An Economic History of the Failure of Broiler Futures

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Abstract

Hedging with a futures market is a risk management alternative available to producers of most agricultural commodities. However, such an option is unavailable to broiler growers as there are no active broiler futures. Over the last 40 years there were three occasions during which futures for broilers were available. Each of the three markets failed to catch on and was thus removed from trading. We investigate the reasons for the failures time and time again. Using an econometric model, we find that the lack of an efficient hedge was a major reason the broiler futures collapsed.

1 Introduction

Knoeber and Thurman (1995) find that 84% of production risk is transferred from broiler growers to integrators via contract production. This is due to a lack of the market price of broilers in calculating grower compensation. From the grower perspective this is a form of risk management. In fact, this is the dominant form of risk management in the broiler industry today. Typically, producers of agricultural commodities can use futures markets, in addition to contracting, to mitigate the variance in the market price of their commodity. Currently, there are futures markets for most agricultural commodities with large cash markets such as cattle, hogs, corn and wheat to name a few. The exception, however, is the broiler industry which is probably one of the larger agricultural industries to not have its own futures market. But this was not always the case.

On July 17, 1993, broiler futures traded for what would be the last time on any futures exchange. Prior to this, the very first time broiler futures ever traded on any exchange was in 1968, when they began trading on the Chicago Board of Trade (CBOT). But that particular futures market stopped trading in December of 1980 (see figure 1 for a timeline of broiler futures markets). This was neither the first time a commodity futures market had failed, nor would it be the last. In fact, the Chicago Mercantile Exchange (CME) tried unsuccessfully to market broiler futures during the 1980s and again during the 1990s[1]. Onion futures are perhaps the most infamous contract to stop trading. It will take an act of Congress to reinstate the trading of onion futures. In 1958, Congress passed a bill[2]

[1] Iced broiler futures were traded on CBOT from 1968-1980 (BrI) while the CME traded broilers from 1979-1982 (BrII) and later from 1991-1993 (BrIII).

[2] USC:Title 7:Section 13-1: (a) No contract for the sale of onions for future delivery shall be made on or subject to the rules of any board of trade in the United States. (b) Any person who shall violate the provisions of this section shall be deemed guilty of a misdemeanor and upon conviction thereof be fined

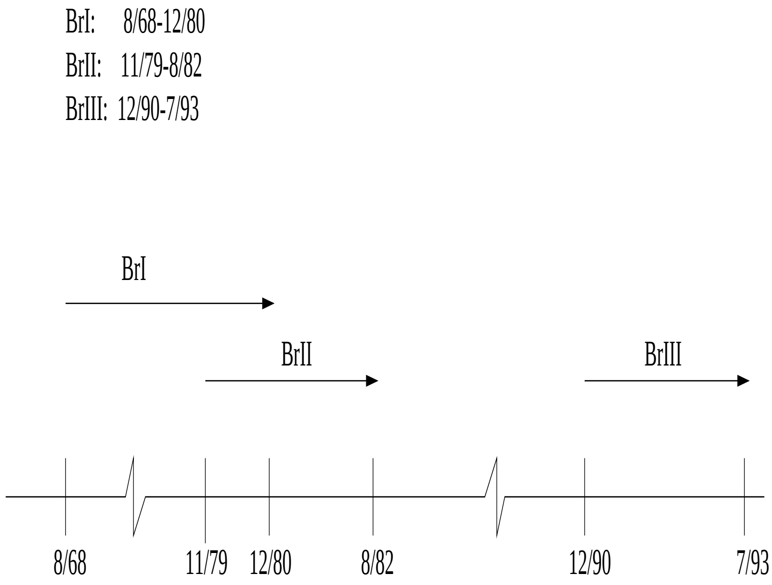

Figure 1: Broiler Futures Timeline

banning the sale of onion futures[3]. As of yet, this law has not been repealed.

After a brief seventeen-month existence between 1987 and 1988, high fructose corn syrup contracts (HCF-55) were also permanently delisted from the Minneapolis Grain Exchange (Thompson, Garcia and Wildman 1996). There are now defunct futures markets for potatoes, GNMA Collateral Depository Receipts (a financial futures), boneless beef, wine, apples and even corn yields. But not every poorly performing futures contract is necessarily delisted. At times, futures contracts are temporarily removed from exchanges to be brought back after revision of certain contract specifications. Such was the case during February of 1997 when live hog futures were discontinued and later replaced by lean hog futures[4]. This begs the question: why do some commodities, such as wheat, live

not more than $5,000. This ban was enacted as a result of complaints from growers that futures trading increased volatility of cash prices.

[3]See (Gray 1963), (Johnson 1977) and (Higgens and Holcombe 1980) for details about the collapse of onion futures.

[4]The contract specifications were changed to reflect cash settlements rather than delivery of hogs.

cattle, and gold to name a few, continue to enjoy successful futures markets, while those for other commodities such as broilers fail? The objective of this article is to provide an economic history of broiler futures and to explore the reasons for their failure time and time again. In this article we use broiler futures data to test the validity of an econometric model in evaluating the failure of these futures contracts. The remainder of this article begins by providing a brief review of the literature on the determinants of successful futures markets. Section 3 provides a description of the broiler industry and the futures contracts. This is followed by section 4 discussing the methodology used to evaluate the broiler futures markets. We then discuss the data in section 5, followed by a discussion of the empirical results in section 6 and finally section 7 provides some concluding remarks.

2 Literature Review

Towards approaching the determinants of successful futures contracts, the literature can be sorted into articles based on 'commodity characteristics' and those based on 'contract characteristics' (Black 1986).

2.1 Commodity Characteristics

Futures markets serve many purposes, chief among which are price discovery and risk management. Current futures prices are often harbingers of future spot prices. Futures prices reflect expectations of traders, inventory levels and any new information affecting either. Futures markets are also avenues for transferring risk from those wishing to avoid it to those willing to accept risk. Arising out of these dual functions are certain key commodity characteristics of futures markets. Leuthold, Jukus and Cordier (1989) identify a list of common characteristics of commodities traded successfully on futures markets: (i) homogeneity of product, or at least non-identification with a producer or manufacturer, which makes for ease of delivery of the product if needed to fulfill the futures transaction; (ii) capability of standardization and grading[5]; (iii) variable or uncertain prices, viewed by Telser (1981) as one of the key commodity characteristics for the suitability of a futures market, since mitigating price variability is the main reason for hedging with a futures market; (iv) active and large cash markets which ensure that no one person has control over the price, thus providing a large pool of potential hedgers; and (v) availability of public information. Carlton (1984) finds that the underlying commodities of successful futures markets have freely determined prices and the absence of regulation; large transaction values; large numbers of buyers and sellers; and correlated prices for slightly differing products. Malliaris (2000) indicates that price uncertainty in a cash market contributes to the creation of a futures market. Black (1986) identifies forward contracting[6] in the commodity as a factor contributing towards the success/ failure of the corresponding futures contract. It is argued that due to the risk of nonperformance by one of the concerned parties (producer or buyer) in a forward contract, a futures contract would be superior and hence a forward contract should not be considered a perfect substitute for a futures contract. However, the ability to tailor a forward contract to the exact specification of concerned parties makes them appealing. Garbade (1982) finds the co-existence of successful forward and futures contracts in some commodity markets.

[5] Standardization of contracts, only possible if one unit of the underlying commodity is indistinguishable from the other, is what sets apart a futures contract from a forward contract

[6] A forward contract is an agreement to make or take delivery of a commodity at a future date at an agreed upon price and quantity.

2.2 Contract Characteristics

The literature on the determinants of successful futures contracts also focuses on specific contract characteristics, principally designed to attract hedgers and speculators (Black 1986). Successful futures contracts are typically defined as those with high trading volumes. Duffie and Jackson (1989) theoretically model the relationship between trading volume and the success of a futures market, under the assumption that an exchange would continue to offer a futures contract, if it generated enough volume resulting in transactions revenue for the exchange. Volume is also an important indicator of the strength of a futures market (Brown 2001).

(i) Hedging: Gray (1978) identifies the importance of contract specification, market power concentration and the attraction of hedgers and speculators to the market. Telser (1981) argues that if hedgers want to participate in a futures market principally to insure against the risk associated with the volatility of commodity prices, then they are better off participating in a forward market. However, futures markets are considered superior to forward markets since they provide a degree of standardization. Also, a forward market requires mutual trust between both parties since there is a chance that one party may not fulfil its obligation.

