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Small-Scale Highland Farming Versus Coastal Agrobusiness

In Peru, strong growth in urban demand for industrially processed dairy products has induced a rapid increase in milk production along the coast but not so much in the Andean highlands, where an increase in milk production would create the greatest benefits. A farm–household optimization model was used to assess the current and changing competitiveness of milk production on the coast (Arequipa and Lima) and in the highlands (Cajamarca). Results show that large farms on the coast, particularly near Lima, are currently the most profitable. However, the high milk prices in Lima are likely to fall because of local market saturation and reduced competition among regional milk buyers. In contrast, milk prices in Arequipa and Cajamarca are expected to rise as a result of increased milk collection by milk processors since milk production costs in these regions are lower and there is a strong incentive to increasingly substitute expensive imported milk powder with locally produced evaporated milk. Improvements in the rural road system and the promotion of agricultural export crops along the coast, particularly in Arequipa, would accelerate the expansion of milk production in the highlands. To improve highland farmers' access to the market, policy makers and development agencies should target their interventions in close collaboration with milk processors. Because they have a strong interest in increasing milk production in their own region, milk processors are also important partners when designing measures to improve farmers' fodder and herd management practices in order to further increase the competitiveness of milk production in the highlands relative to the coast.

Keywords: *Milk production; small-scale farming; regional development; comparative advantage; policy; Peru.*

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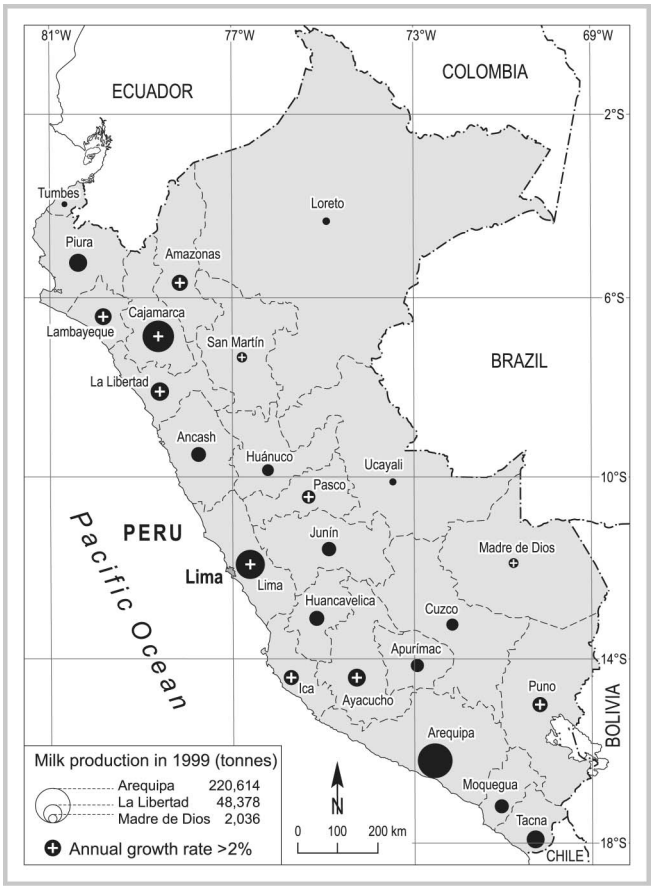

FIGURE 1 Geographical distribution of milk production within Peru at the department level. (Map by author, adapted by Andreas Brodbeck)

Introduction

Worldwide, milk production is a key activity in most mountain regions, providing regular and secure income to resource-poor farmers. In most developing countries, strong urban growth provides interesting prospects for national milk producers; a higher demand for milk could substantially improve the situation of mountain regions when market access is granted. Because milk is a product with high market value, particularly when processed, milk production is a suitable economic strategy for mountain regions to offset the negative marginalization effects of current globalization processes (Rieder and Wyder 1997). The prospects for such a strategy are particularly good since international milk prices are expected to rise as a consequence of pending and upcoming World Trade Organization (WTO) negotiations (Konandreas 1999).

In Peru, better access of Andean highland farmers to the national dairy market would offer substantial economic, social, and ecological benefits to farmers and their regions (Dollfus 1982). Higher farm profits would considerably stimulate the regional economy because direct and indirect savings would increasingly be used for off-farm activities (Seifert 1990), and a shift toward more milk production would offset the high risks involved in producing agricultural crops. Hence, farmers' livelihood security would be enhanced (Ørskov 1993). Moreover, expansion of fodder crops may reduce soil erosion on slope areas, leading to improved soil fertility, unless pastures are overgrazed.

