] Chile is the only South American country with an alpaca population that is eligible currently to export ruminants to the U.S. Nonetheless, Chilean alpaca exports to the U.S.

[2] FMD is a highly contagious viral syndrome that causes ruminants to contract blisters on their mouths, tongues, lips, and feet.

[3] Although Peru and much of South America have never been characterized as FMD free, the alpaca herd in the U.S. is exclusively of South American origin due to the opportunity from 1979-98 to import livestock from countries classified as high disease risk through the Harry S. Truman Animal Import Center (HSTAIC) located in Key West, Florida. Of the 6,713 animals imported through the center over the 19 years that the facility was in operation, 5,046 were alpacas (U.S. Environmental Protection Agency, 1998). Underutilization of HSTAIC forced its closure in 1998, effectively prohibiting the importation of alpacas and all other animals into the U.S. from any country not currently classified as FMD free.

have not been a factor due to the substantial costs, quarantine time, and risks associated with intercontinental trade in live animals, and, since 1998, their preclusion from the ARI.

Furthermore, in 2003 the Canadian border was closed to the importation of all ruminants due to Bovine Spongiform Encephalopathy (BSE) concerns, thereby eliminating the possibility of importing alpacas to the U.S. from the north.[4] While Canada's alpaca population is small relative to that of the U.S., this additional restriction ensures that progressively higher alpaca prices in the U.S. cannot attract importation and cross-country arbitrage from the North or the South.[5]

Although they are not presently binding in the U.S. due to the aforementioned FMD concerns, barriers to the exportation of alpacas have been imposed by the Peruvian government, which regards the animal as a national symbol. Prior to 1990, alpacas could not be exported from Peru due to stringent government regulations surrounding the animal. Under Alberto Fujimori, the Peruvian government began to allow limited exporting of alpacas, hoping to safeguard against the establishment of significant herds in other parts of the world which could threaten their domestic fiber industry. Since 1997, Peru has allowed the exportation of only 3,308 alpacas (Gil, 2005).

Due to this export quota, the smuggling of alpacas from Peru through Bolivia and, ultimately, to Chile has become an issue. Reportedly, Chile exports nearly 4,000 alpacas per year (Alpaca Peru, 2004), despite having a domestic alpaca population of only 30,000 head. Individuals are reportedly able to buy Peru's premiere alpacas for sometimes less then $100, smuggle them

[4] Although alpacas have multiple stomachs, meeting the definition of a ruminant utilized by the USDA, the risk associated with their importation is minimal as alpaca meat is not consumed in the U.S. and there have been no documented incidences of BSE or scrapies, the equivalent of BSE in sheep, in alpacas.

[5] The mutual presence of these dual entry barriers makes it impossible to determine the effect of the registry closure on the price of alpaca breeding stock in the U.S., leaving unanswered the question of whether closure of the registry could be effective in restricting supply in the absence of the importation limitations imposed by the U.S.

through Bolivia and into Chile, where they can be exported at prices ranging from 15,000 to 50,000 dollars (Alpaca Peru, 2004).[6]

Table 1 provides an indication of the U.S. alpaca prices that have been generated as a consequence of the confluence of the economic factors affecting the U.S. industry. There is no systematic public reporting of alpaca prices, so table 1 represents a survey of over 900 auction prices collected by the authors. Although the table evinces considerable variation in the sales prices of alpacas, even the lowest prices recorded at the auctions surveyed were several thousand dollars, with average prices in most cases exceeding $25,000, and with prices exhibiting a clear tendency to rise during the four-year period surveyed. Although we cannot attest that the prices reported in the table are a representative sample, they are broadly consistent with the information that AOBA provides to potential investors—the acquisition cost of an average female is between $12,000 and $25,000 while the price for an average herd sire could fall in the range of $20,000-$50,000 (AOBA, 2004).

[6] Because nearly half of Peru's alpaca population resides in Puno, near the Bolivian border, smuggling animals from these locations is relatively easy.

Table 1. Alpaca Auction Price Statistics

	2001	2002	2003	2004
	All prices are in U.S. dollars			
	Total Huacaya[a]			
Average	16,910.47	23,464.62	28,194.59	26,080.16
Observations	43	171	157	160
High	57,750	165,000	102,000	83,000
Low	3,900	6,500	6,000	6,000
	Total Suri[a]			
Average	16,866.67	26,443.24	27,496.51	30,796.20
Observations	27	111	86	79
High	34,100	265,000	84,000	103,000
Low	7,200	6,500	9,500	11,500
	Huacaya Males			
Average	26,700	56,794.12	42,044.44	46,270.83
Observations	5	17	18	12
High	57,750	165,000	101,000	83,000
Low	10,000	16,500	6,000	11,500
	Huacaya Females			
Average	15,622.37	19,785.39	26,401.08	24,443.07
Observations	38	154	139	148
High	48,400	46,200	102,000	80,000
Low	3,900	6,500	6,000	6,000
	Suri Males			
Average	14,575	58,709.09	32,250	40,785.71
Observations	4	11	10	7
High	20,500	265,000	84,000	103,000
Low	7,800	6,500	12,000	15,000
	Suri Females			
Average	17,265.22	22,894	26,871.05	29,825
Observations	23	100	76	72
High	34,100	53,000	67,000	68,000
Low	7,200	9,500	9,500	11,500

[a]Huacaya and suri are the two major types of alpacas in the U.S. See the main text for further discussion.

The following auctions were surveyed to compile the data in this table: 2004—America's Choice Alpaca S (ACAS) , Breeder's Showcase Alpaca Sale (BCAS), Mapaca Jubilee Alpaca Sale, AOBA Alpaca Sale (AOBA-AS); 2003-- ACAS, Celebrity Alpaca Sale (CAS), AOBA-AS, Parade of Champions Alpaca Sale, Breeder's Choice Alpaca Sale (BCAS); 2002- ACAS, CAS, AOBA-AS, Accoyo Alpaca Sale (AAS), BCAS, 2001-- Spring Celebration Alpaca Sale, AOBA-AS, BCAS, AAS.

The Domestic and International Alpaca Fiber Industry

South Americans first domesticated alpacas centuries ago in order to utilize their fiber, and Peru, with the largest alpaca population in the world, is also the leading alpaca fiber and textile product exporter. The three plus million Peruvian alpacas produce over 4,000 tons of fiber annually, nearly 80% of all alpaca fiber production in the world (Vega, 2002).

