DETERMINANTS OF EFFICIENCY FOR BRAZILIAN DAIRY FARMS

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Submitted to the Faculty of the
Graduate College of the
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in partial fulfillment of
the requirement for
the Degree of
DOCTOR OF PHILOSOPHY
December, 2000

DETERMINANTS OF EFFICIENCY FOR

BRAZILIAN DAIRY FARMS

Thesis Approved:

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ACKNOWLEDMENTS

I would like to thank EMBRAPA, the Brazilian Agricultural Research Corporation, for the scholarship.

My appreciation to Dr. Dean F. Schreiner, much more than an academic advisor to me, for his support, guidance, encouragement and motivation throughout my academic program. I extend my gratitude to Dr. Arthur L. Stoecker, Dr. Francis Epplin and Dr. William D. Warde for serving on my committee.

I am grateful to the employees of Brazilian Dairy Cattle Center, especially to Dr. Aloísio T. Gomes for his encouragement and assistance in obtaining scholarship. My gratitude to Alziro Carneiro for his dedication and special care in holding of my personal affairs in Brazil during this period.

I am especially thankful to Dr. Eliseu Alves.

I would say thanks to my parents, Ewaldo and Leonila, for their wisdom and support to my dreams. My gratitude to Ângela, my wife, for her love, patience, support and encouragement.

I would like to dedicate this dissertation to my sons Vinícius and Mateus.

TABLE OF CONTENTS

LIST OF TABLES

I. INTRODUCTION

Milk production in Brazil represents 10% of the GDP of the domestic agricultural sector. Of the 4.8 million farms in Brazil in 1990, 37% (1.8 million) had some dairy activity (IBGE, 1999). And of these 1.8 million milk producers in 1990, it is estimated that about 600 thousand left the activity in the 1990's. As a significant labor employer, the number of dairy farms plays an important role in retaining rural people from migrating to urban areas. Milk production and productivity of milk producers are expected to increase because of higher domestic demand for milk (and demand for milk quality) and because of competitiveness with imports. In 1998, dairy imports represented 10.1% of the domestic consumption.

To better understand the dynamic changes in the Brazilian dairy industry, the interdependence of three components needs to be considered: (1) characteristics of the milk production sector; (2) structure of the processing industry and its linkages to milk producers and markets of fluid milk and manufactured dairy products; and (3) the consequences of changes in macroeconomic policies in the early 1990s.

General Problem

In general, the milk market can be characterized by a large number of heterogeneous milk producers and a concentrated processing and distributing industry. In a static view, milk production can be described by five main characteristics, all interrelated:

1. Widely heterogeneous production systems — Dairy farms vary from low-input grazing with crossbred cows to high-input Holstein free-stall farms. While the dairy herd of developed countries is mainly based on Holstein, in Brazil, the Indian breeds, such as Gir, Guzera, and Nelore, are important. Although producing less milk, the Indian breeds are used because of their dual purpose for beef and milk, as well as their rusticity and adaptation to a more adverse and tropical environment. The importance of the European breeds, such as Holstein, Jersey and Swiss, is their high milk productivity per cow. They constitute the most specialized farms, and require more sophisticated production technologies.

2. Large number of small milk producers — From over a million producers, about half of the total domestic production comes from 90% of those producing less than 200 liters per day (Alves and Assis, 1998; Gomes, 1998).

3. Low productivity per cow — Table 1 summarizes a comparison of production, number of farms, and number of cows among selected traditional milk producing countries in 1997. The productivity per cow of the Brazilian herd is 950 liters/cow/year, one-fourth of that in Argentina (3,650 liters/cow/year), and one-eighth of the United States (7,559 liters/cow/year).

4. Low level of production per farm — Table 1 shows that the volume per farm in Brazil (47 liters/farm/day) is more then twenty times lower than in Argentina (1,091 liters/farm/day).

Table 1. Comparison Among Selected Countries of Milk Production, Number of Farms and Cows, Productivity, and Producer Price, 1997.

Country	Milk Production			Number of Farms	Number of Cows		Producer Price
	Per Cow/Year (Liters)	Per Day/Farm (Liters)	Per Year (Billion Liters)	(Thousand)	Total (Million)	Per Farm	(US$/Liter)
United States	7,559	1,834	70.3	105	9.3	89	0.30
Europe	5,579	400	120.5	825	21.6	26	0.39
Australia	4,947	1,814	9.4	14	1.9	136	0.20
Argentina	3,650	1,091	8.8	22	2.4	109	0.21
New Zealand	3,333	2,078	11.0	15	3.3	220	0.16
Uruguay	2,879	774	1.3	5	0.4	80	0.18
Brazil	950	47	19.0	1,182	20.0	17	0.22

Source: Jank and Galan (1998).

5. Differences among regions — Natural resources and environment, size and state of the market, level of technology adoption, are determining factors that characterize structural differences in production among regions.

A few large national and multinational companies constitute the most relevant part of the processing industry. It is estimated that they process 59% of the domestic milk production, and that the remaining 41% (about 8 billion liters/year) is sold directly to consumers in the so called "informal milk market," which corresponds to about 31% of gross income of the sector (Jank and Galan, 1998, p. 181). Large cooperatives are usually formed by the coalition of smaller local cooperatives, with the objective of gaining processor scale. Most of their products are sold back in the production region. The milk assembly is broadly based on the collection and transporting of 40-quart cans. More recently, there has been a significant substitution of this system for tank trucks, especially in the south and southeast regions.

Macroeconomic policy in the early 1990s contributed to the main factors that accelerated changes in the Brazilian dairy economy. Milk price deregulation in 1990, the signing of the Mercosul Common Trade agreement[1], and the 1994 macroeconomic stabilization plan, which officially adopted an open economy policy, all contributed to changes in the Brazilian dairy economy.

In addition to large historical imports, the open economy process and economic stabilization brought a more competitive environment to the industry. For the consumer, the results have been better price and quality, more diversified products, and improved services. Therefore, new bundles of manufactured products and different channels of distribution and marketing systems have taken place. Special attention has been given to the ultra high temperature processed milk (UHT) which, to some extent, has substituted for the fluid milk grades C and B (Jank and Galan, 1998). As a result, the combination of historically large imports and open economic policy have accelerated concentration of milk processing by merging small local cooperatives and processing industries into fewer large regional cooperatives, and large national and multinational companies.

Specific Problem

Although price deregulation had immediate and direct effects on milk producers, the more significant changes in market environment have been the consequences of combined results of economic stabilization and an open economy policy. Essentially, higher consumer income and demand for quality products (often typified by imports) raised the competition for price and quality in the domestic processing and distribution markets. Because of higher competition, lower prices have been paid to producers for the

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1 Initially grouping Brazil, Argentina, and Uruguay in a trade union.

raw milk by the processing industry in an attempt to reduce per unit cost[2]. As a result, farms have been decreasing in number but increasing in size and use of technology and thus adjusting their production system for lower cost and higher efficiency.

From a dynamic perspective, the milk producer changes can be attributed to the interrelationships of a detailed set of factors:

1. Price deregulation — This had an immediate and direct effect on the producer's price. However, combined with the open economy policy, it created for the processing sector an even more oligopsonistic environment, thus increasing the need for price negotiation[3].

2. Open economy environment — This forced the Brazilian producers to compete with producers of other countries. Very often, because of subsidies in the exporting countries, the price of imported milk has been lower than the domestic price. Brazil was the sixth largest importer in 1996. Table 2 illustrates the participation of dairy imports relative to total consumption. From 1995 to 1998, on average, dairy imports represented more than 11% of total consumption. Brazil imports about 75% of all milk products exported by Argentina and 40% of what Uruguay exports (Jank and Galan, 1998, p. 189).

3. Ultra high temperature processed milk — This type of milk packaging, also called UHT, has been widely adopted in Brazil. Its success is attributed to the particular characteristic that it permits milk to be transported and stored without refrigeration. It is also the most preferably system of marketing by large

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2 It is also reflected in concentration of the processing and distribution industries, increase in size and reduction in number of firms, price differentiation, and marketing strategies.

3 Price discrimination may be one of the factors related to the reduction in number of small farms.

supermarkets because they can buy milk in larger quantities and sell at lower margins than traditional fresh milk, which needs daily replacement and refrigeration (Jank and Galan, 1998, pp. 228-9). From the producer perspective, it is said that the presence of the UHT's milk in the production region raises unfair competition, because the farmer's product (fresh fluid milk) cannot be stored for long time-periods and has additional cost of refrigeration. The share of UHT reached about 53% of all fluid milk consumed in 1998.

Table 2. Production, Imports[4] and Percent of Imports Relative to Total Consumption of Milk in Brazil, From 1990 to 1998.

Year	Domestic Production (10^6 Liters)	Imports (10^6 Liters)	Total Consumption (10^6 Liters)	Imports/Consumption (%)
1990	14,484	906	15,390	5.89
1991	15,079	1,313	16,392	8.01
1992	15,784	276	16,060	1.72
1993	15,591	632	16,223	3.90
1994	15,784	1,250	17,034	7.34
1995	16,474	3,200	19,674	16.26
1996	18,515	2,450	20,965	11.69
1997	18,666	1,930	20,596	9.37
1998	20,213	2,270	22,483	10.10

Sources: IBGE (1999) and Gomes (1999, pp. 4 and 20).

4. Changes in geographic shares of production — Some traditional beef producing regions have been increasing their share of milk production over time. Table 3 illustrates how the percent of production changed regionally from 1990 to 1997. The Southeast, a traditional and large milk-producing region, decreased its share from about 47.8% to 45.0%, while the Central-West, a traditional beef-

[4] Refers to the aggregated value of all imported dairy products converted to liters of milk.

and grain-producing region, increased its share from 11.7% to 14.4%. There is a belief (not yet conclusive) that this increase of milk production in the Central-West region is related to lower prices for grain. That is, because this region produces grain, concentrate feeds are less costly, which is an incentive for dairy farming (Jank and Galan, 1998, pp. 244-6).

Table 3. Distribution of the Brazilian Milk Production According to Geographic Regions in 1990 and 1997.

Geographic Region	1990		1997	
	Volume		Volume	
	10^6 Liters	%	10^6 Liters	%
North	555	3.8	841	4.5
Northeast	2,045	14.1	2,389	12.8
Central-West	1,698	11.7	2,695	14.4
Southeast	6,923	47.8	8,396	45.0
South	3,262	22.5	4,345	23.3
Total	14,484	100.0	18,666	100.0

Source: IBGE (1999).

5. Consumer demand — A more stable economy and reduced inflation have stabilized and increased incomes and thus changed demand preferences and marketing strategies. The producer has been directly affected by a continuous growth in demand for better quality and volume and a need for technological adjustments.

6. Milk assembly — The tendency has been for a gradual substitution of the traditional 40-quart cans picked up at the farm to bulk tanks or processor's trucks. Greater attention has been given to the transportation of raw milk, either by reducing per unit assembly cost or combining technologies to preserve

the raw milk quality.

7. Quality and volume — By facing a more oligopsonistic market, lower prices are more likely to be paid to the producer. However, price has also been linked to quality and volume. It has been observed that an increased number of private firms and cooperatives have adopted alternative systems of differentiated prices. Bonus and/or higher prices are established according to specific standards of quality and volume attained by the farmers. As an incentive, cooperatives and firms have been financing refrigeration systems for producers and/or groups of farmers. These systems are used to lower the temperature of the milk produced from the evening's milking shift and enable keeping this milk at the farm until the next morning. This system reduces per unit cost of transportation, and has been one of the most adopted practices in the last years (Jank and Galan, 1998, pp. 234-43).

8. Breed — Despite the rusticity of the Indian breeds, higher productivity per cow has been obtained by using European breeds. However, the adoption of these breeds usually requires higher levels of investment, technology and management. The type of breed has also been associated with size of operation and other indicators of efficiency and productivity of labor, land and capital.

The factors described above are all related to the milk producer in a process that converges to a natural selection of efficiency. In a competitive environment, less efficient firms are more likely to merge, increase in size, adopt a more appropriate technology, or leave the activity. The evidence indicates that the small producer is the most affected as shown by the reduction in the number of these producers. Table 4 presents a comparison of the percent of producers and volume produced by size of operation in two periods in time, 1990 and 1997, for one region in Brazil, particularly from the Itambé processing industry influence area. Considering only the two smaller size categories – producing 100 liters or less – their share in total production decreased from 42% to 25% in nine years. Those producing more than 500 liters tripled their participation in the same period of time. The total number of small farms (100 liters or less) decreased from 82% in 1990 to 72% in 1997.

Table 4. Percent Distribution of Production and Number of Producers by Size of Operation, Itambé[5], Brazil, 1990 and 1997.

	Production (%)		Number of Producers (%)	
Liters per day	1990	1997	1990	1997
Less the 50	20.8	11.6	61.8	51.8
From 51 to 100	21.3	13.9	20.0	20.8
From 101 to 500	47.4	44.2	17.3	23.6
More than 500	10.5	30.3	0.9	3.8
Total	100.0	100.0	100.0	100.0

Source: Itambé – Relatório Annual (1976/1997). In: Gomes (1999).

According to MilkPoint (2000a), the number of producers for the 12 largest milk processing industries in Brazil decreased from 175,450 in 1997 to 133,367 in 1999, which represents about a 24% reduction. In the same period, the number of producers in Paraná State decreased from 44,324 to 32,421, which represents about a 26.8% reduction (MilkPoint, 2000b).

These results provide considerable evidence that small and medium size farms are gradually being eliminated from the dairy activity, and/or are replaced by larger units.

[5] Relative to the Itambé processing industry influence area.

Given the characteristics of these production systems, a question arises: what are the determinants of efficiency or inefficiency in milk production systems? In examining the literature, considerable attention has been given to size, physical capital, returns to scale, and human capital, in an attempt to explain the concentration that has been observed in many countries in Europe and in the United States. However, in the Brazilian case, because of social, technical and environmental conditions, production systems may react in a different way[6]. Therefore, the question is: are there significant differences in efficiency between, for example, farms located in the South region and the same-size farms located in the Northeast or Central West of Brazil? If that is the case, are these differences due to use of different breeds, level of management by the owner/operator, or specific farm location?

If current market forces continue, and also if there is a continuous substitution for imports, then higher production levels will be demanded in the future. The question that remains is: how would each homogeneous size group respond to milk price and wage rate changes? What would be the constraints? Will the use of improved technology and capital play key roles in determining higher production and productivity levels for future systems?

The usefulness of the production frontier is to know what is actually possible to obtain for a given set of factor inputs and farm operation characteristics. Thus, policies can be established to correct potential imperfections or constraints. Identifying the relative differences in efficiency for a given bundle of resources will be decisive for potential improvements by the producer. The research and extension agencies will benefit in providing better information to producers in allocating resources. Therefore,

[6] It includes facilities to produce alfalfa and grass with high concentration of protein.

the task of identifying sources of efficiency and inefficiency appears to be relevant results translated into knowledge for higher production, increased productivity, and the survivability of the Brazilian dairy farm, which is ultimately the purpose of this research.

Objectives

The objective of this research is to estimate the relative state of technical efficiency of the milk producing industry, and examine the determinants of economic competitiveness of Brazilian dairy farms. The specific objectives are to:

1. Estimate the stochastic production frontier and efficiency parameters for individual dairy farms, for different regions and breed classifications;
2. Estimate the parameters of a set of farm-level explanatory variables for the technical inefficiency for individual dairy farms, for different regions and breed classifications;
3. Estimate input and explanatory elasticities for different regions and breed classifications; and
4. Evaluate and characterize the farms by efficient and inefficient sets, according to size, productivity, and exogenous factors determinant of efficiency, at given resource levels and technology.

II. LITERATURE REVIEW

This review focuses on how specific 'determinants' are discussed in the literature, in the context of the approach, assumptions, data and findings. For simplicity, these structural determinants are grouped in categories[7], which to some degree are related (and interrelated) to dairy production efficiency (or inefficiency), and may affect the whole structure. The factors considered are: (1) Farm size and number of farms; (2) Economies of scale; (3) Farm income and survivability; (4) Supply response and prices; (5) Farming knowledge and adoption of new technologies; (6) Degree of specialization, productivity and breed; and (7) Labor, capital and use of natural resources.

In the literature, the terms 'returns to scale' and 'economies of scale' are often used to express similar concepts as a measure of 'scale economies'. RTS is the measure of the relative change in the production level resulting from a proportional change in the quantities of all inputs. As provided by Sahoo, Mohapatra and Tivedi (1999), "the concept of returns to scale" is related to "the concept of production unit" and its degree of homogeneity (p. 379). 'Economies of scale' is a concept based on the per-unit cost of production, derived from an underlying production function, as the level of output expands. Besides RTS, economies of scale may also include savings in cost from other factors, also called 'scale effects', such as "behavior of overhead and indivisibility of

[7] Conventional variables such as land, capital, feed are usually considered in each specific category.

factors of production," externalities, "nature of contracts" and labor, technical and managerial economies (p. 380).

Farm Size and Number of Farms

Farm size, along with RTS, is the most emphasized issue. The study of size has focused on RTS, economies of scale, size of optimal efficiency, herd size and herd growth, human capital, size distributions, and policies.

Bravo-Ureta (1986), investigating a sample of 222 New England dairy farms in 1980, used a probabilistic production frontier[8] (Cobb-Douglas function) and found RTS equal to 1.058. The average technical efficiency was estimated at 82%, suggesting that milk production could be expanded about 18% with the same amount of resources. Bravo-Ureta found technical efficiency independent of farm size, and interpreted the reduction in number of farms and increased farm size as "a consequence of the low income associated with the small farms, rather than the greater efficiency of larger farms" (p. 412).

Kumbhakar, Biswas, and Bailey (1989, pp. 601-4), in a study of efficiency of Utah dairy farms, used dummy variables to express differences in size in the production function and found large farms technically more efficient.

Quiroga and Bravo-Ureta (1992, pp. 609-14), in a dual profit model, analyzed the short- and long-run adjustments for Vermont dairy from 1966-1988. Their empirical model (normalized quadratic) incorporated milk and livestock for output; four variable inputs (concentrate feed, forage, hired labor, and energy); two quasi-fixed inputs (family

[8] This approach consists in progressively discarding observations and re-estimating the function until the coefficients stabilize.

labor and herd size); a time variable accounting for technological change; and four dummies to control for group size differences. They found evidence of suboptimal utilization of quasi-fixed inputs or that smaller farms were operating below full capacity.

Kumbhakar (1993, pp. 340-1), in a study of farm-size, scale and efficiency of Utah dairy farms found that small farms were less profitable and more susceptible to profit reduction in cases of a reduction in the output/input price ratio.

Weiss (1999), studying growth and survival of Austrian farms, found that "smaller farms do grow faster than large ones", suggesting higher RTS for small farms, adjusting "toward some minimum efficient scale of production" (p. 111).

A positive relationship between farm size and technical efficiency was also supported by Kalaitzandonakes (1992), while analyzing the average technical efficiency of Missouri grain farms. Kalaitzandonakes called attention to factors, other than just RTS, that may be related to size, such as "entrepreneur ability, education, farming experience and other personal attributes" of the farm operator (p. 440).

Summer and Leiby (1987) studied the effects of human capital on herd size and growth for dairy farms in the United States. They found that an additional year of schooling was found to increase the size of the herd by 3%, and concluded "more dairy-specific human capital would imply larger herd size" (p. 470).

Jaforullah and Devlin (1996) using a translog production frontier approach, found 76-95% as an average of technical efficiency for New Zealand dairy farms. They included broadly defined variables, such as 'total dairy herd', total labor (including unpaid family labor), total 'dairy outputs', and land and all buildings as 'fixed assets'. They found CRS and no evidence for a large farm to be technically more efficient than a medium or small size farm, and suggested the inclusion of 'human capital' variables in further research.

Cocchi, Bravo-Ureta, and Cooke (1998) compared the productivity of dairy farms, over time, for six Northern states in the United States, assuming a translog cost function. They found that "large farms were, on average, 12% to 20% more efficient than small farms" (p. 293), with the implication that "the elimination of the dairy support program … would accelerate the trend toward fewer and larger farms" (p. 294).

Economies of Scale

Returns to scale have important implications on the efficiency parameter estimates. In production, a non-CRS implies that the proportions of inputs are dependent on scale as well as relative prices of inputs.

Matulich (1978), studying efficiency in large-scale dairy farms in the United States, found that "significant economies of size were evident up to 750-cow herds" (p. 645), and "milking and feeding systems, and better capacity utilization appear to afford greater overall production efficiency" (p. 646). Matulich considered the findings as conditional to: (1) the presence and efficiency of the "commercial enterprise and the multienterprise dairy farm"; (2) "availability of quality labor"; and (3) "highly specialized" management (p. 646).

From a sample of 106 owner-operated dairy farms in 1981, Grisley and Gitu (1984) used a translog variable cost function to investigate the production structure of Pennsylvania dairy farms. They found unitary elasticity of scale at the mean level, and feeds and labor were found cross-price inelastic and substitutes.

Finan, Langworthy, and Fox (1990, p. 699) in an analysis of the Portuguese dairy sector, related economies of scale to larger farms as a result of having 'preferential access to inputs and credit' and better access to information, and thus facing lower costs and more readily adopting new technologies.

'Substantial scale economies' was found by Moschini (1990) using a semiparametric model for Ontario dairy farms. Moschini considered a multiproduct cost function for a sample of 612 farms, from 1978-1983 and used a Fisher price index for four groups of inputs: labor, feed, other inputs and capital.

Kumbhakar, Ghosh, and McGuckin (1991, p. 283) found that large farms were technically and allocatively more efficient, but no evidence of increasing RTS.

Thijssen (1992a) found no significant differences in results by comparing production technology using primal and dual approaches, with 'flexible functional forms' (translog) and varying intercept to reflect managerial differences. One output and four input variables were considered, and the normalized variable of profit was obtained from the ratio of the Törnqvist price indices of variable input and output. The substitution elasticities in both models were characterized by high standard errors, which the author relates to the dependence 'on many estimated parameters', for its calculation. The scale elasticity was 1.08, estimated at the sample mean.

Kumbhakar (1993) analyzed the effects of returns to scale, farm-size, technical, allocative and scale inefficiencies on profitability of Utah dairy farms. This author found that small farms, relative to medium and large farms, were: (1) less profitable; (2) less efficient; (3) more susceptible to profit reduction in case of reduction of output/input price ratio; (4) more scale inefficient; and (5) had less chance of survivability.

Jaforullah and Whiteman (1999), studying the relationship between size and technical efficiency for New Zealand dairy industry, found that 19% of the farms of the sample were operating on the optimal scale and 53% below the optimal scale. The average technical efficiency was estimated in 89% and the optimal size equaled 260 animals in the herd.

Fraser and Cordina (1999) used a DEA model to analyze irrigated dairy farm efficiency in Australia. They found no significant correlation between technical efficiency and herd size, but "a significant number of farms exhibit increasing returns to scale" (p. 277). Decreasing returns to scale was also found for the larger set of farms over 200 cows, which the authors related to "inappropriate factor mix" or a more complex decision process. The potential reduction of water consumption was estimated at 16% if all farms were operating at full-efficiency.

Farm Income, Efficiency and Survivability

Luijt and Hillebrand (1992) analyzed the continuity of Dutch dairy farms, in the context of fixed factor availability and family income. Based on panel data, from 1979-1987, they found that "family members usually take over the fixed inputs at a considerable reduced price" and the probability of a dairy farm being continued by a family member, instead of liquidation, was estimated at 45% (p. 280). The conclusion was that the availability of fixed inputs and the presence of an heir were important factors for continuity. Finally, they suggested further work to consider part-time farming, as well as the possibility of a farm switching to some other agricultural activity.

Hirschl and Long (1993) analyzed demographic and family factors as determinants of dairy farm survivability. The study was conducted in the metropolitan area of New York, with the hypothesis that significant losses of dairy farms were the result of urban development pressures, in the two survey periods 1984 and 1990. In the survey, respondents were asked about: nonfarm development (pressures to purchase farmland, residential areas, property taxes, local laws, scarcity of labor, lack of housing), access to local processing and services, herd size or acreage planted, changing in farm type, milk production, hired labor, tenure, number of families sharing ownership, off-farm income, off-farm employment, age, major family difficulties, personal goals, and other questions.

Weiss (1999), studying growth and survival of Austrian farms, found that "the probability of survival for part-time farms" was "2.92% lower than that of full-time farms" (p. 108). Survivability was found positively related to: (1) the operator's age, for young farmers; (2) married operator; (3) the number of family members; (4) "agriculture-specific schooling"; and (5) "new principal operator within the last five years." Factors such as 'age', for older farm operators, and 'gender' (farms operated by woman) were found negatively related to survivability (4.39%). 'General schooling' was not found to affect survivability (p. 110). For further empirical models of farm survival, the author suggested to consider "farm income, debt, profitability and productivity, and farmer's attitude toward risk" (p. 114).

The share of production of the small farms in total production may have important implications on their chances to survive individually as a group. Kamieniecki, Gnyp, and Trautman (1999), analyzing the technical and economic characteristics of Polish dairy farms, stated: "dairy companies cannot give up these suppliers [farms possessing 1-4 cows] because of the small number of farms with over ten cows" (p. 301).

Weersink, Nicholson, and Weerhewa (1998), studying specific reasons why farm household members work off-farm, in New York and Ontario, found that off-farm earnings "provide for basic necessities and maintain the dairy farm business", raise living standards, and protects against "downturns in farm income". It also relates to wealth and self-insurance activities (p. 142).

Taylor, Drummond and Gomes (1986), studying the effectiveness of subsidized credit programs in improving productivity of traditional farming in Southeastern Minas Gerais, Brazil, found no effect on technical efficiency of participant farms. The average efficiency for participant and nonparticipant farms were 18% and 17%, respectively.

For more detailed review of the frontier functional literature for the efficiency analysis of developing country agriculture, see Bravo-Ureta and Pinheiro (1993).

Supply Response and Prices

Quiroga and Bravo-Ureta (1992, p. 612) found output supply and input demand elasticities were 'consistently' higher in the long-run compared to the short-run. Responsiveness of milk output to own-price in the long-run (elasticity of 4.06) was much greater than the short-run elasticity of 0.01.

Thijssen (1992b) used a system of factor demand and output supply to evaluate the responsiveness of Dutch dairy farms, and tested random effects model[9] with farm varying

[9] As stated by the author, in these models the intercept terms are treated as part of the model's disturbance term. The null hypothesis of same intercepts for all observations was rejected by the Hausman's test.

intercepts for purposes of measuring managerial and quality of land differences. By using Törnqvist price indices, the author considered milk and meat as output, and four inputs: variable input (feed, fertilizer, pesticides, fuel, etc), labor (family and hired labor), capital (livestock, buildings and machinery), and land. The own-price elasticity was estimated at 0.10. The influence of capital on output was 0.37; for land 0.43; and the influence of technical change in production was estimated at 0.6% per year.

Staal, Delgado, and Nicholson (1997) found high transactions costs for smallholder dairying in East Africa; decrease in prices received and increase in transaction costs with distance, "depending on the size of sales and the flexibility of contractual relationships"; and the importance of 'organizations of collective action' as means to reduce transaction costs, cost of collection transport, and need of information (pp.791-2).

Zepeda (1995) investigated the role of exogenous factors on number and size of Wisconsin dairy producers. This author found that "farmers respond symmetrically when entering or exiting dairy farming" but "more responsive to price decreases" (p. 849). Milk-feed price ratio was found positively associated with 'net new entry', but negatively associated with "the net new entry of large farms" (p. 844).

Upton and Haworth (1987) using a sample of 14 years data from 81 British farms compared growth rates of output, labor use and size. They found that faster growing rates were found for the farming group predominantly milk and more than 150 hectares (20 –50% arable), followed by "specialist milk producer with 50 hectares or less" (p. 360). They also found CRS and farm size "related to managerial ability and propensity to invest in the farm", 'planned future expansion', and 'family size or number of dependents' (p. 362). Farm growth was found negatively correlated with off-farm income, and the correlation between growth of labor and machinery depreciation was found positive.

Haden and Johnson (1989) studied the factors that contributed to the financial performance of 81 Tennessee dairy farmers. Using a quadratic specification, they found "number of dairy cows, production per cow, price of milk, and forage cost per cow" as influencing financial performance (p. 110). The ratio 'milk sales to total sales' suggested that diversification[10] had "little effect on efficiency of resource use", but "positive influence upon cash flows" (p. 111). Production per cow was found to be positively related to financial efficiency, suggesting benefits from "more advanced herd management practices, which are cost-effective" (p. 110).

Technical inefficiency is frequently attributed to distortions, which may arise from protectionism policies. A study by Lachaal (1994) found "a negative relationship between protectionism and technical efficiency" and "productivity growth", for the U. S. dairy sector. It was also found that "subsidies in the dairy industry have been factor-biased" and "subsidy has been feed saving, neutral with respect to labor, and material using" (p. 308).

Wackernagel (1998) analyzed potential impacts on Vermont dairy farms, by using simulation models. He found that (1) 'price stabilization' had larger "impacts on larger farms ... but not proportionally larger"; (2) larger farms were "at greater risk of financial difficulty" (p. 61); and (3) "price level is more of a constraint to economic sustainability than price variability" (p. 62).

Breed and feed rations may influence protein and the percentage of butterfat in the milk, which may have important implications on quality, volume and price of the raw

[10] Particularly tobacco, which is very labor intensive, and widely grown by dairy farms in their sample.

milk produced by a farm. Buccola and Iizuka (1997) examined costs and pricing of milk components in U.S. dairy farms. Holstein cows were found more productive, but "with lower fat and protein concentration", and because this breed is more costly to feed its "effective output is comparatively low at mean feed quantities" (p. 458). Geographic feed cost effects were attributed to differences in 'pasture quality'. The 'butterfat-protein trade-off' was found very low, –0.51, suggesting that component pricing plans would "permit protein prices to rise toward protein's marginal productivity in cheese production", but feed management adjustments would be "only weakly effective in increasing protein production" (p. 461).

Another issue has been the implicit value for milk at retail and producer levels. Gillmeister, Yonkers, and Dunn (1996), studying hedonic pricing of milk components at the farm level, found the marketing system inefficient in "transmitting milk component values." Particularly, "the relative values of butterfat to solids-not-fat and water to solids-not-fat" were found "higher than that perceived in the retail market" (p. 190).

Tiffin (1991) studied factors influencing decisions on England dairy farmers, and found that "factors other than price play a substantial role in the determination of the optimum output of milk" (p. 400), and recognized the necessity to "understand better the influence of price on the technology of the dairy farm" as well as "the elements conditioning the technology which a farmer operates at a point in time" (p. 402).

Greater attention has been given to the transportation of raw milk, either by reducing per unit assembly cost or combining technologies to preserve the raw milk quality. Gallagher, Thraen, and Schnitkey (1993), studying the assembly cost for Ohio, found that small scale producers could reduce costs "by installing larger storage tanks and reducing the frequency with which their milk is collected" and that average assembly cost could be reduced by increasing the average capacity of the truck (pp. 85 and 87).

Kumbhakar and Heshmati (1995) studied the efficiency for Swedish dairy farms, from a rotating panel of 1425 farms during 1976 to 1988. They found that the 'mean persistent[11] technical inefficiency' was 10.27% and the 'mean residual inefficiency' was 3.90%. They interpreted that "farms with relatively high levels of persistent technical inefficiency" were "likely to go out of business if support payments" were "reduced or stopped" (p. 671), and concluded: "unless persistent inefficiency is reduced, these farms will not be able to survive for a long time in a competitive market" (p. 672).

The influences of farm size on technological adoption in dairy farms was carried out by El-Osta and Morehart (1999) for the United States. Education was found positively related to the adoption of management-intensive technology but not to capital-intensive. Age of operator was not found significant in adopting management-intensive technology (alone) but significant in adopting capital-intensive and declining after age 52. They also found that farms that "use more paid labor" were those "predominantly larger farms," and those more likely in adopting capital- and managerial-intensive technology (p. 91).

Chavas and Kraus (1990) studied the dynamic effects of prices on milk supply response in the U.S. Lake States. They found "dairy supply more responsive to milk price than any other economic variables," and that feed prices and slaughter cow prices had lower effects (p. 84).

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11 "Persistent inefficiency captures the effects of unobserved time-invariant inputs" (Kumbhakar and Heshmati, 1995 p. 671).

Blayney and Mittelhammer (1990) examined the milk supply response with respect to technology and price-induced effects for the Washington state milk producers. They found that "technology effects … overwhelmed the effect of market price changes" so that "substantial changes in milk price or input prices would be required to slow (or reverse) the expansionary effect on the state's milk supply induced by advances in dairy sector technology (p. 871).

Ramsden, Gibbons, and Wilson (1999) studied the impacts of changing output-input price ratio on the UK dairy farm. They found that increasing milk price increases the number of cows per farm, yield per cow, concentrate use per cow, stocking rate, fertilizer use per hectare, and labor milking time. Technically efficient farms would "maintain profitability by continuing with strategies based on high-yielding cows being fed high levels of concentrate feeds" (pp. 206-10).

Age and Education Level of the Operator

A model expressing the estimated efficiency parameters as a function of variables such as farm size, operator's education level, age, participation in cooperative, and others was recommended by Bravo-Ureta (Bravo-Ureta, 1986, p. 411).

Stefanou and Saxena (1988) evaluated the human capital influences on input-allocation decisions in a dual, non-frontier profit model, using a sample of 131 farms in Pennsylvania for 1982. Moreover, education and experience were found substitutes and important in determining efficiency. "Operators with post-secondary education demonstrate a greater degree in flexibility in allocation of their inputs" (p. 342). They concluded that farmers were maximizing production rather than profit.

Kumbhakar, Biswas, and Bailey (1989) conducted a system approach investigating economic, allocative and scale inefficiency for a sample of 116 dairy farmers in Utah for 1985. While education was found positively related to production, off-farm income was found negatively related and higher for small farms.

Kumbhakar, Ghosh, and McGuckin (1991) investigated technical and allocative efficiency of U.S. dairy farms. They used a generalized stochastic production frontier model in a profit maximization framework and Cobb-Douglas functional form. In addition to the conventional inputs (number of dairy cows, total labor, capital stock in a flow concept), they considered farm-size and regional dummies as control variables. They found education levels as factors determining technical efficiency.

In studying dairy farmers in the metropolitan area of New York, Hirschl and Long (1993, p. 471) found that age and personal difficulties of the operator were the most important factors determining survivability.

Kumbhakar (1993, pp. 340-1) found that marginal contribution of years of schooling was greater for medium and large farms. These elasticities ranged from 0.089 to 0.101.

Bravo-Ureta and Rieger (1991) found a positive relationship of farm size, education level, and extension with technical efficiency, but not with allocative and economic efficiencies.

Tauer (1995a) studied the farmer productivity by age, by using separated functions for each age-group, and data from 44 states in the U.S. Tauer found that farmer efficiency, on average, increases about 0.5-1.0% per year, up to 35-44 years and then declines at a similar rate. Middle-aged farmers were found 10-20% more productive then the youngest and the oldest.

Tauer and Stefanides (1998) found age and additional education as factors influencing the ability of New York dairy farmers to better select inputs maximizing profit. They conclude that, on average, these farmers could have increased their profit by 20%.

Farming Knowledge and Adoption of New Technologies

Cruise and Lyson (1991) examined differences in dairy performance between two communities with "similar farm structural and environmental characteristics, but different in performance" (p. 41), in the northeastern region of the United States. Differences in "production levels … between the two communities" were found "in terms of education systems, market competition, and access to reliable sources of information" (p. 52).

Zepeda (1990) investigated factors influencing the adoption of technology in the dairy industry. This author found productivity associated with the adoption of technology and that "the levels of explanatory variables, such herd size or education, appears to be the determinant of the probability of having adopted each technology" (p. 457). Adoption of 'management-intensive technology' was found associated with education and enhanced by 'industry involvement' such as cooperatives (pp. 466-7). Experience was found negatively associated with technological adoption, which the author related to an increase of risk aversion of older operators (p. 464).

Degree of Specialization, Productivity and Breed

Bravo-Ureta (1986, p. 406) considered separate equations for Holstein and 'other breeds' and found a difference of "5.2 percent neutral upward shift on the intercept term for the Holstein equation" relative to the intercept for 'other breeds' (p. 408).

Hallam and Machado (1996) estimated the technical efficiency and its relationship with farm characteristics for the Portuguese dairy industry. Their estimation method was the 'within estimator'[12] on a Cobb-Douglas production frontier, in a panel data context. They found more efficiency for large farms (elasticity equal to 0.12), 'autonomous' farms and farms located in the Central region, but "no strong evidence in favor of the 'horizontal strategy' of increasing specialization" (p. 91). The average technical efficiency was found to be 60-70%.

The causality between dairy farm size and productivity was investigated by Weersink and Tauer (1991), for 48 states in the United States. They found that greater production per cow, as well as higher beef prices[13] or crop prices caused larger average herd sizes. In their conclusion, farm size influences technological change and dairy research would not "lead to larger dairy farms", but other economic factors[14] which may influence "larger dairy farms leading them in a position to adopt the [sic] new technology" (p. 1144).

Heshmati (1999) estimated a translog stochastic production frontier for Swedish dairy farms, using the GLS method. It was found that 16% of the farms were fully

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12 "Consists of applying OLS to deviations from individual means," by assuming the error term fixed for each farm (p. 83).

13 As pointed out by the authors the average dairy farms would increase due to small dairy farmers switching to beef cows.

14 They conclude: "the major determinant of changes in dairy structure may be dairy price policy" (p. 1144).

efficient and mean technical efficiency was 94.5%, with no improvements over time. The mean of technical efficiency was found "higher for farms with small animal stock", which was attributed to 'family labor' efficiency (p. 927). Age was found positively related to output, but declining over time. The technical progress calculated from 1985-1988 was less than 1% per annum.

Tauer (1995b) investigated the paradigm whether New York dairy farmers were maximizing profit or minimizing costs. It was found that "farmers are better at achieving cost minimization than profit maximization" apparently because the "input usage generally increases each year as farmers increase output, even with productivity held constant" (p. 427).

Smith and Taylor (1998) estimated economies of size and production cost functions for Alabama dairy farms. They include a dummy variable to measure breed differences and found 'other breeds' less feed-conversion efficient with 'significant diseconomies of size' (p. 383). Holstein farms and "the smaller, lower cost group of Jersey farms" were found more competitive and to "have an advantage in average feed costs" (p. 384).

Mdoe and Wiggins (1997), analyzing smallholder dairying in Tanzania, found that returns to dairying were about 20%. They reported that 'larger scale' farmers "prefer raising Friesians[15] because of their high potential for milk yield", but did not find an "increase in the rate of return to capital from adopting the upgraded animals or using more intensive systems or both", which lead them to conclude that the pattern of intensive raising of Friesians has only been viable with government subsidies (p. 84).

El-Osta and Johnson (1998) analyzing determinants of financial performance of commercial dairy farms in the United States, found age negatively related to farm net

[15] Another name for Holstein breed.

income. They found the adoption of "combined capital- and management-intensive technologies by dairy farms in the traditional milk-producing States" was only 9 percent (p. 21). The authors emphasized that these farmers are "quite satisfied with the size of their operation (60-100 cows)", and based on family labor skills they are "able to produce milk as efficiently as larger operations", and "compete in per-unit profitability with farms many times larger" (p. 22). Their study provided "evidence of the linkage of herd size to the profitability of the farm business, particularly for commercial dairy farms in the non-traditional milk-producing States" (p. 27).

Labor, Capital and Use of Natural Resources

Quiroga and Bravo-Ureta (1992, pp. 613-4), by evaluating the impact of decreases in milk price, concluded that it is likely to decrease the use of hired labor relative to family labor, in the long-run.

Hoque and Adelaja (1984) investigating the effects of input prices and technical progress of dairy from five Northeastern States, found capital and machinery substitutes for labor and feed; and complementarity between capital and machinery. They concluded that "the new technology going into the dairy industry has been labor saving, machinery oriented and energy using" (p. 243).

The way which labor is incorporated in feed production may have distinct results on animal and milk production. Berentsen and Giesen (1995) analyzed possible effects of changing circumstances on representative Dutch dairy farming. By using a linear programming model, they compared a situation where "increasing production per cow is a way to compensate the loss of labor income due to levy" and found that "higher plant production completely offsets the negative economic consequences of the levy", and "contributes positively to the environment" (pp. 171-3).

Bravo-Ureta and Rieger (1991) estimated a Cobb-Douglas stochastic production frontier from cross-sectional data for a sample of 511 New England dairy farms. The average technical, allocative and economic efficiency was found as 83.0%, 84.6% and 70.2% respectively. The authors used "state-level average input prices" rather then input prices for individual farms, which may explain the "little difference between technical and allocative efficiency" (pp. 421 and 425).

Gomes (1999) analyzed technical efficiency and the impacts of dairy production changes in the Brazilian dairy sector, using a DEA model, applied to a sample of 241 dairy farms from 1996. Of the farms, 50% were found to be efficient and 29% with IRS. In order to analyze the reasons for inefficiency, the author classified and divided the sample according to technical efficiency[16]. It was found that 'efficient', relative to 'inefficient', farms were those farms that: (1) had higher productivity for labor, capital and land (p. 144); (2) employed relatively more capital and land (p. 145); (3) paid higher wage rates and used relatively more silage (instead of sugar cane with urea, which was found particularly higher for the 'inefficient' set); (4) obtained higher milk to concentrate ratio; and (5) received higher average price for the milk (p. 146). It was also found that "the value of the marginal product of capital decreases as the productivity per cow increases "confirming the necessity of differentiated requirements of factors among the extracts analyzed" (p. 147).

[16] The author called 'efficient' a producer with technical efficiency equal or superior to 90% under CRS (p. 144).

III. CONCEPTUAL FRAMEWORK

Open Economy and the Role of Agricultural Technology

Open economy policy is important in bringing about structural change in the agricultural sector of developing countries. Under this environment, domestic demand and supply are affected through the market, making production systems more efficient in the competitive open market. Efficiency increases the domestic aggregate supply, decreases market price and increases competitiveness with foreign suppliers.