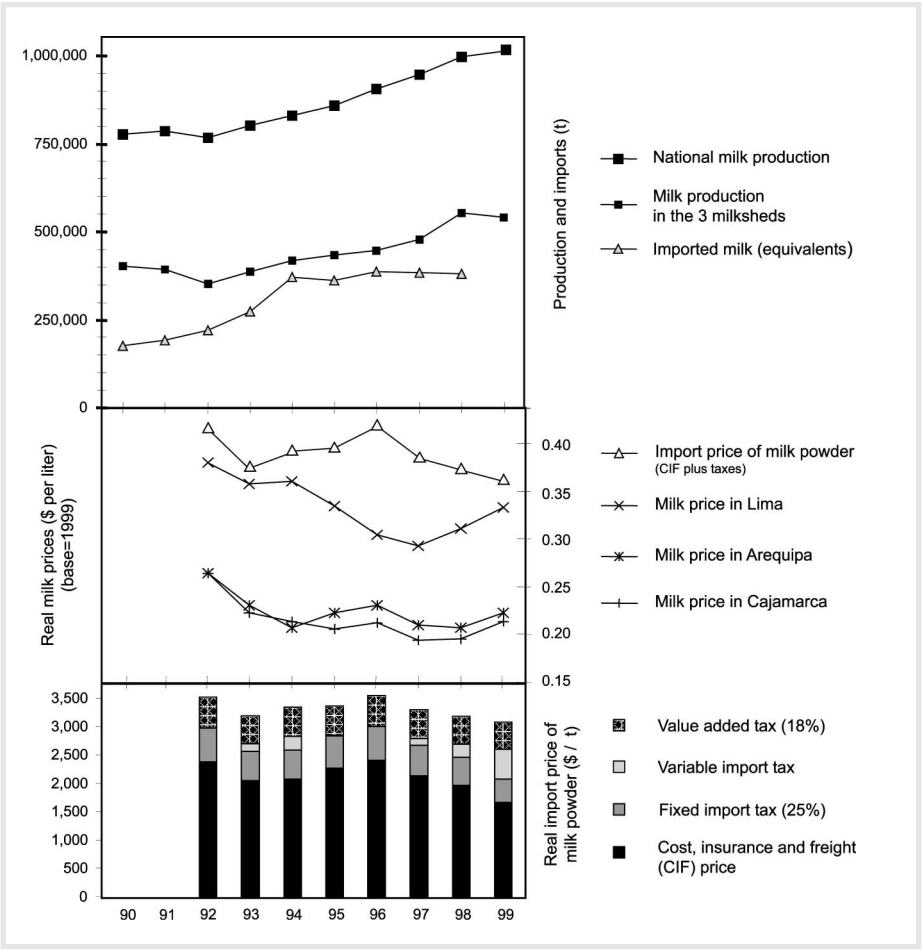

FIGURE 2 Trends in milk production and milk powder imports (in liquid-milk equivalents), with corresponding real milk prices.

Despite these advantages, there is no evidence that highland farmers will be the main beneficiaries of increased domestic demand for dairy products. Milk production has grown fastest along the coast, where most industrially processed milk is marketed. The present article analyzes and discusses the expected spatial changes in the Peruvian dairy sector.

Spatial differences in Peru's milk production

In 1999, more than 1 million tons of milk were produced in Peru, most of it (more than 95%) on the coast and in the highlands (Figure 1). Peru's milk production is concentrated in 3 main milksheds that host all major dairy enterprises (McBride 1997): Arequipa (including Tacna and Moquegua) in the south, Cajamarca in the north, and Lima in the center. These 3 regions produce half of Peru's milk (Figure 2). As in other milk-producing regions, small-scale farming dominates milk production in these milksheds; in all 3 regions, at least 95% of all milk-producing farms have herds with fewer than 20 animals (Table 1).

Nonetheless, there are considerable differences between these milksheds. In Cajamarca, milk production commonly complements agricultural crop production. Under highland conditions as they exist in the area, available resources (eg, water, land, labor, manure, crop residues) are better used in mixed farming systems (Jodha 2000). In contrast with sales from crop production, which are very seasonal because of the pronounced rainy season (from November to May), sales of milk, cheese, and meat provide important income for small-scale farmers throughout the year (Wiegers et al 1999). Moreover, animals are important "living savings accounts" that help prevent liquidity shortfalls due to the common lack of access to bank loans (Ørskov 1993).