Through evolution in the extreme climate of the Andes, alpacas have acquired a fleece that does not retain water, protects against solar radiation, and guards against extreme temperature variations. Present-day alpacas' coats are almost exclusively fleece whereas before domestication they possessed much more guard hair, which is coarse and undesirable for textile production. Alpaca fiber is fine, smooth, soft, and can easily be dyed virtually any color desired. Alpaca fiber contains microscopic air pockets which provide excellent insulation. Further, alpaca fiber does not contain lanoline and consequently few individuals are allergic to the textiles produced.

Sheared annually, the average alpaca produces between 6 and 8 pounds of raw fiber per year. Alpaca fiber prices are determined primarily by two specific criteria: micron count and the type of alpaca (huacaya or suri) producing the fiber.[7] The higher the micron count of the fiber, the coarser the yarn and the lower the quality of the ultimate textile product produced.[8] Consequently, processors pay a premium for fiber with lower micron count. Micron count and the weight of the fiber are inversely proportional, a quintessential trade off between quality and quantity. The age of an animal is inversely related to both the quality and quantity of its fiber. Tuis, alpacas 18-24 months old that have yet to have their first shearing, are believed to produce

[7] Huacaya alpacas comprise over 80% of the alpaca population in the U.S. and produce short, crimped fiber. Suri alpacas are more rare and earn a premium for their fine, lustrous fiber which resembles long mohair.

[8] Until recently, fiber quality in Peru was discerned through feel or "handle". However, use of laser scanning technology to determine fiber quality has become established in the U.S., and Peruvian processors are now beginning to incorporate these more objective standards to determine prices.

the highest quality fiber. As the animal ages, its fiber becomes coarser, causing quality to decline.

Micron count is also a function of the inputs available to the animal and a host of environmental factors. High-protein feeds and supplements may increase the quality of the fiber, while adverse environmental situations such as transportation, stress, pregnancy, etc., can increase micron levels diminish fiber quality.

Revenues from the Sale of Alpaca Fiber in North America

The market for alpaca fiber in North America has been limited due to lack of large-scale processing facilities. To date, revenue generated from the sale of alpaca fiber in North America emanates primarily from two sources: small-scale (cottage), independent textile producers or the Alpaca Fiber Cooperative of North America (AFCNA). The AFCNA was established in 1998 with the goal of pooling members' fiber in order to be able to sell fiber in bulk, mitigate costs, and increase participation in value-added textile markets. The lack of processing facilities in the U.S. has forced AFCNA to utilize processors in South America, despite the significant transportation costs associated with such outsourcing.[9]

According to Kara Heinrichs (2004), President of the AFCNA, reputable producers with established contacts in the niche textile markets can obtain upwards of $44/lb. for raw fiber of baby or royal baby quality (a micron count of 22.9 or less). Yet, it is widely accepted within the industry to be virtually impossible to sell raw fiber in any significant volume, at these prices. The growing number of fiber-producing animals in the U.S. has essentially saturated this niche-market demand, forcing most producers to seek alternative outlets for their clip. Consequently,

[9] AFCNA fiber has been processed in Peru for as little as $9/lb, substantial cost savings, relative to prices charged by U.S. mills, which more then covers the shipping and customs costs. Yet AFCNA withheld the 2004 clip to be processed with that collected in 2005 in hopes of processing it exclusively in the U.S. and marketing products made from this fiber under a North American Alpaca Trademark.

many have turned to the AFCNA to process and market their fiber. AFCNA members receive anywhere from $5.00/lb. for royal-baby-quality fiber to 0.50/lb. for short or coarse/strong fiber (AFCNA, 2004). In addition, a premium of nearly $2.50/lb. has been paid for high-quality fiber produced by suri alpacas.

Although the AFCNA prices are above the prices paid for raw fiber in the world market, they are significantly less then prices reportedly paid by cottage-industry textile producers.[10] Additionally, AFCNA patrons do not receive payment in cash but, rather, through credits at the cooperative store. The cooperative's path since its inception has been rocky, and it has yet to turn a profit or pay patronage dividends to members, suggesting that even these prices are not sustainable without cost reductions or improvements in the fiber market.

Costs of Production for Alpaca Fiber

The AFCNA (2005) estimates that the feeding, vaccination and general health requirements of the average alpaca raised in the U.S. are approximately $169 annually (about $26/lb. of fiber harvested annually). We derived an independent cost estimate by surveying the veterinary literature (e.g., Van Suan, 1999 and Purdy, 2004) and various industry publications regarding the nutritional requirements for camelids in North America. Based upon a simple and modest feeding regime with a focus on minimizing costs, we estimate that feeding requirements for an average alpaca are about $208 annually at current input prices. In addition, alpacas must also be wormed and vaccinated to maintain adequate health and ability to produce quality fiber. For an average-sized alpaca, annual worming and vaccination costs total nearly $100. Thus, we estimate that it costs approximately $308 per year ($47/lb. of fiber harvested) to provide proper

[10] World market prices as recently as 2002 reflected no premium for suri fiber and the maximum price paid for any quality fiber (white royal baby) was $3.80/lb. in U.S. dollars (AFCNA, 2005). Consequently, the AFCNA reports paying its members a premium of $4.70/lb. and $1.20/lb. for suri and huacaya fiber, respectively.

nutrition and veterinary care for an alpaca. Details on our cost estimates are provided in the Appendix.

Profitability Analysis

Based on AFCNA's conservative estimate of production costs, the price of unprocessed fiber would have to be nearly $26/lb. for alpaca breeders to cover variable production costs from fiber revenues, but even those raising suri alpacas and producing the highest-quality fibers are receiving only on the order of $7.50/lb. from AFCNA. Based upon our cost estimates, raw fiber prices would have to increase to $47/lb. for breeders to cover the variable costs associated with maintaining their herds.