Keynes (1930) and Hicks (1939) argue that one could view hedging as the act of a hedger transferring risk inherent in the cash market, by paying an insurance premium to a speculator in the futures market. So effective hedging of a commodity depends on the predictable relationship between its cash and futures prices, known as the basis. Speculators, who enter a futures market to profit from price volatility, also require the predictable relationship between cash and futures prices. Blau (1944) also argues that futures markets are designed to shift the risk associated with unknown fluctuations in commodity prices. Using a portfolio approach, Stein (1961) and Johnson (1960) argue that a hedger is someone who maximizes the expected utility of a portfolio consisting of spot and futures contracts.

(ii) Speculators: Working (1970) says that contract terms need to parallel cash market trade. If a futures contract is a perfect substitute for a cash transaction then the correlation between the two prices will be high (Black 1986). Without such a relationship there would be a lack of adequate speculators, resulting in less hedging since there would be no one to pick up the excess demand or supply of contracts, thus creating large price changes (Gray 1977) [7]. Silber(1981) studies changes made to certain futures contracts in order to attract speculators.

In our analysis, we consider a combination of commodity and contract characteristics to investigate the reasons for the failure of broiler futures markets. We use Black(1986)'s econometric model that captures most of these characteristics. We also conduct our analysis in comparison to a successful futures contract such as the live cattle futures contract. The contrast with this successful contract will shed some light on the possible reasons behind the failure of broiler futures.

[7] Hedgers desire liquidity as well since it lowers transactions cost, in the form of small changes in price as due to large buy or sell orders (Brown 2001) .

3 Industry Background

In this section we will provide a brief history of the broiler industry with special attention to the three periods during which broiler futures were traded.

3.1 Production and Consumption

It is generally agreed that the commercial broiler industry first began in the early 1920s in Maryland (Lacy 2001). Prior to this, farmers raised chickens mostly for personal consumption, with surpluses being sold in nearby cities. The poultry industry grew along with populations in and around cities such as Philadelphia and New York, and in regions such as the tri-state area of Delaware, Maryland and Virginia. New York City became a major center for the distribution of chickens, giving rise to the term “New York dressed”[8]. By 1935 annual broiler production had grown to 43 million birds, even if annual consumption was only 0.7 pounds per capita Rogers(1998). Beef has traditionally been the most consumed meat on a per-capita basis. Figure 2 displays per-capita beef and broiler consumption over the last 30 years. From figure 2 it can be noted that per-capita broiler consumption overtook per-capita beef consumption around 1993. For 2003 the per-capita consumption of broilers and beef were 76 pounds and 65.2 pounds, respectively[9]. But one needs to realize that at the retail level beef is sold with bone and fat trimmed from the meat *prior* to sale, whereas broilers are sold with most of the product discarded as waste *after* the retail sale. So when compared on a boneless-weight basis, beef is still

[8]The term New York dressed indicates that feathers have been removed from the broilers, but no further processing has taken place (Bailey 1969) .

[9]Source: USDA Poultry Yearbook.

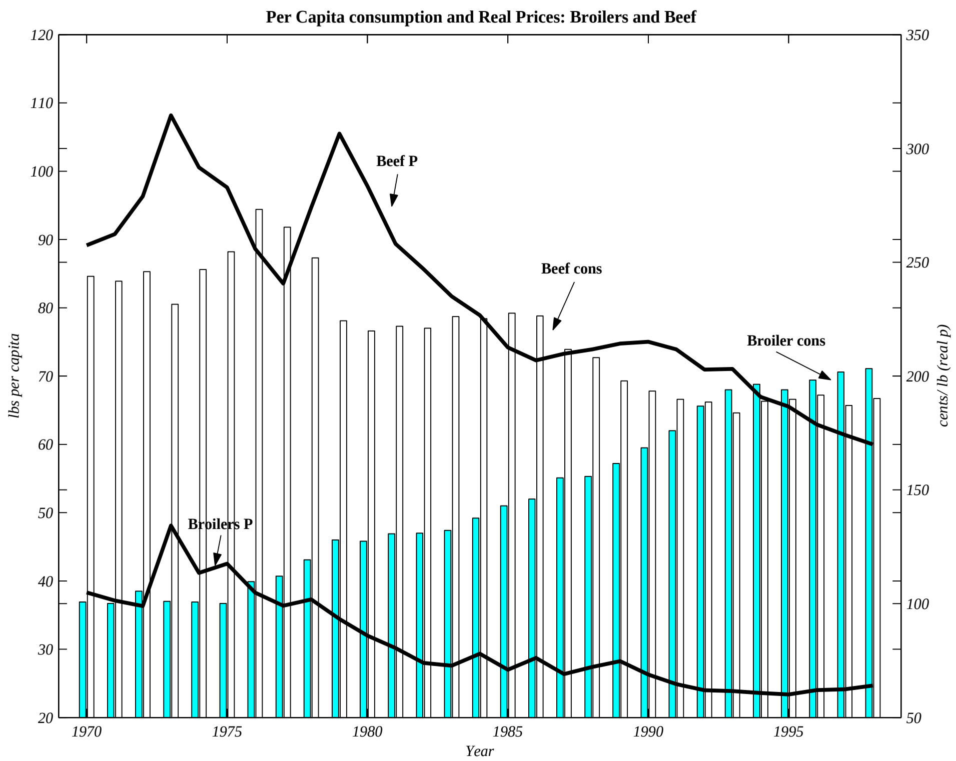

Figure 2: Per Capita Consumption and Real Prices: Broilers and Beef

Source: 2000 USDA Poultry Yearbook

consumed more than broilers, 62 pounds per-capita to 53.2 pounds per-capita for 2003[10]. While declining real prices were a major contributor to increases in consumption of both beef and broilers (figure 2), the perception of chicken as a healthy alternative to red meat may have further increased relative broiler consumption. In 2001, 42.45 billion pounds of broiler meat were produced at a value of $16.69 billion compared to 42.37 billion pounds of beef valued at $29.27 billion (USDA 2001).

A shift occurred in the industry when production switched from seasonal to year-round. This shift was a major contributor to the dramatic increase in the production

[10]Source: http://www.cattlefax.com

of broilers from 1945 when 1.11 billion pounds of broiler meat and 19.5 billion pounds of beef were produced. Finally there have also been vast improvements in production efficiency over the last 75 years. In 1930 it took an average of 14 weeks and 5 pounds of feed per liveweight pound to get a broiler to market. In 2000, it took only 7 weeks and 2 pounds of feed per liveweight pound to get the average broiler to market[11] (Lacy 2001). In contrast the beef production cycle is much longer, taking six to eight months for cattle to be market-ready.

3.2 Marketing

The process of price determination also varies between the live cattle and broiler markets. In the wholesale broiler market, price determination is fairly informal. On Fridays of each week, and sometimes on Thursdays and on rare Wednesdays, broiler suppliers negotiate with buyers as to the quantity and price of broilers to be delivered the following week. This negotiation is generally conducted over the phone between buyers and producers and occurs in major cities and regions. All cash markets are thus regional. The twelve-city market price is a weighted average spot market price, in lieu of an actual cash market. Of course, both producers and buyers still use supply and demand factors to form price expectations.

Price determination in the cattle market is a little less informal. Weekly cattle auctions held across the Mid-West are still the basis for cattle cash market price determination. The 'national' cash price for live cattle, as provided by the USDA, is a weighted average

[11]There have been improvements in both feed conversion, from an average of 5.0 to 2.0, as well as average liveweight from 2.0 pounds to 5.1 pounds.