Differences in altitude and slope and access to water and land imply structural differences between different farm types. Valley bottoms (2800–3200 m) in general have much better access to water than slope areas (3200–3500 m) and upper hills (Jalca; >3500 m) (Bernet and Tapia 1999). Hence, milk production levels are higher in the valley bottoms where permanent pastures are cultivated. In the other 2 zones, feeding problems in the dry season call for rustic cattle types, also used for animal traction (Malpartida et al 1995). Jalca farmers have the advantage of accessing vast natural pastures at higher altitudes (Figure 3a). But in these remote areas, farmers face greater market access problems and thus receive lower milk prices (Mosley 1982).

FIGURE 3a Milk production in the Jalca in Cajamarca (3500 m), where farmers have access to extensive high pastureland. (Photo by Thomas Bernet)

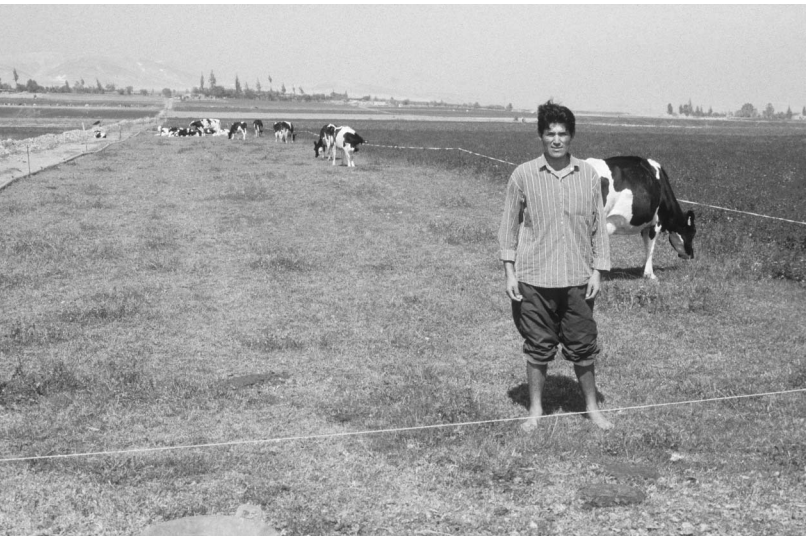

FIGURE 3b Milk production on irrigated land in a 5-hectare landholding in Majes, Arequipa (1500 m), where alfalfa is the main feed. (Photo by Thomas Bernet)

In Arequipa, most milk is produced in the irrigation zones on the coast, where farmers produce both milk and agricultural crops (eg, onions, garlic, potatoes). Because of the particularly high price risk for agricultural crops, milk production—despite its lower profitability compared with agricultural crops—plays an important role in providing farmers with the necessary security and equity for crop production (Bernet et al 2001b). Milk production is primarily based on alfalfa, which is pastured, and corn, used fresh or ensiled (Figure 3b).

TABLE 1 Overview of herd size and production in the 3 Peruvian milksheds; distribution in percent, based on INEI (1996).

Milkshed	Parameter	Herd size		
		<20%	20–100%	>100%
Arequipa	Farms	95	5	0
	Cows	76	20	4
	Milk	59	34	7
Cajamarca	Farms	99	1	0
	Cows	91	7	2
	Milk	77	16	7
Lima	Farms	95	4	1
	Cows	68	15	17
	Milk	32	28	40

In Lima, milk production is based on stable feeding. Fresh corn and feed concentrates are the main sources of feed. Small farms have deficient fodder and herd management, primarily because they lack capital and know-how. Particularly large farms (up to 800 head) are run efficiently and professionally by contracted labor.

Methodology

The goal of this study was to anticipate spatial distribution changes in the Peruvian dairy sector, taking into account expected milk price changes and different development scenarios. For this purpose, a farm–household optimization model (see Bernet et al 2001a) was used to assess current and future competitiveness of typical milk farms in the 3 main Peruvian milksheds. The competitiveness of the different farm types (Table 2) is assessed on the basis of profit per liter of sold milk, which is derived from agricultural income by deducing the farmer's own labor and capital costs, adjusted by the net benefits of manure, animal traction, and crop residues.