The situation is more promising for breeders who are able to sell alpaca fiber to cottage industry textile producers instead of AFCNA. Based upon the estimated value paid by cottage-industry textile producers of $44/lb. for raw fiber, a producer would earn a variable profit per animal (net of harvest costs) from fiber sale of $92 based upon AFCNA's costs or a per-animal loss of $47, based upon our cost estimate. Thus, by utilizing reported revenues from sales to the niche cottage milling sector and conservative estimates of production costs, it is possible to generate some scenarios where fiber sales generate per-animal revenues in excess of per-animal variable production and fiber-harvest costs. However, it is worth reiterating that cottage industry textile producers represent an extremely limited niche market and do not collectively demand a large portion of the industry's fiber even at its current size.[11] Instead the typical producer must

[11] Clearly the reported prices for sales to the cottage milling industry must be viewed with some circumspection. Given that a large share of U.S. production is apparently selling for a small fraction of these prices, and fiber can be imported from Peru at a considerably lower cost, it is not clear why rational millers would pay these premium prices.

sell through the AFCNA, where the implicit revenue obtained through store credit does not remotely remunerate even the most conservative estimates of alpaca production costs.[12]

Although the preceding analysis is not sanguine regarding the opportunities to cover the variable costs of raising alpacas through the sale of alpaca fiber, it is, nonetheless, too optimistic because the revenue estimates have assumed that (i) all fiber produced is royal baby, (ii) alpacas produce a uniform fiber quality, and (iii) other costs such as shipping and insurance are insignificant.[13] In reality, the fiber clip from any animal is not of uniform quality. Only about 60-70% of the clip from an animal (the blanket, neck, and middle legs), or 3.6 to 5.6 pounds, can be sold as quality fiber. The remaining portions of the clip (lower leg, belly, britch, and apron) can be sold for a lesser price if they have a micron count less then 31.9 and are not matted or stained.

Statistics reported by the AFCNA (2005) confirm that significant quality heterogeneity exists in U.S. alpaca-fiber harvest. Only 1-2% of total past clip collections have been of royal baby quality and an additional 4-8% were of baby quality. Therefore, at most 2% of the total U.S. clip harvested would be valued at $7.50/lb. (suri) and $5/lb. (huacaya). As much as 66% of all fiber collected by AFCNA is either superfine (23-26.9 micron count) or adult (27-31.9 micron count) quality, which are valued by AFCNA at only $3/lb. and $1/lb., respectively, for huacaya fiber and $4.5/lb. and $1/lb., respectively, for suri fiber. Table 2 summarizes the cost and revenue analysis, including the optimistic scenario involving sale to independent textile producers and

[12]Another possible fiber-marketing strategy for alpaca owners is to procure custom fiber processing and sell processed fiber to independent textile producers. We gave little consideration to this strategy because we found little information on it, and, more importantly, because processing is unlikely to be an activity that generates economic profit for alpaca owners. Alpaca owners would have no advantage relative to textile producers in obtaining processing services, and, thus, willingness of buyers to pay for processed fiber relative to raw fiber should not exceed the full cost of procuring processing services.

[13] Shipping costs are a function of volume and distance shipped and will vary across producers. We have no good estimates for shipping costs, but their omission causes our and AFCNA's cost estimates to be understated ceteris paribus. Similarly our information suggests that most producers insure their animals. Average insurance rates are 3.25% of the value of the animal (AOBA, 2004).

more realistic scenarios involving a mix of fiber quality and sales at the prices paid by the AFCNA. Notably under the more realistic scenario, the value of a huacaya's fiber does not cover the variable costs associated with harvesting it.

Table 2. Revenue and Cost of Fiber Production

	Independent Producer	**AFCNA Member**			
		Suri	Suri	Huacaya	Huacaya
	6.5 lbs. Royal Bab	6.5 lbs Royal Ba	5 lbs Baby 1.5 lbs Adu	6.5 lbs Roy Baby	5 lbs Baby 1.5 lbs Adul
Revenue from fiber	286	48.75	31.50	32.50	21.50
Shearing	25	25	25	25	25
Sorting		5.98	5.98	5.98	5.98
Net Revenue From Fiber	261	17.77	0.52	1.52	-9.48
Variable Cost (authors)	307.85	307.85	307.85	307.85	307.85
Variable Cost (AFCNA)	169	169	169	169	169
Profit From Fiber (authors	**-46.85**	**-290.08**	**-307.33**	**-306.33**	**-317.33**
Profit From Fiber (AFCNA	**92**	**-151.23**	**-168.48**	**-167.48**	**-178.48**

International Trade in Alpaca Fiber and Textiles

Although barriers to international trade in live alpacas are multiple and, for the short term, apparently immutable, trade barriers for alpaca fiber have been virtually eliminated. In December 2001, the Andean Trade Preference Act (ATPA) expired and prompted passage the Andean Trade Promotion and Drug Eradication Act (ATPDEA). According to the Office of the United States Trade Representatives (USTR) (2003) "the objective of both laws has been to promote broad-based economic development, diversify exports, consolidate democracy, and discourage drug trafficking by providing sustainable economic alternatives to drug-crop production in Bolivia, Columbia, Ecuador and Peru". Whereas under the ATPA only four Peruvian commodities (copper, asparagus, jewelry and zinc) received trade duty and quota exemptions, with the revision over 6,000 products became eligible for various types of trade regulation exemptions.

Prior to passage of the ATPDEA, Peruvian textile producers were subject to tariffs of over 21 percent in many cases. According to the USTR (2003), "the National Society of Industries estimates that the largely duty-free textile and apparel exports from Peru to the U.S. under the ATPDEA could increase from $400 million in 2002 to $2 billion in 2006". With respect to the alpaca industry specifically, the Government of Peru estimates that the increased access to U.S. markets could cause alpaca fiber and textile exports to the U.S. to grow from 30 to 50 percent in one year (USTR, 2003).

The Capital Asset Pricing Model for Alpacas

Following the work of Jarvis (1974), an alpaca can be regarded as a capital good whose fundamental economic value is determined by the derived demand for the product(s) it produces. Thus, the competitive auction price paid for an animal should be based on the discounted present value of the purchaser's expected future cash flows, as computed at time of the auction. This analytical framework will enable us to indicate whether prevailing auction prices in the U.S. are representative of alpacas' true economic value.

