Short-Run Captive Supply Relationships with Fed Cattle Transaction Prices

by

Clement E. Ward, Stephen R. Koontz,

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Questions have been raised about the impacts on spot market prices from meatpackers purchasing fed cattle two or more weeks in advance of slaughter. Three base models were estimated to study: (1) the relationship between use of captive supplies and fed cattle transaction prices; (2) the impact on fed cattle transaction prices from buyers having an inventory of fed cattle procured by captive supply methods from which to deliver cattle for slaughter; and (3) price differences between cash transaction prices and prices for fed cattle purchased under different captive supply methods. There was some evidence that impacts from either delivering cattle from an inventory of captive supplies or having an inventory of captive supply cattle were negative but small. Forward contract prices were found to be significantly lower than cash fed cattle prices.

Background

Behavioral changes in fed cattle procurement have accompanied structural changes in meatpacking. Some meatpackers increased their use of non-cash-price coordination of fed cattle from feedlots to their slaughtering plants, rather than rely exclusively on market price coordination. Non-cash-price coordination is also referred to as packer-controlled supplies or captive supplies.

Captive supplies take three forms: (1) packer feeding in packer-owned and commercial feedlots; (2) fixed price and basis forward contracts; and (3) exclusive marketing and purchasing agreements with individual cattle feeding firms. Two elements are common to each form of captive supplies. First, meatpackers have a portion of their slaughter volume needs purchased two or more weeks prior to the livestock being slaughtered. These forward purchases enable meatpackers to plan cash market purchases and deliveries in coordination with purchases by captive supply methods. Second, captive supply transactions between sellers and buyers do not result in a cash price which can be included in public market price reports.

A major question relating to structural and behavioral changes in meatpacking pertains to the net effect captive supplies have on slaughter cattle prices. Each form of captive supplies may have differential net impacts. Specific objectives of this research were to: (1) Estimate the relationship between use of captive supplies and fed cattle transaction prices; (2) Estimate the impact on transaction prices from buyers having an inventory of fed cattle procured by captive supply methods; and (3) Estimate the price differences between cash transaction prices for fed cattle and prices for fed cattle purchased under different captive supply methods.

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Conceptual Model

Procurement of fed cattle by each captive supply method reduces the supply of available catt that can be purchased in the cash market just prior to slaughter (i.e., within the normal two weel prior to slaughter). Effectively, the short-run supply curve for available fed cattle shifts to the le

There is also a demand effect. Packers procuring cattle by each type of captive supplies ma not bid as aggressively for cash market cattle because some percentage of their slaughter needs hav been purchased previously by the various types of captive supplies. Thus, the short-run demar curve for fed cattle shifts to the left also.

The net effect from captive suppliers is theoretically ambiguous. The leftward shift in th supply curve for fed cattle has a positive effect on fed cattle prices. However, the decline in deman has a negative effect. The empirical question is what is the net effect.

Purcell (1990) recognized that packers likely have a minimum plant utilization goal to kee them cost competitive. He recognized that the drive to achieve a plant utilization goal is affected i the short-run by the extent to which packers use or do not use captive supplies. While in one scenari described by Purcell the result is lower-than-expected fed cattle prices, he states that other scenario and outcomes are possible and empirical research is needed to determine the short-run price impact from use of captive supplies.

Only one study to date examined the relationship between captive supplies and transactio prices (Schroeder, et al.) and results indicated captive supplies had relatively small negative pric effects. Three limitations of the study were: (1) lack of access to all captive supply data during th study period; (2) no breakdown of captive supplies into the three component types; and (3) onl considering one-way causality from captive supplies to transactions prices.

The third limitation is especially relevant for this study. One hypothesis in this study is tha packer decisions to have captive supply cattle delivered for slaughter and decisions to purchase casl market cattle are determined simultaneously. The quantity of cattle which will be delivered fo slaughter over a relatively short period (i.e., about one month) is predetermined to a considerabl extent. Cattle placed on feed will reach desirable slaughter weight and quality after a relativel predictable period on feed, usually 90 days or more. Thus, cattle placed on feed by packers will b ready for slaughter at some predictable later period. As cattle reach the desired slaughter weight an quality, there is a market window of about three to four weeks during which to deliver cattle fo slaughter such that the cattle remain in an acceptable range of weight and quality. Conceivably packers could purchase some given number of cattle in the cash market and then determine how many captive supply cattle to deliver and when to have them delivered. Alternatively, packers could decide how many captive supply cattle to deliver and when to have them delivered, and then determine how many cattle to purchase in the cash market. This simultaneity question needs to be assessed empirically.

