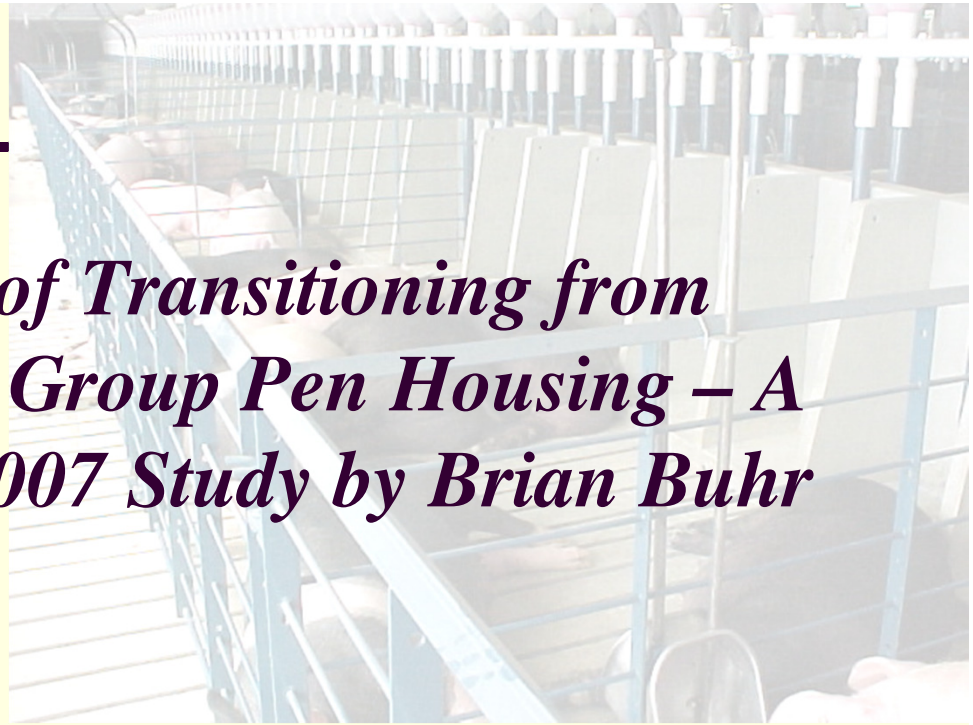
Economic Impact of Transitioning from Gestation Stalls to Group Pen Housing – A Revisiting of the 2007 Study by Brian Buhr



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Industry Economic Impacts of Transition

- Impacts on Productivity/Costs
  - Levels and Risks
- Capital Costs of Transition
  - Facility Cost Comparisons
  - Facility Age and Loss of Function
- Consumer Demand Issues
  - What Must be Paid?
- Market Response
  - Relative Competitiveness
  - Net Cost to Producers and Consumers
- General Insights/Strategic Issues

Impacts on Productivity/Welfare

- Survey of Commercial Producers
  - No clear evidence of differences across systems.
  - Management/Labor issues
  - Variability will be a major factor
    - Greater Risk of Catastrophic Loss with Pens
    - E.g., ESF w/ 50% death loss due to conditioning
  - Need crates about 32 days minimum.
  - Need crates for 'fall-outs'
  - If NO crates productivity will be impacted.
  - Sampling Issues: clearly early adopters, high quality. What happens when there is broader industry adoption?

Building Alternatives

- Electronic Feeding (ESF)
  - Same Footprint – large pen
  - Construction Cost Inexpensive
  - Maintenance/Management Costs Higher
  - Difficult to retrofit
- Small Pen Drop Feeding – Trickle feeding is our of style, apparently
  - Larger Footprint by about 10%
  - Slightly higher costs – materials and total size
- Free Access Stalls – New player
  - Larger Footprint by about 30% - 40%
  - Relatively expensive equipment
  - Maintenance may be an issue – moving parts

Opportunity Loss of Transition

- If barns are replaced prior to end of useful life, there is an additional cost of capital.
- If allowed to transition at the end of the useful life (assumed to be 25 years) then difference is simply capital cost and any productivity differences.