Apart from a small market for alpacas as pets or as rural "lawn mowers", the only marketable product produced by alpacas, except more alpacas, is fiber.[14] Production practices can influence both the quantity of fiber, F, that an alpaca produces annually and the quality of the fiber, measured primarily by micron count, m. Thus, when alpaca owners choose variable inputs, such

[14] Alpacas can be used to graze pasture lands and provide aesthetic value to rural landscapes. Although their cartoon-like appearance may attract publicity, their grazing ability does not warrant the price premium demanded by alpaca breeders with registered animals to sell. According to Kershaw (2004), a few animals are bought and sold as pets for a few hundred dollars without being registered. Thus, the market for unregistered alpacas as pets or grazing animals is limited at best and quite distinct from the commercial market at issue here. The cost of registered alpacas is a powerful deterrent to using them to graze pasture lands when more cost-effective options, such as goats or sheep, are available.

as feed, labor, and veterinary services to utilize in alpaca production, they must take account of these joint effects in determining the optimal input mix.

For simplicity we assume that input decisions in a given year t affect profits only in year t, so that there are no feedback effects across years. Let $\boldsymbol{X} = \{X_1, \ldots, X_n\}$ denote a vector of variable inputs and $\boldsymbol{w} = \{w_1, \ldots, w_n\}$ the vector of those inputs' prices. Let $\boldsymbol{S}$ denote a vector of fixed characteristics of an alpaca, such as its age and breed, and **Z** denote exogenous market factors that affect the price of alpaca fiber. (We omit time subscripts except when they are necessary for clarity.) P_f is the grower price per lb. of fiber, which is determined by m and $\boldsymbol{Z}$. We can then express both quality and quantity of fiber in terms of $\boldsymbol{X}$, given $\boldsymbol{S}$: $F(\mathbf{X}|\mathbf{S}), m(\mathbf{X}|\mathbf{S})$. Assuming an interior solution, the optimal application of inputs per animal is determined by the conditions:

(1) $$\frac{\partial P_f(m(\mathbf{X}|\mathbf{S})|\mathbf{Z})}{\partial X_i} F(\mathbf{X}|\mathbf{S}) + \frac{\partial F(\mathbf{X}|\mathbf{S})}{\partial X_i} P_f(m(\mathbf{X}|\mathbf{S})|\mathbf{Z}) = w_i,\ i = 1, \ldots, n,$$

i.e., the marginal value product of an input in fiber production is the sum of a "quality effect," given volume, and a "volume effect," given quality.

Solving the system in (1) enables us to formulate the value function indicating the maximum variable profits associated with an alpaca's fiber production in a given year t: $\pi_t(\mathbf{w}, \mathbf{S}, \mathbf{Z})$. Of course, purchasers of juvenile alpacas will incur husbandry costs prior to the time the animal begins to bear fiber. Denote those expected costs discounted to the time of purchase by $C(\boldsymbol{w},\boldsymbol{S})$.

The expected value at time t derived from ownership of a male alpaca, $V_M(t)$, not used for breeding can then be expressed as follows:

(2) $$V_M(t) = E_t\left\{\sum_{t=t_1}^{t_3} \frac{\pi_t(\mathbf{w}, \mathbf{S}, \mathbf{Z})}{(1+r)^t} - C(\mathbf{w}, \mathbf{S})\right\},$$

where E_t denotes expectations formed in period t, $t_1 \geq t$ denotes the time when the alpaca can first be sheared and its fiber sold, $t_3 > t_1$ represents the animal's life expectancy, and r denotes the relevant discount rate. The summation term in (2) represents the discounted variable profit from the fiber stream provided by the animal. Note also that there is no terminal value because, unlike cattle, alpacas have no value in meat consumption.[15]

$V_M(t)$ will differ among potential bidders, both due to differences in expectations and to differences in profitability due to location of the bidder's ranch, his/her skill as a producer, etc. In any type of auction format, each potential buyer's bid for a fiber-male alpaca is based upon the bidder's $V_M(t)$, but determining the optimal bid is nontrivial because the bid must in general be adjusted downward from $V_M(t)$ to account for factors such as the bidder's degree of risk aversion, the competitiveness of the auction, and the winner's curse (e.g., Krishna, 2002 and Klemperer, 2004). It suffices for our purposes to merely note that the winning bid, $B_M(t)$, is positively correlated with the $V_M(t)$ and bounded from above by highest value of $V_M(t)$ emanating from the pool of bidders: $B_M(t) \leq \sup\{V_M(t)\}$.

The valuation equation for female alpacas, $V_F(t)$ includes the same terms as the valuation for fiber males plus an additional term to reflect the revenue derived from the female alpaca's ability to also produce cria.[16] Let D denote the market value at auction of a cria. Clearly D is based upon the characteristics, **S**, of the mother and of the father, $\mathbf{S_M}$, the expectation of demand factors, **Z,** that determine the price of fiber during the cria's productive life, the expectations of costs, **w**, of maintaining an alpaca, and, of course, whether the cria is male or female. We

[15] A straightforward adaptation of (2) could be used to establish the condition that a male alpaca is retained in the herd for fiber production as long as the discounted expected variable profits from fiber production are nonnegative.

[16] We do not analyze value for alpaca males used for sires for two reasons. First, relatively few males will be used as herd sires. Second, stud fees are a zero-sum game from the industry's perspective, in the sense that members of the industry both pay and receive the same revenues. Stud fees, thus, cannot contribute anything to the overall profitability of the industry.

assume that gender can't be controlled by the owner, and males and females are born with equal probability, so $D_t(\mathbf{S},\mathbf{S_M}, \mathbf{Z}, \mathbf{w})$ represents the value at time t of a cria that has equal probability of being male or female. The value function, expressed at time t, for a female alpaca is thus:

(3) $$V_F(t) = E_t\left\{\sum_{t=t_1}^{t_3}\frac{\pi_t(\mathbf{w},\mathbf{S},\mathbf{Z})}{(1+r)^t} + \sum_{t=t_2}^{t_3}\frac{\mathrm{D}_t(\mathbf{S},\mathbf{S_M},\mathbf{Z},\mathbf{w})}{(1+r)^t} - C(\mathbf{w},\mathbf{S},\mathbf{Z})\right\},$$

where t_2 is the time when the female is first able to reproduce. In general, a typical female alpaca bears her first cria at two to three years of age and has the ability to have 6 to 7 offspring over her lifetime.

Analysis: Are U.S. Alpaca Prices the Product of a Speculative Bubble?