Data

Data were collected by the Packers and Stockyards Administration from 43 plants owned by 25 firms. Data records consisted of several types of information for each transaction of 35 head or 40,000 pounds or more for slaughter days from April 5, 1992 to April 3, 1993. The original data set consisted of transaction data for a total of 200,616 sale lots of cattle. As a result of missing data, irreconcilable differences in data, incompatible data among plants, and data errors, the data set was reduced. The final data set consisted of 139,189 sale lot observations from 28 plants owned by 9 firms. Within that base data set for specific regression equations, missing data for selected variables further reduced the number of observations available for the specific estimation procedure.[1]

Secondary data supplemented the primary data in the analysis. Secondary data included: (1) daily boxed beef cutout values from the Agricultural Marketing Service (AMS), U.S. Department of Agriculture (USDA); and (2) daily live cattle futures market prices from the Chicago Mercantile Exchange (CME).

Empirical Models

Three base models were specified and estimated, each corresponding to one of the study objectives. In all models, the unit of observation is a transaction record for a sale lot of fed cattle purchased on day t.

Captive Supply Shipments-Price Relationships Model

The following system of equations attempts to model the simultaneity of decisions regarding delivery flow of cattle from the captive supply inventory and cash market purchasing behavior as measured by the impact on transaction prices. This first equation is an identity used to measure individual plant utilization and capture the interaction between the various sources of fed cattle for each plant.

$$(1) \quad UTILN_t = [(NFC_t + NPF_t + NMA_t + NSP_t) / CAP_t]$$

$UTILN_t$ = Percentage of each plant's utilization from captive supplies and cash (i.e., spot) market purchases of cattle on the day cash market cattle were purchased

NFC_t = Number of head of forward contracted cattle purchased by each plant on day t

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[1] When observations are deleted from a data set, questions are raised as to the effect such deletions have on empirical results. Even with data deletions, this study had a more complete data set with which to conduct an empirical study of captive supply impacts on transaction prices than any previous study. The Packers and Stockyards Administration was mandated to collect data from meatpackers, including some smaller plants that did not retain specific data needed for this study. Thus, some data deletions were for those smaller plants.

NPF_t = Number of head of packer-fed cattle purchased by each plant on day t
NMA_t = Number of head of marketing agreement cattle purchased by each plant on day t
NSP_t = Number of head of cash market cattle purchased by each plant on day t
CAP_t = Maximum daily plant capacity for each plant during the data period

The second through fourth equations are the models used to explain variation in deliveries of fed cattle purchased by each of the three captive supply methods.

(2) $PQFC_t = f(BSS_t, TRPRC_t, UTILN_t, DDOW_{i,t}, DMON_{i,t})$

$PQFC_t$ = Percentage of forward contracted cattle during the market window period (i.e., t plus 28 days) which were delivered to each plant on the day cash market cattle were purchased
BSS_t = Basis on the day cash market cattle were purchased (i.e., dressed weight cash market price converted to a live weight price minus the preceding day's closing live cattle futures market price for the nearby contract)
$TRPRC_t$ = Cash market transaction price on the day cash market cattle were purchased
$DDOW_{i,t}$ = Zero-one dummy variable for day of the week cash market cattle were purchased (i.e., Monday, Tuesday, ..., Saturday-Sunday)
$DMON_{i,t}$ = Zero-one dummy variable for month of the year cash market cattle were purchased (i.e., January, February, ..., December)

(3) $PQPF_t = f(LCFMP_{t-1}, TRPRC_t, UTILN_t, DDOW_{i,t}, DMON_{i,t})$

$PQPF_t$ = Percentage of packer fed cattle during the market window period (i.e., t plus 28 days) which were delivered to each plant on the day cash market cattle are purchased
$LCFMP_{t-1}$ = Preceding day's closing live cattle futures market price for the nearby contract

(4) $PQMA_t = f(LCFMP_{t-1}, TRPRC_t, UTILN_t, DDOW_{i,t}, DMON_{i,t})$

$PQMA_t$ = Percentage of marketing agreement cattle during the market window period (i.e., t plus 28 days) which were delivered to each plant on the day cash market cattle were purchased

The fifth equation is the model to explain the variation in cash transaction prices.