The combination of competitive imports and high domestic supply decreases commodity prices if there are not changes in aggregate demand. Aggregate demand, however, may always respond positively to open economy policy if employment and income increases through a more efficient and competitive domestic economy. New equilibriums in the commodity markets are thus determined by structural change, adoption (change) of new technology, and efficient use of resources on the supply side and growth of employment and income on the demand side[17].

The effects of the adoption of technology can vary in magnitude and intensity, depending on the point in time, region, kind of technology, and other natural and social factors. Alves (1997) analyzed the effects of technology on rural employment by decomposing technologies into mechanical, bio-chemical and organizational. In his approach, mechanical technology has higher effects on hired labor, but less effects on

[17] Population growth rate is about 1% per annum in Brazil.

family labor. Bio-chemical technology affects the producer, through the market, by increasing production and productivity per area or animal, which directly affects the number of firms and indirectly the employment of family labor. Managerial technology reduces employment by indirectly achieving more efficiency. In reality, there is a strong interaction among these technologies. If a farm uses a tractor, it most likely also uses fertilizer, and other management tools.

The less efficient farms will not be able to continue operating. The outcome is a higher aggregate production provided by a fewer number of larger farms, employing fewer workers relative to the amount produced. In the end, given the technical constraint to production, input and output prices determine the optimal size of the enterprise and the number of enterprises. The small producers are those with the higher chance to be affected, because of their lower net income (Alves, 1998).

Efficiency Measurements

The performance of a firm is measured by economic efficiency, which can be decomposed into technical and allocative. Technical efficiency is the ability of a firm to produce the maximum for a given bundle of inputs, while allocative efficiency is the ability to equate the marginal value product to the marginal cost. A firm is said to be technically efficient if there is no other combination or process that can produce the same output with less input.

Technical efficiency refers to the farmer's ability to make the choice of the 'best practice' (to be on the frontier), while allocative efficiency relates to the ability of the farmer to combine the levels of inputs given the prices. Under these conditions, the efficiency of a firm, and in turn, its ability to survive in the long run, depends on (a) how efficiently inputs are used for a given technology, regardless of prices (technical efficiency), and (b) how inputs are converted into production, given the market prices.

Empirically, not all firms operate on their frontier, and thus the measurement of relative efficiency is important knowledge for a firm's survivability. Quantification of these measurements is useful to: (a) facilitate comparisons across similar units; (b) identify factors causing variations in efficiency; and (c) establish policies to improve efficiency.

Efficiency in Milk Production

The growing number of large farms can be explained by the arguments of a more efficient technological adaptation, endowments, location, region, enterprise goals, returns to size, higher price due to quality and volume, breed, degree of specialization, profit maximization, and others. The existence of a large number of small farms may also be related to price support policy. If small farms were less efficient relative to medium and large farms than this policy would allow them to continue operating with less-efficient resource allocation.

IV. METHODS AND PROCEDURES

The theoretical foundations for the production frontier research methods started with Farrel (1957). Since then, several methods have been developed and adapted to measure technical efficiency. They are broadly divided into 'deterministic' or 'nonparametric', and 'stochastic' or 'parametric'.

The Deterministic Frontier Production Function

'Data Envelopment Analysis' (DEA), is one of the most frequently used 'nonparametric' approaches. Using mathematical techniques, it can accommodate multiple inputs and outputs simultaneously, and needs no explicit functional form or assumption for the error term distribution (Bauer, 1990; Aigner, Lovell, and Schmidt, 1977; Seiford and Thrall, 1990; Maindiratta, 1990; Fraser and Cordina, 1999).

Bjurek, Hjalmarsson and Forsund (1990), studying productive efficiency of social insurance offices based on deterministic parametric and nonparametric frontiers, found that the differences in the overall ranking of the units are very small between the approaches.

The 'deterministic' methods assume the same 'production frontier technology', in such a way that "... variation in performance is therefore attributable *only* to differences in efficiency" (Jaforullah and Devlin, 1996, p. 3). Considering $f(X_{ik}; \beta_k)$ as a general

Cobb-Douglas or translog function, the econometric approach for deterministic frontier model is defined by:

$$Y_i = f(X_{ik};\beta_k)e^{(-U_i)} \tag{1}$$

where $i = 1, 2, \ldots, N$; $k = 1, 2, \ldots, K$; Y_i represents the possible production level for i^{th} farm; X_{ik} is the quantity of the k^{th} input used by the i^{th} farm; β_k is an unknown parameter for the k^{th} input; and U_i is a non-negative random variable associated with farm-specific factors affecting the i^{th} farm's efficiency, with values between zero and one. The inequality relationships of (1) are defined as:

$$Y_i \leq f(X_{ik};\beta_k) \tag{2}$$

where Y_i is the observed production values for i^{th} farm; and β are the maximum-likelihood or corrected ordinary least-squares (COLS) parameters (Battese, 1992; Greene, 1980).

The main shortcoming for the 'deterministic' approaches, including the 'statistical deterministic', is that the estimated frontier is very sensitive to outliers (Sahoo, Mohapatra, and Trivedi, 1999, p. 394; Ahmad and Bravo-Ureta, 1996, pp. 399-400), and the implicit assumption of these models that "… all deviations from the frontier are associated with inefficiency" (Jaforullah and Devlin, 1996, p. 4). Seiford and Thrall (1990, p. 29) also found that DEA decreases its ability to discriminate between farms as the number of factors and products increases.

The Stochastic Frontier Production Function

Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977) provide the stochastic frontier approach (SFA), which extends the deterministic approach by allowing noise and inefficiency terms for the error measurement. The error term accounts for two parts: (1) inefficiency, by itself; and (2) random effects, that treat agricultural output as a stochastic variable due to random forces, such as disease and weather conditions, luck, fires, pests, and other exogenous random factors beyond the farm's control (Jaforullah and Devlin, 1996, p. 3; Reinhard, Lovell, and Thijssen, 1999, p. 50; Amara et al., 1999, pp. 32-3; Ruggiero, 1999, p. 556).

The weakness of the stochastic approach is that it requires the functional form of the production frontier and the distributional assumptions for the error terms to be explicitly specified (Jaforullah and Devlin, 1996, p. 4). Gong and Sickles (1992, pp. 259-60), in comparing the relative performance between the DEA and stochastic approaches, found that "… the stochastic frontier models outperform the DEA …" for functional forms close to the given underlying technology.

The majority of stochastic frontier studies have focused on inefficiency in the aggregative way, with the assumption that the frontier function is a 'neutral shift from the realized production function'. By taking equation (1), the general stochastic production function is defined as:

$$Y_i = f(X_{ik};\beta_k)e^{(V_i - U_i)} \qquad (3)$$

where i, k, Y_i and X_{ik} are as defined earlier; V_i is a random error term i.i.d. $N(0,\sigma_V^2)$, which is associated with random factors, such as weather, and measurement errors, not under control (and independent of U_i). It allows the deterministic function to be stochastic; and U_i is assumed to account for technical inefficiency and to be i.i.d. as $|N(0,\sigma^2)|$.

Recently, a number of models for the stochastic frontier function have been developed. Kumbhakar (1990) proposed a model where technical inefficiency was specified as a function of time. Later, Coelli (1992) suggested a stochastic production function to accommodate (unbalanced) panel data, defined as:

$$Y_{it} = f(X_{ikt}; \beta_{kt}) e^{(V_{it} - U_{it})} \tag{4}$$

where i and k are as defined earlier; Y_{it} represents the production for the i^{th} farm at the t^{th} period; X_{ikt} is the k^{th} input associated with the i^{th} farm at the t^{th} period; and V_{it}; $t = 1, 2, \ldots, T$; and with

$$U_{it} = U_i^{-\eta(t-T)} \tag{5}$$

where U_i are nonnegative[18] random variables assumed to account for technical efficiency in production and to be i.i.d. as truncations at zero of the $N(\mu, \sigma_U^2)$; η and β are maximum likelihood parameters to be estimated[19]; σ_V^2 is replaced[20] by σ_U^2, with:

$$\sigma^2 = \sigma_V^2 + \sigma_U^2 \tag{6}$$

and

$$\gamma = \frac{\sigma_U^2}{\sigma_V^2 + \sigma_U^2} \tag{7}$$

The parameter γ must lie between zero and one, as discussed in Battese and Coelli (1995; 1988). Its statistical significance can be used as a "test whether any form of stochastic frontier function is required at all"[21] (Coelli, 1992). Estimates for γ close to one "indicates that the inefficiency effects are likely to be highly significant" (Battese and

18 "Then OLS estimator of the intercept parameter is negatively biased." (Battese and Coelli, 1988, p. 394).

19 Details and the likelihood function are presented in the Appendix of Battese and Coelli (1992).

20 Based on the work of Battese and Corra (1977).

21 If H_0: $\gamma = 0$ cannot be rejected, then ordinary least-squares would be preferred.

Coelli, 1995). This and other hypothesis tests are tested using the generalized likelihood-ratio statistic, defined by:

$$LR = -2\ln\left[\frac{L(H_0)}{L(H_A)}\right] \tag{8}$$

where $L(H_0)$ and $L(H_A)$ are the values of the likelihood function for the null and alternative hypotheses, respectively. The generalized likelihood-ratio statistic, *LR*, has asymptotic distribution which is a mixture of chi-square distributions, $\frac{\chi_0^2}{2} + \frac{\chi_A^2}{2}$, as stated by Coelli, Rao, and Battese (1998, pp. 190-2). Coelli (1995a) suggested that a one-sided generalized likelihood-ratio test should be used, where the critical value for a test of size α is given by $\chi^2_{1,(2\alpha)}$.

Several empirical studies (e.g. Kalirajan, 1990) have investigated the determinants of technical inefficiency. In a second-stage regression, the technical inefficiency is assumed dependent on factors such as age and education level of the operator and farm size, that determine individual differences in production performance (Coelli, 1995b).

Kumbhakar, Ghosh, and McGukin (1991) and Reifschneider and Stevenson (1991) were the first who noticed inconsistence in the way the second-stage was used[22]. They developed a method estimating all parameters in a single-step maximum likelihood procedure.

Battese and Coelli (1995) extended the single-step maximum likelihood procedure to also accommodate panel data. Applied to cross-section data, this specification, may be expressed as:

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[22] The inefficiency effects, assumed i.i.d. in the first-stage, are further assumed to be a function of firm-specific factors in the second-stage (Coelli, 1995b).

$$Y_i = f(X_{ik};\beta_k)e^{(V_i - U_i)} \quad (9)$$

where i, k, Y_i and X_{ik} are as defined earlier; V_i's are random variables independent of U_i, and i.i.d. $N(0,\sigma_V^2)$; U_i are random variables assumed to account for technical inefficiency in production and assumed to be i.i.d. as truncations at zero of the $|N(Z_i\delta,\sigma^2)|$, and where

$$U_i = Z_i\delta + W_i \quad (10)$$

and the Z_i are explanatory variables[23] associated with the technical inefficiency of production of the i^{th} farm; δ are parameters to be estimated; and W_i is a random variable, defined by the truncation of the $N(0,\sigma^2)$, such that $W_i \geq -Z_i\delta$.

The technical efficiency, as defined in Coelli, Rao and Battese (1998) is given by the ratio of the observed output for the i^{th} farm, Y_i, relative to the potential output that could be achieved, defined by the frontier function. For a Cobb-Douglas stochastic frontier production function, the technical efficiency for the i^{th} farm is defined as:

$$TE_i = \frac{Y_i}{e^{X_i\beta}} = \frac{e^{X_i\beta - U_i}}{e^{X_i\beta}} = e^{-U_i} \quad (11)$$

where TE_i represents the mathematical expectation of the technical efficiency for the i^{th} farm; Y_i represents the observed output for the the i^{th} farm; X_i represents the input vector for the i^{th} farm; β represents an estimated parameter; and U_i are random variables assumed to account for technical inefficiency in production, as defined in equation (10).

A Modified Cobb-Douglas Specification

From equation (9), the general modified Cobb-Douglas stochastic frontier production function can be written as:

[23] Input variables specified in the stochastic frontier function may be included, since "the inefficiency effects are stochastic." (Battese and Coelli, 1995).

$$Y_i = \prod_{k=1}^{K} X_{ik}^{\beta_k + \sum_{j=1}^{J} \beta_{kj} D_j} e^{\alpha_0 + \sum_{j=1}^{J} \alpha_j D_j + \sum_{r=1}^{R} \left(\lambda_r R_{ir} + \sum_{j=1}^{J} \lambda_{rj} D_j R_{ir} \right) + V_i - U_i} \qquad (12)$$

where Y_i represents the dairy output produced for the the i^{th} farm; X_{ik} represents the quantity of the k^{th} input used by the i^{th} farm; D_j is the j^{th} dummy variable; R_{ir} represents the r^{th} variable used for linear combinations of specific input ratios and/or organization differences; V_i is a random variable independent of U_i , and i.i.d. $N(0,\sigma_V^2)$; U_i are random variables assumed to account for technical inefficiency in production and assumed to be i.i.d. as truncations at zero of the $|N(Z_i\delta,\sigma^2)|$; and β, α, and λ are parameters to be estimated.

The Inefficiency Effect Model Specification

The technical inefficiency-effects equation is estimated simultaneously with equation (12) and can be specified as:

$$U_i = \delta_0 + \sum_{m=1}^{M} \left[\delta_m Z_{im} + \sum_{j=1}^{J} \delta_{mj} D_j Z_{im} \right] + W_i \qquad (13)$$

where Z_{im} is the m^{th} explanatory variable associated with the production technical inefficiency; D_j is the j^{th} dummy variable; δ are parameters to be estimated; and W_i is a random error term defined by the truncation of the $N(0,\sigma^2)$, such that the point of truncation is $W_i \geq -Z_i\delta$.

Procedure

The empirical analysis is conducted in six parts, which are:

1. Description of the sample data;

2. Estimation of the production frontier parameters;

3. Estimation of the inefficiency-effects parameters;

4. Estimation of the input, scale and inefficiency-effects elasticities and input marginal value of production; and

5. Evaluation and characterization of the efficiency of the farms and their determinants.

Description of the Sample Data

The objective of this part is to provide an overview of the sample data as well as a description of the process of how observations and variables were selected from the original source. Three main criteria are used to obtain the sample from the original data base, which are:

1. Dairy activity — Some dairy activity is required for a farm to be included as an observation in the sample.

2. Breed — The hypothesis is that the production function responds to specific breed classification. Minor breed classification may be aggregated if 'homogeneity' cannot be rejected. Dairy cattle breed was included by Hallam and Machado (1996) in studying Portuguese dairy farms. Smith and Taylor (1998, p. 382), studying Alabama dairy farms, considered breed as a source of "substantial variations in average characteristics."

3. Location — The literature has also called attention to effects due to differences in regional location of dairy production, e.g. Hallam and Machado (1996),

Kumbhakar, Ghosh, and McGuckin (1991), Bravo-Ureta (1986), and Kamieniecki, Gnyp, and Trautman (1999).

Estimation of the Production Frontier Parameters

This part is addressed to objective (1). Two models, breed and location, are estimated one at a time.

The variables for the production function frontier are listed in Table 5. The empirical model to be estimated is a linear version of equation (12), and is specified as:

$$\begin{aligned} Y_i = \alpha_0 &+ \beta_{COW}\log COW_i + \beta_{LND}\log LND_i + \beta_{CAP}\log CAP_i + \beta_{LAB}\log LAB_i + \\ &\beta_{CST}\log CST_i + \beta_{CON}\log CON_i + \lambda_{RDO} ROU_i + \lambda_{FLB} RLB_i + \\ \alpha_1 D_1 &+ \beta_{COW1} D_1 \log COW_i + \beta_{LND1} D_1 \log LND_i + \beta_{CAP1} D_1 \log CAP_i + \beta_{LAB1} D_1 \log LAB_i + \\ &\beta_{CST1} D_1 \log CST_i + \beta_{CON1} D_1 \log CON_i + \lambda_{RDO1} D_1 ROU_i + \lambda_{FLB1} D_1 RLB_i + \\ \alpha_2 D_2 &+ \beta_{COW2} D_2 \log COW_i + \beta_{LND2} D_2 \log LND_i + \beta_{CAP2} D_2 \log CAP_i + \beta_{LAB2} D_2 \log LAB_i + \\ &\beta_{CST2} D_2 \log CST_i + \beta_{CON2} D_2 \log CON_i + \lambda_{RDO2} D_2 ROU_i + \lambda_{FLB2} D_2 RLB_i + \\ U_i &+ V_i \end{aligned} \tag{14}$$

where D_1 and D_2 represent a set of dummy variables[24]; V_i is a random variable independent of U_i , and i.i.d. $N(0, \sigma_V^2)$; U_i is a vector of random variables assumed to account for technical inefficiency defined in equation (15) below; β, α, and λ are parameters to be estimated; and all other variables as defined in Table 5.

The parameters of the stochastic frontier production function, equation (14), are estimated by the method of maximum likelihood, using the computer program FRONTIER Version 4.1, as described in Coelli (1992), Coelli (1996) and Coelli, Rao, and Battese (1998).

[24] In the model for breed, D_1 = 1 if Pure Holstein breed (PH), and D_1 = 0 (zero) otherwise; D_2 = 1 if three-quarters Holstein or other Pure European breeds (H&PE), and D_2 = 0 (zero) otherwise. For location, D_1 = 1 if Northeast region (NE), and D_1 = 0 (zero) otherwise; D_2 = 1 if South region or São Paulo (S&SP), and D_2 = 0 (zero) otherwise.

Table 5. List of Variables to be Used to Estimate the Production Frontier Parameters.

Variable		Description	Type	Unit of measurement
		Dependent Variable:		
Y	=	Milk production	Quantity	R$/year
		Explanatory Variables:		
COW	=	Number of cows	Quantity	Number
LND	=	Pasture land	Quantity	ha
CAP	=	Cost of capital in buildings and machinery	Quantity	R$/year
LAB	=	Total labor	Quantity	Days/year
CST	=	Other variable costs	Quantity	R$/year
CON	=	Concentrated feed	Quantity	Tons/year
ROU	=	Ratio dairy output/total farm output	Ratio	Ratio of values of output
RLB	=	Ratio family labor/total labor	Ratio	Ratio of quantities of labor

The output variable, *Y*, refers to the total dairy farm gross revenue[25], including milk, cheese and butter, sold or consumed within the farm. Jaforullah and Devlin (1996, pp. 4-5) in a similar situation used total farm output (as well as inputs) approach in estimating technical efficiency for the New Zealand dairy industry. Here, however, the input quantities also refer to dairy as a proportion of the dairy output, rather than for the whole farm.

Note that *ROU* is used as a proxy of the degree of specialization[26] for a dairy farm. The null hypothesis is that lower attention is given to the dairy activity, if other activities are present in the farm. This issue is discussed in a similar context by Bardhan (1973) in defining crop composition in a study of productivity of Indian agriculture, and by Haden and Johnson (1989) in analyzing the performance of Tennessee dairies.

Hired and family labor is analyzed by both *LAB* and *RLB*. The relation of these two inputs may carry important implications on adjustments in use of other inputs (Lopez, 1984, p. 359).

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[25] Animals are not included.

[26] It would be very serious to assume, for example, two 10-cow farms to be the same, if one is 95%-dairy and the other 5%-dairy.

Estimation of the Inefficiency-Effects Parameters

This part is addressed to objective (2), and two models are estimated, for breed and for location, one at a time, based on equation (13). Dummies are used to capture these differences. The explanatory variables are listed in Table 6. The empirical inefficiency-effects model for the stochastic frontier production function can be written from equation (13) as:

$$
\begin{aligned}
U_i = \delta_0 &+ \delta_{AIN} AIN_i + \delta_{PAR} PAR_i + \delta_{PAF} PAF_i + \delta_{DST} DST_i + \delta_{TEL} TEL_i + \\
&\delta_{ELC} ELC_i + \delta_{FOU} FOU_i + \delta_{COO} COO_i + \delta_{PAY} PAY_i + \delta_{AGE} AGE_i + \\
&\delta_{EDU} EDU_i + \delta_{OWN} OWN_i + \delta_{LIV} LIV_i + \\
&\delta_{AIN1} D_1 AIN_i + \delta_{PAR1} D_1 PAR_i + \delta_{PAF1} D_1 PAF_i + \delta_{DST1} D_1 DST_i + \delta_{TEL1} D_1 TEL_i + \\
&\delta_{ELC1} D_1 ELC_i + \delta_{FOU1} D_1 FOU_i + \delta_{COO1} D_1 COO_i + \delta_{PAY1} D_1 PAY_i + \delta_{AGE1} D_1 AGE_i + \\
&\delta_{EDU1} D_1 EDU_i + \delta_{OWN1} D_1 OWN_i + \delta_{LIV1} D_1 LIV_i + \\
&\delta_{AIN2} D_2 AIN_i + \delta_{PAR2} D_2 PAR_i + \delta_{PAF2} D_2 PAF_i + \delta_{DST2} D_2 DST_i + \delta_{TEL2} D_2 TEL_i + \\
&\delta_{ELC2} D_2 ELC_i + \delta_{FOU2} D_2 FOU_i + \delta_{COO2} D_2 COO_i + \delta_{PAY2} D_2 PAY_i + \delta_{AGE2} D_2 AGE_i + \\
&\delta_{EDU2} D_2 EDU_i + \delta_{OWN2} D_2 OWN_i + \delta_{LIV2} D_2 LIV_i + W_i
\end{aligned}
\qquad (15)
$$

where D_1 and D_2 represent a set of dummy variables[27]; W_i is a random error term defined by the truncation of the normal distribution with zero mean and variance, σ^2; δ are parameters to be estimated; and the other variables are as defined in Table 6.

The parameters of the inefficiency-effects model, equation (15), are estimated by the method of maximum likelihood, using the computer program FRONTIER Version 4.1, as described in Coelli (1992), Coelli (1996) and Coelli, Rao, and Battese (1998).

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[27] In the model for breed, $D_1 = 1$ if Pure Holstein breed (PH), and $D_1 = 0$ (zero) otherwise; $D_2 = 1$ if three-quarters Holstein or other Pure European breeds (H&PE), and $D_2 = 0$ (zero) otherwise. For location, $D_1 = 1$ if Northeast region (NE), and $D_1 = 0$ (zero) otherwise; $D_2 = 1$ if South region or São Paulo (S&SP), and $D_2 = 0$ (zero) otherwise.

Table 6. List of Variables Used in the Evaluation of Farm Inefficiency-Effects.

Variable		Description	Type	Unit of measurement
		Use of Dairy Technology		
AIN	=	Artificial insemination	Dummy	Yes = 1; Otherwise = 0
PAR	=	Pasture rotation	Dummy	Yes = 1; Otherwise = 0
PAF	=	Pasture fertilization	Dummy	Yes = 1; Otherwise = 0
		Farm Infrastructure		
DST	=	Distance from urban area	Quantity	Km
TEL	=	Telephone	Dummy	Yes = 1; Otherwise = 0
ELC	=	Electricity	Dummy	Yes = 1; Otherwise = 0
		Farming Activity		
FOU	=	Ratio farm output / family total income	Ratio	Ratio
COO	=	Sell production to a cooperative	Dummy	Yes = 1; Otherwise = 0
PAY	=	Days until payment	Number	Days
		Operator Characteristics		
AGE	=	Age of the operator	Number	Years
EDU	=	Operator education level	Number	Years
OWN	=	Operator is the owner	Dummy	Yes = 1; Otherwise = 0
LIV	=	The owner lives on the farm	Dummy	Yes = 1; Otherwise = 0

Estimation of Elasticities

This part is addressed to objective (3). For the production function, due to the particular case of a modified Cobb-Douglas, the elasticities for the variables that appear in the linear form are obtained by multiplying the estimated parameter by the average of that particular variable. For the inputs, the estimated parameters can be taken directly as the input elasticities[28]. The marginal value product is also calculated for the inputs.

For the inefficiency-effects model, the elasticities are obtained for the average of the variables involved. The elasticity is a product of estimated parameter multiplied by the quotient of the explanatory variable and efficiency, both taken at their averages.

[28] Total labor could be interpreted as a special case, calculated as $E_{LAB} = \beta_{LAB} - E_{RLB}$ because it also appears in *RLB*, defined by the ratio of family labor (*FLB*) and total labor (*LAB*).

Evaluation and Characterization of Efficient Farms and their Determinants

This part is addressed to objective (4). The results are summarized by characterizing the frequency distributions[29] of the farms, according to three categories:

1. The most efficient;
2. The medium efficient; and
3. The least efficient.

Beside the inefficiency-effects parameters, location and breed, number of cows and other variables are used to characterize performance for the categories above. Average measures of output per unit of the following variables are:

1. Output per day;
2. Output per cow;
3. Output per hectare;
4. Output per day of labor; and
5. Output per unit of capital.

Data and Sources

The data were provided by EMBRAPA — Empresa Brasileira de Pesquisa Agropecuária — the Brazilian Agricultural Research Corporation, as part of a general survey conducted in 1998 by EMBRAPA and the Getúlio Vargas Foundation (1998). The objective was to obtain an updated "picture" of the Brazilian typical farm as a

[29] A structured query language (SQL) database software is used.

whole, and provide a broad data base to be used by EMBRAPA's researchers of different fields of study.

Special attention was given to the use of natural resources, labor, capital, machinery, technology, products produced, costs, management, and demand for credit, research, and training. In a sample of 1,879 observations, dairy appears as an activity in 775 farms, which are part of the sample used. Summarized descriptive statistics for the sample are presented in Table 7

Software and Tools

A relational database software[30] and SQL are used on the original sample data to obtain the variables for the production frontier and efficiency explanatory models.

SAS® software is used in the preliminary regression analyze to define homogeneous classifications for breed and location.

The production frontier and the inefficiency-explanatory factor model are estimated by the computer program FRONTIER Version 4.1, as described in Coelli (1992), Coelli (1996) and Coelli, Rao, and Battese (1998).

[30] Microsoft® Access 2000.

Table 7. Descriptive Statistics for a Sample of 775 Brazilian Dairy Farms, 1998.

Name	Description	Unit	Average	Standard Deviation	Minimum	Maximum
	Dairy Output					
Y	Value of dairy output	R$/year	9,882	23,530	161	325,500
	Dairy Inputs					
COW	Number of cows	Quantity	23.35	31.80	1	260
LND	Pasture land	ha	23.37	93.54	0.1	1,744
CAP	Cost of capital	R$/year	583	926	2	9,816
LAB	Total human labor	Days/year	378	506	1	7,137
CST	Other variable costs	R$/year	1,311	2,938	1	39,096
CON	Concentrated feed	Tons/year	11.20	36.58	0.001	684.38
ROU	Ratio dairy / total farm output	Ratio	0.448	0.299	0.01	1
RLB	Ratio family labor / total labor	Ratio	0.667	0.338	0	1
	Inefficiency-Effects					
AIN	Artificial insemination	Dummy	0.231	0.422	0	1
PAR	Pasture rotation	Dummy	0.315	0.465	0	1
PAF	Pasture fertilization	Dummy	0.276	0.447	0	1
DST	Distance from urban area	km	20.94	17.28	1	96
TEL	Telephone	Dummy	0.145	0.352	0	1
ELC	Electricity	Dummy	0.825	0.381	0	1
FOU	Ratio farm output / total income	Ratio	0.799	0.246	0.01	1
COO	Sell production to a cooperative	Dummy	0.366	0.482	0	1
PAY	Days until payment	Number	17.16	14.03	0	60
AGE	Age of the operator	Years	53.28	13.73	18	93
EDU	Operator education level	Years	3.817	3.359	0	22
OWN	Operator is the owner	Dummy	0.894	0.308	0	1
LIV	Operator lives on the farm	Dummy	0.813	0.389	0	1

Source: Reseach data sample.

Note: R$ = Monetary values are expressed in Reals, 1998, when the exchange rate was about R$1.10 for US$1.00.

In order to obtain the frequency distributions of efficient and inefficient farms, the predicted technical efficiency parameter for each farm (obtained from the production frontier) is introduced as a variable in the sample data. The relational database software defined above is used to obtain specific frequency distributions and correlations.

V. RESULTS AND DISCUSSION

Description of the Sample Data

This part describes the sample data and the process and criteria used to select farms and variables from the original source. The sample data were obtained from a broader database provided by EMBRAPA - the Brazilian Agricultural Research Corporation.

Data Source

The data are from a survey that was conducted by the Getúlio Vargas Foundation and EMBRAPA during the period of August/97 to May/98. The objective of the survey was to obtain an updated "picture" of the Brazilian typical farm and to make the data available for further research. The survey was conducted in ten states, within four regions, where 1,879 farmers were interviewed emphasizing social and economic variables.

Sample Data

With the purpose of this research in mind, we were interested in the sample data that represents as much as possible the reality of the Brazilian dairy production sector. Two procedures were followed: (1) exclusion of observations for farms without any dairy activity (or incomplete data); and (2) adjustment of shared inputs proportionally[31] to the dairy activity of each farm, when non-dairy activities were present. Therefore, instead of selecting only farms with dairy as the major output (say, ≥80%), all farms with some dairy activity were considered, no matter the nature of other farm or non-farm activity (if any). For the inclusion of all farms with some dairy, four arguments were considered:

1. The Brazilian dairy production characteristics — The production sector is strongly based (in number of producers) on non-specialized type dairy farms;
2. Typical producer — Recent studies on Brazilian dairy focused mainly on producers with 50% or more dairy activity (e.g. Gomes, 1999; and Souza, 2000). This may not represent the typical producer because more diversified farming systems are excluded[32]; and
3. Inefficiency factor — The inclusion of less specialized farms may be important in explaining inefficiency in the use of inputs in dairy production[33].

The final sample included 775 observations, considering all farms with some dairy activity.

In this study, it is assumed that appropriate sampling techniques were used in the original survey. However, Tables 8 and 9 compare the observed distribution of production and number of producers among geographical regions obtained from the census data with the distribution of the sample data.

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31 For farm and non-farm activities (if any).

32 For the sample of farms with some dairy (775 out of 1,879), the average value of dairy output to all farm output was 45%. In 40% of those with some dairy (308), dairy output accounted for 50% or more of total farm output.

33 Shared farm inputs are evaluated proportionally to dairy output.

Table 8. Distribution of the Brazilian Milk Production, Number of Producers, and Average Productivity per Farm per Day, According to Geographic Regions in 1995/96.

Region	Production/Year (10^6 liters)	Production/Year (%)	Producers (Number)	Producers (%)	Productivity (Liters/Day)
North	846	4.7	118,118	6.5	19.6
Northeast	2,274	12.7	540,737	29.9	11.5
Central-West	2,611	14.6	148,592	8.2	48.1
Southeast	8,090	45.1	396,915	21.9	55.8
South	4,111	22.9	605,679	33.5	18.6
Brazil	17,931	100.0	1,810,041	100.0	27.1

Source: Table prepared by IBGE, from 1995/96 census data, on request of EMBRAPA.

Table 9. Number of Sample Observations, Percent of Dairy Output, Average Number of Cows and Production, According to State and Breed.

Region	State	Number of Observations (Number)	Number of Observations (%)	Dairy Output (%)	Average Size Cows (Number)	Average Size Production (L/Day)	Breed Classification PH (%)	Breed Classification H&PE (%)	Breed Classification CB&Z (%)	Breed Classification Total (%)
Northeast	CE	148	19	43	24	39	0	7	93	100
	PE	139	18	62	13	102	0	71	29	100
Central-West	GO	26	3	48	94	217	8	23	69	100
Southeast	ES	39	5	32	31	88	0	26	74	100
	MG	98	13	55	26	125	1	44	55	100
	RJ	31	4	69	54	180	3	10	87	100
	SP	40	5	59	41	271	10	32	58	100
South	PR	107	14	29	18	153	37	13	50	100
	SC	59	8	26	9	57	22	10	68	100
	RS	88	11	30	8	46	20	18	62	100
	Sample	775	100	45	23	105	10	28	62	100

Source: Research sample data.

Note: *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; *CB&Z* = Cross-breed or Zebu; *CE* = Ceará; *PE* = Pernambuco; *GO* = Goiás; *ES* = Espírito Santo; *MG* = Minas Gerais; *RJ* = Rio de Janeiro; *SP* = São Paulo; *PR* = Paraná; *SC* = Santa Catarina; and *RS* = Rio Grande do Sul.

The four most important regions considered in the sample (Table 9) were responsible for 95% of the Brazilian production in 1995/96 (Table 8).

From the viewpoint of number of producers per region, the sample data also seems to be reasonable. From the sample number of observations, more weight was given to three geographic regions: Northeast (NE), Southeast (SE), and South (S), which represented about 85% of the Brazilian producers in 1995/96 (Table 8).

Regional Location

For the criterion of location differences, preliminary tests were conducted to verify whether farms from two or more locations (state or region) could be considered homogeneous as a group. The following procedure was used:

1. Regression analysis — SAS© software was used to estimate a simplified Cobb-Douglas model, similar to equation (12) in Chapter IV, without dummies for slope[34];
2. Dummies — Intercept changes were tested by using dummies (0-1) for states and regions; and
3. Homogeneity — The level of 10% of significance (F-test) was adopted as a rule of thumb to group homogeneous states and regions together.

In general, the results of these preliminary tests indicated that states within the Northeast region were statistically similar. Two states, Goiás (GO) and São Paulo (SP), were regrouped to the Southeast and South regions, respectively.

For the Northeast region (Table 9), the average number of cows per farm in Ceará (CE) was twice that of Pernambuco (PE). However, they were not statistically different, probably because farms in PE appear less diversified than farms in CE. In PE, dairy output on average was 62% versus 43% for CE.

[34] Dummies for slope were used only in the final models.

Producers of the state of São Paulo appeared to be significantly different from producers in the other Southeast states. Evidence of this is the percent of producers with Pure Holstein breed (10%), which is relatively higher than the other Southeast states. Compared to the states of the South region, SP has a lower percent of farms with Pure Holstein but a higher average number of cows per farm and also a higher dairy output (59%).

The state of Goiás tested significantly different from São Paulo. However, when tested against each of the other remaining states of the Southeast region, the null hypothesis of being statistically equal could not be rejected.

For the final model, three regional locations were considered, as listed in Table 10:

1. NE = Northeast, represented by the states of Ceará (CE) and Pernambuco (PE);
2. SE&CW = Southeast, represented by the states of Espírito Santo (ES), Minas Gerais (MG), and Rio de Janeiro (RJ) and Central-West, represented by the state of Goiás; and
3. S&SP = South, represented by Paraná (PR), Santa Catarina (SC), and Rio Grande do Sul (RS), and the state of São Paulo.

Characteristics of the sample, classified by region, are shown in Table 10. Milk producers from NE, on average, appeared to be relatively small in number of cows (19 cows/farm) and low in per day production (70 liters/farm/day). The percent of Pure Holstein farms[35] for this region was zero. Producers from South and São Paulo (S&SP) appear to be more diversified (33% dairy) and with the highest percent of farms with Pure Holstein (26%).

[35] Defined as a farm with at least 40% of the herd as Pure Holstein.

Table 10. Number of Sample Observations per Region, Average Percent of Dairy Output, Average Number of Cows, Average Production per Day and Percent of Observations by Breed Classification.

Region	Total Sample Observations		Dairy Output	Farm Size		Breed Classification			
				Cows	Production	PH	H&PE	CB&Z	Total
	(Number)	(%)	(%)	(Number)	(L/Day)	(%)	(%)	(%)	(%)
NE	287	37	52	19	70	0	38	62	100
SE&CW	194	25	51	41	139	2	32	66	100
S&SP	294	38	33	16	118	26	17	57	100
Sample	775	100	45	23	105	10	28	62	100

Source: Research sample data.

Note: *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; *CB&Z* = Cross-breed or Zebu; *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; and *S&SP* = South region and São Paulo.

Breed

Breed of the herd is another variable that was treated as a factor of differentiation of the dairy system. In the original sample, breed was in six categories:

1. Pure Holstein;
2. Other Pure European breeds;
3. Three-quarters Holstein (bloodline);
4. Pure Indian breeds;
5. Zebu; and
6. Other breeds or cross-breeds.

The original sample measurement was made by the percent of the herd (by number of animals) that was classified under at least one or more of these options such that if added together the total was 100% for each farm.

A set of dummies was established to redefine each farm under only one of the six breed categories above. The dummy variable for a particular classification was assigned with 1 (one) for the breed that made the highest percent (but not lower than 40%) among the six categories. Observations that could not be classified under a specific category with at least 40% were considered cross-breed.

The next step was to conduct preliminary tests to verify whether particular categories could be grouped. The following procedure was used:

1. Regression analysis — SAS© software was used to estimate a simplified Cobb-Douglas model, similar to equation (12), without dummies for slope[36];

2. Dummies — Intercept changes were tested by using dummies (0-1) for breed categories; and

3. Homogeneity — The level of 10% of significance (F-test) was adopted as a rule of thumb, to group homogeneous breed categories.

In general, the results of these preliminary tests indicated that three main groups of breed should be considered: Pure Holstein (PH); Three-quarters Holstein and Other Pure European breeds (H&PE); and Pure Indian breeds, Zebu and Cross-breeds (CB&Z).

Characteristics of breed classifications are shown in Table 11. The majority were farms (62%) operating with cross-breed, Zebu or non-defined breeds (CB&Z). Zebu alone is the major breed of 11% of the sample. The majority of Zebu producers, 77%, are located in the Northeast region. Besides significant in number of producers, this breed category (alone) could not be statistically distinguished from the conventional cross-breed category. Only about 1% of the CB&Z were producers with Pure Indian breeds.

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[36] Dummies for slope were used only in the final models;

Table 11. Number of Sample Observations per Breed Classification, Average Percent of Dairy Output, Average Number of Cows, Average Production per Day and Percent of Observations per Regional Classification.

Breed Classification	Total Sample Observations (Number)	(%)	Dairy Output (%)	Farm Size: Cows (Number)	Production (L/Day)	Region Location: NE (%)	SE&CW (%)	S&SP (%)	Total (%)
PH	79	10	38	24	249	0	5	95	100
H&PE	219	28	57	26	146	49	29	22	100
CB&Z	477	62	40	22	62	38	26	36	100
Sample	775	100	45	23	105	37	25	38	100

Source: Research sample data.

Note: *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *S&SP* = South region and São Paulo; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; and *CB&Z* = Cross-breed or Zebu.

The second category in number of farms in the sample was the three-quarters Holstein and other Pure European breeds (H&PE). This category was 28% of the sample with 49% of the farms located in the Northeast. The number of farms with Other European breeds was only 1% of the sample, which also represents 4% of the H&PE category. The percent of dairy's output relative to the farm's total output (57%), on average, was the highest for this category suggesting that farms operating with this breed classification are less diversified.

Finally, Pure Holstein is the breed category of 10% of the farms in the sample. Farms using this breed were 95% located in the South region.

Dairy Output

Dairy output was limited to only milk production including cheese and butter sold and/or consumed within the farm. In the literature, dairy output is frequently broadly defined to include animals, either consumed or sold. Jaforullah and Devlin (1996 pp. 4-5), however, defined dairy output as the revenue earned from all-farm activity. The authors argued that, in the sample of their study conducted in New Zealand, dairy revenue was between 70 and 100% of total farm output.

In this study, animals are not included as dairy output. The reasons for this criterion are:

1. Dairy output — The dairy output would be biased in the case of beef producers as the major activity, but also in selling milk as a sub-product or secondary farm-activity;

2. Diversification — The inclusion of animals would have required the exclusion of observations up to an arbitrary level of dairy/animal output. Given that, on average, dairy appears as 45% of the farm output (Table 11), important information would be lost in analyzing the diversified dairy production systems;

3. Shared inputs — By excluding output due to animals from dairy output and, at the same time including it as e.g. beef production activity, the shared inputs (e.g. labor, land, machinery, capital, etc.) for the dairy production function could be restricted as a proportion of the dairy output and total farm output; and

4. Dual purpose — Dummy variables are used to separate dual purpose breeds from milk producing breeds.

In the production frontier function, dairy output is measured as the total revenue for dairy (R$/year), 1998. To estimate the volume of production per farm[37], value of output is divided by the annual average milk price.

Estimated measures of milk production per farm per day are shown in Table 12. From the sample, 55% of the farms were producing less than 50 liters per day, with an overall average of 105 liters. NE was the region with the highest percent of farms (69%) producing less than 50 liters per day, with an overall average of 70 liters per farm per day, which represents about one-half of the average of the S&SP and SE&CW regions.

Table 12. Distribution of Production per Farm (Liters/Day) for Sample and by Location and Breed.

Distribution		Regional Location			Breed Classification		
(Liters/Day/Farm)	Sample	NE	SE&CW	S&SP	PH	H&PE	CB&Z
			Percent of Farms				
< 10	12	21	8	7	0	13	14
10 – 50	43	48	27	49	30	33	50
50 – 100	17	13	21	19	18	17	18
≥ 100	28	18	44	25	52	37	18
Total	100	100	100	100	100	100	100
			Liters per Day per Farm				
Average	105	70	139	118	249	146	62
Standard Deviation	215	129	251	250	340	304	90

Source: Research sample data.

Note: *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *S&SP* = South region and São Paulo; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; and *CB&Z* = Cross-breed or Zebu.

For breed, the sample showed a larger volume of production by PH farms. For this breed, 70% of the producers produced more than 50 liters per day, and more than 50% produced at least 100 liters. The average for all PH farms was about 250 liters. The

[37] Because the annual average milk price was used, it may not accurately express the volume.

opposite occurred for CB&Z producers where 64% of the farms were producing less than 50 liters per day, with an average of 62 liters per day.

Number of Cows

In the literature, very often the total dairy herd is used as a proxy of size (e.g. Jaforullah and Devlin, 1996). In this study, size was defined in terms of the number of dairy cows in the herd, including dry and milking cows. It is consistent with our definition of dairy output and shared inputs.

The distribution of the number of cows per farm is shown in Table 13. In terms of number of cows, the majority (88%) were farms with less than 50 cows. SE&CW is the region with the highest percent (26%) of farms with 50 or more cows. The average number of cows per farm was also the highest (41) for this region. It represents more than double the average number of cows for the other regions. In the NE and S&SP regions, more than 90% of farms owned less than 50 cows.