At current fiber prices and input cost levels, an alpaca in the U.S. whose sole economic purpose is to produce fiber, e.g., a gelded male, has no economic value under any of the scenarios depicted in table 2 that involve sale of fiber through AFCNA because none of the scenarios yield a positive variable profit. Positive variable profit and, hence, positive economic value can be ascribed in the optimistic but isolated scenario (table 2) where a producer (i) is able to sell raw fiber at $44/lb., (ii) can maintain an alpaca herd at the costs reported by AFNCA, (iii) anticipates that this profit margin will continue into the future, and (iv) has no aversion to the risk inherent in this type of operation. In this setting a producer would be willing to pay upwards of $339 for a juvenile alpaca (2 years of age), based solely upon the animal's fiber producing potential.[17] Of course, the caveats that applied to this optimistic fiber production scenario also apply to valuations based upon it: the cottage millers are a niche industry incapable of buying a large

[17] The discounted present value profit calculation assumes that an alpaca is purchased at auction at age two and sheared for the first time shortly thereafter. Additionally, we assume that the purchaser retains ownership of the animal and harvests fiber annually throughout its 15 year life span. A discount rate of 10% is utilized to convert all figures to present value, while both fiber prices and variable costs are assumed to be constant over the 14-year time frame considered.

amount of fiber, the AFCNA maintenance-cost estimates seem too low, and it is unclear why textile producers are willing or would continue to be willing to pay quality-adjusted prices markedly in excess of typical U.S. or world prices.

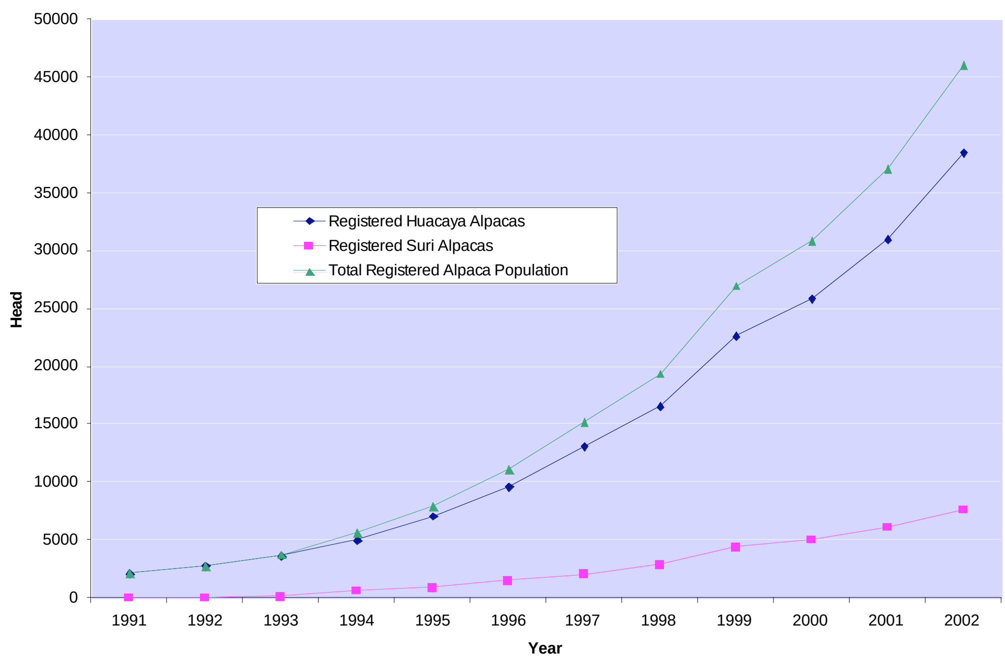
Of course, proponents of the industry would respond to this analysis by arguing (correctly, in the current environment) that many alpacas (most females and some males) have considerable economic value as breeding stock. Second, they would argue that alpacas produce a desirable, luxury fiber that is likely to experience increasing demand as its properties become better understood by consumers and, further, as the U.S. alpaca herd grows, various costs of maintaining alpacas and processing fiber will fall. Thus, both rising fiber prices and falling maintenance and processing costs should be anticipated in an alpaca valuation equation.

These seemingly distinct arguments about breeding value and future profitability of fiber production and sale actually collapse to only one argument that hinges on the future profitability of producing and selling fiber, as we now show. Although Jarvis (1974, 1982) does not extend his valuation framework in this direction, it follows that the economic value of a cria, $D_t(\mathbf{S},\mathbf{S_M},\mathbf{Z},\mathbf{w})$, in equation (3) produced by a female alpaca or sired by a male alpaca whose valuation is at issue, is determined by the value of the product(s) the cria is expected to produce in the future, namely fiber and still more cria. Those second-generation cria would, in turn, be evaluated the same way. Thus, the Jarvis framework leads ultimately to a valuation process that requires forecasts of the market conditions for fiber and alpaca stock over the long term, in the limit to infinity. Of course, discounting applies to this valuation process, so events forecast to occur further and further into the future become less and less important to the evaluation and ultimately can be ignored.

It is axiomatic to the valuation process for an alpaca that, because the only broadly marketable product that an alpaca produces is fiber, its economic value, whether expressed directly through the animal's own fiber or indirectly through the fiber of its progeny, must be based exclusively upon forecasts of the value of producing and selling fiber. Because alpacas sold today as breeding stock have values wildly in excess of even the most optimistic scenarios based upon current fiber prices and production costs, these prices can be justified by economic fundamentals only if investors can rationally forecast substantially better conditions in the fiber market in terms of higher fiber prices, lower production costs, or both that will make fiber production and sale a much more profitable proposition in the future than it is today.

What can a rational economic assessment tell us about the prospects for fiber production in North America? The stock of registered alpacas is rising rapidly, as figure 1 illustrates. The population more than doubled between 1998 and 2002, rising from 19,384 registered animals to 46,105 during this period. The population rose further, to nearly 62,000, by the start of 2004. Biological growth often follows an exponential path, and we can use a biological growth function to forecast future growth in the U.S. alpaca herd.