Results

Current competitiveness of milk production

Results show that the competitiveness of milk production varies strongly between and within milksheds (Table 3). Varying profits between the different farm sizes within the same milkshed are determined by the relative magnitude of economies of size, expressed both on the income side (ie, better negotiation power for milk prices, improved management) and the cost side (ie, lower expenditure per cow). Economies of size are very pronounced in large agrobusiness farms near Lima. Contracted specialists and stable-feeding allow high milk productivity at low cost due to the

TABLE 2 Characteristics of milk production systems in the 3 milksheds, based on Bernet and Tapia (1999), Bernet et al (2000), Bernet et al (2001a).

Characteristics	Arequipa Coast		Lima Coast			Cajamarca Valley			Cajamarca Jalca		
Farm size	Small	Large	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
Altitude (m)	500–1500		0–500			2800–3200			>3500		
Annual precipitation (mm)	<100		<100			400–650			900–1400		
Type of cattle	Holstein		Holstein			Holstein			Crosses		
Main feed	Alfalfa, corn		Corn, concentrates			Ryegrass-clover			Natural pasture		
Type of stable	Night		All day			None			None		
Type of pasturing	Fence		None			Stake			Person		
Fodder conservation	Yes		Yes	No		No			No		
Own animal traction	No		No			No			Yes		
Milk price ($ per liter)	0.18	0.24	0.27			0.21			0.18		
Herd cows (no.)	7	78	10	35	220	4	7	10	6	9	18
Total land (ha)	5.0	42.0	0.03	0.4	12.7	2.2	3.5	6.5	10.0	12.4	19.9
Share irrigated land	100%	100%	0%	0%	100%	100%	100%	100%	9%	13%	19%
Own farm equity ($)	500	20,000	2000	5000	20,000	500	1500	3000	350	800	2000
Cow body weight (kg)	590	590	450	645	645	469	469	469	398	398	398
Calving interval (months)	15.7	15.7	16.0	14.6	14.6	17.0	16.0	15.0	16.5	16.5	16.0
First insemination (months)	19.0	19.0	20.5	17.0	17.0	19.0	19.0	19.0	19.0	19.0	19.0
Mortality calves	7%	7%	15%	4%	4%	15%	15%	15%	15%	15%	15%
Milk production lactation (liter)	4500	5400	3650	6763	7817	3000	3000	3000	2000	2000	2000
Meat price cow ($ per kg)	0.45	0.44	0.56	0.56	0.56	0.50	0.50	0.50	0.46	0.46	0.46
Heifer price ($ per kg)	2.20	2.67	3.50	3.50	3.50	2.50	2.50	2.50	2.50	2.50	2.50
Steer price ($ per kg)	1.00	1.19	2.00	2.00	2.00	1.10	1.10	1.10	1.10	1.10	1.10
Calf price ($ per kg)	1.00	1.49	1.50	1.50	1.50	1.20	1.20	1.20	1.20	1.20	1.20
Water costs ($/1000 m^3)	0.4	1.2	0.7	0.7	0.7	—	—	—	—	—	—
Interest rate, short (real, month)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Interest rate, long (real, year)	13%	15%	9%	15%	15%	15%	15%	15%	15%	15%	15%
Hired labor men ($ per day)	4.8	5.4	4.9	4.9	4.9	2.7	2.7	2.7	1.3	1.3	1.3
Hired labor women ($ per day)	3.9	4.1	—	—	—	1.7	1.7	1.7	0.9	0.9	0.9
Own labor men ($ per day)	2.4	2.7	2.5	6.0	6.0	1.3	1.3	1.3	1.3	1.3	1.3
Own labor women ($ per day)	1.9	2.1	—	—	—	0.9	0.9	0.9	0.9	0.9	0.9

increased negotiation power in the purchase of inputs, especially feed. The higher milk yields on large farms compared with medium farms explain one third of the difference in profit per cow; two thirds is explained by reduced costs in capital, feed, and labor. In Arequipa, larger farms are primarily competitive because they are in a position to negotiate higher milk prices with processors.

In Cajamarca, average milk production costs are reduced only on larger slope farms and Jalca farms. On larger slope farms, savings occur in providing feed for animal traction used for growing agricultural crops. On large Jalca farms, average pasturing costs are lower since 1 person takes care of a larger herd. In contrast, on valley and slope farms, the time required for pasturing increases in proportion to the increment in herd

size, as animals are pastured by tethering (Bernet and Tapia 1999). In the valley, large farms are even less competitive than medium-size farms because they require additional, more expensive labor.