Table 13. Distribution of Number of Cows per Farm for Sample and by Location and Breed.

Distribution		Regional Location			Breed Classification		
(Cows/Farm)	Sample	NE	SE&CW	S&SP	PH	H&PE	CB&Z
	Percent of Farms						
< 10	38	42	15	50	33	38	39
10 – 50	50	49	59	45	54	47	51
50 – 100	8	7	16	5	11	11	7
> 100	4	2	10	0	2	4	3
Total	100	100	100	100	100	100	100
	Number of Cows per Farm						
Average	23	19	41	16	24	26	22
Standard Deviation	32	24	44	24	29	37	30

Source: Research sample data.

Note: *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *S&SP* = South region and São Paulo; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; and *CB&Z* = Cross-breed or Zebu.

Finally, the average number of cows per farm appeared not to be differently distributed due to breed classifications.

Land

Like other shared inputs, land is defined specifically for the dairy activity. It is consistent with the purpose to model the dairy producer, broadly defined, to include diversified producers as well as specialized producers.

Measured in hectares, land includes the following areas of the farm:

1. Natural and formed pasture area;
2. Area used for buildings; and
3. A proportion of the crop area — The latter is calculated by multiplying the total crop area by the ratio of the value of dairy specific crop consumption (e.g. not purchased corn) to the value of the total crop production. For the sample, the average total crop land area is 18.4 ha, and the average area for dairy crop land is 0.81 ha.

The average number of hectares per producer is 23 ha (Table 14). The sample shows significantly larger farms in the SE&CW region, with an average of 66 ha versus 10 ha in the other regions. In both, NE and S&SP regions, about 70% of the farms operate with areas less than 10 ha of land for the dairy activity. For breed, in general, 50% to 60% of the producers were operating with less than 10 ha.

Table 14. Distribution of Pasture Land (ha) per Farm for Sample and by Location and Breed.

Distribution (Hectares/Farm)	Sample	Regional Location NE	SE&CW	S&SP	Breed Classification PH	H&PE	CB&Z
	Percent of Farms						
< 10	62	65	38	73	61	52	67
10 – 30	19	23	19	16	23	22	17
≥ 30	19	12	43	11	16	26	16
Total	100	100	100	100	100	100	100
	Hectares per Farm						
Average	23	10	66	9	13	27	23
Standard Deviation	94	26	175	25	36	76	106

Source: Research sample data.

Note: *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *S&SP* = South region and São Paulo; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; and *CB&Z* = Cross-breed or Zebu.

Capital

A flow concept was applied to capital, also defined specifically for the dairy activity. The measurement is in Real[38] (R$/year), 1998, and includes the following capital inputs:

1. Buildings — 100% of the capital in buildings specific for the dairy activity;
2. Machinery and equipment — 100% of the capital in machinery and equipment specific to conduct of the dairy activity; and
3. Shared capital — A proportion of capital in buildings, machinery and equipment that is shared with other activities in the farm. It is calculated by multiplying the total of shared capital (tractors, trucks, etc) by the dairy output share.

An interest rate of 4% was used to estimate the annual cost of capital.

[38] In the period between 1994 and 1998 the exchange rate of the Real and the US Dollar was about R$1.10/US$1.00.

The highest level of capital is in SE&CW region, where the cost of capital is R$939, more than twice that of the NE region, as shown in Table 15.

Table 15. Distribution of the Cost of Capital, 1998 (R$/Farm) per Farm for Sample by Location and Breed.

Distribution (R$/Year/Farm)	Sample	Regional Location			Breed Classification		
		NE	SE&CW	S&SP	PH	H&PE	CB&Z
	Percent of Farms						
< 500	68	79	42	74	51	67	72
500 – 1000	17	12	26	15	22	13	17
≥ 1000	15	9	32	11	27	20	11
Total	100	100	100	100	100	100	100
	Reals per Year per Farm						
Average	583	351	939	574	1,227	619	459
Standard Deviation	926	489	1,072	1,067	1,771	1,006	576

Source: Research sample data.

Note: *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *S&SP* = South region and São Paulo; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; *CB&Z* = Cross-breed or Zebu; and R$ = Monetary values are expressed in Reals, 1998, when the exchange rate was about R$1.10 for US$1.00.

From the viewpoint of breed, the highest investment is shown for PH (R$1,227/year), which is twice that of H&PE and three times that of CB&Z.

Labor

Total labor for dairy was derived from the total labor for the farm, which includes hired labor as well as non-paid family labor. It is measured in days per year of full-time equivalent units. A full-time worker was defined as an adult male working 8 hours per day, 5 days per week, equivalent to 250 days per year.

Hired labor includes temporary and permanent labor. Temporary labor was obtained by adding the number of days of all temporary workers in the farm during the year. Permanent labor was based on the number of full-time equivalent workers multiplied by 250 days a year.

The quantity of family labor was estimated by first calculating the quantity of days of a full-time equivalent worker for each family member. The procedure involved four steps:

1. Age — A quantity of 250 days per year is multiplied by a factor, previously established according to age. The factor is equal to zero for people below 8 years, and 0.1 is added to the factor (up to one) for each year, until 17 years; between 17 years and 50 years a factor equal to one is assigned; for people older than 50 years the factor is decreased by 0.1 for each additional 5 years, up to zero;

2. Gender — The quantity obtained in (1) is multiplied by one if the person is a male, or by 0.8 if a female;

3. Farm activity — A third factor considers whether the family member works on the farm and/or in a non-farm activity. This factor is calculated by dividing the value of the income earned from the farm by the total income, which includes farm and non-farm income or off-farm employment; and

4. Farm family labor — The farm family labor is the summation of the quantity of the equivalent full-time worker units of all members of the family.

The total labor for the dairy activity is a proportion of the total labor for the farm. The factor used is the ratio of the dairy output to all output for the farm.

The distribution of the number of full-time workers per farm is shown in Table 16. In the S&SP region, the average is 0.8 workers per farm, and 81% of the farms use less than 2 workers. NE and SE&CW show an average of about two workers per farm. Given that the volume of production per farm (Table 12) is quite similar between SE&CW and S&SP (139 liters/day and 118 liters/day, respectively), a general analysis suggests that labor is more productive in S&SP than in SE&CW. For NE, the number of workers was 2.1 per farm and the average production per farm was about one-half of SE&CW, which suggests that the labor in NE is even less productive than in SE&CW.

Table 16. Distribution of Number of Full-Time Equivalent Workers per Farm (8 hours/day) for Sample and by Location and Breed.

Distribution		Regional Location			Breed Classification		
(Workers/Farm)	Sample	NE	SE&CW	S&SP	PH	H&PE	CB&Z
	Percent of Farms						
< 2	50	30	32	81	64	37	54
2 – 3	37	51	52	15	23	37	40
≥ 3	13	19	16	4	13	26	6
Total	100	100	100	100	100	100	100
	Workers per Farm						
Average	1.5	2.1	1.8	0.8	1.2	2.3	1.2
Standard Deviation	2.0	1.9	1.9	1.9	1.7	3.0	1.2

Source: Research sample data.

Note: *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *S&SP* = South region and São Paulo; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; and *CB&Z* = Cross-breed or Zebu.

Similar analysis can be made for breed. Comparing e.g. PH and CB&Z, the average number of workers per farm is the same, but the average production per farm per day (Table 12) is four times higher. Aside from other factors, it suggests that, even for small farm sizes, breed is an important variable to be considered in the labor productivity analysis.

The composition of labor (ratio of the quantity of family labor to total labor) is shown in Table 17. For comparison among regions, the SE&CW region has the lowest ratio (0.43) of family labor relative to total labor or about 63% of the producers operate with 50% or less of family labor. This means that in SE&CW, producers use more units of hired labor than family labor.

Table 17. Distribution of the Ratio of the Quantity of Family Labor Relative to the Quantity of Total Labor for Sample and by Location and Breed.

Distribution (Ratio)	Sample	Regional Location NE	SE&CW	S&SP	Breed Classification PH	H&PE	CB&Z
	Percent of Farms						
< 0.25	16	11	36	9	16	21	13
0.25 – 0.50	17	22	27	6	9	16	19
0.50 – 0.75	15	19	15	11	18	13	16
≥ 0.75	52	48	22	74	57	50	52
Total	100	100	100	100	100	100	100
	Ratio per Farm						
Average	0.67	0.67	0.43	0.82	0.71	0.64	0.67
Standard Deviation	0.34	0.30	0.32	0.29	0.34	0.36	0.33

Source: Research sample data.

Note: *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *S&SP* = South region and São Paulo; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; and *CB&Z* = Cross-breed or Zebu.

Other Variable Costs

'Other variable costs' include several specific and shared costs. The measurement is in Real[39] (R$/year), 1998, and includes expenditure for inputs as follows:

1. Veterinarian products — The proportion of the dairy output relative to the output of all activities in the farm involving animals;

2. Technical assistance and mechanical repairs — The proportion of the dairy output relative to the total output of the farm; and

[39] In the period between 1994 and 1998 the exchange rate of the Real and the US Dollar was about R$1.10/US$1.00.

3. Expenditures for oil, fuel, electricity, gas, and telephone — The proportion of the dairy output relative to the total income of the family.

The distribution of the observations of other variable costs per cow per farm is presented in Table 18. Farms from S&SP have the highest cost per cow per farm (R$86/cow/year).

Table 18. Distribution of the Other Variable Cost per Cow, 1998 (R$/Farm) per Farm for Sample by Location and Breed.

Distribution (R$/Year/Cow/Farm)	Sample	Regional Location NE	SE&CW	S&SP	Breed Classification PH	H&PE	CB&Z
		Percent of Farms					
< 20	31	47	23	19	6	33	34
20 – 50	31	30	39	28	23	30	33
≥ 50	38	23	38	53	71	37	33
Total	100	100	100	100	100	100	100
		Reals per Year per Cow per Farm					
Average	61	39	56	86	113	60	53
Standard Deviation	88	71	50	113	94	84	86

Source: Research sample data.

Note: *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *S&SP* = South region and São Paulo; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; *CB&Z* = Cross-breed or Zebu; and R$ = Monetary values are expressed in Reals, 1998, when the exchange rate was about R$1.10 for US$1.00.

Among breed categories, variable costs for PH are about R$113 per cow per farm per year. On average, it is twice the expenditure for the other breeds.

Concentrated Feed

In the frontier production function, the unit of measurement for concentrated feed is tons per year per farm. The quantity of concentrated feed per cow is shown in Table 19.

NE is the region where on average producers use more concentrated feed per cow. About 69% of the producers use more than one kg of concentrated feed per cow per day.

Table 19. Distribution of the Quantity of Concentrated Feed (kg/Cow/Day) per Farm for Sample by Location and Breed.

Distribution (kg/Cow/Day/Farm)	Sample	Regional Location			Breed Classification		
		NE	SE&CW	S&SP	PH	H&PE	CB&Z
	Percent of Farms						
< 1	51	31	67	61	56	47	52
1 – 3	40	63	25	27	25	42	41
≥ 3	9	6	8	13	19	11	7
Total	100	100	100	100	100	100	100
	kg per Cow per Day per Farm						
Average	1.05	1.26	0.87	0.97	1.17	1.15	0.99
Standard Deviation	1.37	1.20	1.43	1.46	1.58	1.47	1.28

Source: Research sample data.

Note: *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *S&SP* = South region and São Paulo; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; and *CB&Z* = Cross-breed or Zebu.

Production Frontier Parameters

This part is addressed to objective (1). Two models, breed and location, are estimated, one at a time.

The parameters of the stochastic frontier model, as defined in equation (14), Chapter IV, were estimated by using software FRONTIER Version 4.1. As described in Coelli (1996; 1992) and explained in appendices of Battese and Coelli (1992), this program uses a three-step procedure in estimating the maximum likelihood estimates, which are:

1. Ordinary Least Squares (OLS) — OLS is used to obtain preliminary estimates of all β-parameters with the exception of the intercept;

2. Grid search — Search of γ, with the β-parameters obtained in the first step and all other parameters (μ, η, and δ) set to zero; and

3. Interactive maximization — A procedure to obtain the maximum-likelihood estimates by using the Davidon-Fletcher-Powell Quasi-Newton method.

The maximum-likelihood estimates for the stochastic frontier and variances in the stochastic frontier parameters are shown in Tables 20 and 21, for breed and location, respectively. The untransformed variables and the estimated individual technical efficiencies are listed in Appendix I.

A test on the significance of the random variable, U_i, as presented in equation (14), is obtained from the likelihood ratio, *LR*, which has approximately chi-square distribution. The value of this statistic, at the level of 0.5% with a parameter equal to one, is 6.63. For both equations, the null hypothesis for the random variable, H_0: $\mu_i = 0$, was rejected with the value of *LR* equal to 365.44 and 274.30, respectively. This indicates that U_i is not zero and that the variables in the inefficiency-model are important in influencing the distribution of the output for Brazilian dairy producers.

The parameter γ is associated with the variance in the stochastic frontier. Given the t-statistic, this parameter is significant at the level of 1% in both equations. It can be broadly interpreted as a proportion of the deviations from the frontier, and it is an indication that the random component makes a significant difference on the production function. Values for γ closer to one indicate that the random error, V_i, is approximately zero. It is also an indication that the traditional average response function would not be a good representation of the data.

Table 20. Maximum-Likelihood Estimates for Parameters of the Stochastic Frontier Models by Breed for Brazilian Dairy Farms.

Specification	Parameter	Parameter Estimates			Corrected Parameters	
		CB&Z	PH (D_1)	H&PE (D_2)	PH	H&PE
Independent Variables						
Constant	α_0	2.5634*** (26.03)	–0.7341** (–2.51)	–0.4542*** (–2.64)	1.8293	2.1092
Log of Number of Cows	β_{COW}	0.4346*** (10.38)	–0.0020 (–0.01)	0.1075 (1.53)	0.4326	0.5421
Log of Pasture Land	β_{LND}	0.0047 (0.83)	0.0056 (0.43)	0.0136 (1.35)	0.0103	0.0183
Log of Capital	β_{CAP}	0.0657** (2.26)	0.1474 (1.60)	–0.0449 (–0.86)	0.2131	0.0208
Log of Total Labor	β_{LAB}	0.1661*** (5.08)	–0.0624 (–0.77)	0.1353** (2.52)	0.1037	0.3014
Log of Other Costs	β_{CST}	0.0715*** (4.64)	0.2230*** (2.68)	0.0356 (1.49)	0.2944	0.1070
Log of Concentrated Feed	β_{CON}	0.0222*** (4.41)	–0.0332*** (–2.72)	–0.0017 (–0.19)	–0.0109	0.0205
Ratio Dairy Output	λ_{ROU}	0.3969*** (7.80)	–0.2697** (–2.39)	–0.0617 (–0.75)	0.1272	0.3352
Ratio Family Labor	λ_{RLB}	–0.1461*** (–3.44)	0.1087 (1.00)	0.1634** (2.08)	–0.0374	0.0172
Variance Parameters						
Sigma-square	σ_s^2	0.0401*** (13.14)				
Gamma	γ	0.2883*** (4.06)				
Log Likelihood Function		177.02				
LR Test (One-Side Error)	*LR*	365.44				
Mean Efficiency		0.7743*** (5.79)				

Source: Research sample data.

Note: The dependent variable is Y = log of dairy output; estimated t-ratios are given below in parentheses; (***), (**) and (*) denote t-statistic significance level of 1%, 5% and 10%, respectively; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; and *CB&Z* = Cross-breed or Zebu.

Each equation contains twenty seven parameters, which are related to three dummy variables to distinguish breed classifications (Table 20) and region locations (Table 21), respectively.

Table 21. Maximum-Likelihood Estimates for Parameters of the Stochastic Frontier Models by Location for Brazilian Dairy Farms.

Specification	Parameter	Parameter Estimates			Corrected Parameters	
		SE&CW	NE (D_1)	S&SP (D_2)	NE	S&SP
Independent Variables						
Constant	α_0	2.1263*** (11.71)	−0.0439 (−0.19)	−0.2414 (−1.06)	2.0824	1.8849
Log of Number of Cows	β_{COW}	0.4666*** (9.44)	−0.1007 (−1.45)	−0.0671 (−0.87)	0.3659	0.3995
Log of Pasture Land	β_{LND}	0.0097 (1.27)	0.0191* (1.83)	−0.0110 (−1.12)	0.0288	−0.0013
Log of Capital	β_{CAP}	0.0448 (0.81)	−0.0221 (−0.34)	0.1689** (2.36)	0.0227	0.2136
Log of Total Labor	β_{LAB}	0.3122*** (5.49)	0.0148 (0.19)	−0.1342* (−1.92)	0.3270	0.1780
Log of Other Costs	β_{CST}	0.1149*** (3.87)	−0.0604* (−1.85)	0.1341*** (2.82)	0.0544	0.2489
Log of Concentrated Feed	β_{CON}	0.0185*** (2.88)	−0.0065 (−0.69)	−0.0176** (−2.11)	0.0120	0.0009
Ratio Dairy Output	λ_{ROU}	0.0834 (1.31)	0.6548*** (7.00)	0.1103 (1.17)	0.7382	0.1937
Ratio Family Labor	λ_{RLB}	−0.2788*** (−4.60)	0.1049 (1.23)	0.1894** (2.29)	−0.1739	−0.0894
Variance Parameters						
Sigma-square	σ_s^2	0.0418*** (8.64)				
Gamma	γ	0.4384*** (5.43)				
Log Likelihood Function		209.88				
LR Test (One-Side Error)	*LR*	274.30				
Mean Efficiency		0.8203*** (7.21)				

Source: Research sample data.

Note: The dependent variable is Y = log of dairy output; estimated t-ratios are given below in parentheses; (***), (**) and (*) denote t-statistic significance level of 1%, 5% and 10%, respectively; *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; and *S&SP* = South region and São Paulo.

Almost all variables were statistically significant in the model, mostly at the level of 1% (*t*-statistic). Only for pasture land the coefficient (β_{LND}) was not significantly different from zero for breed classification. The signs of the final coefficients (after correction for the dummies) of the stochastic frontier in both equations are as expected. The exceptions are concentrated feed (β_{CON}) for Pure Holstein (PH), and pasture land in the equation for regional location.

The constant term (α_0) was statistically different from zero for all three breed dummies, indicating that the intercepts of the frontier functions among breeds are probably different. For location, the constant terms for Northeast (NE) and South (S&SP) appear not to be different from Southeast (SE&CW). It indicates that breed by itself would affect the average efficiency level of farms, no matter location.

Number of cows (β_{COW}) was highly significant in both equations, but it appears not to be statistically different among breeds or location. It is an indication that size is an important factor but without distinction for breed or location.

Pasture land (β_{LND}) was statistically different from zero only for Northeast. The sign for the South region (S&SP) was negative, but not significant even at 10% (t-statistic). For breed, β_{LND} was not different from zero, with positive signs for all coefficients. The results may be interpreted as evidence that land measured by area may not be a good proxy for this input, and that quality may be more relevant. As it will be discussed below, pasture rotation and pasture fertilization are factors statistically significant in explaining inefficiency.

Capital (β_{CAP}) was not statistically different among breeds. For location, β_{CAP} was statistically significant only for Southeast (S&SP). Given the characteristics of the dairy activity in this region, it is an indication of a probable interaction of capital and technology.

The coefficient of total labor (β_{LAB}) for three-quarters Holstein and Pure European (H&PE) appears to have different effects on the production frontier than the other two breeds. For location, the South region (S&SP) was different from the other regions.

The coefficient for other variable costs (β_{CST}) is statistically different for Pure Holstein (PH) and for Southeast (S&SP). It is evidence of a need for more veterinarian services for farms using breeds with higher production per cow, which is the case of PH mainly located in S&SP.

The coefficient for concentrated feed was statistically significant and with a negative sign for Pure Holstein. The explanation for this unexpected result could be that: (1) misinterpretation of the question in the original questionnaire; and/or (2) unbalanced or sub-optimal ratio between concentrated feed and other feed source of fiber that should be provided for better response of this input.

The ratio of dairy output to farm output was intended to measure the effect of specialization on the intercept term of the frontier function. The final coefficients (after correction for the dummies) were positive for all breeds. It indicates that specialization plays an important role in the production frontier, affecting efficiency. Among breeds, Pure Holstein (PH) appeared to be different from the other breeds. For location, statistical significance for this variable was identified only for Northeast (NE).

The ratio of family labor to total labor was intended to capture the efficiency of family labor relative to hired labor in the dairy activity. This coefficient would affect the intercept as well as the elasticity of total labor. All final coefficients (after correction for the dummies) had negative signs, with the exception of the category of three-quarters Holstein and Pure European breed. This indicates that, in general, family labor is less efficient than hired labor. It could be interpreted, in other words, as evidence that family labor is probably available in excess, and that labor is hired only if strictly necessary. This is because, in Brazil, temporary labor is usually available[40] when needed.

Inefficiency-Effects Parameters

This part is addressed to objective (2). Two equations, breed and location, are considered, one at a time, by using dummies to capture these differences. The model is based on equation (13) estimated simultaneously with equation (12), as defined in Chapter IV. The variables and the estimated individual technical efficiencies are listed in Appendix I.

The maximum likelihood estimates for parameters of the inefficiency-effects models are listed in Tables 22 and 23, for breed and location, respectively. Because these parameters are estimated simultaneously with the production frontier parameters, the variance parameters listed in Tables 22 and 23, are the same as those listed in Tables 20 and 21, for breed and location, respectively.

The variance parameters were discussed above. For both equations, they indicate that the variables in the inefficiency-model are important in influencing the distribution of the output for Brazilian dairy producers.

A positive sign for the coefficient means that inefficiency is directly related to the variable. A negative sign means that if the variable increases, inefficiency decreases.

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[40] Probably not applicable for more specialized labor, such as used for milking and cowboy activities, which is usually fixed labor.

Table 22. Maximum-Likelihood Estimates for Parameters of the Inefficiency-Effects Models by Breed for Brazilian Dairy Farms.

Specification	Parameter	Parameter Estimates			Corrected Parameters	
		CB&Z	PH (D_1)	H&PE (D_2)	PH	H&PE
Constant	δ_0	0.6973*** (6.99)			0.6973	0.6973
Artificial insemination	δ_{AIN}	−0.1652** (−2.30)	−0.2607 (−1.50)	−0.2122* (−1.76)	−0.4259	−0.3774
Pasture rotation	δ_{PAR}	−0.1244*** (−2.81)	−0.1969 (−1.61)	0.2426*** (3.05)	−0.3213	0.1182
Pasture fertilization	δ_{PAF}	−0.0416 (−0.93)	0.5722*** (3.46)	−0.1244 (−1.37)	0.5305	−0.1660
Distance from urban area	δ_{DST}	0.0022** (2.06)	−0.0043 (−0.59)	−0.0021 (−1.08)	−0.0020	0.0001
Telephone	δ_{TEL}	0.0116 (0.21)	−0.3730** (−2.41)	−0.1850* (−1.95)	−0.3614	−0.1734
Electricity	δ_{ELC}	−0.0324 (−0.78)	−0.7888*** (−2.65)	0.0089 (0.15)	−0.8212	−0.0234
Ratio farm output / income	δ_{FOU}	−0.4346*** (−6.59)	−0.7468*** (−2.95)	−0.2383** (−2.38)	−1.1813	−0.6729
Sell to Cooperative	δ_{COO}	0.0618 (1.29)	−0.0335 (−0.19)	0.0071 (0.09)	0.0283	0.0688
Days until payment	δ_{PAY}	−0.0018 (−1.08)	0.0008 (0.16)	0.0047 (1.54)	−0.0009	0.0029
Age of the operator	δ_{AGE}	0.0021 (1.51)	−0.0026 (−0.69)	−0.0017 (−0.91)	−0.0005	0.0004
Operator education level	δ_{EDU}	−0.0038 (−0.56)	0.0198 (1.00)	−0.0047 (−0.43)	0.0160	−0.0086
Operator is the owner	δ_{OWN}	−0.1573*** (−3.25)	1.5388*** (5.93)	0.2159** (2.45)	1.3815	0.0586
Operator lives in the farm	δ_{LIV}	0.0199 (0.43)	0.0204 (0.11)	0.0418 (0.56)	0.0403	0.0617
Variance Parameters						
Sigma-square	σ_s^2	0.0401*** (13.14)				
Gamma	γ	0.2883*** (4.06)				
Log Likelihood Function		177.02				
LR Test (One-Side Error)	*LR*	365.44				
Mean Efficiency		0.7743*** (5.79)				

Source: Research sample data.

Note: The dependent variable is *U*, obtained from the stochastic frontier model; estimated t-ratios are given below in parentheses; (***), (**) and (*) denote t-statistic significance level of 1%, 5% and 10%, respectively; *CB&Z* = Cross-breed or Zebu; *PH* = Pure Holstein; and *H&PE* = ¾ Holstein or other Pure European breeds.

Table 23. Maximum-Likelihood Estimates for Parameters of the Inefficiency-Effects Models by Location for Brazilian Dairy Farms.

Specification	Parameter	Parameter Estimates SE&CW	NE (D_1)	S&SP (D_2)	Corrected Parameters NE	S&SP
Constant	δ_0	0.7790*** (6.32			0.7790	0.7790
Artificial insemination	δ_{AIN}	−0.8341*** (−3.87)	0.8563** (2.42)	0.7109*** (3.13)	0.0222	−0.1232
Pasture rotation	δ_{PAR}	−0.0724 (−0.78)	0.0224 (0.20)	0.0312 (0.31)	−0.0500	−0.0412
Pasture fertilization	δ_{PAF}	0.0262 (0.12)	−0.0937 (−0.40)	−0.0944 (−0.43)	−0.0675	−0.0682
Distance from urban area	δ_{DST}	−0.0021 (−0.61)	0.0046 (1.28)	0.0035 (0.77)	0.0025	0.0015
Telephone	δ_{TEL}	0.1887* (1.83)	−0.4886*** (−2.73)	−0.2009* (−1.77)	−0.2999	−0.0123
Electricity	δ_{ELC}	−0.0834 (−0.80)	0.0704 (0.62)	0.0497 (0.27)	−0.0131	−0.0338
Ratio farm output / income	δ_{FOU}	−0.5962*** (−3.94)	−0.1748 (−1.05)	0.1459 (0.86)	−0.7711	−0.4503
Sell to Cooperative	δ_{COO}	0.0551 (0.64)	−0.0649 (−0.33)	0.0034 (0.04)	−0.0098	0.0585
Days until payment	δ_{PAY}	−0.0037 (−1.09)	0.0042 (0.90)	0.0033 (0.88)	0.0006	−0.0003
Age of the operator	δ_{AGE}	0.0026 (0.91)	−0.0020 (−0.64)	−0.0024 (−0.73)	0.0005	0.0002
Operator education level	δ_{EDU}	−0.0036 (−0.31)	−0.0119 (−0.73)	0.0004 0.03)	−0.0155	−0.0032
Operator is the owner	δ_{OWN}	−0.2176* (−1.72)	0.0698 (0.48)	0.2413 1.52)	−0.1479	0.0237
Operator lives in the farm	δ_{LIV}	−0.0872 (−0.96)	0.1006 (0.92)	0.0252 0.24)	0.0134	−0.0620
Variance Parameters						
Sigma-square	σ_s^2	0.0418*** (8.64)				
Gamma	γ	0.4384*** (5.43)				
Log Likelihood Function		209.88				
LR Test (One-Side Error)	*LR*	274.30				
Mean Efficiency		0.8203*** (7.21)				

Source: Research sample data.

Note: The dependent variable is *U*, obtained from the stochastic frontier model; estimated t-ratios are given below in parentheses; (***), (**) and (*) denote t-statistic significance level of 1%, 5% and 10%, respectively; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *NE* = Northeast; and *S&SP* = South region and São Paulo.

Artificial insemination (δ_{AIN}) was statistically significant in both equations. Less inefficiency is expected for farmers that use this practice. For Northeast (NE) the coefficient was positive showing the opposite for this technology in this region.

Pasture rotation (δ_{PAR}) and pasture fertilization (δ_{PAF}) were not statistically significant in the equation for location. For breed, significance and positive sign for Pure Holstein for pasture fertilization was not expected.

Distance from urban area (δ_{DST}) showed that it is positively related to inefficiency for Cross breed, but appeared not to be relevant for location.

Farms with telephone (δ_{TEL}) showed to be statistically more efficient for Pure Holstein (PE) and Pure European (H&PE) breeds, but not for Cross breed farms or location in the Southeast region.

Electricity (δ_{ELC}) was not significant in the equation for location, but seems to be very important for efficiency of farms with Pure Holstein (PH).

The ratio of farm output to total farm income (δ_{FOU}) was negative and highly significant in both equations. Note the high magnitude of the coefficient for Pure Holstein (-1.18), which is not a surprise. It is strong evidence that the higher the technology level (here expressed by breed), the lower the inefficiency for strictly doing farm activity. It turns out that more efficiency in the dairy activity is expected for farms where the family's total income is less dependent on off-farm employment or non-farm activities.

On average, inefficiency seems not to be significantly related to farms selling to cooperatives (δ_{COO}), days until payment (δ_{PAY}), age of operator in years (δ_{AGE}), operator's education level (δ_{EDU}), and whether the operator lives on the farm (δ_{LIV}).

Farms where the operator is the owner showed to be more efficient only for Cross breed or farms located in the Southeast or Central-West region (SE&CW). Other breeds and regions showed the opposite.

Input Elasticities and Marginal Value Product

This part addresses objective (3) and involves production elasticities and marginal value products evaluated at the average prices for inputs of the stochastic production function, for breed and location. The elasticities are presented in Table 24; the marginal value products in Table 25; and the input prices in Table 26.

Table 24. Estimates for Input Elasticities for the Stochastic Production Function Evaluated at the Means by Location and Breed, for Brazilian Dairy Farms.

Specification	Parameter	Parameter Estimates					
		Regional Location			Breed Classification		
		SE&CW	NE	S&SP	CB&Z	PH	H&PE
Independent Variables							
Number of cows	E_{COW}	0.4666	0.3659	0.3995	0.4346	0.4326	0.5421
Pasture land	E_{LND}	0.0097	0.0288	−0.0013	0.0047	0.0103	0.0183
Capital	E_{CAP}	0.0448	0.0227	0.2136	0.0657	0.2131	0.0208
Total labor	E_{LAB}	0.4982	0.4430	0.2377	0.2636	0.1287	0.2899
Other variable costs	E_{CST}	0.1149	0.0544	0.2489	0.0715	0.2944	0.1070
Concentrated feed	E_{CON}	0.0185	0.0120	0.0009	0.0222	−0.0109	0.0205
Ratio of dairy output	E_{ROU}	0.0374	0.3305	0.0867	0.1777	0.0570	0.1501
Ratio of family labor	E_{RBL}	−0.1860	−0.1160	−0.0597	−0.0975	−0.0250	0.0115

Source: Research sample data.

Note: *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region *NE* = Northeast; *S&SP* = South region and São Paulo; *CB&Z* = Cross-breed or Zebu; *PH* = Pure Holstein; and *H&PE* = ¾ Holstein or other Pure European breeds.

Table 25. Estimates for the Marginal Value Product for the Inputs for the Stochastic Production Function Evaluated at the Means by Location and Breed, for Brazilian Dairy Farms.

Specification	Unit of Measurement	Sample Average	Marginal Value Product (R$/Year)					
			Regional Location			Breed Classification		
			SE&CW	NE	S&SP	CB&Z	PH	H&PE
Dependent Variable	R$/year	9882.38						
Input Variables								
Number of cows	Number	23.35	197.49	154.86	169.09	183.95	183.10	229.45
Pasture land	ha	23.37	4.11	12.19	−0.56	2.00	4.35	7.74
Capital (flow)	R$/year	582.60	0.76	0.38	3.62	1.11	3.61	0.35
Total labor	Days/year	381.85	12.89	11.47	6.15	6.82	3.33	7.50
Other variable costs	R$/year	1310.81	0.87	0.41	1.88	0.54	2.22	0.81
Concentrated feed	Tons/year	11.20	16.29	10.55	0.76	19.61	−9.65	18.07

Source: Research sample data.

Note: *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region *NE* = Northeast; *S&SP* = South region and São Paulo; *CB&Z* = Cross-breed or Zebu; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; R$ = Monetary values are expressed in Reals, 1998, when the exchange rate was about R$1.10 for US$1.00; and the cost of capital was based on an annual interest rate of 4%.

Table 26. Average Prices for the Inputs for the Stochastic Production Function by Location and Breed, for Brazilian Dairy Farms.

Specification	Unit of Measurement	Sample Average	Regional Location			Breed Classification		
			SE&CW	NE	S&SP	CB&Z	PH	H&PE
Dependent Variable	R$/L	0.26	0.24	0.32	0.20	0.27	0.22	0.24
Input Variables								
Cows (to be used for 5 years)	R$/cow/year	63.00	68.00	58.60	64.00	57.00	86.80	67.20
Pasture land (flow)	R$/ha/year	59.24	64.16	11.32	102.80	54.48	119.44	47.92
Capital (flow)	R$/year	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hired labor	R$/day	7.53	6.57	4.48	11.13	7.00	12.94	6.73
Other variable costs	R$/year	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Concentrated feed	R$/t	133.42	135.26	155.64	110.51	134.97	110.76	138.22

Source: Research sample data.

Note: *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region *NE* = Northeast; *S&SP* = South region and São Paulo; *CB&Z* = Cross-breed or Zebu; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; R$ = Monetary values are expressed in Reals, 1998, when the exchange rate was about R$1.10 for US$1.00; and the cost of capital and pasture land were based on an annual interest rate of 4%.

The elasticity for number of cows varied from 0.37 for Northeast (NE) to 0.54 for three-quarter Holstein and other Pure European breeds (H&PE). This means that on average, an increase in 1% in the number of cows would increase production by 0.37% to

0.55%, all other factors constant. The marginal value product for number of cows is the contribution of one additional cow to the production, in monetary units per year (R$/farm/year), assuming all other factors constant. The marginal value product varied from R$155/year for Northeast (NE) to R$230/year for three-quarter Holstein and other Pure European breeds (H&PE). By assuming the productive life of a cow is five years, the cost of a cow per year can be calculated by dividing the price by five (undiscounted). The cost of a cow varied from $57/year to $87/year (Table 26), which is about one-third of the marginal value product. Assuming the average sample's price of a cow of R$315, which corresponds to a cost of R$63 (Table 26), this means that R$1.00 expended on the cost of investing in a cow per year [R$/(cow/5 years)] will return between R$2.45 (Northeast) to R$3.63 (three-quarter Holstein and Pure European) per year[41]. Compared to the highest returns obtained for capital, which were S&SP (R$3.62/year) and PH (R$3.61/year), this indicates that extensive efficiency could be obtained by the producers, in general, if the number of cows is increased.

For pasture land, Northeast (NE) was the region where the elasticity (0.029) and the marginal value product (R$12/year) were the highest. In this region, the cost of land was the lowest ($11/year). The results suggest that for this particular region, efficiency could be improved by increasing the area (or perhaps quality) of pasture land. For all other classifications, the marginal value products were several times lower than their respective costs, suggesting that the area of pasture land may be sub-optimally used, perhaps because of a lack of capital.

For capital, the highest elasticities are shown for South region (0.214) and Pure Holstein (0.213), and significantly lower values for Northeast (0.022) and for three-

[41] Assuming all other factors constant

quarter Holstein and other Pure European breeds (0.021). The marginal value products were also the highest for S&SP (R$3.62/year) and PH (R$3.61/year). This indicates that, for these classifications, one Real of cost of capital (R$1.00/year), which corresponds to 4% of an investment equivalent of R$25, would return more than three times as much. It is also evidence of an interaction between capital and improved technology, characterized here by PH.

For labor, however, the magnitudes for the elasticities are the opposite as observed for capital. Higher elasticities are shown for Cross breed (0.50) and three-quarter Holstein and other Pure European breeds (0.29). The lowest marginal value products for labor were South region (R$6.15/year) and Pure Holstein (R$3.33/year), which are also those classifications with the highest costs for labor, respectively, R$11.13/year and R$12.94/year. These results suggest that, in the long term, labor will probably substitute for capital, especially considering that the cost of labor is relatively higher than the minimum wage, which was about R$6.00/day, in 1998.

For location, the elasticities for other variable costs varied from 0.05 for Northeast (NE) to 0.25 for South (S&SP), and for breed from 0.07 for Cross breed (CB&Z) to 0.29 for Pure Holstein (PH). Note that the behavior of the elasticities for other variable costs are very similar to capital discussed above. The marginal value products are higher than the cost for the same categories as observed for capital. Again, higher technology, observed for PH, and which is more concentrated in the South region, requires more expenditure in veterinarian products, knowledge and energy.

The elasticities for concentrated feed, respective marginal value products, and prices indicate that quantities of this input are probably not used rationally. There is no clear explanation for a negative sign for one of the elasticities and it seems that some inefficiency may be associated with use of concentrates on the farm, perhaps because of unbalanced ration or not considering the opportunity cost of this input.

The ratio of dairy output to farm output, here used as a proxy of specialization, varied from 0.04 for Southeast (SE&CW) to 0.33 for Northeast (NE). This indicates that the effect of diversification is not significantly affecting efficiency in dairy production. Higher effect on dairy production is shown for NE compared to the other regions. For breed, the lowest elasticity is for Pure Holstein (0.06) and the highest is for Cross breed (0.18).

Dairy production is inversely affected by the ratio where family is employed relative to total labor. This indicates that, in general, family labor is not as efficient as hired labor. This could be interpreted as evidence that family labor is available in excess, and that hired labor is necessary. This may be because, in Brazil, temporary labor is usually available[42] when needed.

Inefficiency-Effects Elasticities

The elasticities for the inefficiency-effects explanatory variables are presented in Table 27, and addresses objective (3).

With respect to the proxy variables used to measure the effect of dairy technology, the majority of the elasticities have negative signs. This indicates that practices such as artificial insemination, pasture rotation and pasture fertilization are factors that reduce inefficiency. For Pure Holstein, inefficiency in production could be reduced by 13% if

[42] Probably not applicable for more specialized labor, such as used for milking and cowboy activities, which is usually fixed labor.

the producer uses artificial insemination or pasture rotation (assuming all other factors constant). For Southeast (SE&CW), the elasticity for artificial insemination is the highest (–0.25) and suggests the importance of this practice in increasing efficiency in dairy production for this region.

Table 27. Estimates for the Inefficiency-Effects Elasticities Evaluated at the Means by Location and Breed, for Brazilian Dairy Farms.

Specification	Parameter	Parameter Estimates					
		Region Location			Breed Classification		
		SE&CW	NE	S&SP	CB&Z	PH	H&PE
Use of Dairy Technology							
Artificial insemination	E_{AIN}	–0.2488	0.0066	–0.0368	–0.0493	–0.1271	–0.1126
Pasture rotation	E_{PAR}	–0.0294	–0.0203	–0.0168	–0.0506	–0.1307	0.0481
Pasture fertilization	E_{PAF}	0.0093	–0.0241	–0.0243	–0.0148	0.1892	–0.0592
Farm Infrastructure							
Distance from urban area	E_{DST}	–0.0559	0.0680	0.0399	0.0604	–0.0547	0.0032
Telephone	E_{TEL}	0.0352	–0.0560	–0.0023	0.0022	–0.0675	–0.0324
Electricity	E_{ELC}	–0.0888	–0.0139	–0.0359	–0.0345	–0.8744	–0.0250
Farming Activity							
Ratio farm output / income	E_{FOU}	–0.6151	–0.7955	–0.4646	–0.4483	–1.2187	–0.6941
Sell to Cooperative	E_{COO}	0.0261	–0.0046	0.0277	0.0292	0.0134	0.0326
Days until payment	E_{PAY}	–0.0810	0.0131	–0.0076	–0.0390	–0.0208	0.0651
Operator Characteristics							
Age of the operator	E_{AGE}	0.1773	0.0376	0.0122	0.1433	–0.0334	0.0293
Operator education level	E_{EDU}	–0.0178	–0.0766	–0.0159	–0.0189	0.0787	–0.0423
Operator is the owner	E_{OWN}	–0.2513	–0.1708	0.0273	–0.1817	1.5953	0.0676
Operator lives on the farm	E_{LIV}	–0.0915	0.0141	–0.0650	0.0208	0.0423	0.0647

Source: Research sample data.

Note: *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region *NE* = Northeast; *S&SP* = South region and São Paulo; *CB&Z* = Cross-breed or Zebu; *PH* = Pure Holstein; and *H&PE* = ¾ Holstein or other Pure European breeds.

Dairy production efficiency appears to be directly affected by location of the farm, measured by the distance in km to an urban area. For each 10 km in distance, inefficiency would be increased from 0.3% to 7%, in general. For Pure Holstein (PH), the elasticity is positive, but it may not be relevant, given that the coefficient for PH was not statistically significant. PH-farms may also be less affected by distance due to larger milk volumes of these farms, which reduces per unit transportation costs.

Whether farms have telephone and electricity appears to be important for decreasing inefficiency in dairy production. For electricity, all partial elasticities are negative, varying from –0.01 for Northeast to –0.87 for Pure Holstein farms. These elasticities suggest interaction (and balance) between infrastructure on the farm and use of better technology of production.

The ratio of farm output relative the total family income shows that off-farming employment or non-farm activities are highly related to performance of the dairy production activity. The elasticities vary from –0.46 for Southeast to –0.80 for Northeast among locations. For breed, the elasticity varies from –0.46 for Cross breed to –1.22 for Pure Holstein. A high elasticity for this variable suggests that more farm specialization is to be expected and, therefore, further reductions in number of farms. Particularly for dairy, this tendency is higher as the breed composition of the herd shifts from Cross breed (–0.45) to more milk-specialized breeds, such as PH.

Marketing, summarized by whether a farm sells to a cooperative and the time in days until payment is received, appears not to be significant in explaining inefficiency in production. The signs for cooperative are mostly positive, suggesting less efficiency is expected for farms working with cooperatives.

With respect to operator characteristics, age was not statistically significant in the models, but has a negative effect on efficiency. Higher education level, apparently with a negative effect on inefficiency, was also not statistically significant in the models.

