

POT-BELLIES, CATTLE BREEDS AND REVEALING SIGNALS

DOUGLAS W. ALLEN*

Believe it or not, there are many interesting economic puzzles at cattle auctions. For example, why does the Holstein breed completely dominate veal sales? And why do other breeds get slaughtered in terms of price when they enter the veal ring? The answer lies in the nature of veal production and the characteristics of the auction which provide the potential for opportunistic behavior. The Holstein's unique pot-belly signal provides a cheap solution to the cheating problem and results in the domination of the Holstein breed at the auction.

I. INTRODUCTION

It is well known that when the desired attributes of a commodity are costly to measure, and when buyers and sellers have asymmetric abilities in measuring, signals may arise to minimize the cost of measurement.¹ As well known is the prospect of sellers of low-quality goods substituting into the signalling margin and disguising their product as high quality—not every red apple is delicious. Since signals are chosen to mitigate costly measurement, it follows that less alterable signals are more effective, other things constant, and will tend to be used over signals that can be manipulated.

II. THE VEAL PARADOX

This simple extension of signalling provides a nice explanation for the puzzling

* Simon Fraser University. Economists are often exhorted to “get their hands dirty” in an effort to understand the world around us. For making the process a little cleaner and for sharing some of their first-hand knowledge of auctions, slaughter houses, veal production and rubber boots I would like to thank Foony Chung, Gerald Lichti, Steve Otway, Ken Pearson, and Bud and Richard Webb. Roger Robertson, president of the Western Veal Producers Association was instrumental in collecting data. I would also like to thank Yoram Barzel, Tom Borcharding, Jim Dean, Curtis Eaton, Dean Lueck, Zane Spindler, and two referees for mucking about in the mire and manure of earlier drafts and helping to clean up my ideas and presentation.

1. See, for example, Spence [1973] or Barzel [1982].

methods by which different breeds of veal calves are sold for slaughter. There are many breeds of cattle: some are dairy breeds, others are beef breeds. All breeds are eventually used for meat production. Old milk cows and breeder bulls get used to produce hamburger; young steers and heifers are used to produce beef; and many calves get used for veal.

In British Columbia (B.C.), slaughter houses buy close to half of their animals through auctions.² The auctioned cattle are brought into a central ring in groups based on the approximate age and size of the animals and usually in ascending order. At the auction all breeds of cattle are sold, and most of the time the breed appears unimportant. For example, when “feeder” cattle are brought into the auction corral, the herd is usually dominated by such beef breeds as Hereford and Angus, but it is not uncommon to find such dairy breeds as Holstein and

2. Merz [1984, 18]. Why buyers and sellers of cattle sometimes use the auction and at other times rely on direct sales is a fascinating question only partially addressed here. Implicit in my analysis is the assumption that when the seller's brand name is not a factor, the auction is a lower cost method of selling than direct selling (possibly because it economizes search costs so much), and that direct selling only arises when the seller's anonymity at the auction imposes too large a cost.

Aryshire in the lot as well.³ This independence of breed and selling classification for beef cattle holds for all categories except one—virtually every veal calf sold at auction is a Holstein (dairy) calf.⁴

The paradox is not only that one breed dominates a particular category, but also that a dairy breed dominates in a meat category—and that this only happens at the auction. As mentioned, Holsteins are used for beef, while beef breeds are sometimes sold directly to a slaughter house for veal. The hypothesis here is that the Holstein calf is the only breed that is able to signal the quality of the highly valued veal meat, and so is the only breed that survives in an auction where the sellers are anonymous.

III. THE VEAL FACTS

Although veal calves are only four to seven months old and weigh approximately 200–250 kilograms, their most important feature is neither age nor size. What makes one animal a veal calf and another “apparently” identical animal a feeder calf (that is, one to be raised for beef) is the method by which they were raised. A veal calf is raised in a small pen in order to restrict movement and prevent

muscle development. More important, a veal calf must be raised solely on milk and high quality grains. This produces a tender *pale* meat. Calves raised on cheaper hay will develop to approximately the same size, but will have a *dark red* meat.⁵ Choice veal calves will sell anywhere from 30 percent to 40 percent higher per pound than similar sized feeder cattle, and 70 percent to 200 percent higher per pound than other slaughter cattle.⁶

The calves are brought into the auction pen either in small lots or one at a time. Although the auctioneer usually makes an announcement that these are veal calves, no attempt to identify the sellers of the calves is made. In fact, several owners are likely to have their cattle mixed together when being sold. There is usually a large variance in price, (at the time of writing veal was selling between \$.60 and \$1.20 per pound) and yet buyers only glance at the animals which are kept in the selling pen for less than thirty seconds. The cattle auctions are English ascending price auctions where the winner is free to choose which and how many calves to purchase, at that price, from that lot. Most veal in the lower mainland of British Columbia is purchased by the five major slaughter houses and is primarily sold

3. Feeders are usually yearling steers about to be sold to feed lots that fatten the animals for slaughter. When the dairy heifers are sold, the dairy breeds dominate (although cross breeds are quite common), but this domination of breeds is rather predictable and uninteresting.