The relatively low profitability of milk production in slope areas reflects the strong fodder constraints for dairy cattle in this production zone. Limited access to water and land constrains both permanent fodder crops and natural pastures. Hence, milk production is primarily attractive for larger slope farms, where crop residues partly compensate for the lack of green fodder as farmers tend to shift away from labor- and capital-intensive crops (potatoes and *oca*) toward extensive ones (cereals, beans, and peas) when more land is available. In this context, animal sales, traction, and manure account for a high percentage of the adjusted milk price (Table 3).

At the national scale, it is important to note that the current import taxation scheme for dairy products protects domestic producers effectively from low international milk powder prices. When FOB prices are low, the application of a variable import tax (higher when world market prices are low) evens out the import price per liter of milk at around US$ 0.35 (see Figure 2). The minimum import price is higher than what processors pay for regionally collected milk (production and collection costs) (① in Figure 4).

Expected changes in competitiveness

Currently, milk prices in Lima appear to be too high since it is just as cheap to transport milk from Arequipa (Majes) to Lima as to buy it directly in Lima (Pa' in Figure 4). When the milk is condensed before transportation (in general, by a factor of 3 through evaporation), processors are in any case better off buying their milk in Arequipa or Cajamarca than in Lima (Pa" and Pc" in Figure 4), as is currently happening (Laive 2000). Milk prices in Lima are likely to be reduced by 15–20% as a consequence of reduced competition (eg, Friesland's processing plant was sold to Gloria SA in 2000) and of Lima City's market saturation with fresh and bulky dairy products, such as yogurt and pasteurized milk.

In contrast, milk prices are expected to rise slightly in Arequipa and Cajamarca as a consequence of increased competition among milk buyers, further growth of the coastal urban markets, and an expected rise in the price of milk powder (import price) in future (Konandreas 1999).

Such regional milk price changes will strongly affect farmers' competitiveness in milk production. Milk producers in Lima will be hurt most since their intensive production systems are highly susceptible to milk price changes. Profits on large farms are likely to decline by 50% if milk prices decline by 20% (Figure 5). Since such milk prices will threaten the survival of medium and small farms, the consolidation process of efficiently managed large farms in Lima will speed up, provoking further improvements in herd and fodder management to increase average milk yields and lower average production costs. Another strategy will be to build alliances among producers to raise negotiating power for purchasing high-quality feed at low cost (Bernet et al 2000).

In Arequipa, a price-induced increase in milk profits is likely to be compensated with higher labor costs driven by increased labor demand for agricultural (cash) crops. However, most relevant for the region's development is the fact that—independent of any increase in milk prices—farmers will shift away from milk production when price fluctuations of agricultural crops diminish (Bernet et al 2001b). This trend has

TABLE 3 Characteristics of current income and costs in the 3 milksheds. The very high values for income per ha for Lima Coast are due to the fact that fodder is not produced on the farms.

Characteristics
Farm size
Agricultural income ($)
Per hectare ($)
Per cow ($)
Land use for fodder
Milk sold per day (liters)
Per cow
Income milk per day ($)
Hired labor (number of persons)
Hay production (t per year)
Silage production (t per year)
Revenue, milk (cents per liter)
Share milk
Share meat/animal selling
Share manure and traction
Costs, milk (cents per liter)
Share feed purchase
Share own fodder production
Share water costs
Share equipment/sanitation
Share labor costs livestock
Share capital costs
Share administration costs
Profit per liter of milk (cents)

already started in one area where a milk processing plant has been closed since most milk producers have shifted toward olive production subsequent to the establishment of an olive oil company (Laive 2000).

Cajamarca will benefit most from a future milk price increase (Figure 5). Given the current low income levels, higher profits considerably improve farmers' savings and investment capacity to further boost production and income. One likely consequence is the implementation of better fodder and herd management practices, through which these farms would become much more competitive—especially if fodder conservation is implemented (Figure 5). In valley farms, the combination of improved fodder and herd management could double agricultural income, as shown in a previous study (Bernet and Leon-Velarde 2000).