Whether the operator is the owner seems to affect efficiency of dairy production in different ways, depending on specific breeds or location. For Southeast or Cross breed, inefficiency would decrease for farm owner-operator. For Pure Holstein, however, owner-operator increases inefficiency. This could perhaps happen because of specialized labor that is usually required for Pure Holstein farms and this to be gained through hired labor.

Whether the operator lives on the farm was a variable not statistically significant. The signs are mainly positive, suggesting that living on the farm is a characteristic that would probably not make the dairy more efficient.

Determinants of Efficient and Inefficient Dairy Farms

This part addresses objective (4), with the purpose to evaluate and characterize determinants of efficiency and inefficiency, according to predicted efficiency, inputs and explanatory factors for individual farms.

The procedure used is frequency distributions of predicted efficiencies evaluated for inputs, input productivities, and explanatory factors. For each variable (or group of variables), three tables are considered:

1. Weighted frequency, by efficiency intervals, for the whole sample – Technical efficiency intervals (rows) and classification variables (columns) are evaluated together, so that rows and column(s) sum to 100% to better evaluate the whole sample;
2. Frequency distribution, by efficiency intervals, for each column-variable – Technical efficiency intervals (rows) are considered, but each classification

variable (column) is evaluated separately, so that each column sums to 100% to better characterize the variable; and

3. Frequency distribution for ranks of efficiency – Technical efficiency ranks (rows) for the 10% percent least efficient farms; the 80% middle efficient farms; and the 10% top efficient farms, so that each row sums to 100% to better evaluate each group of farms.

Breed and Location

The frequency distribution of efficiency of farms by location and breed are presented in Tables 28, 29, 30 and 31.

In Table 28, 19% of the sample's most efficient farms (≥0.90) are located in the South region (S&SP). This represents about one-half of all producers from this region (Table 29).

Cross breed (CB&Z) represents the majority of the farms of the sample, 62% (Table 28). From all Pure Holstein farms, 73% are more than 0.90 efficient (Table 29).

From the 10% least efficient farms in the sample (Table 30):

- 3% are Pure Holstein farms; and
- 66% are located in the Northeast region:
  - 28% from Pernambuco (Table 31); and
  - 38% from Ceará (Table 31).

Table 28. Weighted Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Location and Breed.

Technical Efficiency	Total Sample		Frequency (%)					
			Regional Location			Breed Classification		
	Obs	(%)	SE&CW	NE	S&SP	CB&Z	PH	H&PE
< 0.50	18	2.3	1	1	0	1	0	1
0.51 – 0.60	65	8.4	2	6	0	5	0	4
0 .61 – 0.70	160	20.6	5	13	3	14	1	5
0.71 – 0.80	193	24.9	9	10	6	17	1	7
0.81 – 0.90	147	19.0	6	4	9	14	1	4
≥ 0.90	192	24.8	3	3	19	11	7	6
Total	775	100	25	37	38	62	10	28

Source: Research sample data.

Note: *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *NE* = Northeast; *S&SP* = South region and São Paulo; *CB&Z* = Cross-breed or Zebu; *PH* = Pure Holstein; and *H&PE* = ¾ Holstein or other Pure European breeds.

Table 29. Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Location and Breed.

Technical Efficiency	Total Sample		Frequency (%)					
			Regional Location			Breed Classification		
	Obs	(%)	SE&CW	NE	S&SP	CB&Z	PH	H&PE
< 0.50	18	2.3	5	3	0	1	1	5
0.51 – 0.60	65	8.4	7	16	1	8	1	13
0 .61 – 0.70	160	20.6	19	34	9	23	8	19
0.71 – 0.80	193	24.9	34	28	17	27	9	26
0.81 – 0.90	147	19.0	23	11	24	23	8	14
≥ 0.90	192	24.8	12	8	49	18	73	23
Total	775	100	100	100	100	100	100	100

Source: Research sample data.

Note: *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *NE* = Northeast; *S&SP* = South region and São Paulo; *CB&Z* = Cross-breed or Zebu; *PH* = Pure Holstein; and *H&PE* = ¾ Holstein or other Pure European breeds.

Table 30. Frequency Distribution of Ranked Predicted Efficiencies of Dairy Farms in Brazil by Location and Breed.

Technical Efficiency Rank	Total Sample Obs	Frequency (%)							
		Regional Location				Breed Classification			
		SE&CW	NE	S&SP	Total	CB&Z	PH	H&PE	Total
Bottom 10%	78	29	66	5	100	49	3	48	100
Middle 80%	619	26	38	36	100	68	6	26	100
Top 10%	78	13	2	85	100	21	50	29	100

Source: Research sample data.

Note: *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *NE* = Northeast; *S&SP* = South region and São Paulo; *CB&Z* = Cross-breed or Zebu; *PH* = Pure Holstein; and *H&PE* = ¾ Holstein or other Pure European breeds.

Table 31. Frequency Distribution of Farms by State, Regional Location, Breed Classification and Predicted Efficiency Rank.

Region Location and States	Sample	Region Location			Breed Classification			Efficiency Rank		
		SE&CW	NE	S&SP	H&PE	H&PE	H&PE	Bottom 10%	Middle 80%	Top 10%
S&CW										
Goiás (GO)	3	13	0	0	4	3	2	1	4	3
Minas Gerais (MG)	13	51	0	0	11	1	20	23	12	6
Rio de Janeiro (RJ)	4	16	0	0	6	1	1	4	4	1
Espírito Santo (ES)	5	20	0	0	6	0	5	1	6	3
NE										
Pernambuco (PE)	18	0	48	0	9	0	45	28	19	2
Ceará (CE)	19	0	52	0	29	0	5	38	19	0
S&SP										
São Paulo (SP)	5	0	0	14	5	5	6	0	5	12
Paraná (PR)	14	0	0	36	11	51	6	1	12	39
Santa Catarina (SC)	8	0	0	20	8	16	3	3	7	17
Rio Grande do Sul (RS)	11	0	0	30	11	23	7	1	12	17
Total	100	100	100	100	100	100	100	100	100	100

Source: Research sample data.

Note: *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; *CB&Z* = Cross-breed or Zebu; *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; and *S&SP* = South region and São Paulo.

From the top 10% efficient farms in the sample (Table 30):

- 50% are Pure Holstein farms;
- 2% are farms located in the Northeast region (Pernambuco); and
- 85% are farms located in the South region; and
  - 39% are from Paraná (Table 31);
  - 17% are from Santa Catarina (Table 31);
  - 17% are from Rio Grande do Sul (Table 31); and
  - 12% are from São Paulo (Table 31).

This analysis indicates that farms with Pure Holstein or farms located in the South region are the most efficient. Paraná is the State with more efficient farms (about 40%). The Northeast is the region where the farms are least efficient.

Size of the Herd, Production and Productivity

The frequency distribution of farms by number of cows per farm, production per farm per day, and production per farm per cow per day are shown in Tables 32, 33, and 34.

In the sample, 13% of the farms with technical efficiency equal to 0.90 (or more) are those producing equal to or more than 100 liters per day (Table 32). Specifically, for farms producing more than 100 liters per day, one-half are at least 0.90 efficient (Table 33).

For the 10% least efficient farms in the sample (Table 34):

- 60% are farms that have less than 10 cows;
- 71% are farms producing less than 20 liters per day;
- 87% are farms producing less than 50 liters per day;
- 83% are farms producing less than 3 liters per cow per day; and
- 95% are farms producing less than 5 liters per cow per day.

For the top 10% efficient farms in the sample (Table 34):

- 50% are farms that have less than 20 cows;
- 26% are farms that have more than 40 cows;
- 67% are farms producing more than 100 liters per day;
- 51% are farms producing more than 10 liters per cow per day; and
- 89% are farms producing more than 5 liters per cow per day.

Table 32. Weighted Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Number of Cows, Production per Day and Production per Day per Cow.

Technical Efficiency	Total Sample		Percent of Farms												
			Number of Cows					Liters per Day				Liters per Day per Cow			
	Obs	(%)	<10	10-20	20-30	30-40	≥40	<20	20-50	50-100	≥100	<3	3-5	5-10	≥10
< 0.50	18	2.3	1	0	0	0	0	2	0	1	0	2	0	0	0
0.50 – 0.60	65	8.4	5	2	1	0	1	6	2	1	0	7	1	0	0
0.60 – 0.70	160	20.6	8	6	1	2	3	8	7	3	2	15	2	3	0
0.70 – 0.80	193	24.9	8	6	4	2	4	5	9	5	6	13	7	4	1
0.80 – 0.90	147	19.0	7	5	2	2	3	0	7	4	5	4	8	5	1
≥ 0.90	192	24.8	8	8	3	2	5	3	7	5	13	2	5	10	8
Total	775	100	38	26	11	9	16	24	31	17	27	43	23	23	10

Source: Research sample data.

Table 33. Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Number of Cows, Production per Day and Production per Day per Cow.

Technical Efficiency	Total Sample		Percent of Farms												
			Number of Cows					Liters per Day				Liters per Cow per Day			
	Obs	(%)	<10	10-20	20-30	30-40	≥40	<20	20-50	50-100	≥100	<3	3-5	5-10	≥10
< 0.50	18	2.3	3	1	4	1	1	7	0	3	0	4	1	1	0
0.50 – 0.60	65	8.4	13	6	11	0	4	23	6	3	1	16	4	2	1
0.60 – 0.70	160	20.6	22	22	13	22	20	34	21	18	9	35	9	12	4
0.70 – 0.80	193	24.9	21	24	33	28	27	21	30	26	21	30	30	18	9
0.80 – 0.90	147	19.0	19	18	16	26	16	1	22	24	20	10	36	22	10
≥ 0.90	192	24.8	22	29	23	23	32	14	21	26	49	5	20	45	76
Total	775	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Research sample data.

Table 34. Frequency Distribution of Ranked Predicted Efficiencies of Dairy Farms in Brazil by Number of Cows, Production per Day and Production per Day per Cow.

Technical Efficiency Rank	Total Sample Obs	Percent of Farms												
		Number of Cows					Liters per Day				Liters per Cow per Day			
		<10	10-20	20-30	30-40	≥40	<20	20-50	50-100	≥100	<3	3-5	5-10	≥10
Bottom 10%	78	60	18	13	1	8	71	16	9	4	83	12	4	1
Middle 80%	619	37	27	10	9	15	21	35	19	25	43	27	23	6
Top 10%	78	26	24	13	12	26	3	18	13	67	4	6	38	51

Source: Research sample data.

This analysis indicates that inefficiency is not necessarily expressed by the number of cows per farm, given that 26% of the top 10% efficient farms have less than 10 cows per farm. Recall from Table 34 that almost 90% of the efficient farms produce more than 5 liters per cow per day, one can conclude that what actually matters is not the number of cows per farm, but the productivity per cow.

Pasture Land

Frequency distributions of farms by size of pasture land, production and number of cows per farm are shown in Tables 35, 36, and 37.

About one-half of the farms of the sample are (Table 35):

- With less than 2 hectares;
- Producing less than 1,000 liters per hectare per year; and
- With less than one cow per hectare.

About 14% of the sample farms (Table 35) producing more than 3,000 liters per hectare per year are farms at least 0.90 efficient. This represents 56% of all farms classified in this productivity category (Table 36). About one-half of the farms at least 0.90 efficient are farms with more than three cows per hectare.

For the 10% least efficient farms in the sample (Table 37):

- 57% are farms that have less than 2 hectares of pasture land;
- 81% are farms producing less than 1,000 liters per hectare of pasture;
- 97% are farms producing less than 3,000 liters per hectare of pasture; and
- 70% are farms that have less than one cow per hectare of pasture.

Table 35. Weighted Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Size of Pasture Land (ha), and Relations of Production and Cows per hectare.

Technical Efficiency	Total Sample		Percent of Farms										
			Area (ha) of Pasture Land				10^3 Liters per ha			Cows per ha			
	Obs	(%)	<2	2-5	5-20	≥20	<1	1-3	≥3	<1	1-2	2-3	≥3
< 0.50	18	2.3	1	0	0	1	2	0	0	2	0	0	0
0.50 – 0.60	65	8.4	5	2	2	0	7	2	0	6	2	1	0
0.60 – 0.70	160	20.6	10	3	5	3	16	4	1	14	4	2	1
0.70 – 0.80	193	24.9	10	5	4	6	15	6	4	15	6	2	2
0.80 – 0.90	147	19.0	10	2	3	4	6	7	6	8	6	3	2
≥ 0.90	192	24.8	11	3	6	6	3	8	14	9	7	4	5
Total	775	100	46	16	19	19	47	27	26	53	25	11	10

Source: Research sample data.

Table 36. Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Size of Pasture Land (ha), and Relations of Production and Cows per hectare.

Technical Efficiency	Total Sample		Percent of Farms										
			Area (ha) of Pasture Land				10^3 Liters per ha			Cows per ha			
	Obs	(%)	<2	2-5	5-20	≥20	<1	1-3	≥3	<1	1-2	2-3	≥3
< 0.50	18	2.3	3	2	1	3	4	0	1	3	1	2	1
0.50 – 0.60	65	8.4	10	12	8	2	14	6	1	11	7	5	3
0.60 – 0.70	160	20.6	21	21	24	15	33	14	5	26	16	14	13
0.70 – 0.80	193	24.9	21	33	22	30	31	24	14	28	24	19	16
0.80 – 0.90	147	19.0	21	15	16	21	12	27	23	15	24	27	19
≥ 0.90	192	24.8	24	17	29	29	6	29	56	17	28	33	48
Total	775	100	100	100	100	100	100	100	100	100	100	100	100

Source: Research sample data..

Table 37. Frequency Distribution of Ranked Predicted Efficiencies of Dairy Farms in Brazil by Size of Pasture Land (ha), and Relations of Production and Cows per hectare.

Technical Efficiency Rank	Total Sample Obs	Percent of Farms										
		Area (ha) of Pasture Land				10^3 Liters per ha			Cows per ha			
		<2	2-5	5-20	≥20	<1	1-3	≥3	<1	1-2	2-3	≥3
Bottom 10%	78	57	21	13	9	81	16	3	70	18	8	4
Middle 80%	619	45	16	19	20	48	30	22	55	26	11	8
Top 10%	78	40	12	24	24	6	15	79	27	29	17	27

Source: Research sample data.

For the top 10% efficient farms in the sample (Table 37):

- 40% are farms that have less than 2 hectares of pasture;
- 79% are farms producing more than 3,000 liters per hectare of pasture; and
- 73% are farms that have more than one cow per hectare of pasture.

This analysis indicates that quality of the pasture land is more critical for dairy efficiency production than number of hectares of pasture. A farm to be in the rank of the top 10% efficiency should be able to support more than one cow per hectare, or produce at least 3,000 liters per hectare per year.

Capital

Frequency distributions of farms by amount of capital (flow) per year, production per unit of capital, and the relationship of quantity of capital per cow and per unit of labor are shown in Tables 38, 39, and 40.

About one-half of the farms of the sample (Table 38) are farms:

- With cost of capital less than R$500/year;
- Producing less than 50 liters per Real in capital cost per year;
- With cost of capital per cow between R$10 and R$30; and
- With cost of capital per unit of labor less than R$2/day of labor.

About 50% of farms (Table 39) where the ratio of capital/day of labor is more than R$5 are 0.90 (or more) efficient.

Table 38. Weighted Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Capital, and the Relationships of Cost of Capital per Liter of Milk, per Cow and per Day of Labor.

Technical Efficiency	Total Sample		Percent of Farms											
			Capital per Year (R$/Year)			Liters per Real (Liters/R$)			Capital per Cow (R$/Cow)			Capital per Labor (R$/Day Labor)		
	Obs	(%)	<500	500-1000	≥1000	<50	50-100	≥100	<10	10-30	≥30	<2	2-5	≥5
< 0.50	18	2.3	1	0	1	2	0	0	0	0	1	2	0	0
0.50 – 0.60	65	8.4	7	1	1	6	1	1	2	4	2	6	1	0
0.60 – 0.70	160	20.6	14	3	3	13	4	4	5	9	6	14	5	2
0.70 – 0.80	193	24.9	16	4	4	11	6	8	7	11	7	16	6	3
0.80 – 0.90	147	19.0	14	3	2	5	6	8	5	9	5	11	5	3
≥ 0.90	192	24.8	16	5	6	5	7	13	2	11	11	9	7	9
Total	775	100	68	17	15	42	25	33	22	45	33	58	24	17

Source: Research sample data.

Note: R$ = Monetary values are expressed in Reals, 1998, when the exchange rate was about R$1.10 for US$1.00.

Table 39. Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Capital, and the Relationships of Cost of Capital per Liter of Milk, per Cow and per Day of Labor.

Technical Efficiency	Total Sample		Percent of Farms											
			Capital per Year (R$/Year)			Liters per Real (Liters/R$)			Capital per Cow (R$/Cow)			Capital per Labor (R$/Day Labor)		
	Obs	(%)	<500	500-1000	≥1000	<50	50-100	≥100	<10	10-30	≥30	<2	2-5	≥5
< 0.50	18	2.3	2	1	4	5	0	0	1	1	4	3	2	1
0.50 – 0.60	65	8.4	10	4	5	13	6	4	10	8	7	11	6	2
0.60 – 0.70	160	20.6	21	21	17	31	16	11	23	21	19	24	19	12
0.70 – 0.80	193	24.9	24	25	27	27	24	23	33	25	20	28	23	16
0.80 – 0.90	147	19.0	20	21	11	12	26	24	22	20	16	19	20	19
≥ 0.90	192	24.8	23	28	36	12	28	38	11	25	34	15	30	50
Total	775	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Research sample data.

Table 40. Frequency Distribution of Ranked Predicted Efficiencies of Dairy Farms in Brazil by Capital, and the Relationships of Cost of Capital per Liter of Milk, per Cow and per Day of Labor.

Technical Efficiency Rank	Total Sample	Percent of Farms											
		Capital per Year (R$/Year)			Liters per Real (Liters/R$)			Capital per Cow (R$/Cow)			Capital per Labor (R$/Day Labor)		
	Obs	<500	500-1000	≥1000	<50	50-100	≥100	<10	10-30	≥30	<2	2-5	≥5
Bottom 10%	78	79	8	13	76	14	10	23	42	35	77	18	5
Middle 80%	619	70	17	13	42	25	33	24	46	30	60	24	16
Top 10%	78	45	20	35	17	29	54	3	42	55	26	32	42

Source: Research sample data.

For the 10% least efficient farms in the sample (Table 40):

- 79% are farms where the cost of capital per farm is below R$500 per year;
- 76% are farms producing less than 50 liters per Real in capital cost per year; and
- 77% are farms where the ratio of cost of capital/day of labor is less than R$2.

For the top 10% efficient farms in the sample (Table 40):

- 54% are farms producing more than 100 liters per Real in capital costs per year;
- 55% are farms where the cost of capital per cow is higher than R$30 per year; and
- 42% are farms where the ratio cost of capital/day of labor is higher than R$5.

This analysis indicates that quantity of capital, expressed here in a flow concept (R$/year/farm, at 4% per annum), is not a strong determinant of efficiency. However, more restrictive for the production system may be the way capital is combined with respect to number of cows and quantity of labor. For instance, for more efficiency one should consider a ratio of not less than R$2/day of labor, or a production not below 50 liters per unit of capital (flow) per year.

Labor

Frequency distributions of farms by number of workers[43], production and cows per worker, and the ratio of area of pasture land per worker are shown in Tables 41, 42, and 43.

About one-half of the sample (Table 41) are farms:

- With less than one full-time equivalent worker; and
- Producing less than 50 liters per day per full-time equivalent worker.

About 18% of the farms of the sample (Table 41) produce more than 100 liters per worker per day and are 0.90 (or more) efficient. This represents almost 60% of all farms producing 100 liters or more per worker per day (Table 42).

About 10% of the sample of farms have more than 30 cows per worker and have 0.90 or better efficiency (Table 41).

For the 10% least efficient farms in the sample (Table 43):

- 94% are farms producing less than 50 liters per full-time equivalent worker;
- 1% are farms producing more than 100 liters per full-time equivalent worker;
- 81% are farms with less than 20 cows per full-time equivalent worker; and
- 51% are farms with less than one hectare of pasture land per full-time equivalent worker.

[43] Workers are measured in days per year of full-time equivalent units. A full-time worker was defined as an adult male working 8 hours per day, 5 days per week, equivalent to 250 days per year.

Table 41. Weighted Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Number of Workers, and Relationships with Production, Number of Cows and Pasture Land per Worker.

Technical Efficiency	Total Sample		Percent of Farms: Number of Workers				Liters per Day per Worker			Cows Per Worker				Hectares per Worker		
	Obs	(%)	<1	1-2	2-3	≥3	<50	50-100	≥100	<10	10-20	20-30	≥30	<1	1-5	≥5
< 0.50	18	2.3	1	1	1	0	2	0	0	2	1	0	0	1	1	1
0.50 – 0.60	65	8.4	4	3	1	1	8	0	0	5	2	1	1	4	3	1
0.60 – 0.70	160	20.6	11	6	2	2	16	3	2	8	6	3	5	9	7	5
0.70 – 0.80	193	24.9	11	6	4	3	14	7	4	8	8	2	7	9	8	8
0.80 – 0.90	147	19.0	11	3	3	2	5	7	7	4	4	4	6	7	7	5
≥ 0.90	192	24.8	14	4	2	5	2	5	18	5	5	4	10	9	7	8
Total	775	100	50	23	14	13	47	22	31	30	26	15	29	39	34	27

Source: Research sample data.

Note: Worker = a full-time adult male working 8 hours per day, 5 days per week, equivalent to 250 days per year.

Table 42. Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Number of Workers, and Relationships with Production, Number of Cows and Pasture Land per Worker.

Technical Efficiency	Total Sample		Percent of Farms: Number of Workers				Liters per Day per Worker			Cows Per Worker				Hectares per Worker		
	Obs	(%)	<1	1-2	2-3	≥3	<50	50-100	≥100	<10	10-20	20-30	≥30	<1	1-5	≥5
< 0.50	18	2.3	1	5	5	1	5	0	0	5	2	2	0	3	2	2
0.50 – 0.60	65	8.4	7	13	9	5	16	2	0	15	9	5	3	10	10	4
0.60 – 0.70	160	20.6	21	26	18	14	35	13	5	25	22	19	16	22	22	18
0.70 – 0.80	193	24.9	22	27	31	27	30	30	14	26	30	17	23	23	24	29
0.80 – 0.90	147	19.0	22	14	21	16	10	31	24	14	17	27	22	19	21	17
≥ 0.90	192	24.8	27	15	16	37	4	24	57	15	20	30	36	23	21	30
Total	775	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Research sample data.

Note: Worker = a full-time adult male working 8 hours per day, 5 days per week, equivalent to 250 days per year.

Table 43. Frequency Distribution of Ranked Predicted Efficiencies of Dairy Farms in Brazil by Number of Workers, and Relationships with Production, Number of Cows and Pasture Land per Worker.

Efficiency Technical Rank	Total Sample Obs	Percent of Farms: Number of Workers				Liters per Day per Worker			Cows Per Worker				Hectares per Worker		
		<1	1-2	2-3	≥3	<50	50-100	≥100	<10	10-20	20-30	≥30	<1	1-5	≥5
Bottom 10%	78	36	41	17	6	94	5	1	52	29	10	9	51	23	26
Middle 80%	619	51	23	14	12	47	25	28	29	27	14	30	38	24	38
Top 10%	78	55	13	10	22	3	10	87	15	17	26	42	32	14	54

Source: Research sample data.

Note: Worker = a full-time adult male working 8 hours per day, 5 days per week, equivalent to 250 days per year.

For the top 10% efficient farms in the sample (Table 43):

- 55% are farms producing with less than one full-time equivalent worker;
- 87% are farms producing more than 100 liters per full-time equivalent worker;
- 68% are farms with more than 20 cows per full-time equivalent worker; and
- 54% are farms with more than 5 hectares of pasture land per full-time equivalent worker.

This analysis indicates that quantity of labor relative to number of cows, and production per worker are determinants for efficiency for dairy production systems. A farm would be more efficient if the ratio of production per worker were not less than 50 liters per day or with not less than 20 cows per worker.

Concentrated Feed

Frequency distributions of farms by other variable costs per cow per year, production per unit of variable costs, and quantity of concentrated feed per cow are shown in Tables 44, 45, and 46.

About one-half of the farms of the sample (Table 44) are farms that feed less than one kg of concentrated feed per cow per day.

About 43% of the farms (Table 45) with variable costs per cow per year of more than R$50 are 0.90 (or more) efficient.

Table 44. Weighted Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Variable Costs per Cow, Production per Unit of Cost and Quantity of Concentrated Feed per Cow per Day.

Technical Efficiency	Total Sample		Percent of Farms: Variable Costs per Cow (R$/Cow/Year)			Liters per Real of Cost (Liters/R$)			Concentrated Feed per Cow per Day (kg)			
	Obs	(%)	<20	20-50	≥50	<20	20-50	≥50	<1	1-2	2-3	≥3
< 0.50	18	2.3	2	0	0	1	0	1	2	1	0	0
0.50 – 0.60	65	8.4	4	2	2	4	2	2	5	3	1	0
0.60 – 0.70	160	20.6	9	8	4	7	6	7	9	8	2	2
0.70 – 0.80	193	24.9	8	9	8	7	10	8	14	7	2	2
0.80 – 0.90	147	19.0	5	7	7	3	8	7	11	3	3	1
≥ 0.90	192	24.8	4	5	16	5	10	10	11	5	5	4
Total	775	100	31	31	38	27	38	35	51	27	13	9

Source: Research sample data.

Table 45. Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Variable Costs per Cow, Production per Unit of Cost and Quantity of Concentrated Feed per Cow per Day.

Technical Efficiency	Total Sample		Percent of Farms: Variable Costs per Cow (R$/Cow/Year)			Liters per Real of Cost (Liters/R$)			Concentrated Feed per Cow per Day (kg)			
	Obs	(%)	<20	20-50	≥50	<20	20-50	≥50	<1	1-2	2-3	≥3
< 0.50	18	2.3	5	1	1	3	1	4	3	3	0	0
0.50 – 0.60	65	8.4	13	7	5	15	6	6	9	12	6	0
0.60 – 0.70	160	20.6	29	24	11	27	17	19	17	29	19	19
0.70 – 0.80	193	24.9	25	28	22	26	27	22	27	27	16	18
0.80 – 0.90	147	19.0	16	23	18	12	22	21	22	12	23	15
≥ 0.90	192	24.8	12	17	43	17	27	28	22	17	36	48
Total	775	100	100	100	100	100	100	100	100	100	100	100

Source: Research sample data.

Table 46. Frequency Distribution of Ranked Predicted Efficiencies of Dairy Farms in Brazil by Variable Costs per Cow, Production per Unit of Cost and Quantity of Concentrated Feed per Cow per Day.

Efficiency Technical Rank	Total Sample Obs	Percent of Farms: Variable Costs per Cow (R$/Cow/Year)			Liters per Real of Cost (Liters/R$)			Concentrated Feed per Cow per Day (kg)			
		<20	20-50	≥50	<20	20-50	≥50	<1	1-2	2-3	≥3
Bottom 10%	78	53	22	25	48	21	31	58	36	6	0
Middle 80%	619	31	34	35	27	39	34	51	28	12	9
Top 10%	78	7	17	76	13	54	33	47	9	23	21

Source: Research sample data.

For the 10% least efficient farms in the sample (Table 46):

- 53% have variable costs per cow per year of less than R$20;
- 48% produce less then than 20 liters per Real of variable costs; and
- 58% feed less than one kg of concentrated feed per cow per day.

For the top 10% efficient farms in the sample (Table 46):

- 76% have variable costs per cow per year of more than R$50;
- 54% produce between 20 and 50 liters per unit (R$) of variable costs;
- 47% feed less than one kg of concentrated feed per cow per day; and
- 44% feed more than 2 kg of concentrated feed per cow per day.

This analysis indicates that other variable costs, expressed here by veterinarian products, technical assistance and energy, is related to farm efficiency. Efficient farms appear to spend about R$50/cow/year and produce between 20 and 50 liters per Real of cost per year.

For concentrated feed, the results indicate that the optimal quantity to be fed should consider the potential of the breed or a specific volume of milk to be produced per kg of concentrated feed used. In general, Northeast is the region where the producers appear to be the least efficient among locations. However, the average consumption of concentrated feed per cow per day was relatively high, about 1.3 kg/cow/day, if compared with the top 10% efficient farms, where the consumption was 1.5 kg/cow/day. For Gomes (1999), studying the Brazilian changes in dairy production, the least productive farms were using concentrated feed beyond the optimal, increasing variable costs and decreasing efficiency. According to Alves (1999), inefficiency of Brazilian dairy producers rely more on the genetic quality than on feed quality.

Ratios of Dairy and Farm Outputs and Family Labor Efficiency

Frequency distributions of farms by the ratios of the dairy output relative to total farm output, farm output relative to total family income, and family labor to total labor are shown in Tables 47, 48, and 49.

About 60% of the farms in the sample have a ratio of dairy output to farm output ≤0.50 and 40% have a ratio greater than 0.50 (Table 47).

For the ratio of farm output to total family income, 24% of the sample is 0.90 (or more) efficient and have a ratio of farm output to family income of more than 0.75. Farms with more than 75% of farm output to family income represent 67% of the sample.

Of farms where the ratio of farm output to family income (Table 48) is lower than 0.25, about 99% have efficiency of 0.70 or less. For more than one-half of the farms of the sample, family labor is more than 75% of total labor (Table 47).

For the 10% least efficient farms in the sample (Table 49):

- 77% are farms where farm output is less than 50% of total family income; and
- 62% are farms where family labor is more than 75% of total labor.

For the top 10% efficient farms in the sample (Table 49):

- 100% are farms where farm output is more than 75% of total family income;
- 40% are farms where family labor is less than 50% of total labor; and
- 51% are farms where family labor is more than 75% of total labor.

Table 47. Weighted Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by The Ratio of Dairy to Farm Output, Ratio of Farm Activity to Income and Family Labor to Total Labor.

Technical Efficiency	Total Sample		Percent of Farms											
			Ratio of Dairy/Total Output				Ratio of Farm/ Output/Income				Ratio of Family/Total Labor			
	Obs	(%)	<.25	.25-.50	.50-.75	≥..75	<.25	.25-.50	.50-.75	≥.75	<.25	.25-.50	.50-.75	≥.75
< 0.50	18	2.3	0	0	1	1	2	0	0	0	1	1	0	1
0.50 – 0.60	65	8.4	2	2	2	2	1	5	2	1	1	1	1	6
0.60 – 0.70	16	20.6	6	6	4	4	1	4	7	8	2	5	4	9
0.70 – 0.80	19	24.9	7	7	6	5	0	2	5	17	4	5	4	12
0.80 – 0.90	14	19.0	8	5	3	3	0	0	3	16	3	3	2	10
≥ 0.90	19	24.8	11	6	3	5	0	0	1	24	5	3	3	13
Total	77	100	33	27	19	20	4	12	17	67	16	17	15	52

Source: Research sample data.

Table 48. Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by The Ratio of Dairy to Farm Output, Ratio of Farm Activity to Income and Family Labor to Total Labor.

Technical Efficiency	Total Sample		Percent of Farms											
			Ratio of Dairy/Total Output				Ratio of Farm Output/Income				Ratio of Family/Total Labor			
	Obs	(%)	<.25	.25-.50	.50-.75	≥..75	<.25	.25-.50	.50-.75	≥.75	<.25	.25-.50	.50-.75	≥.75
< 0.50	18	2.3	0	1	4	6	45	4	0	0	4	4	2	2
0.50 – 0.60	65	8.4	6	8	10	11	19	41	9	2	5	6	6	11
0.60 – 0.70	16	20.6	18	23	23	20	35	37	39	12	15	28	28	18
0.70 – 0.80	19	24.9	20	27	30	25	0	14	32	26	23	30	28	23
0.80 – 0.90	14	19.0	23	18	17	15	0	3	15	24	21	17	16	20
≥ 0.90	19	24.8	33	23	16	23	1	1	5	36	32	15	20	26
Total	77	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Research sample data.

Table 49. Frequency Distribution of Ranked Predicted Efficiencies of Dairy Farms in Brazil by The Ratio of Dairy to Farm Output, Ratio of Farm Activity to Income and Family Labor to Total Labor.

Technical Efficiency Rank	Total Sample Obs	Percent of Farms											
		Ratio of Dairy/Total Output				Ratio of Farm Output/Income				Ratio of Family/Total Labor			
		<.25	.25-.50	.50-.75	≥..75	<.25	.25-.50	.50-.75	≥.75	<.25	.25-.50	.50-.75	≥.75
Bottom 10%	78	19	25	26	30	26	51	13	10	13	13	12	62
Middle 80%	619	33	28	20	19	2	8	20	70	15	18	16	51
Top 10%	78	41	28	10	21	0	0	0	100	27	13	9	51

Source: Research sample data.

This analysis confirms, as discussed previously, that the ratio of dairy output to total output seems not to have significant effect on the production frontier, indicating that other non-dairy farm activities do not increase inefficiency.

However, the ratio of farm output to total family income has positive and significant effect on dairy production efficiency. It indicates that off-farm employment and/or other non-farm activities decrease efficiency of dairy. With respect to effects of this variable on production efficiency, the elasticity was very high (-1.22) for Pure Holstein (refer to Table 27) suggesting more specialization could be expected for Pure Holstein dairy farms.

As discussed above, family labor seems not to be more efficient than hired labor.

Age and Education of the Operator and Distance

Frequency distributions of farms by age and education level of the operator, distance from urban area to the farm, and days until production payment are shown in Tables 50, 51, and 52.

About 13% of the sample (Table 50) are farm operators between 30-50 years of age and are 0.90 (or more) efficient. Farms with operators 60 years old or more are about 33% of the total sample and about half have an efficiency less than 0.70 and half have an efficiency 0.70 or better.

About one-half of the sample (Table 50) refers to farms:

- Located between 10 and 30 km from a urban area; and
- Where the payments for production are received after twenty or more days.

Table 50. Weighted Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Age and Education Level of the Operator, Distance from Urban Area to the Farm and Days Until Production Payment.

Technical Efficiency	Total Sample		Percent of Farms												
			Age of the Operator (Years)				Education of the Operator (Years)			Distance from Urban Area (km)			Days Until Payments		
	Obs	(%)	<30	30-50	50-60	≥60	<3	3-5	≥5	<10	10-30	≥30	<10	10-20	≥20
< 0.50	18	2.3	0	0	1	1	2	1	0	0	1	1	1	0	1
0.50 – 0.60	65	8.4	0	2	2	5	6	2	1	1	4	4	6	1	1
0.60 – 0.70	160	20.6	1	6	4	10	11	6	3	4	10	7	9	5	7
0.70 – 0.80	193	24.9	1	8	8	8	10	10	6	5	14	6	8	5	12
0.80 – 0.90	147	19.0	1	9	5	5	6	8	5	5	12	2	6	2	11
≥ 0.90	192	24.8	1	13	6	4	4	10	11	10	13	2	5	4	15
Total	775	100	3	38	26	33	38	37	25	25	53	22	36	16	47

Source: Research sample data.

Table 51. Frequency Distribution of Predicted Efficiencies of Dairy Farms in Brazil by Age and Education Level of the Operator, Distance from Urban Area to the Farm and Days Until Production Payment.

Technical Efficiency	Total Sample		Percent of Farms												
			Age of the Operator (Years)				Education of the Operator (Years)			Distance from Urban Area (km)			Days Until Payments		
	Obs	(%)	<30	30-50	50-60	≥60	<3	3-5	≥5	<10	10-30	≥30	<10	10-20	≥20
< 0.50	18	2.3	0	1	2	3	4	2	1	1	2	5	4	0	2
0.50 – 0.60	65	8.4	4	4	7	15	15	6	3	5	7	16	17	4	3
0.60 – 0.70	160	20.6	21	15	17	30	30	17	13	15	19	30	26	28	14
0.70 – 0.80	193	24.9	17	21	32	25	26	26	22	21	26	27	22	32	25
0.80 – 0.90	147	19.0	17	24	18	15	15	23	19	20	22	11	16	10	24
≥ 0.90	192	24.8	41	35	24	12	10	26	42	38	24	11	15	26	32
Total	775	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Research sample data.

Table 52. Frequency Distribution of Ranked Predicted Efficiencies of Dairy Farms in Brazil by Age and Education Level of the Operator, Distance from Urban Area to the Farm and Days Until Production Payment.

Efficiency Technical Rank	Total Sample Obs	Percent of Farms												
		Age of the Operator (Years)				Education of the Operator (Years)			Distance from Urban Area (km)			Days Until Payments		
		<30	30-50	50-60	≥60	<3	3-5	≥5	<10	10-30	≥30	<10	10-20	≥20
Bottom 10%	78	1	18	25	56	65	27	8	11	47	42	73	6	21
Middle 80%	619	3	38	27	32	38	37	25	24	55	21	35	17	48
Top 10%	78	5	57	19	19	12	46	42	47	45	8	11	22	67

Source: Research sample data.

For the 10% least efficient farms in the sample (Table 52):

- 56% are farms where the age of the operator is more than 60 years;
- 65% are farms where the operator has less than 3 years of formal education;
- 89% are farms located more than 10 km from an urban area; and
- 73% are farms where the payments for the production are received within 10 days.

For the top 10% efficient farms in the sample (Table 52):

- 57% are farms where the age of the operator is between 30 and 50 years old;
- 42% are farms where the education level of the operator is more than 5 years;
- 8% are farms located more than 30 km from an urban area; and
- 67% are farms where the payments for production are received after 20 days.

This analysis shows that younger and more educated operators tend to be more efficient. Farms with operators more than 60 years old, or with operators with less than 3 years of formal education are the least efficient. Distance from the farm to an urban area seems to have negative effect on production efficiency. Days until production payment seems not to be relevant for production efficiency.

Characterization of the Determinants of Efficiency and Inefficiency

This part addresses objective 4, and is discussed in two parts: the first pertains to the dairy production system and the second to exogenous explanatory factors.

Average measures of dairy production inputs and their interrelationships with predicted efficiency ranks are presented in Table 53.

Overall, comparisons of the absolute magnitudes of the average measurements for the variables considered (columns of Table 53) indicate that there exists similarity captured by the classifications for breed and location and the ranked efficiency criteria.

Considering the criterion of comparing the 10% least efficient farms of the sample, results show that, among breeds, the Cross breed are least efficient in production; and for location, there exists a high similarity between the average measurements for almost all variables considered for Northeast.

In comparing efficiency by the criterion of the top 10% most efficient farms of the sample (average efficiency equal to 0.97), results show that Pure Holstein (PH) is the breed that matches very closely the characteristics of efficient farms (average efficiency equal to 0.90); and for location, the average measurements of the variables for producers located in the South (S&SP) region (average efficiency equal to 0.86) are similar to the efficient set of farms.

Table 53. Average Measures of Dairy Production Inputs and their Interrelationships with Efficiency and Inefficiency in Brazil by Regional Location, Breed Classification and Predicted Efficiency Rank.

Variable	Sample	Region Location			Breed Classification			Efficiency Rank		
		SE& CW	NE	S&SP	CB&Z	PH	H&PE	Bottom 10%	Middle 80%	Top 10%
Average Technical Efficiency	0.77	0.75	0.70	0.86	0.76	0.90	0.75	0.54	0.78	0.97
Income Composition										
Dairy output (R$1,000/year)	9,882	12,090	7,470	10,781	5,606	24,409	13,956	2,149	7,467	36,715
Farm output (R$1,000/year)	28,861	39,025	12,947	37,689	21,873	65,904	30,718	4,145	23,471	96,104
Family income (R$1,000/year)	33,479	46,618	17,349	40,555	26,548	68,743	35,854	11,623	28,034	98,338
Specialization										
Ratio dairy to farm output	0.45	0.51	0.52	0.33	0.40	0.38	0.57	0.57	0.44	0.40
Ratio farm output to income	0.80	0.77	0.73	0.89	0.80	0.93	0.75	0.41	0.83	0.97
Ratio family labor to total labor	0.67	0.43	0.67	0.82	0.67	0.71	0.64	0.72	0.67	0.63
Farm Size										
Total capital stock (R$1,000)	68	142	27	60	56	108	79	35	63	145
Total area of farming land (ha)	123	157	174	49	139	73	106	114	123	126
Total herd (Number)	48	83	44	30	46	46	55	28	48	74
Dairy Size										
Production per day (liters/day)	105	139	70	118	62	249	146	23	82	370
Number of cows	23	41	19	16	22	24	26	13	23	35
Pasture land (ha)	23	66	10	9	23	13	27	7	24	35
Dairy Inputs per Cow										
Capital (R$/cow/year)	32	40	24	36	32	47	29	48	29	44
Total labor (Days/cow/year)	28	21	48	13	24	12	43	58	26	14
Family labor (Days/cow /year)	19	9	32	10	16	8	27	42	17	9
Variable costs (R$/cow /year)	61	56	39	86	53	113	60	43	57	116
Veterinarian (R$/cow /year)	20	16	12	33	14	33	25	13	15	46
Concentrated feed (kg/cow/day)	1.05	0.87	1.26	0.97	0.99	1.17	1.15	0.68	1.04	1.51
Number of Cows per Input										
Cows per worker	29	39	12	40	29	41	27	12	31	37
Cows per hectare	1.39	0.98	0.89	2.15	1.26	2.65	1.21	0.94	1.32	2.41
Dairy Production (liters)										
Liters per cow per day	4.7	3.4	4.0	6.1	3.5	9.1	5.5	1.9	4.3	10.2
Liters per hectare per year	2,694	1,222	1,235	5,089	1,776	8,733	2,514	638	2,115	9,323
Liters per worker per day	109	86	28	204	88	309	82	17	96	301
Liters per unit of capital	110	61	159	94	95	96	147	47	117	118
Liters per unit of variable costs	69	36	115	47	67	44	83	45	75	47
Prices										
Milk (R$/liter)	0.26	0.24	0.32	0.20	0.27	0.22	0.24	0.29	0.25	0.23
Cow (R$/cow)	315	340	293	320	285	434	336	295	301	443
Land (R$/ha)	1,481	1,604	283	2,570	1,362	2,986	1,198	770	1,426	2,619
Family labor (R$/day)	15	19	5	23	10	45	16	15	12	38
Hired labor (R$/day)	8	7	4	11	7	13	7	5	7	12
Concentrated feed (R$/t)	133	135	156	111	135	111	138	145	134	114

Source: Research sample data.