(5) $TRPRC_t = f(ABBCV_{t-1}, LCFMP_{t-1}, DTYP_{i,t}, AHotWt_t, AHotWt_t^2, NoHd_t, NoHd^2, PYG1\text{-}3_t, FWD_t, DDOW_{i,t}, UTILN_t, TRND_t, TRND_t^2, TRND_t^3, DPLT_t, PQFC_t, PQPF_t, PQMA_t)$

$TRPRC_t$ = Cash market transaction price on the day cash market cattle were purchased
$ABBCV_{t-1}$ = Preceding day's boxed beef cutout value on the day cash market cattle were purchased, adjusted for the percentage of the sale lot grading USDA Choice grade and above or Select grade and below
$DTYP_{i,t}$ = Zero-one dummy variable for the type of cattle purchased (i.e., steers, heifers, mixed sex, Holstein, and dairy cattle)
$AHotWt_t$ = Average dressed weight of the sale lot

$AHotWt_t^2$ = Square of the average dressed weight of the sale lot
$NoHd_t$ = Number of head in the sale lot
$NoHd^2$ = Square of the number of head in the sale lot
PYG1-3_t = Percentage of USDA Yield Grade 1-3 cattle in the sale lot
FWD_t = Number of days between purchase and delivery for cash market cattle on the day cash market cattle were purchased
$TRND_i$ = Month cattle were purchased, i=1-n
$TRND^2_i$ = Square of the month cattle were purchased
$TRND^3_i$ = Cube of the month cattle were purchased
$DPLT_{i,t}$ = Zero-one dummy variable for packing plant that purchased cash market cattle (i.e., plant 1, plant 2, ..., plant 28)

Additional explanation is provided for selected variables. Maximum daily slaughter (CAP_t) was based on the largest number of cattle slaughtered any one day during the data period. As computed here, the inventory for each type of captive supply ($PQFC_t$, $PQPF_t$, and $PQMA_t$) does not represent the total inventory of captive supply cattle at the time cash market cattle are purchased, only the number of captive supply cattle actually delivered during the following 28 days. Basis (BSS_t) was calculated by taking the dressed weight price times 63 percent (i.e., an estimated average dressing percentage) to convert the dressed weight price to a live weight price, minus the preceding day's closing live cattle futures market price for the nearby contract.

Several variables included in Equation (5) are based on previous studies of fed cattle transaction prices (Jones, et al.; Schroeder, et al.; Ward 1981, 1982, 1992). Variables unique to this study were a quadratic variable for number of head in the sale lot ($NoHd_t$, NoHd2), percentage plant utilization ($UTILN_t$), included to proxy the functional relationship between plant utilization and slaughter-processing costs (Ward 1993), and extent of captive supply deliveries ($PQFC_t$, $PQPF_t$, $PQMA_t$). During the study period, prices trended downward then reversed and trended upward the remainder of the period. Therefore, cubic time-trend variables ($TRND_i$, $TRND^2_i$, $TRND^3_i$) were included to remove the trend in fed cattle prices.

Captive Supply Inventory-Price Relationships Model

A second model was estimated to determine the impact on fed cattle transaction prices from buyers having an inventory of fed cattle procured by captive supply methods. Model 2 is similar to equation 5 of Model 1 but Model 2 differs in two important ways. First, Model 2 is a single-equation model which assumes no simultaneity between the decision to have a given inventory of captive supplies and to purchase fed cattle in the cash market. Second, the percentage delivery variables in equation 5 of Model 1 are replaced by variables for actual inventory of captive supplies at the time cash market cattle are purchased,

QFC_t = Number of forward contracted cattle available for delivery over the next 28 days, on the day cash market cattle were purchased;
QPF_t = Number of packer fed cattle available for delivery over the next 28 days, on the day cash market cattle were purchased; and

QMA_t = Number of marketing agreement cattle available for delivery over the next 28 days, o day cash market cattle were purchased.

As computed here, captive supply inventory variables do not represent the total invento captive supplies at the time cash market cattle are purchased, only the number of captive supply c actually delivered during the following 28 days.