Concluding discussion

If the current import taxation scheme and the expansion of agricultural crops in the coastal areas of southern Peru (Arequipa) continue, highland farmers are expected to be the major beneficiaries at the national scale. The substantial economic, social, and ecological benefits resulting for the highlands justify government interventions that accelerate expansion and intensification of milk production at the farm and regional levels. In order to attract milk processors to highland regions, further road improvements and adequate product taxation are most relevant. Equally important are successful promotion of agricultural export crops in Arequipa (to speed up the region's shift from milk to crop production) and government interventions that improve

	Arequipa Coast		Lima Coast			Cajamarca Valley			Cajamarca Slope			Cajamarca Jalca		
	Small	Large	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
	4043	75,830	1759	15,466	191,955	1080	1670	2645	569	801	1723	1058	1561	3165
	809	1805	58,428	44,188	15,115	491	480	408	210	152	125	106	126	159
	616	968	176	442	873	250	237	276	228	170	147	167	169	178
	73%	68%	—	—	95%	75%	76%	56%	41%	30%	30%	95%	94%	91%
	63	907	78	530	3860	27	45	59	10	19	43	24	33	63
	9.7	11.6	7.8	15.1	17.5	6.2	6.4	6.2	4.2	4.1	3.7	3.8	3.5	3.6
	11	218	21	143	1042	5	9	12	2	3	8	4	6	11
	0.2	6.7	0.2	5.3	26.8	0.0	0.0	0.2	0.0	0.3	1.7	0.1	0.1	0.8
	0.0	0.0	—	—	0.0	—	—	—	—	—	—	—	—	—
	0.0	0.0	—	—	0.0	—	—	—	—	—	—	—	—	—
	21.4	27.4	30.6	32.0	31.3	28.2	28.7	29.8	28.3	28.7	32.8	27.8	29.1	29.8
	84%	88%	88%	84%	86%	73%	72%	69%	62%	62%	54%	63%	61%	59%
	15%	11%	11%	15%	13%	25%	26%	28%	32%	32%	28%	36%	34%	34%
	1%	1%	1%	0%	0%	2%	2%	3%	6%	7%	18%	1%	6%	6%
	17.4	18.6	30.6	28.0	21.5	25.6	25.4	27.0	31.2	30.8	28.9	25.3	23.4	21.3
	0%	0%	57%	43%	44%	40%	42%	31%	17%	27%	32%	25%	30%	32%
	60%	44%	0%	0%	6%	21%	19%	29%	33%	30%	30%	24%	21%	25%
	1%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	14%	21%	14%	14%	9%	15%	16%	15%	19%	19%	20%	19%	21%	22%
	18%	9%	22%	18%	14%	18%	18%	18%	29%	21%	16%	27%	23%	16%
	7%	7%	7%	13%	11%	5%	5%	7%	2%	2%	3%	4%	5%	5%
	0%	16%	0%	13%	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	4.0	8.9	0.0	4.0	9.8	2.5	3.3	2.8	–2.9	–2.1	3.9	2.5	5.7	8.4

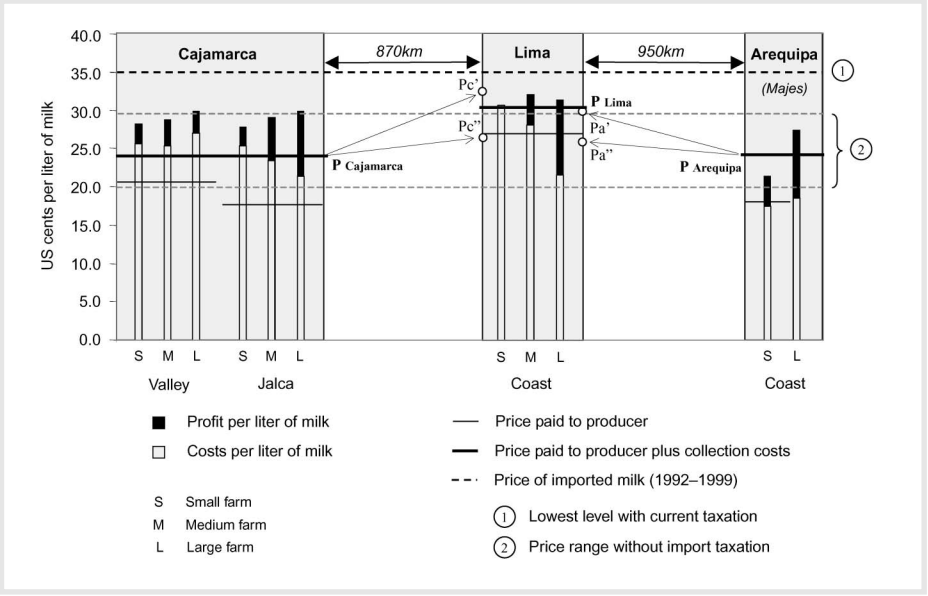

FIGURE 4 Variability of profits and milk prices in the 3 milksheds compared with prices for imported milk with and without taxation.