Figure 1. The Registered Alpaca Population in the United States



The Malthusian parameter or instantaneous rate of natural increase in the population, β_2, is estimated using:

(4) $$\ln pop = \beta_1 + \beta_2 t + \varepsilon ,$$

where ln *pop* represents the natural log of total population of alpacas in the U.S. and t represents time.[18] Estimation results for (4) are provided in table 3 for two alternative estimation horizons. Based upon the history of U.S. alpacas from 1991-2002, the estimated growth parameter is $\hat{\beta}_2 = 0.28$.[19] Because this growth rate is influenced somewhat by imports prior to 1998, a more conservative and perhaps realistic growth rate focuses on just years after 1998. The estimated growth parameter for this period is $\hat{\beta}_2 = 0.17$.

Table 3. Estimation Results for the Malthusian Parameter

1991 – 2002			
	Coefficient	Standard Error	P value
Constant	-554.818	20.74	0
Time	0.282	0.01	0
1999 – 2002			
	Coefficient	Standard Error	P value
Constant	-347.44	26.14	0.006
Time	0.17	0.013	0.005

Table 4 indicates the time in years required for the U.S. alpaca population to reach various levels, given either of these two growth rates. For example, even under the more conservative

[18] This approach yields a constant growth rate parameter and is an adequate representation of growth if the graph of the natural log of population relative to time is approximately linear, which seems to be true for the U.S. alpaca herd.
[19] 1991 was the first year for which reliable alpaca population numbers were available for the U.S. through the ARI. Additionally, because the Durbin-Watson statistic associated with the original regression was less then the Durbin-Watson lower critical value at the 5% level of significance, we adjusted the model for first order serial correlation and use this estimate of the Malthusian parameter throughout the analysis.

growth rate, the U.S. alpaca herd size is projected to reach one million, 16 times its size in 2004, in just over 16 years.

The good news about this rapid growth is that it may enable the fiber processing sector and possibly the upstream industries supplying inputs to alpaca production to benefit from economies of size and reduce the costs for processing alpaca fiber and providing inputs into alpaca production. Indeed this is the industry's expectation when it speaks of establishing a viable textile industry. On the negative side, this rate of expansion of the U.S. alpaca herd will imply a roughly proportional expansion of domestic fiber supply, meaning that the lucrative niche cottage industries, already unable to absorb a significant portion of the U.S. clip, will become even less relevant as a market outlet for U.S. producers. We have already noted the seeming incongruity of the claim that niche millers are apparently willing to pay substantial premiums above AFCNA or world prices. There is even less reason to believe that these lucrative niches will exist with the projected increasing abundance of domestic fiber.

Table 4. Size of the U.S. Alpaca Herd for Alternative Growth Rates

	Growth Rate	
	0.17	0.28
Population	Years Necessary to Reach Population	
250,000	8.21	4.99
500,000	12.29	7.46
750,000	14.68	8.91
1,000,000	16.37	9.94
1,250,000	17.68	10.73
1,500,000	18.75	11.39
1,750,000	19.66	11.94
2,000,000	20.45	12.41
2,250,000	21.14	12.83
2,500,000	21.76	13.21
2,750,000	22.32	13.55
3,000,000	22.83	13.86
3,250,000	23.30	14.15
3,500,000	23.74	14.41
3,750,000	24.14	14.66
4,000,000	24.52	14.89

Regardless of the growth of the domestic alpaca herd, the U.S. will for the foreseeable future be a small player in alpaca and fiber production relative to Peru, with its growing herd of over three million animals.[20] How does the dominant Peruvian alpaca sector affect the evolution of the industry in the U.S.? As we have noted, through implementation of the ARI, import barriers due to FMD and BSE concerns, and Peru's own reluctance to export its alpaca herd, significant and for the short term relatively immutable barriers have been raised to the entry of alpacas from outside the U.S. Thus, for the U.S. an autarkic state exists with respect to trade in alpacas, enabling them to sell for average prices in the $25,000 range in the U.S. and for a small fraction of that amount in Peru.

However, as noted, there are essentially no barriers to trade in fiber since the passage of the ATPDEA, and Peru fully expects its fiber and textile exports to the U.S. to increase significantly as a consequence. Is it possible that an autarkic equilibrium in live animals involving a U.S.-Peru price differential of perhaps 800% or higher can be sustained when there are no barriers to arbitrage in the single marketable product these animals produce, namely fiber? The answer clearly would seem to be no. Alpacas, wherever they reside, are valued, based upon the fundamental Jarvis capital asset model, according to the value of the fiber they and their progeny produce. If the fiber market is subject to free trade and arbitrage, then fiber prices across producing countries for a similar level of quality will converge with due allowances for transportation and other arbitrage costs, meaning that prices for the capital asset must converge also.[21]

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[20] Statistics from the Ministerio de Agricultura in Peru indicate that the Peruvian herd increased from 2,668,000 in 1990 to 3,087,000 in 2003. Since this rate of growth is clearly less than what is biologically feasible, it suggests culling within the Peruvian herd, most likely do to profitability concerns.

[21] A close analogy is to consider that farmland in one location, say Iowa, cannot be arbitraged with farmland in different location, say Illinois, for obvious reasons. But if the farmland can be used to raise the same crop, say corn,

Inputs into alpaca production are less readily arbitraged across national borders, and this fact may lead to a sustainable equilibrium with some transnational differences in the value of alpacas. However, the likely case is that inputs to raising alpacas are cheaper in Latin America than in the U.S., making animals there more valuable, ceteris paribus.

How Fast Must Fiber Prices Rise to Justify Today's Alpaca Prices?

Although apparently no demand models for alpaca fiber have been estimated, it is reasonable to assume that, as a luxury product, garments made from alpaca fiber have an income elasticity greater than 1.0, and, thus, U.S. and world demand for alpaca fiber might be expected to grow somewhat faster than the overall growth rates for economic activity. Given the current state of the fiber industry, we designed a simple simulation analysis to answer the question of how rapidly fiber prices must increase over time as a consequence of demand growth, holding all costs constant at today's levels, to justify the types of prices we observe for alpaca stock.