Note: *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region *NE* = Northeast; *S&SP* = South region and São Paulo; *CB&Z* = Cross-breed or Zebu; *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; R$ = Monetary values are expressed in Reals, 1998, when the exchange rate was about R$1.10 for US$1.00; and the cost of capital was based on an annual interest rate of 4%.

However, the average prices for milk were lower for the top 10% most efficient farms, as well as for farms with Pure Holstein (R$0.22/liter) and farms located in the South region (R$0.20/liter). This result was a surprise and contradicts the expectation and findings of previous research conducted in Brazil, such as Gomes (1999 pp. 122 and 146) and Souza (2000). Ceará (Northeast) was the state with the higher average price (R$0.39/liter), and the states of the South region were those with the lowest average prices. For Santa Catarina and Rio Grande do Sul the average price was R$0.19/liter; producers from Paraná received R$ 0.20/liter and São Paulo R$0.23/liter. This result may be explained by direct competition with imports of fluid milk from Argentina and Uruguay, affecting the States of the South region, closer to these countries.

From previous discussion and considering Table 53, some variables appear to be critical in determining the boundary limits between efficiency and inefficiency, and others may be not as critical as expected.

For the sample studied, the following variables seem to have primary effects on efficient or inefficient production:

1. Dairy output – For the efficient farms, the average output was almost R$37,000, about five times higher that the 80% middle efficient farms.

2. Farm output to family income ratio – The average ratio for the efficient set was 0.97, and for the inefficient 0.41, indicating that dairy farm families less dependent on other farm income are more efficient. In other words, more specialized dairy farms are more efficient.

3. Volume – Production per day per farm seems to be critical with respect to efficiency. Volume is significantly more important than number of cows, if

breed is considered. For the 80% middle efficient farms, the average was 82 liters per day; for the bottom 10%, 23 liters; and the top 10% produce 370 liters per day, on average. Pure Holstein farms produce about 250 liters per day, and the average for the total sample was about 105 liters per farm per day. This suggests that at least 200 liters per farm/day is required for reasonable efficiency.

4. Total labor – Efficiency is reflected by the productivity of labor. Labor availability seems not to be critical to dairy production. However, excess labor relative to number of cows is shown to be critical. The average labor per cow per year was 28 days, which is twice the quantity used by Pure Holstein farms, as well as the top 10% most efficient group. This analysis suggests that a balance of more than 20 days/cow/year would tend toward inneficiency.

5. Cows per worker – For the sample, the number of cows per worker was 29. However, the least efficient had 12 cows/worker. About 41 cows per worker are shown for Pure Holstein farms, and 37 per worker for the top 10%, which suggests that from 35 to 40 cows/worker is expected for the efficient farm.

6. Cows per hectare – Quality of pasture land is expressed for the Pure Holstein as well as for the top 10% farms by 2.65 and 2.41 cows/ha, respectively. The average for the sample is 1.4 cows/ha, and the least efficient group is about 1.0 cow per hectare.

7. Production per worker – For the 10% least efficient farms, 17 liters per worker per day is shown; for the 80% middle efficient, almost 100 liters/worker/day. For the South region, it was about 200, and for Pure Holstein farms, as well as

for the top 10%, it is about 300 liters per worker. The results suggest that productivity between 200 and 300 liters/worker/year indicates efficiency, considering labor as a single input.

8. Production per hectare – While the less efficient farms were producing about 600 liters per hectare per year, producers for the South showed about 5,000; Pure Holstein, almost 9,000; and the top 10% efficient farms, more than 9,000 liters per hectare per year. This suggests that the quality of the pasture land is a critical factor. On average, a farm should be able to produce 5,000 liters of milk per hectare of pasture land per year to be considered more efficient than the average.

9. Production per cow – This is probably the most important parameter to be evaluated. Farms from the South region appear to produce 6 liters/cow/day; Pure Holstein, 9 liters/cow/day; and the top 10% efficient farms about 10 liters per cow per day. This result is closely related to breed. Based on the sample, a farm is considered efficient under Brazilian conditions if an average of about 8 liters per cow per day is obtained.

10. Prices for labor – Pure Holstein farms and the top 10% efficient farms are paying twice the price of hired labor compared to groups of less efficient farms. This may be an indication that more efficient dairy farms probably relay more on fixed and/or specialized hired labor.

11. Prices for inputs – The prices of concentrated feed, among regions and breeds, are a good indication of efficiency and ability of the farmer to reduce production costs. There are clear differences among the groups with respect to

the average price paid for concentrated feed. The most efficient farms paid, on average, R$114/t for concentrated feed versus R$145/t for the least efficient farms. Pure Holstein farms paid R$111/t versus R$133/t for the sample average.

12. Prices for milk – The highest average milk price is received by producers located in the Northeast (the least efficient region), and lowest in states located in the South. The competition due to imported fluid milk from Argentina and Uruguay seems to be affecting prices received by producers in the South. Moreover, producers from the South were more efficient, in general.

Measures of explanatory factors for the efficiency of dairy farms are shown in Table 54. An overall examination of the distribution of farms classified by location, three similarities can be identified: Northeast (NE) with the 10% least efficient farms; Southeast (S&CW) with the 80% middle efficient group; and South (S&SP) with the top 10% efficient rank. This is consistent with other efficiency determinants discussed above, for the production frontier.

From the explanatory variables considered for 'dairy technology', three appear not to be identified with differences in efficiency. For the sample considered, it seems that whether the farm uses sugar cane, cut grass, or concentrated feed does not affect efficiency. For concentrated feed, however, recall from Table 53 that the quantity per cow per day for Northeast (1.26), Pure Holstein (1.17), and the top 10% (1.51) did not differ in absolute value. Note however, that the Northeast appears to be the least efficient region in all results discussed above. This indicates that differences in efficiency, in the case of sugar cane, grass and concentrated feed, is more related to factors other than the use itself, such as breed, animal health, and the way the feeds are combined.

Table 54. Average Measures of Explanatory Factors for the Efficiency of Dairy Farms in Brazil by Region Location, Breed Classification and Predicted Efficiency Rank.

Variable	Sample	Region Location			Breed Classification			Efficiency Rank		
		SE& CW	NE	S&SP	CB&Z	PH	H&PE	Bottom 10%	Middle 80%	Top 10%
Dairy Technology										
Artificial insemination (%)	23	15	1	50	16	89	14	1	17	90
Pasture rotation (%)	31	29	16	48	31	73	18	10	30	67
Pasture fertilization (%)	28	10	19	48	25	72	16	5	26	60
Use of mechanical milking (%)	13	4	0	33	7	68	8	1	9	60
Use of silage (%)	19	13	4	38	15	53	15	1	17	54
Use of sugar cane (%)	18	49	2	13	16	14	23	13	18	23
Use of cut grass (%)	53	49	57	52	50	48	63	55	52	60
Use of concentrated feed (%)	57	49	74	47	56	52	62	56	57	63
Farm Infrastructure										
Distance from urban area (km)	21	19	31	12	23	12	20	32	21	13
Telephone (%)	14	13	4	25	11	42	11	9	10	51
Electricity (%)	82	92	59	100	80	99	83	66	82	100
Car (%)	53	63	21	79	51	87	47	22	52	95
Farming Activity										
Sell to a cooperative (%)	37	49	2	62	32	72	34	21	36	55
Days until payment (days)	17	23	5	25	17	23	14	8	17	24
Soil conservation (%)	15	3	0	39	13	47	9	1	14	41
Reforest (%)	23	22	0	46	21	54	16	5	22	51
Operator Characteristics										
Age of the operator (years)	53	57	55	49	54	49	53	61	53	47
Operator education (years)	3.8	4.4	2.5	4.7	3.8	5.7	3.3	2.2	3.9	5.2
Desire to change breed (%)	77	81	88	64	81	32	85	90	79	49
Desire to be trained (%)	33	40	20	40	28	54	35	14	33	51
Technical courses (%)	6	4	0	15	4	20	6	0	5	24
Read technical newspaper (%)	4	8	1	5	3	9	3	2	3	10
Technical programs on TV (%)	40	42	42	38	37	41	47	27	42	41
Migration										
Operator is the owner (%)	89	92	82	96	87	99	91	78	90	95
Live on the farm (%)	81	55	89	91	81	91	78	87	80	84
Intends to move (%)	12	11	10	14	12	9	13	18	11	12

Source: Research sample data.

Note: *PH* = Pure Holstein; *H&PE* = ¾ Holstein or other Pure European breeds; *CB&Z* = Cross-breed or Zebu; *NE* = Northeast; *SE&CW* = Southeast region without São Paulo and the State of Goiás, from Central-West region; and *S&SP* = South region and São Paulo.

With respect to the operator, technical programs on television and whether the operator is the owner or lives on the farm does not affect the rank of efficiency.

For the 10% least efficient farms, on average:

1. Technology:

    - 1% use artificial insemination;
    - 10% use pasture rotation;
    - 5% use pasture fertilization;
    - 1% use mechanical milking; and
    - 1% use silage.

2. Farm infrastructure:

    - Farms are of a distance of about 32 km from an urban area, on average;
    - 9% have telephone;
    - 66% have electricity; and
    - 22% have a car.

3. Farming activity:

    - 21% sell to cooperative.

4. Operator:

    - Older (61 years);
    - Lower level of education (2.2 years);
    - 90% desire to change the breed;
    - 14% desire to participate in training programs;
    - Does not participate in technical courses; and
    - 2% read technical newspaper.

For the top 10% efficient farms, on average:

1. Technology:

    - 90% use artificial insemination;
    - 67% use pasture rotation;
    - 60% use pasture fertilization;
    - 60% use mechanical milking; and
    - 54% use silage.

2. Farm infrastructure:

    - Farms are of a distance of about 13 km from an urban area, on average;
    - 51% have telephone;
    - 100% have electricity; and
    - 95% have a car.

3. Farming activity:

    - 55% sell to cooperative.

4. Operator:

    - Younger (47 years);
    - Higher level of education (5.2 years);
    - 49% desire to change the breed;
    - 51% desire to participate in training programs;
    - 24% participate in technical courses; and
    - 10% read technical newspaper.

In general, farms would be more efficient if:

- Use artificial insemination;
- Use pasture rotation and fertilization;
- Use mechanical milking system;
- Use silage;
- Have telephone and electricity;
- Have a car; and
- Younger operator with 5 years or more of formal education.

VI. SUMMARY AND CONCLUSIONS

Summary

Since the early 1990s the Brazilian dairy producers have been exposed to greater competition from price liberalization and an open economy, and to accelerating changes in technology, use of resources, and size of dairy operations. These conditions have brought about significant adjustment in the dairy production sector including for example, a 25% reduction in the number of dairy farms from 1997 to 1999[44].

The objective of this research was to estimate the relative state of technical efficiency of the milk producing industry, and to examine the determinants of economic competitiveness of Brazilian dairy farms. Four steps were considered. First, estimation of the stochastic production frontier and efficiency parameters for individual dairy farms, for different regions and breed classifications; Second, estimation of the parameters of a set of farm-level explanatory variables for the technical inefficiency for individual dairy farms, for different regions and breed classifications; Third, estimation of the input and explanatory elasticities for different regions and breed classifications; and Fourth, evaluation and characterization of the farms by efficient and inefficient sets, according to size, productivity, and exogenous factors determinant of efficiency, at given resource levels and technology.

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44 According to MilkPoint (2000a), the number of producers for the 12 largest industries in Brazil decreased from 175,450 in 1997 to 133,367 in 1999, which represents about 24%. In the same period, the number of producers in Paraná State decreased from 44,324 to 32,421, which represents about 26.8% (MilkPoint, 2000b).

A modified Cobb-Douglas stochastic production frontier approach was applied to a sample of 775 farms and maximum-likelihood parameters for the production function and the inefficiency model were estimated simultaneously.

Two models were estimated: one, considering three regions – South, Southeast and Northeast; and the other for breed classifications – Pure Holstein, three-quarter Holstein and other European breeds, and all other breeds including cross breeds. For the production function value of dairy output, number of cows, land, capital (flow), total labor, concentrated feed, silage, other costs and the ratios of family/total labor, capital (flow)/labor, and dairy/farm output were considered. For the inefficiency model the use of artificial insemination, pasture rotation, pasture fertilization practices, age and education level of the operator, and farm specialization levels were examined. Dummies for intercept and slope were used in both models.

The parameters associated with the variance in the stochastic frontier indicate that the traditional average response function would not be a good representation of the data. These results indicate that the explanatory variables in the inefficiency-effect model are significant on the stochastic production function for all regions and breed classifications, and the variables in the inefficiency-model are important in influencing the distribution of the output for Brazilian dairy producers.

Input elasticities were estimated for the production frontier. Among location, Northeast region showed the lowest elasticities for number of cows (0.37), for capital (0.02), and for other variable costs (0.05), and the highest elasticities for pasture land (0.03) and for the dairy output to farm output ratio (0.33).

Southeast (without São Paulo) and Central-West (aggregated) had the lowest elasticity for family labor ratio (–0.19), and the highest elasticities for number of cows (0.47); labor (0.50); and concentrated feed (0.02).

South and São Paulo (aggregated) showed the lowest elasticities for labor (0.24) and highest elasticities for capital (0.21) and other variable costs (0.25).

Among breeds, Cross breed and Zebu (aggregated) showed the lowest elasticities for pasture land (0.005); other variable costs (0.07); and family labor to total labor ratio (–0.10), and the highest elasticity for dairy output to farm output ratio (0.18).

Three-quarters Holstein and other Pure European breeds (aggregated) had the lowest elasticity for capital (0.02), and the highest elasticities for number of cows (0.54); pasture land (0.02); labor (0.29); and family labor to total labor ratio (0.01).

Pure Holstein showed the lowest elasticity for number of cows (0.43); labor (0.13); dairy output to farm output ratio (0.06), and the highest elasticities for capital (0.21) and for other variable costs (0.29).

For number of cows, the elasticities indicate that an increase in the number of cows increases production significantly. The marginal value product is more than twice the annual capital cost of a cow.

The results indicate that, for pasture land, significant efficiency is obtained by additional land for the Northeast. In this region, the marginal value product of pasture land per year is five times higher than the rental cost of a hectare of land per year.

The marginal return for a unit of capital is higher for the South region and for Pure Holstein. Considering the results for capital and labor, there is significant evidence that, in the long term, labor will be substituted by capital in the South region and/or for Pure Holstein farms.

Dairy production is inversely affected by the ratio of family labor to total labor. This indicates that, in general, family labor in dairy is not as efficient as hired labor. This is interpreted as evidence that family labor is probably available in excess, and that labor is hired only if strictly needed. In Brazil, temporary labor has been generally available[45] when needed.

For the explanatory model, artificial insemination, pasture rotation and pasture fertilization, the elasticities vary from –0.024 to –0.248, indicating that these technologies have important effects on efficiency. Education level and age of the operator appeared not to be statistically significant in the model.

The ratio of farm output relative to total family income shows that off-farm employment or non-farm activities are negatively related to the performance of the dairy production activity. This suggests that more farm specialization (i.e. dairy specialization) can be expected and, therefore, a reduction in number of farms. This tendency is greater, as the breed composition of the herd moves from Cross breed to more milk-specialized breeds, such as Pure Holstein.

Higher average milk prices are received by producers located in the Northeast (the least efficient region), and lower prices by the states located in the South. This indicates that competition due to imported fluid milk from Argentina and Uruguay is affecting the prices received by producers in the South. Moreover, producers from the South are, in general, more efficient.

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[45] Probably not applicable for more specialized labor, such as used for milking and cowboy activities, which is usually fixed labor.

Comparison of farms among location and breed classification and among the bottom 10%, the middle 80%, and top 10% efficient farms indicates that similarities are captured for specific variables.

The average measures of the 10% least efficient farms are closely related to those for Cross-breed among the breed classifications and those for Northeast among locations.

In comparing efficiency by the criterion of the top 10% most efficient farms of the sample, the results indicate high correlation with farms with Pure Holstein (50%) among the breeds and farms located in the South region (85%) among locations.

The results indicate that the following variables are determinants for the top 10% efficient farms:

1. Dairy output – The average output was R$37,000 for the efficient farms, five times higher that the 80% middle efficient farms.
2. Farm output to family income ratio – This indicates that dairy farm families are less dependent on non-farm income and are more efficient.
3. Volume – Production per day per farm appears critical with respect to efficiency, and significantly more important than number of cows when breed is considered. While the 80% middle efficient farms produce about 80 liters per day, the top 10% produce 370 liters per day, on average, suggesting that at least 200 liters per farm/day is required on the more efficient farms.
4. Total labor – Efficiency is reflected by the productivity of labor. The average labor was 28 days, which is twice the quantity used by Pure Holstein farms, as well as the top 10% most efficient farms. This suggests that less than 20 labor days/cow/year is critical for an efficient farm.

5. Cows per worker – A range between 35 to 40 cows/worker is expected for an efficient farm.

6. Cows per hectare – For Pure Holstein farms, as well as the top 10% efficient farms, the ratio of cows per hectare is about 2.5.

7. Production per worker – Pure Holstein farms, as well as the top 10% efficient farms, produce about 300 liters per worker per day.

8. Production per hectare – The top 10% efficient farms show about 9,000 liters per hectare per year.

9. Production per cow – This is closely related to breed. Farms from the South region produce 6 liters/cow/day; Pure Holstein, 9 liters /cow/day; and the top 10% efficient farms about 10 liters/cow/day.

10. Prices for Labor – Pure Holstein farms and the top 10% efficient farms pay twice the price of hired labor compared to the least efficient farms. This may indicate that dairy farms that are more efficient relay more on fixed and/or specialized hired labor compared to the least efficient farms.

11. Prices for inputs – The prices of concentrated feed among regions and breeds are a good indication of efficiency and ability of the farmer to reduce production costs. There are clear differences among the groups with respect to the average prices paid for concentrated feed. Pure Holstein farms paid R$111/t versus R$133/t for the sample average. The least efficient farms paid, on average, 27% more for concentrated feed than the most efficient farms.

12. Technology – Efficient farms are those using artificial insemination, pasture

rotation, and pasture fertilization, mechanical milking, silage and at least 40% of Pure Holstein in the herd.

13. Farm infrastructure – Farms with telephone, electricity and car are more efficient.

14. Operator – Higher education level and younger operator are factors correlated with farms that are more efficient.

15. Breed – Farm efficiency is significantly increased by farms with Pure Holstein breed in the herd.

Conclusions

Several conclusions are drawn from the results. First, the variance parameters in the stochastic frontier indicate that the explanatory variables in the inefficiency-effect model are significant on the stochastic production function and important in influencing the distribution of the output for Brazilian dairy producers. The traditional average response function would not be a good representation of the data.

Second, for the two models considered, Pure Holstein, among breeds, and South region and São Paulo, for location, appear to be correlated and significantly more efficient than the other classifications.

Third, Pure Holstein shows the lower elasticity for labor, and higher elasticities for capital and other variable costs. This indicates proportionally lower effect for farms using this breed with respect to labor, at the same time that higher effect is expected for capital. In the case of Pure Holstein, the marginal value product for capital was higher than the marginal costs, and the marginal value product for labor was lower than its cost. Substitution of capital for labor is expected for Pure Holstein farms.

Fourth, for pasture land, positive elasticity effect is expected for Northeast. The marginal value product for pasture land is significantly higher than its cost, for this region. Additional pasture land increases efficiency for farms in this region.

Fifth, dairy production is inversely affected by the ratio of family labor to total labor. Family labor in dairy is not as efficient as hired labor. Hired labor is probably available when needed. The effects are significantly higher for Pure Holstein, probably because of specialized fixed hired labor.

Sixth, the number of cows increases production significantly, and the marginal value product of a cow is more than twice the annual capital cost of a cow.

Seventh, artificial insemination, pasture rotation, pasture fertilization, use of mechanical milking and use of silage are technologies that have high correlation with the top 10% efficient farms.

Eighth, farms with telephone, a car and electricity are more efficient.

Ninth, higher education level and younger operator are factors correlated with farms that are more efficient.

Tenth, Pure Holstein farms and farms that are more efficient pay twice the price of hired labor compared to the least efficient farms. This means that dairy farms that are more efficient rely more on fixed and/or specialized hired labor compared to the least efficient farms.

Eleventh, costs of inputs are lower for the more efficient or Pure Holstein farms.

Twelfth, dairy farm families less dependent on non-farm income are more efficient. This effect is higher for Pure Holstein farms.

Thirteenth, production per day per farm is critical with respect to efficiency, and it appears significantly more important than number of cows in the case of non-Pure Holstein farms. A production of at least 200 liters per farm/day is expected for an efficient farm.

Fourteenth, a range between 35 to 40 cows/worker (or between 200 to 300 liters/worker/day) is expected for an efficient farm.

Fifteenth, efficient farms show about 9,000 liters per hectare per year.

Sixteenth, the lowest prices received for milk are farms in the South region, probably due to price competition with imported fluid milk from Argentina and Uruguay.

Limitations and Further Research

The inclusion of all farms with some dairy activity, i.e. the inclusion of less specialized farms in explaining inefficiency, may represent the Brazilian typical farm with dairy. However, because the inputs are considered proportionally to dairy, and also because other non-dairy farm and non-farm activities are not explicitly included in the model, the results cannot be extended without considering dairy in the context of diversified farms. Further research may consider a system of equations for the inclusion of other farm activities.

Total land, originally considered for the model, was substituted for pasture land because of unexpected negative sign on the coefficients. Some measurement of quality for land may be considered in further research.

Concentrated feed appears with negative sign in one of the models. It seems to be a misinterpretation (by the interviewer and/or interviewee) with respect to the question. Unbalanced ration effects may be associated with concentrated feed.

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APPENDICES

Appendix I – Sample Data for the Stochastic Production Frontier for the Brazilian Dairy Farms, 1998.

N	TE	Y	Cow	Lnd	Cap	Lab	Cst	Con	Rou	RLb	SeCw	NE	SSP	CbZ	PH	HPE	Ain	Par	Paf	Dst	Tel	Elc	Fou	Coo	Pay	Age	Edu	Own	Liv
1	0.69	522	7	3.6	98	32.2	134	2.56	0.03	1.00	0	0	1	1	0	0	0	0	0	22	1	1	0.91	1	30	46	3	1	1
2	0.98	29200	35	23.0	929	563.7	5198	51.10	0.66	1.00	0	0	1	0	1	0	1	1	1	6	1	1	1.00	1	40	57	4	1	1
3	0.66	584	1	0.1	33	196.8	1128	0.18	0.42	1.00	0	0	1	1	0	0	1	0	0	5	0	1	0.22	0	0	65	4	1	1
4	0.91	3508	11	14.5	245	217.4	1410	0.00	0.27	0.91	0	0	1	1	0	0	1	1	1	24	0	1	0.82	1	30	61	2	1	1
5	0.99	10800	22	7.3	250	1048.8	439	8.03	0.84	0.60	0	0	1	0	1	0	1	0	1	13	0	1	0.82	0	30	28	8	0	1
6	0.93	3754	13	3.4	151	271.4	1691	14.24	0.26	0.97	0	0	1	1	0	0	1	1	1	14	0	1	0.86	0	30	60	3	1	1
7	0.97	9278	10	11.0	216	77.1	884	10.95	0.15	0.86	0	0	1	0	1	0	1	0	0	17	0	1	1.00	1	30	30	8	1	1
8	0.92	3240	8	2.9	125	37.2	797	2.92	0.07	0.87	0	0	1	0	1	0	1	1	1	23	0	1	1.00	1	30	27	8	1	1
9	0.98	12045	30	6.8	706	301.0	1435	21.90	0.49	1.00	0	0	1	0	1	0	1	1	0	15	0	1	1.00	1	0	56	4	1	1
10	0.80	876	5	0.0	25	24.1	556	0.00	0.06	0.95	0	0	1	1	0	0	0	0	0	11	1	1	1.00	0	0	53	4	1	1
11	0.86	4015	7	1.2	253	204.1	1213	0.00	0.25	1.00	0	0	1	0	1	0	1	1	1	12	0	1	0.92	1	0	57	7	1	1
12	0.83	4752	12	2.4	178	253.9	1360	0.00	0.39	1.00	0	0	1	1	0	0	0	1	0	15	0	1	0.66	1	45	65	5	1	1
13	0.98	27704	19	2.4	513	769.5	3577	0.00	0.61	1.00	0	0	1	0	1	0	1	1	1	23	1	1	1.00	1	30	51	5	1	1
14	0.92	6570	13	4.6	484	345.0	3069	18.98	0.40	1.00	0	0	1	1	0	0	1	1	0	30	0	1	1.00	1	0	39	8	1	1
15	0.83	3600	10	3.0	208	329.2	708	10.95	0.60	1.00	0	0	1	1	0	0	1	1	0	18	0	1	0.69	1	30	71	4	1	1
16	0.97	3000	9	7.0	136	20.4	1509	3.29	0.05	0.69	0	0	1	0	1	0	1	1	1	12	1	1	0.98	0	0	62	3	1	1
17	0.96	3650	10	20.0	158	48.6	227	0.00	0.11	1.00	0	0	1	0	0	1	1	0	0	1	0	1	1.00	0	30	43	4	1	1
18	0.99	16100	20	3.4	602	185.9	1729	18.25	0.25	0.33	0	0	1	0	1	0	1	1	0	7	1	1	0.94	1	30	48	5	1	1
19	0.77	3230	10	0.0	195	80.0	947	10.95	0.16	1.00	0	0	1	0	1	0	1	0	1	5	0	1	1.00	1	30	55	6	1	1
20	0.86	2402	8	0.7	95	118.4	124	0.00	0.15	1.00	0	0	1	1	0	0	0	0	1	13	0	1	1.00	1	30	57	3	1	1
21	0.58	460	14	0.0	52	42.1	56	0.00	0.05	0.69	0	0	1	1	0	0	0	0	0	24	0	1	0.47	0	0	58	4	1	1
22	0.81	4129	13	0.4	423	43.9	675	9.49	0.08	0.55	0	0	1	1	0	0	0	0	0	12	0	1	0.94	1	30	64	1	1	1
23	0.87	1730	6	0.0	86	19.2	143	0.00	0.04	0.50	0	0	1	1	0	0	0	0	0	10	0	1	1.00	1	30	40	4	1	1
24	0.86	2156	7	0.0	162	63.0	188	0.00	0.06	1.00	0	0	1	1	0	0	0	0	0	12	0	1	1.00	0	0	51	4	1	1
25	0.77	2044	13	0.0	130	32.9	337	0.00	0.07	0.42	0	0	1	1	0	0	0	0	0	14	1	1	0.88	1	30	55	4	1	1
26	0.91	2176	7	0.0	460	160.9	275	0.00	0.29	1.00	0	0	1	1	0	0	1	0	0	12	0	1	1.00	0	30	60	3	1	1
27	0.87	5954	30	2.0	330	63.2	1571	21.90	0.42	1.00	0	0	1	1	0	0	1	0	1	20	0	1	0.78	0	30	67	2	1	1
28	0.88	1384	12	0.0	57	11.9	201	0.00	0.05	1.00	0	0	1	1	0	0	0	0	1	16	0	1	1.00	0	30	44	4	1	1
29	0.80	2244	11	1.0	61	17.2	105	12.05	0.02	0.74	0	0	1	1	0	0	0	0	0	26	0	1	1.00	1	3	49	4	1	1
30	0.73	816	8	0.0	219	130.3	185	0.00	0.29	1.00	0	0	1	1	0	0	0	0	0	27	0	1	1.00	1	30	37	4	1	1
31	0.78	1800	10	0.0	71	314.0	90	0.00	0.42	1.00	0	0	1	1	0	0	0	0	0	35	0	1	1.00	0	0	33	4	1	1
32	0.83	1204	6	0.0	61	40.1	304	0.00	0.04	0.94	0	0	1	1	0	0	0	0	0	7	0	1	0.95	0	21	54	3	1	1
33	0.92	12000	30	10.0	470	428.7	1997	32.85	0.40	0.71	0	0	1	0	1	0	1	1	1	11	0	1	1.00	0	30	42	8	1	1
34	0.88	1904	13	0.5	94	135.9	130	0.00	0.19	1.00	0	0	1	1	0	0	0	1	0	12	0	1	0.95	0	30	46	2	1	1
35	0.66	425	14	0.5	83	3.9	122	15.33	0.01	1.00	0	0	1	1	0	0	0	0	0	12	1	1	0.89	1	20	55	4	1	1
36	0.89	3399	21	0.0	204	90.3	936	23.00	0.13	1.00	0	0	1	1	0	0	0	1	1	17	1	1	1.00	1	30	42	4	1	1
37	0.95	3041	7	0.5	323	88.5	635	7.67	0.10	0.60	0	0	1	0	0	1	1	1	1	8	0	1	0.90	0	30	56	1	1	1
38	0.75	1200	8	10.0	38	48.0	107	0.00	0.24	1.00	0	0	1	0	0	1	0	1	0	5	0	1	1.00	0	30	54	8	1	1
39	0.97	10950	20	7.3	407	66.5	1238	0.00	0.27	1.00	0	0	1	0	1	0	1	1	1	7	1	1	1.00	1	30	47	8	1	1
40	0.96	15400	13	8.5	350	42.9	789	9.49	0.17	1.00	0	0	1	0	1	0	1	1	1	15	0	1	1.00	1	15	42	3	1	1
41	0.96	46400	31	10.0	1265	337.8	2816	45.26	0.42	0.93	0	0	1	0	1	0	1	1	1	14	0	1	1.00	1	15	42	3	1	1
42	0.77	90750	200	242.0	3454	1564.0	6267	0.00	0.90	0.05	0	0	1	0	1	0	1	1	1	8	0	1	0.84	1	30	51	16	1	0
43	0.76	13800	20	23.0	892	358.4	1140	0.00	0.32	0.08	0	0	1	0	1	0	1	1	1	8	1	1	0.47	1	30	64	16	1	0
44	0.98	1674	4	0.0	470	21.5	144	0.00	0.11	1.00	0	0	1	0	1	0	1	1	0	14	0	1	1.00	1	30	54	2	1	1
45	0.98	6563	10	2.0	880	68.6	547	10.95	0.27	1.00	0	0	1	0	1	0	1	1	0	30	0	1	1.00	1	30	41	4	1	1
46	0.91	870	5	0.0	53	18.2	86	0.00	0.07	1.00	0	0	1	1	0	0	1	0	0	25	0	1	1.00	0	30	50	3	1	1
47	0.87	1590	4	0.0	57	59.2	77	2.92	0.24	1.00	0	0	1	1	0	0	0	0	0	14	0	1	1.00	0	30	43	4	1	1
48	0.82	465	3	0.0	16	34.0	69	0.00	0.14	1.00	0	0	1	1	0	0	0	0	0	9	0	1	1.00	0	30	41	3	1	1
49	0.81	1865	8	0.0	370	41.8	149	8.76	0.17	1.00	0	0	1	1	0	0	0	0	0	17	0	1	1.00	1	30	48	4	1	1
50	0.85	3125	9	0.5	455	41.0	487	6.57	0.16	1.00	0	0	1	0	0	1	0	0	0	10	0	1	1.00	0	30	47	3	1	1
51	0.75	470	5	1.0	207	2.9	88	5.48	0.02	1.00	0	0	1	1	0	0	0	0	0	13	0	1	0.94	0	30	64	1	1	1
52	0.98	2525	6	1.5	425	56.2	261	4.38	0.22	1.00	0	0	1	0	1	0	1	1	0	15	0	1	1.00	0	30	29	6	1	1
53	0.79	1657	10	0.0	52	90.6	232	0.00	0.36	1.00	0	0	1	1	0	0	0	0	0	12	0	1	1.00	1	30	49	2	1	1
54	0.85	2772	10	0.0	71	88.6	283	0.00	0.44	1.00	0	0	1	1	0	0	0	0	0	12	0	1	1.00	0	30	55	0	1	1
55	0.79	2868	13	2.0	61	47.3	82	0.00	0.19	1.00	0	0	1	1	0	0	0	0	0	15	0	1	1.00	1	30	31	4	0	1
56	0.82	3195	14	0.5	468	38.0	267	0.00	0.24	1.00	0	0	1	1	0	0	0	0	0	13	0	1	0.81	0	30	64	4	1	1
57	0.79	9390	24	42.0	378	422.6	672	0.00	0.48	0.92	0	0	1	0	0	1	0	0	0	3	0	1	0.93	0	30	59	2	1	1
58	0.80	3351	15	15.0	246	71.2	793	2.19	0.04	1.00	0	0	1	1	0	0	0	0	0	17	0	1	0.76	0	45	63	2	1	1
59	0.91	2091	6	4.0	162	35.3	332	0.00	0.03	0.77	0	0	1	1	0	0	0	1	0	22	0	1	0.90	0	30	48	3	1	1
60	0.93	9880	12	24.0	360	455.1	902	0.00	0.63	0.97	0	0	1	1	0	0	1	0	1	3	0	1	0.67	0	30	47	4	1	1
61	0.65	1445	10	17.3	72	39.0	174	0.00	0.52	1.00	0	0	1	0	0	1	0	0	0	12	1	1	0.39	0	30	61	1	1	1

(Continue)

(Continue)

N	TE	Y	Cow	Lnd	Cap	Lab	Cst	Con	Rou	RLb	SeCw	NE	SSP	CbZ	PH	HPE	Ain	Par	Paf	Dst	Tel	Elc	Fou	Coo	Pay	Age	Edu	Own	Liv
62	0.93	6766	21	9.0	322	88.6	1349	0.00	0.18	0.82	0	0	1	1	0	0	1	1	0	5	0	1	0.80	1	2	52	3	1	1
63	0.98	8154	20	12.0	588	79.0	1651	0.00	0.11	0.65	0	0	1	0	0	1	1	1	1	5	1	1	1.00	1	30	40	6	1	1
64	0.69	4600	30	47.0	253	90.6	1433	0.00	0.10	1.00	0	0	1	0	0	1	0	1	0	13	0	1	0.93	1	30	50	3	1	1
65	0.91	8760	26	17.0	406	187.4	2126	18.98	0.12	0.59	0	0	1	1	0	0	1	0	0	11	1	1	0.81	0	30	50	4	1	1
66	0.90	3020	9	5.5	99	84.7	647	0.00	0.12	0.98	0	0	1	0	1	0	1	1	1	6	0	1	1.00	1	10	45	7	1	1
67	0.96	3883	6	0.0	231	14.2	727	0.00	0.14	1.00	0	0	1	1	0	0	1	1	1	3	0	1	0.90	1	0	68	4	1	1
68	0.91	2058	5	20.0	149	88.4	264	1.10	0.06	1.00	0	0	1	0	0	1	0	0	0	58	1	1	0.99	0	30	49	5	1	1
69	0.98	10084	12	10.0	722	110.6	1555	0.00	0.13	0.72	0	0	1	0	1	0	1	0	0	10	1	1	0.96	1	30	71	2	1	1
70	0.80	9636	15	16.0	164	724.4	443	3.29	0.85	1.00	0	0	1	1	0	0	0	0	0	30	0	1	1.00	1	30	52	2	1	1
71	0.98	7644	11	3.0	509	111.3	1707	2.41	0.20	0.79	0	0	1	0	1	0	1	1	1	15	1	1	1.00	1	30	39	4	1	1
72	0.91	6680	20	9.0	211	646.9	519	0.00	0.75	1.00	0	0	1	1	0	0	1	0	0	25	0	1	0.94	0	60	55	4	1	1
73	0.77	1700	7	0.5	235	236.0	104	0.00	0.31	1.00	0	0	1	1	0	0	1	0	0	16	0	1	0.64	0	0	68	2	1	1
74	0.97	1106	2	0.0	252	15.4	67	2.92	0.03	0.89	0	0	1	0	1	0	1	0	0	11	0	1	1.00	0	30	37	8	1	1
75	0.89	1374	6	0.0	347	97.9	240	0.00	0.07	1.00	0	0	1	1	0	0	1	0	0	20	0	1	0.90	0	30	43	4	1	1
76	0.66	1282	9	0.1	298	15.8	258	4.93	0.02	1.00	0	0	1	0	1	0	0	1	0	11	1	0	0.90	1	30	58	5	1	1
77	0.83	1061	5	0.7	265	46.4	116	3.65	0.07	1.00	0	0	1	1	0	0	0	0	0	12	0	1	1.00	0	30	41	4	1	1
78	0.62	840	9	1.0	281	230.1	119	0.00	0.58	1.00	0	0	1	1	0	0	0	0	0	18	0	1	0.57	0	30	55	4	1	1
79	0.92	1248	6	0.7	164	88.5	107	4.38	0.14	1.00	0	0	1	1	0	0	1	1	0	2	0	1	1.00	1	30	45	4	1	1
80	0.93	6328	8	0.0	559	222.4	853	8.76	0.16	1.00	0	0	1	0	1	0	1	0	0	27	0	1	0.72	1	30	50	2	1	1
81	0.99	65700	65	14.5	2219	549.4	4661	118.63	0.26	0.72	0	0	1	0	1	0	1	0	0	3	1	1	0.99	0	40	65	1	1	1
82	0.99	17630	23	7.3	534	378.8	4809	0.00	0.29	0.70	0	0	1	0	1	0	1	1	0	11	1	1	0.86	1	30	38	3	1	1
83	0.92	3600	9	4.8	149	59.2	2010	0.00	0.04	0.73	0	0	1	1	0	0	1	0	0	12	1	1	1.00	1	30	54	4	1	1
84	0.86	4855	22	0.0	484	108.6	2609	0.00	0.43	1.00	0	0	1	0	0	1	0	1	1	9	0	1	1.00	1	0	40	4	1	1
85	0.50	3182	7	0.0	892	500.0	3612	0.00	1.00	0.50	0	0	1	0	1	0	1	1	1	14	1	1	0.13	1	0	40	8	1	1
86	0.79	2754	9	0.0	225	116.6	2969	0.00	0.17	0.29	0	0	1	1	0	0	0	0	1	6	0	1	0.92	1	7	59	4	1	1
87	0.94	5280	7	0.0	318	65.7	283	0.00	0.26	1.00	0	0	1	0	0	1	0	0	1	10	0	1	0.87	1	7	47	8	1	1
88	0.95	4080	10	0.0	227	37.5	356	0.00	0.19	1.00	0	0	1	1	0	0	1	1	1	15	0	1	1.00	1	0	52	4	1	1
89	0.92	6240	8	1.0	311	34.0	336	0.00	0.07	0.50	0	0	1	0	1	0	1	1	1	16	0	1	0.97	1	7	32	11	1	1
90	0.78	612	5	0.0	62	26.1	445	0.00	0.13	1.00	0	0	1	1	0	0	0	0	1	1	0	1	1.00	1	7	52	4	1	0
91	0.67	2040	3	0.0	324	176.6	758	0.00	0.88	1.00	0	0	1	1	0	0	0	0	1	22	0	1	0.43	0	7	55	4	1	1
92	0.64	714	11	0.0	409	9.4	87	0.00	0.03	1.00	0	0	1	0	1	0	0	0	1	17	1	1	0.94	1	3	42	4	1	1
93	0.89	1105	4	0.0	59	23.0	34	0.00	0.09	1.00	0	0	1	1	0	0	0	0	1	13	0	1	1.00	0	3	34	4	1	1
94	0.89	1615	7	0.0	132	55.5	441	0.00	0.22	1.00	0	0	1	1	0	0	1	0	1	22	0	1	1.00	1	3	36	4	1	1
95	0.95	9800	6	0.5	137	81.8	546	3.29	0.17	0.94	0	0	1	1	0	0	0	0	1	3	0	1	1.00	0	30	43	3	1	1
96	0.92	3124	15	0.0	255	117.4	330	0.00	0.17	0.51	0	0	1	1	0	0	0	1	1	6	1	1	1.00	0	30	55	4	1	1
97	0.95	4034	5	1.5	152	51.6	398	3.65	0.10	0.90	0	0	1	1	0	0	0	1	1	6	1	1	0.96	0	30	27	4	1	1
98	0.95	4034	5	1.5	245	9.4	398	3.65	0.10	0.45	0	0	1	1	0	0	0	1	1	6	1	1	0.96	0	30	40	4	1	1
99	0.84	1469	4	0.3	55	44.9	315	0.00	0.22	0.98	0	0	1	1	0	0	0	0	0	5	1	1	1.00	1	30	51	4	1	1
100	0.93	4015	11	0.0	201	90.7	427	0.00	0.21	0.85	0	0	1	1	0	0	0	1	1	9	0	1	1.00	1	30	56	7	1	1
101	0.96	1989	10	1.0	104	19.1	155	18.25	0.06	0.83	0	0	1	0	0	1	1	1	1	5	0	1	1.00	0	30	43	4	1	1
102	0.84	1220	5	0.0	89	40.6	102	0.00	0.09	1.00	0	0	1	1	0	0	0	0	1	2	0	1	0.83	0	0	40	5	1	1
103	0.84	2084	7	0.0	192	64.6	213	0.00	0.26	1.00	0	0	1	1	0	0	0	1	0	6	0	1	0.67	1	30	41	4	1	1
104	0.64	1070	4	0.5	251	74.2	138	0.00	0.37	1.00	0	0	1	1	0	0	0	0	1	10	0	1	0.32	1	30	60	2	1	1
105	0.71	450	2	0.0	80	52.1	83	0.00	0.18	0.85	0	0	1	1	0	0	0	0	1	7	0	1	0.65	1	30	45	4	1	1
106	0.96	14660	10	5.5	518	229.2	1263	10.95	0.51	1.00	0	0	1	1	0	0	0	1	1	10	0	1	1.00	0	30	38	5	1	1
107	0.79	1920	5	0.0	111	80.6	221	0.00	0.30	0.74	0	0	1	0	0	1	0	0	0	12	0	1	0.69	0	0	52	4	1	1
108	0.91	918	3	0.0	359	1.4	151	0.00	0.06	0.00	0	0	1	1	0	0	1	0	0	7	0	1	1.00	1	30	49	4	1	1
109	0.91	1836	5	0.0	129	51.2	69	0.91	0.20	0.96	0	0	1	1	0	0	0	1	1	7	0	1	1.00	1	30	49	4	1	1
110	0.91	2880	5	0.0	180	69.8	186	0.00	0.28	1.00	0	0	1	1	0	0	0	0	0	4	0	1	1.00	0	30	43	4	1	1
111	0.78	1152	3	0.0	225	98.0	253	0.00	0.49	1.00	0	0	1	1	0	0	0	0	0	9	0	1	1.00	1	30	58	5	1	1
112	0.89	1836	5	0.0	179	77.9	200	0.00	0.39	1.00	0	0	1	1	0	0	1	0	0	14	0	1	1.00	1	30	58	3	1	1
113	0.82	2700	7	0.0	61	136.4	158	0.00	0.68	1.00	0	0	1	1	0	0	0	0	0	6	0	1	1.00	1	30	54	2	1	1
114	0.77	1190	5	0.0	124	118.5	118	1.83	0.47	1.00	0	0	1	1	0	0	1	0	0	4	0	1	0.64	1	30	50	3	1	1
115	0.90	2240	6	0.0	231	56.6	332	0.00	0.28	1.00	0	0	1	1	0	0	1	0	0	13	0	1	0.85	0	30	58	2	1	1
116	0.80	922	4	0.0	126	77.7	188	0.00	0.31	1.00	0	0	1	1	0	0	0	0	0	10	0	1	1.00	1	30	33	5	1	1
117	0.82	1652	5	3.0	243	53.2	137	0.00	0.27	1.00	0	0	1	1	0	0	0	0	0	7	0	1	1.00	1	30	56	3	1	1
118	0.89	2117	4	0.0	16	94.7	68	0.00	0.38	1.00	0	0	1	1	0	0	0	0	0	13	0	1	1.00	0	30	48	4	1	1
119	0.93	3600	6	1.8	421	56.8	978	0.00	0.23	1.00	0	0	1	1	0	0	0	1	0	12	0	1	1.00	1	40	42	0	1	1
120	0.91	1900	6	0.0	65	83.5	81	0.00	0.33	1.00	0	0	1	1	0	0	1	0	0	13	0	1	1.00	1	30	37	2	1	1
121	0.93	1498	3	0.0	37	65.7	47	0.00	0.26	1.00	0	0	1	1	0	0	1	0	0	14	0	1	1.00	1	30	30	6	1	1
122	0.85	756	3	0.0	50	27.4	38	0.00	0.14	1.00	0	0	1	1	0	0	0	0	0	15	0	1	1.00	0	35	52	2	1	1
123	0.82	1436	4	0.0	144	63.2	271	0.00	0.44	1.00	0	0	1	1	0	0	0	1	0	12	0	1	0.60	1	30	26	4	1	0
124	0.95	8400	16	7.0	370	26.8	704	11.68	0.09	0.81	0	0	1	1	0	0	1	0	0	13	0	1	1.00	1	30	38	8	1	1
125	0.98	3192	6	5.0	133	18.0	239	0.00	0.12	1.00	0	0	1	0	1	0	1	1	0	16	0	1	0.95	1	30	66	4	1	1
126	0.65	1152	4	0.0	119	160.2	281	0.00	0.64	1.00	0	0	1	1	0	0	0	0	0	14	0	1	0.33	0	30	41	3	1	1
127	0.93	1728	5	0.9	97	40.1	93	0.00	0.20	1.00	0	0	1	1	0	0	1	1	0	13	0	1	1.00	1	1	56	3	1	1
128	0.77	2020	7	0.5	110	164.5	199	0.64	0.66	1.00	0	0	1	1	0	0	0	0	0	11	0	1	1.00	1	30	47	2	1	1
129	0.90	1037	5	0.5	156	75.8	159	0.00	0.30	1.00	0	0	1	1	0	0	1	0	0	10	0	1	1.00	0	30	44	5	1	1
130	0.82	2550	6	0.0	119	73.1	202	0.00	0.29	1.00	0	0	1	0	1	0	1	0	1	15	0	1	1.00	1	30	44	5	1	1
131	0.97	2414	5	0.0	46	48.8	179	5.48	0.20	1.00	0	0	1	0	1	0	1	0	0	10	0	1	1.00	0	30	50	5	1	1
132	0.85	6480	14	5.0	483	90.3	2264	5.11	0.48	0.79	0	0	1	0	1	0	1	1	1	5	0	1	0.83	1	0	70	0	1	1
133	0.76	1020	4	2.5	127	99.2	629	0.73	0.40	1.00	0	0	1	1	0	0	0	0	0	5	0	1	1.00	1	30	43	5	1	1
134	0.94	2448	11	1.0	205	46.5	952	24.09	0.19	1.00	0	0	1	1	0	0	1	1	1	6	0	1	1.00	1	30	47	5	1	1
135	0.67	4500	13	1.2	238	84.3	1943	37.96	0.34	1.00	0	0	1	0	1	0	1	0	1	7	0	1	0.90	1	30	34	8	1	1
136	0.60	1836	8	8.0	324	150.0	270	4.38	1.00	1.00	0	0	1	1	0	0	0	0	1	1	0	1	0.39	1	30	65	1	1	1
137	0.95	7344	7	2.0	252	210.9	388	0.00	0.84	1.00	0	0	1	0	1	0	1	1	1	5	0	1	1.00	0	15	50	2	1	1