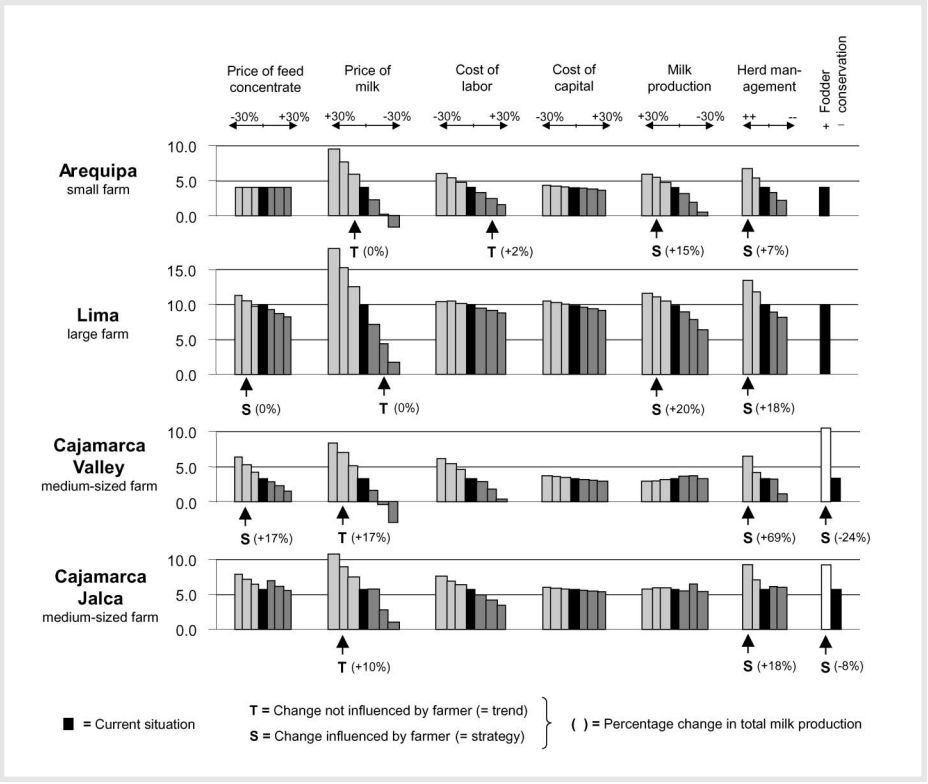

FIGURE 5 Projected farm profits for the most competitive farm types in a market situation changed as a result of new policy directions.

product quality and the image of highland dairy produce (Figure 6). Both types of intervention would support a reorientation of milk buyers toward highland areas. Special emphasis is needed to promote cheese making since domestic producers increasingly have to compete against aggressive cheese importers; many countries have shifted away from milk powder to cheese production to handle overproduction in milk. On the legal side, an explicit judicial base to effectively implement regional product labeling is a priority. Such a measure could create an important incentive for joint actions of milk processors and tourism agents because both are interested in attracting urban clients but suffer similarly from not adequately marketing their products and services by selling the beauty of their mountain environment.

Thus, milk processors must be perceived as important partners for governmental and nongovernmental development agencies. First, they are interested in stimulating the region's milk production; and second, they