The framework begins with a single juvenile alpaca female (age 2) that might be purchased at auction today for a price in the $15,000-25,000 range. This female was assumed to bear fiber annually from the time of her purchase over her assumed 15-year life span. Based upon consultations with veterinarians, this female was assumed to bear a cria on average every 18 months, seven in total over her lifetime with a reproduction rate of 100%. Additionally, we assume that 50% of all cria born are female and the remaining 50% are male. These cria also eventually bear fiber and, if female, also bear additional cria, and so on as the generations unfold. All of this activity is attributable ultimately to the purchase of the original female and determines her value according to Jarvis' formulation, as expressed in equation (3). Although the process in

then the prices of farmland in Iowa and Illinois must converge, with due allowances for productivity differences, input costs, transportation, etc.

principle continues indefinitely, we truncated the simulation at 20 years, assuming that this represents a maximum time horizon over which any rational investor would seek to recoup his investment. We ignored stud fees under the rationale explained in note 16—they add zero net revenue to the industry on aggregate and, thus, are appropriately ignored for our representative alpaca as well.

The key parameters in the simulation are *g*, the exogenous rate of growth in fiber prices, the discount rate r—we alternatively used 8%, 10%, and 12%, the maintenance costs which we assume to be constant over time—we used both AFCNA's and our own estimates, and the initial value for fiber to which the growth rate is applied annually—from table 2 we utilized the realistic fiber revenue estimates of $31.50 (suri) and $21.50 (huacaya). The market valuation of our original alpaca is the discounted value of all of the fiber produced over the 20-year horizon by the original alpaca and her progeny, less the costs of maintaining the herd and harvesting the fiber.[22]

Results of the simulation for alternative values of g, r, and costs of alpaca maintenance are reported in table 5. Moderate growth in prices, i.e., in the range of one, three, or five percent, sustained over the entire 20-year horizon (while holding costs constant at current values) does not generate a positive economic value for the original female. For example, at a 10 percent discount rate, even sustained five percent annual growth in fiber prices leads to a discounted loss ranging from $22,000-45,000, depending upon the alpaca type and maintenance cost estimate utilized. Even a 10 percent growth in fiber prices does not produce a positive valuation. Indeed,

[22] Of course, the typical alpaca rancher would intend to sell many of the cria born during this horizon, but the key point is that the fundamental value of these cria is based upon the expectation of the value of the fiber they and their progeny will produce. The effect of "retaining" all of the progeny in the herd to produce fiber is to ascribe 100% of the fiber revenue over the horizon to the original female, whereas if sales occurred, buyers would be expected to capture some of the economic value. Thus the no-sale assumption invoked in the simulation errs on the side of overvaluing the original female.

an annual growth rate in prices in excess of 20 percent is needed to justify alpaca prices in the range of $15,000 or higher.[23]

Table 5. Profitability Simulation

	Fiber Revenue Annual Growth Rate				
	Discount Rate 8%				
	1%	3%	5%	10%	21%
Suri (authors)	-59370.84	-57741.52	-55537.41	-46051.23	26606.28
Suri (AFCNA)	-32270.81	-30641.49	-28437.38	-18951.19	53706.31
Huacaya (authors)	-60859.48	-59747.40	-58243.01	-51768.31	-2176.68
Huacaya (AFCNA)	-33759.44	-32647.37	-31142.98	-24668.28	24923.35
	Discount Rate 10%				
	1%	3%	5%	10%	21%
Suri (authors)	-45605.72	-44398.58	-42772.46	-35821.41	16772.95
Suri (AFCNA)	-24796.12	-23588.98	-21962.86	-15011.82	37582.55
Huacaya (authors)	-46739.59	-45915.67	-44805.78	-40061.41	-4163.67
Huacaya (AFCNA)	-25929.99	-25106.07	-23996.18	-19251.82	16645.92
	Discount Rate 12%				
	1%	3%	5%	10%	21%
Suri (authors)	-35468.98	-34566.00	-33355.02	-28215.79	10170.32
Suri (AFCNA)	-19290.64	-18387.66	-17176.68	-12037.45	26348.66
Huacaya (authors)	-36342.93	-35726.61	-34900.08	-31392.35	-5192.30
Huacaya (AFCNA)	-20164.59	-19548.27	-18721.74	-15214.01	10986.04

However, it is far from clear that even substantial demand growth for fiber, if it materializes, can translate into the substantial growth in prices that the simulation analysis demonstrates are

[23] Our analysis ignores the value of the stock of alpacas that exist at the end of the 20-year horizon. The stock's value, of course, would depend upon fiber prices forecast into the even more distant future. Note that the present value of $1 received 20 years from now at a 10 percent discount rate is less than $0.15, making stock value relatively unimportant in the analysis, even if one were able to estimate it with any confidence.

needed to justify the current price levels for alpacas. As noted, the U.S. fiber supply is itself poised to grow rapidly and offset the price impacts of demand growth. Although it is currently growing slowly, the large Peruvian herd is poised to grow rapidly, if fiber and textile prices were to rise at a significant rate, providing a further supply response to mitigate fiber and textile price increases caused by demand-side growth. The long-run industry supply of alpacas in Peru and the other Andean countries is probably very elastic because alpacas are able to survive in the extensive mountain regions, where few or no alternative agricultural products can be produced. Thus inputs into Andean alpaca production, including land, can be considered in very elastic supply to the alpaca industry.

Anatomy of a Speculative Bubble: Lessons from the Alpaca Industry

In many ways our conclusion that today's prices for alpaca breeding stock are the outcome of an unsustainable speculative bubble is not surprising, given the warning signs surrounding this industry. Advertising that focuses on attracting additional producers, limited information on the investment, control of the available information by industry representatives, investment appeals directed mostly to small-scale investors, and commonly held misconceptions perpetuating unreasonable prices are telltale signs that have been prominent throughout the history of speculative bubbles in agriculture.

Advertising in the development stages of any industry is necessary to distribute information about product attributes. Yet, marketing aimed at attracting additional producers rather then promoting the product actually being brought to market for consumption creates a substantially different effect. As Cole (1926) noted in his discussion of the Chinese mulberry tree bubble, limited information was available through agriculture and industry publications which promoted industry development with articles surrounding "successful cultivation, the happy experience of experimenters, and testimonials of the tree's exceptional qualities," completely ignoring the marketable product generated by the trees, namely silk. Similarly, the alpaca industry's advertisements are designed to attract additional producers instead of promoting alpaca fiber.

Another parallel between the alpaca and the Chinese mulberry tree industries surrounds the processing of the product that each produces. Like mills with the capabilities of processing alpaca fiber, facilities to process the silk derived from the Chinese mulberry were few and small in scale in the U.S. The processing situation, coupled with the comparative advantage of silk producers and processors in Italy and France, lead to the eventual demise of the industry. Similarly, processors in Peru appear to possess significant advantages in alpaca textile production.