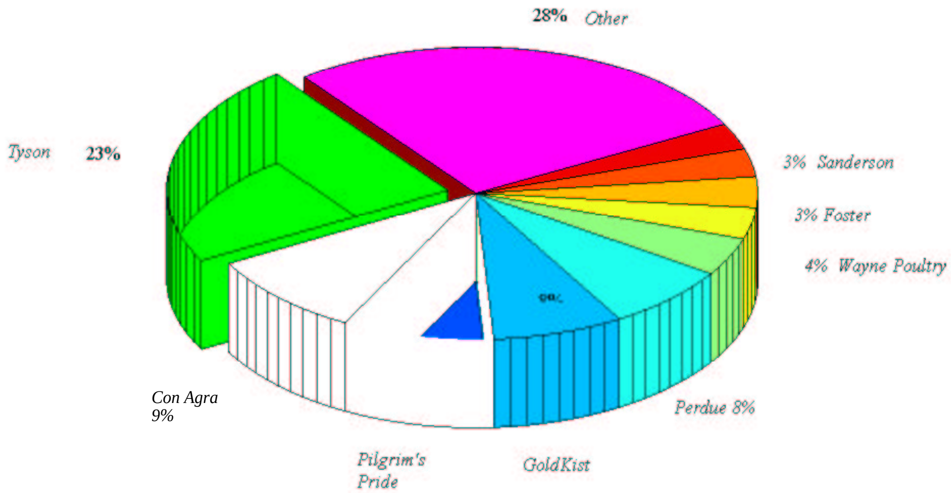

Figure 3: Market Share in Broiler Industry, 2001Source: Watt Poultry USA

of auction prices from five major beef producing states.

3.3 Current Industry Profile

In 1935 the top four broiler companies produced 30% of the industry's output (CR4 ratio). Twenty years later they were responsible for 32% of the output (Rogers 1998). Figure 3 provides a breakdown of the market shares of the top ten broiler producers as of 2001. These top ten companies combined to produce 80% of the industry output. Table 1 provides concentration ratios for the broiler industry for 2001. As shown in Table 2,

Table 1: Concentration Ratios in Broiler Industry, 2001

No. of Companies	*% of total output*
Top 4	48%
Top 8	66%
Top 10	80%
Top 20	90%

Source: USDA (2001)

CR4 concentration ratios have increased in the hog, cattle, turkey and poultry industries over the last 40 years. As of 1997, of the selected commodities from Table 2, the cattle industry had the highest CR4 concentration ratio at 71%, while broilers had the lowest, 41%. Another difference between the broiler and beef industries is in their methods of production. While over 90% of broilers are grown under contract, only 30% of cattle are similarly raised. The broiler industry is vertically integrated such that integrators own all aspects of production, whereas the majority of the cattle industry is fairly independent. Sixty-five percent of live cattle purchased by beef packers are done so at live cattle auctions (Lawrence, Schroeder and Hayenga 2001). Processors purchase live cattle mostly from numerous independent feedlot operators.

3.4 Broiler Futures I: 1968 - 1980 (BrI)

Given the informal nature of wholesale broiler price determination, it is not uncommon at times for prices to fluctuate in immediate response to demand and/or supply shocks. Towards the latter half of 1966, broiler prices were 21 cents per pound, much below the annual average (Bailey 1969). Due to a supply shortage, the price had increased roughly 33% to 28 cents by February 1967. At the time a report commissioned by the CBOT indicated that in the 52 week period preceding June 1968, weekly broiler prices had

Table 2: Selected Agricultural Processors' CR4 Concentration Ratios

Census Year	Broilers	Cattle	Hogs	Turkey
1963	14	26	33	23
1967	23	26	30	28
1972	18	30	32	41
1977	22	25	31	41
1982	32	44	31	40
1987	42	58	30	38
1992	41	71	43	45

Source: MacDonald et al. (2000)

fluctuated by approximately 38%. The CBOT argued that this type of fluctuation in the market price could result in economic catastrophe for some producers, given the already small profit margins in the broiler industry (Bailey 1969). Hence they figured there would be substantial demand on the part of broiler producers for a futures market in order to mitigate risk from such price fluctuations. So iced broiler futures began trading on the CBOT in August of 1968 but were discontinued on Jan 1, 1981. We refer to this period as BrI.

During the late 1960s, around the time broiler futures were first introduced, the poultry and beef industries were not as concentrated as they are today. Twenty-three percent of total broiler industry output was produced by the top four processors (see Table 2) with over 80% of broiler growers under contract with integrators (Bailey 1969). Concurrently, 26% of beef production was produced by the top four processors.

3.5 Broiler Futures II: 1979 - 1982 (BrII)

By 1979, the broiler industry had become even more vertically integrated compared to the first time broiler futures were offered, back in the late 1960s. Eighty-seven percent of broiler growers were now under contract while close to 30% of industry output was being supplied by the top four processors (see Table 2 and (Economic Research Service 2002)). At the same time the cattle industry saw an increase in its CR4 ratio to 40%.

Towards the end of the 1970s, the CBOT was struggling with low interest in their broiler futures (see figure 4). Even as trading volume for BrI continued to decline, the CME offered a broiler futures contract (BrII) of their own beginning in November of 1979. Anyone desiring to invest in broiler futures now had a choice between two exchanges, at least for another fourteen months[12] until January 1981 when the CBOT stopped trading its broiler futures. The CME would stop trading BrII by August 1982.

BrII contract specifications did not vary significantly from those of BrI. With regards to settlement, both contracts required the physical delivery of iced broilers, their underlying commodity. They varied across contract months and in the size of each contract. Each BrI contract was for 25,000 lbs while a BrII contract was for 30,000 lbs. No particular reason was provided for this difference in contract sizes. Other features of the two contracts were fairly similar. So why would an exchange offer a similar futures contract while another exchange was struggling with their own offering? The CME argued that broiler futures would be better suited for trading on their exchange since most livestock futures were traded there. In contrast, the CBOT dealt mainly with grain futures as part of

[12]Even though BrI were not removed from the exchange until January 1981, no trade occurred after December 23, 1980.

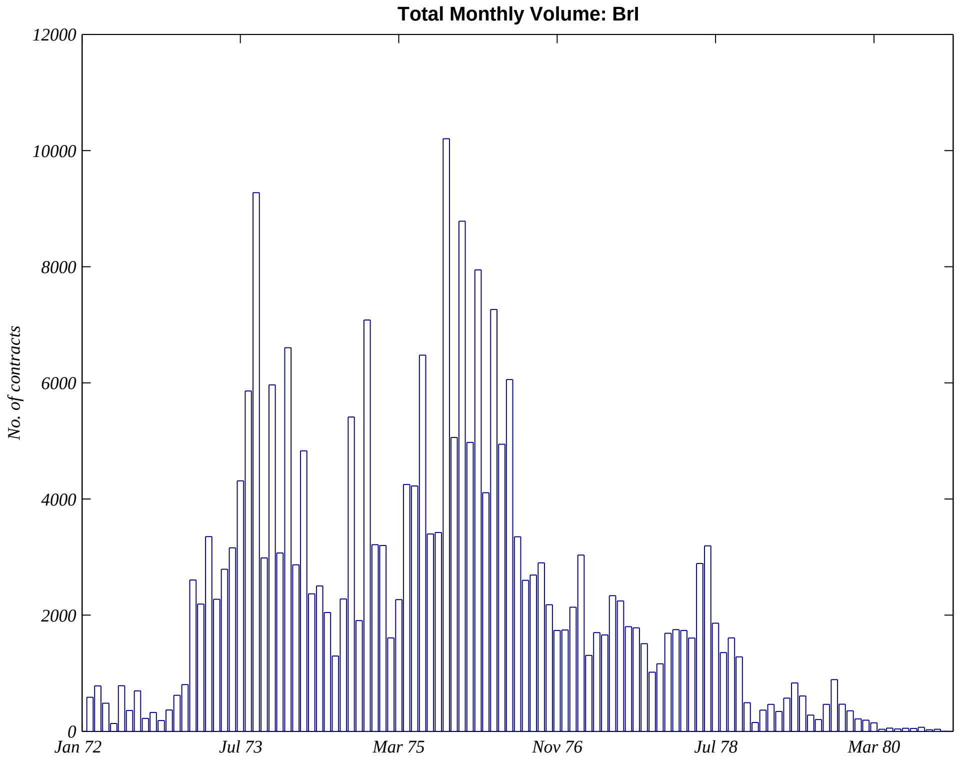

Figure 4: Total Monthly Volume: BrI

its agricultural commodities portfolio. The CME felt that traders on its exchange, who were already familiar with livestock, would flock to broiler futures, resulting in a higher volume than that experienced at the CBOT. Sold on this argument, the CFTC approved the trading of broiler futures on the CME. Figure 5 validates the CME's beliefs about the suitability of broiler futures on their exchange. Initially the duplicate broiler contracts had a large impact, out-trading BrI by a margin of almost five-to-one, based on weekly volume. An interesting observation in figure 5 is that over the course of the overlapping time period the futures prices on both markets are remarkably close to each other. Given that the futures prices were relatively close to each other and that there were no discernable differences in contract specifications, the fact that the CME had a higher volume of