Captive Supply-Cash Price Differences Model

Model 3 is specified to estimate price differences between cash transaction prices for fed c and prices for fed cattle purchased under captive supply methods. Model 3 is also similar to equa 5 of Model 1 and to Model 2 but the dependent variable is the purchase price for cash market captive supply cattle, rather than just cash market cattle as in Models 1 and 2. The purchase p may be a transaction price, as would be the case for cash market cattle, or it may be a transfer or accounting price, as in the case of packer fed cattle. Two independent variables in Model 3 d from previous models,

$DMETH_{i,t}$ = Zero-one dummy variable for procurement methods (i.e., forward contract, packer marketing agreement, and cash market); and
$FWDALL_t$ = Number of days between purchase and delivery for cash market and captive sup cattle on the day cash market cattle were purchased.

Previous research has found that the time between purchase date and slaughter date affec transaction prices. Second, a variable was added to measure the difference between cash mar transaction prices and prices for fed cattle purchased by other methods.

Empirical Results

Cross section, time series data were analyzed using two stage least squares regression (Mo 1) and ordinary least squares regression (Models 2 and 3).[2] Reported significance of coefficie refers to the 0.01 confidence level. Coefficients on most variables had the correct sign based theory or previous research.

Captive Supply Shipments-Price Relationships Model

Initially, four versions of Model 1 were estimated. Two versions using plant dummy variab in equation (5) and two using firm dummy variables. For each of those versions, alternative inventc periods were used from which forward contract, packer fed, and marketing agreement cattle cou be delivered, 28 days and 14 days. Table 1 provides the results for Model 1, using a 28-day capti

[2] Difficulties were encountered with the Statistical Analysis System (SAS) software in testing for and correcting potential heteroscedasticity and serial correlation in the panel data. Thus, reported results are uncorrected model estimates.

supply inventory and plant dummy variables.

A number of variables are of importance in this study. However, the focus is on the three endogenous variables included to measure price impacts from delivering cattle from an inventory of captive supply purchases at the time cattle are purchased in the cash market. Generally, increases in the percentage deliveries of forward contracted cattle were associated with increases in plant utilization, increases in cash market prices, and decreases in basis. Increases in the percentage deliveries of packer fed cattle were associated with increases in cash market prices, decreases in plant utilization, and declines in futures market prices, though not all coefficients were significant. Increases in percentage deliveries of marketing agreement cattle were consistently associated with increases in cash market prices, decreases in plant utilization, and decreases in futures market prices.

Results from the transaction price equation indicate that increasing deliveries of cattle from each of the captive supply inventories was associated with lower transaction prices for fed cattle in two-thirds of the equations estimated (i.e., eight of twelve equations). Coefficients were not significant in three equations and were positive and significant in one equation.

The coefficient on the percentage deliveries of forward contracted cattle in equation (5) was negative and significant in the plant and firm, 28-day version of the model but not the 14-day versions. A 1 percent increase in percentage deliveries of forward contracted cattle was associated with a \$0.05/cwt. decline in fed cattle transaction prices in the plant version of the model. For perspective purposes, a 1 percent increase in percentage deliveries from the inventory of forward contracted cattle would represent a significant increase in use of forward contracts. The 28-day and 14-day percentage deliveries from forward contracted cattle inventories averaged 2.25 and 5.28 percent, respectively, over the one-year data period.

Coefficients on the percentage deliveries of packer fed cattle were mixed positive and negative and mixed significant and not significant. Both coefficients in the 14-day versions were negative and significant, while in the 28-day versions, the coefficient was positive and significant in the firm version but not significant in the plant version. A 1 percent increase in percentage deliveries of packer fed cattle was associated with a \$0.30 to \$0.25/cwt. decline in fed cattle transaction prices in the 14-day versions and with a \$0.20/cwt. increase in transaction prices in the 28-day, firm version. Again, for perspective purposes, a 1 percent increase in percentage deliveries from the inventory of packer fed cattle would represent a significant increase in use of packer feeding. The 28-day and 14-day percentage deliveries from packer fed cattle inventories averaged 0.53 and 1.02 percent, respectively, over the one-year data period.