Technical Assumptions

Table 2. Production Coefficient Assumptions 2400 Sow Facility

Number Sows	2,400	head
Farrowing Capacity	375	head
Gestation Capacity	2,025	head
Average Annual Cull Rate: Breeding Females	40%	
Average Annual Mortality Rate: Breeding Females	7%	
Farrowing Rate	88%	
Total Pigs Born Per Litter	12.0	pigs
Stillborn Pigs/Litter	0.5	pigs
Pigs Born Alive/Litter	11.5	pigs
Pre-Weaning Mortality	0.5	pigs
Weaned Pigs Per Litter	11.0	pigs
Pig Birth Weight	3.0	lbs
Litters Farrowed / Breeding Female / Year	2.3	litters
Weaned Pigs Sold Per Sow Per Year	25.1	pigs
Avg Lactation Length	20.0	Days
Avg Gestation Length	114.0	Days
Avg Wean-Breed Interval	6.0	Days
Total Farrowing Cycle Interval	140.0	Days
Average Days in Gestation Barn/Litter	134.2	Days
Total Days is Gestation	308.0	Days
Days in Crate Prior to Farrowing (Pre-load)	5.0	Days
Total Days in Crate	57.0	Days
Percent of Time in Gestation	84%	
Avg Live Weight (lbs) / Standard Weaned Pig	12.0	lbs
Percent Full-Value Pigs Transferred	95%	
Weaned Pigs Transferred Per Year	57,331	pigs

(Source: Lammers et al., ISU, 2007 and KSU MF-2153, and PigChamp Summaries)

Assumed 2400-sow and 1200-sow base units of sow production with key Productivity factors.

From technical parameters create partial budget to simulate changes in productivity.

Updated Prices

Product and Input Prices			
		Unit	Price
Weaned Pig		Head	$42.00
Corn, Omah		bushel	$4.70
48% Soybean Meal, Decatur		ton	$300.00
Dical		lb.	$ 0.313
Limestone		lb.	$ 0.020
Salt		lb.	$ 0.040
Vit/TM Premix - Sow/Nurs		lb.	$ 0.900

Base Facility Cost Assumptions

- 2400 Sow Stall ~ $1,675/sow
  - BGFW – site prep, equip, permits, etc.
- 2400 Sow Drop Feed Pens ~ $1,843/sow
  - Primarily due to increased square footage 18-20/sow
  - More penning materials
- 2400 Sow ESF ~ $1,570/sow
  - Less penning, same footprint as stalls (15 sq ft/sow)
  - Major concern is management and maintenance costs
- 2400 Sow Free Access Stalls -- $1975/sow
  - More space
  - Relatively expensive equipment

Productivity Differences Used In The Original Paper

Table 11. Variables Affected by Productivity Changes to Pens

Variable	Value under Pens	Percent Change from Stalls
Sow Mortality	8.54%	22% increase
Farrowing Rate	79%	5% decrease
Total Pigs Born Per Litter	11.5 pigs	4% decrease
Stillborn Pigs Per Litter	0.42 pigs	17% decrease
Labor	$9.08/ weaned pig	15% increase
Genetics Charge	$7.12 /weaned pig	22% increase
Sow Death Loss Charge	$0.68/weaned pig	5% increase
Maintenance and Repair[a]	$3.38/weaned pig	75% increase

[a]Assumed only for ESF facilities due to complexity of equipment.

- Actually worse case in nature – at least one respondent indicated this impact.
- Only consistent impact was farrowing rate decrease and stillborn pigs per litter.

Scenarios For Analysis

- **Capital Costs Only – Best Case Scenarios**
  - No production Performance Differences.
  - Simulated all combinations of replacement timing from immediately to at end of useful life.
- **Capital Costs PLUS Productivity Differences**
  - Statistically significant factors identified in literature review – Farrowing rate
  - Anecdotal evidence from large systems that have made changes in last 5 years – Labor, repairs, mortality
  - Scenario to reduce productivity by 10% for a 24-month transition period