4. This observation was initially made while growing up on a small farm in the lower mainland of British Columbia. Recent trips to the auction barns and conversations with veal growers reveal that it still persists. Section IV presents more evidence on this point, but on the two recent visits to the auction where I actually counted, of the 106 veal calves, 95 were Holstein. Of the other eleven, four were Holstein crosses and the remainder were different dairy breeds. Most notably, not a single beef animal was sold as veal. Although the observations are admittedly quite local, I have no evidence to suggest this observation does not occur elsewhere. Longworth [1983, 95–102] in describing the Japanese beef industry notes that veal are sold through huge auctions, and that the veal industry is completely supplied by the Holstein breed.

5. Some make a distinction between veal and baby beef (or white and pink veal). The former are raised only on milk, the latter supplemented with grains. This is a little confusing, but the key point is that pink veal/baby beef is still considered valuable pale meat. Consider:

“Veal” is the flesh of a calf slaughtered at some 6 to 16 weeks of age, having been fed on milk or milk substitute only. The flesh is very pale or even white in colour and is very tender.... [Baby beef] is slaughtered at about 12 months of age having received an all-concentrate diet. The flesh is pale in colour, is very tender ... (Dodsworth [1972, 5–6])

To my knowledge, virtually all veal sold at the auction is pink veal or baby beef. White veal is sold directly from the farmer to the slaughter house. I will return to this observation in section IV.

6. Taken from weekly Fraser Valley auction price reports.

through the three auctions that deal mostly with cattle.⁷

The Veal Measurement Costs

In this situation sellers have a distinct advantage over measuring the attributes of the calf, since they know exactly what the calf was fed and how it was raised. On the other hand, the buyer is unaware who the seller is and knows nothing of how the animal was raised.⁸ Under such circumstances a seller will attempt to substitute calves fattened on hay for those raised on more expensive milk and grain, since direct measurement of the color and texture of the meat is not possible at the time of purchase. Given anonymity, product warranties and reputations cannot be established at the auction—not white veal. This is a classic “lemons” situation where no veal calves should be sold at all.

Yet we observe the sale of veal calves at the auction. This paradox is sensibly resolved, once an accurate and nonalterable signal of the relevant quality can be discerned. Although a beef calf’s physical appearance is independent of the type of feed, a Holstein develops a very distinct “pot belly” when fed hay as opposed to only milk and grain.

In all breeds of cattle, hay feedings increase stomach size. Huber, in summarizing the research done on the development of calf digestive systems states:

7. Auctions that specialize in selling cattle tend to accommodate the professional farmer rather than the “hobby” farmer (for example, sales are held during the middle of the week).

8. The auction’s failure to identify sellers can also be explained by the measurement cost hypothesis. Sellers necessarily measure the quality of their animals, and if buyers could do likewise they would. However, since every potential buyer measures the calf, too much measuring is done and the net gains from trade fall. By suppressing this information, the auction makes it extremely costly for a buyer to duplicate the unavoidable measurement done by the seller. See Barzel [1982, 37] for a detailed discussion of this point.

The capacity of the reticulorumen [first and second stomachs] and the total stomach at 12 weeks was about twice as large for calves fed milk, hay, and grain as for those receiving only milk.... In calves fed milk... the reticulorumen and omasum grew roughly proportional to body weight, but on grain and hay the reticulorumen grew at four times and the omasum at two and one-half times body weight. [1969, 1303]

This is something well known among farmers, although the reason for it is less clear. According to most veal farmers the bloating results from different feeds entering different stomachs. Grasses and hays enter the rumen, where the food is partially digested in what is basically a fermenting tank and later regurgitated and chewed as “cud.” This fermenting process produces a large amount of gas and causes the stomach to appear bloated. On the other hand, milk and grains bypass the rumen and avoid the production of gas. Hence bloating is a signal of grass feedings and, therefore, dark red meat.⁹

All calves, of course, have rumens. The Holstein pot belly results from an additional characteristic of the breed—their height. Holsteins are tall, lanky animals, and grow vertically faster than the beef breeds. Thus a Holstein veal calf could put on as much weight as a Hereford calf, and still look skinny. It is the bony physique that makes the bloated stomach stand out and appear as a pot belly.