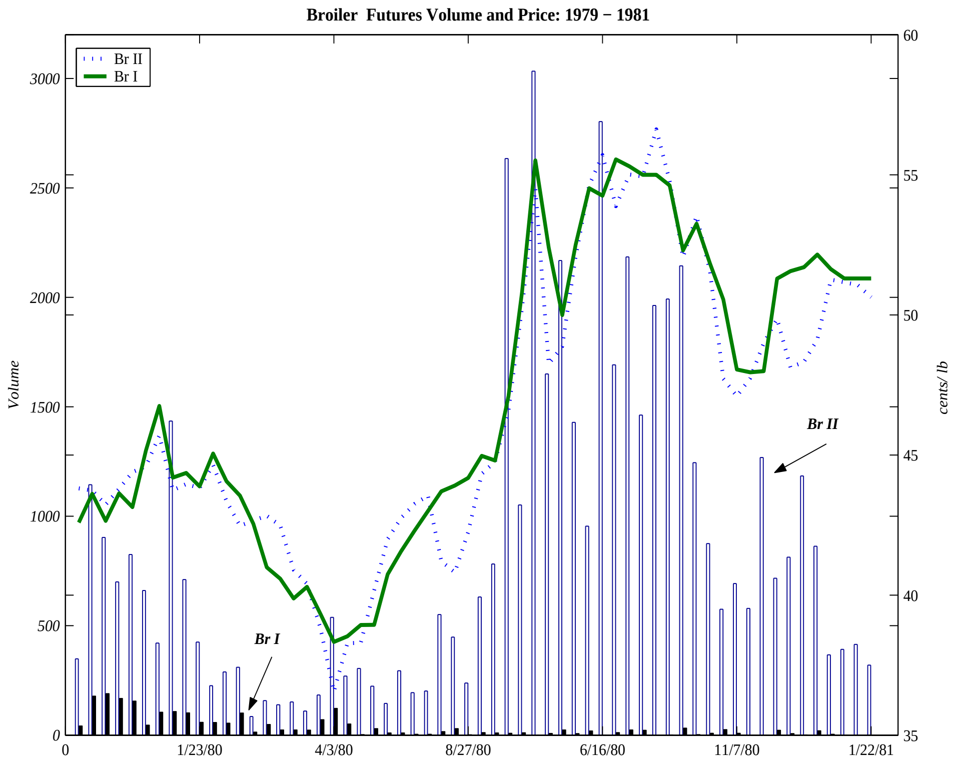

Figure 5: Broiler Futures on CBOT (BrI) and CME (BrII):

Concurrent Weekly Volume and Price

transactions lent support to their claim that broiler futures would be more suitable for trading on their exchange. Alas, this would not continue to be true. As indicated by figure 6, BrII eventually saw a decline in volume and stopped trading by August 1982. While initial volume seemed promising, BrII never quite had the average monthly volume comparable to that of BrI. Over the course of their existence, the average monthly trading volume for BrI and BrII were 2,295 and 2,159 contracts respectively.

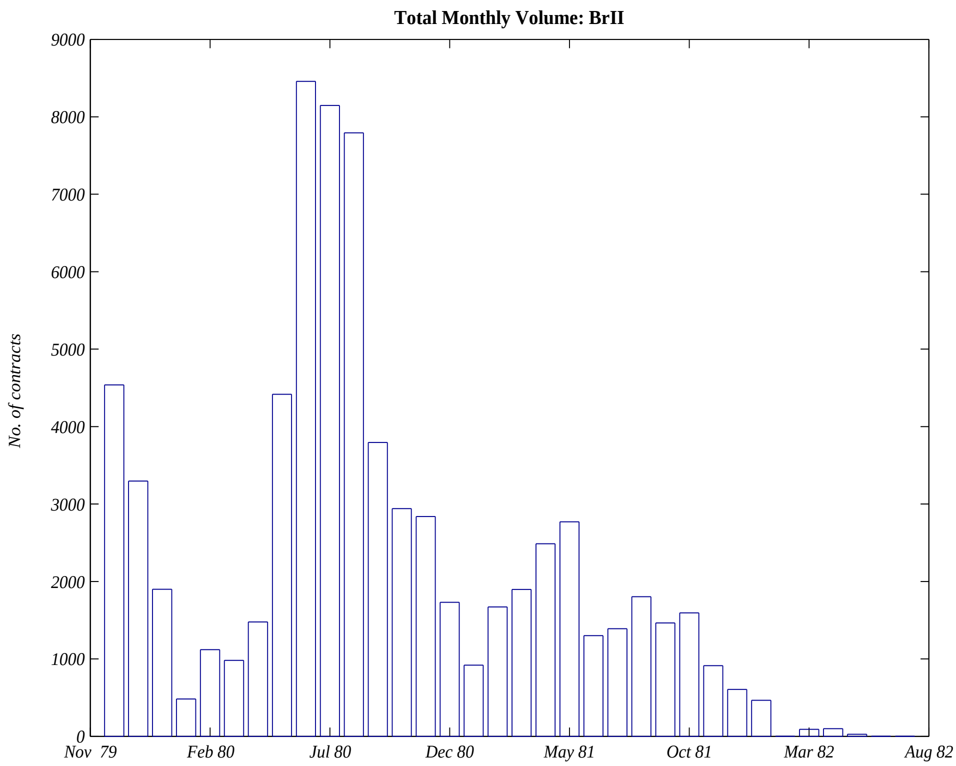

Figure 6: Total Monthly Volume: BrII

3.6 Broiler Futures III: 1991 - 1993 (BrIII)

Broiler cash prices changed approximately 33% over the 52 week period preceding December 1990. The broiler industry continued to increase its output at a rapid pace, which now stood at 19.7 billion pounds per year. The CME felt that conditions such as these, i.e. volatile cash prices and a growing broiler industry, warranted another attempt at providing a broiler futures market. So in December 1990 the CME received regulatory approval from the CFTC to begin trading broiler futures (BrIII) for a second time on their exchange. This time around they were certain that the futures market would succeed, especially given the growing demand for poultry (Crawford Jr. 1991a).

The two traders instrumental in developing BrIII believed that the new product would

Table 3: Contracts Settled by Physical Delivery or Cash Settlement

	Broilers I (BrI)			*Live Cattle (LC)*		
Year	Open Interest	Settled	Percent	Open Interest	Settled	Percent
1974	317944	1137	0.36	2553977	3491	0.14
1975	182648	1361	0.75	2263291	1489	0.07
1976	184006	1755	0.95	2636475	2773	0.11
1977	59850	2058	3.44	2804570	1430	0.05
1978	71299	2153	3.02	4659726	1113	0.02
1979	22933	991	4.32	6989561	5399	0.08
1980	8773	773	8.81	6490817	5186	0.08
1981	369	32	8.67	4465035	6284	0.14
	Broilers II (BrII)			*Live Cattle (LC)*		
1980	41258	367	0.89	6490817	5186	0.08
1981	27323	386	1.41	4465035	6284	0.14
1982	6597	86	1.30	4399429	2280	0.05
	Broilers III (BrIII)			*Live Cattle (LC)*		
1992	1649	560	33.96	3707721	2082	0.06
1993	53	31	58.49	3148280	454	0.01

be successful if, within six months, an average of 10,000 contracts were traded daily[13]. The major difference in contract specifications for broiler futures this time around was concerning settlement. Instead of making or taking delivery of chickens, those holding long positions or short positions at expiration settled with each other through cash payments. The value of the expiring contract was evaluated using the twelve-city weighted average price of broilers as reported by USDA. The following Monday's twelve-city broiler price was used to determine the value of a contract that expired the previous Friday[14]. The exchange was optimistic about the potential success of this new version of broiler futures, even though 60% of new contracts launched usually fail (Crawford Jr. 1991b). It reasoned that cumbersome physical delivery provisions of the underlying broilers frustrated traders

[13]This translates into approximately 200,000 contracts per month.