Method of Analysis: Infinite Net Present Value

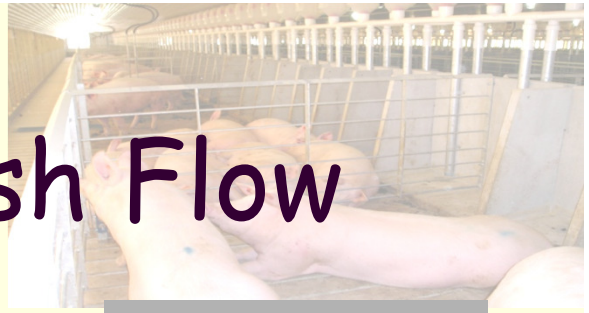
- Assumes can reinvest in similar project at end of useful life indefinitely.
- Allows for analysis of projects of differing lifespan which exists with replacement of assets on the ground.
- Project NPV:

$$NPV = \sum_{i=1}^{N} \frac{NCF_t}{(1+k)^t} - I_0$$

- Infinite NPV:

$$NPV(N,\infty) = NPV(N)\left[\frac{(1+k)^N}{(1+k)^N - 1}\right]$$

Primary Input: Net Cash Flow



Baseline Net Cash Flows of Scenarios, 2400-Sow Farms			
	Capital Costs Only	Permanent Productivity	24-month Transition Period
Gestation Stall Barn	$482,806		
Retrofit Small Pen Drop	$425,337	$304,697	$66,055
New Small Pen Drop	$428,956	$311,448	$72,806
New ESF	$258,315	$131,193	-$98,487
Retrofit Free Access	$367,138	$241,452	$12,621
New Free Access	$367,651	$278,170	$49,339

Net Present Values – Drop Systems

Infinite Horizon Net Present Value Analysis of Alternative Sow Housing Systems

Scenario	Drop Feed Small Pens Capital Only	Capital Plus Permanent Costs	Capital Plus Permanent Plus 24-month Transition
Continue Stall Housing	**$ 1,956,940** [c]	**$ 1,956,940**	**$ 1,956,940**
Build New Drop Feed Pen @ 25 years	$ 1,722,375	$ 1,462,358	$ 1,339,906
Retrofit to Drop Feed Pen @ 15 years	$ 1,454,260	$ 552,957	$ 322,315
Retrofit to Drop Feed Pen @ 5 years	$ 1,191,657	$ (989,070)	$ (1,443,981)
Retrofit Drop Feed Pen Average All Ages	**$ 1,381,120**	**$ 101,803**	**$ (195,455)**
Build New Drop Feed Pen @ 15 years	$ 1,112,390	$ 207,175	$ 151,080
Build New Drop Feed Pen @ 5 years	$ (339,899)	$ (2,226,018)	$ (2,086,352)
Build New Drop Feed Pen Average All Ages	**$ 667,112**	**$ (511,247)**	**$ (508,060)**

Net Present Values -- ESF

Infinite Horizon Net Present Value Analysis of Alternative Sow Housing Systems

Scenario	ESF Feed Large Pens		
	Capital Only	Capital Plus Permanent Costs	Capital Plus Permanent Plus 24-month Transition
Continue Stall Housing	**$ 1,956,940** [c]	**$ 1,956,940**	$ 1,956,940
Build New ESF Feed Pen @ 25 years	$ 1,697,958	$ 1,375,429	$ 1,536,988
Build New ESF Feed Pen @ 15 years	$ 875,475	$ 473,965	$ 554,747
Build New ESF Feed Pen @ 5 years	$ (1,335,128)	$ (2,519,180)	$ (1,280,674)
Build New ESF Feed Pen Average All Ages	**$ 185,634**	**$ (484,930)**	**$ 14,295**

Net Present Values – FA Stalls

Infinite Horizon Net Present Value Analysis of Alternative Sow Housing Systems

	Free-Stall Pens		
Scenario	**Capital Only**	**Capital Plus Permanent Costs**	**Capital Plus Permanent Plus 24-month Transition**
Continue Stall Housing	**$ 1,956,940**	**$ 1,956,940**	**$ 1,956,940**
Build New Free-Stall Pen @ 25 years	$ 1,653,858	$ 1,355,829	$ 1,229,612
Retrofit to Free-Stall Pen @ 15 years	$ 979,659	$ (37,834)	$ (278,999)
Retrofit to Free-Stall Pen @ 5 years	$ 324,311	$ (2,123,862)	$ (2,604,813)
Retrofit Free-Stall Pen Average All Ages	**$ 797,955**	**$ (641,646)**	**$ (954,244)**
Build New Free-Stall Pen @ 15 years	$ 1,032,487	$ 1,890	$ (62,021)
Build New Free-Stall Pen @ 5 years	$ (574,996)	$ (2,625,125)	$ (2,500,831)
Build New Free-Stall Pen Average All Ages	**$ 533,702**	**$ (773,850)**	**$ (780,697)**