Virtually the only information available to potential alpaca investors is provided by the industry through promotional publications, farm and ranch websites, industry seminars and colloquiums, and television advertisements. The same has been true for similar "exotic" but inessential agricultural enterprises that have been the subjects of speculative euphoria, such as tulips, ostriches, Shetland ponies, and emus. At no point throughout the evolution of these industries was the underlying market demand sufficiently broad to warrant such investor interest or rampant speculation without the assistance of promotion to expand the base of potential investors.

Further, alpaca ranches are primarily small-scale operations, whose owner-investors may lack the expertise and resources to conduct independent investment analysis, and often come to agriculture from other careers—behavior that is encouraged in the advertisements (e.g., exhibit 1). According to Gillespie and Schupp (2002), the ostrich industry in its infant stages was promoted in much the same fashion, with claims that this animal represented the perfect investment for individuals with small quantities of land to enter an agricultural industry.

Similarly, raising chinchillas for fur was touted as a way in which retirees could supplement income, housewives could have their own businesses, and hobbyists could become distributors and make a bundle (Animal People, 1994).

Not unlike the current situation in the alpaca industry, in the early stages of the development of the Merino sheep industry in the U.S., breeders enjoyed a sustained period where livestock trade embargos as a result of Non-Intercourse acts increased domestic demand for breeding stock (Cole, 1926). During the period when the embargo was in effect, the domestic herd grew, as did the supply of their wool. As the domestic supply of breeding stock became more plentiful, the embargo was lifted, causing the ultimate and precipitous decline of breeding stock prices. Although the wool processing and manufacturing industry in the U.S. was improved as a consequence of significant domestic herd expansion, breeding stock and ultimately wool prices plummeted, causing a large portion of the domestic herd to be destroyed for meat. Thus, while the processing sector expanded, providing adequate capacity for wool processing, by the time these improvements occurred the Merino sheep industry was essentially destroyed. Similarly, ostrich owners believed that a viable slaughter market would only evolve with more animals available domestically for slaughter (Gillespie and Schupp, 2002), which further perpetuated the price of breeding stock, ultimately causing the eventual crash to be more substantial. Thus, the shared belief of investors in the alpaca industry that development of the fiber industry will only be realized through herd expansion is not an uncommon phenomenon in this stage of industry development where speculation is widespread.

Conclusion

The U.S. alpaca herd has grown from scratch to over 60,000 animals in just 20 years, and the industry stands poised for rapid growth, fueled by the prospects of fetching prices in the $25,000 range for breeding stock. Our analysis has chronicled the growth of this industry, analyzed its structure, and considered its role in the broader world context. Our ultimate purpose has been to assess whether current U.S. prices for alpaca stock can be supported by market fundamentals or whether they likely represent a speculative bubble that is destined to burst to the dismay of investors swayed by the persuasive television commercials and the animals' charming appearance. In this regard, the evidence seems to be rather overwhelming that the current prices are not supportable by economic fundamentals and, thus, are not sustainable.

An alpaca's economic value must be based upon the marketable products it or its progeny will produce. The primary usable product produced by alpacas is fiber, and, based upon the most reasonable assessments of fiber value and the variable costs of raising alpacas to produce fiber, alpaca fiber production is not currently profitable in the U.S.. Dramatic improvements over time in the alpaca fiber market, as illustrated by the simulation results reported in table 5, are thus required to justify today's price levels for alpaca stock based upon their investment value. Our assessment is that such improvements in the market are extremely unlikely to occur because, even in the serendipitous event that substantial demand growth occurs for fiber, a parallel supply-side response is likely to offset much of the price impact from demand growth.

Our conclusion that current prices for alpaca stock are not supportable by market fundamentals and that the industry represents the latest in the rich history of speculative bubbles in agriculture may provide a useful caution for those considering investing in the industry. Further, the historical record suggests that subsequent speculative bubbles are destined to appear on agriculture's horizon, whether in the U.S. or elsewhere. The lessons that can be distilled from the U.S. alpaca experience may be useful in recognizing and mitigating the severity of these subsequent events and hence also reducing the harm inflicted upon unwary investors.

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Appendix: Alpaca Costs of Production

Our analysis is based upon an average alpaca that weighs 137.5 pounds and produces 6.5 pounds of fiber annually. Although in some areas of the country during certain seasons alpacas can graze on pasture lands, our cost estimates we assume that an animal will require hay year round. According to Van Saun (1999), hay should comprise 92% of a camelid's diet. Based on this principle, an alpaca should consume 2% of its body weight in hay daily. Therefore, an average alpaca will consume slightly less then 2.75 pounds of hay per day and 1,004 pounds per year. Alpacas must be fed hay with 8-12 percent protein, such as grass or timothy. Although lactating females and growing cria require higher protein levels feeds, we assume one type of hay quality is fed year round. On average a bale of grass or timothy hay costs approximately $12.95 and weights nearly100 pounds, resulting in an annual feeding cost per animal of $143.

Vitamin and mineral supplements are extremely important for all camelids, especially for alpacas producing high-quality fiber (Van Saun, 1999). Numerous grain manufacturers have developed feed supplements specifically formulated for llamas and alpacas. A specialty feed to supplement hay, forage, or pasture should be fed at one-half percent of the animal's body weight per day. Consequently, an average-size alpaca would consume slightly less then a pound a day. On average a 50 pound sack of supplementary feed costs $11. Accordingly, annual supplement costs for an average-size animal total approximately $66.

An alpaca should be wormed every eight weeks. The most common wormer used is Dectomax and is administered via intramuscular injection. Assuming that the owner/breeder dispenses the worming medications himself, the annual worming cost for an alpaca is approximately $14.50. Alpacas must also be vaccinated with an 8-way vaccination, a CD&T vaccination, and a rabies vaccination. These maintenance requirements cost the owner/breeder approximately $85 annually, assuming that all injections except the rabies vaccine are administered by the owner/breeder. Federal law requires that rabies vaccines are administered by a licensed veterinarian. Thus, an estimated veterinary call fee of $25 is included in the vaccination cost estimate.