[14]All broiler contracts expired on the last Friday of the trading month. In case of holidays, contracts would expire on the last business day prior to the Friday.

and had led to the demise of previous futures (Dow Jones News Service 1990). Table

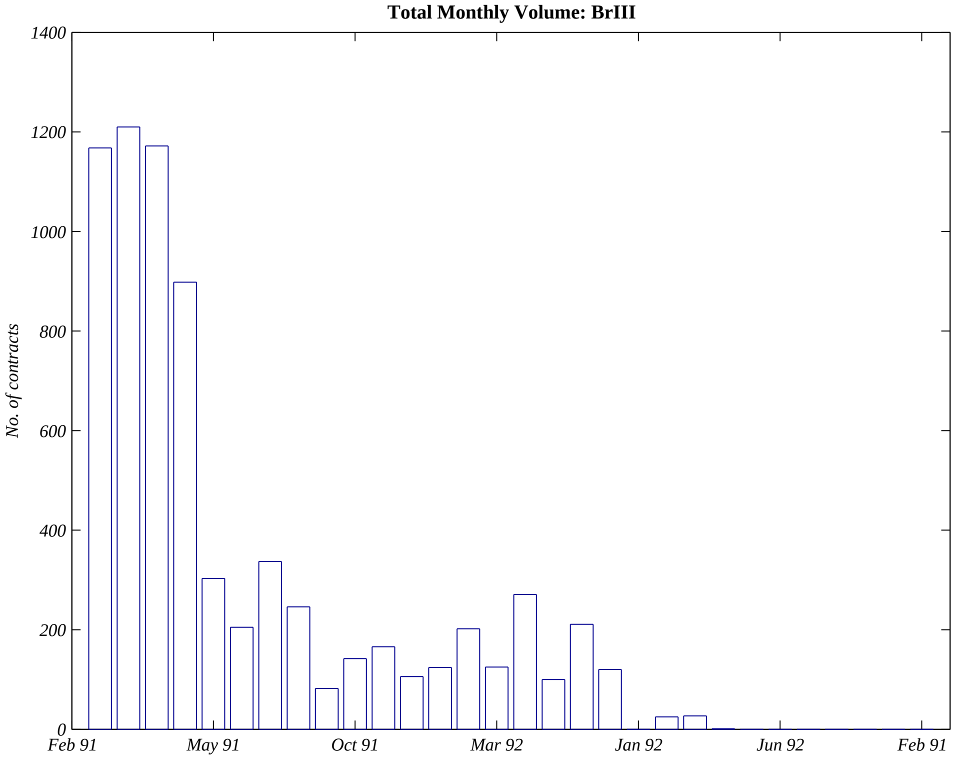

Figure 7: Total Monthly Volume: BrIII

3 shows the open interest[15] along with the number of contracts settled via delivery for broiler and live cattle futures[16]. Cattle futures data is offered for comparison of broiler futures with an exceptionally successful futures contract.

If a contract is open at expiration, the holder of that contract must make or take delivery of the underlying commodity. Two to four percent of most futures contracts are settled by physical delivery. Traders, especially those who speculate, would rather offset

[15]Open Interest is the total number of futures contracts, either long or short in a delivery month or market, that have been entered into and not yet liquidated by an offsetting transaction or fulfilled by delivery. At the start of trading of a particular futures contract month, the open interest is zero. This changes when a new buyer buys from a new seller or an existing long sells to an existing short, or vice-versa. It remains unchanged if a new buyer buys from an existing long or a new seller sells to an existing short (Schwager 1984).

[16]Table 3 only displays values for years when data was available. Missing years do not detract from the general trend indicated by the table.

their positions prior to expiration than be forced to make or take physical delivery. A high percentage of settlement through physical delivery or cash settlement implies one of two things: (i) either the traders purchased contracts with the expressed intent of holding them to maturity; (ii) or they could not find off-setting trades prior to expiration. On average less than one quarter of one percent of cattle futures were settled by physical delivery while more than 3% of broiler futures were settled by physical delivery in a majority of the years that BrI contracts were traded. Even during BrII, less than the typical amount of contracts were settled by physical delivery. So the CME's reasoning that physical delivery led to the demise of BrI and BrII does not seem to be supported. In fact, during BrIII, over a third of the contracts in the first year and over half in the second year were cash settled due to lack of a liquid market.

Two large potential hedgers, Tyson Foods and McDonald's Corporation, expressed reluctance to use broiler futures (Kilman 1990). McDonald's did not have a need to hedge since they had supply arrangements with processors and Tyson was simply not interested[17]. But the number two processor, Con-Agra and another fast food chain, KFC expressed support for broiler futures (Kilman 1990). Other reasons offered for previous failures were that processors had little use for the type of broilers[18] specified by the contract and there were too few delivery points (Kilman 1990). With BrIII, this problem was eliminated since settlement was not based on physical delivery but rather on cash-settlement. Even with these alterations to contract specifications, BrIII failed to avoid the fate of its predecessors. For much of 1993, BrIII had single-digit volume (see figure

[17]In an interview one Tyson executive implied that hedging does not necessarily save a company from bankruptcy (Crawford Jr. 1991a).

[18]Contract settlement called for delivery of dressed, ready-to-cook, USDA Grade A broilers. The average weight varied across BrI and BrII. The actual type of broiler required varies by firm.

7) before eventually being removed from trading by July 1993. Not all futures contracts go through such growing pains.

3.7 Live Cattle Futures: 1964 - Present (LC)

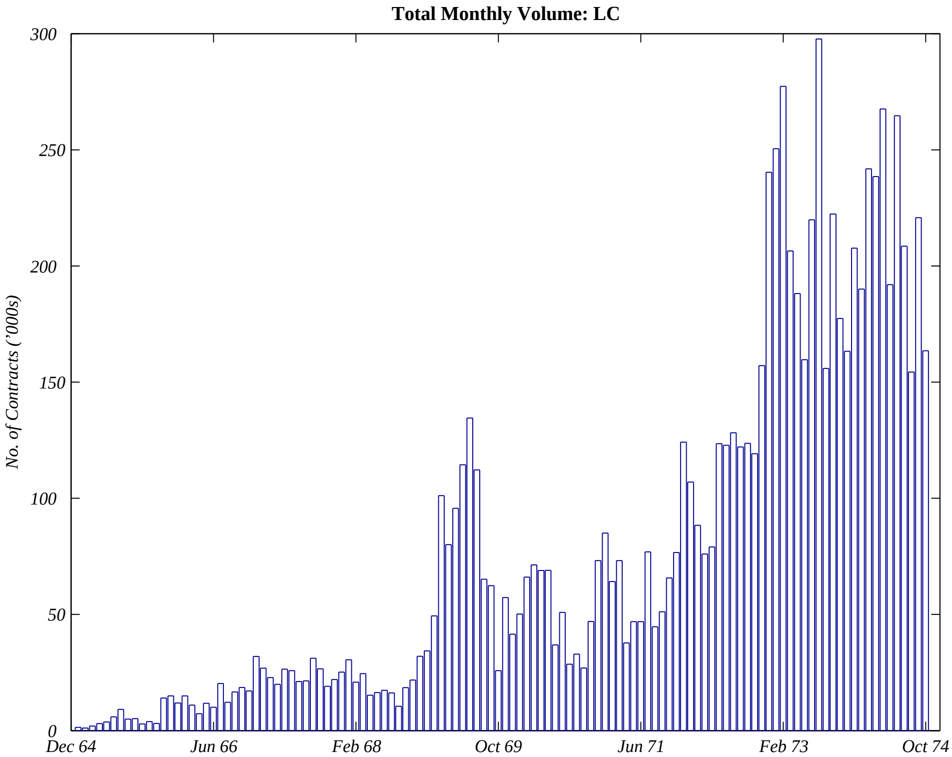

Figure 8: Total Monthly Volume: LC

Live cattle futures, introduced in November of 1964, did not go through similar growing pains albeit they have gone through many changes over the years since introduction. When introduced, live cattle futures were the first non-storable commodity to be traded on any exchange. There was much initial opposition from the packing industry and the board of directors of the American Meat Institute, a trade organization (Schwager 1984). These objections notwithstanding, live cattle futures have been a tremendous success. As of 2002 average daily volume was approximately 12,000 contracts with an average open interest of 103,000 contracts. By every measure live cattle futures have been successfully trading for the last 40 years, while broiler futures traded for a combined total of 20 years during the last 40 years. The most recent offering of broiler futures had the shortest tenure of just under 3 years. Why was the development of a successful broiler futures market so difficult? We now turn to the methodology that will be used in answering this question.