NPVs – Aggregated for 2400-sow units

Infinite Horizon Net Present Value Analysis of Alternative Sow Housing Systems

	Aggregate Industry Impacts of Transitioning Existing Barns		
Scenario	Capital Only	Capital Plus Permanent Costs	Capital Plus Permanent Plus 24-month Transition
Total Aggregate Cost to Retrofit Barns to Drop Feed	$ 771,599,546	$ 2,485,883,568	$ 2,884,210,417
Total Aggregate Cost to Build New Drop Feed	$ 1,728,369,779	$ 3,307,371,499	$ 3,303,100,998
Total Aggregate Cost to Build New ESF Feed	$ 2,373,550,588	$ 3,272,106,724	$ 2,603,144,889
Total Aggregate Cost to Retrofit Barns to Free-Stall	$ 1,553,040,512	$ 3,482,106,151	$ 3,900,986,414
Total Aggregate Cost to Build New Free-Stall	$ 1,907,139,445	$ 3,659,259,727	$ 3,668,433,543

Estimating Industry-Wide Costs

- Depends on number of facilities which must be replaced.
  - Based on 2011 USDA estimates of sow numbers and size of operations.
  - 1,610 – 1200-sow barns with 155 already converted
  - 1404 – 2400-sow barns with 64 already converted
  - 10.1% of sows housed in non-stall facilities.

Estimating Industry-Wide Costs

- Depends on Age of Facilities
  - No information – assumed uniform distribution.
  - 25 year useful life, 1/25 of the barns are replaced each year.
  - Interpretation: If retrofit within 5 years, 20% of the industry will transition normally at end of life of facilities, 80% will be transitioning early, representing and opportunity loss of capital.

Total Costs of Capital Changes

Aggregate Cost -- Capital Costs Only

Scenario	2400 Sow Three Cycle NPVa	1200 Sow Three Cycle NPVa	Total Industry Cost	Decrease in Industry NPVd	Increase in Mkt Hog Cost
Retrofit Barns to Drop Feed	$ 771,599,546	$ 468,144,672	$1,239,744,218	-28%	6.9%
Build New Drop Feed	$1,728,369,779	$ 955,762,691	$2,684,132,470	-59%	14.8%
Build New ESF Feed	$2,373,550,588	$1,279,580,289	$3,653,130,877	-81%	20.2%
Retrofit Barns to Free-Stall	$1,553,040,512	$ 900,269,863	$2,453,310,375	-54%	13.6%
Build New Free-Stall	$1,907,139,445	$1,054,619,648	$2,961,759,093	-65%	16.4%

Total Costs of Capital and Permanent Costs

Aggregate Cost -- Capital Costs + Permanent Costs

	2400 Sow Three Cycle NPVa	1200 Sow Three Cycle NPVa	Total Industry Cost	Percent Decrease in Industry NPVd	Percent Increase in Mkt Hog Cost
Retrofit Barns to Drop Feed	$2,485,883,568	$1,280,430,716	$3,766,314,284	-86%	21.6%
Build New Drop Feed	$3,307,371,499	$1,653,685,749	$4,961,057,248	-114%	28.4%
Build New ESF Feed	$3,272,106,724	$1,776,468,420	$5,048,575,144	-112%	27.9%
Retrofit Barns to Free-Stall	$3,482,106,151	$1,967,014,370	$5,449,120,521	-121%	30.1%
Build New Free-Stall	$3,659,259,727	$2,023,516,013	$5,682,775,740	-126%	31.4%