Now it becomes rather obvious why the practice of selling Holstein veal calves through an auction survives. Buyers can tell at a glance (a relatively inexpensive

9. Around the auction yard and among the government agriculture experts, all kinds of theories exist for why hay feedings increase stomach size (too much roughage, not enough roughage, the grass is too wet or too dry, the stomachs are immature and get upset, and on and on). The one thing that is never in dispute is the basic fact that grass fed calves have larger stomachs. A B.C. veal industry profile reports a veal producer defining a veal calf as an animal with “a shiny, smooth coat, and no stomach” (Wilton [1991, 6]).

measurement procedure) whether the calf will make good veal or not. Beef breeds, along with pot bellied dairy animals sold in the veal category will receive a lower price at the auction because buyers anticipate opportunistic behavior on the part of the seller—namely, they suspect that the calf has been fed hay.¹⁰

IV. FURTHER REVELATIONS

White versus Pink Veal

It was mentioned above that among the veal calves only pink veal or baby beef is sold at the auction—not white veal. Both animals must be kept away from grasses, with the major difference that white veal is raised only on milk or milk replacer. Since white veal is more expensive to produce than pink veal, the same incentive exists to substitute cheaper grains for milk and pass off pink veal as white veal at the auction. However, since both feeds bypass the rumen, neither develops the pot-belly signal. With no signal, buyers at the auction anticipate pink veal and pay accordingly. Hence only pink veal survives at the auction, while white veal is sold directly from the farmer to the slaughter house.¹¹

10. Since most dairy breeds develop easy to spot pot-bellies with hay feedings, other dairy breeds can also survive in the auction's veal category. Of the dairy breeds, Holsteins have the lowest feed to pound ratio. Other dairy breeds can only compete with the Holstein breed by initially selling at a discount. Since week-old calves never sell at a negative price, it is usually too costly to produce veal with Jersey or other dairy breeds when Holstein calves sell for \$5-\$50 each. When week-old Holstein calves start to sell in the \$120-\$150 range, other (cheaper) dairy breeds start to enter the veal market as well. On one particular visit to the auction, the Holstein veal calves averaged \$1.03 per pound, while the non-Holstein breeds averaged \$.74 per pound. Among the non-Holstein animals was a particular pot-bellied Jersey (dairy) animal that sold for only \$.64 per pound (the lowest price on that particular day).

11. A study of the Ontario *white* veal industry notes that the slaughter house deals directly with the farmer:

Packers frequently book numbers of calves for delivery from producers a week or two in advance with the price to be settled closer to delivery. (Beswick et al., [1988, 12])

In order to test this prediction, I surveyed 120 veal producers throughout British Columbia.¹² The survey simply asked how many veal calves were produced in 1991, how were they sold, what was their breed, and whether or not the calves were pink or white veal. The response rate was approximately 25 percent and the results are presented in Table I. Examining panel (a) for a moment, it is clear that selling through the auction is the dominant form of sale for pink veal, and that with this method, Holsteins are practically the only breed sold. Of the forty cross breed animals that were sold at the auction, thirty came from one particular seller, who mentioned on the back of his survey "[buyers] preferred the Holstein breed. Prices received at the auction would almost always reflect this." Hence, consistent with the signalling model, when non-Holsteins are sold at the auction, they suffer in terms of price.

Panel (b) is just as dramatic. For white veal almost all of the calves were sold to the slaughter house directly. Twelve calves were sold through the auction. Although there is no evidence, the model here would predict that those twelve calves sold at the pink veal price.

In other words, the standard method of *white* veal purchases was not the auction. Furthermore, a study of the Canadian veal industry states that:

White veal is the result of a milk based, special formula feeding. This product is utilized by mid to high priced restaurants and usually sold under a brand name. (Fisher [1988, 4])

Since sellers are anonymous at the auction a brand name can only be developed by direct sales to the slaughter house. In personal correspondence, slaughter house managers were quite adamant on this point. According to them white veal is *never* purchased at the auction.

12. The survey was conducted through the Western Veal Producers Association. I was not allowed access to the identities or locations of any of the farmers, although postmarks indicated that they were from all over the province. Due to anonymity I was unable to do any follow-up survey on the non-respondents.

TABLE I
Cross-Tabulations: Breed by Method of Sale

	Auction	Slaughter House	Private Consumption
<i>(a) Pink Veal</i>			
Holstein	1103	6	7
Other Dairy Breeds	66		3
Beef and Cross Breeds	40	18	6
<i>(b) White Veal</i>			
Holstein	12	112	
Other Dairy Breeds			
Beef and Cross Breeds			

Sales to the Slaughter House

The fact that other breeds of calves are not easily measured at the time of purchase as being good veal products should not prevent them from ever being used as veal. My analysis implies only that these calves will not be sold as veal when the identity of the seller is not revealed. To the extent that veal is sold through private transactions, the mixture of breeds is expected to increase, since reputations, on-site inspections after the kill, and long-term contracts may be used as a substitute for product measurement at the time of purchase. By the same reasoning, farmers who raise veal for personal consumption should also be less discriminating in terms of breed.¹³ Panel (a) of Table I provides some evidence to support this prediction as well. Whereas Holsteins dominate the sales at the auction, this cannot be said of the sales to the slaughter house or the

animals used for private consumption, where breed appears unimportant.¹⁴

Age and Price

Along these same lines, larger veal calves tend to sell for lower prices per pound than smaller calves despite the fact that the percentage of body weight made up of meat is higher. On the two visits I made to the auction to count, the calves

13. If there is any discrimination in terms of breed it should be the opposite of the auction. A farmer will eat the high measurement cost animals since these have the lowest opportunity cost to him. One veal farmer told me: "When I get a nice white-face (beef cross) I save him for my own table."