4 Methodology

In order to probe the reasons behind the broiler futures failures we need to consider both the commodity characteristics and contract characteristics of futures as is common in the literature. To recap, the commodity characteristics considered important for the existence of successful contracts are: (i) a commodity which cannot be identified by any particular brand (homogenous product), (ii) a commodity capable of being graded and standardized, (iii) easily available public information regarding the commodity, (iv) a large cash market, (v) significant variability in the cash price. Contract characteristics considered essential to have successful contracts deal with attracting substantial hedgers and speculators and the effectiveness of the contract as a tool for hedging.

Both broilers and cattle meet the first few commodity characteristics. Consumers do not identify with a particular brand of either chicken or beef. Also, both commodities are easily graded and standardized. The USDA inspects and grades poultry and cattle as to their quality at the time of slaughter. While these characteristics are necessary for successful contracts, they are not sufficient. A tractable model, which captures both necessary and sufficient variables in predicting the success/ failure of futures is needed. Black (1986) uses such a model.

4.1 The Model

The model as stated in Black (1986) is:

$$\ln Volume_i = \ln \beta_0 + \beta_1 \ln Var_i + \beta_2 \ln RR_i + \beta_3 \ln CLIQ_i + \beta_4 \ln SIZE_i + \epsilon_i \qquad (1)$$

where $Volume_i$ is the average monthly[19] volume of futures contract i; β_0 is the constant; Var_i is commodity i's cash price variability; RR_i is the residual risk ratio defined as follows:

$$RR_i = \frac{\text{residual risk}_{cross}}{\text{residual risk}_{own}} = \frac{\frac{Var[R_c^*]}{Var[U]}}{\frac{Var[R_o^*]}{Var[U]}} \qquad (2)$$

where 'residual risk$_{cross}$' and 'residual risk$_{own}$' are the risk remaining in a portfolio containing a cross-hedge[20] and a portfolio containing an own-hedge respectively. $Var[R_c^*]$ is the variance of a hedged portfolio containing the cash commodity and related futures, $Var[R_o^*]$ is the variance of a hedged portfolio containing the cash commodity and its own futures, and $Var[U]$ is the variance of the unhedged portfolio. This comes from Ederington (1979) which shows that the R^2 from regressing change in cash prices onto change in futures prices is $R^2 = 1 - \frac{Var[R^*]}{Var[U]}$. The residual risk then is $1 - R^2 = \frac{Var[R^*]}{[Var[U]]}$, leading to the comparison between own-hedged and cross-hedged portfolios as represented by equation (2). $CLIQ_i$ is the monthly volume in the cross futures market and $SIZE_i$ is the total size of the cash market, measured in terms of number of contracts per month.

[19] Black (1986) uses daily volume.

[20] A cross-hedge is taking a position in a related futures contract, when a futures contract does not exist in the cash commodity.

In this chapter, we will explain the reasons for the failure of broiler futures by testing the validity of equation 1 using broiler futures and cattle futures data. We now discuss each variable in detail to hypothesize their relationship with the dependant variable, $Volume$.

4.2 Volume

Let us first consider the futures exchange itself. A futures exchange is a non-profit,[21] member-owned[22] institution that facilitates the exchange of futures contracts. Under its organizational profile, the CBOT states its principal role is "...to provide contract markets for its members and customers ..."[23]. The implied secondary role is to "...also provide opportunities for risk management for users who include farmers, corporations, small businesses and others"[24]. So the primary goal of an exchange is to offer any contract which would result in high volume. High volume for the exchange results in higher commissions and transactions fees for its members. While the exchange itself may be a not-for-profit organization, its members nonetheless are for-profit institutions. So it can be argued that contracts are considered failures, and subsequently delisted by the exchange, if they do not generate enough volume, as designated by the particular exchange.

What is considered a 'successful' level of volume may vary across exchanges[25]. So, we

[21] In 1999 the CBOT, the largest futures exchange in the US, considered a proposal to restructure itself into a for-profit corporation, although this change has not yet taken place.

[22] Only members or their representatives are allowed to trade on exchanges. Member status is acquired by purchasing a 'seat' on the exchange through a bid and ask system. As of Dec 12, 2003 a full membership on the CBOT sold for $520,000 (http://www.cbot.com). The price of an exchange seat is viewed by some as an indication of the exchange's ability to attract business that generally rises during times of commodity-price volatility and falls during low trading volume on the exchange (WSJ 1980).

[23] Under "organizational profile" at http://www.cbot.com

[24] ibid.

[25] Typically, all new contracts offered on the exchange go through a 'probationary' phase. On the CME the end of the probationary phase known as 'the Initial Termination Date' for new products, is "...the

turn to the literature for some volume threshold values. Sandor (1973) uses an average annual volume of 1,000 contracts as the threshold to determine a contract's success, while Silber (1981) uses an annual volume of 10,000 contracts as a measure of success. Black (1986) uses a threshold of 1,000 contracts traded daily as an indicator of contract success[26]. Never during their existence did broiler futures average such volume levels (see figures 4, 6 and 7), hence they were removed from trading. But since our objective is to explore the reasons for broiler future failures and not to predict whether or not they will fail, we are not particularly concerned with a threshold value for our dependent variable. We are more concerned with the results of estimating equation 1 in order to check if the parameters support theoretical predictions.

4.3 Price Variability (Var)

As previously mentioned, without the presence of hedgers, there would be no futures markets. Variability in the cash price of a given commodity is the main reason hedgers turn to futures markets. So it would follow that the higher the cash price variability, the higher the trading volume, such that $\frac{\partial Volume_i}{\partial Var_i} > 0$.

4.4 Residual Risk (RR) (Effective Hedging)

An ideal hedge is one where the underlying futures commodity exactly matches the cash commodity. Even though not all commodities have a corresponding futures market, one

latter of (1) two years after the date that trading in such products starts or (2) the first day of the month after volume of trading for that product (futures and options combined) averaged at least 1,000 contracts per day ..." (CME 2003).

[26] Generally speaking, a market with average daily volume of 1,000 contracts is considered successful (Schwager 1984)

can still reduce output price risk via the futures market with cross-hedging. This can be an effective risk management tool if there is a dependable price relationship between the cash commodity and the related commodity futures contract (Black 1986). Compared to an own-hedge (where the cash commodity being hedged and the futures contract underlying commodity are the same), the cross-hedge is generally characterized as having higher residual risk. Residual risk, as defined earlier, is the risk remaining in the hedged position compared to a perfect hedge where all risk is eliminated. For example, if the R^2 from the cross-hedge regression is 0.244 and the R^2 from the own-hedge regression is 0.468, the RR variable is calculated to be 1.4211.[27] If on the other hand, R^2 from the cross-hedge is 0.75 and from the own-hedge is 0.45 then RR will equal 0.4545. The closer is R^2 to one, the more effective is the hedge. Given the formulation for RR, the more effective the own-hedge greater is RR. If the own-hedge is more effective than the cross-hedge, hedgers would prefer their own commodity futures contract. So the relationship between $Volume_i$ and RR_i should be $\frac{\partial Volume_i}{\partial RR_i} > 0$.

4.5 Liquidity in the cross futures market (CLIQ)

If the cross futures market can be used as a more effective hedging tool, traders would rather be in that particular market. Occasionally even if a cross-hedge has a lower R^2 (is less effective) traders might flock to its markets due to increased liquidity. If there are significantly more transactions that take place in the cross futures market, the associated liquidity costs will be lower relative to the own futures market. Liquid markets are markets where selling and buying can be accomplished with minimal effect on price. While

[27] $RR = \frac{1-0.244}{1-0.468} = 1.4211$

volatility in a futures market would attract some traders, the lack of liquidity would keep them away since it may be difficult for them to find off-setting transactions when needed. This being the case one would expect the cross futures volume to be inversely related to the volume of the own futures market, $\frac{\partial Volume_i}{\partial CLIQ_i} < 0$.