Costs – Capital + Permanent + Transition Period

Aggregate Cost -- Capital Costs + Permanent Costs + 24-month Transition					
	2400 Sow Three Cycle NPVa	1200 Sow Three Cycle NPVa	Total Industry Cost	Percent Decrease in Industry NPVd	Percent Increase in Mkt Hog Cost
Retrofit Barns to Drop Feed	$2,884,210,417	$1,637,154,971	$4,521,365,389	-100%	25.0%
Build New Drop Feed	$3,303,100,998	$1,826,565,552	$5,129,666,550	-113%	28.3%
Build New ESF Feed	$2,603,144,889	$1,403,147,158	$4,006,292,047	-88%	22.1%
Retrofit Barns to Free-Stall	$3,900,986,414	$2,199,416,921	$6,100,403,335	-135%	33.7%
Build New Free-Stall	$3,668,433,543	$2,028,588,996	$5,697,022,539	-126%	31.5%

Industry Level Total Impact

- Best Case = Loss of $1.239 billion
  - Retrofit barns to Drop Feed, Small Pens – No productivity hits or added costs.
- Absolute Worst Case = $6.100 billion loss
  - Retrofit to Free Access Stalls
  - Added permanent costs – Labor
  - 2-year transition with -10% productivity hit

Market Adjustments – Costs +6.9%

CHANGE IN RETAIL AND FARM QUANTITY

Change Retail Quantity (percent)			Change Farm Quantity (percent)		
Pork	Beef	Chicken	Pork	Beef	Chicken
-0.0061	0.0006	0.0006	-0.0144	0.0002	0.0005

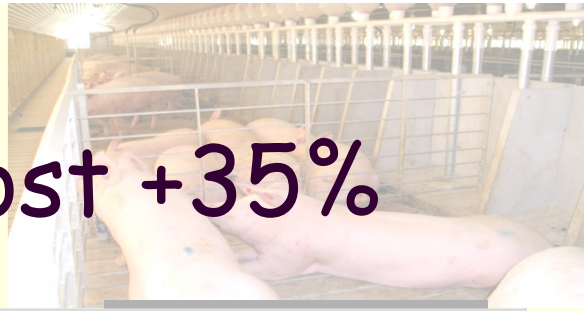
CHANGE IN RETAIL AND FARM PRICE

Change Retail Price (percent)			Change Farm Price (percent)		
Pork	Beef	Chicken	Pork	Beef	Chicken
0.0091	0.0006	0.0006	0.0328	0.0012	0.0008

CHANGE IN PRODUCER & CONSUMER SURPLUS

Change in Producer Surplus (Mill. $)			Change in Consumer Surplus (Mill. $)		
Pork	Beef	Chicken	Pork	Beef	Chicken
-727.91	87.41	39.19	-446.4	-43.83	-17.52

Market Adjustments – Cost +35%



CHANGE IN RETAIL AND FARM QUANTITY					
Change Retail Quantity (percent)			Change Farm Quantity (percent)		
Pork	Beef	Chicken	Pork	Beef	Chicken
-0.0311	0.0032	0.0029	-0.073	0.0009	0.0026

CHANGE IN RETAIL AND FARM PRICE					
Change Retail Price (percent)			Change Farm Price (percent)		
Pork	Beef	Chicken	Pork	Beef	Chicken
0.0462	0.0028	0.0029	0.1663	0.006	0.0041

CHANGE IN PRODUCER & CONSUMER SURPLUS					
Change in Producer Surplus (Mill. $)			Change in Consumer Surplus (Mill. $)		
Pork	Beef	Chicken	Pork	Beef	Chicken
-3570.29	440.66	196.11	-2233.04	-220.77	-88.45

Other Key Issues

- Relative Competitiveness by Age of Facilities.
  - Regional Impact
  - Firm Impact
- Rather than mandates, allow for labeling or other voluntary information provision.
  - If mandate, consumers who don't have preference are taxed.
- What Really Improves Sow Welfare?
  - Which system maximizes productivity and welfare?
  - First mover risks are potentially large.
  - What does HSUS really want? Is there a welfare treadmill?

Bottom Line

- Regardless of system any transition that requires premature capital replacement will be costly.
- Productivity information in actual commercial production is absolutely critical – becoming available and impacts are not huge.
- The longer the time horizon, the less the cost to producers and consumers.