(Continue)

(Continue)

N	TE	Y	Cow	Lnd	Cap	Lab	Cst	Con	Rou	RLb	SeCw	NE	SSP	CbZ	PH	HPE	Ain	Par	Paf	Dst	Tel	Elc	Fou	Coo	Pay	Age	Edu	Own	Liv
138	0.90	10000	13	10.0	838	317.2	785	75.92	0.63	0.50	0	0	1	1	0	0	0	1	1	20	0	1	1.00	1	15	38	7	1	1
139	0.97	26400	23	42.0	1103	244.1	3710	1.26	0.98	1.00	0	0	1	0	1	0	1	1	1	12	1	1	1.00	1	15	48	8	1	1
140	0.98	116000	54	80.0	6620	685.7	11167	2.96	0.98	0.29	0	0	1	0	1	0	1	1	1	2	1	1	1.00	1	15	57	4	1	1
141	0.95	27500	31	21.2	921	236.5	2176	169.73	0.95	1.00	0	0	1	1	0	0	1	1	0	20	0	1	1.00	1	20	40	6	1	1
142	0.92	12500	18	4.2	973	94.6	1370	98.55	0.34	0.91	0	0	1	1	0	0	0	1	1	34	0	1	1.00	1	15	39	4	1	1
143	0.94	13000	20	15.0	838	95.8	1135	109.50	0.36	0.95	0	0	1	1	0	0	1	1	1	16	0	1	0.96	1	20	18	7	0	1
144	0.97	67500	45	60.0	2732	138.8	6538	1.64	0.08	0.14	0	0	1	0	1	0	1	1	1	7	1	1	1.00	1	15	44	11	1	1
145	0.81	7580	7	0.0	89	488.5	1232	5.11	0.91	1.00	0	0	1	1	0	0	1	0	1	10	0	1	0.63	0	0	33	5	0	1
146	0.95	1020	4	0.0	64	46.3	90	0.00	0.19	1.00	0	0	1	1	0	0	1	1	0	6	0	1	1.00	0	15	44	5	1	1
147	0.94	4500	10	0.0	70	149.7	515	7.30	0.52	1.00	0	0	1	1	0	0	1	1	1	2	0	1	0.78	0	30	57	4	1	1
148	0.83	660	3	0.0	39	36.2	109	0.00	0.14	1.00	0	0	1	0	0	1	0	0	0	10	0	1	1.00	0	30	43	4	1	1
149	0.99	1669	3	0.0	76	6.4	80	3.29	0.02	0.78	0	0	1	0	1	0	1	0	0	23	1	1	1.00	1	30	35	5	1	1
150	0.87	950	4	0.3	78	16.8	125	0.00	0.04	0.99	0	0	1	1	0	0	1	0	1	35	0	1	0.89	1	30	63	4	1	1
151	0.54	360	2	0.0	29	35.6	208	0.00	0.53	1.00	0	0	1	1	0	0	0	0	0	18	0	1	0.13	1	30	50	4	1	1
152	0.97	50400	38	0.0	7589	266.0	5077	27.74	0.71	0.21	0	0	1	0	1	0	1	1	1	20	1	1	0.82	1	15	46	4	1	1
153	0.94	135000	69	31.0	4389	498.2	10164	0.00	1.00	0.50	0	0	1	0	1	0	1	1	1	11	0	1	1.00	1	15	30	9	1	1
154	0.98	60000	33	29.0	2551	473.7	9528	0.00	0.91	0.38	0	0	1	0	1	0	1	1	1	1	1	1	1.00	1	15	51	4	1	1
155	0.98	203000	97	30.0	4340	1112.5	14596	0.00	0.89	0.20	0	0	1	0	1	0	1	1	1	12	1	1	1.00	0	15	42	5	1	1
156	0.97	58800	40	20.0	3276	544.4	8819	0.00	0.47	0.22	0	0	1	0	1	0	1	1	1	9	1	1	1.00	1	15	31	8	1	1
157	0.97	101680	44	8.0	2975	689.7	12761	0.00	0.44	0.16	0	0	1	0	1	0	1	1	1	6	1	1	1.00	1	15	36	11	1	1
158	0.94	14300	22	15.0	515	418.4	1162	1.20	0.93	1.00	0	0	1	0	1	0	1	1	1	18	0	1	1.00	1	10	55	3	1	1
159	0.97	2475	8	1.0	174	34.5	139	5.84	0.07	0.87	0	0	1	0	0	1	1	0	1	1	1	1	0.88	1	30	68	2	1	1
160	0.88	945	2	0.0	33	21.1	144	0.00	0.08	1.00	0	0	1	1	0	0	0	0	0	1	0	1	1.00	1	30	42	4	1	1
161	0.84	1482	10	0.0	411	21.7	143	7.30	0.05	0.95	0	0	1	1	0	0	1	0	0	15	1	1	0.79	0	30	63	1	1	1
162	0.95	4125	10	0.0	214	6.2	104	0.00	0.02	1.00	0	0	1	0	1	0	0	1	1	1	1	1	1.00	0	15	42	4	1	1
163	0.84	1500	11	0.0	97	12.3	183	0.00	0.05	1.00	0	0	1	0	1	0	0	0	0	18	0	1	1.00	1	30	48	4	1	1
164	0.94	2525	8	0.3	60	38.1	185	2.92	0.15	1.00	0	0	1	1	0	0	1	0	1	1	0	1	1.00	1	30	43	4	1	1
165	0.95	5850	40	4.0	1041	69.8	854	29.20	0.19	0.69	0	0	1	1	0	0	1	1	1	18	0	1	1.00	0	0	46	11	1	0
166	0.89	6450	14	0.0	643	225.0	820	0.00	0.29	0.97	0	0	1	1	0	0	0	1	1	15	0	1	0.78	0	30	77	0	1	1
167	0.91	6250	8	0.0	146	326.9	2199	0.00	0.40	0.85	0	0	1	1	0	0	0	1	1	13	1	1	0.86	0	15	59	4	1	1
168	0.88	1890	5	0.0	270	23.8	190	3.65	0.10	0.52	0	0	1	0	1	0	1	1	1	15	0	1	0.93	1	30	40	11	1	1
169	0.91	4827	7	2.0	297	22.8	1076	7.67	0.17	0.13	0	0	1	0	1	0	1	1	1	18	1	1	0.55	0	30	52	4	1	1
170	0.95	2400	4	0.0	145	46.6	251	2.92	0.50	1.00	0	0	1	1	0	0	1	1	1	12	0	1	0.89	0	30	42	4	1	0
171	0.87	3650	5	0.0	649	12.4	410	3.65	0.19	0.75	0	0	1	1	0	0	0	0	0	8	0	1	0.77	0	30	49	3	1	1
172	0.95	15900	11	1.5	1133	190.1	954	40.15	0.54	0.98	0	0	1	1	0	0	0	1	1	12	0	1	0.91	0	30	60	5	1	1
173	0.87	1650	4	0.6	30	44.2	267	0.00	0.54	0.93	0	0	1	1	0	0	1	1	0	16	0	1	0.85	1	30	40	8	0	1
174	0.95	1350	7	0.0	42	17.1	120	0.00	0.21	1.00	0	0	1	1	0	0	1	1	1	6	0	1	0.86	1	30	36	8	1	1
175	0.97	3120	6	0.0	193	45.9	161	0.00	0.09	0.86	0	0	1	1	0	0	1	1	1	9	0	1	1.00	0	30	40	4	1	1
176	0.88	3910	11	0.5	191	172.1	547	8.03	0.24	0.72	0	0	1	1	0	0	1	0	1	15	0	1	0.68	1	30	26	4	1	1
177	0.96	3200	5	0.0	189	52.6	423	3.65	0.27	1.00	0	0	1	1	0	0	1	1	1	26	0	1	0.93	0	30	34	4	1	1
178	0.82	1390	3	0.0	67	157.9	408	0.55	0.47	0.93	0	0	1	1	0	0	1	1	1	10	0	1	0.32	0	10	47	4	1	1
179	0.95	2822	5	0.0	197	17.8	620	0.00	0.09	1.00	0	0	1	1	0	0	1	1	1	42	0	1	0.95	1	4	56	4	1	1
180	0.93	6252	7	0.0	386	58.5	1544	0.00	0.23	1.00	0	0	1	0	1	0	0	1	1	21	1	1	1.00	0	0	47	4	1	1
181	0.97	27798	32	0.0	1166	854.0	1658	0.00	0.63	0.26	0	0	1	0	1	0	1	1	1	20	1	1	0.93	0	4	43	11	1	1
182	0.98	27432	40	0.0	3379	110.5	1988	0.00	0.29	0.53	0	0	1	0	1	0	1	1	1	15	1	1	1.00	1	7	56	3	1	1
183	0.95	11040	11	0.0	480	177.1	816	0.00	0.79	0.89	0	0	1	0	1	0	1	1	1	28	0	1	1.00	1	7	51	4	1	1
184	0.96	1368	3	0.0	99	10.4	46	0.00	0.04	1.00	0	0	1	1	0	0	1	1	1	36	0	1	1.00	0	5	42	4	1	1
185	0.80	1020	5	0.0	143	47.6	237	3.65	0.24	1.00	0	0	1	1	0	0	1	1	1	10	0	1	0.73	1	30	55	5	0	1
186	0.84	1296	7	0.0	121	66.6	104	5.11	0.15	1.00	0	0	1	1	0	0	0	1	0	12	0	1	0.85	0	30	56	5	1	1
187	0.69	3240	4	0.0	415	108.9	3048	4.38	0.50	0.93	0	0	1	1	0	0	0	0	1	9	0	1	0.15	0	30	51	5	1	1
188	0.69	367	3	0.0	32	0.6	41	3.29	0.04	0.00	0	0	1	1	0	0	0	0	0	4	0	1	0.73	1	15	67	5	1	1
189	0.95	1836	10	5.0	156	12.7	311	7.30	0.05	1.00	0	0	1	1	0	0	1	1	1	8	0	1	0.99	0	30	47	3	1	1
190	0.76	1190	4	4.0	148	44.3	329	0.00	0.10	0.44	0	0	1	1	0	0	0	1	0	18	0	1	0.44	1	30	59	16	1	0
191	0.73	1800	2	0.0	179	175.6	282	0.37	0.88	1.00	0	0	1	1	0	0	0	0	0	2	0	1	0.57	0	30	59	2	1	0
192	0.95	3441	9	2.0	173	46.0	409	0.00	0.06	0.97	0	0	1	0	0	1	1	1	1	4	0	1	0.81	1	15	50	4	1	1
193	0.93	2592	8	0.0	285	12.4	483	0.00	0.06	1.00	0	0	1	1	0	0	0	1	1	2	1	1	0.96	1	30	58	5	1	1
194	0.93	1728	6	1.0	40	129.6	369	0.00	0.45	0.86	0	0	1	1	0	0	1	1	1	22	0	1	1.00	1	30	42	4	1	1
195	0.67	694	5	1.0	70	95.5	60	0.00	0.46	0.97	0	0	1	1	0	0	1	0	0	21	0	1	0.46	1	30	60	0	1	1
196	0.95	4104	11	3.0	282	56.8	1108	8.03	0.25	0.88	0	0	1	1	0	0	1	1	1	5	0	1	1.00	1	30	57	5	1	1
197	0.77	918	5	0.0	100	29.4	95	1.83	0.20	1.00	0	0	1	0	0	1	0	0	1	5	0	1	0.75	1	30	65	4	1	1
198	0.97	5120	10	1.0	732	121.3	874	5.48	0.49	1.00	0	0	1	0	0	1	1	0	1	11	0	1	1.00	1	30	44	5	1	1
199	0.93	5400	9	0.5	596	105.4	933	6.57	0.37	0.89	0	0	1	1	0	0	1	0	1	12	0	1	0.90	1	35	34	9	1	1
200	0.95	3420	8	0.5	609	99.5	1273	5.84	0.40	1.00	0	0	1	0	0	1	1	0	0	4	0	1	1.00	0	30	42	5	1	1
201	0.77	1734	5	0.5	337	85.9	177	1.83	0.34	1.00	0	0	1	0	0	1	0	0	0	10	0	1	1.00	1	35	39	5	1	1
202	0.89	2040	7	0.5	131	105.7	180	5.11	0.42	1.00	0	0	1	0	0	1	0	0	1	6	0	1	1.00	0	35	33	8	1	1
203	0.88	3420	9	2.0	245	129.9	765	0.00	0.52	1.00	0	0	1	1	0	0	1	0	1	13	0	1	0.68	1	35	44	5	1	0
204	0.96	4000	6	0.5	340	61.3	581	2.19	0.24	0.96	0	0	1	1	0	0	1	1	1	6	0	1	1.00	1	35	33	5	1	1
205	0.94	1080	4	0.0	361	36.3	315	1.46	0.15	1.00	0	0	1	0	0	1	1	0	0	19	0	1	1.00	1	35	36	5	1	1
206	0.93	2600	4	2.0	68	43.9	1326	1.46	0.18	1.00	0	0	1	0	0	1	1	0	0	15	0	1	0.83	1	35	38	5	1	1
207	0.97	6935	15	4.0	352	87.7	257	5.48	0.31	0.89	0	0	1	0	0	1	1	0	1	7	0	1	1.00	1	35	49	4	1	1
208	0.88	3420	8	1.0	806	93.5	735	2.92	0.37	1.00	0	0	1	0	0	1	0	0	1	20	0	1	1.00	1	35	31	6	1	1
209	0.58	522	2	0.5	141	34.1	55	0.73	0.26	1.00	0	0	1	0	0	1	0	0	0	20	0	1	0.48	1	35	50	4	1	1
210	0.88	3800	6	1.5	420	118.9	719	2.19	0.48	1.00	0	0	1	0	0	1	0	0	1	21	0	1	1.00	1	35	38	5	1	1
211	0.75	2280	7	0.5	154	126.2	181	2.56	0.50	1.00	0	0	1	0	0	1	0	0	0	14	0	1	1.00	1	35	40	4	1	1
212	0.60	1710	9	1.0	352	47.9	914	3.29	0.48	1.00	0	0	1	0	0	1	0	0	0	6	0	1	0.53	0	35	71	4	1	1
213	0.77	1995	6	1.5	221	81.9	647	2.19	0.30	0.93	0	0	1	0	0	1	0	0	0	8	0	1	1.00	1	35	38	5.5	1	1

(Continue)

(Continue)

N	TE	Y	Cow	Lnd	Cap	Lab	Cst	Con	Rou	RLb	SeCw	NE	SSP	CbZ	PH	HPE	Ain	Par	Paf	Dst	Tel	Elc	Fou	Coo	Pay	Age	Edu	Own	Liv
214	0.94	17520	25	0.0	3053	110.5	2190	22.81	0.46	0.83	0	0	1	0	1	0	1	0	1	8	1	1	1.00	0	0	53	5	1	1
215	0.76	2755	6	1.0	745	37.9	730	4.38	0.15	1.00	0	0	1	0	1	0	1	0	1	12	0	1	1.00	0	30	35	7	1	1
216	0.93	10680	14	0.0	371	93.4	1275	15.33	0.37	1.00	0	0	1	1	0	0	0	1	1	8	0	1	1.00	1	0	48	4	1	1
217	0.76	1140	8	0.0	643	6.1	593	0.00	0.09	1.00	0	0	1	1	0	0	0	1	1	10	1	1	0.42	1	30	46	3	1	1
218	0.73	3420	15	0.0	362	49.0	395	0.00	0.62	1.00	0	0	1	0	1	0	1	1	1	3	0	1	0.64	1	30	55	1	1	1
219	0.94	2052	2	0.0	201	39.3	422	1.46	0.20	1.00	0	0	1	0	1	0	1	1	1	4	0	1	1.00	1	30	58	5	1	1
220	0.96	7560	12	0.0	376	36.4	2232	8.76	0.18	1.00	0	0	1	0	1	0	0	1	0	7	0	1	1.00	1	30	58	0	1	1
221	0.94	3420	7	0.0	232	35.3	444	10.22	0.18	1.00	0	0	1	0	1	0	1	1	1	13	0	1	1.00	1	30	54	5	1	1
222	0.96	11808	23	0.0	284	54.5	3065	25.19	0.27	1.00	0	0	1	1	0	0	1	1	1	5	0	1	0.97	1	30	60	5	1	1
223	0.94	5178	12	0.0	161	43.0	495	0.00	0.13	0.74	0	0	1	0	1	0	1	1	1	7	0	1	1.00	1	30	46	7	1	1
224	0.84	2280	8	0.0	142	76.8	614	0.00	0.23	0.20	0	0	1	1	0	0	0	1	1	8	0	1	0.87	1	0	52	2	1	1
225	0.93	1368	5	0.0	209	71.4	76	3.65	0.29	1.00	0	0	1	1	0	0	1	1	0	8	0	1	1.00	1	30	28	4	1	1
226	0.88	1728	12	0.0	363	27.9	1678	0.00	0.09	0.79	0	0	1	1	0	0	0	1	0	8	0	1	1.00	1	30	47	8	1	1
227	0.92	4560	14	0.0	636	37.5	1518	30.66	0.12	0.79	0	0	1	1	0	0	0	1	1	12	0	1	1.00	1	30	48	4	1	1
228	0.91	2508	5	0.0	142	85.9	756	0.00	0.34	1.00	0	0	1	1	0	0	0	1	0	10	0	1	1.00	1	30	37	3	1	1
229	0.93	14706	50	0.0	679	105.9	2948	18.25	0.14	0.33	0	0	1	0	1	0	1	1	1	12	0	1	1.00	1	30	40	5	1	1
230	0.70	2964	8	0.0	337	196.1	594	2.92	0.36	0.46	0	0	1	0	1	0	1	1	1	5	0	1	0.64	1	30	33	5	1	1
231	0.82	1026	15	0.0	322	10.8	155	5.48	0.01	0.68	0	0	1	0	1	0	1	1	1	8	0	1	0.92	1	30	33	7	1	1
232	0.94	2052	10	0.0	454	23.3	1332	3.65	0.12	1.00	0	0	1	1	0	0	1	1	1	14	0	1	1.00	1	30	51	5	1	1
233	0.94	1710	9	0.0	142	26.4	702	6.57	0.10	0.93	0	0	1	1	0	0	1	1	1	14	0	1	1.00	1	30	50	5	1	1
234	0.89	2280	10	0.0	180	39.1	478	14.60	0.15	0.96	0	0	1	1	0	0	0	1	1	16	0	1	1.00	1	30	48	5	1	1
235	0.85	2910	11	0.0	265	104.4	891	8.03	0.13	1.00	0	0	1	1	0	0	0	1	0	6	0	1	0.87	0	0	61	3	1	1
236	0.98	6120	13	0.0	522	61.2	1136	18.98	0.24	1.00	0	0	1	0	1	0	1	1	0	7	0	1	0.94	1	30	47	5	1	1
237	0.96	5220	20	0.0	664	30.6	1112	14.60	0.02	0.29	0	0	1	1	0	0	1	1	1	14	1	1	0.96	1	30	34	15	1	0
238	0.87	2628	10	1.5	704	34.0	1676	10.95	0.36	0.79	0	0	1	1	0	0	1	1	1	16	0	1	0.70	1	30	64	3	1	1
239	0.91	6780	7	0.0	125	41.3	660	5.11	0.55	1.00	0	0	1	0	1	0	1	1	1	16	0	1	0.80	1	30	65	5	1	1
240	0.68	240	6	0.0	88	4.7	134	4.38	0.02	1.00	0	0	1	1	0	0	0	1	1	18	0	1	0.90	1	30	45	8	0	1
241	0.91	5551	17	0.0	799	71.4	635	0.00	0.29	1.00	0	0	1	0	1	0	1	1	1	23	0	1	1.00	1	4	43	8	1	1
242	0.77	333	5	0.0	155	9.5	155	0.00	0.05	1.00	0	0	1	1	0	0	0	1	1	23	1	1	1.00	1	4	53	3	1	1
243	0.91	1841	10	0.0	122	6.6	159	3.65	0.03	1.00	0	0	1	1	0	0	0	1	1	3	0	1	0.92	1	30	49	4	1	1
244	0.77	2700	6	0.0	69	116.8	520	6.57	0.26	1.00	0	0	1	0	0	1	0	0	0	25	0	1	0.74	0	15	47	4	1	1
245	0.97	10950	20	7.3	407	66.5	1238	0.00	0.27	1.00	0	0	1	0	1	0	1	1	1	7	1	1	1.00	1	30	47	8	1	1
246	0.76	2172	8	2.7	101	51.6	863	0.00	0.26	1.00	0	0	1	0	1	0	1	0	1	10	0	1	1.00	1	45	53	4	1	1
247	0.75	620	6	1.3	55	45.3	105	0.00	0.18	1.00	0	0	1	1	0	0	0	0	0	12	0	1	1.00	1	30	45	4	1	1
248	0.76	450	6	10.0	129	13.6	69	0.00	0.02	1.00	0	0	1	0	0	1	0	0	0	15	0	1	1.00	0	30	52	1	1	1
249	0.82	3000	20	12.0	127	24.4	522	0.00	0.05	1.00	0	0	1	0	0	1	0	1	1	8	0	1	0.98	1	30	58	1	1	1
250	0.67	250	6	7.2	76	13.6	41	0.00	0.03	0.50	0	0	1	0	0	1	0	0	0	10	0	1	0.73	0	30	49	4	1	0
251	0.73	1080	10	15.6	141	49.6	545	0.00	0.11	1.00	0	0	1	0	0	1	0	0	0	18	0	1	1.00	1	30	58	4	1	1
252	0.92	15330	120	84.0	526	43.4	759	0.00	0.06	0.09	1	0	0	0	0	1	0	0	0	78	0	1	0.92	1	30	39	22	1	0
253	0.97	26280	152	610.0	1034	341.7	2564	55.48	0.17	0.03	1	0	0	0	0	1	1	0	0	65	1	1	0.88	0	25	73	6	1	0
254	0.75	7665	250	213.0	1059	94.5	824	0.00	0.10	0.50	1	0	0	1	0	0	0	0	0	62	1	1	1.00	0	30	54	4	1	0
255	0.81	9720	50	0.0	522	187.4	2398	27.38	0.67	0.00	1	0	0	1	0	0	1	1	1	80	1	1	0.55	1	30	32	16	1	0
256	0.97	45990	150	550.4	3200	1793.5	7363	0.00	0.94	0.08	1	0	0	0	0	1	1	0	0	65	1	1	1.00	0	15	64	4	1	1
257	0.89	12960	200	219.0	834	284.3	2589	73.00	0.44	0.23	1	0	0	1	0	0	0	1	1	4	0	1	1.00	0	45	65	8	1	0
258	0.75	6480	80	242.0	602	176.8	1370	0.00	0.53	0.25	1	0	0	0	0	1	0	0	0	43	0	1	0.64	0	20	31	16	0	0
259	0.67	9801	35	79.0	341	289.6	1031	12.78	0.74	0.17	1	0	0	1	0	0	0	0	0	15	0	1	0.66	1	15	75	4	1	0
260	0.66	5548	36	14.5	733	231.6	1084	13.14	0.46	0.50	1	0	0	0	1	0	0	1	1	22	0	1	1.00	0	30	44	11	1	0
261	0.75	9709	33	70.2	585	500.0	1790	12.05	1.00	0.50	1	0	0	1	0	0	0	0	1	20	0	1	1.00	0	30	30	4	0	0
262	0.61	8322	20	29.0	1117	318.3	960	0.00	0.57	0.36	1	0	0	0	1	0	0	0	1	15	0	1	1.00	0	30	57	2	1	0
263	0.90	20075	100	348.0	1630	154.8	4556	18.25	0.13	0.21	1	0	0	1	0	0	0	0	0	25	1	1	1.00	0	30	27	13	1	0
264	0.87	32120	120	340.0	2244	650.8	2904	328.50	0.88	0.54	1	0	0	1	0	0	1	0	0	16	0	1	1.00	1	30	65	4	1	1
265	0.83	12483	100	949.0	1811	268.6	1864	0.00	0.28	0.26	1	0	0	1	0	0	0	0	0	40	0	1	1.00	0	30	44	6	1	0
266	0.85	29200	100	338.0	1210	417.1	4964	36.50	0.38	0.18	1	0	0	1	0	0	0	0	0	25	0	1	1.00	1	45	51	1	1	0
267	0.88	10950	35	43.6	626	85.5	2610	6.39	0.08	0.25	1	0	0	1	0	0	0	0	0	32	0	1	1.00	0	30	46	2	1	0
268	0.76	14600	70	325.0	1423	551.9	735	12.78	0.80	0.22	1	0	0	1	0	0	0	0	0	30	0	1	1.00	0	30	62	3	1	1
269	0.75	7300	50	91.0	1005	136.1	1229	0.00	0.48	0.12	1	0	0	1	0	0	0	0	0	19	0	1	0.84	0	30	83	4	1	0
270	0.81	4380	20	170.0	602	79.9	546	0.00	0.19	0.20	1	0	0	1	0	0	0	0	0	15	0	1	0.94	0	30	75	1	1	0
271	0.50	803	6	0.0	217	83.0	312	0.00	1.00	1.00	1	0	0	0	0	1	0	0	0	20	0	1	0.37	1	30	43	3	1	1
272	0.69	2409	8	2.4	315	250.0	384	0.00	1.00	1.00	1	0	0	0	0	1	0	0	0	8	0	1	1.00	1	30	49	0	1	1
273	0.52	2409	15	0.0	835	345.0	741	0.82	1.00	0.22	1	0	0	0	0	1	0	0	0	36	0	1	0.54	1	30	58	1	1	1
274	0.46	13140	72	48.4	1310	1193.0	855	26.28	1.00	0.00	1	0	0	0	0	1	0	1	0	28	0	1	0.27	1	30	52	3	1	0
275	0.71	4015	27	0.0	582	376.2	226	0.00	0.84	1.00	1	0	0	0	0	1	0	0	0	18	0	1	1.00	1	30	29	1	1	1
276	0.46	6424	22	22.2	1233	451.0	922	8.03	1.00	0.04	1	0	0	0	0	1	0	1	0	6	0	1	0.26	1	30	59	0	0	1
277	0.87	4818	15	14.5	1213	419.8	574	2.74	0.45	0.69	1	0	0	0	0	1	1	1	0	22	0	1	1.00	1	30	59	4	1	1
278	0.68	17520	100	363.0	9816	914.9	1934	0.00	0.65	0.29	1	0	0	0	0	1	0	1	0	21	0	1	1.00	1	30	65	1	1	0
279	0.49	4818	27	1.5	2240	622.8	359	6.90	0.83	0.00	1	0	0	0	0	1	0	0	0	16	0	1	0.14	1	30	50	3	0	0
280	0.81	4807	8	2.4	667	536.5	1334	0.00	0.96	0.36	1	0	0	0	0	1	0	0	0	36	0	1	1.00	0	0	55	1	1	1
281	0.49	788	2	0.0	409	350.0	171	1.10	1.00	0.29	1	0	0	0	0	1	0	0	0	3	1	1	0.13	1	30	74	1	1	1
282	0.63	8760	40	14.5	2099	305.0	758	10.95	1.00	0.18	1	0	0	0	0	1	0	0	0	21	0	1	0.62	1	15	45	2	0	1
283	0.58	2008	8	7.3	315	40.6	822	1.46	0.97	1.00	1	0	0	0	0	1	0	0	0	16	0	1	0.46	1	0	49	1	1	1
284	0.68	10499	35	0.0	1982	1935.5	2592	15.33	0.90	0.65	1	0	0	0	0	1	0	0	0	37	0	1	1.00	1	30	69	1	1	1
285	0.73	3614	10	0.0	657	250.0	240	0.00	1.00	1.00	1	0	0	0	0	1	0	0	0	14	0	0	1.00	1	30	47	1	1	1
286	0.93	17520	50	314.2	4472	627.4	4252	0.00	0.47	0.19	1	0	0	1	0	0	1	1	0	28	0	1	1.00	1	30	46	2	1	1
287	0.67	12045	43	7.4	867	517.9	1842	23.54	0.96	0.46	1	0	0	0	0	1	0	1	0	26	0	0	1.00	1	30	40	2	0	1
288	0.75	16060	30	21.2	1044	888.0	4369	24.64	1.00	0.28	1	0	0	0	0	1	0	1	0	20	1	1	1.00	1	30	45	1	1	1
289	0.80	32120	52	20.8	5033	1009.7	2992	56.94	0.94	0.00	1	0	0	0	0	1	1	1	0	18	0	1	0.53	1	30	52	3	0	0

(Continue)

(Continue)

N	TE	Y	Cow	Lnd	Cap	Lab	Cst	Con	Rou	RLb	SeCw	NE	SSP	CbZ	PH	HPE	Ain	Par	Paf	Dst	Tel	Elc	Fou	Coo	Pay	Age	Edu	Own	Liv
290	0.46	161	6	0.0	239	200.0	0	0.00	1.00	1.00	1	0	0	0	0	1	0	0	0	24	0	0	0.11	0	0	56	0	1	1
291	0.70	6018	13	0.0	769	1040.8	2157	3.08	0.94	0.77	1	0	0	0	0	1	0	0	0	22	0	1	1.00	1	30	54	0	1	1
292	0.59	3614	17	6.3	1082	471.0	384	6.21	1.00	0.42	1	0	0	0	0	1	0	1	0	15	0	0	1.00	1	30	60	1	1	1
293	0.52	2810	10	13.2	1524	539.0	777	4.02	1.00	0.07	1	0	0	0	0	1	0	0	0	16	0	1	0.32	1	30	52	2	0	0
294	0.61	4818	18	0.0	891	362.4	103	2.30	0.98	1.00	1	0	0	0	0	1	0	0	0	22	0	1	0.67	1	30	73	0	1	1
295	0.56	2409	27	1.2	919	315.6	930	0.00	0.69	0.77	1	0	0	0	0	1	0	0	0	9	0	1	0.72	1	30	71	1	1	1
296	0.71	21900	70	9.6	2389	1336.5	4704	13.29	0.90	0.01	1	0	0	0	0	1	0	1	0	13	1	1	0.87	1	30	80	1	1	0
297	0.57	764	4	0.5	188	191.7	22	0.73	0.71	1.00	1	0	0	0	0	1	0	0	0	12	0	1	0.44	0	0	70	1	1	1
298	0.68	14308	52	0.0	3474	900.4	2296	30.37	0.94	0.26	1	0	0	0	0	1	0	1	0	12	0	1	1.00	1	30	42	1	0	1
299	0.49	4015	30	26.7	1927	278.0	638	6.57	0.74	0.01	1	0	0	0	0	1	0	0	0	24	0	1	0.15	1	30	45	3	0	0
300	0.38	161	1	1.0	1187	256.0	105	0.00	1.00	0.02	1	0	0	1	0	0	0	0	0	26	0	1	0.01	0	0	35	2	0	0
301	0.54	23287	55	22.8	1422	1077.0	2977	30.11	1.00	0.00	1	0	0	0	0	1	0	1	0	20	0	1	0.39	1	30	60	3	0	0
302	0.93	13140	19	5.4	828	413.3	1911	10.75	0.22	0.32	1	0	0	1	0	0	1	0	0	5	0	1	1.00	0	0	55	4	1	1
303	0.78	3756	24	9.1	392	226.4	465	14.89	0.26	0.41	1	0	0	1	0	0	0	0	1	7	0	1	1.00	1	30	59	4	1	1
304	0.81	4288	10	1.3	419	95.2	296	14.69	0.12	0.35	1	0	0	1	0	0	0	0	0	10	0	1	0.92	0	0	63	1	1	1
305	0.61	4491	35	50.1	366	184.6	1726	54.29	0.12	0.06	1	0	0	1	0	0	0	0	0	9	0	0	0.44	0	0	71	1	1	0
306	0.72	360	1	1.1	167	58.7	56	0.15	0.07	0.64	1	0	0	1	0	0	0	0	0	4	0	1	0.88	0	0	59	2	1	1
307	0.68	2730	12	0.0	315	195.1	1055	22.89	0.19	0.31	1	0	0	0	0	1	0	0	0	12	0	1	0.79	1	30	63	4	1	1
308	0.95	15863	50	42.0	1042	575.1	3534	41.06	0.21	0.22	1	0	0	0	0	1	1	0	0	2	0	1	1.00	0	30	33	8	1	1
309	0.69	2248	18	46.2	1772	80.6	731	33.84	0.03	0.07	1	0	0	1	0	0	0	0	0	2	1	1	0.79	0	30	79	0	1	1
310	0.81	3292	16	1.3	696	192.5	259	15.77	0.18	0.89	1	0	0	1	0	0	0	0	0	5	0	1	0.93	0	30	59	4	1	1
311	0.91	12366	80	47.4	1322	370.0	5901	35.04	0.12	0.21	1	0	0	1	0	0	1	1	1	5	1	1	0.66	0	30	58	4	1	0
312	0.72	9067	70	72.6	1360	259.0	2597	57.49	0.08	0.28	1	0	0	0	0	1	0	1	0	12	0	1	0.88	0	15	62	4	1	0
313	0.74	4818	33	9.6	856	133.6	1431	36.74	0.10	0.28	1	0	0	1	0	0	0	0	0	2	0	1	0.74	1	30	53	5	1	0
314	0.73	8672	30	21.5	1003	169.0	3842	0.00	0.14	0.10	1	0	0	0	0	1	0	1	0	2	0	1	0.77	0	30	64	3	1	0
315	0.79	3774	12	0.0	463	172.3	1442	0.00	0.19	0.99	1	0	0	1	0	0	0	0	0	23	0	1	0.93	1	15	61	4	1	1
316	0.77	3854	9	15.1	266	391.6	1268	0.57	0.76	0.42	1	0	0	1	0	0	0	1	0	20	0	1	0.78	0	30	71	4	1	1
317	0.74	5110	17	2.9	1018	429.0	2755	3.13	0.44	0.33	1	0	0	1	0	0	0	1	0	18	0	1	0.44	0	0	44	15	1	0
318	0.72	5139	15	21.7	477	382.7	3581	6.84	0.64	0.87	1	0	0	1	0	0	0	1	0	22	0	1	0.49	0	30	67	4	1	1
319	0.64	4979	31	0.0	370	400.3	1002	2.22	0.67	0.44	1	0	0	1	0	0	0	0	0	18	0	1	0.38	0	30	51	4	1	0
320	0.65	2598	5	16.5	597	455.9	582	0.10	0.77	1.00	1	0	0	1	0	0	0	1	0	22	0	1	0.38	0	0	76	1	1	1
321	0.80	3091	15	31.0	492	598.3	1972	1.31	0.54	1.00	1	0	0	1	0	0	0	1	1	14	0	1	0.79	0	30	58	4	1	1
322	0.80	4015	9	2.5	281	361.8	683	4.20	0.48	1.00	1	0	0	1	0	0	0	1	0	23	0	1	0.75	0	30	74	3	1	1
323	0.67	882	8	0.0	150	255.1	508	3.93	0.19	0.65	1	0	0	1	0	0	0	0	0	10	0	1	0.77	0	0	35	4	1	1
324	0.69	990	6	3.4	137	104.9	328	1.55	0.43	1.00	1	0	0	1	0	0	0	1	0	16	0	1	0.50	0	15	56	5	1	1
325	0.84	6906	24	1.5	408	345.7	734	21.90	0.53	1.00	1	0	0	1	0	0	0	1	0	16	0	1	0.82	0	30	64	3	1	1
326	0.82	4562	8	3.6	641	208.1	643	0.00	0.31	0.37	1	0	0	1	0	0	0	1	0	32	0	1	0.55	0	0	36	11	1	0
327	0.69	1825	9	0.0	556	121.0	207	0.00	0.24	0.32	1	0	0	1	0	0	0	1	0	19	0	1	0.28	0	30	69	4	1	0
328	0.72	402	4	0.0	167	13.6	152	0.00	0.01	0.57	1	0	0	1	0	0	0	0	0	23	0	1	0.93	0	0	54	4	1	0.5
329	0.84	9169	37	75.8	1493	252.8	1964	72.93	0.08	0.19	1	0	0	1	0	0	0	1	1	26	1	1	0.95	1	30	73	4	1	1
330	0.92	20988	34	123.9	1946	94.9	1499	70.74	0.02	0.04	1	0	0	1	0	0	0	0	1	34	1	1	1.00	0	30	62	8	1	0
331	0.62	1460	4	3.6	347	98.0	341	0.00	0.13	0.32	1	0	0	1	0	0	0	0	0	17	0	1	0.29	0	0	76	4	1	1
332	0.84	9270	38	8.2	334	356.5	608	119.98	0.17	0.44	1	0	0	1	0	0	0	0	0	22	0	1	0.97	0	30	43	1	1	1
333	0.93	12295	10	4.6	311	841.2	1258	9.67	0.92	0.67	1	0	0	0	0	1	1	0	0	17	0	1	0.74	0	8	44	5	1	1
334	0.53	759	11	0.0	228	62.1	190	11.24	0.26	0.76	1	0	0	1	0	0	0	0	0	31	0	1	0.31	0	0	76	4	1	1
335	0.67	3700	11	0.0	513	420.4	414	3.33	0.44	0.96	1	0	0	1	0	0	0	0	0	29	0	1	0.36	0	30	51	4	1	0
336	0.59	6826	90	215.1	2610	728.1	1657	57.49	0.24	0.09	1	0	0	1	0	0	0	1	0	20	1	1	0.35	0	15	35	6	0	1
337	0.91	3051	9	0.0	565	26.7	151	5.42	0.02	0.63	1	0	0	1	0	0	0	1	0	1	0	1	0.87	0	30	75	4	1	0
338	0.87	6388	15	5.9	422	331.0	324	2.19	0.16	0.51	1	0	0	1	0	0	0	0	0	1	0	1	1.00	0	15	55	3	1	1
339	0.82	4082	6	13.4	323	483.0	694	1.53	0.27	0.63	1	0	0	1	0	0	0	1	0	1	0	1	0.70	0	0	58	1	1	1
340	0.72	4462	17	0.0	422	617.0	742	0.00	1.00	0.51	1	0	0	1	0	0	0	0	0	5	0	1	0.61	0	30	35	6	1	1
341	0.58	690	10	0.0	85	153.8	134	0.00	0.44	1.00	1	0	0	1	0	0	0	0	0	12	1	1	0.52	0	0	71	2	1	1
342	0.74	2962	20	0.0	83	193.9	357	0.00	0.47	0.98	1	0	0	1	0	0	0	0	0	10	0	1	0.68	0	30	61	2	1	1
343	0.61	1612	18	0.0	152	234.6	243	0.00	0.31	0.47	1	0	0	1	0	0	0	0	0	16	0	0	0.46	0	30	76	3	1	0
344	0.74	2412	19	15.0	484	256.6	462	0.00	0.27	0.74	1	0	0	1	0	0	0	0	0	10	0	1	0.95	0	0	64	4	1	1
345	0.93	22500	37	25.5	1506	854.0	3693	20.26	0.28	0.05	1	0	0	0	1	0	1	1	1	16	0	1	0.95	0	15	70	4	1	0
346	0.74	380	3	0.0	73	44.8	78	0.00	0.18	0.98	1	0	0	1	0	0	0	0	0	20	0	1	0.99	0	0	38	4	1	1
347	0.97	75600	50	0.0	1614	1782.5	7943	91.25	0.79	0.11	1	0	0	0	0	1	1	0	0	7	1	1	0.76	0	15	32	3	1	0
348	0.67	13770	35	1.0	734	850.3	1494	6.39	0.84	0.49	1	0	0	0	0	1	0	1	0	1	0	1	0.73	0	15	41	2	1	0
349	0.80	11211	37	9.0	169	187.7	593	0.00	0.73	0.03	1	0	0	1	0	0	0	1	0	7	0	1	0.41	0	15	37	2	1	0
350	0.63	568	7	0.0	166	109.6	76	3.83	0.18	0.73	1	0	0	1	0	0	0	0	0	2	0	1	0.65	0	0	56	0	1	0
351	0.73	3240	9	0.0	288	274.9	431	3.29	0.56	0.92	1	0	0	1	0	0	0	0	0	15	0	1	0.67	0	30	59	4	1	1
352	0.76	3845	15	4.5	220	341.4	788	5.48	0.53	0.55	1	0	0	1	0	0	0	0	0	9	0	1	1.00	1	30	61	7	1	1
353	0.59	360	2	0.0	125	200.0	118	0.00	0.31	1.00	1	0	0	1	0	0	0	0	0	5	0	1	0.45	0	0	68	2	1	1
354	0.63	2538	25	0.0	434	154.8	692	27.38	0.15	0.50	1	0	0	1	0	0	0	0	0	14	0	1	0.38	0	30	52	3	1	1
355	0.85	9625	40	30.0	718	245.9	871	0.00	0.06	0.04	1	0	0	1	0	0	0	0	0	20	0	1	0.98	1	30	39	4.5	1	1
356	0.76	12075	20	3.0	452	550.7	2384	7.30	0.97	0.41	1	0	0	0	0	1	0	0	0	8	0	1	0.91	0	30	64	4	1	1
357	0.82	4500	6	0.0	283	568.1	1367	4.38	0.59	0.52	1	0	0	0	0	1	0	0	0	4	0	1	1.00	0	30	42	5	1	1
358	0.80	3656	10	0.0	208	304.2	636	5.48	0.24	0.51	1	0	0	1	0	0	0	0	0	4	0	1	0.91	0	30	70	2	1	1
359	0.69	15225	26	30.0	877	594.9	3827	14.24	0.71	0.26	1	0	0	1	0	0	0	0	0	14	0	1	0.38	0	30	57	4	1	1
360	0.93	52560	70	30.0	1541	1051.2	6831	0.00	0.75	0.01	1	0	0	0	0	1	1	1	0	10	0	1	0.85	1	15	46	2	1	0
361	0.97	295650	180	150.0	2700	3800.4	39096	328.50	0.74	0.13	1	0	0	0	0	1	1	0	0	5	0	1	0.97	0	30	50	2.5	1	0
362	0.97	13688	10	84.3	569	577.4	2163	18.25	0.44	0.05	1	0	0	0	0	1	1	1	1	9	0	1	0.88	0	10	32	2	1	0
363	0.97	54000	50	50.0	1588	694.7	4890	219.00	0.32	0.11	1	0	0	0	0	1	1	0	0	11	0	1	0.99	1	30	32	2	1	0
364	0.79	8200	18	9.0	285	471.4	870	13.14	0.57	0.42	1	0	0	1	0	0	0	0	0	2	0	1	0.60	0	30	33	7	1	1
365	0.92	46368	77	25.0	923	900.6	2751	0.00	0.59	0.07	1	0	0	0	0	1	1	1	0	9	0	1	0.70	1	7	52	3.5	1	0