For each version (i.e., plant, firm, 28-day, and 14-day), the coefficient on the percentage deliveries of marketing agreement cattle was negative and significant. A 1 percent increase in percentage deliveries of captive supply cattle was associated with a \$0.41 to \$0.10/cwt. decline in fed cattle transaction prices. Larger negative coefficients were found for the plant versions of the model than the firm versions and for the 14-day versions compared with the 28-day versions. A 1 percent increase in percentage deliveries from the inventory of marketing agreement cattle also would represent a significant increase in use of marketing agreements. The 28-day and 14-day percentage deliveries from marketing agreement inventories averaged 1.90 and 5.23 percent, respectively, over the one-year data period.

A modified-Hausman test was used to test for simultaneity (Godfrey). Test results at the percent level indicated there was simultaneity between percentage deliveries from the inventory o forward contracted and marketing agreement cattle but not packer fed cattle. Results indicate tha decisions by packers to deliver forward contracted and marketing agreement cattle are made at th same time as decisions to purchase cash market cattle. However, simultaneity tests indicate that th decision to deliver cattle fed by or for packers is made independently of the decision to purchase cash market cattle.

All previous studies which examined impacts from deliveries of forward contracted cattle (Elam; Hayenga and O'Brien; Schroeder et al.) found some negative or mixed impacts on fed cattle prices. Negative impacts in Elam and Schroeder et al. were slightly larger than in this study while negative impacts in Hayenga and O'Brien were much larger but results were mixed significant and not significant.

Captive Supply Inventory-Price Relationships Model

Several versions of Model (2) were estimated, using either a 28-day or 14-day captive supply inventory and using either plant dummy variables or firm dummy variables. Two types of inventory variables were included in separate versions of Model 2; the inventory variables described previously, plus a single inventory variable which was the sum of all captive supply cattle available for delivery over the next 28 days (and 14 days) when cash market cattle were purchased.

Coefficients on individual captive supply inventory variables were mixed positive and negative and mixed significant and not significant. Coefficients on the total captive supplies variable were consistently negative but were mixed significant and not significant. Coefficients are strictly interpreted as price impacts associated with a one head increase in the inventory. However, coefficients are quite small. Thus, here coefficients are discussed in terms of price impacts from a 1,000 head increase in the respective type or sum of captive supplies, though a 1,000 head increase represents a significant increase in captive supplies relative to the level during the study period.

A 1,000 head increase in the forward contract inventory was generally associated with a small but positive and significant impact on transaction prices. Significant coefficients ranged from \$0.02/cwt. in the 14-day, firm version of Model 2 to \$0.01/cwt. in the 28-day, firm version. The coefficient was not significant in the 14-day, plant version of the model. To keep these coefficients in perspective, the 28-day and 14-day inventories of forward contract cattle averaged 7,201 and 3,137 cattle, respectively.

For packer fed cattle, a 1,000 head increase in the inventory of packer fed cattle was associated with a generally negative and significant effect on fed cattle prices. Significant coefficients ranged from negative \$0.18/cwt. in the 28-day, plant version of the model to positive \$0.07/cwt. in the 14-day, plant version. The coefficient was not significant in the 14-day, firm version of the model. The negative relationship between packer fed cattle inventory and transaction prices was considerably larger relative to other coefficients for this model. The 28-day and 14-day inventories of packer fed cattle averaged 640 and 245, respectively, over the one-year data period.

The estimated impact from having an inventory of marketing agreement cattle was consistently negative and significant but not large. The impact from a 1,000 head increase in the inventory of marketing agreement cattle ranged from a minus $0.04/cwt. in the 14-day, plant version of the model to minus $0.01/cwt. in the 28-day, firm version. For the data period, the 28-day and 14-day inventory of marketing agreement cattle, respectively, ranged from 11,929 to 5,325 head.

Above results suggest type of captive supply has a differential impact on fed cattle prices. Coefficients for the total captive supply inventory variable were consistently negative but not large, and in one version of the model (28-day, plant version), the coefficient was not significant. Significant coefficients ranged from a negative $0.01/cwt. in the 14-day, plant version to less than $0.01/cwt. in the 14-day, firm version of Model 2. These are the estimated impacts on fed cattle transaction prices from a 1,000 head increase in captive supply inventory. The mean 28-day and 14-day inventory of all captive supplies over the one-year period ranged from 19,770 to 8,707 head, respectively. Results for the quarterly estimates of impacts from the total inventory of captive supplies were less consistent than for the full-year model.