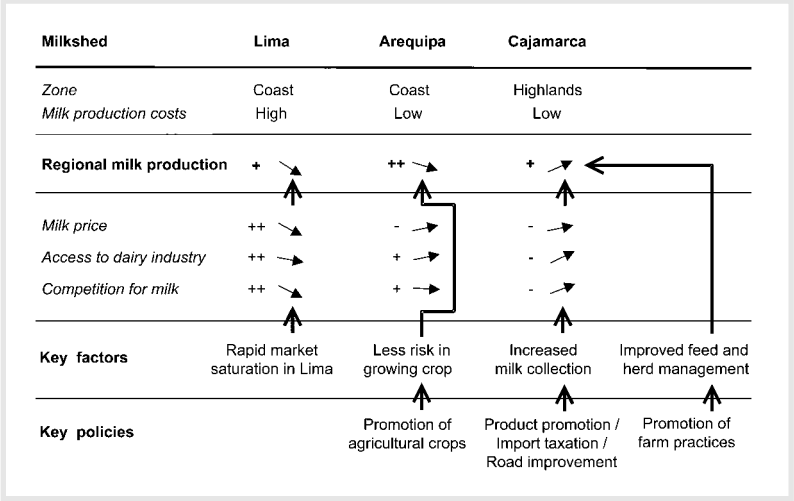

FIGURE 6 Expected impact of key factors and government interventions on current regional milk production trends (+ and – refer to the current situation, arrows to expected trends).

are the crucial link between farmers and the promising urban markets. Moreover, milk processors commonly have vast experience in agricultural extension (eg, in fodder and herd management) and are in an excellent position to provide milk producers with cost-effective loans based on easy milk payment deductions.

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REFERENCES

Bernet T, Julca J, Saenz J, Prain G. 2000. Peri-urban milk production in Peru: assessing farmers' decision-making within a changing market. *Livestock Research for Rural Development* 12(4). Available online: www.cipav.org.co/lrrd/lrrd12/4/bern124.htm

Bernet T, Leon-Velarde C. 2000. Income effects of fodder and herd management on small-scale milk producers in the northern Peruvian Andes. *Livestock Research for Rural Development* 12(3). Available online: www.cipav.org.co/lrrd/lrrd12/3/bern123a.htm

Bernet T, Ortiz O, Estrada RD, Quiroz R, Swinton SM. 2001a. Tailoring agricultural extension to different production contexts: a user-friendly farm–household model to improve decision-making for participatory research. *Agricultural Systems* 69:183–198.

Bernet T, Pradel W, Walker T. 2001b. Crops versus milk: unfulfilled expectations in southern Peru. *Livestock Research for Rural Development* 13(3), in press. Available online: www.cipav.org.co/lrrd/lrrd13/3/bern133.htm.

Bernet T, Tapia M. 1999. *Análisis de los Sistemas de Producción en la Microcuenca de la Encanada, Cajamarca*. Documento de trabajo 2. Lima: [CIP] Centro Internacional de la Papa.

Dollfus O. 1982. Development of land-use patterns in the Central Andes. *Mountain Research and Development* 2:39–48.

[INEI] Instituto Nacional de Estadística y Informática. 1996. *III Censo Agropecuario (Resultados Definitivos).* Compendio estadística IV. Lima: INEI.

Jodha NS. 2000. Globalization and fragile mountain environments: policy challenges and choices. *Mountain Research and Development* 20:296–299.

Konandreas P. 1999. Next round of negotiations in agriculture with special reference to the dairy sector. *Bulletin of the International Dairy Federation* 343:5–18.

Laive. 2000. *89 Memoria 1999*. Lima: Laive SA.

Malpartida E, Pinares C, Bello J. 1995. Sistemas de producción en la cuenca lechera de Cajamarca. *In:* Herve D, Rojas A, editors. *Vías de Intensificación de la Ganadería Bovina en el Altiplano Boliviano*. La Paz: [ORSTOM/IRD] Institut de recherche pour le développement.

McBride EQ. 1997. *Política Alimentaria e Importación de Alimentos de Origen Animal en el Perú* [Thesis]. Lima: Universidad Nacional Agraria La Molina, Facultad de Zootécnica.

Mosley P. 1982. Marketing systems and income distributions: the case of milk producers in highland Peru. *Food Research Institute Studies* 18:275–291.

Ørskov ER. 1993. *Reality in Rural Development Aid*. Aberdeen, UK: Rowett Research Services.

Rieder P, Wyder J. 1997. Economic and political framework for sustainability of mountain areas. *In:* Messerli B, Ives JD, editors. *Mountains of the World: A Global Priority*. London: Parthenon, pp 85–102.

Seifert R. 1990. *Cajamarca: Via Campesina y Cuenca lechera*. Lima: [CONCYTEC] Consejo Nacional de Ciencia y Tecnologia.

Wiegers ES, Hijmans RJ, Hervé D, Fresco LO. 1999. Land use intensification and disintensification in the upper Cañete Valley, Peru. *Human Ecology* 27:319–339.