(Continue)

(Continue)

N	TE	Y	Cow	Lnd	Cap	Lab	Cst	Con	Rou	RLb	SeCw	NE	SSP	CbZ	PH	HPE	Ain	Par	Paf	Dst	Tel	Elc	Fou	Coo	Pay	Age	Edu	Own	Liv
366	0.77	4732	15	0.0	250	192.9	947	10.95	0.41	0.42	1	0	0	1	0	0	0	0	0	9	0	1	0.89	1	15	57	6	1	0
367	0.76	5162	14	4.5	291	413.0	667	0.26	0.61	0.96	1	0	0	1	0	0	0	0	0	10	0	1	0.80	0	15	67	4	1	1
368	0.88	14040	34	4.5	858	754.4	3017	0.00	0.84	0.17	1	0	0	1	0	0	1	0	0	15	0	1	1.00	0	15	68	3	1	1
369	0.71	5600	40	0.0	638	81.7	320	7.30	0.16	0.04	1	0	0	1	0	0	0	0	0	38	0	1	0.78	1	30	61	4	1	1
370	0.80	10950	125	153.0	533	751.3	2286	0.00	0.36	0.21	1	0	0	1	0	0	0	1	0	20	0	1	0.67	1	45	52	16	1	0
371	0.94	25550	50	43.4	489	856.0	1557	0.00	0.86	0.40	1	0	0	0	0	1	1	1	0	18	0	1	1.00	1	30	40	8	1	0
372	0.70	5256	39	40.0	941	337.6	1179	0.00	0.75	0.89	1	0	0	1	0	0	0	0	0	24	0	1	0.81	1	30	61	10	1	1
373	0.84	10512	30	34.0	600	492.2	610	0.00	0.47	0.67	1	0	0	1	0	0	0	0	0	10	0	1	0.72	1	45	46	15	1	0
374	0.63	1752	14	17.0	302	200.1	350	0.00	0.50	0.38	1	0	0	1	0	0	0	0	0	15	0	0	0.68	1	30	68	4	1	0
375	0.49	484	4	37.0	406	307.5	191	0.00	0.67	0.33	1	0	0	1	0	0	0	0	0	16	0	1	0.13	0	0	69	10	1	0
376	0.60	2640	41	12.0	430	503.1	609	0.00	0.59	1.00	1	0	0	1	0	0	0	0	0	20	0	0	0.73	1	30	79	2	1	1
377	0.54	2008	15	12.0	322	470.0	1029	0.00	1.00	0.74	1	0	0	1	0	0	0	0	0	3	0	1	0.29	1	30	80	9	1	1
378	0.96	158480	260	381.0	4466	3793.8	11266	0.00	0.77	0.05	1	0	0	0	0	1	1	1	0	50	1	1	1.00	1	45	40	11	1	1
379	0.79	15111	77	72.1	363	262.3	2487	0.00	0.49	0.09	1	0	0	1	0	0	0	0	1	27	0	1	0.95	1	30	83	3	1	0
380	0.82	7008	32	14.2	350	428.0	2290	0.00	0.71	0.42	1	0	0	1	0	0	0	0	0	20	0	1	1.00	1	45	39	10	1	0
381	0.80	8395	30	5.0	302	481.1	1376	0.00	0.84	0.35	1	0	0	1	0	0	0	0	0	13	0	1	1.00	1	30	56	8	1	0
382	0.75	14016	75	6.5	409	743.6	1491	0.00	0.67	0.05	1	0	0	1	0	0	0	0	0	8	0	1	0.93	1	30	81	4	1	1
383	0.65	8030	40	29.0	348	480.0	2500	0.00	1.00	0.31	1	0	0	1	0	0	0	0	0	10	0	0	0.62	1	30	61	4	1	0
384	0.75	27750	120	115.0	640	1225.2	1629	0.00	0.82	0.17	1	0	0	1	0	0	0	0	0	13	0	1	0.53	1	30	36	12	1	0
385	0.75	4928	20	15.0	132	270.1	738	0.00	0.74	0.41	1	0	0	1	0	0	0	0	0	24	0	0	1.00	1	45	67	4	1	0
386	0.61	2373	24	0.0	492	246.1	993	0.00	0.12	0.07	1	0	0	1	0	0	0	0	0	18	0	1	0.33	1	30	68	13	1	0
387	0.57	3212	20	0.0	286	331.0	875	0.00	0.76	0.81	1	0	0	0	1	0	0	0	0	36	0	1	0.59	1	30	72	4	1	1
388	0.80	9375	31	44.6	527	379.6	1472	0.00	0.53	0.21	1	0	0	1	0	0	0	0	0	32	0	1	1.00	1	30	61	10	1	0
389	0.79	2820	11	11.0	190	261.6	303	0.00	0.22	0.76	1	0	0	1	0	0	0	0	0	45	0	1	1.00	0	15	51	4	1	1
390	0.74	11220	22	30.0	155	379.1	1655	20.08	0.54	0.29	1	0	0	1	0	0	0	0	0	5	0	1	0.46	1	30	52	12	1	0
391	0.81	6760	20	20.3	567	555.4	610	0.00	0.68	0.55	1	0	0	1	0	0	0	0	0	3	1	1	1.00	1	30	49	7	1	1
392	0.85	30734	90	38.4	464	1006.0	3820	0.00	1.00	0.14	1	0	0	1	0	0	0	0	0	8	0	0	1.00	1	30	37	13	1	0
393	0.71	7590	35	34.3	241	388.0	51	0.00	1.00	0.28	1	0	0	1	0	0	0	0	0	20	0	0	0.76	1	30	49	3	1	0
394	0.72	4180	11	9.0	492	185.7	1314	0.00	0.45	1.00	1	0	0	1	0	0	0	0	0	21	0	1	0.76	1	30	82	0	1	1
395	0.73	24640	160	440.0	1770	390.2	3571	58.40	0.39	0.15	1	0	0	0	0	1	0	0	0	22	0	1	0.79	1	30	68	10	1	0
396	0.92	39820	90	74.0	1224	1820.0	6344	49.28	1.00	0.14	1	0	0	1	0	0	1	1	0	3	1	1	0.82	1	30	45	14	1	1
397	0.74	20250	33	25.0	999	813.9	3650	36.14	0.97	0.30	1	0	0	1	0	0	0	0	0	24	0	1	0.78	0	40	34	17	0	1
398	0.83	15250	80	174.0	1143	726.4	103	0.00	0.69	0.14	1	0	0	1	0	0	0	1	0	10	0	0	0.94	1	20	69	8	1	0
399	0.76	8140	43	79.5	1271	764.8	1052	0.00	0.96	0.31	1	0	0	1	0	0	0	1	0	12	0	1	1.00	1	30	31	4	0	0
400	0.81	11640	35	33.7	643	648.6	938	0.00	0.85	0.26	1	0	0	1	0	0	0	0	0	15	0	1	1.00	1	35	57	8	1	0
401	0.79	6000	35	17.0	1998	597.9	1446	0.00	0.52	0.35	1	0	0	1	0	0	0	1	0	10	1	1	0.85	1	45	70	2	1	0
402	0.81	11040	40	20.0	535	494.9	2401	36.50	0.69	0.38	1	0	0	1	0	0	0	1	1	4	0	1	0.80	1	30	62	1	1	1
403	0.79	9720	78	50.0	3569	375.0	527	0.00	0.84	0.73	1	0	0	1	0	0	0	1	0	15	0	1	0.84	1	30	54	3	1	1
404	0.74	3542	20	0.0	579	504.8	1254	0.00	0.67	1.00	1	0	0	1	0	0	0	1	0	12	0	1	0.62	0	30	71	1	1	1
405	0.64	1448	11	17.5	642	203.0	213	0.00	0.26	0.84	1	0	0	1	0	0	0	0	0	6	0	1	0.51	1	30	67	1	1	0
406	0.74	14040	60	90.0	1719	722.1	3922	0.00	0.44	0.12	1	0	0	1	0	0	0	1	0	8	0	1	0.40	1	40	60	2	1	0
407	0.90	8760	32	0.0	798	430.9	1371	0.00	0.45	0.47	1	0	0	1	0	0	0	1	0	17	0	1	1.00	0	0	39	2	1	0
408	0.86	11880	28	36.0	1036	630.0	3621	0.00	1.00	0.32	1	0	0	1	0	0	0	1	0	15	0	1	1.00	1	45	53	2	1	0
409	0.79	2916	10	44.0	911	169.7	736	0.00	0.12	0.14	1	0	0	1	0	0	0	1	0	10	0	1	0.77	0	0	79	1	1	0
410	0.75	4995	18	100.0	1531	414.5	2051	0.00	0.39	0.19	1	0	0	1	0	0	0	1	0	22	0	1	0.68	0	0	59	2	1	1
411	0.71	8100	49	38.0	2668	407.2	1198	0.00	0.45	0.28	1	0	0	1	0	0	0	0	0	1	0	1	0.93	1	0	79	0	1	1
412	0.86	7074	18	0.0	1007	93.4	1213	0.00	0.34	0.09	1	0	0	1	0	0	1	0	0	10	0	1	0.62	1	30	36	3	1	1
413	0.92	9760	18	0.0	318	269.1	1089	19.71	0.10	0.07	1	0	0	1	0	0	1	0	0	18	1	1	1.00	1	30	58	8	1	1
414	0.52	955	6	0.0	16	115.0	294	0.00	1.00	0.72	1	0	0	1	0	0	0	0	0	36	0	1	0.32	0	0	31	11	0	1
415	0.76	900	13	0.0	207	63.8	173	0.00	0.03	0.75	1	0	0	1	0	0	0	0	0	11	0	1	1.00	0	0	42	4	1	1
416	0.83	3564	15	0.0	283	214.6	196	0.00	0.06	0.44	1	0	0	1	0	0	0	0	0	9	0	1	1.00	0	0	61	2	1	1
417	0.84	2926	10	0.0	206	136.7	124	0.00	0.06	0.64	1	0	0	1	0	0	0	0	0	10	0	1	1.00	0	0	61	3	1	1
418	0.84	10296	50	5.0	802	300.2	2448	0.00	0.06	0.05	1	0	0	1	0	0	1	0	0	8	1	1	0.53	1	30	43	4	1	0
419	0.72	550	4	0.0	362	24.1	6	0.00	0.04	1.00	1	0	0	1	0	0	0	0	0	14	0	1	0.84	0	0	69	0	1	1
420	0.97	34800	35	5.0	2206	1128.7	5567	31.94	0.31	0.04	1	0	0	0	0	1	1	0	0	8	1	1	0.93	1	30	62	8	1	0
421	0.77	10439	48	10.0	580	325.5	830	0.00	0.20	0.85	1	0	0	0	0	1	0	0	0	6	0	1	1.00	1	30	61	0	1	1
422	0.75	9234	40	100.0	834	537.7	1335	0.00	0.21	0.13	1	0	0	0	0	1	0	0	0	11	0	1	0.88	1	30	80	4	1	0
423	0.76	11585	70	50.0	1467	471.3	2440	0.00	0.13	0.39	1	0	0	0	0	1	0	0	0	33	0	1	1.00	1	30	64	4	1	1
424	0.80	4752	20	15.0	655	107.8	1668	5.48	0.04	0.83	1	0	0	1	0	0	0	0	0	26	0	1	1.00	1	30	57	4	1	1
425	0.83	402	5	0.0	66	8.7	82	0.00	0.01	0.89	1	0	0	0	0	1	0	0	0	27	0	1	1.00	0	0	61	0	1	1
426	0.86	8030	20	20.0	1205	499.7	2645	0.00	0.43	0.13	1	0	0	1	0	0	1	0	1	4	0	1	0.74	1	30	64	4	1	0
427	0.71	1927	20	0.0	259	189.1	211	0.00	0.14	0.61	1	0	0	0	0	1	0	0	0	26	0	1	1.00	1	30	78	0	1	1
428	0.69	1577	15	0.0	200	125.3	257	0.00	0.13	0.75	1	0	0	1	0	0	0	0	0	24	0	1	0.59	1	30	36	8	1	1
429	0.84	7015	30	10.0	255	119.9	1122	21.90	0.07	0.45	1	0	0	1	0	0	0	0	1	21	0	1	1.00	0	0	63	4	1	1
430	0.74	22163	40	48.0	427	1105.3	1901	58.40	0.46	0.06	1	0	0	0	0	1	0	1	1	22	0	1	0.73	1	30	65	4	1	0
431	0.68	1204	30	0.0	165	67.9	161	0.00	0.08	0.75	1	0	0	1	0	0	0	0	0	11	0	1	0.91	0	0	78	0	1	1
432	0.91	19162	100	45.0	748	125.8	1317	0.00	0.07	0.11	1	0	0	1	0	0	0	1	0	23	1	1	1.00	1	30	56	8	1	1
433	0.71	4818	15	0.0	452	613.8	734	0.00	0.57	0.89	1	0	0	1	0	0	0	0	0	16	0	0	0.45	0	30	38	8	1	1
434	0.97	3942	5	3.0	448	291.1	1389	3.65	0.31	0.47	1	0	0	0	0	1	1	0	1	18	0	1	1.00	0	30	48	4	1	1
435	0.79	4818	30	8.0	624	153.9	1315	0.00	0.25	0.74	1	0	0	0	0	1	0	0	0	47	0	1	1.00	0	30	56	4	1	1
436	0.79	8200	30	27.0	518	504.1	1998	5.48	0.37	0.55	1	0	0	1	0	0	0	0	0	25	0	1	1.00	1	30	45	5	1	1
437	0.79	19619	60	24.0	1132	754.1	3763	0.00	0.63	0.92	1	0	0	0	0	1	0	1	0	1	1	1	1.00	1	30	78	4	1	1
438	0.75	3011	25	0.0	377	179.0	582	0.00	0.36	0.50	1	0	0	1	0	0	0	0	0	23	0	1	0.86	1	30	43	11	1	0
439	0.54	657	6	4.0	659	90.6	146	3.29	0.45	1.00	0	1	0	0	0	1	0	0	0	33	0	0	0.42	0	0	59	1	1	1
440	0.59	1971	5	0.0	105	908.2	258	2.74	0.69	1.00	0	1	0	0	0	1	0	0	0	13	0	1	0.44	0	0	63	1	1	1
441	0.62	2135	10	6.0	172	376.5	204	5.48	0.57	0.90	0	1	0	1	0	0	0	0	0	18	0	1	0.50	0	0	68	0	1	0

(Continue)

(Continue)

N	TE	Y	Cow	Lnd	Cap	Lab	Cst	Con	Rou	RLb	SeCw	NE	SSP	CbZ	PH	HPE	Ain	Par	Paf	Dst	Tel	Elc	Fou	Coo	Pay	Age	Edu	Own	Liv
442	0.57	657	12	4.0	400	120.7	92	0.00	0.25	0.95	0	1	0	1	0	0	0	0	0	38	0	0	0.59	0	0	53	1	1	1
443	0.76	6880	15	5.0	2190	895.4	1905	8.21	0.64	0.83	0	1	0	1	0	0	0	0	0	1	0	1	0.81	0	20	53	0	1	1
444	0.73	4320	15	0.0	236	198.7	403	0.00	0.30	0.40	0	1	0	1	0	0	0	0	1	35	0	0	0.70	0	15	67	2	1	1
445	0.73	20304	194	10.0	1285	1084.6	1757	106.22	0.49	0.12	0	1	0	1	0	0	0	0	0	30	0	1	0.98	0	15	67	0	1	1
446	0.62	9070	154	2.5	417	478.9	438	56.21	0.33	0.45	0	1	0	1	0	0	0	0	0	65	0	1	1.00	0	10	62	4	0	1
447	0.58	8304	70	3.0	248	659.3	763	51.10	0.79	0.33	0	1	0	1	0	0	0	0	0	60	0	0	1.00	0	15	67	0	0	1
448	0.57	1215	10	0.5	207	241.7	121	9.13	0.50	0.93	0	1	0	1	0	0	0	0	0	72	0	0	1.00	0	0	36	2	0	1
449	0.74	6112	14	10.0	572	532.2	463	12.78	0.68	0.57	0	1	0	1	0	0	0	0	0	7	0	1	1.00	0	0	27	7	0	1
450	0.49	534	2	0.5	159	540.4	7	0.73	0.64	1.00	0	1	0	1	0	0	0	0	0	70	0	0	0.24	0	8	64	2	1	1
451	0.65	9709	24	5.0	175	1033.9	1511	17.52	0.86	0.38	0	1	0	1	0	0	0	0	0	26	0	1	0.42	0	10	49	3	1	0
452	0.68	6388	60	6.0	1347	247.8	425	43.80	0.40	0.72	0	1	0	1	0	0	0	0	0	20	0	0	1.00	0	0	29	0	0	1
453	0.42	438	5	0.0	206	376.0	29	1.83	0.56	0.46	0	1	0	1	0	0	0	0	0	80	0	1	0.11	0	0	61	0	1	1
454	0.57	1168	10	1.5	113	338.3	60	0.00	0.54	0.58	0	1	0	1	0	0	0	0	0	82	0	1	1.00	0	8	59	3	0	1
455	0.56	3102	20	0.0	547	464.5	148	5.48	0.65	0.25	0	1	0	1	0	0	0	0	0	81	1	1	0.64	0	8	77	4	1	1
456	0.63	4450	15	0.0	449	317.9	1428	8.21	0.82	0.69	0	1	0	1	0	0	0	0	0	80	0	1	0.80	0	10	68	1	1	1
457	0.59	1942	8	0.0	439	173.4	292	4.38	0.45	0.80	0	1	0	1	0	0	0	0	0	81	1	1	0.59	0	8	66	3	1	1
458	0.42	964	10	0.0	211	440.0	35	3.65	1.00	0.30	0	1	0	1	0	0	0	0	0	82	0	0	0.26	0	8	85	0	1	1
459	0.94	13250	16	3.0	514	810.7	2133	23.36	0.77	0.43	0	1	0	0	0	1	0	0	0	6	1	1	1.00	0	10	46	8	0	1
460	0.58	1095	3	0.0	68	188.8	51	2.19	0.69	0.95	0	1	0	1	0	0	0	0	0	55	0	1	0.37	0	30	75	2	1	1
461	0.74	4533	23	1.0	221	326.0	114	20.99	0.54	0.74	0	1	0	1	0	0	0	0	0	35	0	0	1.00	0	0	49	4	1	1
462	0.66	6132	60	1.5	109	716.0	40	32.85	1.00	0.63	0	1	0	1	0	0	0	0	0	32	0	1	1.00	0	10	24	2	0	1
463	0.60	7020	21	4.0	144	598.4	379	11.50	0.85	0.44	0	1	0	1	0	0	0	0	0	96	0	0	0.71	0	0	65	1	1	0
464	0.68	10948	10	30.0	2113	717.6	926	5.48	0.62	0.45	0	1	0	1	0	0	0	0	0	84	0	1	0.71	0	0	63	2	1	1
465	0.69	4032	90	30.0	1601	134.0	568	49.28	0.15	0.17	0	1	0	1	0	0	0	0	1	50	0	1	1.00	0	15	65	4	1	1
466	0.65	3600	20	1.0	640	686.1	131	10.95	0.36	0.62	0	1	0	1	0	0	0	0	1	55	0	0	1.00	0	15	48	0	0	1
467	0.71	1440	9	2.0	742	293.0	269	4.93	0.23	0.94	0	1	0	1	0	0	0	0	1	45	0	1	0.91	0	15	47	0	1	1
468	0.68	4020	45	2.0	680	226.9	2509	24.64	0.20	0.32	0	1	0	1	0	0	0	0	1	55	0	0	0.90	0	15	60	6	1	1
469	0.66	3888	44	5.0	200	270.6	111	24.09	0.15	0.51	0	1	0	1	0	0	0	0	1	40	0	0	1.00	0	15	53	0	0	1
470	0.67	8352	50	5.0	2525	504.0	760	27.38	0.32	0.13	0	1	0	1	0	0	0	0	1	50	0	1	1.00	0	15	55	0	0	1
471	0.64	2648	20	0.0	413	313.8	445	10.95	0.51	0.00	0	1	0	1	0	0	0	0	1	58	0	1	1.00	0	15	24	0	0	1
472	0.58	864	9	1.0	91	142.5	500	4.93	0.25	0.44	0	1	0	1	0	0	0	0	0	50	0	0	1.00	0	15	46	0	0	1
473	0.66	3011	10	0.0	128	310.6	173	7.30	0.74	0.64	0	1	0	1	0	0	0	0	0	27	0	0	0.74	0	10	68	1	1	1
474	0.66	5110	40	8.0	276	479.8	848	21.90	0.54	0.50	0	1	0	1	0	0	0	0	0	14	0	1	1.00	0	8	51	2	0	1
475	0.72	2590	25	1.0	316	228.6	269	0.00	0.27	0.53	0	1	0	1	0	0	0	0	0	25	0	1	1.00	0	15	44	15	0	0
476	0.77	15330	150	0.0	1313	733.2	775	54.75	0.47	0.73	0	1	0	1	0	0	0	0	0	45	0	1	1.00	0	15	41	0	1	1
477	0.63	2920	8	3.0	321	382.8	197	4.38	0.47	0.55	0	1	0	1	0	0	0	0	0	75	0	0	1.00	0	0	37	4	0	1
478	0.59	3229	25	0.0	58	301.2	50	9.13	0.99	0.82	0	1	0	1	0	0	0	0	0	70	0	0	1.00	0	10	41	1	0	1
479	0.66	12045	80	0.0	139	717.1	444	58.40	0.48	0.68	0	1	0	1	0	0	0	0	0	60	0	1	1.00	0	10	64	1	0	1
480	0.49	777	5	0.0	72	244.3	28	2.74	0.37	0.91	0	1	0	1	0	0	0	0	0	75	0	1	0.18	0	0	74	2	1	1
481	0.57	2190	50	15.0	1225	325.4	77	27.38	0.23	0.31	0	1	0	0	0	1	0	0	0	35	0	1	0.40	0	0	54	10	1	1
482	0.69	2920	15	10.0	257	209.7	157	8.21	0.26	0.56	0	1	0	1	0	0	0	0	0	42	0	0	0.85	0	0	50	1	1	1
483	0.73	3833	12	5.0	63	537.8	7	6.57	0.45	0.88	0	1	0	1	0	0	0	0	0	74	0	0	1.00	0	0	55	5	1	1
484	0.69	11415	18	3.0	383	1225.0	1250	19.71	1.00	0.16	0	1	0	1	0	0	0	0	0	15	0	1	1.00	0	10	52	0	0	1
485	0.72	4374	6	2.0	301	542.9	75	4.38	0.90	0.74	0	1	0	1	0	0	0	0	0	12	0	1	1.00	0	15	48	0	0	1
486	0.80	7227	14	4.0	1182	705.8	1744	10.22	0.74	0.26	0	1	0	1	0	0	0	0	0	25	0	1	1.00	0	10	43	16	1	1
487	0.69	1480	4	0.0	31	189.9	19	2.92	0.37	0.96	0	1	0	1	0	0	0	0	0	25	0	0	1.00	0	0	46	1	0	1
488	0.64	2044	8	0.0	82	299.8	210	5.84	0.59	0.40	0	1	0	1	0	0	0	0	0	55	0	1	1.00	0	30	52	3	0	1
489	0.62	1825	6	0.0	155	216.7	33	3.29	0.83	0.76	0	1	0	1	0	0	0	0	0	60	0	0	0.62	0	30	57	2	1	1
490	0.69	1825	4	0.0	98	207.1	63	2.19	0.64	0.93	0	1	0	1	0	0	0	0	0	30	0	1	0.68	0	30	71	1	1	1
491	0.71	10804	58	4.0	526	676.9	561	52.93	0.41	0.39	0	1	0	1	0	0	0	0	0	25	0	1	1.00	0	10	50	7	0	1
492	0.81	26280	60	3.0	271	1014.8	72	54.75	0.66	0.20	0	1	0	1	0	0	0	0	0	30	0	1	0.91	0	10	67	3	1	1
493	0.65	5000	40	2.0	451	336.2	466	21.90	0.39	0.25	0	1	0	1	0	0	0	0	1	40	0	1	1.00	0	15	76	3	0	1
494	0.72	4320	30	2.0	900	281.4	358	16.43	0.27	0.19	0	1	0	1	0	0	0	0	1	38	0	0	0.87	0	0	54	8	1	0
495	0.68	3480	9	2.0	1994	467.4	286	4.93	0.57	0.55	0	1	0	1	0	0	0	0	1	55	0	1	1.00	0	15	36	2	0	1
496	0.91	21600	85	15.0	3322	947.6	3443	46.54	0.71	0.15	0	1	0	0	0	1	0	1	1	35	1	1	1.00	0	10	54	8	1	1
497	0.76	11520	37	1.0	1035	742.0	619	20.26	0.52	0.39	0	1	0	1	0	0	0	0	1	58	0	1	0.94	0	10	60	4	1	1
498	0.94	36000	50	10.0	716	1133.2	2234	27.38	0.69	0.24	0	1	0	0	0	1	0	1	1	45	1	1	0.97	0	15	57	8	1	1
499	0.72	2880	15	0.0	433	197.5	305	8.21	0.22	0.45	0	1	0	1	0	0	0	0	0	50	0	1	1.00	0	10	67	4	1	1
500	0.74	2880	12	0.0	193	299.5	161	6.57	0.18	0.56	0	1	0	1	0	0	0	0	0	50	0	1	1.00	0	15	66	2	1	1
501	0.71	3120	8	2.0	523	312.2	227	4.38	0.41	0.20	0	1	0	1	0	0	0	0	1	60	0	0	1.00	0	15	69	2	1	1
502	0.69	5760	18	4.0	935	460.5	790	9.86	0.46	0.27	0	1	0	1	0	0	0	0	1	40	1	1	0.75	0	10	69	4	1	1
503	0.67	7200	30	10.0	1019	450.2	500	16.43	0.48	0.43	0	1	0	1	0	0	0	0	1	46	0	0	1.00	0	10	55	2	0	1
504	0.75	7200	10	2.0	605	615.6	843	5.48	0.73	0.42	0	1	0	1	0	0	0	0	1	36	0	1	0.87	0	10	72	2	1	1
505	0.76	7200	20	4.0	1205	615.9	1167	10.95	0.59	0.52	0	1	0	1	0	0	0	0	1	49	0	1	0.91	0	15	48	4	1	1
506	0.93	36000	20	5.0	1339	780.4	1638	10.95	0.97	0.33	0	1	0	0	0	1	0	0	1	30	0	1	0.98	0	15	65	2	1	1
507	0.65	3600	14	0.0	858	402.4	943	7.67	0.49	0.12	0	1	0	1	0	0	0	0	1	45	0	1	0.72	0	10	72	4	1	1
508	0.76	7200	20	0.0	888	658.1	1150	10.95	0.73	0.40	0	1	0	1	0	0	1	0	1	40	0	1	1.00	0	10	57	1	0	1
509	0.90	5760	35	5.0	1112	209.6	595	19.16	0.27	0.32	0	1	0	0	0	1	0	0	1	42	0	0	0.90	0	10	45	10	1	0
510	0.62	4320	15	0.0	435	566.6	830	8.21	0.52	0.28	0	1	0	1	0	0	0	0	0	55	0	1	1.00	0	15	72	2	0	1
511	0.71	11520	40	2.0	322	866.3	1846	21.90	0.58	0.47	0	1	0	1	0	0	0	0	0	45	0	1	0.80	0	10	55	3	1	1
512	0.60	2160	5	0.0	286	260.5	260	2.74	0.46	0.26	0	1	0	1	0	0	0	0	0	60	0	1	0.52	0	0	70	4	1	1
513	0.65	1000	5	0.0	465	143.8	134	2.74	0.24	0.17	0	1	0	1	0	0	0	0	0	58	0	1	1.00	0	0	73	4	1	1
514	0.68	1400	6	0.0	915	225.0	531	0.00	0.52	1.00	0	1	0	1	0	0	0	0	0	60	0	1	1.00	0	10	72	2	1	1
515	0.74	4320	30	0.0	226	190.1	512	16.43	0.33	0.26	0	1	0	1	0	0	0	0	1	45	0	1	0.94	0	10	67	8	1	1
516	0.67	2000	13	0.0	376	178.9	201	7.12	0.17	0.53	0	1	0	1	0	0	0	0	0	64	0	1	1.00	0	0	74	3	1	1
517	0.61	1656	28	0.0	238	151.2	8	0.00	0.27	0.48	0	1	0	1	0	0	0	0	0	60	0	0	0.66	0	0	66	6	1	0

(Continue)

(Continue)

N	TE	Y	Cow	Lnd	Cap	Lab	Cst	Con	Rou	RLb	SeCw	NE	SSP	CbZ	PH	HPE	Ain	Par	Paf	Dst	Tel	Elc	Fou	Coo	Pay	Age	Edu	Own	Liv
518	0.66	5249	18	0.0	223	600.6	50	16.43	0.98	0.57	0	1	0	1	0	0	0	0	0	30	0	0	0.69	0	10	63	3	1	0
519	0.68	3475	10	0.0	182	278.9	46	10.95	0.66	0.73	0	1	0	1	0	0	0	0	0	40	0	0	0.80	0	0	67	4	1	1
520	0.76	1512	2	0.0	36	783.2	45	1.10	0.73	0.99	0	1	0	1	0	0	0	0	0	22	0	1	1.00	0	10	61	0	1	1
521	0.75	7302	12	2.0	1023	681.2	391	6.57	0.55	0.77	0	1	0	1	0	0	0	0	0	10	0	1	1.00	0	10	48	0	0	1
522	0.77	6935	40	35.0	1522	541.9	314	29.20	0.25	0.54	0	1	0	0	0	1	0	0	0	52	0	0	0.94	0	0	46	3	1	1
523	0.57	6014	40	12.0	535	646.8	554	14.60	0.54	0.58	0	1	0	1	0	0	0	0	0	75	0	0	0.89	0	0	49	1	0	1
524	0.67	4562	40	18.0	499	346.0	177	21.90	0.29	0.55	0	1	0	1	0	0	0	0	0	65	0	0	0.94	0	0	45	1	1	1
525	0.65	7300	30	15.0	2019	673.7	715	21.90	0.33	0.57	0	1	0	1	0	0	0	0	0	53	0	0	1.00	0	0	48	2	0	1
526	0.64	2464	15	6.0	448	234.5	299	10.95	0.35	0.61	0	1	0	1	0	0	0	0	0	94	0	0	1.00	0	0	51	1	1	1
527	0.60	3102	10	5.0	542	562.9	150	5.48	0.64	0.63	0	1	0	1	0	0	0	0	0	76	0	0	0.77	0	0	65	1	1	1
528	0.69	9125	70	15.0	1519	411.3	269	51.10	0.14	0.05	0	1	0	1	0	0	0	0	0	55	0	0	0.89	0	0	63	0	1	0
529	0.64	3650	19	15.0	1173	404.4	542	13.87	0.35	0.57	0	1	0	1	0	0	0	0	0	36	0	0	1.00	0	0	36	1	0	1
530	0.64	5110	30	15.0	822	404.2	199	16.43	0.22	0.39	0	1	0	1	0	0	0	0	0	43	0	0	1.00	0	0	59	1	0	1
531	0.73	3285	20	3.0	568	341.7	20	10.95	0.52	0.88	0	1	0	1	0	0	0	0	0	23	0	0	0.92	0	0	37	1	1	1
532	0.84	15750	37	30.0	346	642.2	1197	27.01	0.36	0.17	0	1	0	0	0	1	0	1	1	6	0	1	0.76	0	7	74	7	0	1
533	0.65	294	4	0.0	27	62.0	41	0.00	0.12	1.00	0	1	0	1	0	0	0	0	0	22	0	0	0.80	0	0	38	1	1	1
534	0.65	1764	6	0.7	169	97.8	271	3.29	0.39	1.00	0	1	0	1	0	0	0	0	0	24	0	1	0.56	0	0	71	2	1	1
535	0.84	2205	7	2.0	99	76.6	275	5.11	0.20	0.37	0	1	0	1	0	0	0	1	1	24	0	1	0.75	0	0	34	3	1	1
536	0.61	1764	7	2.0	19	94.1	341	3.83	0.39	0.41	0	1	0	1	0	0	0	0	0	20	0	0	0.46	0	0	71	0	1	1
537	0.71	4410	25	4.0	217	315.1	739	0.00	0.36	0.29	0	1	0	1	0	0	0	1	1	41	0	1	0.73	0	20	50	2	0	1
538	0.66	2160	7	0.6	124	165.4	238	3.83	0.25	1.00	0	1	0	1	0	0	0	0	1	40	0	0	0.74	0	15	36	1	0	1
539	0.63	2268	16	6.0	352	498.9	522	0.00	0.34	0.95	0	1	0	1	0	0	0	0	1	17	0	1	0.51	0	15	41	10	0	1
540	0.61	700	5	0.6	108	95.7	104	0.00	0.12	1.00	0	1	0	1	0	0	0	0	0	28	0	0	0.66	0	15	39	4	0	1
541	0.61	252	1	0.2	6	69.5	28	0.00	0.11	1.00	0	1	0	1	0	0	0	0	0	22	0	0	0.45	0	0	60	1	1	1
542	0.68	1008	6	1.0	89	127.5	182	0.00	0.11	0.63	0	1	0	1	0	0	0	0	1	24	0	1	0.51	0	0	35	3	1	1
543	0.68	1860	6	0.0	169	373.5	73	0.00	0.29	0.73	0	1	0	1	0	0	0	0	0	6	0	1	0.67	0	0	31	5	0	1
544	0.76	3658	10	1.0	100	364.6	242	3.65	0.30	0.50	0	1	0	1	0	0	0	0	0	15	0	1	0.86	0	0	59	1	1	1
545	0.88	2016	6	0.0	148	126.5	142	0.00	0.13	0.45	0	1	0	1	0	0	0	1	0	18	0	0	0.94	0	30	49	2	1	1
546	0.90	8584	20	15.0	90	693.1	280	7.30	0.37	0.87	0	1	0	1	0	0	0	1	0	19	0	0	1.00	0	30	52	1	1	1
547	0.67	6300	40	3.0	546	485.0	1680	21.90	0.40	0.20	0	1	0	1	0	0	0	0	0	46	0	0	0.74	0	0	39	11	1	1
548	0.64	1764	10	0.0	131	369.6	333	1.83	0.39	1.00	0	1	0	1	0	0	0	0	0	27	0	0	0.76	0	0	74	4	1	1
549	0.59	441	4	0.0	232	140.3	76	0.00	0.12	0.96	0	1	0	1	0	0	0	0	0	12	0	0	0.57	0	0	76	0	1	1
550	0.58	588	6	2.0	338	58.2	89	2.19	0.06	0.95	0	1	0	1	0	0	0	0	0	48	0	0	1.00	0	0	61	1	0	1
551	0.58	441	5	3.0	71	123.1	49	0.91	0.14	1.00	0	1	0	1	0	0	0	0	0	1	0	1	0.45	0	0	71	1	1	1
552	0.65	336	2	0.0	58	151.6	57	0.00	0.14	0.99	0	1	0	1	0	0	0	0	0	24	0	1	0.64	0	0	48	4	1	1
553	0.72	441	4	0.5	10	67.1	33	0.00	0.14	0.94	0	1	0	1	0	0	0	0	0	24	0	0	1.00	0	0	47	3	1	1
554	0.67	441	4	0.0	90	99.6	66	0.00	0.09	1.00	0	1	0	1	0	0	0	0	0	27	0	1	0.82	0	0	56	0	1	1
555	0.57	455	4	1.0	61	219.4	90	0.00	0.14	1.00	0	1	0	1	0	0	0	0	0	27	0	1	0.45	0	0	70	0	1	1
556	0.57	756	4	0.0	71	192.9	225	0.00	0.36	0.81	0	1	0	1	0	0	0	0	0	27	0	0	0.38	0	0	61	0	1	1
557	0.55	869	7	1.0	198	435.3	266	0.00	0.26	1.00	0	1	0	1	0	0	0	0	0	35	0	0	0.43	0	0	69	0	1	1
558	0.53	756	4	0.0	130	176.9	144	0.00	0.21	1.00	0	1	0	1	0	0	0	0	0	31	0	1	0.39	0	0	68	2	0	1
559	0.60	2352	20	0.5	366	649.4	721	3.65	0.50	0.93	0	1	0	1	0	0	0	0	0	35	0	0	1.00	0	0	48	0	0	1
560	0.71	700	4	0.5	41	139.1	101	0.00	0.22	0.96	0	1	0	1	0	0	0	1	1	30	0	0	0.69	0	0	69	0	1	1
561	0.67	1764	10	1.0	276	437.9	274	1.83	0.25	0.94	0	1	0	1	0	0	0	0	0	28	0	0	0.83	0	0	62	3	1	1
562	0.74	1680	7	1.0	207	276.2	17	0.00	0.22	0.32	0	1	0	1	0	0	0	0	0	26	0	0	0.97	0	0	55	2.5	1	1
563	0.56	1764	24	0.6	208	141.5	263	13.14	0.07	0.80	0	1	0	1	0	0	0	0	0	54	0	1	0.75	0	0	70	3	0	0
564	0.77	1680	12	0.5	594	197.2	744	0.00	0.26	0.60	0	1	0	1	0	0	0	1	0	54	1	0	1.00	0	0	34	10	1	1
565	0.71	51450	90	25.0	3274	1203.8	8150	82.13	0.33	0.00	0	1	0	1	0	0	0	0	0	27	1	1	0.57	0	22	34	2	0	1
566	0.84	20580	100	5.5	655	1698.0	2924	0.00	0.44	0.43	0	1	0	1	0	0	0	1	1	27	0	0	0.97	0	15	93	0	1	1
567	0.62	1764	18	4.0	195	232.1	693	6.57	0.22	0.24	0	1	0	1	0	0	0	0	1	12	0	0	0.72	0	0	87	3	1	1
568	0.65	882	6	0.0	138	277.7	149	1.10	0.21	0.98	0	1	0	1	0	0	0	0	0	9	0	0	0.74	0	0	59	1	1	1
569	0.67	10500	65	6.0	855	961.7	1907	35.59	0.34	0.34	0	1	0	1	0	0	0	0	1	48	0	0	0.96	0	8	28	0	0	1
570	0.57	7200	25	2.0	1730	659.6	2060	9.13	0.66	0.50	0	1	0	1	0	0	0	0	1	25	0	0	0.26	0	0	74	2	1	1
571	0.56	441	5	0.4	109	259.9	92	0.00	0.19	1.00	0	1	0	1	0	0	0	0	0	42	0	0	0.56	0	0	64	3	1	1
572	0.64	1260	6	0.5	121	216.0	138	0.00	0.30	1.00	0	1	0	1	0	0	0	0	0	45	0	0	0.74	0	0	72	0	1	1
573	0.67	4500	15	2.0	391	330.8	935	8.21	0.30	0.39	0	1	0	1	0	0	0	0	1	24	0	1	0.91	0	8	76	0	0	1
574	0.59	504	7	2.0	107	168.3	71	0.00	0.10	1.00	0	1	0	1	0	0	0	0	0	25	0	0	0.59	0	0	62	0	1	1
575	0.77	6174	22	1.0	377	336.1	894	0.00	0.39	0.31	0	1	0	1	0	0	0	0	1	23	0	0	0.85	0	15	61	2	1	1
576	0.57	2940	14	1.5	379	336.6	1112	7.67	0.75	0.78	0	1	0	1	0	0	0	0	1	25	0	0	0.35	0	15	78	0	1	1
577	0.68	3098	31	7.0	584	135.4	361	22.63	0.14	0.27	0	1	0	1	0	0	0	0	1	25	0	0	1.00	0	15	38	0	0	1
578	0.68	2205	8	1.5	236	145.6	391	4.38	0.32	1.00	0	1	0	1	0	0	0	0	0	32	0	0	0.74	0	0	58	1	1	1
579	0.80	16464	40	5.0	221	519.7	1045	21.90	0.50	0.14	0	1	0	1	0	0	0	0	0	25	0	1	0.96	0	8	62	1	1	1
580	0.71	2100	8	2.0	149	233.8	128	4.38	0.26	0.82	0	1	0	1	0	0	0	0	0	34	0	0	0.88	0	0	57	2	1	1
581	0.70	4116	20	1.5	283	386.3	475	10.95	0.32	0.60	0	1	0	1	0	0	0	0	0	34	0	0	0.90	0	0	62	4	1	1
582	0.75	6174	20	2.0	320	367.7	730	10.95	0.38	0.21	0	1	0	1	0	0	0	0	0	36	0	0	1.00	0	8	60	5	1	1
583	0.68	2940	8	2.0	278	321.5	278	4.38	0.45	0.44	0	1	0	1	0	0	0	0	0	49	0	1	0.82	0	0	62	2	1	1
584	0.75	6174	20	3.0	375	385.7	663	10.95	0.38	0.44	0	1	0	1	0	0	0	0	0	30	0	1	0.92	0	8	67	1	1	1
585	0.71	7497	25	3.0	282	730.7	1086	13.69	0.42	0.43	0	1	0	1	0	0	0	0	0	30	0	1	1.00	0	8	40	2	0	1
586	0.75	7497	25	2.0	572	587.5	1344	13.69	0.38	0.51	0	1	0	1	0	0	0	0	0	46	0	1	1.00	0	8	60	3	1	1
587	0.78	41328	50	52.0	891	1817.3	2279	27.38	0.95	0.23	0	1	0	0	0	1	0	0	0	54	0	1	1.00	1	20	58	0	1	1
588	0.71	21168	35	100.0	472	2445.6	1116	19.16	0.89	0.67	0	1	0	0	0	1	0	0	0	54	0	1	0.94	1	20	75	1	1	1
589	0.69	21840	35	40.0	420	503.5	1668	0.00	0.83	0.41	0	1	0	0	0	1	0	0	0	10	0	1	0.37	0	0	45	1	1	0
590	0.52	918	3	3.5	61	697.5	4	0.00	0.66	1.00	0	1	0	0	0	1	0	0	0	9	0	0	0.18	0	0	57	1	1	1
591	0.86	24768	20	150.0	378	1045.1	3337	0.00	0.92	0.84	0	1	0	0	0	1	0	0	0	70	0	0	1.00	0	7	42	1	1	1
592	0.74	7020	9	3.0	39	693.3	600	0.00	0.79	0.80	0	1	0	0	0	1	0	0	0	12	0	1	0.56	0	0	38	1.5	0	0.5
593	0.75	21168	20	4.0	117	2099.4	1349	18.25	0.94	0.78	0	1	0	0	0	1	0	0	0	58	0	1	0.94	1	20	63	1	1	1