4.6 Size of the cash market (SIZE)

The obvious reason to have a large cash market is to make available a large supply of potential hedgers. Another reason that the size of the cash market matters is because it prevents manipulation of the market and allows for the free movement of prices (Black 1986). The hypothesized relationship between size of the cash market and volume is $\frac{\partial Volume_i}{\partial SIZE_i} > 0$.

5 Data

Our data come primarily from three sources: the CBOT, *The Wall Street Journal* and the Bridge/ CRB database. Data for BrI begins from January 1972. Futures data prior to 1972 was unavailable and as such for the purposes of this estimation, BrI starts in January of 1972. When we refer to BrI, we do so to the time period of 1972 – 1980. Cash and futures prices as well as volume data for BrI come from the CBOT, while all data pertaining to BrII come from *The Wall Street Journal.* Cash prices, futures prices and volume for BrIII and live cattle (LC) come from the Bridge/ CRB database. The time span for the LC futures covers the period from December 1964 (when LC futures were first introduced) to Dec 1971.

5.1 Data Management

A monthly frequency of all variables is used in estimating equation 1. While some variables had monthly observations, others needed to be transformed to a monthly observation in the following manner:

<u>*Volume:*</u> The monthly volume used in the estimation is a sum of the weekly values as stated in the databases.

<u>*Var:*</u> The standard deviation of daily cash prices for a month is used as the measure of the price variability of that particular month.

<u>*RR:*</u> The production cycle for broilers ranges between six to eight weeks. We choose seven weeks (thirty-five days) as the hedging horizon to calculate R^2s to be used in calculating RR. Daily changes in cash price are used for the regression of cash price changes onto futures price changes. The sample for each such regression consists of 35 observations. The same procedure is followed to attain futures price changes.

<u>*SIZE:*</u> Data for cash market size are from the USDA monthly poultry slaughter and monthly cattle slaughter. The total weight at slaughter is then converted to contract equivalents by dividing total weight by the contract size of the relevant contract. Each broiler contract during BrI, BrII and BrIII was for 25,000 lbs, 30,000 lbs and 40,000 lbs respectively. One LC contract is for 40,000 lbs. Market size related in terms of contracts gives an indication of the size of potential hedgers. Poultry slaughter data prior to 1974 was either incomplete or unavailable.

For BrI a complete data set (monthly observations) was only available from 1974, providing us with a total of 84 observations. We use the same number of observations from a comparable time period for live cattle. BrII and BrIII each have a total of 33 and 29 monthly observations respectively. With the exception of BrI, all other futures either traded or continue to trade on the CME. BrI traded on the CBOT.

Live hog futures are used as the related futures for cross hedging for both broilers and live cattle. The time series for hog futures are from comparable time periods. Data for live hog futures, traded on the CME, were obtained from the Bridge/ CRB dataset.

6 Empirical Analysis

Table 4 displays the expected and estimated parameter signs from regressing equation 1. For purposes of brevity only parameter signs and levels of significance are reported. The first row of table 4, labelled '*Expected*', lists parameter signs as predicted by theory. The second row, labelled *LC* lists the estimated signs from regressing live cattle futures data using equation 1. As predicted by theory, variables *Var* and *SIZE* have the correct sign and are significant at the 5% level. However, *RR* is not significant and thus not a source of major concern, even if the sign is opposite of that expected. On the other hand, *CLIQ* is significant at the 5% level and has a sign opposite to that predicted by theory. The positive sign on *CLIQ* implies that as trading volume increases in the cross futures market (live hogs), it also leads to increased volume in the LC market. The same significant relationship ($CLIQ > 0$) is found for the BrI dataset. Since other parameters for BrI, BrII and BrIII are not significant, we are not concerned with their signs. Our control group of successful futures, LC, did not have the desired signs. So we need to augment (Black 1986) to arrive at a regression equation which will adequately explain the live cattle futures data and help explain the broiler futures.

Table 4: Signs of Estimated Parameters: Black (1986)

Estimation	*Var*	*RR*	*CLIQ*	*SIZE*
Expected	+	+	−	+
LC	+*	−	+*	+*
BrI	+*	−	+*	−
BrII	+	+	−	−
BrIII	+	+	+	−

* values significant at 5% level; ** values significant at 10% level

Before we suggest an augmentation, let us consider the two variables with signs contrary to our expectations, *RR* and *CLIQ*, both of which deal with cross hedging. The underlying assumption is that hedgers, vital to the success of a futures contract, in the absence of a futures market in their cash commodity will hedge using a related commodity[28]. Having the ability to cross hedge when an own hedge is not possible takes a certain degree of sophistication and understanding of the futures markets which many farmers may not possess. The typical reason provided for less than 5% of farmers using hedging as a risk management tool is the complexity of the futures market (Berck 1981). While this seems to be a simplistic line of reasoning others have also found that hedging participation is positively related to education, off-farm income, forward contracting sales of crops and livestock and computer use (Mishra and El-Osta 2002). Still others find that basis[29] risk, which makes hedging ineffective, is instrumental in deciding whether or not a farmer chooses to hedge[30]. Basis risk is indirectly evident in the variable *RR*, but in

[28]The futures market with the highest correlation with the cash price of the commodity being hedged is used in cross-hedging.

[29]Basis is the difference between the cash price at a specific location and the futures price of a commodity. Basis risk is the risk associated with the unexpected changes in the basis between the time a hedge is placed and the time when it is lifted.

[30]See Bond, Thompson and Geldard (1985) and Lubulwa, Beare, Bui-Lan and Foster (1997).

order to understand the success/ failure of futures contracts, especially in the agricultural commodities, we need to incorporate a more direct measure of the basis risk. With RR and $CLIQ$ not being significant, and to incorporate a more direct measure of a basis risk, we propose the following augmented model:

$$\ln Volume_i = \ln \beta_0 + \beta_1 \ln Var_i + \beta_2 \ln basis_i + \beta_3 \ln SIZE_i + \epsilon_i \tag{3}$$

where $basis_i$ is the basis risk and other variables are as previously defined. If there is no dependable relationship between the cash price and the futures price, then hedging indeed does become ineffective. So one would expect the bigger the basis risk of a commodity, the less the transaction volume in its futures market, $\frac{\partial Volume}{\partial basis} < 0$

Table 5: Signs of Estimated Parameters: Hegde (2004)

Estimation	*Var*	*basis*	*SIZE*
Expected	+	−	+
LC	+*	−*	+*
BrI	+	−	−*
BrII	+	−	−
BrIII	+	−*	−

* values significant at 5% level; ∗∗ values significant at 10% level

Table 5 displays the parameter signs from estimating equation 3 using LC, BrI, BrII and BrIII data. With this augmented model, the parameters from the regression using LC data are significant at the 5% level and have the expected signs. Now that validity of the model is established with the 'control group' LC (the successful contract), we can try to estimate the same equation using broiler data. If the parameters are not significant or if the signs are not as expected then we can arrive at some possible reasons for the broiler futures failures. From Table 5 we see that the $SIZE$ variable under BrI and the *basis* variable under BrIII are the only significant variables. It is curious why the sign on $SIZE$ is negative (even if not significant). The *basis* variable has the correct sign, even if it is not significant. We need to examine more closely the basis for all three futures. In combination with that examination, we may be able to hypothesize as to the reasons behind broiler failures.

Basis is expected to converge to zero as a contract approaches expiration. At expiration, the basis is expected to be zero as the futures price and the cash price equalize. However *local* basis, which is the difference between the price received by a farmer in his region and the futures price, is not expected to equal zero at contract expiration. This is because futures contracts require physical delivery to exchange-designated locations, which may be different than the location of the farmer. Basis risk is defined as the unexpected widening or narrowing of the basis between the time a hedge position is established and the time that it is lifted. Basis risk can result in changes to the expected price from hedging. The hedge ratio which is a ratio of futures position to cash position for a hedger is affected by basis risk. It is basis risk which is of interest to us, since hedging becomes ineffective with high basis risk.