Captive Supply-Cash Price Differences Model

The base model was estimated using either plant dummy variables or firm dummy variables. The focus here is on the dummy variables included to measure price differences among purchase prices. The coefficients on these variables were mixed positive and negative and significant and not significant.

Negative, significant price differences were found between forward contract prices and cash market prices. Coefficients in the two base models were -$3.16/cwt. in the plant model and in the firm model, -$3.02/cwt. Those amounts translate to -$1.99 and -$1.90/cwt., respectively, on a live weight basis using a 63 percent dressing percentage. These results parallel finding by Eilrich, et al., that net basis contracts and simulated hedged prices were -$1.37 to -$1.77/cwt. less than cash market prices on a live weight basis for data from 1988 to 1990. The results also support the theoretical conclusion (Carlton; Barkley and Schroeder) that forward contract prices must be lower than the expected value of cash market prices. It might be noted that cubic trend variables removed the within-year trend in fed cattle prices over the data period.

Coefficients for the packer fed variable in both the plant and firm versions of Model 3 were not significant. The price recorded for packer fed cattle is in essence an internal transfer or cost accounting price between the cattle feeding division and cattle slaughtering division of the packing company. This price might be expected to track cattle feeding costs or track the cash market price, so that transfer prices represent market conditions and do not give a consistent performance advantage to either the cattle feeding or cattle slaughtering profit center. Thus, insignificant price differences may indicate packers transferred packer fed cattle from feeding to slaughtering at a price which closely corresponded to cash market prices.

Prices for marketing agreement cattle were significantly higher than cash market cattle, ranging from $0.10/cwt. in the plant version of the model to $0.07/cwt. in the firm version. Theoretically, if marketing agreements result in better communication between feeders and packers, along with additional information regarding how purchased cattle dressed, then one could expect a positive price difference between fed cattle purchased by marketing agreement compared with those purchased in the cash market. Over time, cattle feeders should use the additional information and improved communications to better feed and market fed cattle, which should be reflected in higher prices. Additionally, the incremental information may allow feeders to alter the type of feeder cattle purchased so as to better match the demands of packers when cattle reach market weight and finish. The higher price may represent a quality difference between marketing agreement and cash purchased cattle and may reflect lower transactions costs associated with procuring cattle via marketing agreement.

Model 3 was also estimated by calendar quarters. Results varied somewhat but were generally consistent for coefficient signs and significance.

Conclusions

Simultaneity was found in the decisions to deliver forward contracted and marketing agreement cattle and the decision to purchase cash market cattle (Model 1). Results were mixed significant and not significant for forward contracted cattle. The negative relationship between percentage deliveries from the inventory of forward contracted cattle and transaction prices was in the $0.03-$0.05/cwt. range (i.e., in dressed weight prices) for each 1 percent increase in percentage deliveries. Significant coefficients on the variable for percentage delivery from the inventory of marketing agreement cattle were consistently negative, ranging from $0.10-$0.41/cwt. for each 1 percent increase in percentage deliveries. For packer fed cattle, results were mixed, ranging from a negative impact of $0.25-$0.30/cwt. to a positive $0.20/cwt for each 1 percent increase in percentage deliveries.

Results estimating the relationship between the size of captive supply inventory and transaction prices were also mixed (Model 2). For the total inventory of captive supply cattle, the relationship was consistently negative for the entire data period. However, the impact was small and perhaps not economically significant. A 1,000 head increase in the total inventory of captive supply cattle (a significant increase relative to the mean total during the study period) was associated with a $0.01/cwt. or smaller decline in fed cattle transaction prices. When estimating the differential impacts of captive supply methods, results were mixed. The inventory of forward contracted cattle was associated with a generally positive effect on transaction prices. For packer fed cattle the inventory-price relationship was mixed negative and positive. The relationship for marketing agreement cattle was consistently negative.

Significant price differences were found among procurement methods (Model 3). Forward contract prices were $3.02-$3.16/cwt. lower than transaction prices for cash market cattle over the one-year study period. Prices for packer fed cattle were not significantly different than for cattle purchased in the cash market. Prices for cattle purchased via marketing agreement were $0.07-

$0.10/cwt. higher than transaction prices for cash purchased cattle.