(Continue)

(Continue)

N	TE	Y	Cow	Lnd	Cap	Lab	Cst	Con	Rou	RLb	SeCw	NE	SSP	CbZ	PH	HPE	Ain	Par	Paf	Dst	Tel	Elc	Fou	Coo	Pay	Age	Edu	Own	Liv
594	0.78	30240	25	40.0	255	1360.1	2435	63.88	0.91	0.15	0	1	0	0	0	1	0	0	0	58	0	1	0.74	1	15	40	15	1	1
595	0.66	30240	60	300.0	800	2744.6	3690	43.80	0.83	0.12	0	1	0	1	0	0	0	0	0	55	0	1	0.72	1	15	67	4	1	1
596	0.85	64512	90	50.0	339	1842.2	2534	49.28	0.94	0.38	0	1	0	0	0	1	0	0	0	59	0	1	1.00	0	8	32	1	1	1
597	0.62	6048	16	32.0	46	1367.0	318	29.20	0.85	1.00	0	1	0	0	0	1	0	0	0	6	0	1	0.56	0	0	65	1	1	1
598	0.84	18144	28	30.0	442	1084.5	1690	20.44	0.87	0.16	0	1	0	0	0	1	0	0	1	15	0	1	0.78	0	8	56	4	1	1
599	0.73	20160	30	44.0	816	1065.8	9213	10.95	0.80	0.15	0	1	0	1	0	0	0	0	1	10	0	1	0.41	0	8	54	11	1	0
600	0.64	12096	17	2.0	1025	1289.2	567	12.41	0.80	0.25	0	1	0	0	0	1	0	0	0	36	0	0	0.51	0	8	65	1	1	1
601	0.93	58464	65	40.0	669	1962.3	593	71.18	0.95	0.17	0	1	0	0	0	1	0	0	1	38	0	1	0.98	0	15	37	8	1	1
602	0.82	4536	5	13.0	284	838.7	714	2.74	0.65	0.31	0	1	0	0	0	1	1	0	0	34	0	0	0.25	0	8	70	14	1	0
603	0.93	9000	15	20.0	167	373.1	28	5.48	0.56	1.00	0	1	0	0	0	1	0	0	1	39	0	0	1.00	0	0	47	2	1	1
604	0.78	3150	6	3.0	40	861.9	83	2.19	0.68	0.98	0	1	0	1	0	0	0	1	0	10	0	1	0.61	0	0	43	0	1	1
605	0.63	7020	15	12.0	230	609.8	7195	13.69	0.89	0.58	0	1	0	1	0	0	0	1	0	10	0	1	0.20	0	0	68	0	1	1
606	0.84	15120	13	5.0	202	648.1	696	14.24	0.88	0.68	0	1	0	0	0	1	0	0	0	38	0	0	0.95	0	0	49	0	1	1
607	0.82	2016	4	2.0	34	423.3	158	0.00	0.65	1.00	0	1	0	0	0	1	0	0	0	10	0	1	1.00	0	0	55	0	1	1
608	0.91	20100	15	12.0	108	1105.9	2840	10.95	0.89	0.97	0	1	0	1	0	0	0	1	0	17	0	1	0.92	0	0	46	3	1	1
609	0.67	605	1	0.0	2	135.4	1	0.00	0.54	1.00	0	1	0	1	0	0	0	0	0	6	0	0	0.60	0	0	33	3	0	1
610	0.60	2738	8	6.0	684	166.8	1541	5.84	0.67	0.81	0	1	0	1	0	0	0	1	0	20	0	1	0.43	0	0	51	1	0	1
611	0.93	17155	12	12.0	86	712.1	59	6.57	0.84	0.29	0	1	0	1	0	0	0	1	0	18	0	0	1.00	0	20	30	2	1	1
612	0.72	1752	6	4.0	20	198.3	11	0.00	0.54	0.95	0	1	0	1	0	0	0	1	0	20	0	0	0.51	0	0	71	2	1	1
613	0.76	5040	10	3.0	35	380.9	237	5.48	0.79	0.94	0	1	0	1	0	0	0	1	0	11	0	1	0.51	0	0	57	3	1	1
614	0.75	1460	4	1.0	12	107.5	10	0.00	0.47	0.87	0	1	0	1	0	0	0	1	0	10	0	0	0.49	0	0	59	1	1	1
615	0.73	3312	8	0.0	48	321.6	26	2.92	0.82	0.90	0	1	0	1	0	0	0	1	0	15	0	0	0.58	0	15	80	1	1	1
616	0.71	730	3	0.5	9	152.3	11	1.10	0.54	0.89	0	1	0	1	0	0	0	1	0	15	0	0	0.48	0	15	35	4	1	1
617	0.87	8870	14	1.5	71	600.3	814	0.00	0.61	0.25	0	1	0	0	0	1	0	0	0	42	0	1	1.00	0	0	45	1	1	1
618	0.76	18720	40	29.0	196	354.9	2454	43.80	0.99	0.00	0	1	0	0	0	1	0	0	0	48	0	1	0.80	0	0	71	1	1	1
619	0.86	59328	46	180.0	438	2055.5	5393	16.79	0.83	0.30	0	1	0	0	0	1	0	0	0	37	0	1	0.89	0	0	23	2	1	1
620	0.60	5940	10	9.0	276	1081.1	257	7.30	0.98	0.23	0	1	0	0	0	1	0	0	0	6	0	0	0.28	0	0	31	5	1	0
621	0.76	9720	28	59.0	271	721.1	294	0.00	0.71	0.25	0	1	0	1	0	0	0	1	0	7	0	1	0.28	0	30	50	1	1	0
622	0.68	1728	8	8.5	18	804.0	37	2.92	0.60	0.76	0	1	0	1	0	0	0	1	0	20	0	1	0.37	0	15	41	2	1	1
623	0.67	180	2	1.5	20	20.4	3	0.00	0.05	0.93	0	1	0	0	0	1	0	0	0	11	0	0	0.57	0	0	67	1	1	0
624	0.82	5138	5	3.0	28	535.2	71	1.83	0.81	0.99	0	1	0	1	0	0	0	1	1	49	0	0	0.81	0	0	67	3	1	1
625	0.60	1440	6	2.0	20	319.1	58	0.00	0.54	0.80	0	1	0	0	0	1	0	0	0	3	0	0	0.48	0	0	76	0	1	1
626	0.66	2480	4	1.0	20	644.6	8	1.46	0.71	1.00	0	1	0	0	0	1	0	0	0	38	0	0	0.55	0	0	61	0	1	1
627	0.58	1800	6	5.0	105	286.3	86	4.38	0.86	0.75	0	1	0	0	0	1	0	0	0	15	0	1	0.41	0	0	50	0	1	1
628	0.91	16020	20	10.0	128	810.3	122	0.00	0.66	0.90	0	1	0	0	0	1	0	0	0	40	0	1	1.00	0	0	49	3	1	1
629	0.67	15246	12	10.0	1011	1170.6	146	0.00	0.94	1.00	0	1	0	0	0	1	0	0	0	34	0	0	0.40	0	0	41	0	1	1
630	0.54	180	7	12.0	48	89.4	51	0.00	0.03	0.15	0	1	0	0	0	1	0	1	1	12	0	0	0.40	0	0	54	1	1	0
631	0.49	450	3	2.0	43	297.3	19	1.10	0.46	1.00	0	1	0	0	0	1	0	0	0	36	0	0	0.22	0	0	67	1	1	1
632	0.75	3834	11	5.0	21	185.4	40	4.02	0.58	0.78	0	1	0	0	0	1	0	0	0	36	0	0	0.79	0	15	33	3	1	1
633	0.70	1890	9	8.0	56	618.0	211	0.00	0.61	0.94	0	1	0	0	0	1	0	0	0	20	0	1	0.72	0	0	23	2	1	0
634	0.66	540	1	0.0	4	155.1	21	0.00	0.28	1.00	0	1	0	0	0	1	0	0	0	21	0	1	0.42	0	0	65	1	1	1
635	0.66	900	10	0.0	91	169.7	16	3.65	0.19	0.89	0	1	0	0	0	1	0	0	0	18	0	1	0.54	0	0	30	8	1	1
636	0.51	605	4	0.0	28	561.5	100	0.00	0.75	0.93	0	1	0	0	0	1	0	0	0	20	0	0	0.29	0	0	23	2	1	1
637	0.62	1440	4	6.0	54	278.3	168	0.00	0.71	0.63	0	1	0	0	0	1	0	0	0	6	0	1	0.30	0	0	45	7	1	0
638	0.77	6480	12	0.0	71	646.6	95	32.85	0.92	1.00	0	1	0	0	0	1	0	0	0	15	0	0	0.85	0	0	54	0	1	1
639	0.64	4562	14	35.0	230	753.3	10688	0.00	0.66	1.00	0	1	0	1	0	0	0	1	0	16	0	0	0.17	0	0	64	4	1	0
640	0.75	360	10	0.0	21	56.3	20	0.00	0.07	0.53	0	1	0	0	0	1	0	0	0	19	0	1	1.00	0	0	54	0	1	1
641	0.88	101790	70	75.0	446	2664.9	6228	89.43	0.94	0.14	0	1	0	1	0	0	0	0	0	28	0	1	0.80	0	15	37	5	1	0
642	0.79	3888	8	6.0	42	143.7	145	0.00	0.60	0.63	0	1	0	1	0	0	0	1	0	28	0	0	0.74	0	0	70	4	1	1
643	0.59	10368	11	30.0	127	372.5	5885	6.02	0.93	1.00	0	1	0	0	0	1	0	0	0	49	0	1	0.25	0	0	64	2	1	1
644	0.75	2592	7	5.0	34	497.6	144	2.56	0.36	1.00	0	1	0	0	0	1	0	0	0	27	0	0	0.88	0	0	52	0	1	1
645	0.73	365	4	1.5	16	170.4	0	0.00	0.15	0.99	0	1	0	1	0	0	0	1	0	6	0	0	0.49	0	0	56	2	1	1
646	0.57	900	5	6.0	55	207.4	144	0.91	0.18	1.00	0	1	0	0	0	1	0	0	0	18	0	0	0.38	0	30	34	4	1	0
647	0.51	405	5	0.0	30	289.3	60	0.00	0.32	1.00	0	1	0	0	0	1	0	0	0	45	0	1	0.30	0	0	62	0	1	1
648	0.82	1080	3	4.0	12	119.5	18	1.10	0.16	1.00	0	1	0	1	0	0	0	1	0	6	0	0	0.83	0	0	59	1	1	1
649	0.74	4936	6	4.0	127	1125.8	339	2.74	0.67	1.00	0	1	0	0	0	1	0	0	0	18	0	1	0.78	0	0	69	0	1	1
650	0.76	7258	15	4.0	140	769.3	1262	0.00	0.62	0.94	0	1	0	0	0	1	0	0	0	9	0	1	0.80	0	0	51	1	1	1
651	0.79	12096	30	40.0	277	618.4	798	10.95	0.61	0.64	0	1	0	0	0	1	0	0	0	50	0	1	0.88	0	0	67	2	1	1
652	0.53	180	3	2.0	9	143.9	9	1.10	0.17	1.00	0	1	0	1	0	0	0	1	0	12	0	0	0.27	0	0	81	0	1	1
653	0.83	3650	10	3.0	96	491.4	108	0.00	0.61	1.00	0	1	0	1	0	0	0	1	0	14	0	1	0.80	0	30	75	1	1	1
654	0.69	3456	15	42.0	209	204.2	408	27.38	0.45	1.00	0	1	0	0	0	1	0	0	0	55	0	1	0.73	0	0	60	0	1	1
655	0.67	1825	8	10.0	44	141.8	44	2.92	0.66	0.93	0	1	0	1	0	0	0	1	0	22	0	1	0.29	0	15	51	1	1	1
656	0.73	900	17	20.0	32	201.6	77	6.21	0.28	1.00	0	1	0	1	0	0	0	1	0	6	0	1	0.86	0	15	59	0	1	1
657	0.63	450	2	13.5	42	60.8	11	0.73	0.21	0.68	0	1	0	1	0	0	0	1	0	2	1	1	0.13	0	0	51	2	1	0
658	0.87	18317	30	30.0	184	549.5	972	16.43	0.58	0.53	0	1	0	0	0	1	0	0	0	15	0	0	1.00	0	0	43	4	1	1
659	0.62	950	8	0.0	63	134.4	67	4.38	0.26	0.43	0	1	0	0	0	1	0	0	0	13	0	0	0.55	0	0	73	1	1	1
660	0.79	2385	3	2.5	15	182.5	54	1.10	0.44	0.77	0	1	0	0	0	1	0	0	0	14	0	1	0.76	0	0	60	0	1	1
661	0.81	3241	8	2.0	28	723.7	56	2.92	0.75	0.99	0	1	0	1	0	0	0	1	0	15	0	1	0.75	0	0	39	4	1	1
662	0.91	9475	12	13.0	70	395.0	82	6.57	0.73	0.92	0	1	0	1	0	0	0	1	0	6	0	1	0.82	0	0	37	4	1	1
663	0.84	2190	6	0.0	24	120.1	30	5.48	0.41	0.84	0	1	0	1	0	0	0	1	0	16	0	1	0.69	0	15	43	3	1	1
664	0.92	3625	2	1.0	15	278.8	43	0.73	0.80	1.00	0	1	0	1	0	0	0	1	0	6	0	0	0.98	0	0	33	0	1	1
665	0.89	18118	14	10.0	172	844.1	271	7.67	0.73	1.00	0	1	0	0	0	1	0	0	0	10	0	1	1.00	0	0	60	0	1	1
666	0.92	19584	14	29.0	247	538.6	295	7.67	0.49	0.32	0	1	0	0	0	1	0	0	0	4	0	1	1.00	0	0	60	4	1	1
667	0.91	7200	10	10.0	140	330.5	936	0.00	0.43	0.79	0	1	0	0	0	1	0	0	1	10	0	1	0.88	0	0	65	0	1	1
668	0.85	7200	10	9.0	87	867.0	84	3.65	0.56	0.92	0	1	0	0	0	1	0	0	0	5	0	0	1.00	0	0	46	0	1	1
669	0.94	34200	15	9.0	310	1464.5	2144	8.21	0.96	0.16	0	1	0	0	0	1	0	0	1	25	0	1	0.98	0	0	35	1	1	1

(Continue)

(Continue)

N	TE	Y	Cow	Lnd	Cap	Lab	Cst	Con	Rou	RLb	SeCw	NE	SSP	CbZ	PH	HPE	Ain	Par	Paf	Dst	Tel	Elc	Fou	Coo	Pay	Age	Edu	Own	Liv
670	0.92	23400	30	20.0	236	1313.9	789	21.90	0.92	0.56	0	1	0	0	0	1	0	0	1	25	0	1	1.00	0	0	47	2	1	1
671	0.76	4050	4	3.0	40	173.2	67	2.92	0.87	1.00	0	1	0	0	0	1	0	0	0	3	0	1	0.68	0	0	57	0	1	1
672	0.72	5130	4	2.5	64	962.6	346	4.38	0.88	1.00	0	1	0	0	0	1	0	0	0	3	0	0	0.69	0	0	57	2	1	1
673	0.87	5850	8	0.0	88	240.3	190	5.84	0.96	1.00	0	1	0	0	0	1	0	0	0	4	0	1	1.00	0	0	35	0	1	1
674	0.92	7200	6	15.0	267	815.9	356	8.76	0.68	1.00	0	1	0	0	0	1	0	0	1	12	0	1	0.95	0	0	34	2	1	1
675	0.91	10800	8	6.0	119	693.4	1144	8.76	0.83	0.54	0	1	0	0	0	1	0	0	1	8	0	1	0.78	0	0	53	2	1	0
676	0.75	2520	8	40.0	112	161.0	449	2.92	0.19	0.65	0	1	0	0	0	1	0	0	0	14	0	1	0.73	0	0	41	4	1	1
677	0.68	3024	3	0.0	139	236.0	211	0.55	0.83	0.53	0	1	0	0	0	1	0	0	0	35	0	1	0.46	0	0	70	2	1	1
678	0.64	450	3	2.5	43	150.4	16	2.19	0.17	1.00	0	1	0	0	0	1	0	0	0	20	0	1	0.65	0	0	70	0	1	1
679	0.92	16200	15	29.0	126	354.8	429	8.21	0.79	0.56	0	1	0	0	0	1	0	0	0	15	0	1	1.00	0	0	27	8	1	1
680	0.58	1080	3	2.0	23	357.1	227	1.92	0.39	0.93	0	1	0	0	0	1	0	0	0	11	0	1	0.36	0	0	42	3	1	1
681	0.96	45000	25	10.0	689	915.3	2120	91.25	0.94	0.26	0	1	0	0	0	1	0	0	1	30	0	1	0.98	0	0	42	4	0	1
682	0.90	19800	12	10.0	241	710.9	951	19.71	0.81	0.51	0	1	0	0	0	1	0	0	1	25	0	1	0.70	0	0	26	6	1	1
683	0.77	5940	18	0.0	43	569.9	134	3.29	0.63	1.00	0	1	0	0	0	1	0	0	0	35	0	0	0.72	0	0	42	11	1	1
684	0.96	35640	15	3.0	347	1017.8	2552	24.64	0.86	0.38	0	1	0	0	0	1	0	0	1	20	0	1	1.00	0	0	25	7	1	1
685	0.79	3690	3	1.8	77	868.4	392	1.10	0.75	1.00	0	1	0	0	0	1	0	0	0	17	0	1	0.88	0	0	45	0	1	1
686	0.70	2070	4	4.0	38	318.9	220	2.19	0.52	1.00	0	1	0	0	0	1	0	0	0	12	0	1	0.70	0	0	57	0	1	1
687	0.68	990	2	2.0	13	372.2	22	0.00	0.74	1.00	0	1	0	0	0	1	0	0	0	15	0	1	0.57	0	0	27	4	1	1
688	0.50	1080	7	2.5	38	1127.5	382	0.00	0.59	1.00	0	1	0	0	0	1	0	0	0	5	0	1	0.32	0	0	75	0	1	1
689	0.90	113760	80	150.0	1661	3893.8	3328	219.00	0.93	0.25	0	1	0	0	0	1	0	1	1	36	0	0	0.91	0	0	49	2	1	0
690	0.73	11880	13	0.0	86	732.2	1300	7.12	0.86	0.49	0	1	0	0	0	1	0	0	0	45	0	0	0.67	0	0	67	0	1	1
691	0.90	19800	12	0.0	447	850.9	836	5.48	0.74	0.78	0	1	0	0	0	1	0	0	0	38	0	1	0.92	0	0	47	4	1	1
692	0.88	13506	30	8.0	86	801.4	595	10.95	0.84	1.00	0	1	0	1	0	0	0	1	0	20	0	1	1.00	0	0	47	1	1	1
693	0.84	3025	5	1.0	18	384.9	27	1.83	0.84	0.98	0	1	0	1	0	0	0	1	0	18	0	1	0.77	0	30	52	2	1	1
694	0.64	2880	5	4.0	27	323.0	152	3.65	0.82	0.76	0	1	0	0	0	1	0	0	0	22	0	0	0.55	0	0	79	0	1	1
695	0.57	3600	6	5.0	39	1004.6	121	2.19	0.91	1.00	0	1	0	0	0	1	0	1	0	9	0	1	0.48	0	0	69	1	1	1
696	0.79	5520	6	4.5	29	651.4	28	2.19	0.87	0.96	0	1	0	1	0	0	0	1	0	24	0	0	0.69	0	0	65	1	1	1
697	0.66	7300	10	0.0	522	556.3	423	13.69	0.98	0.35	0	1	0	1	0	0	0	1	0	3	1	1	0.13	0	0	52	4	1	1
698	0.70	4050	11	2.0	22	263.6	253	4.02	0.58	0.99	0	1	0	0	0	1	0	1	0	15	0	1	0.83	0	0	54	0	1	1
699	0.69	1728	8	0.0	87	102.6	23	4.38	0.21	0.50	0	1	0	0	0	1	0	0	0	2	1	1	0.19	0	0	36	0	0	1
700	0.53	432	4	0.0	237	284.8	41	0.00	0.37	0.98	0	1	0	0	0	1	0	0	0	27	0	1	0.37	0	0	79	0	1	1
701	0.65	432	2	1.0	19	114.3	6	1.10	0.14	1.00	0	1	0	0	0	1	0	0	0	40	0	1	0.56	0	0	58	0	1	1
702	0.63	960	20	0.0	49	165.5	15	0.00	0.38	0.92	0	1	0	0	0	1	0	0	0	9	0	1	0.64	0	0	70	0	1	1
703	0.56	1752	20	0.0	337	459.8	44	0.00	0.81	1.00	0	1	0	0	0	1	0	0	0	14	0	1	0.43	0	0	59	0	1	1
704	0.74	1080	17	10.0	243	94.1	3	0.00	0.10	0.26	0	1	0	0	0	1	0	0	0	7	0	0	0.65	0	0	47	8	1	0
705	0.84	3370	19	0.0	119	163.7	64	0.00	0.82	1.00	0	1	0	0	0	1	0	0	0	15	0	1	1.00	0	0	55	4	1	1
706	0.72	1512	9	0.0	31	276.2	216	3.29	0.39	0.71	0	1	0	0	0	1	0	0	0	15	0	1	0.64	0	8	22	11	1	0
707	0.43	1080	25	15.0	146	547.9	399	0.00	0.32	0.69	0	1	0	0	0	1	0	0	0	65	0	0	0.12	0	0	76	0	1	1
708	0.58	270	1	3.5	71	423.0	18	0.00	0.23	1.00	0	1	0	0	0	1	0	0	0	13	1	1	0.22	0	0	73	0	1	1
709	0.64	5475	10	30.0	94	560.9	242	5.48	0.76	0.34	0	1	0	0	0	1	0	0	0	16	0	1	0.25	0	0	37	11	1	0
710	0.62	930	15	4.0	42	69.5	72	5.48	0.10	1.00	0	1	0	0	0	1	0	0	0	40	0	0	0.76	1	30	45	0	1	0
711	0.41	270	10	0.0	58	588.2	7	0.00	0.56	1.00	0	1	0	0	0	1	0	0	0	50	0	1	0.09	0	0	52	0	1	1
712	0.81	1369	2	50.0	889	33.6	273	0.37	0.02	0.30	0	1	0	1	0	0	0	0	0	22	0	1	0.90	0	0	45	9	1	1
713	0.55	1340	6	3.0	52	593.1	250	2.19	0.60	0.86	0	1	0	0	0	1	0	0	0	17	0	1	0.37	0	0	65	4	1	1
714	0.50	1260	6	1.0	144	343.0	898	2.19	0.76	0.44	0	1	0	0	0	1	0	0	0	19	0	1	0.23	0	0	54	3	1	1
715	0.47	800	15	2.0	288	314.4	48	0.00	0.73	0.42	0	1	0	0	0	1	0	0	0	35	0	1	0.19	0	0	80	4	1	1
716	0.64	180	1	4.0	86	100.6	0	0.00	0.25	1.00	0	1	0	0	0	1	0	0	0	40	0	1	0.30	0	0	63	4	1	1
717	0.65	540	8	5.0	42	30.8	10	0.00	0.21	1.00	0	1	0	0	0	1	0	0	0	24	0	0	0.65	0	0	61	0	1	1
718	0.57	450	3	0.0	12	433.8	16	0.55	0.39	1.00	0	1	0	0	0	1	0	0	0	14	0	1	0.42	0	0	47	3	1	1
719	0.79	3456	4	0.0	15	247.5	269	1.46	0.63	0.92	0	1	0	1	0	0	0	0	0	11	0	1	0.65	0	15	55	4	1	0
720	0.75	540	4	2.0	36	127.3	0	0.00	0.18	1.00	0	1	0	0	0	1	0	0	0	42	0	0	0.62	0	15	54	4	1	1
721	0.91	4320	12	0.0	57	705.3	0	0.00	0.88	1.00	0	1	0	1	0	0	0	1	0	28	0	0	0.99	0	0	43	0	1	1
722	0.50	180	3	3.0	10	82.0	0	0.00	0.46	1.00	0	1	0	1	0	0	0	0	0	42	0	0	0.12	0	0	72	0	1	1
723	0.61	600	4	2.0	22	147.5	8	0.00	0.33	0.89	0	1	0	1	0	0	0	0	0	5	0	1	0.39	0	0	69	0	1	1
724	0.83	1575	5	0.0	50	210.7	0	0.00	0.65	0.78	0	1	0	1	0	0	0	0	0	8	0	1	0.67	0	0	32	7	1	1
725	0.87	16128	16	4.0	136	669.6	2619	8.76	0.85	0.89	0	1	0	1	0	0	0	0	0	11	0	1	0.94	0	15	50	4	1	0
726	0.68	8170	80	700.0	2806	141.8	1727	0.00	0.26	0.28	1	0	0	1	0	0	0	0	0	68	0	0	0.79	0	15	67	5	1	0
727	0.91	45720	220	#####	4289	923.6	7420	0.00	0.58	0.06	1	0	0	1	0	0	1	1	1	41	1	1	0.84	0	0	73	5	1	0
728	0.73	9720	70	311.7	1176	253.3	4051	0.00	0.45	0.18	1	0	0	1	0	0	0	0	0	45	0	1	0.94	0	15	78	4	1	0
729	0.80	25700	150	203.9	1249	600.9	7552	41.06	0.70	0.29	1	0	0	1	0	0	0	0	0	28	1	1	0.88	0	30	43	11	1	0
730	0.71	5913	35	107.9	362	247.3	702	0.00	0.80	0.81	1	0	0	1	0	0	0	0	0	77	0	0	1.00	0	15	45	3	1	1
731	0.89	7560	17	8.0	1714	159.1	592	12.41	0.51	0.00	1	0	0	0	0	1	0	0	0	6	0	1	1.00	0	0	49	0	1	0
732	0.68	6431	147	0.0	374	46.8	342	0.00	0.31	1.00	1	0	0	0	0	1	0	0	0	7	0	1	0.87	1	45	65	0	1	1
733	0.82	5130	28	1.5	511	209.7	779	0.00	0.20	0.57	0	0	1	1	0	0	0	0	0	7	1	1	1.00	1	30	52	4	1	1
734	0.76	2660	31	16.9	467	91.0	692	0.00	0.12	0.68	0	0	1	1	0	0	0	0	0	23	1	1	0.88	0	30	48	4	1	1
735	0.95	6000	16	0.0	169	156.7	857	0.00	0.23	0.29	0	0	1	1	0	0	1	1	0	7	0	1	0.85	0	30	60	2	1	0
736	0.93	12350	70	87.1	618	314.6	3307	255.50	0.22	0.40	0	0	1	1	0	0	1	1	1	8	1	1	0.96	0	30	76	1	1	1
737	0.86	6120	30	60.5	324	143.3	206	0.00	0.57	1.00	0	0	1	1	0	0	0	0	0	15	0	1	1.00	0	15	33	4	1	1
738	0.88	1900	10	19.4	146	56.3	258	0.00	0.08	1.00	0	0	1	1	0	0	0	0	0	5	0	1	1.00	0	30	46	12	1	1
739	0.88	33300	90	71.0	2541	738.7	7591	0.00	0.54	0.47	0	0	1	1	0	0	0	1	0	25	1	1	0.93	1	30	65	3	1	0
740	0.88	13140	80	53.0	754	392.6	3153	21.90	0.36	0.74	0	0	1	1	0	0	1	0	0	18	1	1	1.00	1	30	57	4	1	0
741	0.64	7646	18	26.0	1043	338.6	689	9.86	0.66	0.39	0	0	1	1	0	0	0	1	1	10	1	1	0.16	1	30	53	18	0	0
742	0.65	3285	23	36.0	705	188.3	533	0.84	0.47	0.38	0	0	1	1	0	0	0	1	0	18	1	1	0.37	1	30	62	3	1	0
743	0.75	4090	10	25.0	253	291.9	170	3.65	0.62	1.00	0	0	1	1	0	0	0	0	0	18	0	1	0.81	0	30	76	0	1	1
744	0.75	340	5	9.7	92	19.7	112	0.00	0.10	1.00	0	0	1	1	0	0	0	0	0	3	0	1	1.00	0	30	52	0	1	1
745	0.81	9090	30	65.3	482	469.4	861	0.00	0.28	0.24	0	0	1	1	0	0	0	0	0	5	0	1	0.84	0	0	54	4	1	1

(Continue)

(Continue)

N	TE	Y	Cow	Lnd	Cap	Lab	Cst	Con	Rou	RLb	SeCw	NE	SSP	CbZ	PH	HPE	Ain	Par	Paf	Dst	Tel	Elc	Fou	Coo	Pay	Age	Edu	Own	Liv
746	0.63	3997	35	70.5	346	192.2	619	0.00	0.55	0.29	0	0	1	0	0	1	0	0	0	6	0	1	0.70	0	30	73	0	1	1
747	0.96	15150	33	21.0	431	451.2	3399	6.02	0.60	0.81	0	0	1	1	0	0	1	1	1	6	1	1	1.00	0	30	57	4	1	1
748	0.92	12320	27	10.0	393	54.7	527	19.71	0.13	0.76	0	0	1	1	0	0	0	0	1	14	1	1	0.92	0	30	52	4	1	1
749	0.64	6570	48	116.0	436	295.3	903	0.00	0.57	0.52	0	0	1	0	0	1	0	0	0	6	1	1	0.33	0	30	66	8	1	1
750	0.87	5548	18	0.0	378	170.3	744	0.00	0.24	0.14	0	0	1	0	0	1	0	1	0	10	1	1	0.96	1	30	64	4	1	0
751	0.97	11443	15	0.0	317	154.5	2374	0.00	0.39	0.38	0	0	1	0	0	1	0	0	0	7	1	1	1.00	0	15	65	11	0	0
752	0.94	7212	30	20.5	636	2.4	393	0.00	0.02	1.00	0	0	1	0	0	1	0	0	0	7	0	1	1.00	0	30	74	0	1	0
753	0.98	325500	250	0.0	3294	7137.1	37185	0.00	0.26	0.01	0	0	1	0	0	1	1	0	0	10	1	1	1.00	1	30	44	11	0	0
754	0.77	9636	25	2.0	738	200.0	7801	0.00	1.00	1.00	0	0	1	1	0	0	0	0	0	22	1	1	1.00	1	15	56	4	1	1
755	0.90	7300	30	120.0	2910	689.6	387	21.90	0.07	0.00	0	0	1	1	0	0	0	1	0	10	1	1	1.00	0	15	32	11	1	0
756	0.98	83956	80	0.0	2270	874.6	11431	0.00	0.43	0.07	0	0	1	0	1	0	1	0	0	3	1	1	1.00	1	45	142	11	1	0.8
757	0.79	13870	33	1.0	1088	168.0	3701	0.00	1.00	0.89	0	0	1	0	0	1	0	0	0	23	0	1	1.00	1	15	65	0	1	1
758	0.81	6935	20	7.0	220	250.0	240	0.00	1.00	1.00	0	0	1	1	0	0	0	0	0	13	0	1	1.00	1	15	38	3	1	1
759	0.65	4500	5	0.0	1200	500.0	4099	5.48	1.00	0.00	0	0	1	0	0	1	0	0	0	2	1	1	0.12	1	15	49	17	1	0
760	0.76	13870	76	0.0	1959	250.0	373	0.00	1.00	0.00	0	0	1	0	0	1	0	0	0	12	0	1	0.78	1	15	36	5	0	1
761	0.85	6844	27	4.0	763	250.0	4620	0.00	1.00	0.00	0	0	1	0	0	1	0	0	0	8	0	1	1.00	0	0	29	6	0	1
762	0.75	6935	22	7.3	224	150.0	915	0.00	1.00	1.00	0	0	1	0	0	1	0	0	0	7	0	1	0.83	1	15	64	3	0	1
763	0.99	164250	66	0.0	7427	1060.9	27976	0.00	0.76	0.11	0	0	1	0	1	0	1	0	0	10	1	1	1.00	0	15	70	4	1	0
764	0.98	76650	60	0.0	5206	900.0	18550	0.00	1.00	0.17	0	0	1	0	1	0	1	1	1	10	1	1	1.00	0	45	63	4	1	1
765	0.63	3600	20	3.0	668	250.0	717	0.00	1.00	1.00	0	0	1	1	0	0	0	0	0	3	1	1	0.33	1	40	42	11	1	1
766	0.98	82782	79	197.0	6784	2575.4	17204	0.00	0.97	0.06	0	0	1	0	1	0	1	1	0	4	1	1	0.92	0	30	69	11	1	1
767	0.91	20805	45	29.0	1364	400.0	6470	0.00	1.00	0.38	0	0	1	1	0	0	0	1	0	2	0	1	1.00	0	30	61	5	1	0
768	0.70	15000	40	10.0	600	330.0	7344	14.60	1.00	0.00	0	0	1	1	0	0	0	1	1	12	1	1	0.23	1	20	53	16	1	0
769	0.80	5782	17	8.4	724	196.9	473	0.00	0.79	1.00	0	0	1	1	0	0	0	0	0	18	0	1	1.00	1	15	45	4	1	1
770	0.75	3942	13	5.8	206	188.5	650	33.22	0.94	1.00	0	0	1	1	0	0	0	0	0	20	0	1	1.00	1	35	52	3	1	1
771	0.96	82782	75	134.0	2396	862.5	17031	684.38	0.91	0.21	0	0	1	0	0	1	1	1	0	24	1	1	0.97	0	45	57	4	1	1
772	0.96	11534	18	17.5	2166	453.4	3094	13.14	0.70	0.23	0	0	1	0	0	1	1	1	1	1	1	1	0.90	1	30	65	4	1	0
773	0.66	210	5	4.4	39	5.6	37	0.00	0.02	1.00	0	0	1	0	0	1	0	0	0	9	0	1	0.83	1	30	44	4	1	1
774	0.79	434	2	0.0	561	6.5	221	0.00	0.03	1.00	0	0	1	1	0	0	0	0	0	12	0	1	0.94	1	30	45	8	1	1
775	0.80	1241	3	2.0	134	25.4	695	0.00	0.13	1.00	0	0	1	0	1	0	1	0	1	10	0	1	1.00	0	30	52	3	1	0

Source: EMBRAPA - Empresa Brasileira de Pesquisa Agropecuária - the Brazilian Agricultural Research Corporation, as part of a general survey conducted in 1998 by EMBRAPA and Getúlio Vargas Foundation (1998).

Note: *N* = Number of observation (farm); *TE* = Predicted technical efficiency; *Y* = Milk production, in R$/year; *Cow* = Number of cows; *Lnd* = Pasture land, in hectares; *Cap* = Cost of capital in buildings and machinery, in R$/year (4% of interest rate per year); *Lab* = Total labor, in full-time equivalent days/year (40h/week); *Cst* = Other variable costs, in R$/year; *Con* = Concentrated feed, in tons/year; *Rou* = Ratio dairy output/total farm output; *Rbl* = Ratio family labor/total labor; *SeCw* = Southeast region without São Paulo and the State of Goiás, from Central-West region; *NE* = Northeast; *SSP* = South region and São Paulo; *CbZ* = Cross-breed or Zebu; *PH* = Pure Holstein; *HPE* = ¾ Holstein or other Pure European breeds; *Ain* = Artificial insemination; *Par* = Pasture rotation; *Paf* = Pasture fertilization; *Dst* = Distance from urban area, in km; *Tel* = Telephone; *Elc* = Electricity; *Fou* = Ratio farm output/family total income; *Coo* = Sell production to a cooperative; *Pay* = Days until payment; *Age* = Age of the operator, in years; *Edu* = Operator education level, in years; *Own* = Operator is the owner; *Liv* = The owner lives on the farm; and R$ = Monetary values are expressed in Reals, 1998, when the exchange rate was about R$1.10 for US$1.00.

VITA

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Doctor of Philosophy

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