Figures 9, 10 and 11 display the basis over selected periods that broilers were traded. If the relationship between cash price and the nearby futures price is valid, the basis should vary around zero as it does with live cattle futures. But we are more concerned with basis risk, the change in the basis. The horizontal line indicates the level of the basis at the start of the period. If the basis returns to this line, then the basis risk is not present. If it diverges from this line, then there is basis risk. All three figures display considerable basis risk. The variation in the basis over the course of trading is also an

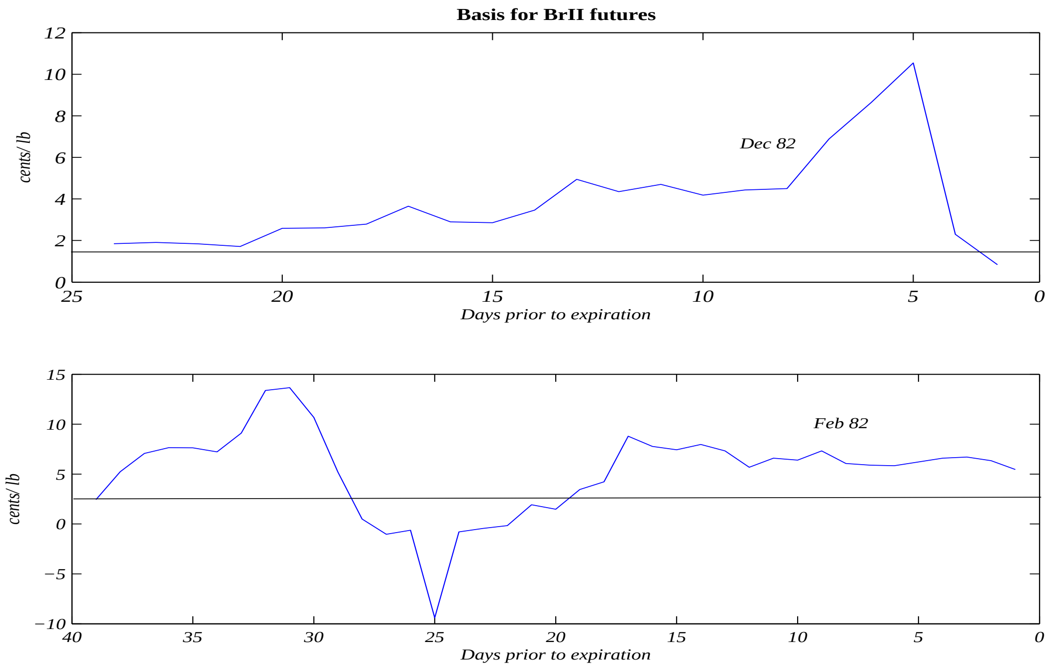

Figure 9: Dec82 and Feb82 Basis

indication of basis risk. Having a high basis risk, as demonstrated by its variance, implies that the hedge ratio would not be close to one and in fact may be closer to zero. Given the variance in the basis, hedging with broiler futures may not be an effective tool for risk management. This offers yet another reason why broiler futures may have failed.

7 Conclusion

The objective of this chapter was to investigate reasons why broiler futures markets repeatedly collapsed over the last 40 years. Much of the literature focuses on certain characteristics of either the underlying commodity or the contract itself as requirements for successful futures contracts. In this chapter we considered a combination of both commodity and contract characteristics. We considered trading volume, the ability to attract

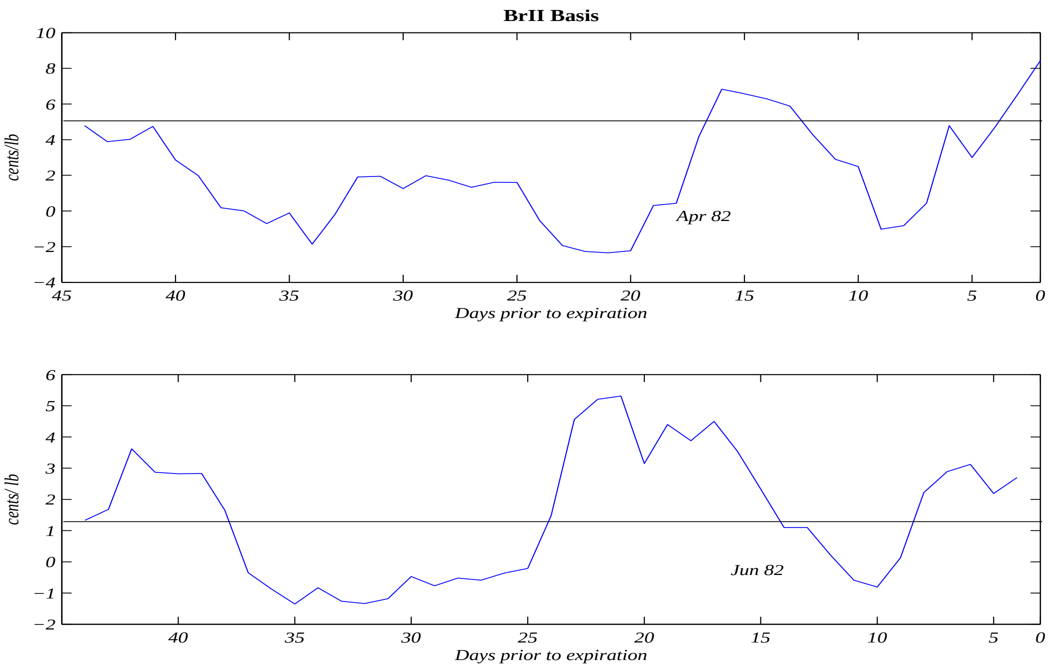

Figure 10: Apr82 and Feb82 Basis

hedgers and speculators, the variability of cash and futures prices and the relationship between cash and futures prices. A primary requirement associated with the characteristics of the commodity is that cash price exhibits substantial volatility. Cash price volatility leads those with an interest in the commodity to use the futures market to manage the resulting risk. Price variability was found to be significant in the two estimated models. We found that our augmented model explained our control group of the successful contract (LC) better than Black (1986). We had mixed results regarding other variables. It seems plausible that due to the basis risk present in broiler futures they did not attract the required volume to ensure continuous trading.

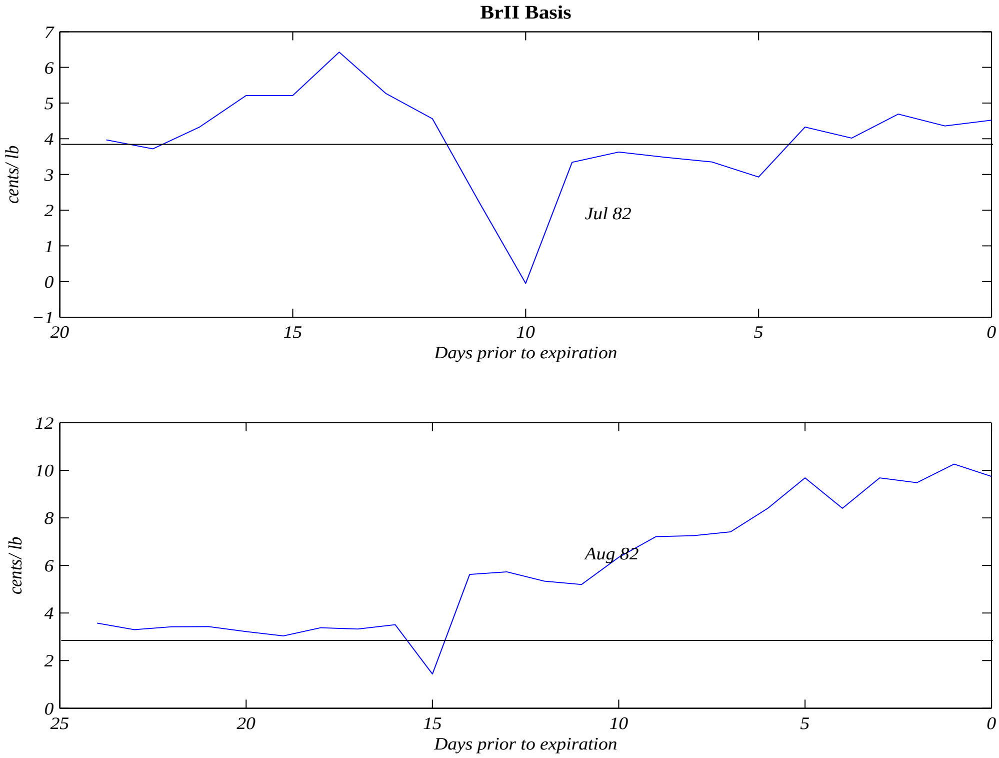

Figure 11: Jul82 and Aug82 Basis

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