The overall conclusion from the three approaches taken in this study is that captive supplies are associated with lower fed cattle prices but the magnitude of the impact on transaction prices is small. Results were generally consistent with other research. A relatively weak negative relationship was found between transaction prices for cash market cattle and either delivering cattle from an inventory of captive supplies or having an inventory of captive supplies from which to deliver at a later time, but results were not robust. Prices paid for forward contracted cattle were significantly lower than for cash purchased cattle and were relatively large, (i.e., $3.02-$3.16/cwt. on a dressed weight basis). Prices paid for marketing agreement cattle were significantly higher than cash purchased cattle but price differences were not large.

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Table 1. Model 1 Regression Results, 28-Day Inventory, Plant Version.

Dependent Variable = $PQFC_t$

Instrumental Variable	Coefficient[1]
Intercept	-13.16*
	(7.15)
BSS_t	-.08*
	(5.65)
$TRPRC_t$	.10*
	(7.00)
$UTILN_t$	.003*
	(15.75)
$DMON_{i,t}$	Base
$DTUES_{i,t}$	.10
	(1.62)
$DWED_{i,t}$	.84*
	(12.14)
$DTHURS_{i,t}$	1.23*
	(15.28)
$DFRI_{i,t}$	1.22*
	(12.56)
$DSAT\text{-}SUN_{i,t}$	-.57
	(1.89)
$DJAN_{i,t}$	1.14*
	(7.67)
$DFEB_{i,t}$	1.15*
	(7.63)
$DMAR_{i,t}$	Base
$DAPR_{i,t}$	3.78*
	(20.22)
$DMAY_{i,t}$	1.72*
	(8.78)
$DJUN_{i,t}$	5.98*
	(25.96)
$DJUL_{i,t}$	1.40*
	(6.02)
$DAUG_{i,t}$	3.90*
	(12.69)
$DSEP_{i,t}$	.67*
	(3.23)
$DOCT_{i,t}$	1.75*
	(8.62)
$DNOV_{i,t}$	1.77*
	(9.05)
$DDEC_{i,t}$	3.17*
	(19.14)

Dep. Mean = 2.25
Root MSE = 7.192
Adj. R^2 = 0.040

Dependent Variable = $PQPF_t$

Instrumental Variable	Coefficient
Intercept	3.95*
	(3.28)
$LCFMP_{t-1}$	-.10*
	(5.68)
$TRPRC_t$	.03*
	(4.00)
$UTILN_t$	-.0006*
	(4.21)
$DMON_{i,t}$	Base
$DTUES_{i,t}$	.03
	(.91)
$DWED_{i,t}$	-.10*
	(2.76)
$DTHURS_{i,t}$	-.19*
	(4.52)
$DFRI_{i,t}$	-.20*
	(3.81)
$DSAT\text{-}SUN_{i,t}$	-.57*
	(3.57)
$DJAN_{i,t}$	.13
	(1.66)
$DFEB_{i,t}$	-.03
	(.35)
$DMAR_{i,t}$	Base
$DAPR_{i,t}$	-.53*
	(4.50)
$DMAY_{i,t}$	-.31
	(2.55)
$DJUN_{i,t}$	.27
	(1.84)
$DJUL_{i,t}$	.62*
	(4.62)
$DAUG_{i,t}$	-.35*
	(2.86)
$DSEP_{i,t}$	-.21
	(1.86)
$DOCT_{i,t}$	-.16
	(1.36)
$DNOV_{i,t}$	-.04
	(.40)
$DDEC_{i,t}$	-.17
	(1.73)

Dep. Mean = .53
Root MSE = 3.841
Adj. R^2 = .008

Dependent Variable = $PQMA_t$

Instrumental Variable	Coefficient
Intercept	6.86*
	(5.87)
$LCFMP_{t-1}$	-.21*
	(12.64)
$TRPRC_t$	.09*
	(10.82)
$UTILN_t$	-.0008*
	(6.47)
$DMON_{i,t}$	Base
$DTUES_{i,t}$	.25*
	(7.72)
$DWED_{i,t}$	-.04
	(1.05)
$DTHURS_{i,t}$	.30*
	(7.08)
$DFRI_{i,t}$	-.28*
	(5.48)
·$DSAT\text{-}SUN_{i,t}$	-1.20*
	(7.69)
$DJAN_{i,t}$	.49*
	(6.35)
$DFEB_{i,t}$	.08
	(1.07)
$DMAR_{i,t}$	Base
$DAPR_{i,t}$	.26
	(2.23)
$DMAY_{i,t}$	-.12
	(1.04)
$DJUN_{i,t}$	-.58*
	(3.96)
$DJUL_{i,t}$	.77*
	(5.97)
$DAUG_{i,t}$	.28
	(2.34)
$DSEP_{i,t}$	.75*
	(6.77)
$DOCT_{i,t}$	.18
	(1.56)
$DNOV_{i,t}$	-.03
	(.27)
$DDEC_{i,t}$	-.36*
	(3.68)