14. States and provinces vary in terms of the relative importance of milk and beef production. As the volume of milk produced relative to beef increases, the fraction of Holstein calves to beef calves will increase, and a larger fraction of the veal produced will be sold through auctions. For example, in a state like Texas or a province like Alberta, beef calves will be used for veal, and therefore should be sold directly to the slaughter house. Unfortunately, American and Canadian agricultural statistics do not distinguish veal calves from other slaughter calves, nor do they distinguish the method of sale. One minor piece of evidence on this comes from a British Columbia veal profile. An Alberta company that "produces leather products solely from the hides of Simmental cross beef calves...The calves are slaughtered at 300-350 lbs. and the hides are sent to Europe. The meat that results is a pink veal which is marketed within the province" (Wilton [1991, 237]). So here is an example of a firm raising non-Holstein veal, and since it is difficult to sell a hideless calf at the auction, the meat must be sold directly to the slaughter house.

were always brought in from smallest to largest. On the first trip, prices for the Holsteins started at \$1.14 per pound and fell to \$.89 per pound. On the second trip prices went from \$1.20 to \$.91. This is also a reflection of meat color. Calves can only be kept off grass for so long. Eventually some hay or grass must be fed to develop the rumen and prevent the other stomachs from "burning out." Hence the larger the animal, the more likely the hay intake has increased, the darker the meat, and therefore the lower the price per pound.

V. CONCLUSION

Aside from the signalling explanation offered here, two other theories told around the economist's lunch table and the farmer's auction barn compete to explain the veal puzzle. The first, heard from economists not farmers, is that perhaps the rate of growth of Holstein calves is such that the optimal timing of harvest is earlier than that of beef calves. Hence the observed predominance of Holstein veal calves results from them simply being the lower cost producers of veal, and has nothing to do with measurement costs. This difference in the rate of growth, however, is not observed. In fact, just the opposite is the case: beef breeds grow faster (in terms of weight) than dairy breeds.¹⁵ Beef breeds are simply bred to mature earlier than their dairy counterparts.¹⁶ Hence, on strictly physical growth

grounds, Holsteins should not dominate the veal sales.

A second explanation, heard from farmers not economists, is that perhaps Holsteins are used for veal because it is a simple by-product of the dairy industry. When a milk producer has a bull calf he just raises it for veal and sells it. This sort of explanation does not make much sense and is refuted by the facts. Veal is produced both by veal specialists and milk producers, and veal specialists are free to purchase any breed of animal. Further Holsteins *are* raised for beef, and beef breeds *are* used for veal—it is only at the auction where the Holstein breed completely dominates. Given that the auction is the revealed preferred method of sale, it simply appears that all veal is Holstein.

I have argued that only Holstein veal calves are sold at auctions because their physiological development acts as a signal of quality to buyers. Part of the success of using breed as a signal is not only its correlation with quality, but its inability to be tampered with. Attempts to cross breed, for example, cannot be hidden since the appearance of the hide changes. The hypothesis is consistent with other observations in the veal market, namely the presence of other breeds in private sales, the fall in price per pound for larger veal at the auction, and the absence of Holstein white veal at the auction.

Signalling tends to be branded as too costly because of the possibility of too much signalling, with "too much" education being the usual example. Here I have provided an example of a trivial and unalterable signal that easily solves a transaction cost problem in the exchange of veal. True, in the scheme of things, successful signals in the production of veal are not important, but how many other signals like this exist? Perhaps quite a few.

15. An absolute as well as a comparative advantage in beef production is probably why some breeds are called beef breeds instead of dairy breeds. Fredeen reports:

Hereford, Aberdeen Angus, Shorthorn ... fatten earlier than other breeds ... Holstein-Friesian ... are large in size, fatten less readily, and milk more heavily than the British breeds. [1968, 42]

16. See Forrest and Roy [1986, 6]. These authors estimate that the difference in live-selling prices due to physical differences in dressing weight, fat content, and shrinkage between Hereford and Holsteins at the 450 kg level was 6.9 percent in favor of the Hereford. If the animal sells for \$1.75/kg (approximately the current price), this amounts to \$55.

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