Dep. Mean = 1.90
Root. MSE = 3.732
Adj. R^2 = .009

Dependent Variable = $TRPRC_t$

Instrumental Variable	Coefficient
Intercept	59.82*
	(51.24)
$PQFC_t$	-.05*
	(7.40)
$PQPF_t$	-.06
	(1.74)
$PQMA_t$	-.36*
	(13.87)
$ABBCV_{t-1}$	.51*
	(105.77)
$LCFMP_{t-1}$	.28*
	(32.36)
$DSTR_{t-1}$	Base
$DDAIRY_{i,t}$	-4.79*
	(28.55)
$DFEDHOL_{i,t}$	-5.91*
	(103.70)
$DHFR_{i,t}$	-.92*
	(45.32)
$DMIX_{i,t}$	-.87*
	(19.36)
$AHotWt_t$	.01*
	(4.39)
$AHotWt_t^2$	-.00001*
	(7.07)
$NoHd_t$	.004*
	(19.89)
$NoHd^2$	-.000006*
	(13.83)
$PYG1\text{-}3_t$	.05*
	(35.06)
FWD_t	.08*
	(28.81)
$DMON_{i,t}$	Base
$DTUES_{i,t}$	-.36*
	(15.59)
$DWED_{i,t}$	-.54*
	(22.67)
$DTHURS_{i,t}$	-.24*
	(7.85)
$DFRI_{i,t}$	-.18*
	(5.33)
$DSAT\text{-}SUN_{i,t}$	-.95*
	(8.42)
$UTILN_t$	.003*
	(28.02)
	(24.28)

$TRND_i$	-7.78*	(82.96)
$TRND^2_i$	.71*	(76.54)
$TRND^3_i$	-.02*	(63.92)
$DPLT1_{i,t}$	Base	
$DPLT2_{i,t}$	-5.06*	(28.59)
$DPLT3_{i,t}$	.20*	(4.38)
$DPLT4_{i,t}$	-2.01*	(15.38)
$DPLT5_{i,t}$	.53*	(4.10)
$DPLT6_{i,t}$	-.96*	(8.30)
$DPLT7_{i,t}$	-.47*	(4.20)
$DPLT8_{i,t}$	-3.41*	(13.61)
$DPLT9_{i,t}$	-.64*	(6.48)
$DPLT10_{i,t}$	-.71*	(13.15)
$DPLT11_{i,t}$	.49*	(10.91)
$DPLT12_{i,t}$	-.44*	(3.90)
$DPLT13_{i,t}$	1.04*	(5.45)
$DPLT14_{i,t}$	.14*	(2.95)
$DPLT15_{i,t}$	-.83*	(6.64)
$DPLT16_{i,t}$	1.57*	(12.34)
$DPLT17_{i,t}$	-2.44*	(26.43)
$DPLT18_{i,t}$	.71*	(14.28)
$DPLT19_{i,t}$	-.94*	(5.24)
$DPLT20_{i,t}$	-1.66*	(13.79)
$DPLT21_{i,t}$	-1.35*	(10.59)
$DPLT22_{i,t}$	-1.27*	(10.28)
$DPLT23_{i,t}$	-1.26*	(9.91)
$DPLT24_{i,t}$	-1.95*	(19.84)
$DPLT25_{i,t}$	-2.48*	(18.06)
$DPLT26_{i,t}$	-3.12*	(22.66)
$DPLT27_{i,t}$	-1.96*	(14.58)
$PLT28_{i,t}$	-1.36*	(10.49)

n	=	105,612
Dep. Mean	=	120.64
Root MSE	=	2.445
Adj. R^2	=	.797

[1]Numbers in parenthesis are absolute values of calculated t statistics; * = .01 significance level.